With Compliments

of

The Seed Production and Input Storage Project

AIC Central Office - Teku

P.O.Box 2072

Kathmandu, Nepal

# SEED PROGRAM DEVELOPMENT STRATEGY

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Ministry of Agriculture

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This publication brought out by SPISP Project basically embodies the papers of the first National Seed Seminar held at Kathmandu from 16th to 20th February 1983 together with options and recommendations that emerged and evolved from the in-depth discussions.

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National Seed Seminar
Organizing Committee

1. Dr. T.N. Pant, Chairman
2. Dr. K.B. Rajbhandary
3. Mr. P.N. Rana
4. Mr. A.M. Pradhananga
5. Mrs. K.L. Rajbhandary
6. Mr. S.S. Bal
7. Mr. Alexander Shilo
8. Dr. B.N. Kayastha, Member Secretary

## MESSAGES

I note with much pleasure that the first National Seed Seminar held in February 1983 provided an excellent forum for free and frank discussion of our seed problems. More than that, it was an event reflective of HMG's special concern to improve the supply of agricultural inputs to all farmers. As a matter of fact, research, seed production, training and extension are links of the same chain and it is necessary to keep them strong. By pursuing the seminar recommendations it should, indeed, be possible to determine the right course for a dynamic seed development program in Nepal. I extend my best wishes for that goal.

Through this seminar the Ministry of Agriculture, Agriculture Inputs Corporation and the Seminar Organizing Committee have done a yeoman's service for a better agriculture. I congratulate them for their endeavour.

Honourable Mohan Man Sainjo
Vice-Chairman
National Planning Commission

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The Ministry of Agriculture attaches a high priority to seed sub-sector. We are willing to support any plan to make it more effective. For this purpose, the leadership of AIC's Seed Division has a key role to play. We place our trust in it with high hopes for the future.

My best wishes for a sound seed program in the service of Nepali farmers.

Dr. Deep Raj Sharma
Acting Secretary Agriculture
Ministry of Agriculture
Singha Durbar.

## APPRECIATION

1. The organizing committee wishes to recognize and record the financial help gladly extended by the seminar co-sponsors, namely, DOA, AIC, SPISP, FAO-VSPP, GTZ, ICP, PAC, LAC, IHDP-NPDP/SATA, NSC, HSC, HFPP and others and sincerely expresses its gratitude for their valuable assistance in successfully organizing this first National Seed Seminar.

2. Mr. S.S. Bal, IADS Project Supervisor of the Seed Production and Input Storage Project has edited and assembled the contents for this publication. His Contribution is acknowledged with appreciation. The variety of papers contained herein should serve as an excellent training material besides a source of reference.

ORGANIZING COMMITTEE
NATIONAL SEED SEMINAR

## FOREWARD

Agriculture is the mainstay of our economy. A majority of the people are dependent on this occupation and their number is said to be increasing by 350,000 every year. In the Sixth Plan, His Majesty's Government has, therefore, assigned a high priority to the development of agricultural sector.

The role of seed as an instrument of change is indeed crucial in the rural economy. There is a growing awareness that without increasing the use of quality seeds of improved varieties the success of our production programs may remain in doubt. The deliberations of the Seed Seminar followed by this valuable publication clearly point out to this awareness.

Most Nepalese farmers experience an array of constraints and problems, much more acutely in the hilly areas, in pursuing higher levels of crop production. The constraints, however, must be removed and as expeditiously as feasible. This is, indeed, a challenging task. It demands persistent action in many directions. A variety of measures such as the spread of new technology, laying of requisite infrastructure, extension of irrigation facilities, supply of the needed inputs, ready access to credit and, not the least, creation of profitable marketing opportunities for the farmers deserve our utmost attention.

As improved seed is an essential component of a viable strategy to tackle the problems of agricultural production, no amount of attention or investment to improve the seed situation should be too great. It is gratifying that this document not only focuses on the current seed status and deficiencies, it even seeks to recommend in concrete terms some alternatives which could, eventually, lead to the establishment of a credible seed program to serve the farmers of Nepal.

By organizing the Seed Seminar the Ministry of Agriculture, in cooperation with others concerned, has demonstrated its special concern for improving the supply of a very important input. No doubt the seminar recommendations, resulting from so much thought and discussion, would prove gainful in formulating pragmatic seed policies in the future. This apart, the valuable material contained in this compilation would serve the useful purpose of stimulating the minds of professionals, seedsman, seed producers, officials, students and others associated with seed production activities.

I should wish to record a word of appreciation for the SPIS Project for its contribution to the cause of seed improvement. This document is but a part of that contribution.

P.N. Rana
Chairman-cum-General Manager
Agriculture Inputs Corporation

## SOME DIGNITARIES ASSOCIATED WITH THE SEMINAR

1. Mr. D.N. Yadav, Hon'ble State Minister for Agriculture
2. Mr. T. Subba, Hon'ble Assistant Minister for Agriculture
3. Mr. D.B. Shah, Chairman, Nepal Peasants Organization
4. Mr. B.B. Khadka, Co-member, National Planning Commission
5. Dr. Dip Raj Sharma, Acting Secretary, Ministry of Agriculture
6. Mr. R.B. Singh, Joint Secretary, Ministry of Agriculture
7. Mr. P.N. Rana, Chairman-cum-General Manager, Agriculture Inputs Corporation
8. Dr. K.B. Rajbhandary, Joint Secretary, Ministry of Agriculture
9. Dr. T.N. Pant, Joint Secretary, Ministry of Agriculture
10. Mr. P.P. Gorkhali, Director General, Department of Agriculture
11. Dr. J.E. Douglas, Head, Seed Unit. CIAT, Columbia
12. Mr. B.P. Sinha, Dean, Institute of Agriculture and Animal Science
13. Dr. P.R. Mathema, Director-General, Department of Food Agriculture and Marketing Service
14. Dr. Bill Gregg, Senior Seed Industry Specialist
15. Mr. S.K. Upadhayaya, General Manager, Agriculture Development Bank
16. Mr. N.K. Basnyat, Registrar, Cooperative Department
17. Mr. O. Neundorf, Liaison Officer, GTZ
18. Mr. George Axon, Representative, FAO, Nepal
19. Dr. Larrynowicz
20. Mr. D.R. Pickett, Chief, ARC, USAID/Nepal
21. Mr. G.E. Alex, Project Officer, ARC, USAID/Nepal
22. Mr. S.P. Spainner, GTZ
23. Mr. A.M. Pradhananga, Deputy Director General, Department of Agriculture
24. Mrs. K.L. Rajbhandari, Chief, STIP, Department of Agriculture
25. Mr. N.B. Basnyat, Registrar, Tribhuvan University

The number of participants exceeded 150 and included almost all the important officers and functionaries connected with agriculture in general and seed in particular. Their individual and collective contribution is gratefully acknowledged.

THE ORGANIZING COMMITTEE

## VOTE OF THANKS

Fellow Participants,

Now as we come to the end of this seminar after five days of very fruitful and interesting deliberations, it is our pleasant privilege to extend our sincere thanks to all the participants who have contributed to the success of this first National Seed Seminar. We are sure the seminar will be remembered as the first monumental milestone by all the people working in seed activities and other agencies involved in it in Nepal. For the first time, a significant awareness has been created about the need to have a strong National Seed Program, to effectively serve the needs of our farmers. We have, no doubt there will be a sure follow-up on our recommendations so that when we meet again like this we shall look back with pride on the achievements of the past.

20 February, 1983

National Seed Seminar
Organizing Committee

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# RECOMMENDED ACTION PLAN

Presented by:
T.N. Pant, Joint Secretary
Ministry of Agriculture

Mr. Chairman, Secretary of Agriculture
Distinguished Delegates
Ladies and Gentlemen

You have just heard the recommendations from the Chairpersons of the four discussion groups. In essence the deliberations of the seminar reemphasize the inaugural address by the Hon'ble Minister of State and also address made by the Hon'ble Assistant Minister and the Central President of Peasants Organization regarding the increased availability of seeds to our farmers. Likewise the seminar has observed that Nepal would not be self-relient in seeds unless a comprehensive national seed program was formulated. Since the recommendations are wide-ranging, often touching on specific details, we have made an attempt to condense the salient ones into a summary form. This should not, however, undermine the significance of the group recommendations that have already been presented. I now read the major recommendations that have finally emerged:

1. A National Seed Board consisting of technical committees should be established at the highest level.
2. There is a strong need for a separate coordinator of foundation seed in the country.
3. The Seminar recommends that based on feasibility either the AIC set-up be restructured to ensure due priority to seed or a National Seed Corporation created as early as possible.
4. In the interest of seed quality the seed technology and improvement program should be strengthened along with an internal quality control system in AIC. Moreover, minimum quality standards of germination and purity for concertified seed should be observed by the seed trade.
5. In order to give better service to farmers the system of seed supply, promotion and pricing needs to be streamlined as per seminar recommendations. In the same context AIC should increase its direct touch with farmers.
6. Private seed industry should be encouraged.
7. The coverage with quality seeds of improved varieties should be doubled within the next five years.
8. The hill seed program should receive developmental assistance during the formative years.
9. Concessional interest rates on loans and exemption from duties and taxes are recommended for the seed industry.
10. Seed storage facilities at district and retail level should be improved.

## REPORT OF GROUP A

## SEED PROGRAM AND ITS COMPONENTS

Chairman: P.S. Rana

This group met in the Garden Hall on the 18th and 20th February 1983 and discussed the above topic in a very cooperative manner. There were 34 members in the list but the actual number fluctuated during the sessions which was not unexpected.

Luckily for the group, B.N. Kayastha, S.S. Bal and many other interested participants had prepared a draft on the topic, which was used as the main source for the discussion.

As regards strengthening seed program components under AIC and STIP, the recommendations were as follows:

1. National Seed Board

The main recommendation was that CSPC (Central Seed Production Committee) should be upgraded and named as National Seed Board. This Board is to be headed by the Secretary of Agriculture and it should have technical committees on the following:

(a) Variety release and maintenance

(b) Seed quality standards

(c) Seed planning

Other related recommendations were as follows:

(1) Members of the Board may include representatives from MOA (Chairman), Ministry of Finance, DOA, AIC, Private Seed Industry, ADB, Cooperative Department, IAAS (T.U.) and Coordinator of foundation seed.

The Secretary of this board could be either from AIC or Department of Agriculture.

(2) Functions of the Board

- To formulate a national seed policy and ensure its implementation.

- To identify and provide solutions to the problems hindering the growth of seed industry from time to time.

- To coordinate the seed production and supply activities of the various projects to serve national goals. Also to seek and coordinate foreign assistance according to need.

- To undertake promotional functions including financial support to seed certification, training, seed technology research and hill seed production effort.

- To deal with issues relating to seed pricing.

- To oversee the functions of the committees on variety release, quality standards and foundation and certified seed and any other matters bearing on the development of national seed program in Nepal.

- Since there is a need for a seed organization, a pre-feasibility study for opening another Corporation for seed specifically, such as a Seed Organization of Nepal, should be initiated.

2. Foundation Seed

Main Recommendations

A senior technical officer should be immediately appointed as the Coordinator of foundation seed. He should be within the Department of Agriculture.

The Coordinator should make an in-depth review of the physical, financial and manpower needs and come up with an action plan for necessary consideration and approval by seed planning committee. The Coordinator should be exclusively responsive for all aspects of foundation seed, including quantity, quality, allocation, storage and supply.

Related Recommendations

- Jhumka and other suitable farms be declared as foundation seed farms and placed under the control of the Coordinator.

- Activities on the foundation seed processing and storage facilities at the commodities stations may also be coordinated.

- All foundation seed be certified except perhaps the initial release seed of a new variety. The breeder should be involved in determining the genetic purity of each variety.

- While allocating the available foundation seed, top priority should be given to AIC and private enterprises which produce certified seed.

- In crops such as wheat the certified I seed should be taken as source seed for all practical purposes in case of shortages.

- The price of foundation seed should be higher than certified seed.

- The quality of foundation seed should be top class in every respect.

3a. An Organization for Certified Seed

Main Recommendations

The existing seed set-up in AIC should be reviewed to ensure desirable changes that can ensure proper priority to seed at all levels. With this in view the AIC's Board should appoint a special committee (with various disciplines included) at the earliest. This group should go into the question of re-organizing management of seed activities under the AIC and the mechanics of doing so most effectively.

Related Recommendations

- Improve seed storage facilities in AIC.

- Improve seed staff mobility.

- Set-aside sufficient contingency budget for smooth management of processing plants and storage godowns.

- Introduce internal quality control system in AIC under a senior officer reporting directly to the chairman.

- Adopt a policy of supplying only certified seeds, as far as feasible.

- Devise, ways to ensure a more direct relationship between AIC and the seed consuming farmers on the one hand and AIC and Sajhas on the other hand.

- Enlarge the retail network for seed marketing so as to be within easy reach of every panchayat in most parts of the country.

- The possibility of AIC having some of its own retail outlets should be examined.

- AIC should assist Sajhas in creating proper storage facilities for seed at the retail outlets. Issues such as dealers development and their knowledge of the product should receive due attention through training and discussions.

- The size of the seed bags for different crop seeds should be based on farmer needs and convenience.

3b. The recommendation that, STIP be a separate entity under the DOA was approved by this group.

4. Manpower Development

Main Recommendations

In order to cope with the future needs of the national seed program, the following training plans should be implemented:

a. Introduce seed technology courses and short-term training programs in IAAS (Tribhuvan University).

b. The STIP should hold regular in-service seed technology training courses for the benefit of the entire seed industry.

Related Recommendations

- The training opportunities offered under different projects should be fully utilized so as to develop competent cadre of seed technologists, engineers, technicians and managers for handling the growing seed program.

- A seed technologist in each of the national commodity programs needs to be included so that there is proper maintenance breeding and morphological description of the various recommended varieties.

- A vegetable Coordinator with an organization like the cereal commodity programs should be instituted so that the vegetable research, training, extension and seed improvement program can gain due momentum in a short period of time by further strengthening the Vegetable Development Division.

5. Hill Seed Program

(1) The new hill seed production program for the small farmers should be considered as a promotional and developmental activity for a period of at least five years. If and when special assistance to this program is necessary, it should be readily extended through the aegis of the National Seed Board.

(2) AIC should create a special cell to look after the working of the hill seed production program, ensure coordination between different projects and help remove the constraints from time to time.

(3) There should be a provision to produce forage and grass seed.

6. Seed Quality

Main Recommendations

a. The seed certification should be voluntary and, with the increase in manpower and facilities of STIP, certification should be extended to other crops, vegetables and potatoes besides cereals and pulses.

b. The seeds quality standards committee with the concerned disciplines should establish minimum quality standards for seed purity and germination for other crops and vegetables not covered by certification.

c. Only the registered seed companies or growers corporations need to have their seed samples officially tested and labelled for general sale.

d. Any variety introduced from abroad should be tested for germination and physical purity and should meet plant quarantine standards. If such varieties need to be sold on a large scale in the country that must be done in collaboration with the National Commodity Programs.

e. Seed legislation should be initiated in the country as soon as possible so that isolation requirement of cross-pollinated crops and standard of seed marketing are met.

f. There should be provision to prevent farmers from growing off-type plants in cross-pollinated crops seed production areas through administrative orders from the Agriculture Department.

g. Research on seed technology, seed pathology and entomology should be strengthened.

Related Recommendations

(1) AIC should handle foundatio and certified seeds supply and only in cases of emergency should it handle "emergency seed" selling it in separate plain bags after testing for seed purity and viability.

(2) Each year in different regions AIC should keep buffer stock of various seeds.

7. Infrastructure Facilities

Main Recommendation

Steps should be taken by AIC and STIP for efficient management of seed drying and processing plants, seed stores, central-regional seed testing laboratories and proper maintenance of the equipment used in these facilities.

Related Recommendations

- AIC should improve the capacity, design and management of its seed stores.

- On-farm seed storage in outlying hilly areas should be intensified through the use of metal bins and suitable bins of local origin.

- Efforts should be made to preserve maize seed quality through the use of artificial drying. Simple cob dryers using corn-cob or solar energy for fuel should be used.

- A mobile servicing unit to service and maintain seed processing plants of AIC, HMG stations and farms should be brought into action as soon as possible.

- Minimum facilities should be made available to further studies and training at IAAS, Tribhuvan University.

8. Seed Demand and Coverage

Main Recommendation

The coverage with improved seed is presently low. It should be at least doubled within the next five years. To cope with this challenge, the seed program should be expanded and strengthened. By the end of VII Plan, 20 percent area of wheat, 20 percent of maize and 12 percent of paddy should be receiving certified seeds through institutional supply system.

Related Recommendations

- The extension services should be mobilised for creating seed quality consciousness among the farmers upto the ward level.

- The seed program should handle area specific improved varieties so that they can spread rapidly.

## REPORT OF GROUP B

## PROMOTION OF PRIVATE SEED INDUSTRY IN NEPAL

Chairman: S.K. Upadhyaya

In Group B, there were 12 participants, who participated in the discussion with full interest and cooperation. The group mainly concentrated its discussion on problems and suggestions on the promotion of private seed industry in Nepal. The major recommendations made by the group in general are as follows:

1. Private seed industry should be grouped into categories.

   a) Seed growers and marketing groups.

   b) Individual farmer seed growers and sellers.

   c) Seed companies.

   d) Contract growers for AIC seed companies.

2. Registration of the seed industry should be done by the Department of Agriculture.

3. Policies should be developed to form a National Seed Board.

4. The hill seed program should get special attention and support from the concerned sectors as it is a promotional activity to serve the small farmer.

5. The basic minimum prices of the seed should be fixed taking into account the cost of seed production, processing, storage, cost of transportation, interest on capital involved, degree of risk and percentage of profit involved, and again at the time of sale, if the market price is lower than calculated price, the government should subsidize the difference in price.

6. In the beginning, private seed industry should get subsidy facility as AIC gets.

7. The sale tax/custom duty should be exempted on seed production, processing storage, tools, equipment and inputs. The Department of Agriculture should prepare a list of the equipment, tools and inputs required for starting a seed enterprise.

8. The seed industry should be exempted from tax for at least 10 years.

9. Credit agencies should provide loans to cover fixed and working capital needs of seed enterprises at reasonable rate of interest. In hill areas, mini metal bin program initiated by ADOs in some districts should also be considered for loans and a detail study on the possibility of expanding such programs should be thoroughly studied and implemented.

10. In the beginning all private seed industry should get free quality tests and inspection services, and regular supervision from Department of Agriculture. The government should strengthen its technical manpower to intensify its supervision, training, and certification system.

11. The private seed industry should be encouraged to enter into the contract with the counterpart foreign private industry for production and export of seeds when foreign foundation seed is used and production and export of certified seed of Nepalese recommended varieties.

12. The private seed industry should be allowed to market the new variety with minimum period of testing in a crop program.

13. Training in the country and abroad should be extended to private seed growers from time to time.

    The government should provide the required foundation seed. If possible, autonomous commercial foundation seed production farms should be established. Government farms also should be expanded.

14. While formulating summer seed program the government should consider the private seed industry contribution, on both demand and supply of seed.

15. On the district seed committees, there should be representatives from the private seed industry.

16. Department of Agriculture should provide technical guidelines/manuals on seed packaging, storage and processing to the private seed growers.

17. Every year, a national seminar on seed should be held to discuss the problems related to seed activity.

18. Lastly all private seed growers should pay more attention on producing quality seed and should comply with minimum standards fixed by National Seed Board.

## REPORT OF GROUP C

## COORDINATION OF SEED PROGRAMS

Chairman: M.L. Pradhan

After thorough deliberations and lively discussions, the group felt that although there is a Central Seed Production Committee it has not been able to function effectively for the following reasons:

1. The committee consisted of persons whose time was demanded much by other duties.

2. Even if the committee met, because of its advisory nature it could not speedly obtain approval regarding, pricing and subsidy policies from the Ministry nor could its decision be carried out by the farm centers concerning production of foundation seeds in more hectare.

3. The committee in practice was cereal crop specific and the problems of the other crops did not receive due attention.

4. There has also been a need for coordinating seed activities of various projects outside the direct authority of the committee.

Observing the aforesaid flaws, the group suggests the following institutional improvement:

1. National Seed Board (NSB)

   The function of the NSB should be to formulate policy guidelines covering all aspects of seed. This Board should be chaired by the Honorable Minister of Agriculture with the following members.

   a. Member, National Planning Commission (Agriculture) - Member

   b. Secretary, Ministry of Finance - Member

   c. Secretary, Ministry of Land Reforms - Member

   d. Secretary, Ministry of Forestry - Member

   e. Secretary, Ministry of Agriculture - Member Secretary.

   The policy decided by the NSB should be implemented by an Executive Committee headed by Secretary, Ministry of Agriculture with the following members:

   1. Director-General of Department of Agriculture

   2. Director-General of Department of Livestock and Animal Health

3. General Manager, ADB

4. Registrar, Department of Cooperatives

5. Chief Conservator, Department of Forest

6. Director-General, Food and Agriculture Marketing Services Department

7. General Manager AIC, Member Secretary

To support the Executive Committee in technical matters there should be permanent technical sub-committees. These sub-committees will analyze the problems in their respective fields and will function as coordinators between the Executive Committee of the NSB and various functionaries on seed matters. The technical sub-committees envisaged are:

1. Cereal and grain legume

2. Vegetables

3. Horticultural (Potatoes and Plantation Crops)

4. Industrial Crops (Jute, Tea, Sugarcane)

5. Forage

6. Marketing

Other technical sub-committees may be formed as and when required.

2. Seed Production Quality and Distribution

The group and the house critically reviewed prevailing situation with AIC. This group proposes to strengthen the AIC seed division by giving it entire control over the administrative and budgetary matters on seed supply.

If this is not possible a National Seeds Corporation should be established as a separate body.

3. Seed Distribution at District and Panchayat Level

The current system was reviewed and three different systems were identified. They are: AIC regular system through branch and sub-branch offices, SPIS Project mini seed-houses in areas where about 40 m.t. of seed can be produced and seed banks.

The group concluded that more mini seed-houses should be established where potential for these exists and resources permit. In areas where is not possible farmers' seed banks should be established.

## REPORT OF GROUP D

## PROMOTION, PRICING AND MARKETING

Chairman: P.R.B. Mathema

Discussions of seed promotion, pricing and marketing group were held on two days. The recommendations made were as follows.

Recommendations:

A. Seed Promotion:

1. Sales promotion activities for improved seeds should be developed. Regular radio broadcasting is recommended with proper coordination with DOA and Radio Nepal.

2. Time schedule for dispatch and delivery of seeds to district headquarters should be fixed in advance.

3. An estimate of cropwise and varietywise quantity of improved seed demand by the farmers should be made at least one year before the sale season. The estimated quantity should be kept on view formulating seed production programs. It is also recommended that the varieties and prices of seeds, that would be made available for sale during up-coming season, should be known to the field level staff 5-6 months ahead of sowing season, and effective demand should be collected on the basis of feedback information.

4. The field level extension workers (JT, JTAs) should be involved mainly in demand creation. The group recommends that they should not be much involved in seed demand collection. The village level and district level cooperatives, the main retail outlets, should be made more responsible in seed demand collection. The group also strongly recommends that institutions involved in seed production should increase direct contact with farmers. Additional technical personnel should be deputed in AIC for those purposes. Those personnel should also make regular supervision of village level cooperatives and, thus, should also act as seed quality controllers Sajha level.

5. Agriculture Assistants should be given incentives and encouraged if they take seeds direct from AIC office on cash and sell to the farmers. Such incentives should be more in the hills. The extra amount of commission needed for the hills should be subsidized by the government.

6. The present commission rate to Sajha and private dealers is inadequate and it is therefore recommended to revise them upward.

7. The group strongly feels and recommends that packing size should be appropriate for different crops and in different areas. Packaging should be done centrally or at the processing centers.

8. Seeds that could not get sold by Sajha cooperatives due to untimely delivery made to the cooperatives should be taken back by AIC.

B. Physical Distribution

1. It is recommended that seed storage facilities at the retail level should be promoted. The storage facilities should also be promoted in district AIC offices

2. Taking into account the nature and condition of roads appropriate means of transportation should be adopted in order to minimize transportation cost.

3. The announcement and payment of tender for seed transportation should be done by the receiving district offices. A minimum standard rate should be decided and the bid below that standard should be rejected.

4. A feasibility survey for additional cold storage in the country for storing potato seeds is recommended.

5. Private sector should be encouraged for the establishment, management and operation of cold storages.

6. In the mid and high hills low cost house-scale potato storage structures should be encouraged to enable the farmers to store their own potato seed requirement.

C. Pricing

1. There should be a nation wide uniform price in all the districts up to the AIC outlets. However, special consideration should be given for price in such hilly areas where seeds are being produced locally under special programs.

2. It is recommended that special seed subsidy program should be developed and launched out for highly inaccessible remote areas of hilly districts.

D. Organization and Management

1. Majority of the members expressed the need for a separate seed corporation. The group also recommended strongly that a thorough feasibility study should be carried on this aspect.

2. The district and village level cooperatives have the main responsibility in carrying seeds from district headquarters to

production areas. Experiences have shown that the cooperatives are not able to serve the farmer's need efficiently. Hence a restructuring of the cooperatives and also a provision of alternatives like private dealership are recommended.

3. External as well as internal management training programs for the personnel involved in seed business should be expanded.

4. AIC should expand its scope of seed business for other crops like fodders, green manures, pulses, etc.

## Capsule Comments

| | |
|---|---|
| - AIC has developed both certified and improved seed programs | - P.N. Rana |
| - Do care for seeds as you do for your children | - A.N. Bhattarai |
| - A campaign should be launched to promote the use of better vegetable seeds | - A. Shilo |
| - Seed production in Lumle has been going on for nine years | - K. Budathoki and G.R. Crooks |
| - The extension service has an immense role in popularizing superior seeds | - J.R. Baral |
| - The production technology demands a coordinated delivery of inputs | - G.E. Alex |
| - Concern for seed quality must pervade every aspect of our seed program | - C.M. Manandhar |
| - It is through the seed industry that private sector can contribute to agricultural development | - K.K. Gyanwali |
| - Pest control without warehouse sanitation is incomplete | - K.C. Sharma |
| - Seed production requires advance planning | - B.P. Parajuli |
| - Seed certification is a tool for consistently providing high quality seed | - K.L. Rajbhandary |
| - An area must be food sufficient before taking up seed production | - I.G. Hunter and M.R. Bhattarai |
| - A rational seed pricing policy assures increased consumption of improved seeds | - B.N. Kayastha |
| - The scope for seed industry to emerge in Nepal is bright | - S.K. Upadhayay |
| - Our plan is to flood both hills and terai with high yielding wheat varieties | - R.N. Devkota |
| - It is high time to expand domestic market and tap the export potential for vegetable seeds | - M.N. Pokharel |

| | |
|---|---|
| - I think farmers use old seeds for the sake of economy | - B.B. Pant |
| - Improved technology has not reached the farmers' door steps | - P.S. Rana |
| - Only a small percentage of planted seed is supplied by public organizations | - B.N. Kayastha |
| - The instrument of seed marketing is instrumental in executing agricultural plans | - H.P. Maag |
| - Crop research could be fruitless without a good seed program | - S.S. Bal |
| - Seed treatment is a simple way of boosting crop production | - K. Shrestha |
| - Only healthy seeds of high germination are fit for storage | - B.R. Gregg |
| - In GTZ, a high priority is attached to seed improvement projects | - O. Neuendorf |
| - Developing countries are in need of increased resources for seed production | - A.O. Wignell |
| - Thanks to climatic diversity all vegetable seeds can be produced in Nepal | - S.S. Rekhi |
| - Seed cost is usually a fraction of total farm cost | - Manohar and Shiva Sharma |
| - Foundation seed should be handled by trained technical personnel | - K.D. Sayer |
| - Better attention should be paid to mechanical damage to seeds | - B.K. Gyanwali |
| - Improved seeds constitute the best low-cost technology | - M.L. Malla and I.C. Bolo |
| - Hill farmers need assistance for maintaining quality seeds | - P.B. Bajracharya |
| - Grain saved is grain produced | - Ganesh K.C. and S.K. Bhalla |
| - A major incentive to a seed grower is payment in cash | - M.D. Bhatta and J.S. Gaudin |

| | |
|---|---|
| - We cannot grow healthy seeds on unhealthy plants | - B.P. Upadhayay |
| - The potential benefits of legumes are either ignored or under estimated | - R.K. Neupane and R.P. Chaudhary |
| - The available manpower should be fully used | - B.P. Rijal |
| - A variety has a great influence on crop productivity | - H.B. Shrestha |

# REPORT ON NEPAL SEED PROGRAM

J.E. Douglas
SPISP Consultant

## Executive Summary

1. Background

   A. From the beginning of a more systematic development of the seed program in the early 1960s until today considerable progress has been made. Many of the components needed to develop a successful program exist.

   B. Seed is a catalyst for agricultural development and higher crop yields. If production is to increase, more good seed of the best varieties must become available to the farmers of Nepal.

   C. National leaders need to carefully examine what now exists in the National Seed Program and take actions necessary to develop the present program into a highly effective mechanism for delivering seed to the farmers.

2. The National Seed Program Rests Upon the Results of Crop Research

   A. The significant advantage in yield, earliness and disease resistance now being demonstrated by the new maize, rice and wheat varieties indicates meaningful advances are possible in total crop production. Similar improvements are being identified from the testing and evaluation of vegetable, grain legume and oilseed varieties. The potential for increased production is much greater than nine years ago because of the improved germplasm with research programs.

   B. A much more dynamic and farmer responsive seed production and supply system plus increased fertilizer use is necessary if the benefits of these research results are going to spread to farmers rapidly.

   C. Favorable market prices from the farmers point of view will also greatly further stimulate production and the use of improved seed and fertilizers.

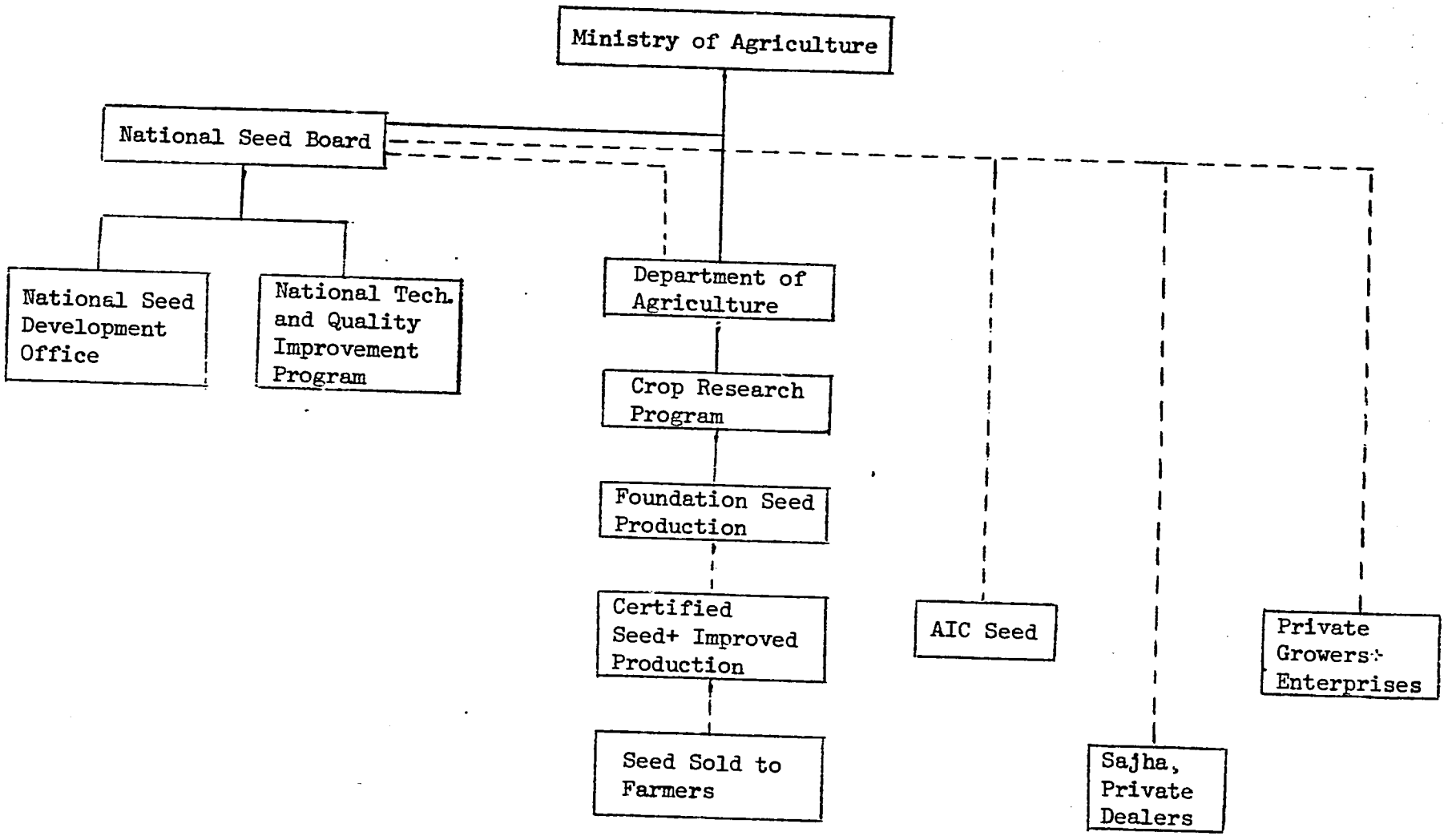
3. Organization and Coordination of the National Seed Program

   A. Although many of the components of a seed program exist, the program lacks a focal point and an effective coordinating mechanism to achieve the maximum benefits desired. The seed seminars recommendation that a National Seed Board be formed to overcome this weakness

is supported. In addition it is recommended that a National Seed Development Office be established to assist the Board in achieving its objectives. It is suggested that the National Seed Development Office have three officers attached to it - (1) Seed Planning and Development, (2) Coordinator of Foundation Seed and, (3) Seed Training and Information.

B. It is recommended that the present Seed Technology and Improvement Program which is in the Agricultural Botany Division be made responsible to the National Seed Board. The program could be renamed to "Seed Technology and Quality Improvement Program" and the present three activities made into clear sections including seed certification, seed testing and seed research. Figure 1 illustrates the concept of a National Seed Board in relation to other components of the National Seed Program.

Figure 5




———— Administrative channel

---------- Links to the Board

4. Initial Seed Increases

A. The initial seed increases - breeder and foundation - are all done at research stations and other government farms. With the establishment of seed conditioning equipment and the maize, rice, wheat and vegetable stations the physical capability exists to produce good quality seed. The seed seminar recommended that a Coordinator of foundation seed be named to help overcome weaknesses in the present program. This proposal is good and can help strengthen this part of the program. However, it is also recommended that each concerned station also have a breeder and foundation seed production specialist. A technician with mechanical aptitude must also be identified and trained to operate the equipment at each location.

B. The Jhumka farm in the Eastern Region should also be included for foundation seed production if the need exists. Foundation seed may be produced on other government farms but they would not be administratively under the Coordinator of foundation seed as would be the case of Jhumka farm. It would be better to concentrate production around the present main stations and contract with farmers for some production rather that to make sizeable investments in new foundation seed farms.

5. Production, Drying, Conditioning and Marketing of Certified and Improved Seed

A. The Agricultural Inputs Corporation (AIC) is the dominant organization producing, conditioning and storing certified and improved cereal seed in the official sector. The Seed Division is directly responsible for this work. The distribution of seed to farmers is done largely through cooperative societies. Vegetable, grain legume, and oilseed are handled through government farms and special projects. Very limited quantities of pasture and forestry tree seeds are produced through official programs.

B. The seed seminar recommended that a careful review be made of the AIC seed activities with a view to determine how they could be strengthened and proposed that the formation of some kind of autonomous Seed Corporation be considered. The seminar also put considerable stress on the need to develop the private sector to carry more responsibility in these activities.

C. This report recommends that the AIC seed program take immediate steps to improve its management of seed stores and institute an internal quality control program with a seed quality control officer. In addition greater assistance on seed quality is suggested from the Seed Technology Improvement Program at Khumaltar. It is also recommended that the Seed Division have a separate section concerned with development and the hill seed project.

D. In the long-term alternatives are outlined for a stronger seed production and supply program. If the private sector is to be encouraged, it is suggested that the alternative of a large National Seed Corporation would work against this objective unless policy changes are made in allocating foundation seed, seed pricing and seed distribution procedures. Instead two alternatives are suggested. One would be a National Seed Corporation with the shares jointly held by the government and the seed growers with policy changes. The other and preferred alternative is a smaller seed corporation with limited objectives and a decentralized production and supply system. The existing conditioning and storage facilities of AIC could be used to provide custom service for developing independent seed grower - sellers and "mini seed enterprises." In some cases the facilities could be sold or leased to seed grower groups in the area.

E. The present pricing and subsidy policies work against the development of farmers-grower-seller or seed enterprises. It is recommended that the maximum premium of 30 percent to seed growers be reduced to 20 percent and that the 10 percent saved be added to the seed selling commission so that a commission of approximately 15 percent be offered for selling seed. This kind of change would encourage more individuals and groups to sell seed. It is recommended that the proposed National Seed Board carefully weigh this issue and its impact on the long-term development of the total seed program and industry.

F. Seed prices should always be above local grain prices in the case of cereals. Since market prices very from area to area a sub-regional pricing pattern seems appropriate.

G. Since these issues are complex and affect more than the AIC, it is recommended that the proposed National Seed Board or a high level committee appointed by the Ministry of Agriculture review these alternatives and established national guidelines for future development of the private and public sector in seed production and supply.

H. Considerable potential exists for vegetable seed production. A ten years development program is needed to help the nation, through the combined efforts of the public and private sectors exploit the potential that exists. It is recommended that AIC Seed Division and the concerned programs put more development effort into seed production of the neglected crops - grain legume, oilseed and pastures. Needs for these seed will become increasingly important as farmers adjust their cropping patterns based on new research findings.

I. The hill seed program is unique and deserves as much continued support as possible. Few other countries have attempted a program

of this nature and it will be to Nepal's credit if effective ways can be developed through the program to assist small farmers meet their own seed requirement more effectively.

Maintaining a seed selling price above local grain market prices will be essential if the program is to succeed.

6. Seed Quality Control

A. The present seed certification, testing and research program in the Agricultural Botany Division is making a useful contribution to the quality of seed used. The essential parts of a good system exist, but increased productivity from the existing staff and some increase in staff is needed for the program to have the kind of impact that is needed. The recommendations from the seminar cover several useful steps that are needed in this aspect of the program.

B. The delays in enacting seed legislation have been appropriate because it is good for the program to improve and gain experience before operating under legal requirements. However, if the proposals to increase the involvement of the private seed industry move forward, it would be appropriate to plan for legislation to provide for a voluntary seed certification program and a truth in-labeling program on seed sold that is not certified.

C. In the short-term, administrative orders to require seed sold to be tested and properly labelled would contribute to better seed quality.

D. The present Seed Technology and Quality Improvement Program should be responsible to the National Seed Board and would ultimately have responsibilities for aspects of seed law enforcement.

E. The new seed testing laboratory building should be expanded to accommodate the National Seed Development Office and seed certification activities.

7. Getting the Seed Used

A. Present situation: The present extension system works primarily to collect the demand for seed for the AIC. In some cases the extension system distributes seed. The SPISP combines a seed production effort with education and extension about new varieties in the hills.

B. The recommendations from the seed seminar that stress "demand creation" and improved efforts by extension to promote good seed of better varieties are good and justify serious consideration.

C. As the research and extension systems work more closely together, it is equally important to draw local seed grower-sellers and

"mini seed enterprises" into the team that can link the promotion of new varieties with seed supplies.

D. The extension system can and needs to do much to activate the seed production - distribution network at the local level as well as increased utilization of good quality seed.

E. The proposed National Seed Board would need to add to its agenda a review of how the present research and extension programs can more effectively integrate their work with the development of increased seed supplies at the local level.

8. Personnel Development, Staffing and Training

A. The National Seed Program is rapidly building competancy especially through the present training effort of SPISP. The proposals made could not be considered without this strengthening of staff.

B. Much additional training will be needed both within the country and abroad. IAAS should incorporate seed technology in its curriculum.

C. It is recommended that the National Seed Development Office have a person who can guide and coordinate seed training activities and lead the development of educational and training material on seed.

D. The productivity per seed technologist does not appear to be as high as one would hope. Improved training, maintaining sufficient incentives for experienced people to remain in seed work and continued improvement in management of seed activities can improve this situation.

9. Resources

A. The physical, human, financial and external resources of the National Seed Program are reviewed and summarized.

B. Assuming the private sector is encouraged, further expansion of seed conditioning and storage facilities could be made during the next 10 years through that sector; however, some incentives such as credit, tax concessions and the lease of equipment to the private sector should be considered. The public sector should continue to invest in the mini seed house program. If need is shown, some further investment in foundation seed facilities would be appropriate after some time when the program expands. The greatest current need is the investment in the spare parts and maintenance on facilities now in place.

C. If a National Seed Development Office is established, an investment in the extension of the new building for the seed technology improvement program would be needed.

D. The staff positions included in the report and some strengthening of the AIC Seed Division and STIP will mean added trained manpower for the program as well as the associated additional financial commitment. These amounts are not large, but they must be recognized.

E. To achieve the objectives outlined will require the continued external assistance now provided through USAID/IADS, GTZ, SATA/FAO and other doner and technical assistance agencies.

# SEED PROGRAM AS AN ESSENTIAL EXTENSION OF THE CROP DEVELOPMENT PROGRAM

A.N. Bhattarai
Chief, Division of Agronomy
Khumaltar

There is an old saying in Nepal "save life during riots and save seed during famine". However, with the need for higher production of crops in the present situation this saying parhaps needs to be modified as "preserve good seeds like you raise and care your children".

## Seed Program is the Beginning

Twenty two years back there was a small agronomy farm inside Singha Durbar where Radio Nepal and Foreign Ministry are located now. Various high yielding rice and wheat varieties from many countries of the world were being tested for their adaptation. Few Japanese rice varieties and Lerma 52, a Colombian wheat variety, were identified as better yielding varieties in Kathmandu conditions. These varieties were multiplied in a hectare or two. Agricultural development office did not exist at that time. Extension program in the form of village development program was in an infancy. The then Chief Agronomist used to carry the seed of these better yielding varieties in a jeep and contact the farmers and convince them to grow these varieties in their fields. This was done also with the help of village development workers. This work was continued during early sixties with the Taiwanese joponica rice varieties and Mexican wheat varieties which created an agricultural revolution in the Kathmandu valley.

Agronomy Division used to work for the development of all crops during that time. Few farms and stations were established in different parts of the country and seed multiplication of better varieties was one of the important function of these farms and stations. Agriculture Inputs Corporation and many other agricultural agencies were established during sixties and due to the better extension work the demand of improved seed increased tremendously and this increased the importance of seed program in all the agronomy farms.

With the tremendous popularity of Mexican wheat varieties, wheat area in the country doubled within a decade. This created a demand of wheat seed in such a big scale that the agronomy farms and stations were not able to meet the demand. As a result we had to import large quantities of wheat seed from India. Bulk seed import of rice and maize varieties was also done; however, due to small quantity involved in these two crops shortage of seed was not a continuing problem.

The yearly large import of improved wheat seed from India during sixties created many problems. Seed was expensive, it did not reach the farmers in time due to transportation problems and sometimes grains not suited even for consumption without processing were received as certified or even foundation

seed from foreign seed agencies. This necessiated the production of wheat seed inside the country. Progressive farmers were contracted by AIC to produce seed and the additional responsibility of giving technical support and supervising seed production was added to the various farms and stations. Thus these farms and stations had to produce foundation seed within the fence, and supervise the seed production program in the farmers fields.

Crop Development Programs

His Majesty's Government established rice, wheat, maize, potato and vegetable development programs during early seventies to coordinate research in respective crop development activities. Oil seed, sugarcane, pulses and cotton development programs were added on the list during later part of seventies.

Seed of high yielding varieties is one of the most important contribution of the crop research or crop development programs. Though some cultural practices have produced better result their adoption by the farmers has been limited due to many reasons. High yielding varieties are already popular in three main cereal crops rice, maize and wheat and the potato. In other crops, improved varieties have been recommended recently and the seed demand is slowly increasing now, while there is already a big demand of seed in wheat, maize, rice and potato crops. Due to adoption of magic varieties wheat seed demand has been generally on a much higher scale than other crops.

Seed Multiplication Program

Just after their inception the cereal crop development programs had to give top priority to the seed multiplication program as some better varieties and package of practices for higher production became available to the farmers. This was more so with the wheat development program.

Seed Division was established in AIC in early seventies but there was a lack of technicians with AIC. Crop development officers had to give full attention to make an estimate of the seed demand, make a draft plan of seed multiplication program with different priorities to various varieties, provide foundation and certified seed to the farmers through AIC, and supervise the seed multiplication program in various districts. During early seventies the wheat coordinator had to spend more than fifty percent of his time for such activities. Recently with some strengthening of the Seed Division of AIC and posting of agricultural technicians in AIC district offices in the seed multiplication area the involvement of the crop development programs in certified and commercial seed production has been lighter. However, the main responsibility of over all coordination and production of foundation seed is intact with the commodity development programs.

Production of Foundation Seed

With the stopping of import of seed of cereal crops from other countries and a big seed multiplication program in the farmers fields, demand of foundation and breeder seed has increased. Production of breeder seed and also foundation seed is the main responsibility of the crop development programs.

Between research and seed multiplication in various farms it is a fact that research always had received top priority and maintenance breeding was considered a necessary headache in the past. Due to this, the foundation seed standard had suffered. This fact was raised and discussed in various crop development seminars and, recently, there is a trend for the better. Cereal crop development programs are giving better attention to maintenance breeding. More care and more interest are being given for the production of seed in various farms and stations. Small seed processing plants for processing foundation seed produced in the crop development program farms are being established with the help of Integrated Cereals Project.

Seed Production for Other Crop Development Programs

Oilseed Crops: Oilseed development program has been established at Nawalpur farm at Sarlahi. This program has recommended some mustard varieties but their yield differences with the local variety are not great; as a result there is not a big seed demand of those varieties.

In peanut also few varieties have been recommended but these also have not become very popular with the farmers and until last year there was very low demand of seeds of these varieties. This year Nepal Vegetable Ghee Factory is trying to push peanut production rapidly on a big scale. This might cause a big demand of peanut seed in the near future. Uptil now, AIC is not dealing with the seed of oilseed crops.

Pulses and Soybeans: A few better varieties have been recommended in lentil, chickpea, blackgram, mungbeans and soybeans. Seed demand for mungbean is increasing rapidly and AIC also is involved in seed multiplication program of mungbean in a limited scale. Seed demand for soybean also is increasing in few districts while seed demand for other legume crops is increasing slowly. Uptil now, the legume crop development program itself has been multiplying the seed of legume crops in various farms and stations but there is a need of AIC involvement to have a bigger seed multiplication program of these crops in the farmers field

Sugarcane: Sugarcane development program is multiplying the basic seed material of the recommended sugarcane varieties and passing it to the sugar factory which in turn multiplies it in its farms or with the sugarcane growers and distributes sugarcane sets to other farmers. AIC is not involved in sugarcane seed business.

Cotton Cotton development program itself is multiplying, distributing and supervising the cotton production program with the farmers.

Potato: National potato development program is working with 330 potato seed growers and producing and marketing 500 m.t. of potato seed of eight superior varieties. AIC is not involved in seed potato business.

Improvement for the Better

Though there has been phenomenal improvement in the seed program within this decade further improvements are necessary for the betterment of the seed sector.

1. Coordination

Better coordination between the crop development programs and AIC is very much desired. There have been some misgivings and misunderstandings in the past that have adversely affected the seed program. For this the Central Seed Production Committee has to function more efficiently and effectively. The committee should review each crop seed program periodically and regularly. Follow up should be regular and with a strong force.

2. Maintenance Breeding

Though there has been some improvement in maintenance breeding in the recent past it should be given further attention by various crop development programs and this would include creation of strong maintenance breeding group in each crop development program, providing good training and proper equipment and implements to them and providing good, processing and storage facilities for production and care of breeder and foundation seed. Creating a psychology of the importance of maintenance breeding in the farms and stations is very important.

3. Seed Division of AIC is to be greatly expanded and should be given more power to discharge its duties more efficiently and quickly. Development business and slow bureaucracy cannot go gether. AIC should be dealing with oilseeds, pulses, vegetables and other crop seeds. Within near future various sections dealing with various crops are to be created within the Seed Division with proper authority and clear responsibilities. Seed program of vegetables and many other crops are not developing fully mainly because AIC Seed Division is small and cannot take more responsibility.

4. Crop development program and the Seed Division of AIC should monitor seed production, seed demand and sales regularly and jointly.

5. AIC is not in a position to handle the seed multiplication of many varieties in each crop while the crop development programs would like to push new varieties which have better qualities. This has created misunderstanding. Even among the recommended varieties AIC is hesitant to increase the area of new varieties as seeds of these new varieties might not be sold while the crop development programs would like to push the new varieties to the farmers. HMG should create some fund to help AIC if all the seeds of new varieties are not sold. Crop development programs also should make an intensive effort to popularize the new varieties through the extension network. Extension workers should be fully aware of the better characteristics of the new varieties. Training is a must for this purpose.

6. Crop development program with the help of extension network and AIC should arrange demonstration of certified seed comparing with farmers seed. This will increase the importance of certified seed.

7. Seed transportation to remote hill areas is expensive and many times not reliable. HMG is subsidizing seed transport only to the district headquarter. Sometimes transport of seed from district headquarter to a remote village could be a very expensive affair and farmers cannot afford such high prices for seed. The mini-seedhouse multiplication program and seed-bank program are encouraging individual farmers to be small seed growers. The seed program run by AIC, Trishuli ADO and other agencies including cropping system program to provide seeds locally and cheaply and in time are programs in the right direction. These programs have to be evaluated and expanded or replicated in other areas. HMG should bear the seed transport expenditure of certified seed from district headquarter to inner areas in the beginning. Crop development program should help the district extension offices to train their staff for better seed production.

8. Various intensive production programs have been targeted in different crops in various districts. These intensive production programs could serve as very good seed multiplication pockets. AIC and DOA of Chitwan are coordinating in such a production cum seed pocket with technical help from the cropping system program. As a result the seed multiplication cum production area is probably having the best crop in its history in the area and farmers, extension and AIC workers are very enthusiastic about its impact. National production responsibility of each crop has been given to the respective crop programs and if they could coordinate with Regional Directors and AIC it will have a tremendous impact both for production and seed multiplication.

9. At the end I would like to repeat and emphasize the need for efficient administration and good coordination for the success of any program. The Central Seed Production Committee has to be activated and might be given more powers to run a successful seed program in Nepal.

One of my friends who has been working for crop improvement and seed programs for more than two decades once remarked that a good seed industry is a fair measure of the development status of a country. Let us all strive hard to build a good seed industry in Nepal.

Table 1

NATIONAL AVERAGE YIELD AND POTENTIAL YIELD OF VARIOUS CROPS WITH THE AVAILABLE IMPROVED TECHNOLOGY

t/ha

| Crop | National Average | Potential with Improved Technology |
|---|---|---|
| Rice | 1.8 | 4.0 |
| Maize | 1.6 | 4.0 |
| Wheat | 1.2 | 3.0 |

Table 2

PERCENTAGE OF AREA COVERED BY IMPROVED VARIETIES OF VARIOUS CROPS

| Crop | Percentage of area covered by improved varieties |
|---|---|
| Rice | 25 |
| Maize | 25 |
| Wheat | 85 |

Source: FASMD

Table 3

AIC SALES OF RICE, MAIZE AND WHEAT SEEDS

| Year | Quantity of seed sold (m.t.) | | |
|---|---|---|---|
| | Rice | Maize | Wheat |
| 1967-68 | 232 | 30 | 508 |
| 1972-73 | 163 | 50 | 1873 |
| 1977-78 | 299 | 144 | 2097 |
| 1981-82 | 243 | 135 | 2218 |
| Percentage of total area covered by AIC distributed seed during 1981-82 | 0.32 | 1.39 | 5.50 |

Source: AIC

Figure 1

A CLOSE CONNECTION BETWEEN RESEARCH AND CROP DEVELOPMENT PROGRAMS AND SEED PROGRAM

| Breeding | Crop Development Program |
|---|---|
| 1. Varietal Testing<br>2. Preliminary Seed Multiplication<br>3. FFT | 1. Crop Development Program<br>2. Agriculture Farms and Farmers<br>3. Cropping System Program |
| 1. Varietal Release<br>2. Maintenance Breeding<br>3. Foundation Seed Multiplication<br>4. Minikits | 1. Central Varietal Release Committee<br>2. Crop Development Program<br>3. Central Seed Production Committee<br>4. ADO and Farmers and Cropping System Program |
| 1. Production Program<br>2. Maintenance Breeding<br>3. Foundation Seed Multiplication<br>4. Seed Multiplication in Farmers Fields | 1. Extension Service<br>2. Crop Development Program<br>3. Central Seed Production Committee<br>4. AIC, Seed Certifying Agency, ADB, Sajha, and Farmers |

# AIC IMPROVED SEED PROGRAM

P.N. Rana
Chairman and G.M., AIC

## 1. Introduction

A program of improved seeds at an institutional level was started for the first time during the first year of the third Five Year Plan when the Agriculture Supply Corporation (ASC) was established. ASC had no seed production system. It simply procured improved seeds produced in government farms and imported seeds from various sources and distributed them among Nepalese farmers. In 1972, ASC was replaced by Agriculture Marketing Corporation (AMC) which also continued seed business along with food marketing business. It was not until the year 1973 that actual work of commercial seed production was started inside the country with contract seed growers. Seed multiplication program was conducted in Bara and Parsa area for the first time. Later on this program was also introduced in Bhairahawa. In 1974 the AMC was bifurcated into two organizations namely (i) Agriculture Inputs Corporation (AIC) and (ii) Nepal Food Corporation (NFC). The former was entrusted with the responsibility of supplying agricultural inputs to the farmers. AIC gradually increased seed production programs in the subsequent years and by now this corporation has a well defined seed production and distribution system.

## 2. Agriculture Inputs Corporation

### (a) Establishment

Established in 1974 under Corporation Act 1965.

### (b) Objectives

Supply of agricultural inputs consistence with the need of agricultural sector in the country.

### (c) Functions

(1) To import chemical fertilizer by inviting global tenders from the international market so long as the country does not have own production and to maintain buffer stock at least for a season and arrange supply for distribution throughout the kingdom.

(2) To conduct seed multiplication program in different regions, collect the seeds, process, treat, store and supply for distribution.

(3) To import and/or procure locally agricultural chemicals for plant protection and grain preservation and supply the same whenever required throughout in kingdom.

(4) To encourage the use of locally produced agricultural tools and implements as well as to import agricultural machinery not produced in the country and distribute the same throughout the kingdom.

(d) Organizational set-up

AIC has one central office, 5 regional offices and 62 branch and sub-branch offices. The central office of AIC has 7 Divisions. The Seed Division in AIC coordinates all the seed production and distribution, programs in different regions of the country.

(e) Relationship with other agencies

AIC maintains working relationship with agencies such as ADB, DOA, Sajha Sansthan and several programs and projects in the agricultural sector. The Seed Division maintains a close liaison with the seed growers and extension workers on formulation and implementation of its seed programs. The allied offices and the nature of their relation with AIC can be enumerated as follows:

Relation with allied offices:

1) Ministry of Agriculture

   a) Guideline instructions

   b) Reporting

2) Agriculture Development Bank

   a) Credit

   b) Production loan

3) Commercial Banks

   a) Agricultural credit

4) Agricultural Development Office

   a) Extension work

   b) Distribution of inputs

5) District Offices (HMG)

   a) Launching subsidy programs

   b) Distribution of inputs

6) Cooperative Societies/Private Traders

   a) Distribution of inputs

7) Central Seed Production Committee

   a) Seed multiplication program

   b) Variety release

8) Contract Seed Growers/Farmers

   a) To multiply seeds

   b) To supply seeds

(f) Manpower

According to post establishment there are altogether 922 staff members in AIC and out of this there are 179 technical posts and the rest 743 posts are non technical (Table 1). The technical manpower comprises of agriculturists, mechanics, plant operators and engineers. Total number of agricultural technicians in AIC (1982-83) is shown in Table 2.

Table 1

TECHNICAL AND NON-TECHNICAL MANPOWER 1982-83

| Level | Total | Technical | Non-Technical |
|---|---|---|---|
| General Manager | 1 | - | 1 |
| Deputy General Manager | 1 | - | 1 |
| 10th Level | 10 | 1 | 9 |
| 9th Level | 5 | - | 5 |
| 8th Level | 30 | 11 | 19 |
| 7th Level | 50 | 17 | 33 |
| 6th Level | 31 | 4 | 27 |
| 5th Level | 217 | 57 | 160 |
| 4th Level | 193 | 44 | 149 |
| 3rd Level | 109 | 45 | 64 |
| 2nd Level | 5 | - | 5 |
| 1st Level | 270 | - | 270 |
| | 922 | 179 | 743 |

Table 2

NUMBER OF AGRICULTURAL TECHNICIAN IN AIC

1982-83

| Office/Region | 10th Level | Senior Agriculture Officer 8th | Agriculture Officer 7th | Agriculture Officer 6th | Junior Technician (JT) | Junior Technician Assistant |
|---|---|---|---|---|---|---|
| 1. Seed Division | 1 | 3 | 5 | 0 | 1 | 0 |
| 2. Eastern Region | 0 | 1 | 1 | 1 | 5 | 1 |
| 3. Central Region | 0 | 1 | 5 | 0 | 7 | 0 |
| 4. Western Region | 0 | 1 | 1 | 2 | 6 | 2 |
| 5. Mid-Western Region | 0 | 1 | 0 | 2 | 4 | 0 |
| 6. Far-Western Region | 0 | 0 | 1 | 0 | 3 | 0 |
| Total (55) | 1 | 7 | 13 | 5 | 26 | 3 |

## 3. Seed Production

By now AIC has developed a systematic program of seed production in the country. The seeds of maize, wheat and some vegetables are produced on contract seed growers fields. The paddy seeds, so far, were produced on government farms, but from this fiscal year on wards AIC has decided to produce rice seed on contract farmer's fields too (as the produce of the government farms is found inadequate to meet the growing demand of the farmers). The major seed production programs of AIC are concentrated in terai region. In FY 1982-83, 89 percent of the area under maize seed multiplication and 93 percent of the area under wheat seed multiplication was in terai (Table 5). AIC has both certified and improved seed programs. The certified seed is field inspected and tagged by the independent seed certifying agency (Agriculture Botany Division/STIP). In short the system of seed production can be summarized as follows:

### Seed Production Systems Used in Nepal

Breeder seed and foundation seed are produced by the crop coordinators. Certified and improved seeds are produced by:

(1) Government owned farms and collected, processed, stored and distributed by AIC through cooperatives.

(2) AIC through cooperatives.

(3) Private seed growers produce, process, store, and distribute improved seed to other farmers in some SPIS Project sites. This system has much to recommend in the hill areas.

The current system involving the AIC as the processor/distributor and the farmers as the seed producers includes the following actions:

a) Foundation seed produced by the coordinated crop programs and government farms.

b) Farmer-seed producers selected.

c) Contracts negotiated between AIC and farmers.

d) Foundation seed delivered to AIC and then to cooperating seed growers.

e) Seed planted and crop grown and rogued by farmers.

f) Field inspections by Seed Technology and Development Program of DOA to check for varietal purity isolation, roguing, insects, diseases and weeds.

g) Seed crop harvested, dried, and cleaned by farmers.

h) Harvested crop inspected and sample taken by Seed Technology and Development Program of DOA.

i) Crop delivered to AIC if it appears to be satisfactory.

j) Farmer is paid local market price plus 10 to 15 percent premium upon delivery.

k) Sample is analysed by Seed Technology and Development Program of DOA and results delivered to AIC.

l) Premium calculated on the basis of analysis and farmer is paid up to 20 percent more premium on the basis of quality of seed delivered.

m) AIC completes processing and packaging.

n) Tags are issued.

o) Seed is placed in short-term storage by AIC.

p) AIC authorized to sell and deliver seed after checking germination.

q) Seed moved to distribution warehouses and country sale points.

r) Seed sold to delears.

s) Seed sold to farmers.

Table 3

WHEAT SEED MULTIPLICATION PROGRAM IN 1982-83

| Development Regions | Target in ha. | Percent | Achievement in ha. | Percent |
|---|---|---|---|---|
| Eastern Region | 1120 | 28 | 1235 | 31.03 |
| Terai | 1075 | 95.98 | 1221.5 | 98.9 |
| Hills | 45 | 4.01 | 13.5 | 1.09 |
| Central Region | 1380 | 34.5 | 1340.43 | 33.68 |
| Terai | 1300 | 94.20 | 1289.83 | 96.22 |
| Hills | 80 | 5.79 | 50.60 | 3.77 |
| Western Region | 1000 | 25 | 935 | 23.49 |
| Terai | 825 | 82.5 | 815 | 87.16 |
| Hills | 175 | 17.5 | 120 | 12.8 |
| Mid-Western Region | 340 | 8.5 | 297 | 7.46 |
| Terai | 340 | 100 | 197 | 100 |
| Hills | - | - | - | 0 |
| Far-Western Region | 160 | 4 | 171.5 | 4.31 |
| Terai | 160 | 100 | 171.5 | 100 |
| Hills | - | 0 | 0 | 0 |
| Total | 4000 | 100 | 3978.9 | 100 |
| Terai | 3700 | 92.5 | 3794.83 | 95.37 |
| Hills | 300 | 7.5 | 184.1 | 4.62 |

Table 4

MAIZE SEED MULTIPLICATION PROGRAM IN 1982-83

| Development Region | Target in ha. | Percent | Achievement in ha. |
|---|---|---|---|
| Eastern Region | 50 | 9.93 | 50 |
| Terai | 50 | 100 | |
| Hills | - | - | |
| Central Region | 480 | 76.19 | 490 |
| Terai | 435 | 90.62 | |
| Hills | 45 | 9.37 | |
| Western Region | 65 | 10.31 | 45 |
| Terai | 50 | 76.92 | |
| Hills | 15 | 23.07 | |
| Mid-Western Region | 35 | 5.55 | 25 |
| Terai | 25 | 71.42 | |
| Hills | 10 | 28.57 | |
| Far-Western Region | - | 0 | |
| Terai | - | 0 | |
| Hills | - | 0 | |
| Total | 630 | 100 | 610 |
| Terai | 560 | 89 | |
| Hills | 70 | 11 | |

Table 5

SUMMARY OF SEED MULTIPLICATION PROGRAM IN 1982-83 (TARGET)

| Crops | Hill | Percent | Terai | Percent | Total |
|---|---|---|---|---|---|
| Maize | 70 | 11 | 560 | 89 | 630 |
| Wheat | 300 | 7 | 3700 | 93 | 4000 |
| Total | 370 | 8 | 4260 | 92 | 4630 |

4. Seed Collection and Processing

AIC collects the seeds produced in government farms and on contract growers' fields as soon as they are prepared. The seeds are then processed in AIC seed plants, treated with protectant chemicals and stored till the next season.

AIC has five seed processing plants at Itahari, Janakpur, Hetauda, Bhairahawa and Nepalgunj (Table 6). Besides there is one more seed plant at Khairenitar which is utilized for processing seeds produced in that area. Two other potential centers in terai (Dang and Dhangarhi) are being considered for extra processing plants. Many small seed plants are being constructed under Seed Production and Inputs Storage Project (SPISP).

5. Seed Storage

The seeds collected by AIC have to be stored till the sales season after they are processed and treated. In total AIC has a godown capacity of 9955 m.t. which could be utilized for storing seeds. But the storage facilities are still inadequate at the seed collecting and processing centers. Moreover, some of the storage godown were not specifically designed for seed and need improvement to be acceptable.

Table 6

SEED PROCESSING FACILITIES WITH AIC

| | Seed Processing plant | Seed Production areas | Seed Distribution areas |
|---|---|---|---|
| 1. | Itahari | Morang<br>Sunsari | Koshi<br>Mechi<br>Sagarmatha |
| 2. | Janakpur | Dhanusa<br>Sarlahi | Janakpur |
| 3. | Hetauda | Bara<br>Parsa<br>Chitwan | Narayani<br>Bagmati |
| 4. | Bhairahawa | Rupandehi<br>Parasi | Lumbini<br>Gandaki<br>Dhaulagiri |
| 5. | Nepalgunj | Banke<br>Bardia | Bheri<br>Karnali |
| 6. | Khairenitar | Kaski<br>Tanahu | Gandaki |
| | | Other Centers to be Considered | |
| 7. | Dhangadi | | Seti<br>Mahakali |
| 8. | Dang | | Rapti |

Table 7

SEED STORAGE CAPACITY OF AIC

| Development Regions | Existing capacity in m.t. | Proposed or under construction in m.t. | Total |
|---|---|---|---|
| Eastern | 16000 | 430 | 2030 |
| Hill | - | 430 | 430 |
| Terai | 1600 | - | 1600 |
| Central | 4300 | 295 | 4595 |
| Hill | 600 | 295 | 895 |
| Terai | 3700 | - | 3700 |
| Western | 1750 | 600 | 2350 |
| Hill | 750 | 600 | 1350 |
| Terai | 1000 | - | 1000 |
| Mid-Western | 500 | 270 | 770 |
| Hill | - | 220 | 220 |
| Terai | 500 | 50 | 550 |
| Far-Western | - | 210 | 210 |
| Hill | - | 210 | 210 |
| Terai | - | - | - |
| Nepal | 8150 | 1805 | 9955 |
| Hill | 1350 | 1755 | 3105 |
| Terai | 6800 | 50 | 6850 |

## 6. Seed Sale

AIC sold a total of 12222 m.t. of paddy, wheat and maize seeds during the fifth Five Year Plan (Table 8). It should be noted that the amount of improved seeds sold by AIC is very insignificant as compared to the total area under cultivation. About 4222 m.t. of paddy, maize and wheat seeds were sold by AIC during the first two years of the sixth Five Year Plan against the targeted amount of 8125 m.t. (Table 9). In this context much has yet to be done in order to cover the plan target. The demand of wheat seed during 1982-83 has indicated some hopeful signs. About 5000 m.t. of wheat seeds was collected and distributed by AIC during this fiscal year.

Table 8

DISTRIBUTION OF IMPROVED SEED THROUGH AIC DURING FIFTH FIVE YEAR PLAN*

(m.t.)

| | Crop | 1975-76 | 1976-77 | 1977-78 | 1978-79 | 1979-80 | Total |
|---|---|---|---|---|---|---|---|
| 1. | Paddy | 184.00 | 259.00 | 300.00 | 256.00 | 306.00 | 1405.00 |
| 2. | Wheat | 1727.00 | 1811.00 | 2098.00 | 2073.00 | 2471.00 | 10180.00 |
| 3. | Maize | 145.00 | 106.00 | 145.00 | 91.00 | 150.00 | 637.00 |
| | Total | 2056.00 | 2276.00 | 2543.00 | 2420.00 | 2927.00 | 12222.00 |

* The figures have been rounded.

Table 9

DISTRIBUTION OF IMPROVED SEED BY AIC
DURING SIXTH FIVE YEAR PLAN

| | Crop | 1980-81 | | 1981-82 | | 1982-83 | | 1983-84 | | 1984-85 | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | T | A | T | A | T | A | T | A | T | A | Target |
| 1. | Paddy | 400 | 205 | 450 | 243 | 525 | - | 625 | - | 750 | - | 2750 |
| 2. | Wheat | 3100 | 1516 | 3500 | 2218 | 4000 | - | 4600 | - | 5400 | - | 20600 |
| 3. | Maize | 300 | 105 | 375 | 135 | 450 | - | 550 | - | 700 | - | 2375 |
| | Total | 3800 | 1826 | 4325 | 2596 | 4975 | - | 3775 | - | 6850 | - | 25725 |

T = Target

A = Achievement (during the first 2 years of the plan period).

# SEED QUALITY CONTROL PROGRAM IN NEPAL

K.L. Rajbhandari,
Seed Technology and
Improvement Program
Khumaltar

## Introduction

Importance of using high quality seed of improved crop varieties need not be elaborated at this august gathering. Everyone is quite aware of the fact that satisfactory harvest frequently depends on the quality of farmers' planting seed. Thus, the seller and the government are both responsible for ensuring and maintaining high quality seed.

Seed quality is usually a composite of several factors such as (a) analytical quality (b) genetic quality (c) physiological quality (d) health quality. These factors are vulnerable to changes in every stage of the seed production program. Hence, concern for quality cannot be left to one person or a single organization, it must pervade every aspect of the seed program from the national commodity programs through initial seed increase and to all subsequent production, drying, processing, storage, handling and distribution activities. However, as an official mechanism for ensuring and maintaining high quality in seed, governments usually take three quality control measures i.e., testing, certification and legislation on seed marketing in sequence depending upon the stage of seed program development. HMG, Nepal has already started the first two control measures i.e. seed testing and certification under one agency named Seed Technology and Improvement Program (STIP). The organizational set up and the activities of STIP are highlighted in this paper.

## Organizational Set-up

Seed Technology and Improvement Program in the Agriculture Botany Division is recognised as a separate project from this current fiscal year (1982). The main objectives of the program are:

- to help assure and make available high quality seed through seed testing, field inspections and seed certification services.
- to undertake seed research at practical level on problems encountered with quality aspect from production through distribution.
- to protect ligitimate seed business as well as farmers against unscrupulous practices and to assist producers and suppliers improve seed quality.

The first seed testing laboratory, now Central Seed Testing Laboratory under this program, was established in the year 1962 in the Agronomy Division to take care of the quality of seed distributed by the Division. It is also accredited to ISTA (International Seed Testing Association) since 1964. The present set-up of the organization is presented in Fig. 1.

Under this broad program, separate units such as Seed Testing Unit, Seed Certification Unit, Seed Research and Training Unit have been identified to meet with the increased demand of quality control services and ultimately to achieve the above said objectives.

To overcome the constraints relating to seed testing and field inspection services, four additional laboratories have been set-up during the Fifth five Year Plan. Out of these, three are recognized as regional laboratories and are responsible for providing the above said services to the respected regions. The central laboratory being in the central region, one in the same region is recognized as satellite laboratory according to the organizational set-up. The organizational set-up of the regional program is given in Fig. 2.

These laboratories are located at Tarahara Agriculture Station, Biratnagar (East), Bhairawa Agriculture Far, Bhairawa (west) Nepalgunj Agriculture Station, Khajura (mid-west) which are very close to AIC processing plants. These are under the technical guidance and supervision of central program and are within the administration of respective station farms. However, the satellite laboratory at Hetauda is under central control.

## Present Activities

### Seed Testing:

Seed testing laboratories have been providing services to the Agriculture Input Corporation, farmers, co-operatives and so on. To cope with the increasing demand for seed testing, an additional building at the centre is under construction under AIC/SPIS Project. Seed testing in all the laboratories is carried out according to ISTA rules except in crop species not covered by ISTA methods in which case studies are carried out and tests are done according to the finding.

Seed testing services are provided for:

1) Determination of pricing value of seed for procurement by AIC.

2) Determination of planting value of seed.

3) Determination of disposition of seed by AIC.

4) Final judgement in seed lot eligibility for certification.

5) Evaluation of research.

Samples are received all the year round in the central laboratory. The average number of samples tested for last five year is 2500 samples per annum. Out of these 60 percent are for germination test, 30 percent for complete test and 10 percent for moisture only. This covers the cereals wheat and maize (33 percent each) rice (12 percent) vegetable 14 percent) pulses (4 percent) and others (2 percent). However, a large number of samples of vegetable crops are being received from the last two years.

In other laboratories the samples received vary from 400 to 800 depending upon the size of the seed multiplication program. The samples tested are mostly cereals. Regional activities peak in May-July (Wheat and Maize) and September-November (rice). During the slack period the staff are used for field inspections.

The system followed in the laboratory is illustrated in Fig. 3.

Seed tests provide information on pure seed, other crop seed, inert matter, weed seed (kind and quality) normal and abnormal seedlings, fresh or hard seed and dead seeds, However, biochemical test with tetrazolium, 1000 grain weight test, vigour test by accelerated aging and moisture test are executed when requested or if relevant to an investigation. Seed health tests are done at Plant Pathology Division and Entomology Division.

For standardization and uniformity in seed testing between laboratories, referee tests are run from time to time. About 10 per cent of the total samples tested in each regional and satellite laboratories is tested in the central laboratory as a check.

Seed Certification Activities

Seed certification was launched in 1972-73 in wheat seed procured from India through TDC (Terai Development Corporation); since then our need is met with local seed multiplication program. Before that, AIC had to import as much as 1800 mt. of wheat seed.

Seed certification though run officially is still on voluntary basis. It is mostly confined to wheat followed by maize and rice. It is limited to certain terai districts only. It is run on a generation system whereby the pedigree of superior crop varieties is maintained through vigorously controlled stepwise multiplication in order to maintain genetic purity of the variety until it is absolute. Besides genetic purity other qualities such as analytical purity, germination etc. are also assured. It is one of the tools of providing consistently high quality seed in adequate amount. Certification is not the same thing as seed multiplication but surely the way to accomplishing quality in the seed produced. It is concerned with how seeds are produced not with who does the production.

Minimum standards for certification for different crops (Appendix 1-2) are approved by the Central Seed Production Committee but are flexible. Certification activities are carried out according to the prescribed standards.

Three grades of seed are recognized after breeder seed. They are foundation, certified generation 1 and 2 followed by improved seed. Improved seed is intended to be replaced by certified seed gradually.

Field Inspections:

They are carried out mainly to help assure isolation, varietal purity, freedom from seed-borne diseases and noxious weeds to meet the prescribed standards. Inspections are done according to the prescribed procedure.

Application forms are expected to be received from the respective stations, farms and AIC with one month of planting. Inspection schedules are prepared according to the information received. Inspection service is also provided to improved seed multiplication fields raised from a known source of seed, particularly in case of shortage of certified seed.

At present, about 600 ha are covered annually from centre and 100 ha to 400 ha each are covered by other laboratories depending upon the size of seed multiplication. 10 percent of the hectarages covered by other laboratories are sample checked from the centre. In case of agriculture station and farms inspection of foundation seed is carried out from the centre to avoid bias and conflict. Peak work loads occur in Jan-May (wheat and winter maize). There is not much pressure in rice and summer maize as they are limited to foundation seed multiplication only.

At least two inspections are done in wheat and rice; first during flowering and the second between dough stage and maturity. In case of maize three inspections are done; first during tasseling, second after maturing and the third before cob shelling. However, the third inspection some times is left to AIC itself.

After final inspections, reports are mostly given to concerned offices directly. Threshing floor inspection though attempted has not regularized yet.

Seeds from the certified crop are collected by AIC. Samples for premium payment and procurement are drawn from each farmers lot at the receiving point in AIC or during processing. However, representative samples for seed testing and labeling are drawn during processing from each lot according to the prescribed sampling procedure. Labels are issued to attach to the bags after processing but before analytical results are known to facilitate processing and warehouse procedure except in case of a questionable seed lot. Seed lots failing to achieve standards have the labels removed by AIC directly or under the supervision of STIP staff. Final testing is still at the central laboratory as the

certification is centralized. However, it will be shifted to the regions in the future.

Attempts are made to maintain or trace the seed source of all gradesu under the certification scheme. As mentioned in the prescribed standards different colour labels (white for foundation seed, white with blue band for certified seed - 1 and white with green band for certified seed -2), are used along with the information on tag number, lot number, kind, variety, year of production, minimum certification standards and the germination test. Improved seed has a yellow colour label and the minimum standards are given on 100 gm. weight basis. The test is valid upto one season provided the polylined bags are intact otherwise it needs to be repeated for revalidation.

Inspection of warehouses is also carried out. Most of the warehouses and seed plants inspected are found to be infested with weevils. It was discussed with concerned personnel at site for better management. However, some of them were found to be well-managed with proper seed lot identification.

When the field inspection reports of last few years are compared, improvement in the field quality standards is observed. Few years back, most of the seed fields had to be rejected because of varietal mixture, poor performance and so on. The slight improvement of varietal maintenance in wheat, in particular, has certainly eased the field inspection work in the subsequent crop. However, much needs to be done to increase the volume of foundation seed. The only disappointing factor is the out break of rust in RR 21 variety from last few years.

It is envisaged that in the near future the doubtful samples of certified seed will be planted in a control plot to check the genetic purity of lots. Such field plots will also be used in assessing and approving seed from that lot for the next generation of seed.

Seed Research

Studies are undertaken on seed problems that have practical implications for all aspects of seed quality.

Maintenance of germinability of various crop seeds in the ambient storage conditions and during transportation is felt a critical problem as there is a big variation in environment from the plain terai to hills and higher hills. Through a number of studies undertaken on this aspect, the following recommendations have been made to retain germinability of seed lots during storage and transportation.

1. Gunny sacks with 250 gauge of polythylene lining and maximum 12 percent seed moisture level is recommended for the safe storage of wheat seed upto two planting season for Kathmandu and similar environment.

2. Any type of packaging material but below 13 percent moisture level is recommended for rice and maize in the same environment but in case of maize for beyond that period the recommendation is same as in wheat.

3. Gunny sacks with minimum 250 gauge of polythylene liner and tin cans with seed moisture content below 12 percent are recommended to be safe for the storage of winter maize upto 510 days in Rampur and similar environment.

Studies in mung bean are continued.

After determining safe device for carrying-over wheat seed, a field experiement was conducted on the basis of which it is recommended that wheat seed aged upto 30 months but with average germination about 90 percent can be used safety without significant loss in yield.

Recognising the problem in identifying the improved varieties of various crops, studies on the morphological and agronomical characters were undertaken. Information on improved varieties of wheat has been developed.

Current studies are focused on optimum time of harvesting of various crop Similarly, realizing that most farmers use their own seed, a drill box survey has been undertaken in 10 districts in the central and western regions with the objective of finding the quality of seed used by farmers and their practice of storing seed. This investigation has the financial support of AIC/SPIS Project. Other two regions will be covered next year.

Problems noticed during seed testing are immediately taken care of. Many studies have been undertaken to determine the duration and intensity of dormancy in crop species and varieties to expedite the testing in time. Dormancy is observed especially in vegetable seeds such as Brassica Juncea var. Nepali rayo and Allium cepa and they show different dormancy behaviour in the seed produced under different micro-environment. Similarly, studies are conducted on testing methods of various crop seeds not covered by ISTA rules.

Testing procedure recommended for some of crops not covered by ISTA rules are given in Appendix 8. Survey and surveillance of weeds associated with crops are being carried out since last few years. Weeds associated with wheat crop in Kathmandu have been published. The weeds associated with other crops in Kathmandu valley and other areas are also available for reference. The work is continued.

The future research work will be concentrated in all the above mentioned aspects.

## Training

Another important activity is training. Training on seed testing methods, sampling, field inspections and other areas of seed is given from time to time to personnel from AIC, regional laboratories and the seed growers. To ensure flexibility, even the analysts are trained in a comprehensive way so that they can carry out all the tests undertaken in a laboratory. More emphasis will be given in future to different aspect of quality seed production and seed testing in general and sampling of seed in particular.

One of the main activities of the centre will be to work on the preparation of mannuals for seed testing, sampling, field inspection and so on and the standardization of methods of seed testing, field inspection and finally seed certification.

## Problems/Suggestions

### Seed Testing:

All the seed testing laboratories are not always in a position to provide timely services due to various reasons such as inadeuqate laboratory facilities, poor transportation and communication. All the tests are not carried out in one laboratory which creates problems of decision on overall quality of a seed lot in time. Improper sampling of seed-lot is also a critical problem. Considerable efforts have been made to overcome these problems and they need to be continued.

- Adequate laboratory and storage space should be provided in the seed testing laboratory at Tarahara to facilitate the testing activities. The regional laboratories should be equipped to cope with the increasing demand of testing. Satellite laboratory should be established for the hills considering the distance and the size of seed multiplication program.

- Routine testing on seed health should be carried out at least in the central laboratory. It is advantageous to have all routine testing services centered in one laboratory. In that case, only one set of sample need to be submitted which will save expense. At the same time it will help to give decision on overall quality aspect of a seed-lot in time. However, the Pathology Division should support training of the technicians and provide guidance from time to time. Problem samples must be referred to that Division.

- In order to realize the real value of testing, the submitted sample should truely represent the seed-lot sampled. The importance and responsibility of the sampler is indicated even in the analysis report. Sampling errors can be overcome by training the personnel responsible for sampling in the central seed testing laboratory and only the trained personnel should be used.

- The routine work of the seed testing laboratory should be supported by seed technology research and the concerned research Division at Khumaltar.

Field Inspection:

Monitoring seed field at the crucial growth stages of the crop is often a constraint because of limited manpower and uncertain mobility. The work is likely to increase manifold with the extension of certified seed production. Faulty application for inspection without detailed information sometimes creates problem of locating all the seed production fields for timely inspection. Scattered seed production fields are not conducive to timely monitoring and field inspection with limited manpower and mobility. Moreover identification of the newly released varieties is sometimes a problem because of inadequate information on diagnostic characteristics.

- There should be adequate manpower with mobility to match with the expansion of seed multiplication program. It is equally important to have vehicles at the disposal of the field inspection staff for timely inspection.

- Field inspection service is also one of the means for educating the farmers in improving the seed production technique for obtaining maximum yield of high quality seed.

- Emphasis should be given in forming certified seed production villages in certain potential areas in different regions.

- Adequate information on some of the morphological and agronomic characteristics should be provided with an authentic seed sample along with the release of the variety to STIP. It is also recommended that breeder should guide the inspector about the variety in the standing crop before it is pushed in the seed multiplication program.

- Varietal characters should be studied in a control plot.

Seed Certification

Seed certification, though realized as the means for developing a quality seed production program is still limited in application due to reasons such as inadequate breeder seed and foundation seed, inadequate extension measures to promote the newly released varieties, lack of acceptance of some of the released varieties, limited seed supply and no official release of varieties in vegetables crops.

Quality assurance in certified seed is sometimes difficult because of improved and certified seed production program concentrated in the same area. It is really rendering quality control impossible in the

field as well as in the processing plant. Other aspects bearing on quality control include, lack of drying facilities at the farmers level particularly in winter maize, improper sanitation in the processing plant and warehouses and weak management in seed handling and storage, and inappropriate packaging material and its size.

- Under national commodity program, a Varietal Maintenance Unit should be established and a specialist with knowledge of plant breeding as well as varietal maintenance should be deputed. Physical facilities should be provided.

- Seed processing plants constructed at the agriculture stations/farm should be brought into operation without delay for timely supply of foundation seed. Jhumka farm is so far the only seed multiplication farm in the country solely opened with a purpose of production of foundation seed. Necessary investments should be made to establish the farm with basic improvements such as land levelling, good irrigation and drainage system, proper harvesting, threshing, precleaning machines and, if necessary, drying, conditioning and storage facilities. It should be run under good management of an experienced seed technologist. The farm can serve as co-ordinating centre for foundation seed. Only our effective performance of this farm will justify the establishment of such farms in other regions of the country.

- Breeder seed of a particular variety (depending upon its acceptability) should be adequate to fulfill the demand of the general farmers for certified seed within 2 to 3 years of release. Buffer stock of foundation seed should be maintained for systematic seed multiplication program.

- There should be an extension drive for the newly released varieties. And such varieties should be pushed for seed production for adequate supply of better quality seed.

- Vegetable crop varieties commercially grown should be officially released and should enter into certificate program.

- Certification should be run extensively in the terai and the inner terai as these areas already have the requisite infrastructure including experienced seed growers, field inspection services, processing plants etc. Improved seed production should be run in the hills till seed supply increases.

- Loss of field certified maize seed due to poor germination can be avoided by collecting ear maize. Screening and drying should be done at the Hetauda seed processing plant and for this purpose the dryer should be brought into operation.

- Plant operators, storekeepers as also the officers should be educated about the importance of sanitation and proper management of the warehouse so that they will realize important their job is to AIC and to the seed program. It is the understanding of the problem that is most important.

- The present poly-coated gunny sack used by AIC should be replaced by an improved one. For this purpose, finding of the research should be considered.

- Because of the inappropriate size of bag, particularly in maize, certified seeds are often sold loosely. It could be avoided by using desirable size of bag for certified seed, so as to plant half an hectare per bag.

General Suggestions for Quality Assurance Program

- Central Seed Production Committee (CSPC) should be more strong and effective and should co-ordinate all supporting components of the seed program. It should be made responsible for the development of seed program.

- CSPC should formulate minimum standard for seed in different commodities not covered by certification on a priority basis. STIP, the concerned commodity program and research divisions should help CSPC in this matter.

- High quality seed (foundation or at least certified generation-1 seed) should be provided to the hills for improved seed multiplication.

- A lot system to identify seed-lots should be established.

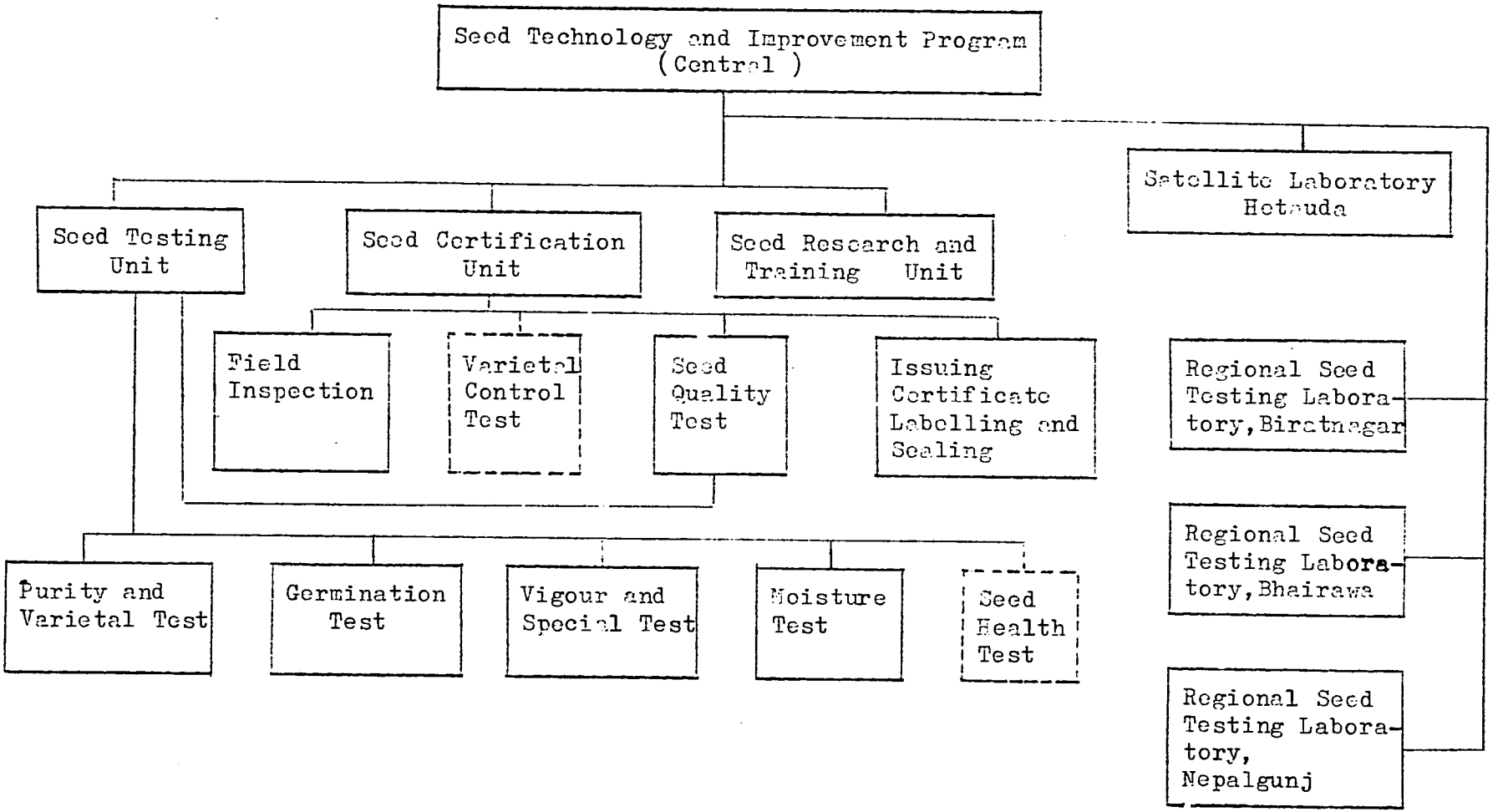
It is a system through which the ultimate objective of providing consistently assured high quality seed of improved varieties can be achieved. Varietal improvement in many crops should occur before seed supply efforts make a significant contribution. However, continued progress on both fronts is needed to properly serve our farmers.

The organizational set-up of STIP in the centre and in the region needs to be strengthened with qualified manpower, physical facilities and mobility to cope with the development of seed program.

Assurance and maintainance of seed quality must be a team approach by all those concerned and dedicated to seed quality. A strong co-ordinating body is very important. The failure of weakness in any component of the seed program will paralyze the whole thing. It is high time that a team of experts should be formed which should critically review the existing constraints of the seed program and recommend future approaches.

Figure - 1

ORGANIZATION OF QUALITY CONTROL PROGRAM




——————— On-going activities

- - - - - - - - - - - - - - Proposed activities

Figure 2

REGIONAL SETUP OF QUALITY CONTROL PROGRAM

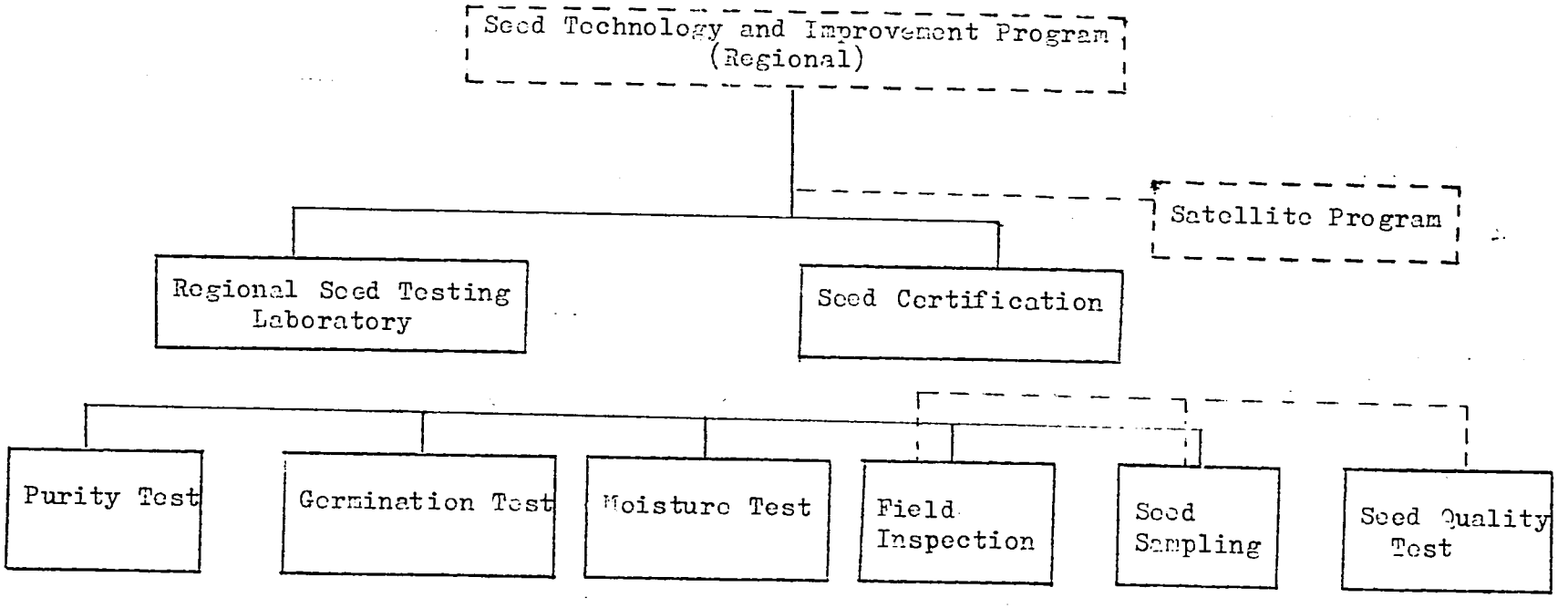
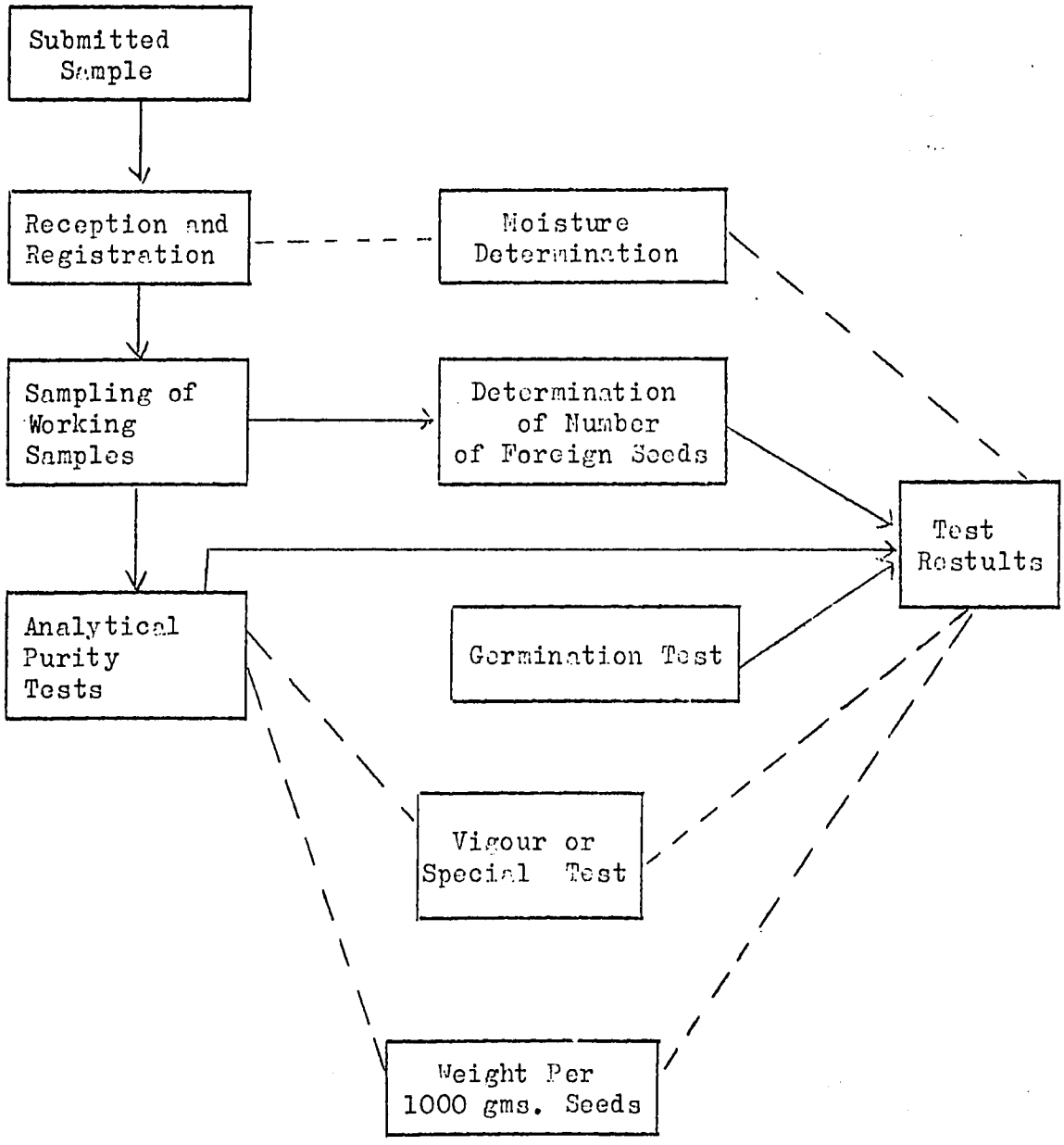


Figure 3

STEPS IN SAMPLE HANDLING IN THE LABORATORY



Appendix 1

**Minimum Certification Standards for Paddy, Wehat and Barley**

1. Certification will be applicable only to those varieties approved by Central Seed Production Committee. Agriculture Botany Division only is authorized for certification.

2. All classes of seed multiplied under this program should have an established seed source. One must be in a position to submit the documentary evidence, like certification tag or sales record when demanded by the certifying body.

3. In case of paddy, the crop will not be eligible for certification if planted on land on which the same kind of crop was grown in the previous season, unless the crop in the previous season was grown from seed of certifiable standards.

4. Field inspection:

   a) A minimum of two inspections will be made, one just prior to flowering or during flowering and the other at maturity but before harvest.

   b) Farmers shall be advised to maintain the field standards during first inspection in case of those fields which can be corrected.

   c) Seed inspectors should cover the field crop as thoroughly as possible and must do impartial evaluation.

5. Minimum field standards:

   a) Minimum area of a specific variety eligible for certification shall be about a hectare in terai and 0.5 ha. in the hills. It may be owned by an individual farmer or a group of farmers. But in any case, the land must be uniform and seed must be of same source.

   b) An isolation distance of minimum 2 meters shall be provided all round a field to separate it from fields of other varieties and minimum 1 meter isolation shall be provided all round to separate from fields of other crops to avoid admixture.

   Special note (For wheat and barley)

   Whenever possible an isolation distance of 150 meters shall be maintained for seed fields of varieties susceptible to loose smut, from surrounding fields infected with

loose smut. Thorough roguing of complete plants infected by this disease should be done in the seed field as well as the adjoining area of 150 meters distance as soon as the infection can be detected but before the seed field comes into flowering. Infected plants and heads shall be burned or otherwise completely destroyed as to prevent further infection.

c) Specific field requirement (Crop purity)

| Factors | Foundation Class | Certified Class |
|---|---|---|
| 1. Off types (Max) | 1/2000 earheads | 4/2000 earheads |
| x2. Other crops (Max) | 1/2000 " | 6/2000 " |
| *3. Weeds (seed bearing stage) (Max) | 1/2000 " | 2/2000 " |
| +4. Disease transmissible through seed or affecting plant quality (Max) | 1/2000 " | 4/2000 " |

x for wheat: Barley, Oats, Gram

* Weed seed indistinguishable or inseparable with the available cleaning equipment e.g. Wild Oat, Bindweed.

\+ for Wheat and Barley: Loose smut.

d) Seed growers under this program shall strictly adopt the improved cultural practices. These fields shall show evidences that precautions have been taken to do roguing, weeding and so on prior to field inspection.

e) In case of appearance of new diseases, pests or weeds, representative samples should be sent to nearest concerned laboratory for examination and identification.

6. After final inspections, reports of the field standards will be made available to the concerning offices.

7. Seed inspection:

a) One or more inspections of harvested lots of seed from inspected fields shall be made at any time during threshing, cleaning process and in storage. A lot shall be rejected if not maintained properly.

b) Seed shall be treated with recommended fungicides and insecticides.

c) A representative sample of each lot of seed should be drawn by seed inspectors and submitted to seed testing laboratory for complete analysis.

c) Specific seed requirement

| Factors | Foundation Class | Certified Class(1st) | Certified Class (2nd) |
|---|---|---|---|
| 1. Pure seed (Min.) | 99% | 97% | 97% |
| 2. Other crop seed including other distinguishable varieties (Max.) | 2/100 gms | 6/100 gms | 15/100 gms |
| 3. Total inert matter (Max) | 2% | 2% | 2% |
| 4. Weed seed (Max.) | 6/100 gms | 15/100 gms | 25/100 gms |
| 5. Germination (Min.) | 85% | 85% | 85% |
| 6. Moisture (Max.) | | | |
| Paddy | 13% | 13% | 13% |
| Wheat | 12% | 12% | 12% |
| Barley | 12% | 12% | 12% |

8. Tagging, labelling and sealing

All seed sold as foundation or certified class of seed shall have certification tag affixed to each container.

a) Colour of tag

Foundation class - white

Certified seed - Blue or blue band on one end (1st generation)

Certified seed - Green or green band on one end (2nd generation).

9. Validity of tag

Shall be for one season if properly maintained.

## Appendix 2

### Minimum Certification Standards

Maize (Zea Mays)

The general seed certification standards will be the same for all the crops, and the following specific standard are to be taken into consideration for maize:

1. Maize is an open-pollinated crop; for certification it must be produced from a known source seed so that its identity may be assured and approved by Agriculture Botany Division.

2. It shall be ear-inspected after maturity.

3. The entire hectarage should be of only one specific variety.

4. Minimum two field inspections should be made.

5. Field standards

   a) Unit of certification-about 1 ha. in terai and 1/2 ha. in the hills.

   b) The seed field must be so isolated that it is not less than 300 meters from other kind of maize in case of foundation seed and 200 meters in case of certified seed; isolated of 1 meter from other crops.

   c) Time isolation-at least two weeks interval of planting between varieties.

   d) A field which contains at any one inspection more than 1 percent of definite off-type plants that have shed or are shedding pollen when 5 percent or more of the desirable plants in the field have receiptive silks shall not be certified.

   e) Farmers under contract for seed production should adopt improved cultural practices.

   f) In case of any diseases or pests or weed plants, representative sample should be subjected to laboratory examination in the nearby laboratory.

   g) Inspectors should complete the field inspection report form and send to the concerning offices.

6. Seed and laboratory inspections

a) One or more inspections of harvested lots of seed from inspected field may be made by Agriculture Botany Division during seed cleaning process and can reject a lot if found mishandled or mislabelled.

b) Seed must be treated with a recommended insecticide and fungicide.

c) A representative sample of seed should be obtained and submitted to the central seed testing laboratory by seed inspectors.

7. Seed standards

During ear inspection a lot should not contain in excess of 1 percent of definite off-type ears in foundation and 2 percent in certified seed.

| a) Factors | Class of Seed | |
|---|---|---|
| | Foundation | Certified |
| 1. Pure Seed (min) | 99% | 98% |
| 2. Other crops seed including other varieties (max) | 0.2% | 0.5% |
| 3. Total inert matter (max) | 2% | 2% |
| 4. Weed seeds (max) | 0% | 0% |
| 5. Germination (min) | 85% | 85% |
| 6. Moisture content (max) | 12% | 12% |

b) Shelling of the seed ears should be done only after inspection.

8. Seed sold for seeding purpose should carry the following tags:

Foundation - White
Certified - White with about an inch blue border on left side.

9. Validity of tags: Will be valid only for one season if properly stored.

# TOWARDS A STRONGER SEED PROGRAM

S.S. Bal
SPIS Project Supervisor &
B.N. Kayastha
Chief, Seed Division, AIC

## ABSTRACT/SUMMARY

Any strategy to increase food production is likely to remain incomplete without the supply of quality seeds to farmers. So, seed supply is an essential service. But it can be provided only if we build a powerful seed program. The mechanics and components of a seed program have been discussed in this paper.

Recognizing the past achievements and future needs, the authors have traced some flows in the on-going seed system and made positive suggestions for improvement.

Since it takes time for a seed program to develop, tomorrow's seed problems can be more confidently addressed if steps in the right direction are taken now. Therefore, attention/action on the following points is recommended:

1) adequate arrangements for foundation seed should be made,

2) specialized seed institutions for certified seed, in public or private sectors, are vital and they should be developed,

3) AIC handles certified seed and grain-seed at the same time raising questions about quality and credibility,

4) a rational policy on seed subsidy is necessary for a healthy seed program development,

5) there is a need to establish seed technology courses at the IAAS for undergraduates and also a training centre for in-service training under the Department of Agriculture,

6) seed marketing strategies need to be reviewed so as to bring the seed supplier (AIC) in direct touch with the farmers, improved transportation, seed promotion and seed handling at the retail level. Moreover, the extension workers should use certified seed as the vehicle for technology adoption by farmers,

7) seed storage needs improvement in term of capacity, design and management,

8) the hill seed program should receive special sympathy and support as it is a promotional activity to serve the small farmers,

9) AIC should exercise internal quality control on the seed supplied to farmers, apart from certification,

10) more intensive use should be made of the seed testing and certification services that already exist.

1. Definition

A seed program may be defined in a number of ways. But, simply put, it is a means of ensuring maximum use of improved seed in a country so as to promote agricultural development. Without a dependable seed program, efforts made in crop research can bear no fruit. Therefore a well-considered seed strategy must be evolved and carefully pursued in the right direction and to serve the desired goals.

2. Importance of good seed

If there is anything for the farmer, of the farmer, by the farmer, it is seed. Good seed is the key input in modern agriculture. Or it is dependent the effectiveness of other farming inputs. The fruit of all plant breeding research is seed for it is seed that stores the highest genetic potential for yield.

It is an irony, however, that despite being an acknowledged instrument of change, the essential catalyst and the cheapest ingredient in agriculture, seed is often the most neglected component The reason is not far to seek, for there exists a so-called alternative to good seed - "the grain-seed" or the seed of convenience. Many of us tend to side trace the vital seed issue by believing tha a majority of the farmers do keep their own seed anyway, as a tradition, and hence why worry. Whether that situation is conducive to increased production or not is for the policy makers and planner to ponder and decide. The undisputed need, of course, is that the organized seed supply sector must pump in more and more improved seed of the new, superior varieties into the nation's fields every year and this step alone could boost the productivity to an appreciable extent. A real breakthrough would be possible, indeed, if alongwith good seed, superior crop varieties, good agronomy, irrigation, credit, fertilizer, pesticides, remuneratives prices etc. are also assured to farmers. The old adage "as you sow, so shall you reap" speaks volumes in support of good seeds importance in agriculture.

3. Desirable replacement frequency

It is a common knowledge that the seed of a hybrid variety should be always renewed because in the F2 generation the hybrid

combination tends to disintegrate. The self-pollinated varieties do not behave this way. With little care, they may not "run-out" for years. A limited generation plan of seed multiplication is advocated for cross-pollinated varieties and composites, as in maize, because natural out-crossing fast interferes with their genetic make-up.

The question usually asked is how often farmers should change the seed of a variety of wheat or rice; once in 3 or 4 or 5 or 6 years or when ? Admittedly, sooner the better, in so far as it is practicable. Once in four years is the general thumb rule. This means covering 25 percent of the crop area with improved seed every year as a national policy to be implemented through a reliable seed program. The actual coverage will, however, be dictated by factors such as release of a better variety, the useful life of the on-going varieties, effectiveness of the steed supply system, seed price, quality assurance and natural conditions effecting farmers' own ability to keep seed for the next crop and a host of other factors.

4. Qualities of good seed

Yet another point often raised is about the benefits of improved seed, the seed that an average farmer himself is unable to produce and hence must obtain from an organized seed production system. In the real sense, a seed is not improved unless it possesses the following virtues:

1) Improved seed of a superior variety,

2) genetically pure,

3) high germination and seedling vigour,

4) free from seed-borne diseases,

5) free from insect pests,

6) free from admixture of other crop seeds and inert matter,

7) free from weed seeds,

8) healthy, plump and lusterous,

9) well-dried, processed, treated and packaged,

10) supplied in convenient-size bags, with a leaflet of recommended cultural practices,

11) properly labelled (and sealed),

12) made available recurrently at the right time and at a fair price.

For the achievement of so many seed qualities, there has to be systematic and organized seed production program supported by a strong quality control system. Then alone farmers' needs can be served as they should be.

There is no doubt about the immense advantages of using an improved seed variety. The improved varieties do have the potential to give 15-20 percent more yield, besides other desirable benefits, as determined in the comparative field trials conducted by the research workers. Under optimum conditions with good fertilization irrigation and agronomy, however, the maximum yield of a high yield ing variety could be even more. This is often experienced in demonstration plots and also in the fields of progressive farmers.

But, supposing, a good variety of a field crop such as RR-21 wheat has established itself on a large area and most farmers do have its seed, would they be able to obtain better yield simply by replacing with improved seed ? Experimentation on this aspect elsewhere has shown an average yield advantage of 8-10 percent due to seed per se. The primary reason for such an increase possibly is better and uniform crop stand in the field. Incidental to it, some saving in seed rate is also possible due to high germination of good seed. Seedling and crop protection by seed treatment can also ensure a substantial gain in yield, as is the case with Vitavax treatment of improved seed in the hills. Control of noxious weeds and seed-borne diseases in the country as a whole is not possible without the use of clean, healthy and certified seed.

For this very reason most countries have established seed certification and plant quarantive services. People engaged in agro-industries using farm produce as the raw material are conscious and demanding about the quality of the material they use. Only through the use of good seed for raw material production, a manufacturer of agricultural goods can hope to make profits and satisfy the consumers' preference and taste with his product. This is very true for industries connected with sugar, textile, edible oils, jute and food preservation.

Thus it can be safely concluded that if seed is realy improved in terms of all the before-mentioned qualities, it is no less than gold in value. Even improvement in terms of a single parameter like germination can ensure enormous benefits to the nation's agriculture. It is rightly said - good seed does not cost, it pays. Seed cost is usually a small element in the total production cost of a farm. Improved seed supply must be given a high priority.

5. Is seed certification necessary ?

Seed certification, in simple words, is a third-party check on quality and hence a means of confidence to the end-user. Obviously, therefore, all improved seed should be certified. Such seed is fi field-inspected for genetic purity and laboratory-tested to meet with the prescribed quality standards. Certified seed helps in generating seed quality consciousness not only among the farmers but also among the seedsmen themselves responsible for producing, handling and distributing quality seeds. Hence the strength of a good seed program should be judged by the extent of certified seed supply and not merely by the tonnage of ordinary planting material. In a new and developing seed program, the adoption of such a criterion would result in qualitative improvement of all departments of the seed program in the long run and hence seed certification should be emphasized as a policy. Seed certification is linked with production and marketing (From Douglas, J.E.).

6. Components of a sound seed program

A strong research base combined with a reliable extension system is to be seen as the pre-requisite for a program of seed development. Next to that, in the service of farmers, a set of professional seed institutions ought to be developed because seed is a living and precious commodity to be handled with specialized care. In short, we need a multi-disciplinary set-up in the formation of a national seed program. Included in this set-up should be:

1) National seed committee functions,

2) initial seed increase and maintenance breeding, arrangements,

3) an organization for foundation seed,

4) quality control systems,

5) establishment of enterprises for the production, drying, processing, packaging, storage and distribution of improved seed,

6) national pricing policies and marketing mechanisms,

7) promotion, publicity and extension for seed,

8) seed technology research to solve practical problems,

9) seed technology educational programs for generating technical personnel,

10) seed legislation and control for consumer protection,

11) a linkage with international agencies to facilitate seed trade and upgrade the available expertise.

12) above all, a complete and responsive infrastructure in terms of foundation seed farms, seed drying and processing plants, seed testing laboratories, and seed stores to cope with the program needs.

*Components of a Seed Enterprise, their Functions, and Supporting Components

| Components | Function | Supporting Components |
|---|---|---|
| ADMINISTRATION | | |
| Shareholders/Members Forming the Seed Enterprise | Provide share capital, may produce seed if shareholders/ members operate farms | |
| Governing Body | Determine policies; make important decisions; approve budget; responsible to members of shareholders | |
| Manager | Chief executive officer to implement policies and decisions of governing body | |
| Finance | Responsible for initial budget preparation, receipts payments and accounts | Bank and other credit sources; credit for seed enterprises, seed growers, and farmers using seeds. |
| RESEARCH: PRIMARILY GENETIC RESEARCH (Optional) | Development and testing of varieties plus limited agronomic research | Crop improvement research: responsibility for government, including both genetic and agronomic research. |
| SEED PRODUCTION Management | Responsible for all seed production processing, and storage | |
| Field Operations | Arrange all seed growing, perhaps including seed stock, guide and supervise seed growers | Seed stock supply, may be supplied from public research program, a special agency, or by a unit of the enterprise. |
| Processing | Drying, cleaning, sizing, treating, and bagging seed. | |

| Components | Functions | Supporting Components |
|---|---|---|
| Storage | Bulk and bag storage in production area and at end use area | |
| QUALITY CONTROL | Responsible for a through quality control system to assure buyer of a good quality product | |
| Guidance and Inspection | Guide seed growers and inspect seed at all stages to assure good quality seed production | Seed certification services; external control on genetic and physical purity to help assure buyer of good products voluntarily used by seed enterprise |
| Sampling and Testing | Sampling from field, processing plant, and storage facility to test and evaluate quality | |
| Marketing Control | Grow out tests of random samples to observe plant uniformity and check on effectiveness of the system | Quality control on seed sold; external control on seed quality, mandetory through legislation, a government responsibility. |
| MARKETING | Responsible for distribution, determining need, accumulating supplies, communication, distribution, and follow-through in the field. | Education: responsibility of government to extend appropriate technology to the farmer. |
| Distribution | Allotment and movement of seed to and use area | |
| Advertising and Publicity | Acquainting public with merit of product and encouraging purchase | |
| Sales | Wholesale or retail selling | |
| Follow-through in | Visits in the field before and after sales to know farmer's problems, to deal with complints, and to gather market intelligence. | |

* From "Successful Seed Program" - J.E. Douglas.

7. The role of private seed industry

In a developing country situation, the seed program primarily deals with open-pedigree public varieties. In reaching the seeds of these varieties to farmers, both public and private sectors have a vital role to play. The private seed enterprises are crucial in the area of seed multiplication, processing, storage and supply to farmers. Seed supply is a time-bound operation and it demands highest efficiency of management. Therefore encouragement to private seed industry alongwith the public sector would appear a step in the right direction. Farmers' interest can be served better by a competitive seed market operating in every nook and corner of the country.

Driven by profit motive, the private sector usually works hard and efficiently. For a government corporation, however, profit is not the only consideration. Meeting the policy needs and social obligations is even more important. So, the best is a blend of both. The seed policy should be so designed and followed as to protect the interest of all segments of a seed program to ensure a coordinated development in the overall interest of the farming community.

8. Farmers' seed exchange

It is to be admitted that natural spread of seed is a common phenomenon, especially in case of self-pollinated varieties. While the organized seed sector caters to a fraction of the seed demand, a considerably larger quantities of seed are exchanged, sold or bartered amongst the farmers. But, without the former the later might soon suffer a qualitative decay. Hence both deserve the fullest of attention. A farmers' own seed exchange program is important but should not be seen as a substitute or paracea for all the problems. If there is a good program of certified seeds supply farmers' dependence on own seed would reduce. Conversely, if there is a vacum and a weak seed program, then farmers have no alternative but to exchange own seed even if that is not the best thing to do.

9. Seed chain sequence

The initial seed of a new variety is usually very small. But it must be rapidly increased, sometimes enoumously, may be from 5 kilograms to 500,000 kilogram for planting. This increase necessarily comes through a series of multiplication steps accomplished over a period of 2-3 years. And that is not all, at the end of the multiplication process the varietal purity should also confirm with the prescribed level of quality. Obviously, there must not be a weak link in the chain from breeder seed to the last stage. Otherwise, the seed system may fail and loose credibility with a detrimental effect on production. Genetic

purity, freedom from admixtures, sound physical appearance and high field germination, besides fair price and timely availability, are important factors of concern to the end-user of improved seed. How can that be assured? Of course, through the establishment of a sound seed program in its entirely.

10. Neighbouring countries experience:

India may be considered as an example. In the last 15-20 years their program has achieved a noteworthy progress. Behind this is the fact that, as early as in the early sixtys, they recognized the need for strong seed institutions to cater to the supply of seeds of high yielding hybrids and varieties. Let's us examine their set-up in some detail.

Seed in India is the combined responsibility of the government, public and private sectors. A conscious effort is made to let them all flourish.

(A) Government Sector

Besides dealing with the policy issues and funding the promotional aspects, the government lends its support to the running of essential seed services. This sector includes the Central Seed Committee at the appex which functions through its sub-committees on (i) variety release, (ii) seed quality standards (iii) seed rules committee and (iv) the central seed certification board. The Seed Technology Division under the Indian Council of Agricultural Research performs research functions, operates the Central Seed Testing Laboratory which does referee testing for the 45 notified seed testing laboratories in the country and trains the seed analysis. The central laboratory is an accredited member laboratory of ISTA as are two more laboratories operated by the National Seeds Corporation and the Forest Research Institute.

The agricultural universities (21 in number) are also involved with the seed program through seed technology teaching, research and through the production of breeder and foundation seed. Included in the central sector is the pioneer organization, National Seeds Corporation (NSC) established in 1963.

In each of the major States, the set-up consists of a State Seed Corporation (SSC), an independent seed certification agency, a state variety release committee and the seed law enforcement agency.

The Seed Act 66 applies to whole of India. The Act requires truthfull labelling of all seed offered for sale. Minimum standards for such labelling have been prescribed and these are

kept somewhat lower than the certification standards. Seed Certification is voluntary but it is widely adopted as an assurance of quality. The government encourages the use of certified seeds, so much so that the official seed corporations deal with only certified seeds as a policy. In the event of unforeseen demand due to drought or floods, the government steps in to augment the seed supply with best available grain but, for that purpose, the services of Food Corporation and State Agriculture Departments are mobilized. This helps in maintaining the credibility of the seed enterprises as suppliers of nothing but good seed.

Seed subsidy is usually discouraged, the only exceptions in the past have been for Jute seed and seeds of pulses and fodder crops with a view to promoting the production of these special crops as an official policy. However, the subsidy is applied strictly to certified seeds and both public and private sectors are equally eligible to avail it as long as they supply certified seeds.

(B) Public Sector

Since agriculture is a priority sector for India to meet its growing food, fibre, industrial and export needs, seed supply is a matter of highest concern for the government. Resulting from this concern, statutory corporations dealing exclusively with seed have been established; the National Seeds Corporation at the central level and State Seed Corporations in 12 out of 22 States. The States that might eventually remain without seed corporations are those that are either too small or lack ecological suitability for seed production and storage. The NSC will, however, continue to fill their seed needs through its inter-state marketing program.

An important feature of the seed croporations is their emphasiz on organized marketing of seed through a large network of private dealers as well as own sale outlets. Most cooperative societies usually seem to shy away from seed marketing. The strategy for India's National Seed Program (NSP) is to reach the country's farmers with certified seed within a "bullock-cart distance". For this purpose, a strong delaers network is being created.

The NSC performs many functions. These are listed hereunder:

1. to provide leadership and ensure coordination for national seed program development.

2. foundation seed production, distribution and liaision with the research programs. For this purpose, in addition to its own three foundation seed farms, the NSC utilizes the resources available with the agricultural universities.

3. production and marketing of all seeds in the country,

4. inter-state marketing on behalf of State Seed Corporations,

5. organizing training courses for seed industry personnel,

6. undertaking and promoting seed export trade,

7. assisting the states that do not have seed production programs,

8. maintaining buffer stock of seeds.

The NSC organizes its own seed production with contract growers. It owns and operates many seed processing plants and storage units all over India. The NSC maintains its own internal quality control set-up in addition to subjecting all seeds to certification by the Certification Agencies.

The working of the State Seed Corporations, however, is on different lines. They are engaged in production, processing, packaging and storage of all seeds required within each state. They operate as service agencies of the private seed growers, who are the shareholders, and meet the administrative expenses through a minimum service charge on the sale price of seed. The share holding of a state seed corporation is divided amonr the state government, seed growers, NSC and the local agricultural university to ensure balancing of interests. In this system the gorwers have a lasting stake in the seed quality and a seed croporation is able to function effectively with the full backing of its primary members. Bank financing for production and storage of seed stocks can be readily obtained. A State Seed Corporation is directly in touch with the farmers. Such decentralization is desirable for providing a good service in a responsible way.

With the creation of State Seed Croporations, seed multiplication of superior varieties of local importance has received special attention which was not possible for the NSC, an All-India organization. In the process the research results of the regional agricultural universities are reaching farmers more rapidly and effectively. This experience underlines the imperative need for a strong linkage between the research and seed programs.

It is pertinent to mention that the Indian seed program places great emphasis on employment of qualified personnel as a policy. The minimum qualification even for the field staff is a bechelors degree in a relevant field. A high percentage of the staff are holders of master degree. Also, there is a regular system of in-service training for the workers.

(C) Private Sector

This sector is extremely strong and provides competition to the public corporations. Most private concerns started with hybrid seeds but have gradually diversified. In south and west India the seed companies specialise in seeds of hybrid maize, hybrid sorghum, hybrid pearl millet, hybrid cotton, and vegetable seeds though in Tamil Nadu and Andhra Pradesh rice seed is also handled in large quantities. In north India, hybrid maize, wheat, rice and vegetable seeds are handled by the private producers in a big way, Some seed companies and associations are large, exceeding an annual turn-over of rupees ten million IC, but hundreds of small family concerns also exist. A couple of companies have their own research programs for breeding new varieties. More specialized concerns have a lucrative trade for meeting the domestic demand, or for custom production, or exports to other countries in respect of flower seeds and planting materials.

Private concerns usually deal with certified seeds because certification enhances their marketing capability. A large number of processing plants belong to private sector producers. They have equal right of obtaining foundation seed from the NSC under a system of advance indenting.

From the foregoing it would appear that there is no monopoly either in seed production or its supply. Farmers have a choice while buying seeds and they pay the most competitive price for the product. The seed trade generally offers money-back guarantee to the generate confidence and increase the sales.

A word for the ISST - Indian Society of Seed Technology. It is based in Delhi with a large membership. It was set-up to promote seed science and technology. Seed Research is an important publication of ISST. It arranges seminars, discussions and symposia on seed subjects from time to time. The recommendations of ISST are usually considered by the government for any improvement in the national seed program.

India's experience in a nutshell

1. Crop research and seed programs are complementary to each other and both should be made strong and dynamic to ensure agricultural progress.

2. For a successful seed program, building up specialized seed institutions is a good goal to persue.

3. The role of private sector in seed is highly important, if only to break a monopoly.

4. An efficient foundation seed system is the foundation of the seed industry. It should receive priority attention.

5. A seed organization should carry qualified, trained and highly motivated staff with a business - like approach and management efficiency.

6. An aggressive seed marketing system aimed at customer satisfaction must be developed.

7. For good seed, farmers do not hesitate to pay the commercial price. So the seed quality must be consistently high.

8. Without good physical infrasturcture like processing plants, drying units, seed stores, seed testing laboratories and means of transportation, it is difficult to maintain the seed supply line and seed quality in the service of farmers.

11. Prospects for seed ventures in Nepal

On the whole the prospects for a public sector enterprise appear more favourable at the present time. At the same time, considerable scope exists for private enterprises specializing in vegetable seeds and hybrid maize seeds to make a start. For a new enterprise in Nepal, the following factors are pertinent and should be taken into account:-

a. Seed demand is sufficiently high because farmers in general are unable to keep seed themselves due to factors such as food deficit, vagaries of wheather, rodents, storage pests etc.

b. Agro-climatic diversity is a unique feature in Nepal such that a variety of seeds including temperate and tropical vegetable seeds, can be successfully produced.

c. As HMG attaches considerable importance to seed supply, a new seed production enterprise can expect to receive all encouragement, such as supply of foundation seed, processing facilities, seed testing and training services.

d. The seed program has been on-going for atleast a decade and hence trained personnel are obtainable.

e. The cropping cycle of most seed crops is favourable as it does not necessitate long period of seed storage between harvesting and planting. For example, six months storage is maximum for wheat and maize and even less for rice.

f. Superior seed varieties are steadily coming out of the research program.

g. Seed quality consciousness exists among the farming communities.

h. Considering the long east-west dimension of the country and 80 percent hilly terrain, a seed marketing venture is expensive, problematic and challenging.

i. Some production areas are prone to the adverse effects of high hunidity, field moisture stress, low seed yields, lack of transport and communication (some of these aspects are already improving).

j. Safe seed storage might demand the construction of good seed stores not only at the plant-sites and relay centres but at the retail points as well.

k. The farmers purchasing power may not permit them buy seeds at the commercial price. This may force dependence on governmental support through subsidy for sometime to come.

12. Current seed situation in Nepal

Although the seed program activities are still in a formative stage, the infrastructure that has developed is quite impressive. A fairly systematic approach to seed production is being followed. Seed processing and storage facilities exist in seven places in the terai and a couple of places in the hills. Additional small scale facilities in about 30 hills sites are being created under the SPIS Project. The country has four seed testing laboratories. Foundation seed production facilities at three research stations are being developed. Training programs for developing technical manpower are underway. An extensive set-up for vegetable seed production has been established under the aegis of Department of Agriculture and AIC with FAO assistance. Thus, all in all, the situation lends hope and optimism on the seed front.

A separte Seed Division in AIC came into existance in 1973. The Central Seed production Committee was formed in 1974 and the first seed testing station at Khumaltar started functioning in 1965.

The AIC has the capacity of producing and supplying roughly 6000 m.t. of cereal seeds annually besides vegetable seeds. Seed certification activities are carried out by the Seed Technology and Improvement program of the Department of Agriculture.

However, inspite of the wide ranging seed development activities, there seems a need to refurbish AIC's seed image and credibility among the generality of farmers. With a little bit streamlining of the system, the country's seed program can achieve the capability of adequately serving the farmers. But unless that is done, any perceptible improvement may not come by in the foreseeable future. By now sufficient practical experience has been gained by the seed personnel on the basis of which mid-course corrections can be made for meeting the future challenge. The existing seed program has

indeed served the first generation needs; however, at this juncture, new strategies have to be developed for a desired impact in the time to come.

For this purpose, it would appear logical to first identify the constraints in the present set-up through an objective analysis of the situation and then, by a consensus, an attempt might be made to remove the apparent deficiencies so as to strengthen the entire seed program to make it move forward in meeting the ever increasing demand for high quality seeds.

It is pertinent in this context that Nepal has a great potential for producing a variety of seeds especially vegetable seeds for the export market. In order to exploit this potential, the development of seed industry is an imperative. The reputation of the seeds produced and supplied within the country or outside must be built up by sustained efforts. Any investment made now to strengthen the seed program will surely pay handsome dividends in the future.

13. The constraints and their remedies

Consultations and discussions with the managers of seed program activities on the one hand and farmers opinion on the other hand have strongly pointed out the need for some policy changes in the present system. These are discussed below with a view to finding out rational solutions.

1. Foundation seed arrangements

These appear to be inadequate. The linkage between the commodity programs as the producers and the AIC as the user of foundation seed is rather week. For the private sector too, the supply of foundation is uncertain. Various projects having to do with seed production also experience problems with foundation seed. If foundation seed remains a bottleneck, the subsequent seed multiplication will be adversely effected.

Suggested improvement

There should be a separate unit for foundation seed under an experience seed technologist. The proposed unit may be responsible for the foundation seed production aspects at each of the commodity stations. The unit could also establish a new foundation seed farm of a suitable size fully equiped with necessary facilities to serve as the coordinating centre for foundation seed.

All foundation seed should be certified except perhaps the first supply at the time of releasing a new variety. The impurties in breeder seed, if any, should be removed at the

stage of foundation seed through rigorous rouging. There should be a buffer stock of foundation seed of the established varieties. In case of maize composites, enough foundation seed should be produced to least for 2-3 years under long term storage, so as to avoid genetic shift.

The allocation of foundation seed may be entrusted to a committee. For field inspections, the breeder and a representative of AIC should accompany the seed certification inspector to ensure proper determination of purity.

Lastly, the present shortage of foundation seed should become a thing of the past as early as possible. Whatever needs to be done for that should be done expeditiously.

2. AIC's seed set-up

As we all know the AIC's performance in meeting the seed requirements of farmers has been questioned in the past and inspite of the recent improvement the situation is not completely satisfactory. The root cause of the problem, apparantly, is the fact that the AIC is primarily a fertilizer organization. For a tangible improvement, an institutional change is necessary such that seed activities can be properly looked after and managed by technical personnel. Experience elsewhere shows that seed production is a specialized job and should be entrusted to a professionally-oriented agency. As time passes and country's seed demand increases there are likely to be greater difficulties in the future unless a seed organization is created now and made responsible to cope with the growing needs.

On the other hand, it would appear that there are certain advantages in AIC dealing with seed. The main advantage is that the existing infrastructure can be utilized for handling and distribution of seed without creating another parallel system. But even that is the case upto the district level as the retailing responsibility rest primarily with the cooperatives.

The present seed set-up of the AIC seems deficient in the following respects:-

a. Inadequate linkage with research, extension and foundation seed programs.

b. Less concern with seed marketing as the role is confined to mere distribution of seed upto district headquarter.

c. Lack of direct touch with the end-user farmers because of Sajha serving as intermediaries.

d. Ineffective management of seed production activities, dispersed as they are.

e. Seed receiving secondary attention being a tiny component of the whole organization.

f. Paucity of specilaized technicians and seed technologists to run the seed production activities.

g. Neglect of internal seed quality control procedures.

h. Casual maintenance of seed stores and processing plants.

i. Minimal supervisory check of field work to ensure achievement of targets.

j. Inadequate liaison with the seed certification unit of DOA.

k. Defective seed lot identification and erratic labelling.

l. Inadequate exercise of commercial judgement on issues such as demand forcasting, pricing and sale promotion.

m. Administrative and financial constraints at different executing levels affecting implementation of the plans.

Suggested improvement

An organizational change seems to be the first necessity. Under AIC management, a subsidiary agency for seed might be created. It could be named as Seed Organization Of Nepal (SOON). The head of the SOON should have the complete responsibility for all aspects of seed production, processing, storage, marketing with necessary financial and administrative powers. He should be assisted by divisional mamagers looking after (a) seed production and quality (b) storage and marketing (c) seed drying and processing and (d) administration and finance. The SOON should function in a decentralized way with a built-in quality control system. A seed processing plant site should be the nerve centre of all the activities. AICs existing district offices can be used for demand collection, secondary seed storage, transportation and supply of seed to Sajhas. To ensure sales promotion and linkages with the Sajha sale outlets and through them with the farmers, the seed marketing officers of the SOON should be assigned area-wise responsibility, Besides marketing, quality assurance functions should be combined with the marketing officers as well so that the consumer can receive the desired service.

While it is recognized that the SOON would entail increased working expenses for AIC, a rough estimation shows that there will be ample scope to increase the turn-over on account of seed sales to offset the expenditure. The SOON can eventually reach a gross sales revenue of about sixty million rupees annually which appears sizeable for a seed organization to be viable.

| Crop | Assumed area (m. ha) | Approximate total seed requirement m.t. (area seed rate) | Desirable target for seed supply m.t. | Estimated sale value (m. rupees) |
|---|---|---|---|---|
| Paddy | 1.20 | 45000 | 4000 | 12 |
| Wheat | 0.40 | 35000 | 8000 | 36 |
| Maize | 0.45 | 10000 | 3000 | 12 |
| | 2.05 | 90000 | 15000 | 60 |

Since the question of re-structuring AIC for strengthening its seed activities is a major issues, the precise feasibility and the modalities of the suggested action need to be gone into by a team of experts. This should follow if the matter is acceptable in principle and a consensus is reached to that effect. If possible, the private seed growers should be encouraged to make their contribution in some kind of a joint sector seed organization.

3. Uncertified seed

At present AIC handles three types of seeds namely, certified seed, improved seed and grain-seed, without a clear distinction from the customers point of view. This has been eroding AIC's credibility as the supplier of good seed. The quality aspect obviously gets a setback in this kind of situation.

Suggested improvement

As far as possible, the AIC should stick to the production and supply of certified seeds only. But in an unforeseen situation arising from drought or crop failure in a particular year, if it becomes unavoidable to handle some grain-seed then that seed must not be packed in the same kind of bags as for certified seed. Grain-seed can be supplied in large gunny bags instead. The ideal situation would, however, demand that grain-seed should not be handled by AIC but by some other agency.

4. Seed subsidy

The phenomenon of demand elasticity in relation to price of seed has been amply demonstrated in the recent experience with wheat seed. With sale price subsidized to Rs. 3.75 per kilo the sale volume jumped from the normal 3000 m.t. to 5000 m.t. It is true that majority of our farmers are small with a limited capacity to pay the commercial price of seed. Hence, till the farm productivity rises and incomes improve, there might be a need for a supportive subsidy to promote the use of improved seed as a national strategy. However, subsidy can be harmful if not properly handled. The subject deserves a very careful consideration at the policy level.

Suggested improvement

In deciding the quantum of seed subsidy, the criterion should be the difference between AIC's commercial sale price and the price that farmers can possibly bear. In any case, the subsidized price should be atleast 10 percent above the prevailing market price of fair quality grain. Secondly, subsidy should be applied to certified seed and equitably to public and private sector seed to avoid any counter productive effect.

5. Training and education

Training of all staff engaged in seed activities is highly essential. The future needs of the seed program are likely to multiply manifolds. The quality of seed supplied to farmers will very much depend on the quality of the personnel. People working for the seed program activities must have the basic knowledge of seed biology, seed physiology and also seed technology.

Suggested improvement

Under the Seed Technology and Improvement Program of the Department of Agriculture, a seed technology training centre should be established. It may hold atleast two in-service training courses annually for a duration of 6-8 weeks. The program should continue as long as it is necessary

Secondly, any new staff recruitment for the seed program activities should specify a minimum of bachelors degree as the qualification and that too in subjects like agronomy, plant breeding, seed technology, botany, horticulture depending on the area of responsibility. This education should be supplemented by training in management.

Furthermore, efforts should be made to teach some basic courses on seed biology, seed physiology and seed technology to the under-graduates students at IAAS, Rampur so that the people working on the extension side will also have an appreciation of the value of good seed for educating the farmers in this respect and thereby help create seed quality consciousness in the villages.

6. Seed marketing strategies

A glaring weakness in AIC's system of seed supply to the farmers is the fact that it has little direct touch with the end-user of its product. The seed goes from AIC production/processing centres to the district offices/stores and onward to Sajha Sansthans. What the Sansthans do with the seed, as the dealers of AIC, is practically left to them. In the process, the responsibility toward the farmers for supplying timely seed gets sadly divided between the two agencies. It is doubtful if the Sajhas are in a position to provide any technical advice or after-sale service to the consumers of seed. On the other hand AIC offices are generally oblivious of farmers difficulties because their responsibility is to reach the seed upto district headquarters.

Suggested improvement

The AIC technical personnel at the grass-roots should act as multipurpose staff. A system should be worked out by which they are there in direct touch with the seed users not only for seed supply but also for quality assurance, technical advice, collecting feed back and attending to farmers problems as extension workers.

Secondly, the Sajha Sansthan workers might be continually trained in simple aspects of seed storage, sales promotion and handling of unsold stocks.

7. Seed storage

The climatic and topographic situation in Nepal requires the creation of stores specially designed for keeping seed. Prevalence of storage pests and rodents is a problem in many areas. Vapour proofing of floors and walls, timely repairs, white-washing, periodic disinfection and careful storage management are just a few steps that can improve seed storage. Additionally, some storage structures would need re-modelling to make them fit for seed, e.g., a store with concrete roof is much safer than one with asbestos or tin sheet roofing. Sometimes, mere ventillation can keep the ambient temperature within cool limits.

Suggested improvement

a) Repair or re-model the existing stores.

b) Adopt a suitable design and material for new seed storage construction.

c) Improve seed storage management by laying down procedures, inspections and staff training.

8. Hill seed production

The production of seed in the hills to meet the local demand and to win the confindence of small hill farmers is a clear necessity. For this purpose, AIC/SPIS project are attempting to lay minimum infrastructure in selected pockets of the hilly areas. As far as possible, community participation by the surrounding farmers is being encouraged so that they can meet their seed needs through self-help and with minimal support from the government. Several other projects are also helping in hill seed production. Under the vegetable seed program, the tempo of seed production is steadily increasing and there are specialized pockets where this activity is going on.

Suggested improvement

a) The hill seed production program should be deemed as a promotional activity to serve the small farmers. Maximum financial and material support should be made available according to need. Transport subsidy seems justified and should be given due consideration.

b) AIC may create a special cell to assist the hill program by ensuring that dedicated site managers are posted and they give their best in each work site. Also, that foundation seed is supplied for each seed crop, credit is made available to the farmers and the seed produced in the hills is properly utilized.

9. AIC's internal quality control

It has been seen that a faithfull application of the principles of seed science and technology to produce high quality seed requires systematic adherence to certain procedures. A seed producing and selling organization must evolve those procedures and ensure their application at all times. Thus regular internal supervision at every stage of seed handling is essential. Besides seed certification, a seed organization should have its own control and check system, with the main purpose to ensure in-built quality control, from the point of seed crop harvesting to seed supply to the farmers.

Suggested improvement

AIC should emphasize on internal quality control, in addition to certification. The system might be in-built and woven into production, processing, storage and supply functions. Quality control must be with a senior officer who could also continually recommend to the top management necessary improvements in the physical facilities that might be lacking.

10. Seed certification

At present seed certification is covering only a part of the seed production program due to various reasons. The seed testing laboratories ought to be more fully utilized to attest the value of planted seed in the country. Secondly, the linkage between AIC and seed certification is not as strong as should be such that the certification staff even have difficulty in locating all the seed production fields, ensure proper isolation and roguing by the seed growers and improve the production agronomy for obtaining maximum yield of high quality seed. Essentially, field inspections are also a tool for training the seed growers and upgrading their skill.

Suggested improvement

a) Seed testing and certification be intensified.

b) Staff mobility be improved through the use of motorcycles alongwith a maintenance allowance to the field staff may be examined.

c) The drawbacks in seed production and handling system should be monitored by the certification agency and brought to the attention of the Central Seed Production Committee for rectification from time to time.

# EXTENSION SERVICES IN SEED PRODUCTION AND DISTRIBUTION POLICY

Jagadish Raj Baral
Deputy Executive Director,
APROSC

## Introduction

The development of agriculture is an indispensable step towards better living standards and this depends upon improved inputs of which seed is the most significant. Indeed, seed is not just an input; it is a dynamic instrument for change, and it can be used to achieve specific agricultural production objectives (Douglas, 1980).

Under the traditional farming system in Nepal, the farmer saves a part of each crop as seed for sowing in the next season. This will no longer suffice if a substantial increase in crop production is to be obtained. To stimulate improved crop production, Feistritzer and Kelly (1973) have rightly mentioned that an essential prerequisite is the production, distribution and utilization of quality seed of improved varieties. In this process, the farmer is the user of the product. By his perceptions he is the one who gives it the final and most rigorous test. The farmer as seed grower, is also the source of the product. And, an effective extension service is, of course a catalytic agent though not sufficient in itself. An effective seed program is a function of many variables such as research, high level administrative commitment essential inputs supply, marketing, alongwith extension service system. It is an extension system that educates the farmers to broaden their knowledge in appreciating the value of seed.

An effective extension service mediates seed producers with users. It helps to energize the production, distribution as well as seed utilization system to sustain on its own. Indeed, establishment of a seed production-supply system will involve many changes in agricultural practices and traditions which require the assistance of an effective extension-advisory service. This demands special attention of extension services in relation to seed production and distribution policy in Nepal.

The paper aims to suggest an action approach: a choice of extension services strategy in seed production and distribution policy. In this quest, the deficiencies have been identified as far as possible by reviewing existing extension services; policies are recommended and an action approach strategy is suggested so that if implemented successfully, seed as an instrument of dynamic change will be appreciated and valued by the majority of the farmers in Nepal.

Best Available Document

Review of Extension Services and a Conceptual Framework

According to the source of supply, extension program in Nepal categories the seed from: (i) farmers to farmers, mainly in paddy, maize, wheat, vegetables, and potato: (ii) Agricultural Inputs Corporation to farmers, i.e. in paddy, maize, wheat and vegetables, and (iii) research/production farms to farmers through district agricultural development offices, like potato, certain cereals, sorghum, jute, sugarcane and others which are not dealt by Agricultural Inputs Corporation.

The policy behind seed diffusing from farmers to farmers is that once a few farmers grow new seed successfully, the others observe, evaluate and finally decide to adopt. Extension system in Nepal envisage a program to demonstrate new varieties, conduct field tours and advice farmers to exchange seeds. Once the worth of a variety is demonstrated, it gets diffused. An extension system has more challenges in providing technical guidance to maintain variety, produce quality seeds by using optimum inputs and select and store the seeds properly. In the first phase of Rasuwa Nuwakot/IRDP the farmers to farmers seed exchange has been successfully demonstrated by providing seed bins to facalitate storage. The involvement of an extension worker in procuring, storing and exchanging seed has on the other hand created conflict and disturbance. This shows that as farmers capability is developed they are in a better position to identify their own profitable seed enterprise without outside effort/ interference.

An overview in seed supply in Nepal indicates that the major supply of paddy, maize, wheat and vegetables is the responsibility of AIC. AIC procures seed from two sources: (i) government research/production farms and (ii) farmers seed multiplication programs. A national seed multiplication program is recommended by the Central Seed Production Committee annually which is executed in the terai districts as a joint responsibility of Agricultural Inputs Corporation (AIC), Department of Agriculture (DOA) and Agricultural Development Bank (ADB) under technical supervision of crop development programs. A district committee of which these three offices are members, selects an area considering the transportation facilities, availability of irrigation, willingness of farmers to participate in the program and so on. A joint decision permits farmer to sign contract with AIC which is supported with loan from ADB and technological guidance from DADO and concerning crop development program.

In view of the high cost of delivering seed to farmers in the hills and mountains and the risks of losses, mixing, mislabelling, and deterioration while being carried by porters from terai/valley, it has been decided that the only viable solution to the problem of supplying seed to isolated farmers is to have the seed produced and processed in nearby areas, where it is to be used. The SPIS project of AIC is in the process to setup 16 mini seedhouses and 12 warehouses in different parts of the middle hill areas of Nepal with an objective of increasing the agriculture productivity of major cereal crops in these areas by disseminating high

yielding variety seeds through these houses (Regmi 1981). The success of this program depends on the mutual understanding and coordination of the DADO, AIC, ADB as well as the degree of willing participation of the local farmers. Experiences of seed exchange program in Rasuwa-Nuwakot can be used in such mini seed-houses in developing private enterprise of a small group of farmers to sustain on its own. Though, the responsibility of DADO, AIC and ADB is defined, in practice personal relationship and mutual understanding only are contributing in achieveing the target. Except for an involvement of district officers in selecting areas, and farmers, seed program does not have specific extension activities in educating the farmers to produce, maintain, store and utilize and promote the seed as an enterprise.

Certain seeds, not dealt by AIC, are directly supplied by research/production farms to farmers through DADOs in Nepal. In this context, extension workers distribute seed to the farmers. Extension activities conduct certain demonstrations which cover utilization aspect. Basically, a systemic seed exchange system does not exist.

Moreover, Feistritzer and Kelly (1978) mentioned that the success of the seed program will largely be determined by the efficiency of the producers, managers, salesmen, technicians and workers who produce and market the seed and recognition by the farmer of the value of improved seed. Indeed, seed production, processing and distribution require knowledge and skills which can be achieved through training. Farmers may need information and support. There must be an educational program to make the farmers realise the value of seed. It implies that training and sound information system is essential to producers, extension workers as well as farmers as users.

As opined by Rajbhandari, K.B., seed production is technically a highly delicate business. It requires exact technical skills and preciseness. The producers need to be technically guided at every step through the processes of seed production. Hence the importance of competent extension service is highly essential.

Although producing and introducing good seed of new varieties are largely technical and economic issues, the adoption of improved seed, like any new farming practice is directly linked with what farmers know, what they understand, how they feel, and what they are willing and able to do. Factors farmers consider in producing, distributing and utilizing seed are relative advantage, reliability, simplicity, compatibility, visibility divisibility and independence (Douglas, 1980). Besides this characteristics of farmers like their knowledge, understanding, acceptance of sources of information, attitudes and beliefs, perceptions of effort and reward, and ability to act indendently influences seed program like other programs. An effective extension system considers that no development plan can be complete without considering the people who are going to carry it out and what motivates them to a designed course of action.

A comparative analysis of existing extension services in seed production and distribution in Nepal with research experiences draws the conclusion that the seed program has not received due priority of extension services. However, the review shares the following:-

Conceptual Framework

1. Seed is not only an input but also a dynamic instrument for change. The process of seed production, distribution and utilization is more complex and influenced by many socio-economic and technical factors that need to be separately focused by an extension system.

2. An effective extension service mediates seed producers with users. It is an extension system that helps to energize the production, distribution as well as seed utilization system.

3. An effective seed promotional activity motivates the producers as well as users to respond better in extension activities.

4. An effective extension system educates the farmers to broaden their knowledge in appreciating the value of the seed and develop confidence in seed producers to establish a profitable enterprise which sustains in the longrun as a perennial source of seed supply locally.

5. Continuous training and sound information system are essential to seed producers, extension workers as well as farmers as users.

6. An effective extension system needs area of responsibilities of complement with timely reward and punishment system which ultimately motivates to coordinate different agencies in seed program.

A model for seed enterprise is depicted in Fig. 1.

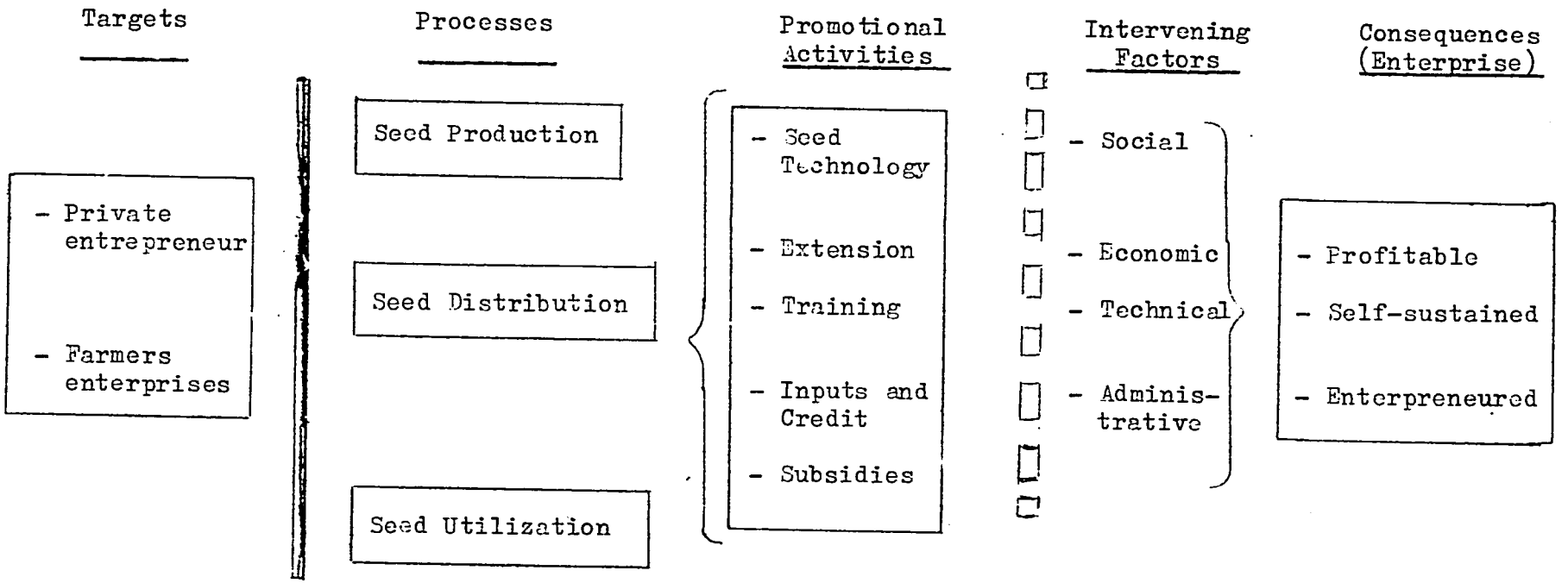



Fig. 1 A Model for Seed Enterprise.

Policy Recommendations and an Action Approach: A Choice of Extension Services Strategy in Seed Production and Distribution Policy

The review has conceptualized that seed is not only an input but also a dynamic instrument for change. The complexity of socio-economic and technical factors in the process of seed production, distribution and utilization needs a sound seed promotional policy to sharpen an extension tool that mediates seed producers with users. Training and sound information system to producers, extension workers as well as farmers as users is another area of polich formation that adds knowledge and skill as well as makes them familar with the objectives and time frame of the seed program. A step towards formulating a policy in establishing a viable self-sustaining seed enterprise at the local level is another important aspect to be considered. Side by side, a sound extension policy must deeply define area of responsibilities which complement with timely reward and punishment system as a motivating tool to different agencies involved in the seed program. Broadly, the policy should spell what extension services could do in seed program and how it could be done. Hence, a workable action approach will be:

1. To identify and establish seed production and distribution system that self sustains in the longrun as a perennial source in supplying and distributing the seed.

   The existing system of production and distribution of seeds from (i) farmers to farmers, (ii) AIC to farmers and, (iii) research/production farms to farmers through extension needs redefinition in terms of work responsibility and coordination. Even to supply limited demands of seed, AIC has a limitation of resources and management capability in a wide geographical heterogenity. Experiences, have also shown that development of farmers capability helps them to identify own profitable private enterprise which will sustain locally longer than any outside effort. Eventually, the basic approach should be to develop farmers capability in identifying seed as a profitable enterprise. AIC should concentrate its efforts to support these seed enterprises, while research/production farms should concentrate on nucleus/foundation seeds.

2. To select an extension system that educates the farmers to broaden their knowledge in appreicating the value of the seed and develop confidence in seed producers to establish a self-sustaining seed enterprise.

   Experiences have shown that frequent transfer of JT/JTAs retarded the efficacy of the educating process of the existing extension system. Services of JTs/JTAs are questionable. On the other hand, certain farmers have demonstrated their capabilities to follow farmers by practising improved technology. An action approach, thus, should be to develop the farmers inner capabilities which will broaden their knowledge to think, plan and act in wider perspective.

Extension system should focus on a Human-Development Centre Approach which will create pressure of demand enabling them to obtain what they need. Demand Creation Approach will force servicing agencies to become alert and effective in their services. As many farmers will develop their own seed enterprises, there will be competition. Competitive Approach will force them to maintain quality as well as proliferate their good will to users. Such system should be backed with promotional activities like subsidies in seed bins, inputs and others. Distribution of seed at the local level will not be a problem and thus continuous production and distribution system will exist locally.

3. To screen out different extension methods that familiarise the need growers and users with the objectives of the seed program and assign responsibility for informing the farmers of the uses and benefits of improved seed.

For popularizing the improved varieties, demonstration has proved to be a successful extension method. Moreover, meetings, field tours discussions, radio interviews and broad-casts will increase efficiacy of demonstration. Seed production competition allied with certain incentives is another effective method to motivate the producers. Seed growers wish to develop seed as a profitable enterprise which needs to be backed with promotional activities. While, seed users want to get quality seed at a reasonable price and when they need, any extension method will be useful if its supremacy is in the motto that farmers believe in results.

4. To develop different trainings for seed producers extension workers as well as farmers as users.

Seed production, processing, distribution methods require knowledge and skills that are not part of the usual background and need to be introduced by training. Aside from the AFC technical staff involved in seed processing and distribution, seed producers should be trained in mainting seed quality in field, threshing floor and storage. Extension workers should be well aware of the changing technology continuously to support the seed growers as well as users. A series of seminars/workshops at national, regional and district level for planners, policy makers, executors and seed growers should be conducted in supporting the seed program as an integral part of the agricultural development. Specially, training should focus to increase the efficiency of management system in all the centres to remove socio-economic constraints in popularizing technological aspects.

5. To delineate an area of responsibility of extension in consonance with a reward and punishment system which ultimately motivates extension workers to be more committed in seed program.

The existing seed program is a joint venture of DADO, AIC and ADB. Joint responsibilities do not develop individual committment which is a must in a program. An individual committment tied with timely reward and punishment will create working environment. An action approach will be to identify their responsibilities in developing seed enterprises at local level. AIC, ADB and DADO should work as committed inputs supplier, credit lender and motivator as well as stablizer of such enterprises. A monitoring and evaluation system should be established at the national and regional level for guiding and maintaining the system.

## Conclusion

Creation of a self-sustaining seed production and distribution system at the local level is crucial to meet increasing seed demand of farmers. Seed can not be manufactured in the factory. It is grown at the farm in a complex socio-economic environment. An effective extension service has an immense role in popularizing the technical superiority of seed. The policy recommended in this paper has been suggested with an action approach with a choice of extension services strategy for (i) identifying seed enterprises in production and distribution from private enterprenour to farmers, (ii) selecting extension system based on Human-Development Centre, Demand Creation and Competative Approach, (iii) screening extension methods of familiarizing seed program, (iv) developing different trainings for seed producers, extension workers as well as farmers as users, and (v) deliniating an area of responsibilities of extension together with a reward and punishment strategy and establishment of a monitoring and evaluation system.

With the recommended policy and an action approach, if worked out effectively, extension system is expected to deliver effective advisory services and punctual supervision in stabilizing profitable farmers seed enterprises locally in large numbers to support the agricultural development program of the nation.

## REFERENCES

1. ANON, 1974. Perspective Study of Agricultural Development for Nepal: Working Paper on Seeds. Plant Production and Protection Division, FAO, Rome.

2. ANON. 1983. A Training Mannual on Seeds. Compiled by SPISP/AIC, Kathmandu, Nepal.

3. DOUGLAS, J.E. (Edi). 1980. Successful Seed Programs: A Planning and Management Guide. Westview Press/Boulder, Colorado, USA.

4. Feiestritzer, W.F. and A.F. Kelly (Edi). 1978. Improved Seed Production: A Mannual on the Formulation, Implementation and Evaluation of Seed Programs and Projects. FAO, Rome.

5. NPDP. 1977, Seed Potato Workshop, May 25-27, NPDP/CIP Kathmandu, Nepal.

6. Regmi, C.C. 1982. Baseline Site Survey Chainpur Village Panchayat, Sankhuwasabha District, Nepal, SPISP/AIC, Kathmandu, Nepal.

# PRIVATE SECTOR IN AGRO-SEED BUSINESS

Krishna K. Gyawali
Managing Director,
Nepal Seed Co.,(P) Ltd.

## INTRODUCTION

1. Agriculture is given priority in the Sixth Five Year Plan, and in the economy it contributes about 62 percent of the gross domestic product. About 90 percent of the population are engated in this sector, and 80 percent of the export of the country depends on agricultural products. The growth rate envisaged during the Sixth Five Year Plan period is to raise GDP by 4.3 percent per annum, and the agriculture sector is supposed to contribute 3.2 percent per annum. To raise the domestic output as per targets of the plan, the total development financial outlay requirement is estimated at Rs 33940 million of which Rs 28750 millions are to be invested in the fixed capital formation representing 18.5 of the aggregate gross domestic product of the plan period.

Table 1

GROWTH TARGET FOR THE SIXTH PLAN PERIOD 1980-85

(At constant 1979-80 prices)

| Economic sector | 1979-80 | 1980-85 | Annual growth rate | As % of GDP | |
|---|---|---|---|---|---|
| | | | | 1979-80 | 1980-85 |
| Agriculture Sector | 13521 | 15827 | 3.2 | 55.4 | 52.5 |
| Non-Agriculture Sector | 10898 | 14313 | 5.6 | 44.6 | 47.5 |
| Gross Domestic Product | 244419 | 30140 | 4.3 | 100.0 | 100.0 |

Source: The Sixth Plan 1980-85 Part 1 (A summary)
HMG, National Planning Commission, Nepal, 1981.

2. Proposed Development Expenditure

Out of the total developmental expenditure of Rs 33940 million Rs 20490 (60.4 percent) million is allocated to public sector, Rs. 1800 million

(5.3 percent) to Panchayat sector and 11650 million to the private sector. The allocation in Agriculture is about 30.4 percent of the total proposed expenditure during the plan period. This allocation of 30.4 percent includes all the following subsectors of agriculture.

| | |
|---|---|
| Agriculture | 10.6% |
| Irrigation | 14.1% |
| Land Reforms | 0.3% |
| Cadastral Survey | 0.7% |
| Forest | 3.9% |
| Meteorology | 0.3% |
| Resettlement | 0.5% |
| | 30.4% |

The allocation of 10.6 percent in agriculture sub-sector includes agricultural research, extension services, livestock development and its inputs, provision of agro inputs such as fertilizer, fungicides, insecticides, seeds, implements and the credit facilities.

Table 2

ALLOCATION TO DEVELOPMENT EXPENDITURE IN AGRICULTURE

| Sectors | Development Expenditure in Agriculture in Million Rupees | Total Development Expenditure in Million | Percent of Total Development Expenditure |
|---|---|---|---|
| Public | 6260 | 20490 | 30.55 |
| Panchayat | 490 | 1800 | 27.22 |
| Private | 3820 | 11650 | 32.79 |
| Total | 10570 | 33940 | 31.1 |

## 3. Production Targets in Agriculture Sector

In the production targets of agriculture, the main emphasis is given to increase the production of food grains, livestocks, oilseeds, fruits and vegetable cashcrops (Table no. 3).

Table 3

PRODUCTION TARGETS SET UP FOR EACH CROP IN THE SIXTH PLAN

| Crops | Production in thousand m.t. in 1985 | Increase in % |
|---|---|---|
| Food crops | 4440.0 | 14.9 |
| Vegetables crops | 723.3 | 49.0 |
| Potatoes | 336.5 | 16.8 |
| Fruits | 360.7 | 31.4 |
| Tobacco | 10.0 | 42.9 |
| Sugarcane | 644.0 | 66.4 |
| Jute | 85.0 | 25.0 |
| Oilseeds | 104.0 | 9.5 |
| Cotton | 2.30 | 3733.3 |
| Tea | 1.4 | 250.0 |
| Livestock Products | | |
| Meat | 77.4 | 20.7 |
| Milk | 754.1 | 24.6 |
| Milk products | 0.29 | 54.3 |

CROP RESEARCH AND EXTENSION SERVICES FOR THE PRIVATE SECTOR

The present crop research programs are geared up for the public sectoral development. It is difficult for the private enterprises to come up with their own research and extension set up. The infrastructural set up created by the Department of Agriculture needs to be shared by the private enterprises also. Its function should be so impartial that the enterpreneures in the seed business in both public and private sectors should have equal faith. This seems relevant especially for the extension services where extension workers are playing the vital role in the promotional activities of the seed business.

The activities of the Department of Agriculture could be summed up as follows:-

a) The activities of the research, government farms and the commodity programs are meant for developing new varieties and technology for the use of those crop varieties.

b) Other activities, include extension services which are directly related with private sector.

c) The activities of out-reach program of crop research.

The main objective of extension services is to bridge the gap between the research and the farmers. The research out-reach is bridging the gap between the research and extension. Nevertheless, these activities do creat an interest also in the private sector. They can play a vital role of promotion and support to encourage the private investor for the growth of seed industry. So their importance should not be overlooked.

QUALITY ASURANCE AND CERTIFICATION FOR THE PRIVATE SEED INDUSTRY

1. The objective of the seed testing and quality for the use of private sector is not only to control but also has to provide services for assuring that the seed under distribution is meeting the standards. The certification system should have enough controlling force so that at least the foundation seed provided to the private sector should meet the seed standards, genetically, physiologically and mechanically. Because the distribution and use of foundation seeds influences directly the quality of certified and improved seeds major attention and importance must be given to the maintenance of high quality foundation seeds.

2. The field visits for supervision and inspection in the certification system should be intensified. These visits should not merely concentrate for activities of accepting and rejecting but on the contrary should impart knowhow technique and education to the concerned so that the promotional activities are accelerated.

3. As far as the private sector is concerned, seed could be classified in three catagories:-

   a) Foundation seed

   b) Certified seed

   c) Truthfully labelled seed

The private sector should be encouraged to get envolved in the production of foundation seed though it is an expensive job for the private enterprises. At the present situation at least 10 percent of the foundation seed should be produced or arranged by the private sector. In the production of certified seed, the private sector should get a target allocation of 40 percent. But at the same time the private sector should be allowed to tag their produce of certified level catagory of seeds as

"truthfully-labelled". Except in case of emergency the distribution of "improved seed" without the tags and labels should be dropped by the public sector, so that private sector gets enough market for high quality seeds.

4. The private seed industry should be allowed and encouraged to enter into contract with the counterpart foreign private industries in the following activities for seed export.

   i) Production and export of seeds where foreign foundation seed stock is used.

   ii) Production and export of certified seed of Nepalese recommended crop varieties. In both activities, the certification program should accelerate activities so that a guarantee could be given to the importer for the high quality of seeds.

SEED PRODUCTION

A. The Sixth Plan national requirement of improved seeds of cereal grains is about 25725 tons. The table below shows the crop-wise requirement over 5 years period.

Table 4

REQUIREMENT OF IMPROVED SEEDS IN THE SIXTH PLAN

IN SOME OF THE CROPS

(In m.t.)

| Crops | 1st year | 2nd year | 3rd year | 4th year | 5th | Total |
|---|---|---|---|---|---|---|
| Maize | 300 | 375 | 450 | 550 | 700 | 2375 |
| Wheat | 3100 | 3500 | 4000 | 4600 | 5400 | 20600 |
| Rice | 400 | 450 | 825 | 625 | 750 | 2750 |
| Vegetable seeds | 360 | 380 | 417 | 458 | 494 | 2109 |

So far the private sectors involvement in seed production is concerned, the production of certified and improved seeds is entirely done by the private farmers. All kinds of seeds of different crops are grown and sold as raw seeds to Agricultural Inputs Corporation.

The distribution of seeds by AIC for maize and wheat is presented below for last 2 years.*

| Year | Maize | Wheat |
|---|---|---|
| 1980-81 | 104 m.t. | 1516 m.t. |
| 1981-82 | 139 m.t. | 2213 m.t. |

This clearly indicates the growth. But there is a need to assess the problems of large scale handling of seeds. It is better to handle a smaller scale operation in seed industry to do a quality work than merely going for bigger scale for quantity work and deterioting the quality.

At present, the function of AIC has given tremendous benefits to private seed growers with assured buying arrangement.

B. The seed production activities could be grouped and rearranged as follows to further enhance the growth:-

| | | |
|---|---|---|
| 1. | Crop variety and technology development and arrangement of breeder seeds | Responsibility of Department of Agriculture |
| 2. | Production of foundation seeds | 50 percent Department of Agriculture research farms.<br>40 percent public sector seed industry (AIC)<br>10 percent private sector seed industry. |
| 3. | Production of certified seed | 60 percent public sector seed industry (AIC)<br>40 percent private sector seed industries |
| 4. | Production of truthfully-labelled seeds | 100 percent private seed industry |

The private seed industry is coming up and if it is to be involved in export, may need to maintain the production of foundation seeds. But an assured supply of major portion of foundation seed has to come from the government farms and public sector seed industry.

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* Source: Agriculture Inputs Corporation.

C. The production of certified and truthfully-labelled seed of all kinds of crops should be allowed and encouraged in the private sector industry, though at the moment almost all the certified and improved seeds are grown by the cultivators of small and large holdings. It is our suggestion that big farmers having above 10 hectare of seed production area should be encouraged to register in the Department of Agriculture as 'registered seed growers' and allowed to process and market their produce directly and indirectly. The following are the catagories of seed producers included in both private and public sectors:-

| Producers | Products |
|---|---|
| 1. Public sector | |
| a) Government farms | Breeder, foundation seed |
| b) AIC | Foundation and certified seed |
| 2. Private sector | |
| a) Seed companies | Certified and truthfully-labelled seeds |
| b) Registered seed growers | Truthfully-labelled and raw seeds |
| c) Contract growers | Raw seeds to be handed over to AID and private seed companies |

D. The responsibilities of public seed industry in seed production

1. Produce and supply all kinds of breeder and nucleus seeds.

2. Produce and supply 90 percent of the foundation seeds.

3. Maintain enough buffer stock so that in case of seasonal failure it could be utilized.

4. The protection and guarantee to procure all the raw seed produced by the contract and registered growers with optimum procurement rates which could be conducive to all the parties concerned.

5. Give protection from the poachers and outsiders (chance takers) so that the interest of the genuine parties (both public and private sectors) concerned is protected.

6. Arrange and provide training in seed production to all the contract and registered growers.

E. The responsibilities of private seed industry in seed production

1. Should work according to the objectives and targets in the five-year plan and should be complementary to the public sector.

2. Assume responsibility of timely supervision of the contract growers' plots and assist them in seed production technology.

3. Give the guarantee to contract growers for the purchase of raw seeds with optimum procurement rate.

4. Arrange foundation seeds to the growers.

F. The responsibilities of the contract growers

1. Should have arrangement of land along with facilities of irrigation, drainage, manure and fertilizer, agro-chemicals, implements needed, threshing floor and minimum storing facilities so that seed grain could be protected before it is lifted by AIC or seed companies.

2. Should have the basic understanding of the production and should abide by the rules put in the contract.

3. Should be willing to remove the rejected seed stock so that there is no mixing with the remaining pure stock.

4. Should agree with the optimum procurement price fixed in the contract.

MARKETING OF SEEDS

The function of marketing of seeds as it is conceived in Nepal includes the following activities especially at the certified seed level.

1. Producing and/or procuring raw seeds

2. Processing, bagging, tagging and using the brand name

3. Storage

4. Distribution of seeds for sale (wholesale distributors and retailers included).

These activities can be split in many different components for independent undertakings. The private enterprises should be allowed to take a single component as their undertaking and specialize, or with the resources available with them, should be allowed to take over all the components. According to the activities these could be classified and grouped as following and the government should allow to expand accordingly.

1. The enterprises interested in the production of seeds only. Here the seed is produced as per requirement of seed distributors and supplied at the contracted price. All the contracted growers and partially registered growers fall in this catagory.

2. The enterprises who are interested in production only and wish to have their own labels and brands but do not wish to have their own marketing structures.

3. The enterprises who produce their own certified and truthfully-labelled seeds, produce and/or arrange foundation seeds to their contract growers, process under their own name and market to the distributors and retailers directly and indirectly.

4. The enterprises who do not produce but procure the processed, certified and truthfully-labelled seeds and retail them.

The enterprises of the above catagories will have to enhance the marketing function directly and indirectly. Let us consider some of the problems related to their activities:-

1. Producing and/or procuring raw seeds:

We have discussed some of the problems in seed production earlier. Here it is preferred to say a little on procurement of raw seeds especially related with the pricing. The growers need to be encouraged with better incentive and premium but at the sametime consideration should be given to sell the seeds through the marketing channels. It is suggested that buying and selling of the seeds should be in such a way that the profit is shared by all the parties concerned equally.

2. Processing bagging and tagging activities:

i) The infrastructure of processing facilities is not available with private enterprises. To create these facilities requires heavy investment. Until the private enterprises come up with its program the public sector should make available its processing facilities for the private enterprises.

ii) The private enterprises should be encouraged and provided credit loan for the establishment of these facilities.

iii) (a) Standard packing materials are required for maintaining the quality of seeds and to attract the customers. At present, it seems no work has been done in this regard. The government should appoint a committee where concerned people should study in this regard and come up with a manual for general use.

(b) It is suggested that while studying the standardization of packing materials, the committee should also study the prospects and feasibility for the industry to produce standard packing materials because there is lack of such materials available within the country.

(c) The use of brands by the private enterprises should also be registered and protection should be given by the concerned authorities and there should be rules and regulation to prohibit misuse by others.

(d) Truthful labelling should be allowed for the private sector-within the country in place of certified seed tags issued by the seed testing laboratory.

3. Storage:

A good storage arrangement must be available for seed marketing from the inception of raw seed collection till the processed seed reaches to the cultivators. Our intention here is not to discuss the technical aspect of storage but to remind the concerned people that good planning is needed for the construction of proper godowns suitable for seeds. This should not be limited to public sector only but should go to private sector also. It has to be developed in all places where seed storage is involved i.e., in seed production farms, at the processing plants, distributors, sale and buffer stock godowns and at the retailers of seed. Besides storage, seed handling is also equally important. So the following points should be taken into consideration to remove some of the problems:

i) The construction of seed godowns for distributors and retailers must be planned for the private sector. There should be credit facilities available to the interested party.

ii) Training in seed storage and handling should be sponsored for retailers and godown keepers of the distributors by the seed companies in both public and private sectors.

iii) Until seed godowns are available in private sector, there should be understanding to share the existing seed godowns of public sector.

4. Distribution of seeds:

a) The distribution of seeds requires very careful planning and is governed by the principles of demand and supply. At present, the prediction of increased growth of market which could be used for private and public sectors is not very reliable. The demand collection procedures and seed trade promotion activities should go side by side from the same seed supplying institutions rather than depending on extension services altogether. It is always better to take help and suggestions from others but it does not mean to leave the business to them.

b) The sale at retail shop level in the private sector is facing problems. As a single sale component, seed is not economical to them. They should be allowed to sell fertilizer and other agro-inputs along with seed.

SUPPORT OF HMG REQUIRED FOR PRIVATE SEED INDUSTRY

Some of the factors influencing the private seed enterprises are:

i) The activities of private sector are not of aggressive type

ii) The future growth is not predictable

iii) The risk is very high

iv) The market is not assured

v) The government policies towards the private investment in seed business are not clear.

vi) The choice of the opportunities in other sectors may be better than seed enterprises.

Taking into consideration the above factors, the policies of HMG in this regard should be arranged in such a way that the support action flows to the private enterprises; thus in turn they may get encouragement to get involved in the program. Following are some of the points that have to be taken care properly by the government so that there is harmony in the seed business for private seed enterprises.

i) Minimum prices of seeds should be fixed taking into the account cost of seed production, processing charges, storage charges, cost of transportation of incoming and outgoing distribution, interest on the capital employed, the degree of risk of the capital involved, and the percentage of the profit allowed for (1) growers (2) processors (3) distributors and (4) dealers.

ii) The flexibility of fetching higher price be allowed in the peak season and also for lowering the price for clearance sale alongwith incentives in sale price, so that the stock does not remain but goes in the soil for planting. This is particularly needed for the retailers.

iii) Any subsidy in the seed program should flow towards the private enterprises also and equally.

iv) His Majesty's Government should recognize the seed business as a subsector of industry as seed industry and be treated accordingly.

v) Like in other industrial and business sectors the seed industry should also get loan facilities upto 90 percent for infrastructural development and operational cost involved.

vi) The custom exemptions and other facilities should be allowed in seed industry for all kinds of needed inputs including machines and seed transport vehicles as per the allowances given to other industries.

vii) The characteristics of a used enterprise are such that it is neither industry nor entirely trading nor simply agriculture. But it is the combination of all these. So the tax exemption should be allowed for the maximum.

viii) All the seed enterprises should be registered in the Department of Agriculture. Reporting and supervision of seed enterprises should be incorporated in the regular report of the Department of Agriculture. This will facilitate achieving the objectives of the Sixth Five Year Plan of the government.

ix) The government should also include the technicians of private enterprises in both national and international training, workshops, seminars, observation tours etc. so that the skill and knowledge in private sector can be upgraded.

## SUMMARY

The program of the development of seed as an input to fulfill the present requirement and increase the production of agriculture is vitally important. At present in the process of agricultural development, crop research and extension which altimately filters down to farmers and cultivators, an aspect where private investors could think of contributing is only seed industry, but it requires a congenial situation to be created and protection to be given. At the same time, this industry should provide good return of income in comparison with other sectors for attracting private investment.

## REFERENCES

1. The Sixth Plan 1980-85, Part I (Summary)
HMG, National Planning Commission Nepal 1981
(English Version)

2. Sixth Plan Part I (Nepalese Version)
HMG, National Planning Commission, Nepal 2037.

3. Proceedings of First Workshop Seminar on Vegetable Seed Production, Kathmandu 1982, Department of Agriculture.

4. Kaplan P.F. 1981, Consultant Report, Social and Economic Factors Influencing Seed Production, Storage, Distribution and Usage in Hill Areas of Nepal, SPISP/AIC, Nepal.

5. Baseline Site Survey - Charikot,
SPIS/AIC, Nepal, 1982.

6. Asian Development Bank, Nepal, 1982, Agriculture Sector Strategy Study, Part II.

# VARIETAL EVALUATION AND RELEASE IN WHEAT

Prakriti S. Rana, Chief,
National Wheat Development Program.

## OBJECTIVES

The main topic of this paper starts once the variety has passed beyond the various selection processes used by the wheat breeder. New varieties of wheat are evaluated for grain yield in comparison to the latest high yielding variety. Other objectives for evaluating wheat varieties are for adaptation to specific locations, resistance to diseases and pests and suitability to low moisture conditions. Keeping these objectives in mind, the varieties, whether introduced from international crop programs or cross-bred in Nepal, are evaluated at various HMG stations/farms.

## AREA OF OPERATION

The Agriculture Department of His Majesty's Government has agricultural stations and farms in all regions representing the terai, inner terai and hills and high hills of Nepal. The location of the various HMG stations/farms are as follows: Kankai, Tarhara, Hardinath, Parwanipur, Rampur, Bhairawa, Nepalgunj, Surkhet, Doti, Khaireni, Khumaltar, Kavre, Pakhribas, Kakani, Lumle, Jumla, Palpa and Nigale. Promising varieties of wheat, before being released to the farmers in general are tested for their suitability and adaptation in farmers' field trials (FFT) in the districts of all regions. Minikits are provided to farmers in most of the 75 districts. In minikits, small amounts of improved variety seed of wheat is given with recommendations for cultural practices in a single page leaflet. These serve to introduce new varieties and recommended package of practices to the farmers of Nepal.

This season four types of FFTs have been designed to suit specific conditions of terai viz. rainfed and irrigated, and hill viz. khet and bari. The varieties for rainfed conditions of terai are NL297, NL352, HUW37, HP 1376, UP 262, RR 21. The varieties for irrigated conditions are NL 288, NL 289, NL 292, NL 298, NL 370, HD 2204, Vasker and RR 21. The varieties for hill khet conditions are NL 88, CC 521, UP 262, Triveni, RR 21 and NL 255. The varieties for bari conditions are HS 94, KAVKO "S", JUPATECO 73, AL 84, Triveni and RR 21. In the terai conditions at 24 locations 83 irrigated and 26 rainfed FFTs are being conducted. In the hills in 19 locations 69 khet and 30 bari FFTs are being conducted.

The varieties being distributed in the hill area in minikits are UP 262, Jupatece 73, NL 255, Triveni, NL 88, HS 94 whereas the varieties for the terai districts are UP 262, Vasker, Lumbini, Triveni, NL 292, HD 2204.

## SALIENT FEATURES OF OPERATION

Improved varieties of wheat in Nepal are introduced from international organizations such as CIMMYT Mexico, ICARDA Syria, AICWIP India, Nebraska and Oregon State University of USA. There is a limited number of crossing work done in Nepal. The crossing work is done mostly in the headquarters of National Wheat Development Program (NWDP) at Bhairawa agriculture farm. Individual seeds are

space planted and rust innoculation is done at heading time. From $F_2$ and $F_3$ populations, individual plant selections are done. Uniform and promissing $F_4$ lines are considered and selected for various nurseries. Promising individual plants are selected from segregating populations. Bulking from uniform populations and individual plant selections from segregating populations is continued from $F_4$ to $F_6$. Lines that are not uniform by $F_6$ are rejected.

The flow from initial cross to the final release of a variety and where the international trials and nurseries fit in is shown in Fig. I. The details of all the selection processes used will be given in another paper by my colleauge. Suffice it to say that at each step the varieties are selected from the point of view of their yielding ability, resistance to disease and insects, for their short or long duration and their specific adaptability to certain region of the country. These selection pressures of high yield, wide adaptability and resistance to disease and insects are applied to all advanced lines and varieties in the Initial Evaluation and Advanced Varietal Trials that are conducted on most farms and stations mentioned.

Before the final release of any particular variety to the general mass of farmer it is tested all over the kingdom in Farmers' Field Trials also. Varieties are tested at least for three years in the Initial Evaluation and Advanced Varietal Trials at most of the HMG stations/farms of Nepal.

When promising varieties are identified a detailed report giving the morphological and agronomic description of the varieties at different locations is prepared. Included in this report is the varietal resistance to disease and insects, their milling quality and protein content. This report is given to the members of the Variety Release Committee for their study and information. In the Variety Release Committee are member of the Agriculture Department Divisional Heads of Agronomy, Soils, Agricultural Botany, Plant Pathology, Entomology, Agriculture Inputs Corporation and the Chiefs of various National Crop Development Programs. In a meeting this committee reviews all the work and listens to the assertions of the plant breeder and then decides upon which variety is to be released and for which areas. The breeder and foundation seed are multiplied in HMG stations/farms and the farmers in the various districts multiply the certified and improved seed. Thus the program continues from year to year. One of the main problems in this program is to produce enough foundation seed as land area of HMG stations/farms are quite limited. Another problem is to maintain good quality seed in terms of purity and sound germination once supplied to the farmers of Nepal.

EXPERIENCES

Some varieties that have given high yields at several locations and over several years have remained within the HMG stations/farms much too long. Instead these varieties should have been released for the farmers and if they were unstable or susceptible to diseases they would have had a natural death and in the meantime the farmers would have benefited. Examples are Jupatece 73 and Tzpp - Plx7c (Vaskar).

Breeder and foundation seed are grown in HMG stations and farms. The land for such seed and the care taken to grow create problems in quantity and quality. These problems have to be tackled. Based on the demand, there has to be more seed multiplication farms, one in terai and hill areas of each region, under HMG or AIC, for this purpose. If it is felt that HMG or AIC cannot take proper ca f such farms then we should have registered seed growers in the areas mentioned to supply good seed. Field and seed inspection will be done by seed testing laboratories of Agriculture Botany Division. Seed collection and selling will be done by AIC and its branches with careful records of lots. If this is not feasible then seed companies should be registered after the Seed Law is passed in the nation. These seed companies should be authorized to buy and sell within each district or region depending upon their efficiency.

Despite several years of experience I am afraid that AIC has yet to provide the right quantity of seed of the best quality at the right time and at the proper location to meet the needs of the farmers of Nepal. For this to come about the packaging has to be based on the quantity needed by the farmers. Transportation has to be swift and timely or well planned ahead of time. The stores for seed especially in the terai areas have to have either temperature or humidity control or preferably both to maintain the high percentage of seed germination, when it is handled in large quantity. More technical staff are needed to handle seed to maintain quality. The demand and supply channels have to be more reliable, efficient and improved. Farmers having to be members of a co-operative to get agriculture credit and then getting coupons to buy improved seed is a lengthy process. This is no way to popularize varieties of wheat or any other crop for that matter.

The other problems the farmers face is that sometimes after they finally get the improved varieties the germination of seed is poor. The price of such seed is high usually. The quality of seed is poor or germination is poor due to poor storage. How this problem should be remedied has already been suggested.

The response of FFTs and Minikits is poor in general but more so for the latter. This is due to the fact that farmers have low level of education and then the JT/JTAs working with them are not motivated enough to respond. This problem can be tackled in two ways. Firstly strengthening agriculture extension activities to better convince the farmers of Nepal. Teaching the farmer assistants who are given training on the importance of FFTs and minikits and also better motivating JT/JTAs to do their work. The quality of JT/JTAs work also needs to be improved in this regard. My personal opinion is that JT/JTAs should be given better pay and housing facilities and their work properly evaluated. They have a calendar of operation but few function according to it. If they did, our response to FFTs and minikits would be better.

In a normal flow of seed from one generation to another, from foundation seed one produces certified seed from which one gets improved seed or the last generation, but due to a lack of foundation seed, certified generations I and II have been devised before the last generation of improved seed. These have created a lot of confusion among the farmers. Such problems could be avoided if regional seed production pockets were formed and regional seed laboratories also functioned so the movement of seed samples and seed was confined to short distances.

Fig. I Showing the process of varietal development in N.W.D.P.

Crossing Block:

$F_1$ ↓ Generation lines

← $F_2$ Bulk (Irrigated)

← $F_2$ Bulk (Rainfed)

← $F_2$ Bulk (spring and winter)

$F_3$ ↓ Generation lines

$F_4$ ↓ Generation lines

$F_5$ ↓ Generation lines

$F_6$ ↓ Generation lines

← International Bread Wheat Screening Nursery,

← Preliminary Observation Nursery,

← Regional Disease and Insect screening nursery,

← Rust Trap Nursery.

↓

Advanced Lines

← Uniform Regional Trial,

← International Spring Wheat Yield Nursery,

← Regional Wheat Yield Trial.

↓

Initial Evaluation Trial.

↓

Advanced Varietal Trial.

↓

Farmer's Field Trial + Minikits.

↓

Variety Release.

The problem of varietal seed mixtures has been another big problem. Out crossing in wheat is rather at a very low percentage level, so mixtures are definitely mechanical mixtures. Where it occures in the long chain of seed production and consumption is any body's guess. Keeping in mind the ethics of seed business this problem must be investigated and solved.

The problem of sterility in the Eastern Region of Nepal is yet to be solved. The problem is not as simple as it sounds. The reasons for sterility in wheat in the Eastern Zone has been contributed by many agents. Some feel it is due to water lodging at the root zone. Thrips have also been blamed. Day and night temperature fluctuation has been suspected, so has hot and dry wind during pollination time in combination with moisture stress but none is sure. Until we have a stable agronomist at the station concerned namely Tarahara agriculture station, we also cannot pinpoint the cause of sterility with scientific evidence.

FUTURE PLAN AND PROGRAM

There are two aspects to our future plans and program. One that is within the HMG stations/farms and two the program with the farmers in co-ordination with the regional agencies of Agriculture Department, Agriculture Inputs Corporation, Agriculture Development Bank and Cooperative Department.

Within the HMG stations/farms we will continue to identify high yielding varieties that are suited for the various parts of Nepal in collaboration with international organizations and regional agencies as mentioned above. Wheat research will continue in terms of varietal development, cultural aspects, plant pathology, insect resistance and maintenance of varieties that are superior. Breeder and foundation seed will be multiplied within HMG stations/ farms.

Programs such as Farmers Field Trials, Minikits and multiplication of certified and improved seeds will be conducted with the farmers of Nepal. In these efforts we hope to have good co-operation with all agencies such as Agriculture Department and their various divisions, Agriculture Inputs Corporation and their branch offices, Agriculture Development Bank and their branches, Regional Agriculture Directorates, Agriculture Development Offices, Co-operative Department and their various Unions and Co-operatives.

Specific problems of the various districts discovered by agriculture extension and production programs will be dealt by the National Wheat Development Program in collaboration with the Regional Agriculture Directorates and HMG stations/ farms in a specific area.

In co-operation with the cropping systems program we hope to come up with ideal varieties of wheat, rice and maize that will give high yields in their given seasons, essentially early to medium maturing varieties of rice which will allow wheat a normal season for good productivity.

We hope to identify a hill sub-station for NWDP where we can grow our segregating lines to identify varieties that have resistance to hill diseases.

To provide high quality seed with good germination we hope to collaborate with Agriculture Inputs Corporation and Agriculture Botany Division's seed laboratory and its regional branches to identify seed pockets in the hills and terai areas of each region, so that seeds need not be transported over long distances and their cost per unit is not exerbitant from the farmers point of view.

We would like to collaborate with AIC and cooperative unions and cooperatives in the village level as regards improving the seed stores so that germination does not deteriorate in long term storage. Seed stores regardless to whom they belong must have facilities either to control the temperature or humidity or both specially in the terai region of the country.

For improved varieties to spread to all corners of Nepal and for them to provide maximum production to the farmers, a sound seed industry to provide cheap but good seed is certainly a most urgent need. Technology for the maximum production of wheat does exist. The means of reaching these technologies to the door steps of the farmers of Nepal have to be improved.

Literature Reviewed:

National Wheat Development Program, Wheat Research Program 1982-83.

National Wheat Development Program, Annual Report 1981-82.

International Agriculture Development Service, Report 1981.

# VEGETABLE SEED SITUATION FOR EXPORT MARKET IN NEPAL

M.N. Pokhrel, Chief,
Vegetable Development
Division

## 1. INTRODUCTION

The location of horticultural farms in different agroclimatic regions has given some advantage to gain experience in vegetable seed production in Nepal. Since last few years, the program of vegetable seed production in private sector has shown a good possibility of increasing the income of small farmers in the hills. Considering the average land holdings (0.3 to 1 ha) and higher profitability from vegetable seed crops as compared to cereals, there is a bright future of vegetable seed industry in Nepal provided that there is an assured market inside or outside the country. As the internal marketing system is poorly developed and seeds remain unsold even when there is high demand of vegetable seed in one part or the other, the production program cannot be boosted up in full scale.

As the advantage of cheap labour and suitable agroclimatic regions provide the opportunity to improve the economy of small farmers through vegetable seed production, it is relevant to give short introduction of geography and climate to have an impression of the country as a whole.

## 2. GEOGRAPHY AND CLIMATE

The kingdom of Nepal is a land-locked mountainous country sand-witched between China and India. The country is rectangular in shape and enclosed between latitude 26°22' to 30°27' N. and longitude 80°4' to 88°12' E. The east west length is 800 km and north south average width is 140 km. The total area is around 145305 Sq. Km. with a population of 15 million. At present only 16 percent area of the country is cultivated and the rest in under snow, forest, rocks and river beds etc.

Nepal can be classified into the following subdivisions from north to south.

1. Higher Himalayan Zone (Alpine climate).

2. Midland Zone (Warm temperate to substropical climate).

3. Terai Zone (subtropical climate).

The Himalayan zone is located in the northern part of the country. There exist few areas which are known as inner Himalayan regions. These regions are made up of dry and cool valleys and are similar to Tibetan plateau and range in elevation from 2400 m to 5000 m. above sea level. The average daily temperature ranges from 1°C to 10°C in December to January and from 12°C to 21°C in June and July. Rainfall is very limited with the highest recorded 140 mm falling from June to September.

The midland zone is a wide belt consisting of fertile valleys, mountain slopes and river basins. Because the elevation ranges from 600 - 2000 m above sea level in this zone the average daily temperature range is 2°C to 17°C in December and January and from 20°C to 27°C in June and July. The average annual rainfall varies on a gradient from 1000 mm in the western hills to 2000 mm in the eastern hills with 85 percent falling between the months of June and September.

The third one is terai zone. It is a flat plain area ranging in elevation from 50 to 75 m above sea level. The average daily temperature fluctuation is from 7°C to 24°C during December and January and from 24°C to 34°C during May and June. The annual rainfall is essentially the same as that of the midland.

## 3. SEED PRODUCTION AREAS

The wide variation of climate and a large number of vegetable crops give the opportunity to grow one or more crops in one or more climatic zones. In irrigated areas where soil is suitable for vegetable crops, seed production programs are being launched successfully. At present, 1[illegible] pockets have been selected to operate these programs. However, the most important areas are as shown.

## DESCRIPTION OF FOUR IMPORTANT VEGETABLE SEED PRODUCTION AREAS

| Description/Area | Thak Marpha | Mushikot | Kathmandu valley | Sarlahi |
|---|---|---|---|---|
| 1. Altitude | 2566 m | 1400 m | 1350 m | 60 m |
| 2. Soil type | Sandy loam | Sandy loam | Clay loam | Sandy loam |
| 3. Microclimate | Very low rainfall freezing in winter low humidity mild summers, afternoon wind | Low rainfall and moderately low humidity frost free winter mild summer | High rainfall (above 2000 mm annually) rainy season June-Sept, dry Nov. to May. Frost in winter mild summer. | High rainfall hot summer mild winter frost free, rainfall from June to Sept. winter dry. |
| 4. Most suitable vegetable for seed production. | Cabbage, Carrot, Cauliflower, Cress, Peas, Turnip, Broad Leaf Mustard. | Onion, Radish, Cauliflower, Peas, Turnip, Spinach, Capsicum, Knol Khol. | Cauliflower, Cress, Spinach, Turnip, Radish, Broad Loaf Mustard. | Tomato, Eggplant, Cucurbits, Capsicum, Spinach. |

## 4. PRESENT SITUATION OF ON GOING PROGRAM

1. Vegetable Seed Production was done in horticultural farms till 1974-75. However, due to the increasing demand of seed, production programs were launched in some of the command areas of horticultural farms in private sector as well. The effect was very encouraging. In the year 1981-82 a quantity of 30 m.t. vegetable seed were produced. Similarly in 1982-83, 36 m.t. seed will be produced in the farmers fields. Horticultural farms situated in different agroclimatic regions manage to supply foundation seed and to supervise the programs in their command areas. Agriculture Inputs Corporation eventually collects the seeds from the farmers.

2. Internal Market:

AIC is the internal marketing agency for vegetable seeds. However it has limitation of technical manpower, suitable stores and proper distribution net-work. Fertilizers and cereal seeds are two big items with AIC, hence vegetable seeds have not got due attention till now. There is big difference in quantity demanded by extension program and seeds sold by AIC in its depots. Even the 30 m.t. of seeds remain unsold every year in the country due to the poor marketing arrangement. Therefore the marketing system needs to be improved greatly.

3. Scope of Future Expansion of the Program:

If the marketing system of vegetable seeds is improved a substantial quantity of seeds (around 150-200 m.t.) could be consumed annually. Presently, the internal market may not be higher than 200 m.t. but, the production could be raised several times more than this amount depending on the internal and external market. Vegetable seed production enterprise is one of the possible means for the low income farmers of Nepal to raise their economy in a short period of time. Therefore, it is high time to improve internal marketing system and to explore the possibility of export so that a large scale production program could be launched in the near future.

4. Organization of Production:

At the national level, there is Vegetable Development Division to test varieties and production of nucleus and foundation seeds and technical supervision of the production program. Central seed testing laboratory in the Agriculture Botany Division, Plant Pathology Division and Entomology Division supervise and check for quality in field as well as in laboratory. FAO Vegetable Seed Production Project is operating in Nepal to improve the quality of basic and commercial vegetable seeds by creating processing, packaging, and storage facilities. In the regional level these facilities are also available for seed testing, variety evaluation as well as technical supervision of contract production programs. Processing and storage facilities are also being created by FAO Project in important pocket areas. AIC for contracting with the farmers and Agricultural Development Bank for advancing production loans are actively involved in this program.

5. Quality Control Procedure:

The system of certification of vegetable seeds has not been in practice so far. However, the following procedures are generally followed:

a) Preharvest control:

i. Basic seeds are produced in government farms.

ii. Rigorous plant, root, head or fruit selection is done by technical staff.

iii. Off-types are rogued out.

iv. Sufficient isolation distances are maintained.

v. Commercial seeds are [illegible]duced in the field of progressive farmers sufficientl[illegible] [illegible]ined in seed production.

b) Post harvest control:

i. Threshing and precleaning is done by the farmers themselves under the supervision of technical staff.

ii. The produce is tested especially for germination and purity in the central seed testing laboratory, Kathmandu which is the member of ISTA.

iii. Seeds collected from the growers' fields are finally processed, treated, packed and labelled for distribution by AIC.

iv. Pathological test are done by Plant Pathology Division, Kathmandu prior to sending the samples out of the country. In case some objectional pathogens are found due measures are taken against them.

v. Phytosanitory certificate is provided alongwith the consignments which are sent abroad.

5. PRODUCTION AND MARKETING POTENTIALS OF VEGETABLE SEED FOR EXPORT

Internationally, vegetable seed trade is a flourishing money spinning industry. Larger share of the business is however enjoyed by private seed companies of Japan, USA, Holland, Denmark and Israel. These seed companies have strong research programs. They develop their varieties and multiply their seeds in areas where production is cheap. They procure their seed from these areas and market it internationally, through their strong international marketing channels.

To compete with such a organised industry it may be very difficult for Nepal. However, Nepal being a country with suitable agroclimatic conditions for seed production and having cheaper farm labour can take up production on contract basis with the large international companies on agreed price and quality. In this system packing and marketing is the responsibility of contracting agencies. They run the risk of unsold stock and losses. There is good possibility for Nepal to develop a program on these lines.

Second system to market the seed is by conventional ways. For this purpose market survey of potential foreign market, competitive prices, marketing channels, quality standards and pricing policies need to be developed.

The areas where Nepal has an edge over others are as follows:

- It is technically possible in Nepal to produce all types of vegetable seeds as suitable agroclimatic conditions are available.

- In terms of price it could be competitive in relation to prices of Holland, Japan, USA, due to cheaper labour.

- About quality standards, FAO Project is creating necessary facilities to improve quality. Quality standard are being developed and these will be matching the standards required for international market.

- Potential markets for Nepal vegetable seed seem to be Bangladesh, Burma, Ceylon, Thailand, India and Pakistan which are nearby countries.

To explore the possible markets in these neighbouring countries, a marketing survey must be done to study the vegetable seed situation.

Current status of vegetable seed trade in the country of survey should cover all aspects required for complete information on the following:-

- Vegetable crops and varieties popular with farmers, area covered and seed quantity required.

- Source from where seed is obtained at present.

- What is the mechanism of variety recommendation?

- Which agency is responsible for seed distribution private or government?

- What are channels of seed marketing?

- What quality standards are required?

- Whether government seed regulations in seed exist; if yes, how they are implemented?

- What are seed quarantine regulations?

- How are the climatic conditions for seed storage? What facilities exist in country for safe storage?
- What are the prices for seed sold at retail level?
- What is margin of profit for seed dealers?
- What packing is required i.e. cans, bags, etc. quantity wise?
- Whether original packing or local packing.
- What is time for planting?
- When seed should reach dealers?
- What are import policies of the government?
- What is mode of payment - hard or soft currency and banking procedure?

# SEED POTATO MARKETING

H.P. Maag
Co-manager
National Potato Development
Program

## 1. OBJECTIVE

As identification of better varieties of any commodity is futile if there is no scheme to produce their seed, so is seed production without marketing. Consequently seed marketing is not an isolated, selfish activity but the ultimate tool for the promotion of new varieties. In a wider sense, seed marketing is one of the instruments as well as instrumental in the execution of an agricultural development policy.

In view of the principles outlined above, NPDP's seed potato marketing activity aims at,

(1) promoting a faster spreading of new varieties among the farming community as compared to the process being entirely left to farmer to farmer exchanges:

(2) making sure that the quality seed potatoes are used as seed and not ending in the cooking pots;

(3) providing seed producers adequate returns so that they remain interested in seed production;

(4) making available to the general farmer quality seed of new varieties at an affordable price and last but not least;

(5) establishing a commercially viable, self-supporting system.

It is obvious that at least part of the above mentioned aims are contradictory to one another. Since, inspite of the introductory remarks, the seed marketing aims may be debatable, supporting facts are mentioned below:-

a. Within the general aim of at least maintaining food output per capita, potato production should increase at least a the same rate as the population. This has to be achieved by increasing production per unit area, for which varieties and seed had been identified as one of the important but not the only means. Consequently, the availability and utilization of the input seed needs to be promoted.

b. Quality seed potatoes cannot be allowed to end in the cooking pot for want of being sold as seed by the producer, since the extensive seed production backstopping efforts would have been in vain and an expensive wastage.

c. All around the world, farmers produce as much as they can readily sell at reasonably profitable prices. However, the farmer being primarily a producer, he cannot and will not engage in larger scale sales activities. As a result in many countries, often specialized government and cooperative bodies have evolved that take care of the marketing needs of the farmers. The needs of the Nepalese farmers in general and the seed growers in particular are in no way different.

d. Seed of any kind is a presious good. It can and must be priced higher than the same commodity produced for consumption. However, the price of seed must not only be affordable but also still such that not only higher yields but also higher economic returns are obtained.

e. Agricultural support price and subsidy systems in developed as well as developing countries have all become a very heavy burden upon government finances and many a government is arching under them. Most subsidies tend to, at one point, outweigh their benefits. As it can be reasonably assumed that neither HMG nor a foreign donor will be able to support a subsidy demanding seed potato marketing scheme, the pace of a commercially viable self-supporting scheme has to be pursued.

From the aforesaid, it is clear that seed marketing in general is the art of making two ends meet, namely the marketing goal (economic viability) and the marketing purpose (objectives (1) - (4)).

The following chapter 2 describes how the seed potato marketing scheme is operating, whereas its achievements and inherent problems are mentioned in chapter 3.

## 2. THE SEED POTATO MARKETING APPROACH

### 1. Introduction

Marketing as a philosophy would mean a systematic and planned orientation towards the requirements of the clients, with the aim of a chieving a good return on capital. As a result, marketing comprises:

- Collection of all relevant informations
- Definition of marketing goals
- Use of the marketing instruments, in particular
  - Identification of the market and sales channels
  - Price policy
  - Public relation and advertising
  - Marketing logistics

2. Markets and sales channels

The marketing strategy may be reduced to the questions: What, to whom and how ? It underlines the particularity that producer and client may be one and the same person. The analogy may be such that a farmer may repurchase part of the seed, that he had produced the season before. In this case, the functions of the seed marketing scheme are services like transport, storage and absorption of storage risk. In all other cases however, the marketing scheme in addition bears the marketing risks.

It can be safely assumed that there is a market for seed potatoes, which has to be tapped through various channels. The following are the possible sales channels, their potentials and weaknesses:-

a. Contract Farmers:

These farmers are a sure and established market. For obvious reasons, they do not repurchase as much seed as the seed marketing unit purchases from them.

b. District Agricultural Offices:

The District Agricultural Offices would be an ideal sales channel, provided the sales prices advocated by NPDP match the ones farmers are ready to pay.

c. Semi Government Institutions like AIC and Sajhas

Here the same applies as under b. above.

d. Integrated Rural Development Projects:

As they are generally integrated into the local structures and correctly so, generally the same applies as under b.

e. Private Dealers

Private Dealers may be useful sales channels, too. However, the interest of private dealers is largely a function of income and profit expectations.

f. Direct Sales to General Farmers Requiring Seed for Potato Production

Sales to farmers necessitates,

- timely, target oriented information and advertising
- temporary sales points, manned by people that are also able to answer the farmers' technical enquiries.

3. Price Policy

a. Seed potato procurement price:

The seed potato procurement prices are fixed according to the principles mentioned in the seed multiplication contract. The principles is market price plus 20 percent. The market price is the average price recorded at various markets. These market prices are investigated.

- in terai 10 days after final haulm-pulling date, since the prices are falling thereafter towards the main harvest period;
- in Kathmandu valley shortly before recollection, since the prices are increasing between haulm-pulling and recollection;
- in the hills 10 days after average haulm-pulling or crop maturity, where haulm-pulling is not necessary, since the prices remain stable throughout the harvesting period.

b. Seed potato sale price:

Sale prices are usually only one of the means of sales promotion. In Nepal, however, the sale prices are of paramount importance due to the prevalent, short term maximum profit orientation and poor esteem or ven disregard of additional services like quality guarantee etc.

In view of the need to assess the economic viability of a seed potato marketing scheme, the theoretical sales prices are calculated according to the following system:

i. Seed purchase costs (market price + 20 percent according to seed multiplication contract)

+ ii. Direct costs (material, transport, storage, handling, depreciation)

+iii. Indirect costs (production supervision and administrative overheads such as salaries, transports, stationary, advertising etc.)

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= Theoratical, ideal sales price (still without profit)

This surcharge calculation is made separately for all production and sales pockets, according to development regions and within them according to ecological regions. This method of sales price calculation is only one of various possibilities. This method does not consider other important factors like

price elasticity, market structure, etc. Nevertheless, this method is sufficient as a first approximation towards an economically sound sales price.

The actual sale prices are fixed according to the prevalent market conditions and considering the following range:

- Minimum sales price = a + b
- Desirable sales price = a + b + c
- Maximum sales price = a + b + c + profit

The above mentioned minimum price comprises the direct costs only and the actual sale prices should under no circumstances be below. The above mentioned desirable sale price is the one at least required for operating a self-sustaining seed marketing scheme.

At present, the indirect costs do not have to be paid by the seed marketing scheme since the involved staff is either paid by HMG or SATA. Nevertheless, there is emphasis on fixing the sales prices as high as accepted in the market. This allows to assess to which degree the overhead costs could eventually be covered through the sales income and ultimately to estimate the economic viability of a seed marketing scheme.

4. Public relations and advertising

The aim of public relations is to make the farmers quality seed minded on the one hand and on the other create an understanding that seed necessarily has a higher price. The aim of advertising is to make potential clients aware of the existing supply, its price and the sales points.

5. Marketing gistics

Marketing logistics comprises the supply of the packing material to the contract farmers, control of grading standard, produce recollection, weighing and sealing of the bags, produce transport to storage, storage and transport of the seed to the sales points. Utmost care is applied at each step so that the produce quality is and remains high, in view of the marketing policy.

6. Marketing policy

Thepolicy is to execute all transactions after the seed purchase on a per bag basis. This is to avoid additional and unnecessary handling costs. In addition, it avoids loss estimates that would have to be built into the sales prices and makes stock control easy. Consequently after storage, during which weight reduction due to evaporative water loss occurs, the bags are not opened and readjusted

to the initial weight, since the number of tuber is not affected. Any weight adjustment would any way be futile since until sale further evaporative water losses and thus weight reductions will occur. To avoid cultiple weight readjustment, which would only increase costs, all sales are affected on a per bag basis.

## 3. EXPERIENCES AND ACHIEVEMENTS

### 1. Markets and sales channels

a. Contract Farmers:

The size of this market is in a fixed proportion to what can be sold through channels b - f. Under constant conditions (no expansion and no shirnkage of the seed demand), the quantities required by the seed growers at the present level of seed production per unit area are about,

- 15 - 20% in terai
- 10 - 15% in Kathmandu Valley
- 20 - 25% in the hills (above 2000 m.asl)

b. District Agricultural Offices:

The difficulties encountered in this market channel are

- frequent changes of people;
- no risk attitude as well as no means to absorb any risk, which consequently fully remains with the seed potato marketing unit;
- inappropriate estimation of sales potential at a given price;
- lacking sales attitude of the involved people;
- inappropriate intermediate storage facilities which together with a long storage period due to slow sales and the perishable nature of the good cause excessive produce rottage before sale, ultimately creating a negative produce image and financial losses;
- no means to pay for the received seed right after delivery, thus the seed has to be supplied on credit;
- slow transfer of sales incomes to the seed potato marketing unit, often after many reminders and visits only, resulting in increased overhead costs.

Nevertheless, there are a few district offices that do a good job. Yet and unfortunately they are the exception and not the rule. Due to the many staff related problems, the sales through this channel vary considerably from year to year, being about

- 10 - 20% in terai
- 30 - 50% in Kathmandu valley including the supplies ex Kathmandu to districts outside the valley
- 10 - 20% in the hills

However, it has also to be mentioned that many demands, for rather small quantities, have been received from many districts which could not be fulfilled for either of the following reasons:

- excessive transportation costs to the respective places
- limited availability of seed
- potential danger of diseases transmission

c. Semi-Government I stitutions (AIC, Sajhas):

The same problems basically apply as under b. above. Small quantities could be sold through these channels so far and only in terai.

d. Integrated Rural Development Projects:

The sales through these institutions have been rather neglected. Partly because similar problems were feared as under b. above but also because of seed unavailability and the potential danger of diseases transmissions. Consequently the proportion of sales through these channels remained rather nominal.

e. Private Dealers:

Most of the private dealers are only ready to sell seed potatoes on commission basis. Therefore and because of the general attitude of big profit without risk, these channels have not been attractive sales outlets. Therefore the sales through these channels remained small and may even be further reduced. The sales through these channels reaches about:

- 20 - 30% in terai
- 0 - 5% in Kathmandu valley

f. Direct Sales to General Farmers:

These sales were largely a function of timely information and advertising. Furthermore, a farmer does not travel very far to purchase his seed potatoes. Consequently, the proportion of such sales is a question of sufficient sale points. The proportion of direct sale reaches about:

- 20 - 30% in terai
- 20 - 40% in Kathmandu valley and
- 40 - 60% in the hills

There is no doubt, that a number of sales channels with good potential are existing. Except the sale to contract farmers none of the other sales channels has functioned satisfactorily. It seems that seed marketing has occured through too many sales channels, none of which was actively and properly prepared and supported by the seed marketing scheme to assume its function.

2. Price policy

a. Seed potato procurement price:

The price fixation system has gone through various phases. In the beginning, NPDP operated through a committee consisting of a farmer, the ADO, and the NPDP representative. Since this committee system did not work properly, it was abandoned and the price is fixed by the NPDP representative alone. However, when assessing the market price, the NPDP representative is occasionally accompanied by contract farmers. This system is accepted by the farmers, since they have experienced the correctness of its application.

b. Seed potato sale price:

The approach outlined under chapter 2.3. has proved very useful. The pre-calculated minimum, and desirable sale prices are together with the actual market prices an essential tool for the ultimate price fixation. The experiences show that the desirable selling prices should be:

Terai

| | | |
|---|---|---|
| Seed procurement price paid to farmers | (a) | 100% |
| Direct costs | (b) | 70% |
| Indirect costs | (c) | 87% |
| Desirable sale price | | 257% |

Kathmandu valley

| | | |
|---|---|---|
| Seed procurement price paid to farmers | (a) | 100% |
| Direct costs | (b) | 25% |
| Indirect costs | (c) | 165% |
| Desirable sales price | | 290% |

Hills

| | | |
|---|---|---|
| Seed procurement price paid to farmers | (a) | 100% |
| Direct costs | (b) | 20% |
| Indirect costs | (c) | 72% |
| Desirable sales price | | 192% |

This method of calculating the desirable sale prices has one weakness. The whole calculation is based on the seed procurement prices paid to the seed growers. This weakness is overcome by recalculating the percentages every year. Over a time sufficient experience and accuracy can be obtained.

The actual sales prices fixation has proved difficult and occasionally created negative reactions.

The contract farmers are usually charged a seed price near the scheme's economic one, even at the risk that some farmers are no longer willing to conclude a seed production contract. In general however, the seed growers do not complain too much about the seed potato price and are ready to accept it, because the scheme also provides them with a ready sales outlet not only in terms of quantity but also in term of purchase price, being 20 percent above the consumption potato price in the market.

The sales price for seed potatoes sold through the District Agricultural Offices, Integrated Rural Development Projects and Semi-Government bodies have to be fixed as early as possible for technical reasons. At this early time, it is not possible to form a reliable opinion of the later market and price situation. If ultimately the prices are too low, the scheme looses sales income. However, if the prices are too high they are not accepted in the markets and the various institutions are not in a position to sell the booked quantities.

The sale prices of all quantities, that have not been booked and/or lifted at a certain date, are adjusted to the prevalent market situation. This price may be lower or higher than the price fixed at the early time.

Based on the recent advertising campaign in Eastern and Central Region Terai as well as discussions in Mid-Western Region Terai, it can be tentatively concluded that farmers are generally willing to pay a higher price than the market price for NPDP seed potatoes. The maximum tolerated price difference is around Rs.- 7.5/kg, which is equal to a surcharge of about 30 percent upon the prevalent selling prices in the markets.

3. Public relations and advertising

This activity has been neglected and advertising was only used at times when the danger of not being able to sell the seed became real. Usually, this is realized quite late only. Thus the remaining advertising time is short for still being in any way effective. First experiences with advertising as a sales promotion instrument showed that radio advertising is quite effective. However, having been implemented shortly before the planting period, it only attracts small clients, i.e. many clients purchasing small quantities.

4. Marketing logistics

The marketing logistics have been managed with increasing success. The enforcement of rigid standards and timings was disliked in the beginning, but necessary for being able to reasonably operate and for avoiding a lot of unnecessary haggling and discussions. In the meantime, however, most of the participants have learnt to stick to the rules also for their own advantage. This means that most farmers are bringing their produce to the recollection places on the promised day. Knowing that improperly graded potatoes are not accepted hardly any farmer has nowadays to do regarding at the recollection centre. Similarly seed distribution is taking place smoothly. More logistic problems do occur with respect to seed potato supply through other channels, due to non-acceptance or partial acceptance of ordered quantities as well as last minutes orders or cancellations, slow decision making and erratic decision changes.

5. Marketing policy

In the local context, where traditionally all seed potato sales are executed on a per weight basis, the introduction of the per bag sales principle was quite difficult. Still nowadays it is met with suspicion and people still fear being cheated. However, if the system is properly explained it is readily accepted.

The bag-wise sale has one disadvantage, as it discourages kitchen garden production, which usually is not such that it requires a whole bag of seed while on the other hand, kitchen garden production may be a person's first trial and experience with quality seed potatoes.

## 4. COMPARISON OF AIMS AND ACHIEVEMENTS

The seed potato marketing scheme has been established as a means to pursue the goals mentioned in chapter 1. Therefore it is necessary to assess to which degree the goals have been achieved until now.

### 1. Faster spreading of varieties

The seed potato marketing scheme is definitively promoting a faster spreading of the new varieties, partly because other farmers than seed growers are purchasing seed from the marketing scheme, thereafter maintaining it for their further use and partly but fairly substantially through farmer to farmer exchanges. This process is particularly noticeable in ecological zones where the farmers are able to store seed potatoes themselves, i.e. in the mid-hills and the higher hills. In terai, this process is hampered by the unavailability of suitable seed storage technologies at the farmers homes so that they rely on cold storage. In places where the farmers do have easy access to cold storage, they increasingly store their own seed.

### 2. Use of seed potatoes as seed

The aim of guaranteeing the use of seed potatoes as seed and to prevent their consumption is achieved, because the seed potatoes are sold in the very period in which the farmers use to purchase seed. Secondly, an increasing number of farmers is convinced of the production advantages through quality seed. Thirdly, the seed potatoes are priced higher than consumption potatoes to underline the quality argument.

### 3. Adequate returns to seed growers

The seed growers do get adequate returns. Depending on crop management, 70 - 90 percent of the produced potatoes are in seed size, for which the producer has a guaranteed sales outlet at a price, which is 20 percent above the market price. In addition, the seed potato marketing scheme provides the packing material, organizes and pays for the transport from the collection points onwards. Thus, besides the better price and the sales guarantee, the producer benefits from various other indirect incentives. According to the estimates, the profits-sales receipts minus production costs (inputs and labour) - obtained by the seed growers are about

Rs 10'000 - 14'000 / ha in Terai

Rs 13'000 - 15'000 / ha in Kathmandu valley and

Rs 3'000 - 5'000 / ha in the hills

### 4. Seed potato supply to general farmers at affordable price

Any judgement of whether this aim has been achieved or not is largely a matter of interpretation and belief. The acceptance

by the purchasers of a certain price at a certain time is not sufficient indication that the clients can afford to pay the price. It may well be that a price is accepted by mere necessity, On the other hand, non-acceptance of a good at a certain price does not necessarily indicate that the potential clients can't afford it, but they don't give it that value. Over a longer period of time however, the demanded and paid prices as well as affordability are in balance. Consequently, the prices at which the seed potato marketing scheme sells can be assumed as generally affordable.

5. Economic viability of the seed potato marketing scheme

The seed potato marketing scheme has not reached the visualized economic viability. At present, the sales receipts roughly cover the seed procurement and the direct costs. The sales income does not contribute to the overhead cost coverage. The reasons for not having achieved economic viability of the scheme are

- too high overhead costs in relation to the quantity produced
- insufficient handling of the sale channels
- too early and too much emphasis on enforcing the economically correct price at a time when the farmers had not yet understood the advantages of quality seed, thus sales problems creating higher sales costs and ultimate sales at distress prices.

The necessary consequences in view of the present failure to achieve economic viability of the seed marketing scheme are outlined in chapter 5.

## 5. AREAS OF OPERATION

The seed marketing scheme, in principle, emphasizes seed potato sales for ware potato production in the same districts in which seed production takes place. This is for two reasons:

1. The seed growers are assumed to have a demonstration effect upon their neighbours regarding seed quality and generally regarding potato production technology.

2. Transportation costs are one of the key cost factors. Therefore emphasis is on reducing costs by avoiding long distance transports. Further emphasis was on sales to adjoining districts, since support on potato production could be given to some extent by the same staff. Further seed potato requests were fulfilled on the basis of availability of suitable stocks and transport cost considerations.

## 6. FUTURE ACTIVITIES

1. Markets and sales channels

The number of sales channels will have to be reduced. However the retained sales channels have to be geared up so as to assume their

function properly. This may necessitate to depute staff specially for the purpose as well as to provide adequate training to the persons supposed to operate the sales channels.

2. Price policy

a. Seed potato procurement prices:

No change in the seed potato procurement price policy seems necessary at present.

b. Seed potato sales prices:

The price policy has to be streamlined according to the new available experiences. This means that the price for seed for further multiplication and the one for seed for ware potato production needs to be more differentiated. As the contract farmers enjoy a sales guarantee, it can be reasonably high, while the price for seed for ware potato production needs to be brought in line with what the general farmers are ready to pay above the market price for quality seed.

3. Public relations and advertising

The public relations and advertising efforts have to be increased. However these instruments have to be adjusted to and to be used as a support of the particular sales channels so that the marketing channel and the sales promotion form a really integrated package.

4. Marketing logistics

The marketing logistics have been handled reasonably well in the past. It will automatically profit from an improved handling of the market channels.

5. Marketing policy

In principle, the seed sales have to continue on a per bag basis, so as to avoid additional, unnecessary handling costs. However, as a means of sales promotion, per kg sales may be visualized so that a larger number of farmers may try new varieties and get acquainted with quality seed.

6. Cost control

A tight control over the costs has to be exercised. In this connection, it is expected that the seed growers will assume increasing responsibility within the system so that the involvement of staff will become gradually less. The ultimate aim must be to reduce the overhead costs per unit seed produced and marketed.

## 7. Economic viability

Further experiences regarding the economic viability of a seed potato marketing scheme are required. Whether this aim can be achieved is still uncertain and depends upon substantial improvements of factors like,

- marketing channels
- their successful support by public relation and advertising in conjunction with
- price policy and
- marketing policy and
- cost control measures

A further number of years is required before a conclusive judgement is possible and permissible. If after this period an economically viable seed potato marketing scheme is still not possible, the attempt should be abandoned for the reasons mentioned in chapter 1. As a result also seed potato production through contract farmers would have to be cancelled. It would then at least become questionable whether basic seed production by NPDP and ultimately varietal evaluation shall be maintained.

Any cancellation of seed potato marketing would look as being very detrimental to potato production promotion. However, it should be kept in mind that even in such a case, the impact of NPDP will have been considerable, because in the meantime the spread of new varieties and potato production technologies will have further occured and they will further be used by the farmers. A further spreading of varieties and technologies would be considerably slowed down, but possibly not come to a standstill. As a result NPDP would in no way become absolete since new technical problems are likely to crop up. In addition, the transfer of technology to and the training of the Nepalese potato growers will still need to be continued.

# ROLE OF VARIETY RELEASE COMMITTEE AND ITS FUNCTIONS

H.B. Shrestha, Chief,
Agriculture Botany
Division

## INTRODUCTION

A variety has a great influence on crop productivity. Hence its registration to safeguard quality is of great importance to increase crop production. With this view, an official Variety Release Committee was initiated in 1974, under the Department of Agriculture/HMG.

## OBJECTIVES

The object of the committee is to provide the farmers with known, tested and superior crop varieties and to eliminate the unknown, untested, and unreliable ones.

## PROCEDURE

Procedure for the assessment of the superiority of a variety/strain has been developed by the committee. In accordance with the procedure, any variety/strain evolved or introduced by the breeding institute or the concerned commodity program has to be tested primarily under initial evaluation trials. The promising ones are then tested under advanced varietal trials at Agriculture station/farms and simultaneously at farmers' fields. The result of trials, at least of two crop seasons, are presented at the workshop by the concerned crop coordinator and are discussed among the scientists of the related discipline. On the basis of recommendations, the breeder/coordinator puts forward the proposal to the committee for release. Performance data of the candidate variety as compared to the released ones are scruitinized by the committee which then finally decides to release or reject the variety.

## COMPOSITION OF THE COMMITTEE AND ITS PRESENT MEMBERS

| | |
|---|---|
| Chairman:- | The Deputy Director General (Crop Science), A.M. Pradhanang. |
| Member-Secretary:- | The Chief, Division of Agriculture Botany, H.B. Shresetha |
| Members:- | The DDG (Technical Services and Extension) S. Moin Shah |
| | The Chief of concerned Commodity Program. |
| | The Chief, Division of Agronomy, A.N. Bhattarai |
| | The Chief, Division of Entomology, K.C. Sharma |
| | The Chief, Division of Plant Pathology, M.M. Amatya |
| | The Chief, Division of Soil Science, R. Shah |
| | The Chief, Division of Vegetable Development, M.N. Pokharel |
| | The Chief, Division of Agriculture Inputs Corporation, B.N. Kayastha |
| | The Chief, Division of Potato Development, B.K. Bhumi |

DATA PRESENTATION

1. Brief reasons in support of the variety proposed for release have to be submitted. For example, whether the candidate variety/strain is to be released because of higher yield, disease or insect telerance, or any other specific reason has to be stated clearly.

2. Pedigree description with agronomical and morphological characters has to be mentioned.

3. Experimental results of minimum two crop seasons have to be submitted.

4. Results of the farmers' field trials have to be included.

5. Disease and insect reaction of minimum two crop seasons have to be mentioned.

6. Available quantity of breeder and foundation seed should be to be stated.

7. Seed samples of the candiate variety have to be submitted to Divisions of Plant Pathology. Entomology and Botany (Seed Technology).

THE MEETING TIME

As and when a breeding institute/commodity program succeed in finding a better variety that is superior either in genetic/agronomic quality or in yield, it is submitted to the member-secretary with the necessary supporting data. The secretary will go through data records and with the consent of the chairman, fix the date and time of the committee meeting and notify the members in advance.

THE MEETING PLACE

The meeting of the Variety Release Committee normally takes place at the Department of Agriculture/HMG Harihar Bhawan/Pulchowk, Lalitpur.

BASIS OF THE VARIETY RELEASE

1. Members of the committee examine closely the merits and demerits of the candidate variety/strain and decide finally to release or reject.

2. The committee is authorized to release the variety/strain nationwide or for a specific area only for a particular reason depending upon the situation.

3. In case of an internationally recognized variety the committee has relaxed performance data for one crop season only.

RECOMMENDATIONS

The package of practices of the candidate variety/strain have to be stated and recommendation of plant protection measures mentioned.

OPTIONAL

1. Early released variety can be withdrawn from the recommended list if the committee feels necessary to do so.

2. The chief of the Divisions of Agronomy or Vegetables shall be the convener of the meeting for the non-commodity and vegetable crops respectively.

Names of the varieties of the crop species released and recommended for cultivation:

| Species | Name of the variety | Year of release | Importance A/ |
|---|---|---|---|
| Rice | CH-45 | 1960 | 1 |
| | H-136 | 1962 | 0 |
| | BR-34 | 1962 | 0 |
| | BR-3 | 1962 | 0 |
| | Taichung-176 | 1966 | 1 |
| | Chinung-242 | 1966 | 1 |
| | Kaoshing-24 | 1966 | 0 |
| | Chainan-2 | 1966 | 3 |
| | Taichung Native-1 | 1967 | 0 |
| | Tainan-2 | - | 3 |
| | IR-8 | 1968 | 2 |
| | IR-5 | 1969 | 0 |
| | IR-20 | 1970 | 2 |
| | IR-22 | 1972 | 0 |
| | Khumal-1 | 1972 | 0 |
| | Parwanipur-1 | 1973 | 3 |
| | Jaya | 1973 | 0 |
| | Masuli | 1973 | 1 |
| | IR-24 | 1975 | 3 |
| | Chandina | 1977 | 0 |
| | Laxmi | 1979 | 1 |
| | Durga | 1979 | 1 |
| | Sabitri | 1979 | 1 |

A/ Very important - 1. Less important - 3
Important - 2. Grown only occasionally or not at all - 0.

| Species | Name of the variety | Year of release | Importance |
|---|---|---|---|
| | Janaki | 1979 | 1 |
| | Bindeswari | 1981 | 1 |
| | Kanchan | 1982 | Gaining popularity |
| | Himali | 1982 | do |
| | Malika | 1982 | do |
| Maize | Amarillo Cuba | 1959 | 0 |
| | Cubano Flint | 1959 | 0 |
| | Khumal yellow | 1968 | 1 |
| | Rampur yellow | 1968 | 2 |
| | Kakani yellow | 1969 | 3 |
| | Hetauda composite | 1972 | 3 |
| | Rampur composite | 1975 | 2 |
| | Sarlahi white | 1975 | 2 |
| | Sanaki Makai | 1979 | 1 |
| | Arun - 2 | 1981 | 1 |
| Wheat | Lerma - 52 | 1960 | 2 |
| | Petic 62 | 1967 | 0 |
| | Lerma Rojo - 64 | 1967 | 3 |
| | S - 331 | 1969 | 0 |
| | S - 227 | 1969 | 0 |
| | NR - 21 | 1971 | 1 |
| | NL - 30 | 1975 | 3 |
| | HD - 1980 | 1975 | 3 |
| | Lumbini | 1981 | Yet to be popularized |
| | UP - 262 | 1981 | do |
| Barley | Bonus | 1974 | 3 |
| | Galy | 1974 | 3 |
| | CI - 10448 | 1974 | 3 |
| | HBL - 56 | 1974 | 3 |
| | Ketch | 1975 | 3 |

| Species | Name of the variety | Year of release | Importance |
|---|---|---|---|
| Millet | Okhale 1 | 1980 | 2 |
| | Dalle - 1 | 1980 | 2 |
| Mung-bean | Pusa Baisaki | 1976 | 2 |
| Lentil | Sindur | 1979 | 3 |
| | Simrik | 1979 | 3 |
| | Sisir | 1979 | 3 |
| Chick-pea | Trisul | 1979 | 3 |
| | Dhanush | 1979 | 3 |
| Black-gram | Kalu | 1979 | 3 |
| Mustard | M - 4 | 1980 | 3 |
| | T - 9 | 1980 | 1 |
| Peanut | B - 4 | 1980 | 2 |
| Soya bean | Hill | 1978 | 2 |
| | Hardee | 1978 | 2 |

PROGRAM CHIEFS

1. G.R. Rajbhandari

   The co-ordinator, National Maize Development Program, Rampur.

2. B.B. Mathema

   Acting co-ordinator, National Rice Development Program, Parwanipur.

3. P.S. Rana

   The co-ordinator National Wheat Development Program, Sidharthanagar.

4. Dular Chand Pathak

   Acting co-ordinator National Oil-seed Development Sarlahi.

# FAO SEED IMPROVEMENT AND DEVELOPMENT PROGRAM (SIDP)

A.O. Wignell,
Technical Senior Officer
FAO, Rome

## BACKGROUND

The use of good quality seed, associated with an adequate supply of water and fertilizers, is the quickest and most rewarding way of increasing crop production and productivity. Without good seed, the impact on crop yields of other inputs will not be highly significant nor, often economical. Apart from its direct impact on yields, good quality seed has other merits: its use can benefit both small and large farmers; it allows for flexibility in cropping strategies; unlike other inputs, it can be adapted to less favourable climatic conditions and finally, it is a renewable resource.

Despite these attractive features, the production of quality seed is still limited in many of the developing countries and is not properly organized. The FAO Seed Review 1979-80 emphasized that the constraints in the seed sector were caused by the lack of proper institutions, inadequacy of finance for facilities and equipment, and the severe shortage of trained manpower, particularly at the intermediate and lower levels, which are critical to the needs of medium and small farmers.

In response to repeated requests from member nations, FAO implemented SIDP in 1973. Todate 130 countries are cooperating with SIDP, which is operated by the Seed Service (AGPS) of the Plant Production and Protection Division.

## OBJECTIVE

The objective of SIDP is to assist the developing countries in the establishment and operation of efficient seed programs and to mobilise multilateral and bilateral resources for this purpose. Specifically, this includes the formulation and implementation of national seed programs and projects; and through these, introduction, evaluation and release of improved varieties, the production and multiplication of seeds and planting material and the quality control, processing, distribution and utilization of improved seeds.

## RESOURCES

The resources of the FAO Regular Program provide the initial input, with subsequent support coming from multilateral, e.g. the United Nations Development Program (UNDP), and bilateral sources under Trust Fund (TF) arrangements and FAO's Technical Cooperation Program (TCP). For this purpose, a built-in feature of SIDP is the promotion of links between national seed development institutions and international and private organizations engaged in seed production and seed research and technology.

The major TF donors were the governments of Austria, Bahrain, China, Denmark, Iraq, Italy, Nigeria, Norway, Sweden, Switzerland and the Arab Gulf Program.

DESIGN FOR IMPLEMENTATION

Since its inception, the SIDP's guiding principle has been the harmonization of technical assistance inputs with the priorities of the crop sector as defined in the country's agricultural development plan. Particular care is taken to select activities which fit with the development stage of the seed sector in the recipient country. For example, in countries where no improved varieties have been identified, the assistance will focus on programs for the introduction, identification and testing of suitable varieties and on the establishment of special farms to produce basic seed of the varieties identified. Where suitable varieties already exist and means for their production are available, assistance will go to the building of institutional capacity, improving technical infrastructure for furthering the release and diffusion of varieties, strengthening seed quality control, including legislation, and overcoming the difficulties in the processing, storage and distribution of seed. In most cases, special attention is given to manpower training and to meeting urgent requests for specialized equipment. The beneficiaries of SIDP are the seed producers and consumers in the developing countries and donors who wish to assist the seed sector.

ACTIVITIES

The emphasis of activities sponsored by SIDP is on varieties adapted for differing agro-ecological conditions, including rainfed and irrigated areas, as well as marginal lands and areas prone to drought. The selection of promising local varieties usable for improvement is also encouraged. Although the primary output of SIDP is the production and provision of seeds, it also includes institution-building and support (training of manpower and preparation of technical guidelines).

Up to 1981, the strategy implied stocktaking of seed production activities in member countries, developing technical guidelines, introduction of suitable crop varieties, formulation and implementation of seed projects. Considering the pre-eminent role of food crops, special attention was paid to the production of quality seed of food crops, though in program formulation the requirements of other crops of major social and economic importance were not neglected. However, because of resource limitations, the bulk of the assistance went to the least developed and most seriously affected countries.

From the inception of SIDP in 1973 until December 1981, 270 projects in over 70 countries had been implemented with a total allocation of US$ 105 million supported by UNDP, TF and TCP. In addition, about 500,000 seed samples were dispatched to 140 countries for experimental purposes, over 1500 people were trained and several text-books, technical guidelines and information material published in English, French, Spanish, Arabic and Chinese.

Since 1982 selected priority actions have been based on seed utilization campaigns and the establishment of seed security reserve stocks. A corresponding effort has been made to respond to an increasing demand from many FAO member countries especially in Africa and Asia for technical support and, in particular, for strengthening of national seed services. Promotional activities have continued and have been expanded to meet specific needs in implementing training programs both at regional and national levels. Detailed information on the availability, characteristics and adaptability of crop cultivars

has been collected and stored for retrieval and dissemination. Priority has been given to the exchange and distribution of crop varieties for evaluation by national institutions.

EQUIREMENTS

To achieve the crucial production increase from improved seeds and to enable developing countries to become self-sufficient in seed production, a sustained and increased level of resources is required.

Further Information available from:

Chief, Seed Service

Plant Production and Protection Division

FAO, Via delle Terme di Caracalla

00100 Rome, Italy

# SEED PRODUCTION AT PAKHRIBAS AGRICULTURAL CENTRE

I.G. Hunter
and M.R. Bhattarai

## INTRODUCTION

Pakhribas Agricultural Centre (PAC) is situated in the Pakhribas Village Panchayat (27°2' lat. 87°17' long) in the Koshi Zone. The Centre has 80 ha. of land ranging in altitude from 4200 ft (1275m) to over 6500 ft (1970m).

The project started in 1973 with a scheme to provide training for retired or redundant British Gurkhas. In 1973 and 1974 the present land was purchased and research and production started. 1975 saw a modification of policy, which resulted in PAC serving the whole farming community of certain "target Panchayats" and not just ex-army personnel. The Panchayats were selected on approval of the Department of Agriculture. Originally, four Panchayats were selected and this has now increased to a total of fifteen. Over this last year, PAC has also started to give support to the Koshi Hill Area Rural Development Project (KHARDEP), working in two Agricultural Service Post (ASP) areas - at Morahang and Tankhuwa. This covers another eight Panchayats. It is anticipated that as more ASPs are developed, PAC will help on technical and seed production matters over a wider area.

## DEVELOPMENT OF SEED PRODUCTION

### 1. Field Crops

Growing crops for seed production started in 1976 to "decrease outside dependence" on seed supplies and to encourage "generation of cash" for the farmers. The first time crops for seed were grown on contract in the, Panchayats was in 1977. This was after initial varietal trials in farmers fields, and was aimed at meeting the local demand. 14 m.t. of RR21 wheat seed was produced in the Panchayats but the maize crop was badly reduced by bad weather. All seed production was preceeded by farmer training on the growing and maintenance of the seed crops.

In wheat, production has steadily increased over the years, maize production levels remaining more stable. Most of the production has been grown on contract in farmers fields, as the land on the centre has only a production capacity of approximately 1 m.t. of wheat and 3 m.t. of maize. Contracts were first drawn up in 1977 and the form has been modified over the year.

In this present season PAC is working with 52 farmers on contract to grow wheat seed (RR21) and last season over 50 farmers grew maize (Hetauda composite, Amrillo del Bajio and Arun 2) on contract. 51 Ha. of wheat seed crop have been sown this season with a potential for yielding 2t/ha. The policy of the extension sections in the past has been to carry out very strict cleaning and seed selection so that only about 20 percent of the crop has been taken for seed. This has been to maintain the standards.

A system of premium payments to the growers has evolved over the years, with the level of bonus, above a base price, worked out on the quality of the seed. The maximum bonus is 30 percent.

Table 1

SEED PRODUCTION OF FIELD AND VEGETABLE CROPS AT PAKHRIBAS AGRICULTURAL CENTRE (in Kgs).

| Crop | Year | | | | |
|---|---|---|---|---|---|
| | 1977-78 | 1978-79 | 1979-80 | 1980-81 | 1981-82 |
| Wheat | 14,000 | 16,409 | 17,082 | 25,000 | 13,739 |
| Maize | NA | 7,037 | 5,600 | 6,558 | 6,278 |
| Vegetables | 50 | 94.68 | 24.72* | 171.2 | 509.5 |
| Peas | 80 | 48 | NA | NA | 26 |

* Change in reporting year. Figures excluded winter vegetable seed production.

The major field crops grown for seed are maize and wheat but some vegetables have been grown at the Centre for a number of years. Lentil seed production has also started.

2. Vegetables

Seed production started in 1975-76 with a total of 9.705 kg of seed being produced at the Centre. The initial crops that were grown for seed included radish, cauliflower, carrot, cabbage and turnip. Vegetables were first grown on contract in farmers fields in 1980. Farmers produce winter vegetable seed but summer vegetable seed production (which is small) is still all done at the Centre. Production targets are set after consultation with HMG(N) and taking into account PAC and KHARDEP's requirements.

DEVELOPMENT OF SEED QUALITY CONTROL

With the start of the seed multiplication program, the need for quality control became evident for several reasons - to ensure viable seeds were sold; to ensure that they were of the correct variety; and as is important, to pay the seed grower the premium given for quality seed. In 1979 a seed laboratory was established and began doing quality control work in 1980. Laboratory techniques were established and a technician trained in carrying out moisture content, germination and purity tests to the International Seed Testing Association standards. Testing is not only done on seed crops but also on trial material used by other sections at PAC.

The next area of quality control that is being investigated in the growing of control plots of all the seed lots tested in the laboratory. This, along with the field inspection, gives a control on varietal purity and internal seed-borne diseases which may not be evident in laboratory testing.

Another development within the last two years has been the use of lot numbers for all seed lots used in the PAC system and the labelling of all seed sold. This is essential for tracing the progress of a batch of seed as it moves through the production process from one generation to another. The label on every bag is provided by AIC as part of their improved seed scheme and provides details on the lot number, variety, label no., production year, germination percentage, moisture, date of testing and treatments, if any.

Table - 2

NUMBER AND TYPE OF TESTS DONE ON INDIVIDUAL CROPS IN THE SEED LABORATORY FROM DECEMBER 1981 TO NOVEMBER 1982

| Crops | TEST TYPE | | | Total |
|---|---|---|---|---|
| | Germination | Purity | Moisture Content | |
| Maize | 77 | 53 | 314 | 444 |
| Wheat | 107 | 82 | 102 | 291 |
| Rice | 21 | 3 | 13 | 37 |
| Barley | 19 | 0 | 0 | 19 |
| Oats | 8 | 3 | 5 | 16 |
| Lentil | 7 | 4 | 14 | 25 |
| Peas | 19 | 1 | 1 | 21 |
| Sorghum | 5 | 0 | 0 | 5 |
| Millet | 3 | 0 | 1 | 4 |
| Soyabean | 3 | 0 | 27 | 30 |
| Radish | 34 | 34 | 34 | 102 |
| Cauliflower | 26 | 25 | 26 | 77 |
| Rayo | 11 | 11 | 11 | 33 |
| Brocolli | 7 | 7 | 7 | 21 |
| F. Bean | 15 | 1 | 1 | 17 |
| Chilli | 4 | 3 | 3 | 10 |
| Turnip | 3 | 3 | 3 | 9 |
| Mustard | 7 | 0 | 0 | 7 |
| Capsicurn | 6 | 0 | 0 | 6 |
| Onion | 2 | 2 | 2 | 6 |

| Crops | TEST TYPE | | | Total |
|---|---|---|---|---|
| | Germination | Purity | Moisture Content | |
| Cabbage | 3 | 0 | 0 | 3 |
| Brinjal | 1 | 1 | 1 | 3 |
| Vetch | 4 | 0 | 0 | 4 |
| Clover | 3 | 0 | 0 | 3 |
| Others | 28 | 1 | 0 | 29 |
| Total | 423 | 234 | 565 | 1222 |

Thus, if a farmer has a problem, the history of the seed can be traced back and if the fault is in the seed, that lot can be withdrawn.

THE PRESENT SYSTEM OF SEED PRODUCTION

The system for seed production on contract is similar for both crops and vegetables and can be broken into phases. They are:-

1) The Planning, Training Phase
   1) Production target set.
   2) Farmer selection.
   3) Farmer training.
   4) Contract.
   5) Lot number allocated to farmer.

2) Growing Phase
   6) Inputs supplied.
   7) Supervision.
   8) Field Inspection.
   9) Harvest/Initial cleaning.

3) Processing, Testing, and Storage Phase
   10) Seed to PAC or project house in Panchayat.
   11) Seed sampled.
   12) Seed tested.
   13) Further drying and cleaning.
   14) Payment of Farmer.
   15) Seed stored in individual lots.
   16) Seed treated and packed.
   17) Seed sold.
   18) Control plot sown out at PAC.

1. Planning/Training Phase

The production targets are set within PAC on consultation with HMG(N) and AIC and take into account the estimated future demand for seed in the PAC target area. In wheat, for example, PAC has 3 generations

growing this year, and so targets have to be estimated for requirements in 1984-85. Farmers are then selected by the field assistants, JT/JTAs on such criteria as experience, interest and suitability of their land for the crop. They attend a four or five day training course at PAC on subjects ranging from crop husbandry to the theory of seed formation. A lot number is allocated to each farmer. This can be done at the end of the training course, and is entered in the register being kept by the extension staff. This register records the farmers name, Panchayat, ward, seed crop, variety, area, origin of seed (by lot no.) and the lot no. of the seed to be harvested.

2. Production Phase

Seed, fertilizers and pesticides are supplied to the farmer from PAC on a cash or ADB loan basis and the farmer plants the seed on the alloted field. Supervision and advice is given to the seed growers throughout the season by the Panchayat based field assistants and visiting senior staff from the extension sections. The crops are inspected by staff. Ideally, the crop should be inspected two or three times, but in some cases one inspection has to suffice due to lack of staff. Harvesting and initial cleaning is done by the farmers under the supervision of the field staff.

3. Processing, Testing and Storage Phase

The seed is brought into the Centre, or the project house in the Panchayat (wheat and maize) by the farmer. It is then sampled by the staff and sent to the laboratory for testing. There it is tested for moisture content, purity (species, weeds, insert matter) and germination. Based on the result of the tests, the farmer is paid a premium above the agreed basic price, in wheat and maize. There is no premium system for vegetables.

From this year the seed is being stored in individual lots and not being bulked as in the past. Wheat and maize are fumigated with Phosthoxin then stored in metal bins lined with plastic. Vegetable seed are stored in plastic bins.

The seeds are stored untreated and are only treated when being packed, approximately one month before distribution and sale. Treatment is with Malathion and BHC dust.

PRICING AND MARKETING PROCEDURES

Purchase price of vegetable seeds is the price laid down by HMG(N). No distinction is made between acceptable and excellent batches of seed. For crop seed, the buying price is worked out by the extension section heads, assistant heads AIC and ADB representatives and farmers representatives. In general, the base price is taken as the market price in the area over a number of weeks. To this, graduated increments are added to a maximum of 30 percent, depending on quality-moisture content, germination and purity.

In the past, PAC subsidised the cost of cleaning, treating and bagging seed. This is being phased out. The selling price is now being set to cover all recurrent costs. In setting the price of seed the following is taken into account:-

Buying price of seed

Labour costs - cleaning, treating

Chemical costs

Packing costs

All marketing in the PAC target area is done through the field assistants or JT/JTAs (KHARDEP). They sell seed from the project houses or Agricultural Service Posts. PAC acts as a project house for Pakhribas Panchayat and also distributes seed to selected growers.

EXPERIENCES

One of the recurrent difficulties in the seed program is getting farmers to honour their contract and sell seed to PAC. This is not a difficulty in the local target area, but in the Taplejung District to the north defaulting can occur. In a bad season, crops are poor and in a food deficit area the farmers with to keep their crops for feed. The PAC northern target area is also on the route north to Wallenchung and Tibet and the farmers get a higher price selling crops to be carried north for food, than they would selling for seed. This illustrates the need for a seed area to be self sufficient in food grain before the sophistication of seed production is introduced. Also some sort of workable penalty system must be developed for contract defaulters.

Another problem which has to be overcome in the hills is one of transport. PAC has been trying to develop self sufficiency in seed, within Panchayats to overcome this. This will cut down transport costs both for the farmers and the institutions, the bulky crops such as maize and wheat being produced and stored in the Panchayats.

Working in 14 Panchayats, quality control is hard to monitor. To be self sufficient within a Panchayat there has to be several seed growers in each panchayat. This then creates problems for effective quality control work in the field. It would seem that after the initial work at PAC of identifying seed growers in all Panchayats, there should now be a change to identifying suitable panchayats in which to concentrate the seed production effort.

In the past, Pakhribas has maintained its own foundation seed, as it has always experienced difficulty in obtaining the right quality of seed, at the right time. This policy will be changing and it is hoped that foundation seed can be brought in from government stations every year, to fit into a generation system of seed production. Several bodies, though, have expressed concern as to the availability of foundation seed on a regular basis. It is therefore suggested, that a new body be set up solely to produce foundation seed. Breeders are not interested in producing it and it is not a commercial crop that is attractive to AIC business. So, as in other countries, a para-government seed

development organisation should be set up to take breeder seed and multiply it to produce foundation seed. The organisation could deal with both cereal and vegetable seed.

As Nepal moves towards nation-wide seed production schemes with the flow of seed between government sources, private sources and aid projects increasing, it is essential to develop a single seed identification system for the country. It is realized that our lot system differs from AIC and HMG(N) systems. Hence, efforts should now be made to standardise lot number construction.

It has also been the experience at PAC that it is very difficult to maintain isolation distances between cross pollinated crops, in particular maize. In the hill situation, with small land holdings, it is sometimes impossible to get the required isolation. PAC have tried several methods of getting over this obstacle. One way has been to get a group of neighbouring farmers to cooperate in seed production, to produce a large block of seed crop. The edges of the crop can always be rejected for seed if isolation is poor. Another method of achieving isolation has been to sow seed crops either before or after the main crops, thus giving isolation in time. This works in theory but it is not so effective in practice. With the wide variety of conditions in the hills, and the composite nature of the maize crops (both local and improved) flowering can occur over a long time span, negating the effect of different sowing dates. Another, more practical method of semi-isolation is to ensure that farmers near a seed crop are growing improved seed of the same cultivar from a known source. As all maize crops in the hills are composite cultivars a small percentage of out-crossing can be accepted if a strict control is kept on the number of generations allowed. This will hopefully be done at PAC if foundation seed can be supplied every year.

A problem that is now being experienced in KHARDEP ASP Panchayats is that AIC are unable to buy and store seed in the ASP buildings. They can only work out of district centres. The Panchayat level work of buying and storing seed is supposed to be carried out by the SAJHAs or an AIC agent. Even if they are present in the ASPs it is felt that they will not have the necessary funds for proper cleaning, storage, treating and packaging of the seed in these ASPs. The only way this can be overcome is if AIC can be authorized to work outside the district centres.

## FUTURE PLANS AND PROGRAM

Pakhribas Agricultural Centre in shifting away from producing seed at the Centre. In the past, foundation seed were maintained through strict control and selection measures. This is being phased out and it is hoped to use government sources for foundation seed.

Pakhribas has in the past, concentrated its extension activities in 14 selected Panchayats. Now, it will be aiding KHARDEP in its agriculture program in 12 ASPs covering approximately 50 Panchayats. Part of this work will be in seed production. PAC will also work with AIC/SPISP to produce a coordinated seed program for the KHARDEP area. The capacity for the laboratory at PAC will probably be increased to cope with seed work for 4 SPISP seed houses (at Pakhribas, Terhathum, Bhojpur and Chainpur), a limited amount of ASP/KHARDEP work, and the HMG(N)/FAO vegetable seed production work centering round the Dhankuta Agricultural Station, Parepatle.

Seed production for the Pakhribas SPISP seed plant will be in the adjacent Panchayats and some work will be monitered in the KHARDEP ASPs although, in the future, it is envisaged that the 4 SPISP plants will serve the whole KHARDEP areas with very little additional ASP seed production.

It is hoped that the seed laboratory will receive official recognition in the near future, so that it can become fully integrated into the HMG(N) seed production and quality control programs.

# THE VEGETABLE SEED PRODUCTION PROJECT

A. Shilo, FAO -
Project Leader
Vegetable Seed
Production Project

## 1. INTRODUCTION

The Vegetable Seed Production Project is a joint Project of HMG-FAO financed by the government of Switzerland. The Project was initiated by a consultancy by a German expert M. Maurer, who was in Nepal in 1978 in the framework of a TCP Project for Training in Vegetable Seed Production.

The Project had initially a total budget of 1.238.500 US$, donated by the Swiss Government, for a duration of three years. The Project Document was signed a August-September 1980 and started in February 1981 with the arrival of the first expert S.S. Rekhi.

To day the international staff consists of five members:

- One Project Leader
- One Expert in Vegetable Seed Production
- Two Associate Experts for Vegetable Seed Production
- One Associate Expert for Seed Marketing

The Projects works in close cooperation with its counterpart team, the Vegetable Development Division of the Department of Agriculture in Khumaltar. The Project under its current phase will end in April 1984.

## 2. GEOGRAPHICAL DISTRIBUTION OF ACTIVITIES

The Vegetable Seed Production works in five seed production centers:

- Khumaltar, in the valley of Kathmandu, in the premises and the farm of the Vegetable Development Division
- HMG Agriculture farm at Marpha (Mustang) in the trans Himalayan zone.
- HMG Horticulture farm at Nawalpur (Sarlahi) in the subtropical zone in the terai.
- HMG Vegetable Seed Production Center at Mushikot (Rukum) in temperate hills.
- HMG Horticulture Farm at Paripatle (Dhankuta) in temperate hills.

This geographical distribution enables the Project to deal with a large range of vegetables for seed production, from cold winter types like cabbage and carrot to subtropical types like cucurbits.

3. RANGE OF ACTIVITIES

- Seed Production
- Field Experiments
- Equipment
- Buildings
- Training

The details of our activities are included in our proposal for working program which was written and published recently.

1. Seed Production:

The project assists the Vegetable Development Division in meeting the targets of seed production fixed by HMG. This assistance covers planning of quantities and varieties of seed to be produced in the five sites, the supply and production of basic seed at the sites, and supervision of the seed production in the farms and in the fields of contract farmers. This supervision embrances all the growing period and post harvest operations until the seed are ready to be handed over to AIC. (For instance, all the radish seed production in Bhaktapur were cleaned in the processing plant at Khumaltar before reaching AIC).

As a whole the project deals with 12-15 different kinds of vegetables, all included in HMG targets, namely cauliflower, cabbage, broad leaf mustard, radish, turnip onion, tomato, eggplant, chillies, beans, peas, cucurbits, leafy vegetables etc.

2. Field experiments:

Field experiments are conducted in three centers under direct supervision of the FAO staff, and in two other centers with as much supervision as the project can give within limitation of its own manpower. The project deals essentially with two kinds of experiments:

- Variety trials, to identify which varieties should be recommended for the fresh market.
- Seed production trials, on varieties already recommended; these trials deal mainly with dates of sowing, spacing and other agronomic practices.

In experiments, the project deals with 8 - 10 different species of vegetables namely cauliflower, cabbage, carrot, onion, radish, tomato, eggplant, watermelon, peas, beans etc.

One full report on the first year of experiments was recently written and published by the expert on vegetable seed, who is also incharge of the experiments. A summary of his conclusions and recommendations is available.

3. Equipment:

One of our first activities was to make a full inventory of existing field equipment in all five sites, and to identify the needs for repairs of new equipment.

The field equipment which needed repair has already been brought back to operational condition, specially in the processing plant at Khumaltar. Most of the new field equipment has been purchased and dispatched to the sites according to the needs. Whenever possible these purchases were made in Nepal.

4. Buildings:

The project has in its program to build eight structures:

- One Training and laboratory building at Khumaltar,
- One Processing shed with air controlled store at Khumaltar,
- Three smaller processing sheds at Nawalpur, Marpha and Mushikot,
- One onion store at Mushikot,
- One small training hall at Mushikot,
- One living quarter at Marpha.

For all the buildings, plans are ready and we are in the process of selecting contractors. The Project already completed the construction of a garage at Khumaltar and a water storage pond.

5. Training:

Training is one of the major components of the Vegetables Seed Production Project. The project organized many activities in the country and abroad as well.

a. Training in Nepal:

For contract and leader farmers: four trainings have already been organized in four sites of the project: Khumaltar, Sarlahi, Dhankuta and Rukum. A fifth training will be held in May in

Marpha so that at the end of the project one training for farmers will have been organized in each site.

For Junior Technicians and Junior Technician Assistants, two training have been already held, one in Khumaltar for JTs from mid-hill area, and one in Sarlahi for the subtropical area. Another training will take place in May in Marpha for JTs from high-hills area. At the end of the Project one training will have been held for JTs from all the three main agroclimatic areas of Nepal.

For officers, two workshops were organized in Kathmandu, in which officers can present results of their activities, discuss the program for the coming season, and listen to some lectures on specific new topics.

The project also organized field days, where farmers are invited to visit seed production plots and experiments in HMG farms, and visits to farmers fields. These field days are organized at crucial time of the season, and give an opportunity to farmers to see new crops, new techniques, and express their views and their problems, which are duly recorded.

b. Training abroad:

The Project has a limited budget for training abroad equal to 22400 $, and tries to take maximum advantage of it.

Three Junior Technicians were sent to India in 1982 to attend trainings organized by the National Seeds Corporation of India. The national counterpart of the project participated in the SIDA conference in Nairobi in June 1981 and in August 1982 was on a 3 weeks study tour in Germany, Denmark and Israel.

One of the officers, has been selected to attend a 2½ months practical training in plant breeding and variety maintenance in Israel. He is expected there at the beginning of March 1983. Three other officers will participate in a 10 days study tour in India, under the leadership of Rekhi, to the National Seeds Corporation of India and seed production area in north India. The project also finance the participation of the DDG, Horticulture to the XXIst International Horticultural Congress in Germany in August 1982.

6. Publications:

Apart from regular reporting and proposals for working programs, the project has published several technical publications, among them:

- Proceedings of the First Workshop on Vegetable Seed Production which is a compendium of the technical lectures given at the workshop.

- Recommendations for plant protection, bilingual in Nepali and English.

- Technical reports on field trials.

- Excerpts and reprints of articles published by FAO consultants and other highly qualified experts.

## 4. NEW ACTIVITIES

### 1. Marketing survey:

The Project will start soon a survey to determine cost of production for vegetable seed, as compared to alternative crops. Later on the survey will try to study distribution channels and prices paid for the seed by farmers. For these surveys an additional associate expert was recently recruited and has already started to work. In a later stage the project intends to request from FAO a high level consultant who will analyse the results of the survey and suggest ways to improve all the marketing part of vegetable seed industry (collecting, distribution, pricing etc.).

### 2. Vegetable Seed Campaign:

The Project will start a vegetable seed campaign, the objective of which is to promote use of better seed among the farmers in vegetable production areas. The vegetable seed campaign will follow the minikit pattern of Integrated Cereals Project, i.e. samples of seed, fertilizers and recommendations for use will be distributed to selected farmers, who will grow these seeds in their fields. A close follow up will be performed. The vegetable seed campaign will operate in five vegetable production areas: Kathmandu, Trishuli, Panchkhal, Mugling and Pokhara, An associate expert is on the way to be recruited, and the campaign will start as soon as he reaches Nepal.

## 5. SCOPE FOR THE FUTURE

To establish a vegetable seed industry on good grounds takes much more than three years, and the project has no pretention to reach such a goal during its short existence. Therefore, now, one year before the official end of the project in its current phase, is time to start thinking on the extension of the project into a phase II.

A consultant was hired in 1982 to analyse the present situation, visit new sites and gather the necessary data to formulate a proposal for an extension of the Project. This consultant spent five months in Nepal, he visited all the sites of the Project plus several potential new sites for seed production. Based on his report (copies of which are still available) the project will very soon prefare a proposal for an extension into a phase II.

# VARIETY DEVELOPMENT, VARIETY MAINTENANCE AND BREEDER AND FOUNDATION SEED PRODUCTION OF MAIZE IN NEPAL

K.D. Sayre
Cropping Systems
Agronomist, ICP

The comments that are offered by the author were solicited primarily because of his association with the National Maize Development Program (NMDP) during 1980 and 1981 as an advisor with the Integrated Cereals Project. They are meant as observations that are relative to variety development, variety maintenance and breeder and foundation seed production of maize in Nepal and are hopefully cognizant of the conditions that currently exist and are likely to continue for some time to come.

Considering the situation as it is in Nepal, it is fair to state that open-pollinated or composite varieties will continue to play the dominant role as the type of maize variety that will be of most practical use for farmers growing maize in Nepal. This does not mean that development of hybrid maize varieties should not be encouraged but it certainly should be kept in proper perspective. For the vast majority of maize farmers, especially in the hills of Nepal, the ability to utilize hybrid maize varieties lies in the distant future. At present other factors such as inadequate local agronomic practices, lack of input supply, particularly seed and fertilizer and restricted farmer economic resources and credit access largely obviate the ability of most farmers to exploit the potential yield of even current improved open-pollinated maize varieties. This coupled with the dislike that many farmers express towards the improved varieties concerning their inferior keeping and eating quality, poor husk cover and generally later maturity as compared to many local varieties argue that shifting to hybrid varieties per se will not make much difference. Resources probably could be better used in helping to eliminate current production constraints at the farmer level and in the development of better open-pollinated maize varieties more tailored to farmers' real needs. Therefore the following comments are confined to the topics under discussion as they relate to open-pollinated or composite maize varieties.

## GENERAL CONSIDERATIONS

In any discussion concerning varietal development, maintenance and seed production, three predominant requirements come into immediate focus: a) adequate experiment stations to evaluate and select potential varieties under uniform conditions; b) adequate facilities to handle and store seedstocks and c) well-trained manpower who are able and allowed to efficiently undertake their responsibilities which should include extensive testing of varieties and other improved production practices in farmers' fields with the active participation of farmers.

In looking at experiment stations, it is clear that at the Rampur Agricultural Farm, where most of the MMDP varietal development activities are conducted and an important part of breeder and foundation seed are produced, the variability within fields and between experimental plots largely precludes the ability of scientists do distinguish between variety or treatment difference in experiments. This variability in most of the fields also makes it difficult to select individual plants in seed multiplication plots that are representative of the variety. The dependence upon rainfall, especially for the winter crop, inhibits the ability to produce reliable quantities of seed. The provision of irrigation would certainly reduce this problem. The current program to develop irrigation facilities at Rampur must continue to have high priority. Improvement in the overall management of the station is also needed.

Other experiment stations that are being used for maize varietal testing and seed production also are lacking in the provision of uniform and reliable conditions for trial work and seed production (Kakani Farm is the notable example). To do the job they must be improved. Some, such as Kakani Farm, should probably be eliminated as locations for maize breeding research.

Nepal is a country of wide agro-climatic differences. Therefore, it is sensible that varieties for the major agro-climatic zones should be developed and tested in these zones. The MMDP is currently embarking on a program to develop specific varieties for the major zones (high-hills, mid-hills and terai) at experiment stations located in these zones. This approach is realistic and admirable and should be encouraged. But it means that adequate experiment stations need to be identified in each zone sound, relevant and appropriate breeding methodologies need to be applied and MMDP scientists stationed at Rampur should be able to frequently visit and work with their colleagues at the selected experiment stations to do the job effectively.

The current situation involving seed storage especially at the stations located at lower elevations and in the terai is a major constraint. At Rampur, for example, one cannot be assured that seed harvested in one season will be viable for planting in the next year due to rodent and insect problems and poor ambient storage conditions. This certainly hampers the breeding effort and means that breeder seed and germplasm stocks must be planted every season not only to multiply the seed but also to insure its continuity. This certainly leads to ineffective use of resources. The new seed storage and processing facility under construction at Rampur will hopefully improve this situation. But sound management of the facility will be required if it is to be utilized successfully.

Other experiment stations that are involved in maize foundation seed production must also have adequate storage facilities and good storage management to handle the seed during the period it is stored there. Long term storage of most stocks, especially germplasm and breeder seed, should be done at Rampur when the new facilities are functioning.

It is the author's perception that the main problem concerning manpower is not so much a lack of well-trained people but rather the fact that many well-trained scientists and technicians are unable or unwilling to perform their duties in an efficient manner. This has been particularly noted at Rampur. Lack of sufficient resources explains part of the problem but certainly

better management and overall planning and coordination could produce more mileage from the limited resources than is currently being achieved. Realistic goals need to be established and then approached in a step-wise multi-disciplinary manner.

MAIZE VARIETY DEVELOPMENT, MAINTENANCE AND PRODUCTION OF BREEDER SEED

These three points are combined for the purposes of this discussion because the breeding strategy to be proposed for developing improved composits maize varieties would automatically encompass varietal maintenance. If handled correctly, production of breeder seed would also be a part of the process.

First it was mentioned earlier that development of improved composite varieties could be more efficiently carried out at experiment stations within the major agro-climatic zones, high-hills, mid-hills and terai, and the NMDP is already moving in this direction. Second, there already exist, improved varieties for these zones, Kakani Yellow and Khumal Yellow for the high-hills, Khumal Yellow for the mid-hills, Rampur Yellow for the mid-hills, Rampur Yellow and Rampur Composite for the lower foothills and terai. These varieties represent marked improvem-nts over many local varieties being grown by farmers but still lack or are not up to some farmers' expectations for certain characterstics (grain type, keeping and eating quality, husk cover, maturity, disease and insect resitance etc.).

The breeding strategy that is suggested would use the appropriate improved varieties as the starting point in each agro-climate zone for a breeding program in each zone to gradually begin to improve each variety with particular attention to the variety's weak points. The approach would rely on the routine use of half-sib populations for which the first cycle of selection would be composed of selected ears (approximately 500 ears) from the recommended variety for each zone. Seed from each ear of the appropriate variety would be planted in ear-to-row plots at one or more experiment stations in the corresponding agro-climatic zone. These rows would be kept as female rows by detasseling before pollination. Other germplasm sources offering genetic characteristics to improve the population could also be planted in the same way as additional female rows. Male rows would be planted between every 2 to 3 female rows and would come from a balanced, bulked composite of the seed used for the female rows. The male rows would be rigorously rogued before pollination by detasseling to remove off types. In this way, plants in the female rows would only be pollinated by the better male plants. For selection of ears to generate the next cycle, each female row can be evaluated as to its appearance at harvest and ears selected only from those rows meeting established criteria. Those female rows coming from germplasm other than the basic improved variety constituting the bulk of the population can be rejected outright or selected. Further more if they offer some potential but are still at variance with the overall population they can be kept for the succeeding cycle as only female rows and not be used in the balanced, bulk composite for the male rows for the next cycle of selection. If they offer a marked potential for improving the population, they can also be included in the male component of the next cycle.

This methodology offers many advantages. First, it requires a minimum of resources. Hand pollinations are not required, simply timely roguing and sound selection practices. Second, it offers the possibility to make gradual, directed improvements in the existing varieties while at the some time assuring their maintenance albeit in a dynamic form if continued improvements are achieved. Third, at any stage or selection cycle, other methods of handling the population (full-sib selection, generation of $S_1$ progenies for testing) can be substituted for a half-sib selection cycle if there is merit in doing so. Fourth artifical inoculation with pathogens or infestations with pests can be introduced to the population to screen for resistance. Lastly, the source of breeder seed for the variety can come directly from bulking the remnant seed of the selected ears. This can be augmented by also selecting ears from the best plants in the male rows or additional ears in the selected female rows and bulking their seed to increase the amount of breeder seed to be made available.

The approach is well-known to the maize breeders in the NMDP. They are certainly capable of doing it if they receive adequate support.

FOUNDATION SEED PRODUCTION

The principles of foundation seed production in maize have been well-documented. Such factors as the requirement for isolation of fields either by space or time are well known and are largely management related. Following adequate production practices such as appropriate fertilizer rates, planting methods, timely planting, weed and pest control, timely harvesting, careful seed drying and handling and sound seed treatment and storage are axiomatic and again management related.

The actual selection of the ears that become the foundation seed merits special comment. First, fields need to be adequately rouged before pollination to eliminate off-type plants. Second, ear selection needs to be done before the plants are completely senescent so that plants of appropriate maturity can be readily identified. The selected ears can be marked by paint to identify them at harvest. Third, it would be extremely helpful if the fields would be divided into a grid pattern, say into 100 $m^2$ sections. If this were done then the plants in each section could be evaluated as a group and a pre-determined percentage of the ears selected dependent on the amount of seed required. Following this approach would help alleviate the effect of variation within the production field on the selection of plants. It makes systematic mass selection a part of foundation seed production. Lastly, the person or persons who actually make the ear selections certainly need to know what they should be selecting for. Many times, the author has seen this task being carried out by temporary laborers and even small children. It must be performed by people who know what they should be looking for and have been thoroughly trained to do so.

# SEED DEMAND AND SUPPLY SITUATION IN NEPAL

Bharat P. Parajuli,
Senior Agriculture
Officer, AIC

and

Shyam K. Upadhyaya,
Agriculture Officer,
AIC

The collection of effective demand for improved seeds is essential for the development of a viable and self-sustaining system of seed production and distribution. The term "effective demand" in a real sense refers to the already existing demand for improved seeds among the farmers at a certain range of price during a particular period of time. In this sense the effective demand for improved seeds of a region or district may be far lower than the actual seed requirement of that place.

## DEMAND CREATION

Whenever a variety is developed and released by the variety releasing committee it would be known to the farmers first through minikit program, extension workers of the DOA and through the activities of different agricultural projects. All the extension workers are supposed to be informed about this newly developed crop variety and they in turn are supposed to tell the farmers of their respective areas about it. If the farmers happen to like this new variety they would start placing demand for more seeds. Thus on the basis of the acceptability more farmers would be interested on this variety and hence, there would be more demand for seeds. This is how the demand is created.

It should be noted here that the original demand creation depends much on the salesmanship of the extension workers. It is, for this reason, highly important that every extension worker should have thorough knowledge of the new variety. But, unfortunately, it has often been observed that many extension workers are not even informed of the new release for a considerable length of time. This is often the case in paddy varieties. Many field level extension workers do not know what is being developed in the research farms.

So long there is a low demand for seeds the produce of the government farms alone would be enough to meet the farmers' demand. But as the demand increases the government farms would be unable to supply seeds to meet the demand. It is at this stage that AIC is supposed to join the show. With the source seeds obtained from government farms AIC runs seed multiplication programs on farmers' fields, procures and distributes seeds to meet the demand.

## DEMAND COLLECTION

Collection of reliable demand is very important while formulating future seed production program. In Nepal the organizations involved in demand collection and their methods of demand collection are as follows:

A. Village Level:

a) Field level staffs of extension wing of DOA (JTs, JTAs and Agriculture Assistants)

b) Sajha Sansthas (Village Level Co-operatives)

B. District Level:

a) Agriculture branch district office (ADO)

b) Branch or Sub-branch Office of Agriculture Inputs Corporation (AIC)

c) District Agriculture Co-ordination Committee.

C. Regional Level:

a) Regional Agriculture Directorate

b) Regional Office (AIC)

c) Regional Seed Committee

D. Central Level:

a) Department of Agriculture

b) AIC Central Office

By now the extension network of the Department of Agriculture has been established in all the 75 districts of the country. The JTs, JTAs and Agriculture Assistants working at village level would collect the demand for agricultural inputs from the farmers of their respective areas and submit it to the ADO at district level as well as to the concerned Sajha Sansthas (Village Level Co-operatives) of the locality. The district level ADO office will review such demand and give it either to the Sajha Union (District Level Co-operative) or in districts where such unions are not present, directly to the AIC district office.

On the other hand there are Sajha Sansthas which are the main seed dealers of AIC. These Sajha Sansthas would collect effective seed demand either through extension workers or by direct contact with the farmers. It, then, would forward such demand either to the Sajha Union or directly to the district level AIC office, where such Sajha Unions are not present.* The Sajha Union would compile demand from different Sajha Sansthas of the district and forward it to the AIC office at district.

The district level AIC office acts as co-ordinator in the collection of effective demand for seeds and other agricultural inputs. It compiles the demand

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* Sajha Unions are present only in 33 districts of the country.

forwarded by Sajha Union or ADO office or directly by village level cooperatives. In many cases the demand thus collected would be discussed in a meeting of District-Level Agricultural Co-ordination Committee. The final demand passed by that committee or accumulated in the district level AIC office would be sent to the Regional Office of AIC and Regional Agriculture Directorate. The AIC Regional Office reviews the seed demand from all the districts in its region. It would then, either discuss such demand in a meeting of Regional Seed Committee* or send it to the Central Office of AIC. The AIC Central Office accumulates seed demand from all the regions of the country and formulates seed production and distribution programs on the basis of such demand. This is how the demand is collected.

Visualizing such a sound organization set-up it seems that there should be no problem in the collection of effective seed demand. But in practice the demand collected is often incomplete, unreliable and untimely.

Moreover it appears that there is a very low demand for improved seeds among the farmers. Farmer to farmer diffusion is the major means of disseminating improved seeds among farmers which often is strongly emphasized by agricultural extension workers. But a major drawback of this practice is that this is carried on perpetually and the seeds which are circulated among farmers are already degenerated. Such seeds would have lost many of the varietal characteristics.

A review of collection and sales of major cereal crops seed through AIC during the first two years of the 6th Five Year Plan (Table 1) would reveal that there is a big disparity among the targeted amounts of seeds for sale, amounts of seeds collected and offered for sale by AIC and the amounts of seeds actually sold. It will be obvious from the table that the amount of seeds collected by AIC is greater than the amount of seeds sold by it (demand). About 2067 m.t. and 1436 m.t. of cereal seeds were left unsold at the end of sales season during the FY 1980-81 and 1981-82 respectively. This is an indication of poor demand for seeds. In the absence of proper storage facilities it is very difficult to save unsold seed stock and use it as seed in the following year. These stocks are usually subjected to germination drop and are either sold in the grain market at lower price (if not treated with poisonous chemicals) or burried in the ground (if treated with chemicals). In the fiscal year 1981-82 about 472.5 m.t. of cereal seed (paddy, maize and wheat) was dumped by various AIC branch offices** In certain cases the seeds supplied to some districts according to their demand would be left unsold and at the same time there

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* The Regional Seed Committee comprises Regional Agriculture Directorate, Regional ADB Office and Regional AIC office and is chaired by the Regional Agriculture Director.

** So far, data on the amount of seeds dumped are collected only from 30 out of 63 AIC branch offices.

would be demand for excess seeds in other districts. For example, during this fiscal year, 1982-83, the central regional office of AIC supplied 15 m.t. of wheat to Dhading district as demanded by the district office, AIC. Out of that supply about 5 m.t. of wheat seed was not sold. Fortunately there was an excess demand for wheat seeds in the nearby Chitwan district and the seed stock from Dhading was directed to Chitwan area. This indicates that the demand collected is not reliable. In cases like this the unsold seed stocks could be utilised elsewhere although an extra cost has to be incurred for it. But in majority of places in the country there are no proper transportation facilities and, hence, the seeds once supplied to a particular place or district cannot be directed to other places if not consumed at that place. The fact that a great quantity of cereal seeds is being dumped every year is an anathema for a country like Nepal.

Now, let us give a closer look to the organisations involved in demand collection and supply of improved seeds. It has already been mentioned that village and district-level co-operatives are the major seed dealers of AIC. Sajha programs have already been implemented in the 68 Districts of the Kingdom.* In total there are 682 Sajha Sansthas and 33 Sajha Unions (Table 2). These two organizations are independent of each other and they are purely private organizations. They have no regional and central offices. Each Sajha union is independent of the Sajha Unions in other districts. The main function of these Sajhas Unions is to supply agricultural inputs and essential commodities to the Sajha Sansthas of their district. These unions take 1 percent dealer commission from Sajha Sansthas for this job. Considering the total number of village panchayats in the country one Sajha Sanstha at village level has to look after 3-6 village panchayats. Besides the Sajha Sansthas are also dealing with other essential commodities in addition to agricultural inputs. Still more the village level co-operatives have a limited manpower. The personnel working at village and district level co-operatives seem dissatisfied because of low payscales and incentives. AIC does not have the authority to control the action of those co-operatives. In this respect the present set-up of Sajha organization is inadequate in dealing with effective demand collection and supply of improved seeds. The recent effort to incorporate Sajha organization into the Agriculture Ministry is justifiable and it might be expected to solve many of the existing co-ordination problems.

The field level extension workers would have been the ideal agents for the effective demand collection of improved seeds. But they are not able to make door to door contact with the farmers. They often collect seed demand on the basis of total cultivated area under a particularl crop of the village or district. Besides seeds they are supposed to look after various other aspects of agricultural production and their number does not seem enough to do all these jobs (Table 3). There are indications in different areas that the field level extension workers (JTs, JTAs and Agriculture Assistants) are not guided properly. Many of them have a feeling that any work related to seed production and distribution is an optional job for them.

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* There are no cooperatives in Khotang, Manang, Humla, Mugu, Dolpa and Kalikot districts.

It may have to be pointed out here that a district AIC office had no mechanism and manpower to make active involvement in the collection of effective seed demand at village level.

SEED COLLECTION

The Agriculture Supply Corporation (ASC) which was established during the first year of third Five Year Plan started procurement and supply of improved seeds for the first time at institutional level. That corporation had no seed production system of its own. By now AIC (the final version of ASC) has a well-defined seed production system. Keeping in view the sales trend and the guidelines set by the Agriculture Ministry and the National Planning Commission, AIC formulates seed production programs. The seeds of maize, wheat and few vegetables are produced on contract farmers' fields. Paddy seeds, so far were produced on government farms. But from this fiscal year 1982-83 AIC has planned to grow early variety paddy seeds on contract farmers fields too as the amount of seeds produced by government farms was inadequate to meet the growing demand of farmers. The source seeds needed for conducting seed multiplication programs are obtained from government farms. AIC and Agriculture Botany Section makes the necessary technical supervision of seed production plots. AIC has both certified and improved seed production programs. Seed certification is done by Agriculture Botany Section in case of certified seed production programs whereas improved seed production programs are supervised only by AIC technicians.

When the crops are harvested and the seeds are prepared by the seed growers AIC collects seeds from them. However the amount of seeds collected by AIC is not up to the target. While formulating seed production programs it is usually estimated that about 1.5 to 2 m.t. of maize and wheat seeds and 2.5 m.t. of paddy seeds could be collected from one hectare production plots of each crop. But practically the amount of seeds that could be collected is lower than that for previous reasons. For example, AIC had a target of selling 5000 m.t. of wheat seeds during 1982-83. In order to procure seeds to meet that target AIC had planned to conduct wheat seed multiplication program in about 35 hectares with contract seed growers. But for various reasons the program could be run only in about 2587 hectares and the actual amount of seed collected from this program was about 3500 m.t. Thus on an average only about 1.35 m.t. of wheat seeds could be collected from one hectare. A review of data on average rate of collection of maize and wheat seeds during 1980-81 and 1981-82 reveals that the maximum rates of collection of maize and wheat seeds per hectare are 1.09 m.t. and 1.35 respectively (Table 4). It is also clear from the table that collection rate was much lower in hills than in terai region. The second must important feature that would be observed in the seed production and collection trends of AIC is that there is a great disparity in the amounts of seeds collected by different development regions. (Table 5 and 6). It would be evident from the tables that more than 83 percent of the total amount of maize seeds is collected in central region alone whereas there is zero collection in Far Western Region. The percentage shares of the Eastern and Western Region in the total sales of maize seeds during 1981-82 (Table 6) are 20.78 percent and 23.55 percent whereas the shares contributed by these regions in the collection of maize seeds were only 3.69 percent and 5.43 percent respectively. Similarly a

review of statistics (Table 5 and 6) would reveal that Central Region is collecting excess amount of wheat seeds. Western Region is almost self-sufficient, but the Far Western Region is so far collecting a negligible amount of wheat seeds. The Eastern and Far Western Regions are not self-sufficient in wheat seeds.

Now let us enumerate few important problems faced by AIC in the collection of improved seeds in desired quantity and quality.

1. Under the pricing system a base price for the seeds produced by seed growers would be fixed before or at the time of sowing. The prevailing market price would be considered in fixing the base price. Later on, a procurement price would be fixed few weeks before the seed collection work starts. While fixing seed procurement price the rule is that if the base price is higher than the prevailing market price in collection season then the base price itself would be the procurement price, but if the market price then is higher than the base price, the market price would be the procurement price. A premium of 10 percent for improved seeds and 15 percent for certified seeds is added to this procurement price. Rest 1-20 percent premium is paid to the farmers on the basis of analysis of seed sample. The main purpose of this policy is to give a fair price to seed growers for their produce. But the difficulties observed under this system are that if the procurement price is too much higher than the market price the farmers might bring more seeds than they have produced. It endangers seed quality and it is very difficult to check the facts as AIC has a very limited technical manpower. On the other hand if the seed collection work is continued for a considerable length of time and if the grain price in the market shoots up the farmers would not like to give their produce to AIC. It would be difficult for a public organisation like AIC to change the decision and fix new procurement price immediately at that situation. About 50 m.t. of wheat seeds was not collected at Chitwan this year simply because of the above stated reason.

2. While delivering seeds the seed growers have to deliver them at the nearest AIC office. In areas where processing plants are present the farmers are supposed to take their seeds to the plants though AIC would bear the transportation cost from AIC office to the processing plant. As the amount of seeds produced by many individual small seed growers may not be enough for a truck load those farmers would be having problems in carrying seeds from their field to the delivery point as the private truck contractors would not carry less than a truck load. AIC does not have enough number of trucks to help in that situation. In many cases the seed collection is hampered by this problem too as the farmers do not want to take much trouble unless the profit is highly attractive.

3. Drying of seeds is another major problem in the collection of seeds from seed growers. This is usually a case in maize seeds. AIC collects maize seeds from seed growers at 13 percent moisture content. But in case of summer seed production programs in hills and winter (September planting) seed production program in terai it is very difficult for the farmers to dry maize seeds up to 13 percent moisture content. The

farmers do not have proper drying yard and storage facilities. In an attempt to lower moisture content many farmers have been found to deteriorate the quality of their seeds. In areas where there are processing plants and artificial drying facilities available AIC might collect seeds from farmers upto 15-16 percent moisture but the farmers are supposed to bear the loss that would occur while drying seeds to 13 percent moisture content. But it has been observed that it would be very difficult to convince farmers that way as many of them have a feeling that they are being cheated by the Corporation. Their justification at that case is that the grain merchant in the market does not consider any moisture level.

4. Many of the seed growers of AIC are not able to make proper management of their produce. If there would be rain at the time of harvesting or threshing the seeds would get wet and be spoiled as those farmers do not have proper threshing yard and storage facilities. This problem hampered wheat seed collection in Bara, Parsa and Rupandehi district this year to a significant level.

5. Because of the processing difficulty a farmer who has already prepared his seeds may have to wait for more than a month before his turn for seed delivery comes. This problem is also discouraging many farmers.

SEED SUPPLY

The seeds collected from the seed growers and the government farms are processed and treated with protectant chemicals. They are then stored in AIC godowns till the sales season.

AIC despatches those seeds in different districts of the country keeping in view the demand of those districts. AIC is supposed to carry seeds up to the district headquarters. The seed dealers (co-operatives and in some areas, private seed dealers) are responsible in transporting seeds from district headquarter to the production areas. It should be noted over here that AIC has no field staffs of its own to reach individual production areas and farmers. At least, the manager in district AIC office would make occasional supervision and cross-check visits to the seed dealers within the district.

Considering the present situation of collection, demand and supply of improved seeds in Nepal the following measure may be recommended for making further improvement in the seed programs of the country.

RECOMMENDATION NO. 1

A successful seed program should be planned well ahead in time. A rough estimate of cropwise and varietywise quantity of improved seeds demanded by the farmers should be made at least one year before the sales season. The seed multiplication program should be formulated on the basis of that demand and the national priority and targets set by Agriculture Ministry and National Planning Commission. The Central Office of AIC should inform the ADO and AIC offices in all the districts about the seed varieties and a possible range of seed price that would available for sale in the upcoming season. These infor-

mations should be relayed by seed division, AIC, as soon as seed multiplication program is launched. On the basis of those informations effective seed demand should be collected by making direct contact with the farmers and the demand thus collected should be reported about 6 months of the sowing season. Accordingly AIC should supply seeds to different districts at least one month ahead of the sowing season.

RECOMMENDATION NO. 2

At the present stage only co-operative dealers appear to be capable of shouldering the great responsibility of taking seeds from district headquarters to the production areas. But co-operatives should be reorganised. Considering their workload either more manpower should be added or the number of village level co-operatives should be increased so that they would be able to make direct contact with the farmers. Adequate incentives should be given to the people working in co-operative organizations so that they would put more enthusiasm into their work. Private dealers may be encouraged in areas where they are necessary.

RECOMMENDATION NO. 3

The village level co-operatives do not have proper storage facilities for seeds. They usually put seeds in the same room along with chemical fertilizers and other essential commodities of daily use with which they are dealing. On a visit of few Sajha Sansthas in Makawanpur district it was found that the maize seeds were being stored on a damp floor without wooden pallets. This often causes deterioration in seed quality. Due to this factor even if AIC might be supplying quality seeds the farmers will get seeds which may be already deteriorated in quality. In such cases it would be difficult even to know what went wrong and where. Usually the people overlook this middle channel (co-operatives) and blame AIC even for the things over which it has no control. It is, hence, very necessary that small seed warehouses be made for potential village level co-operatives. In the first phase such seed godowns (which may be just one room) should be constructed at the Sajha Sansthas near major seed consumption centres. A project that would improve management as well as physical facilities of village level co-operatives may be launched.

RECOMMENDATION NO. 4

In the main seed consumption districts there should be a Junior Technician (JT) level technical staff who would supervise and cross-check the seed stocks of village level co-operatives which is very necessary to control seed quality. He would also act as a co-ordinator in effective demand collection of improved seeds in his district. In other districts where seed sale is low the district AIC manager might do this job. At central level there should be a separate unit in AIC seed division which would look after effective demand collection and distribution aspects of improved seeds.

RECOMMENDATION NO. 5

It would be evident (from table 3) that although the established posts of JT and JTAs look large in number, the average numbers of JT and JTAs actually

working in one district are 6.73 and 12 respectively. Considering the various types of works they are supposed to do the number in the collection of effective demand for improved seeds. On the first hand their number should be increased as per the number of posts established and secondly they should be instructed to pay more attention to seed programs.

RECOMMENDATION NO. 6

There should be a close coordination and effective communication between the research stations, extension and AIC. Extension personnel should be informed about the new varieties well in time. Extension workers should guide the farmers to use recommended seed varieties by giving detail information to the farmers about newly released varieties.

RECOMMENDATION NO. 7

While formulating seed production programs the minimum seed collection rate should be taken into account. 15 to 20 percent more amount of seed should be produced than the targeted amount for sale. Such extra amount of seed if collected, may be kept as a buffer stock to meet emergency situation.

RECOMMENDATION NO. 7

AIC trucks should be mobilised for the collection of seeds from production areas to the processing plants. This would solve the problems for small seed growers whose individual product would not make a full load for a truck. AIC trucks should also be mobilised for transportation of seeds within different districts especially where small amounts of seed have to be delivered to various offices.

RECOMMENDATION NO. 7

The corn cob drier at Hetauda should be repaired and arrangements should be made to dry maize seeds on the cob itself. This would help to stop quality deterioration in maize seeds to a large extend. In other areas the small scale drier system may be introduced.

RECOMMENDATION NO. 8

The seed receiving system by AIC should be quick. The seeds should be collected as early as possible when the farmers prepare seeds. Adequate storage should be constructed at each processing plant and precleaners may be added to all other processing plants (except Hetauda which is already having it).

RECOMMENDATION NO. 9

There should be a clear cut policy regarding price subsidies and production loan. These policies should be forcast before formulating seed multiplication programs. Due to sudden reduction in seed price at the sales season there would be a sudden increase in seed demand and AIC would have difficulties in supplying the required amount of seed. Wheat seed demand in Eastern Region during this wheat season is an example of this approach. While there

was a demand only for about 800-1000 m.t. of wheat seeds in that region prior to reduction in price the demand immediately rose upto 2000 m.t. as more than 30 percent reduction was made to the original seed price. Seed price eventually, was even lower than market grain price. To meet that demand AIC had to make extra collection even from flour mills. Similarly, if the loaning policy of the bank is liberal the demand would be increased and vice versa.

RECOMMENDATION NO. 10

In case of emergency if there is a need to collect ordinary seeds, the main organisation involved in quality seed business (AIC) should not be involved in this process. It has been observed that AIC is loosing faith of the farmers as it supplies such ordinary seeds too. It is usually very difficult to regain the faith once lost.

Table 1

COLLECTION* AND SALES OF MAJOR CEREAL CROPS SEEDS THROUGH AIC DURING FIRST TWO YEARS OF THE SIXTH FIVE YEAR PLAN

m.t.

| Crops | 1980-81 | | | 1981-82 | | |
|---|---|---|---|---|---|---|
| | Target | Collection | Sales | Target | Collection | Sales |
| 1. Paddy | 400 | 300 | 205 | 500 | 297 | 243 |
| 2. Maize | 300 | 250 | 105 | 500 | 300 | 135 |
| 3. Wheat | 3100 | 3345 | 1516 | 5000 | 3435 | 2218 |
| | 3800 | 3895 | 1828 | 6000 | 4032 | 2596 |

* The collection figures refer to fresh seeds that were available for sale during the given fiscal year.

Table 2

TOTAL NUMBER OF SAJHA UNIONS AND SAJHA SANSTHAS

| Region | Number of Districts | | Number of Sajha Unions | | Number of Sajha Sansthas | |
|---|---|---|---|---|---|---|
| | Hills | Terai | Hills | Terai | Hills | Terai |
| 1. Eastern Region | 7 | 6 | 2 | 6 | 43 | 120 |
| 2. Central Region | 12 | 7 | 6 | 7 | 103 | 159 |
| 3. Western Region | 12 | 3 | 3 | 3 | 68 | 67 |
| 4. Mid-Western Region | 7 | 3 | 1 | 3 | 23 | 47 |
| 5. Far-Western Region | 7 | 2 | - | 2 | 22 | 30 |
| Total | 47 | 21 | 12 | 21 | 259 | 423 |

Table 3

NUMBER OF JUNIOR TECHNICIANS (JTs) JUNIOR TECHNICAL ASSISTANTS (JTAs)

| Development Region | Posts Established | | No. actually working | |
|---|---|---|---|---|
| | JT | JTA | JT | JTA |
| 1. Eastern Region | 162 | 278 | 89 | 205 |
| 2. Central Region | 191 | 412 | 179 | 361 |
| 3. Western Region | 162 | 290 | 153 | 230 |
| 4. Mid-Western Region | 150 | 171 | 55 | 71 |
| 5. Far-Western Region | 90 | 121 | 29 | 34 |
| Total | 755 | 1272 | 505 | 901 |

Source: Department of Agriculture (DOA).

Table 4

AVERAGE RATE OF COLLECTION OF MAIZE AND WHEAT SEEDS

DURING 1980 81 AND 1981-82

Collection: m.t./ha

| Region | Maize | | Wheat | |
|---|---|---|---|---|
| | 1980-81 | 1981-82 | 1980-81 | 1981-82 |
| 1. Terai | 0.97 | 1.13 | 1.29 | 1.40 |
| 2. Hills | 0.34 | 0.47 | 0.89 | 0.59 |
| 3. Total | 0.79 | 1.09 | 1.27 | 1.35 |

Table 5

PERCENTAGE SHARE OF MAIZE AND WHEAT SEED COLLECTION

DURING 1980-81 AND 1981-82

| Development Region | Maize | | Wheat | |
|---|---|---|---|---|
| | 1980-81 | 1981-82 | 1980-81 | 1981-82 |
| 1. Eastern Region | 8.69% | 5.14% | 20% | 27% |
| 2. Central Region | 83.33% | 90.18% | 43% | 35.5% |
| 3. Western Region | 5.43% | 4.67% | 22% | 27% |
| 4. Mid-Western Region | 2.53% | - | 15% | 9% |
| 5. Far-Western Region | - | - | - | 1.5% |
| Total | 100% | 100% | 100% | 100% |

Table 6

PERCENTAGE SHARE OF SALES OF MAIZE AND WHEAT SEEDS

| Development Region | Maize (%) | Wheat (%) |
|---|---|---|
| 1. Eastern Region | 20.78 | 30.92 |
| 2. Central Region | 46.62 | 35.75 |
| 3. Western Region | 23.55 | 24.52 |
| 4. Mid-Western Region | 7.82 | 5.86 |
| 5. Far-Western Region | 1.21 | 2.93 |
| Total | 100 | 100 |

## SEED PRODUCTION AND INPUT STORAGE PROJECT (SPISP

S.S. Bal &
Peter G. Rood
SPIS Project

### 1. INTRODUCTION

The SPIS Project funded by USAID was designed to assist HMG in establishing a system of local seed production in the mid-hill areas of Nepal supported by arrangements for the storage and supply of other inputs so as to help in increasing the production of food crops, leading to an improvement in the economic condition of the farmers. Launched in the beginning of 1980, the project is expected to run for 5 years on the basis of the grant agreement between HMG and the government of the United States of America.

The project has a budget of about 5.5 million dollars. The Agricultural Inputs Corporation acting on behalf of HMG and the International Agricultural Development Service (IADS) are engaged in executing the project.

### 2. OBJECTIVES AND SCOPE OF WORK

In accordance with the contract, the objective of the project is to assist the Ministry of Agriculture to establish a responsive and labour-intensive system in the mid-hills for producing, testing, processing, storing and distributing seeds of major food crops; and for stocking and distributing all the inputs used in the production of these crops to the small farmers as cheaply and effectively as possible.

The related objectives are:

- to establish a seed production and supply system for the hills,
- to pave the way for the development of private seed producing and marketing enterprises,
- to create seed processing, treating, packaging and storage facilities at selected sites,
- to promote greater use of improved seeds in the hills,
- to ensure manpower development for future needs,
- to work towards qualitative improvement in seeds supplied to farmers,
- in addition, to assist HMG/N to improve all facets of the national seed production and distribution system.

Scope of Work:

- It covers the following:
- Socio-economic and baseline surveys for the selection of sites,

- establishing 20 mini seedhouses,
- construction of 13 warehouses,
- providing support for physiological research,
- a long-term storage unit for germ plasm,
- establishment of the central seed testing laboratory at Khumaltar,
- technical services and consultancies covering more than a dozen areas of specialization,
- to organize 35 in-country training sessions,
- overseas degree courses for ten participants, non-degree training program for 20 and need-based study tours of seed industry operations in other countries,
- supply and installation of equipment in the listed facilities,
- organizing seed production in the operational sites,

3. LIST OF SPIS PROJECT SITES

| S.No. | Site | District | Type |
|---|---|---|---|
| 1. | Sundar Bazar | Lamjung | Seedhouse |
| 2. | Gyandi | Parbat | " |
| 3. | Galkot | Baglung | " |
| 4. | Majhuwa | Gulmi | " |
| 5. | Arughat | Gorkha | " |
| 6. | Charikot | Dolakha | " |
| 7. | Trishuli | Nuwakot | " |
| 8. | Dhading Besi | Dhading | " |
| 9. | Patan | Baitedi | " |
| 10. | Phidim | Panchthar | " |
| 11. | Chainpur | Sankhuwasabha | " |
| 12. | Pakhribas | Dhankuta | " |
| 13. | Bijuwar | Pyuthan | " |
| 14. | Dipayal | Doti | " |
| 15. | Rampur Tar | Okhaldhunga | " |

| S.No. | Site | District | Type |
|---|---|---|---|
| 16. | Yamkha | Khotang | Seedhouse |
| 17. | Jirikhinti | Terathum | " |
| 18. | Bhojpur | Bhojpur | " |
| 19. | Dailekh | Dailekh | " |
| 20. | Chaurijhari | Rukum | " |
| 21. | Chainpur | Bajhang | Seed-cum-warehouse |
| 22. | Sanfe Bagar | Achham | " |
| 23. | Ghorahi | Dang | " |
| 24. | Damauli | Tanahun | Warehouse |
| 25. | Waling | Syanja | " |
| 26. | Birendra Nagar | Surkhet | " |
| 27. | Marpha | Mustang | " |
| 28. | Ilam | Ilam | " |
| 29. | Daman | Makawanpur | " |
| 30. | Dadeldhura | Dadeldhura | " |
| 31. | Sindhulimadi | Sindhuli | " |
| 32. | Udayapur | Udayapur | " |
| 33. | Tansen | Palpa | " |

## 4. SEEDHOUSE FUNCTIONING

A seedhouse is usually located in a potential seed production and distribution pocket. Preference is given to comparatively remote sites. The seedhouse is constructed for use as the physical facility for seed drying, cleaning, bagging and storage and to serve as the meeting ground for the seed growers, and farmers. In most places, the equipment used is simple, hand-operated type that might be replaced later on with more complex one in line with the gained experience.

A whole-time JT is the site manager and he is assisted by a farmers' representative known as Co-Manager in running the seedhouse.

A large number of small farmers participate in the seed production activities. They are given training under the project. The seed produced by the seed growers is brought to the seedhouse, cleaned and packaged in convenient size moisture-proof bags and then stored safely till the next planting season.

With the establishment of a seedhouse, carrying seed from the terai is unnecessary as only a small quantity of foundation seed is usually sufficient for local multiplication. Seeds of new varieties are also being introduced through the seedhouse.

5. FARMER-MANAGED SYSTEM

The SPIS Project eventually aims at developing a privately-managed seed production system to ensure community participation by farmers themselves. To this end, efforts are concentrated at a pilot site where the farmers have shown a very keen interest in this program.

Under the farmer-managed system the seed produced is not necessarily bought by AIC directly, instead it remains the property of the local Seed Growers Association who produce, store, and market the seed independently with technical support from AIC/SPISP. The AIC assists them in securing bank loan and assuring to purchase any seed that remains surplus to local requirement. After a few years of experience, it should be possible for the farmers own representative, the paid Co-Manager, to run the seedhouse with minimum packstopping from the official machinery.

6. INNOVATIONS

A number of ideas are being pursued in an effort to establish a sound seed production and input storage system in the remote hilly sites. Following are some examples:-

1. Both AIC-run and farmer-run system are being tried in different locations.

2. For drying of maize seed ears, a solar-cum-kerosene dryer has been developed. Priliminary tests have shown a temperature rise of 11°C in sun and 6°C under partial sun, indicating a good promise for effective and low cost drying.

3. Mountain stream at a pilot site in Lamjung district is being exploited to generate 8-10 kilowatts of electricity to be used in the seedhouse for operating the seed drying processing equipment.

4. To assist the farmers of the Panchayats that are away from the seedhouse, an outreach program based on metal bin storage of seed has been initiated.

5. Keeping in view the traditional role of the women in farming and seed selection, special efforts are being made to train and involve women in seed production and marketing activities.

6. The size of the seed bag has been reduced from 40 kg to 10 kg for wheat and rice and 5 kg for maize to suit the small farmers. Each seed bag contains a leaflet containing the recommendations on improved cultural practices.

7. In order to improve the shelf life of seed, a double bag packing system utilizing a 250 gauge polyethene inner has been adopted.

8. Some of the seed stores have a provision for cooling by simple ventilation.

9. Minikits are made available to the site farmers. Also, the seed growers are receiving the seed of new varieties for trial seed production. A number of Peace Corps Volunteers are helping in these activities.

10. In view of the complementarity between r-search and seed production, an inter-linked seed production program is being tried at one of the ICP's cropping systems sites. Similarly, jointly cooperative activities are undertaken with other projects like VSPP, IHDP, HFPP and PAC.

11. High altitude seed stores are being developed for safe storage of AIC's terai-produced maize seed.

12. A seed film is being made to serve as a source of training and motivation.

13. A pedal operated seed cleaner is being tried as an improvement over hand operated Burrows Model 30 cleaner.

14. In order to improve germination testing procedures, a walk-in-germinator is being provided at Khumaltar.

15. Local fabrication of seed equipment in Nepal has also been tried with encouraging results.

## 7. TRAINING

The project has both in-country and out-of country training opportunities. In fact, training is a vital component and recognizing its importance its scope in the remaining period of the project has been exapnded. A training manual is in the making. Since inception, the in-country training program has trained 260 farmers and 175 officials in aspects of seed technology apart from the informal and on-the-job training of seed growers at various project sites.

## 8. EXPERIENCE

The hill seed production program of SPISP is still in a formative stage. In majority of the sites construction work is in hand and seed production is being launched for the first time. However, first year's working at a pilot site has produced highly encourating results. The experience gained is summed up as below:-

1. Seed production in the remote hill sites is a distinct possibility.

2. Farmers are happy and enthusiastic about the locally produced aeed as it has satisfied their demand in time.

3. Consumption of improved seed through the seedhouse system has shown a substantial increase.

4. The seed quality of locally produced seed is superior.

5. More and more farmers are eager to participate in the seed program.

6. The farmers like the AIC/SPISP to run, support and demonstrate the system for sometime so that they can then take over with confidence and run the whole operation themselves.

7. Seed production fields of improved varieties serve as demonstration spots for new technology.

8. A seedhouse stands as a symbol of official developmental effort for the benefit of small hill farmers.

# GTZ's APPROACH TO SEED DEVELOPMENT PROGRAMS

O. Neuendorf
Program Officer
GTZ, W. Germany

GTZ recognized the vital role of seed industry in agricultural development many years ago and since then has acquired extensive worldwide experinece in seed development programs (see attached reference list). Within GTZ's overall activities, seed improvement projects are of high priority.

GTZ believes that seed improvement has a wide range of beneficial effects on the economy as well as on the social pattern of a country, namely

- increase of agricultural output (total and per unit area)
- decrease of food imports and seed thus saving foreign exchange
- improvement of nutritional status
- increase of farmers income thus promoting the economy
- promotion of jobs
- the use of better seed requires better agricultural practices and improves the knowledge of the farmer in general.

To achieve all this it is of utmost importance that all activities of the participating people and institutions are well organized and coordinated.

They have to be planned according to the stage of development of any existing seed industry or traditional seed exchange at village level.

A functioning seed industry can be divided into the following components:

1. Research and Breeding

   - Breeding/Selection
   - Introduction/Initial Evaluation
   - Variety Testing/Multiplication Trails
   - Multiplication
   - Training

   Result : Breeder Seed

2. Seed Legislation

   a. National Variety Registration

- Review/Multiplication Trails
- Release

Result : Registered Variety

b. Seed Quality Control

- Seed Testing
- Fieldinspection
- Seed Certification
- Seed Trading Control

Result : Quality Seed

3. <u>Seed Production</u>

a. Seed Farm or Program Farmer

- Maintenance Breeding (if not done by the breeder)
- Multiplication

Result : Basic Seed for Multiplication

b. Seed Grower

- Identification and Registration of Grower
- Seed Supply (Basic or Certified)
- Supply of other Inputs
- Extension/Roguing
- Transport to Processing Plant
- Post Harvest Control
- Training

c. Seed Plant

- Processing
- Storing and Dressing
- Post Harvest Control
- Packing/Labeling
- Transport to Market

d. Marketing

- Assessment of Consumer Needs
- Programming Production and Buffer Stock Supply
- Distribution
- Pricing

Result : Certified Seed for Consumer

4. Wholesale/Retailer

5. Agricultural Banks/Credits

6. Extension Service

As can be seen, all these components are interlinked and are only as good as the weakest link.

Therefore, learning from past experience GTZ must insist that the institutions involved in the seed business cooperate closely.

However, the responsibilities which the government has to the consumer and the producer must be kept quite separate.

The duties of the government are to lay down a policy on seed which serves to improve the existing situation and assures that any seed legislation will further the interest of private seed growers.

At the same time the user should be protected from seed which has been tampered with or neglected due to unfavourable conditions in route from the producer to the user.

One should be aware of the fact that the establishment of a seed industry will not be a self-financing business for a number of years. Therefore subsidies are needed which, however, will prove a sound national investment.

It must be ensured that all institutions and persons in the seed business know and can implement their assigned task.

In the beginning it is certainly not expected to produce huge quantities of seed, rather produce small quantities which are handled properly and for which a demand situation has been created in the market. To increase the amount of quality seed by an already proven system is more likely to help to establish a viable seed industry then any other approach we can think of.

RECENT GTZ SEED DEVELOPMENT PROJECTS

1. For all these programs GTZ was involved from appraisal to implementation as an advisor working with the counterpart organization in the respective country.

2. This list represents only a selection of recent GTZ seed development projects. Older projects are omitted. Where seed development forms part of a larger rural development project, no mention has been made of the project.

3. The value of the projects includes only GTZ funding.

4. Counterpart contributions are not included.

| Country | Activity | Client | Period | Value (millions DM) |
|---|---|---|---|---|
| Argentina | Basic and certified seed production of soya, by state and private producers | INTA, Misiones | 1976-81 | 4,0 |
| Bangladesh | Foundation of a autonomous seed industry, to include basic and certified seed, production, processing, storage and marketing for wheat and rice | Bangladesh Agricultural Development Corporation | 1981-83 | 16,5 |
| Bolivia | Experimentation and production of lupin seed | Ministerio de Asuntos Campesinosy Agropecuarios | 1977-79 | 0,5 |
| Costa Rica | Genebank for the collection, storage and utilization of tropical seeds and fruits | CATIE, Turrialba | 1976-83 | 7,3 |

| | | | | |
|---|---|---|---|---|
| Ethiopia | Genebank for the collection, storage and utilization of wheat, barley and tropical highland crops. | Institute of Agricultural Research | 1976-84 | 14,6 |
| Jordan | Seed production in wheat and barley, seed processing, marketing | Jordan Cooperative Organization (JCO) | 1981-85 | 2,9 |
| Kenya | Seed potato production and marketing | Ministry of Agriculture | 1965-78 | 6,3 |
| Morocco | Production, seed testing and processing, storage and marketing in wheat, barley, seed potatoes, sugar cane and fodder plants | SONACOS | 1977-87 | 47,0 |
| Morocco | Breeding, basic seed production in oil seeds | INRA | 1966-76 | 5,0 |
| Nepal | Seed production of wheat, maize and rice, processing, storing and marketing | AIC | 1983-86 | 3,2 |
| Pakistan | Increasing seed potato production for import substitution | Ministry of Agriculture | 1981-84 | 2,4 |
| Peru | Seed production of lupins, experimentation in food technology | Ministerio de Salud | 1976-78 | 7,2 |
| Philippines | Development of seed potato production, seed testing | Bureau of plant Industry | 1977-85 | 7,5 |

| | | | | |
|---|---|---|---|---|
| Portugal | Seed potato production for import substitution | GDPPA | 1981-83 | 3,3 |
| Senegal | Production and marketing of basic and certified maize seed | Ministry of Rural Development and Water Resources | 1980-83 | 6,4 |
| Sierra Leone | Development of rice seed autonomous industry including maintenance breeding, certified seed production, processing and marketing, seed testing | Ministry of Agriculture and Natural Resources | 1976-84 | 19,0 |
| S. Korea | Seed production in fodder plants | Ministry of Agriculture | 1974-79 | 5,5 |
| Sri Lanka | Seed production, processing and marketing in the state and private sector for rich and fodder plants | Ministry of Agriculture | 1979-83 | 2,8 |
| Tanzania | Foundation of National Coconut Industry, involving breeding and multiplication | Ministry of Agriculture | 1979-86 | 38,5 |
| Trinidad | Variety trials and seed production of soya beans, maize, sorghum and vegetables | Ministry of Agriculture | 1974-78 | 3,5 |
| Tunisia | Seed testing and certification station for wheat, barley and vegetables | Ministry of Agriculture | 1970-78 | 2,2 |

# SEED PRODUCTION AT LUMLE AGRICULTURAL CENTRE

Ian G. Hunter,
K. Budathoki and
G.R. Crooks

## 1. INTRODUCTION

Lumle Agricultural Centre (LAC) is situated in Lumle and Dhikurpokhari Panchayats in Kaski district. The centre covers approximately 58 hectares of which 16 hectares is under cultivation. The altitude of the centre lies between 1,465 and 1,830 m. Main horticultural crops grown at the centre are : apple, peaches, plums, citrus and various kinds of vegetables. Main agronomic field crops are : wheat, barley, maize, soyabean, peas and potatoes.

The main objective of LAC is to increase food production per unit area by a combination of investigations, the introduction of improve technology, followed by an efficient extension system. Thus farmers living standards can be raised.

Although the introduction of improved seed of any cultivar is only one of several components which might raise yields (others include the use of irrigation water, chemical fertiliser, plant protection etc.), it has been shown both at LAC and in farmers' fields that the use of improved seed alone can increase crop yields significantly under the local rainfed conditions, without the use of other components.

The main objectives of seed production at Lac and in the LAC target areas are :

a. To achieve self sufficiency in improved seeds

b. To maintain good quality seed

c. To reduce transportation costs

d. To provide the required quantities of improved seed on time

e. To provide additional income to small farmers who act as seed multipliers

f. To guarantee an improved cropping program to the farmers.

## 2. AREA OF OPERATION

LAC's target area covers 23 Panchayats in the districts of Kaski, Parbat and Myagdi, in the zones of Gandaki and Dhaulagiri. A village-based seed production program was intitated when LAC started working in its target area. In order to achieve the objectives listed in 1 above, home based field staff were recruited and trained. The field staff cover an average

of 1.5 to 2 panchayats each in a single discipline (Agronomy, Horticulture, Pasture/Forestry or Livestock) although they are now being retrained to become multi-disciplinary so as to come more in line with HMG's system of extension.

To achieve self-sufficiency in seed supply, efforts are now being made to ensure that each village is capable of satisfying the demand for improved seed from its own production. Any shortfall in supply is made up by transporting seed from one village to another. In addition to these extensive seed production programs an intensive seed production pocket program is being launched within the target area for both cereal and vegetable crops. Any surplus seed remaining after the demand of farmers has been met are channelled to AIC and district agricultural offices according to their demand.

## 3. HISTORY OF WORK

Seed production has been going on at LAC for over 9 years. Wheat and maize are the main crops. Panchayat seed production started in 1975 with just over 1 ton of wheat being produced. Maize seed production in the Panchayats started in 1977. This was also the year that vegetable production started in the LAC target area. Table 1 gives the seed production figures for LAC since 1973. The cultivars that LAC deal with are Kakani Yellow in maize and RR 21, LR 64 and Lerma 52 in wheat.

## 4. ARRANGEMENT OF FOUNDATION SEED

Foundation seeds for the multiplication programs in the target area are maintained in the centre. Here, the crop can be strictly supervised, given proper isolation etc. The seed produced from the centre grown crops are bulked, tested and treated before being sent out to the panchayats for further multiplication. LAC tries to produce all its requirements for foundation seed so that it can be sure of the seed quality and origin. When there is a short fall though, seeds are brought in from the National Development Program.

## 5. SEED GROWER

It is the responsibility of the LAC field staff to select seed multipliers and multiplication sites. When looking for potential growers the following are taken into consideration.

1. Land suitability,
2. the facility for irrigation (winter vegetables),
3. farmers enthusiasm,
4. availability of resources such as manure,
5. farmers willingness to grow crops as advised by the field staff.

After selection, a farmer is offered a contract which stipulates such things as:-

1. the multipliers must accept the LAC purchase price,

2. he must only use seed supplied by LAC,

3. crops must be planted with due care to the need for isolation,

4. farmers must dry and clean their seed before selling it back to LAC,

5. seed from non-selected, crops will not be purchased,

6. seed should not be sold to other farmers or agents without consulting LAC.

Training is given, on a village-based level, to the farmers on the crops they are going to multiply. In the case of vegetable seed multiplication the foundation seed are then sold to the farmers along with the necessary fertilizers and pesticides. With field crop seed production, however, the seed has, in the past, been given out on "loan", the loan (in seed) being "repaid" at the end of the season from the resultant crop. This practice is now being stopped and farmers will have to pay for their seed.

## 6. SEED MULTIPLICATION

The seed crops are grown by the farmers under the close supervision of the field staff and senior staff based at LAC. Care is taken over the isolation of cross pollinated crops. Roguing and plant selection (in vegetables) is done by senior staff and on an average 25 to 30 percent of the crop is discarded at this stage. Harvesting is done by the farmers, who also thresh and dry the seed.

## 7. SEED COLLECTION, PROCESSING, TREATMENT, STORAGE AND PACKAGING

### a) Field Crops (mostly wheat and maize)

Seed production on contract in the Panchayats is stored in the farmers' own home until next year's demands are worked out by the field staff. As soon as all the seed requirements are known, the seeds are processed, (by the farmers) then sufficient amounts purchased by the field staff after testing for germination. It is stored in bulk in village stores, or in the field staff's houses, until sowing time. During the storage period the seed are treated by LAC's mobile seed dressing team and carefully monitored for pests and storage diseases. If the seed is stored in a private house, LAC pays a storage rent of Rs. 0.10 per kg. Farmers bring their own containers to take away the seed at the time of purchase.

A base price for seed is decided upon in each Panchayat in discussions between LAC field staff, seed multipliers and the panchayat. Seed producers are paid this base price plus a bonus of 30 percent (on an all or none basis) to encourage quality production.

b) Horticultural Crops

After harvest, the seeds are brought into LAC in small sacks-each grower's lot being kept separate and being given a number for identification. In LAC, the seeds are tested for germination, treated with chemicals, and stored. LAC also packs the vegetable seed into suitable packets prior to distribution.

LAC pays the vegetable seed growers the government base price for vegetable seed plus a 30 percent incentive. This is to cover losses that may have occurred over the season e.g. with strict roguing.

8. SEED TRANSPORTATION

The LAC filed crop seed production plan has always been aiming at self-sufficiency, in the final commercial grade of seed, within an area - say one or two Panchayats. This along with the storing of the seed in the field, has greatly reduced the need for transporting bulky seed over long distances in the hills. There are areas, though, where demand exceeds production and seed have to be brought in from surplus production areas. If this has to be done, LAC, pays one way porterage for the transport of the seed. One way porterage is also paid to farmers multiplying vegetable seed, for them to bring their seed in to the Centre. All other transport costs have to be met by the farmers purchasing the seed. All movement of seed in the target area is by porter. Field crop seeds are carried in sacks from the producer to the stores but a great variety of containers are used by farmers when buying seed from the Panchayat store. Vegetable seeds are transported to Lumle in sacks but are then packed in plastic bags for distribution.

9. PRICING AND MARKETING PROCEDURES

The selling price of the field crops seed is the base price worked out at the time of buying the seed from the seed multiplier (see 7a). The 30 percent bonus to the producer and cost of inputs and labour during storage and treatment are borne by LAC. Vegetable seed are priced so as to cover all costs from seed purchase to packeting.

Marketing is all done through the Field Assistants. With Maize and Wheat an estimate of the demand is drawn up before buying the previous crops so that there are no large excesses. Grain from areas of over production can also be moved to deficit areas in time, when supply and potential demand are known beforehand. Farmers buy the seed at the field staff's house or in the house where the seed is stored and it is then his responsibility to get the seed back to his farm.

Any extra seed bought by LAC from the growers is sold to AIC or the DADO offices if they have requested it. If the farmer has seed surplus to the requirements of LAC he can dispose of them as he wishes.

Table 1

SEED PRODUCTION AT LUMLE AGRICULTURAL CENTRE, 1973 TO 1982 (KG)

| Crop | 1973-74 | 1974-75 | 1975-76 | 1976-77 | 1977-78 | 1978-79 | 1979-80 | 1980-81 | 1981-82 |
|---|---|---|---|---|---|---|---|---|---|
| Wheat | 589 | 780 | 1026 | NA | NA | 20145.5 | 21333 | 36097 | 60011 |
| Maize | - | - | 183 | 500 | NA | 4388 | 11586 | 15689 | 14369 |
| Vegetables | 5 | 32.780 | 27.930 | 110 | NA | 89.55 | 65 | 134.56 | 372.241 |
| Peas | 15 | 65 | 68 | NA | NA | 24 | NA | 88 | NA |
| Soyabean | - | - | - | - | - | - | 580.5 | 821 | 832 |

# VEGETABLE SEED PRODUCTION STATUS AND FUTURE SCOPE IN NEPAL

S.S. Rekhi, FAO
Vegetable Seed Production
Project, Nepal.

## VEGETABLE SEED PRODUCTION IN NEPAL

Although Nepal is a small country it represents almost all types of climates due to altitude variation from sea level to almost 8800 meters height of the Mount Everest.

Due to these climatic conditions it is possible to produce seed of almost all types of vegetables. In general, the high hills of Mustang, Jumla and Palpa have been found suitable for the seeds of cabbage, carrot, beets etc.

Mid-hills of Kathmandu valley, Palpa, Rukum, Dhankuta, Sindhuli are most suitable for seed production of vegetable crops like cauliflower, radish, cress, spinach, turnips, beans and onions.

Subtropical climate of terai is most suitable for tropical vegetable crops such as eggplant, okra, cowpea, pittergourd, bottlegourd as monsoon crops. This area is also found to be most suitable for seed production of tomato, peas, tropical cauliflower, tropical radishes and onion as winter crops.

Since vegetable seed production is difficult to be mechanised it is a labour intensive type of agriculture. In Nepal, the holdings being small there is surplus of family labour. This could be gainfully employed in labour-intensive high-returr seed production program.

In most countries, due to rise in living standards and scarcity of meat and fish, vegetables are finding important place in food habits. Due to this some of the countries such as Bangladesh, Pakistan, Middle-east oil producing countries are importing vegetable seeds worth millions of rupees every year. Due to suitable conditions available in Nepal, it could take advantage to produce and meet the demand within Nepal and in other countries.

## SCOPE OF VEGETABLE SEED PROGRAM IN NEPAL

At present annual demand of vegetable seed in Nepal is about 400 m.t. By the end of VI Plan it is estimated to increase to 500 m.t. To produce this seed 4000 farmers each with 5 ropani of land under seed production would be required. If export demand of seed is built up production could be increased to higher levels. In this regard the example of vegetable seed industry of Taiwan is relevant to know. Three decades before this country was no where in the field of vegetable seed production, but today it is one of the most important vegetable seed production centers.

## PRESENT SEED PRODUCTION IN NEPAL

Against annual demand of vegetable seeds of 400 m.t. the following vegetable seed production during the last 5 years has been achieved under the organised seed production program.

Table 1

VEGETABLE SEED PRODUCTION AND DISTRIBUTION

m.t.

| Year | Govt. supported | HMG Hort. Farms | Total |
|---|---|---|---|
| 1977-78 | 5.2 | 10.4 | 15.6 |
| 1978-79 | 14.6 | 10.0 | 24.6 |
| 1979-80 | 8.0 | 12.0 | 20.0 |
| 1980-81 | 15.0 | 9.0 | 24.0 |
| 1981-82 | 31.4 | 8.0 | 39.0 |

From above it is seen that production is much less than the demand of seed within the country.

## COMPARATIVE ECONOMICS

The farmers of Nepal are now fully convinced that the vegetable seed production is a remunerative agro-based industry in the rural sector.

Per unit area returns from the vegetable seed crops being high farmers in the selected areas can take advantage. Comparison of seed yields of important vegetable crops that are possible in Nepal vis-a-vis production in developed countries in given below:

Table 2

COMPARATIVE SEED YIELD/HECTARE

| Crop | Area of production in Nepal | Maximum seed yield kg/ha | Seed yield in other countries kg/ha |
|---|---|---|---|
| Cabbage | Marpha | 1200 | 1000-1200 |
| Carrot | Marpha | 1500 | 1200-1500 |
| Radish | Marpha, Kathmandu | 1200 | 1500-1800 |
| Cauliflower | Dhankuta | 500 | 350-500 |
| Tomato | Nawalpur | 160 | 200-300 |
| Eggplant | Nawalpur | 300 | 300-350 |
| Peas | Nawalpur | 1800 | 1500-1800 |
| Beans | Dhankuta | 1600 | 1500-1800 |
| Onion | Rukum | 500 | 800-1000 |
| Chillies | Nawalpur | 200 | 300-400 |
| Okra | Nawalpur | 1200 | 1200-1500 |

From the above it is evident that successful seed industry can be built up in Nepal.

CONSTRAINTS

Lack of Research base -

Vegetable seed industry should be based on a sound variety maintenance program. In the absence of proper maintenance, vegetable varieties run down fast and quality is affected.

In Nepal there is need to conduct some adaptive research mainly with the aim of improving productivity. Important areas of research are agronomic practices, plant protection, irrigation, seed harvesting, handling and storage.

For this, a research unit that can handle this work on a continuing basis is needed.

## IMPROVEMENT IN PRODUCTION AND MARKETING SYSTEM

At present contract seed production with farmers is not receiving proper attention and most seed production work on vegetable seed is undertaken rather casually. To improve the situation, the agency handling this aspect of production is required to strengthen facilities in terms of trained manpower and material facilities.

On marketing side it has been observed that inspite of the fact that seed produced is much less than the actual demand, there are always unsold stocks.

To improve the situation marketing and distribution system needs to be strengthened. Efforts are also needed to explore foreign markets where Nepal can sell its vegetable seeds.

## QUALITY CHECKS

In a sound seed industry quality checks at various stages of production, cleaning, storage, packing and distribution is very important. In Nepal, good facilities for seed testing, and trained manpower to handle this work are available. There is need to mobilise the efforts so that quality control program is carried on sound basis.

Initially it is not necessary to impose seed legistation. Instead it is necessary to create an atmosphere of quality seed consciousness so that improved seed is recognised. Efforts, therefore, are necessary through extension, demonstration and training to bring about awareness of quality seed amongst the farmers.

# PRACTICAL SAFE SEED STORAGE AND ITS MANAGEMENT

Bill Gregg
Seed Division
Dept. of Agricultural Extension
Bangkok, Thailand

The value of seed is entirely in the embryo plants they carry; seed must reach the farmer with the ability to establish the desired field stand. Seeds are seldom planted immediately after harvest. They normally are stored for a few weeks, months, or sometimes years, before planting. Storage must protect seed from deterioration and damage to minimize loss of germination and vigor and must maintain seed identity, physical condition and purity. For a seed program to be successful, it must provide adequate safe storage.

Storage life of seed varies with condition of both seed and storage. The primary factors influencing seed storability are known, and can be controlled, to a large extent, by careful planning and good management.

## Seed Deterioration

Germination and vigor are highest when seed first reaches physiological maturity. Thereafter, deterioration moves inexorably forward toward death, never stopping. Deterioration cannot be reversed or eliminated, once it has occurred (Delouche 1968b).

All seeds in a lot do not have the same life span; they age and die at different rates over a period of time. Differential rates of deterioration result in three distinct phases during a seed lot's storage life.

First, a period of high viability in which relatively little deterioration occurs;

Second, a relatively short period in which germination declines sharply to low levels;

Third, thereafter, a relatively slower rate of decline until all seed are dead.

Good storage seeks to minimize deterioration and prolong the first phase, in which little loss of viability occurs.

## Causes of Deterioration

1. Preharvest field conditions. Seed deteriorate in the field prior to harvest under unfavorable weather conditions, primarily rain, high moisture, high humidity, and high temperatures (Justice and Bass 1978). Hot dry weather with inadequate soil moisture during seed maturation also causes deterioration. Seed which have begun to deteriorate in the field usually do not store well.

2. Maturity at harvest. Immature seed -- smaller than normal size, wrinkled, shriveled, immature color, lightweight, etc. -- do not store well.

3. Mechanical injury. Mechanically-injured seed have reduced storability; they not only deteriorate faster, but are also more susceptible to storage fungi and treatment damage.

4. High temperature. Storage life of seed decreases as storage temperature increases. Harrington's "thumb-rule" (Harrington and Douglas 1970) states that from 0 to 50°C each 5°C increase in storage temperature halves the seed's life span. Both constant and short exposure to high temperatures have been shown to cause deterioration and reduce seed storability. High-moisture seed are more susceptible to damage from high temperatures.

5. High moisture. The most damaging single influence on storage life is apparently high seed moisture. As moisture content increases, seed deterioration increases. Harrington's "thumb-rule" (Harrington and Douglas 1970) states that for seed of 5-14 percent moisture content, each 1 percent reduction in moisture content approximately doubles seed storage life.

High moisture seed deteriorate faster, and are more susceptible to damage from extreme temperatures, fumigation, treatment, storage fungi, insects, heating, and mechanical injury.

General response of seed to moisture content is shown by the following relationships adapted from Harrington and Douglas (1970) and from Delouche (1968 a):

| Moisture | Seed Condition |
|---|---|
| 35-80 percent | Immature, still developing. |
| 18-40 percent | Physiologically mature, but not yet field maturity. Respiration rate high; field deterioration may occur; heating occurs if seed are harvested and bulked or stored without drying; insects and fungi active. Susceptible to mechanical injury. |
| 13-18 percent | Most resistant to mechanical injury; respiration rate high; heating occurs if seed are bulked or stored in upper levels of this range without drying; mold end insect damage may occur. |
| 8-10 percent | Reasonably safe for 1-3 years open storage in temperate climates; insect activity low; seed susceptible to mechanical injury. |
| 4-8 percent | Safe for sealed storage. |

| | |
|---|---|
| 0-4 percent | Extreme dessication, may damage some seed; some may show secondary dormancy. |
| 33-60 percent | Germination occurs when seed re-absorb moisture up to these levels. |

Exposure to high atmospheric relative humidity (RH) also increases seed moisture content. Seed are hygroscopic and absorb moisture from the humidity or invisible water vapor of the air at high atmospheric RH; conversely, they lose moisture to the air under low RH. Exchange of moisture with the surrounding air effects seed moisture content until it reaches equilibrium with atmospheric RH. Equilibrium moisture content varies with different crop seed; in general, it is lower for oily seed than for starchy seed.

6. Fungi. Storage fungi, primarily Aspergillus and Penicillium species, occur almost universally and may attack seed stored at RH of 65-100 percent (Justice and Bass 1978). When seed moisture content and/or atmospheric RH is high, storage fungi can grow rapidly, and may damage seed and cause heating. "Hot spot" damage to bulk stored seed is usually caused by insect or fungal activity in small areas where high moisture content has built up. All crop seed are not equally susceptible to fungi. Cereal seed are very susceptible, while some vegetable seed seem more resistant.

7. Insects. About a dozen species of storage insects occur widely and may cause serious damage to seed stored at 9 percent or higher moisture content. Insects attack the endosperm and/or embryo, and also create high moisture which leads to heating (Justice and Bass 1978).

8. Pests. Rats, mice, and birds eat seed, damage bags and scatter, mix and contaminate seed.

9. Seed treatment. Seed of high moisture, with mechanical damage, or stored for long periods are sometimes adversely affected by certain seed treatment chemicals. Some combination treatments affect germination; treatments safe for some crop seed may damage others; excessive treatment rate also affects storability.

10. Fumigation. Some fumigants adversely affect seed viability under certain conditions. Increased seed moisture, temperature, fumigant dosage, and time of exposure increase rick of damage (Justice and Bass 1978).

11. Natural storage life. Some crop seed inherently can survive for relatively long periods; others naturally have a short storage life. Peanut (Arachis hypogea L.) soybean (Glycine max (L.) Merrill) onion (Allium cepa L.), and lettuce (Lactuca sative L.) seed have naturally short life spans, while many legume seed (especially those with hard impermeable seed coats) survice for relatively long periods (Justice and Bass 1978).

## When Seeds are Stored

Some form of storage takes place from the time seed mature in the field until they are planted by the using farmer. Seed may deteriorate from unfavorable conditions at any stage; all must be properly managed to ensure that seed store well and reach the farmer with acceptable viability.

"Storage" occurs during the following periods:

A. Maturation to harvest, in the field.

B. Harvest to threshing (in a small-scale agriculture).

C. Threshing to delivery to the processing plant.

D. Receiving, drying and preprocessing storage.

E. Processing.

F. Storage after processing.

G. Transport from processing to the area of use.

H. Storage in the retail outlet.

I. Transport to the using farmer.

J. Storage on the farm, prior to planting.

K. Carryover to a later planting season.

For practical purposes, a seed program may group these into:

1. Preparing seed for storages. All stages before seed are delivered to the processing center: in the field before harvest; during harvest, threshing, and holding on the producing farm. Deterioration here determines initial storability of seed received by the seed program.

2. Pre-processing storage. From arrival at the seed center until processing is completed: receiving, drying, storage awaiting processing, and during processing.

3. Processed seed storage. All storage and transport of processed seed at the processing center, wholesale and retail distributors, etc. This is usually considered as seed storage.

## Preparing Seed for Storage

Since low-quality seed do not store well and good storage only slows down seed aging, careful pre-storage management is essential to minimize deterioration before storage begins.

Only healthy, undamaged, non-deteriorated, fully mature seed of high germination and vigor should be stored. To keep storability high until seed reach the processing center:

1. Plan production so seed are harvested during dry weather.

2. Harvest only when seed reach full field maturity.

3. Do not delay harvest.

4. Harvest and thresh at optimum seed moisture contents to minimize mechanical damage, by suitable equipment adjusted and operated properly.

5. Immediately dry seed and unthreshed plants to safe moisture contents, do not bulk or bag high moisture seed.

6. Protect seed and unthreshed plants from rain, ground moisture, high temperatures, insects, rats, birds, chemicals, fertilizers, fuels, etc.

7. As soon as possible, transport the seed to the processing center for proper drying and storage.

Pre-Processing Storage

Seed deterioration may occur due to poor management at the processing center. While this period is usually short, it is important to seed storability. Deterioration can be minimized by:

1. Immediately upon arrival of seed, measure moisture content and dry as required, or move into safe storage.

2. Immediately check for insect infestation. Fumigate and/or treat as soon as possible.

3. Store, label, and handle to ensure identity and purity.

4. Immediately test germination; remove unacceptable lots.

5. Process as soon as possible.

6. During processing keep seed cool, dry, uncontaminated, and free of damage and mixtures.

Storage of Processed Seed

After seed are processed to the desired quality, storage must maintain its identity and purity, protect it from insects and pests, and keep it cool and dry to prevent deterioration. Usual storage periods are:

A. Short-term: Until the following planting season, usually within 3-9 months. Most seed for farmer use goes through only short-term storage.

B. Carryover: Until a later season. Two carryover periods are usually encountered:

1. Carryover for approximately 1 year, until the next year's planting season; the usual carryover for most reserve or buffer seed stocks.

2. Carryover to a later planting season usually 2-4 years. Programs which produce seed of many varieties and have suitable storage conditions often stagger production and store seed for such periods, to reduce costs. Basic seed is commonly carried over for such periods.

C. Long-term: Several years storage for breeder seed, genetic resource collections, etc. Seldom used for farmer seed, due to cost.

Safe Storage

Seed which are immature or damaged deteriorate much sooner; mature seed which are undamaged, dry, and cool store better, and maintain high viability longer.

Unfavorable storage conditions speed up deterioration causing seed to die relatively sooner; favorable conditions slow the rate of seed aging, and maintain high germination longer. Practical storage guidelines gained from this are:

1. At any stage in its life, seed may suffer damage or unfavorable conditions which speed up deterioration and reduce storability.

2. Only healthy, undamaged, high-quality, non-deteriorated, fully mature and preferably untreated seed of high germination and vigor should be store for any period of time. Less storable lots should be planted as soon as possible.

3. Seed should be stored under dry cool conditions and protected from deteriorative influences, so that viability is high after the required storage period.

Seed deterioration, as well as insect and fungi activity, is reduced by lowering temperature and moisture content (and correspondingly, RH). How cool and how dry depends on the storage period, desired final seed quality, kind of seed, and economic consideration. The longer the storage, the lower temperature and moisture content must be. At lower temperatures, seed of higher moisture content can be safely stored; at lower moisture contents, seed can be safely stored at higher temperatures. These apply to reasonable storage periods; reducing only one cannot achieve maximum potential seed storage life.

It is not possible to specify exact storage conditions required, due to the many variables. However, for long-term storage of ganetic resource seed

FAO (1974) proposed desirable standards of 18 to 20°C at 5 percent seed moisture content (in equilibrium with about 10-15 percent RH for starchy seed, and 20-25 percent for oily seed). Minimal standards proposed were 5°C or less at 5-7 percent seed moisture and/or not more than 20 percent RH.

Delouche (1968 a) considered moisture content of 10-13 percent at temperate climate temperatures safe for short-term storage (6 to 12 months) of cereal seed; 8-10 percent moisture content at temperate climate temperatures suitable for 1-3 years open storage; and temperatures below 50°F and seed moisture in equilibrium with RH of less than 50 percent suitable for 3-8 years.

For any storage period seed quality is maintained better by providing the best storage conditions possible under existing economic constraints.

Providing Safe Storage Conditions

Seed can be safely stored if the storage is designed, equipped and managed to provide the required dry, cool, protective conditions.

Seed can be protected from moisture and high RH by the package and/or the storage facility. Lower temperatures can be maintained by the storage facility.

Moisture control: Moisture control requires protecting dried seed from moisture and high RH. Methods include:

1. Keeping short-term nonconditioned storage as dry as possible.

2. Lowering storage humidity by ventilating a well-constructed nonconditioned storage when ambient RH is low.

3. Placing low-moisture seed in a vaporproofed storage when RH is very low, and keeping the storage sealed to prevent entry of moisture vapor.

4. Dehumidifying the air inside a completely vaporproofed storage.

5. Packaging very dry seed in hermetically-sealed vaporproof containers.

Controlled ventilation (Harrington and Douglas 1970) is effective where the ambient RH is low enough for the required periods. Placing dry seed in a closed vapor proofed but not dehumidified storage is usually most feasible in an air-conditioned storage where thermal insulation and air-conditioning prevent convection build up of high RH near the floor, and removes some moisture.

Air in a vapor proofed storage may be dehumidified by either refrigeration or chemical dessicant dehumidifiers.

Very dry seed may be hermetically sealed in vapor proof packages to keep seed moisture content at its original level regardless of ambient RH.

Temperature control. Seed storages can be cooled by:

1. Designing and constructing a nonconditioned storage to minimize entry of solar rediation and outside heat.

2. Thermally-insulating a conditioned storage, and removing heat by air conditioning (refrigeration).

Kinds of Storage

Seed are stored either in bulk or in bags or other packages.

Bulk Storage

Bulk storage is common for short-term storage of large amounts of seed awaiting processing, including unshelled (ear) corn seed. In temperate climates processed seed is also sometimes stored in bulk for short periods. Many designs and sizes of bins, tanks, cribs, etc., are used. Seeds are frequently dried in such bulk storage units.

In tropical climates, wide temperature differentials which occur between outside air and the bulk seed mass, and at different points within the mass, result in moisture migration. Moisture accumulates in spots until dangerous levels are reached, and seed deteriorate rapidly. Deterioration spreads through the seed mass as more heat and moisture are generated.

Under humid tropical conditions bulk short-term storage may be used, but adequate mechanical aeration drying must be incorporated and properly used to keep the seed uniformly dry end cool.

Bagged Seed Storage

According to storage conditions provided, bagged seed storages are either conditioned or nonconditioned. Conditioned storages are specially constructed to creat a sealed space in which lower-than-ambient temperatures are created by refrigeration equipment, and lower RH by dehumidifiers. Temperature and RH are reduced as required for the seed crop and storage period.

Nonconditioned Storages

Nonconditioned storages create the best storage conditions possible under ambient conditions by using only suitable building design and construction; no special equipment (except ventilation fans) is used. Nonconditioned storage is used for most short-term storage of seed for farmers, and is adequate for carryover of very dry seed sealed in vapor proof packages. Under temperate climates it is suitable for short carryover in vapor porous bags.

A ventilated nonconditioned storage should be in a dry well-drained clean area to keep the environment as dry and pest-free as possible. The floor should be one meter above ground level (or at truck bed height), with a

built-in vapor barrier. Moisture-proofing is not adequate; the floor should be vapor-proofed.

The storage should have no windows and only one (sometimes tow) door in the center of the end to minimize floor space required for aisles. Install a rat shield around the building; entrance is by movable ramp and a rat proof ladder of smooth pipe. Floors and walls are smooth-finished to eliminate cover for pests. Walls and ceiling have enough thermal insulation value to minimize entrance of solar and outside heat; wall construction material may be adequate, but the ceiling/roof often requires additional thermal insulation.

Roof is joined to the walls without cracks. Exhaust fans and ventilation openings are screened with 6 mm wire mesh and located so as to remove hot air from the top and moist air from the floor level (Harrington and Douglas 1970).

Rain or moisture must not enter through the roof, walls, or door. A marquee roof over the entry protects the door area from rain. Roof and walls are light-colored to reflect solar heat. Extended roof overhang shades and cools walls, and protects ventilation openings from rain.

Separate storage from processing so it can be closed to keep out insects, pests, personnel, dust, etc.

Conditioned storages: Conditioned storages incorporate the general characteristics of nonconditioned storages, and must also be sealed and insulated to minimize entry of heat and humidity.

Floor, walls, and ceiling must have a vapor barrier equivalent to 8-10 mil polythylene film installed with bitumen. It must be continuous and uninterrupted to form a complete vapor seal around the entire storage space.

Adequate and continuous thermal insulation must be installed on the ceiling and walls. Floors are sometimes not insulated. Amount of insulation -- its value or heat resistance -- and insulation of the floor depend on storage temperatures desired and cooling equipment. Thermal insulation is installed on the inside or dry side of the vapor barrier.

A conditioned storage has no windows or ventilation openings, and only one door. The door contains a complete vapor barrier and thermal insulation, with seals or gaskets on all edges so heat and humidity cannot enter around the door. The door should be reached through an antechamber consisting of an outer sealed door and a small entry room equally insulated and vapor proofed. The outer door is closed before the inner door is opened; the antechamber serves as an airlock to prevent a direct opening from the outside into the storage.

The storage space, completely sealed by continuous thermal insulation and vapor barrier, is mechanically cooled and dehumidified to the desired conditions. Refrigeration or air conditioning equipment removes heat to cool it to the desired temperature. Heat load must be calculated for each storage to determine the equipment required. For most moderate sized storages in seed multiplication programs where seed are stored and/or carried

over for normal periods, either standard air conditioners or refrigeration equipment may be used. Larger storages and long-term storages at low temperatures, usually require refrigeration equipment.

Air inside the storage is dried by either refrigeration or dessicant dehumidifiers. Refrigeration dehumidifiers are suitable where higher RH is acceptable; dessicant dehumidifiers can maintain lower RH. Dessicant dehumidifiers, either dual bed or revolving drum, add more to the storage heat load. Dehumidifiers should be installed outside, to save storage space and minimize the added heat load.

A combination of cooling equipment and dessicant dehumidifiers is easiest to plan and operate, and is suitable for most storage needs.

Removing seed from cold storage. If seed in vapor porous packages are taken from cooled storage into warm humid outside air, seed temperature may be below the dewpoint of the air. When this occurs, moisture from the air condenses on the seed, seed moisture increases, and the seed lose viability rapidly.

This can be prevented by:

1. Packing seed in vapor tight packages for cold storage; or

2. Quickly moving seed in vapor porous packages from cold storage into a dehumidified room at ambient temperature, for storage until seed warm up to outside temperatures; or

3. If all seed will be removed from a cold dehumidified storage at about the same time, stop the cooling equipment and operate only the dehumidifier until seed warm up to outside temperatures.

Vapor Proof Seed Packages

Being hygroscopic, seed gain moisture from high atmospheric RH. If seed are hermetically sealed in vapor proof packages, moisture vapor in the outside air cannot enter the package. Thus, seed moisture content does not change regardless of ambient RH. Very dry seed in vapor proof packages can be stored for 2-4 years in good nonconditioned storages, at reduced storage construction and operation costs.

Packaging very dry seed in vapor tight containers appears to hold much promise as a low-cost, simple means of protecting seed viability during both storage and transport, especially under humid tropical conditions and where adequate storages are not available. The packaged seed are not affected by outside air RH; being very dry, the seed can withstand reasonably higher temperatures; low seed moisture is maintained after leaving storage, providing protection during transport, in retail stores, and on the farm. Also, there are no moisture problems in taking seed out of cold storages.

Moisture content of seed sealed in vapor proof packages must be considerably lower than for nonvapor proof packages. There is no exchange of moisture

vapor between air outside and inside the package, so seed moisture content determines equilibrium RH of air sealed inside the package. For example, air inside a vapor proof bag of corn (Zea mays L) seed at 13 percent moisture will equilibrate at about 65 percent RH. At this RH seed respiration is high, fungi are active, and insects can multiply. These create additional moisture and heat, so seed deteriorate rapidly.

Reported data indicates that in general, seed can be safely sealed in vapor proof packages if their moisture content is low enough to be in equilibrium with approximately 30-35 percent RH.

Vapor tight bags for larger amounts of seed may be made of solid thick films of polythylene (10 gauge or more), polyester, or plastic with similar vapor transmission characteristics; multiwall paper or other laminations which include suitable layers of plastic film, asphalt/plastic, asphalt/aluminium foil, aluminium foil/plastic, etc. The bags must either be heat-sealed or of moisture vapor will enter through holes left by the sewing machine needle (Harrington and Douglas 1970).

Some bag materials are not vapor proof, but are vapor resistant to varying; i.e. they do not prevent entry of vapor, but have a slow rate of vapor transmission. These include bags of woven plastic threads with only a thin film of solid plastic; sewn multiwall bags; multiwall bags of materials of higher vapor transmission rates, etc. These bags can keep seed moisture low longer than porous bags, but seed slowly increase in moisture under high ambient RH. When seed moisture reaches higher levels inside such bags, vapor cannot escape readily and seed deteriorate rapidly. Careful management should be employed when such bags are used.

Small amounts, as vegetable and flower seed, may be packaged in heat sealed vapor proof bags, pouches, or packets of suitable polythylene, polyster, laminated aluminium/plastic, cellophane/plastic, etc. Sealed tin cans, gasketed metal cans, gasket-sealed glass jars, and sealed rigid plastic containers may also be used. Paper packets and friction-sealed tin cans are not vapor tight.

Due to increased susceptibility of low-moisture seed to mechanical injury vapor proof seed bags must be handled gently.

## Store Management

Even with the best storage facilities, seed deteriorate if management procedures and planning are inadequate.

## Maintaining Identity

If identity of seed is lost, its value is also lost. Good storage management maintains seed identity by:

1. Every bag adequately identified with secure, complete labels.

2. Storage divided into smaller numbered areas to identify exact lot location.

3. Seed lots stored or stacked separately.

4. Stack cards to identify all stacks.

5. Adequate, up-to-date records.

Maintaining Purity

To prevent contamination of seed:

1. Keep bags in good condition.

2. Prevent scattering of seed by birds, etc.

3. Keep bags in their correct lots and well-identified.

4. Keep the storage spotlessly clean.

Protection from Insects, Pests, Fungi and Damage

Keeping seed cool and properly dried minimizes damage by storage fungi and insects. To prevent damage:

1. Prevent insect and pest entry into the storage.

2. Keep the storage and surrounding area clean, to reduce food and cover.

3. Control insects and pests by a complete control program which includes fumigation, seed treatment, space sprays, residual surface sprays, and poison baits, before damage occurs.

4. Do not store chemicals, feeds, fuels, fertilizers, etc., in the seed storage.

Stacking

Properly dried bagged seed may be stacked to afficient storage heights without weight or pressure damage to seed at the bottom. Damage to stacked seed occurs from:

1. If bags fall or are dropped off the stack, mechanical seed injury results. Bags should be removed from stacks by conveyor, forkift pallat, or hand-carrying, never by dropping.

2. Poor ventilation, especially when the floor has no vapor barrier, results in air convection currents due to temperature differences within the storage. This causes moisture movement within the storage, and RH of cooler air near the floor increases. Increased moisture content and rapid deterioration of seed at the bottom of stacks results.

Good Stacking Management Includes

1. Ensure proper ventilation around seed; stack only on pallets with at least 10 cm open space for air movement; leave 25-30 cm open space between stacks and walls, and 50-60 cm above stacks.

2. Provide adequate aisle space so storage operations do not damage or misplace bags.

General Management

1. Keep buildings in good repair. Maintain cooling and dehumidification equipment in good operating condition; keep adequate spare parts; practice preventive maintenance.

2. Regularly monitor and record storage conditions; be sure they are suitable.

3. Regularly check seed germination; improve storage conditions as required to keep seed viable. Chart germination against storage time and conditions to obtain storage management data.

4. Move or rotate stored seed so they are planted before they can deteriorate.

Carryover

Carryover must be planned and managed to minimize deterioration both before and during storage. This includes:

1. Provide some storage suitable for the required carryover under local conditions, in addition to short-term storage.

2. Test seed at harvest; sell lots with lowest acceptable viability first. Carryover only lots of highest viability and vigor, to ensure highest viability after storage.

3. Estimate the anticipated carryover at harvest, and immediately process and move possible carryover seed into the carryover storage.

4. Possible carryover of "less storable" crop seed should be processed first and put immediately into carryover storage. For example, leave corn (*Zea mays* L.) or rice (*Oryza sativa* L.) seed for later processing while soybean is immediately processed and moved into favorable storage.

Energy Conservation

Specific measures every storage should use to save energy and reduce costs include:

1. Safeguard seed quality so that no lot is lost. Loss of seed wastes all energy and expense invested in it.

2. Storage construction --thermal insulation, vapor barriers, door construction and seeling, etc. -- should be over-designed (i.e., significantly more than minimum required) to minimize operation of and dependence on equipment to maintain storage conditions.

3. Paint buildings with a light-colored heat-reflecting paint to reduce absorption of solar heat.

4. Keep the area around the storage clean and dry to minimize dehumidifier operation.

5. Use sealed, vapor proofed and insulated anteachamber entries for conditioned storerooms.

6. Plan storage layout and stacking to minimize distance and number of times seed is moved.

7. Proper air vents in nonconditioned storages remove hot air and reduce convection-current moisture with minimum fan operation.

8. Plan seed production for harvest in dry seasons, harvest at full field maturity, and dry by sun or shaded solar heating.

9. Plan removal of seed from storage, and transport, to reduce number of times storage rooms are opened, and truck trips required.

10. Eliminate re-drying of seed, by proper humidity and moisture control.

11. Packing properly-dried seed in vapor proof packages is potentially a major energy-saver; dehumidifiers are not required, higher storage temperatures can be used, redying is eliminated, nonconditioned storage is more useful, and seed is protected during transport and storage without special equipment.

12. Construct all storage with vapor barrier floors raised to truck bed level to reduce storage moisture and facilitate loading trucks.

13. Permit only essential workers into conditioned store rooms for the shortest time possible, to reduce storage moisture and facilitate loading trucks.

14. Install spring-loaded closers on doors of conditioned storages, to reduce entry of heat and moisture.

15. Use only flourescent lights to reduce heat load and electricity use.

16. Locate main storages as near as possible to processing, in layouts which minimize seed movement.

17. When large conditioned storage capacity is required, build several smaller rooms rather than one large room. When seed volume is reduced

during off seasons, turn off equipment in empty rooms. Smaller rooms with separate cooling and dehumidification equipment also ensures some conditioned storage during equipment failures.

References

1. Anonymous, 1974. Proposed standards and procedures for seed storage installations used for long-term conservation of base collections. Report by a working group of the FAO panel of experts on plant exploration and introduction. Rome. May.

2. Delouche, James C. 1968 a. Precepts for seed storage. Proc. Short Course for Seedsmen. Seed Techn. Lab., Miss. State Univ.

3. Delouche, James C. 1968 b. Physiciology of seed storage. Proc. 23rd corn and Sorghum Res. Conf. Amer. Seed Trade Assn. 23:83-90.

4. Harrington, J.V., and J.E. Douglas, 1970. Seed Storage and Packaging. National Seeds Corp. and Rockefeller Foundation. New Delhi, India. 222 pp.

5. Justice, Oren L., and Louis N. Bass. 1978. Principles and Practices of Seed Storage. Agriculture Handbook 506. USDA. Washington D.C. 289 pp.

6. Sittisroung, Prasoot, 1967. Storage of rice (Oryza sativa) and cowpea (Vigna sinensis) seed, M.S. Thesis. Mississippi State University.

7. Walch, G. Burns, and James C. Delouche. 1968. Environmental and structural requirements for seed storage. Miss. Agriculture Exp. Sta. Journal Paper 1607.

# REDUCTION OF LOSSES IN SEED STORAGE

# AND

# ROLE OF RURAL SAVE GRAIN PROJECT

Ganesh K.C. and
S.K. Bhalla (FAO)

## 1. Introduction

The Kingdom of Nepal lies principally in southern slopes of Himalayas between longitudes 80° and 88° East and latitudes 26° and 30° North. It is roughly the shape of a rectangle 800 Kms long and 170 Kms wide with an area of 140,797 sq. Kms. However, in Nepal there are tremendous altitudinal differences which together with the division of the year into dry and wet seasons, with increasing rainfall from west to east cause extreme climatic contrasts. Thus all the climatic and vegetation zones of the earth are represented.

For ease of discussion, Nepal may be divided into three physical regions: terai, region or lowlands, midland region and highlands. The terai is plain area which averages 300 m above sea level and is considered a part of gangetic plain. Major rivers have deposited their rich alluvial soil in this area making it very productive agricultural land. The midland region or mid-hills is the 'heart' of the country with elevation from 600m to 2750m. The moist subtropical to temperate climates of this area not only favor human habitation but also agriculture of considerable diversity. The Himalaya region or mountains extend above 2750m and contain the highest mountain system in the world with Mt. Everest being the highest summit at 8848m.

## 2. Nepal's Agriculture in General

Agricultural sector is the biggest sector of the Nepalese economy accounting for over 60 percent of GDP and providing employment to over 90 percent of labor force and constituting about 80 percent of exports. Therefore, this sector could be taken as to be the major sector determining the level of well being of a majority of Nepalese.

## 3. Importance of Seeds in Agricultural Development

Seeds are the most important input. The importance of good seeds was even known and realised during earliest time of civilization. Egyptians are reported to have used underground pits for storage of seeds.

The importance of good and viable seeds is also realised by farmers all over Nepal and they take care of seeds to the best of their capability, resources and means available to them. However, the most of the frmers do not undertake separate up-keep and storage of seeds but store their seeds with foodgrains in different prevalent storage methods and

structures - sometimes using their traditional methods and mostly none at all. At the time of need they use seeds for foodgrains and vice versa.

4. Seed/Foodgrains Storage Problems

In most of the developing countries the post-harvest field is not given due consideration for increasing the total food production. Mostly, the planners emphasize on two lines of action:

(a) Reducing the population growth;

(b) Increasing the food supply by expanding the production.

Only lately, the vital aspect of increasing food production by reducing the losses has started getting some attention. Any program of post-harvest loss reduction has numerous problems. Some of the major problems that are associated with our post-harvest operations are as follows:

(a) Farmers work hard, to grow crops increase production, but are loosing much of their grains after harvest to insects, rodents, birds, but neither the total magnitude of loss nor the extent to which it can be reduced is known.

(b) Not much information is available on improving the existing storage structures or using simple, cheap and low costing materials.

(c) Little attention is paid on improving the existing storage facilities.

(d) Generally the programs are oriented on production side and it is widely believed that storage problems arise and need attention only in surplus areas.

(e) Most farmer think the post-harvest losses are unavoidable as they are a God's curse. Farmers think of the loss on an individual basis, but the nation has to bear it in cumulative terms.

(f) Most of the existing structures such as Ghyampo, Mandro, Kothi, Dheri, Soli, and drums lack moisture proofing, air-tightness, temperature control and rodent proofing. Also, farmers store seed and foodgrain together which causes problems of treatment in the event of infestation.

(g) The existing extension program is oriented mainly towards providing information on crop cultivation only.

(h) Women who are the real seed/foodgrains handlers during farm-level storage, do not participate in training and demonstrations on improved storage system.

(i) There is a lack of facilities for loan from the credit agencies for buying post-harvest inputs.

(j) Due to lack of control and education, some farmers are using toxic chemicals randomly. Washing the treated seed and using it for feed is often done.

(k) Non-availability of equipment like sprayer, duster, fumigation sheet at farm-level hampers post harvest preservation of seeds/foodgrains.

(l) Central level storage has paid little attention to sanitorial measures and it has no code of practices for storage management.

5. Role and Position of Rural Save Grain Project

A rural Save Grain Program was set up in Nepal in the year 1980 on a pilot scale through FAO assistance.

Rice, wheat and maize are the staple foods of Nepal. 70 percent of the produced grain is consumed locally. Conservation of staple food at farm-level is therefore, important. The present program is designed to improve the efficiency of post-harvest activities, including threshing, drying, cleaning, milling and storage. The program has its main objectives the reduction of losses and improvement of grains quality in on-farm operations, including the introduction of improved and efficienty ways of harvesting, threshing, drying and processing and storage of staple grains. The program emphasizes loss reduction activities in the rural sector as well as the establishment of an infrastructure for the prevention of losses in the commercial sector.

The FAO pilot project has under-taken studies of the extent and causes of post-harvest losses in farm-level operations: Some of the achievements are mentioned below:

(a) It has developed, tested and evaluated improved storage structure like metal bin, Pucca kothi, sandwitched bin with top and a bottom metal base. Farmers of districts Rasuwa, Nuwakot, Gorkha, Lele, Bhairahawa, Kavre Palanchok, Dadhikot, Chitwan and Sindhuli are using the metal bins of mostly 0.4 m.t. capacity as seed bins. A study on seed storage in metal bins was carried out at Lele in cooperation with ICP. The result was very much encouraging. It has been found that by adopting the improved structure with improved storage practices significant saving of seed could be achieved.

(b) Recently at Balambu, Trishuli, Dadhikot the project has constructed Pucca Kothi and is doing the basic studies.

(c) An awareness of post-harvest problems and their solutions has been created through the extension and training program operated in the main project areas and in cooperation with a limited number of other on-going agricultural programs.

(d) The loss assessment studies have demonstrated that average storage loss of 5-8 percent (by wt) can be reduced to less than 1 percent if the package of improved storage facilities are adopted (on an average this represents an annual saving of around 60 Kg of grains per household).

(e) It has assisted in pest control services at farm level storage as well as off-farm storage.

(f) It has conducted and participated in a number of training programs on post-harvest operations for farmers, JT, JTAs, PLAs, women workers and storekeepers and supervisors and technicians of AIC and Food Corporation.

(g) It has also assisted the projects like K-BIRD, CIDA IRDP, TWP, PAC, Pakhribas in storage services training and metal bin fabrication.

(h) The project during its study period has produced a number of leaflets, posters, manuals, flip-charts on post-harvest systems and improved practices in simple language.

(i) The Rural Save Grain Project now has an appropriate message to extend to farmer at least in the areas where it has been operating and nearby areas which have similar agro-climatic conditions for storage practices.

The present program of saving grain needs to be continued to achieve the national objectives of increasing agricultural production for the growing population (2.66 percent/annum), to give employment opportunities, and to raise the economic condition of the people. Beside this, efforts to increase the production includes the introduction of new HYVs, which, based on evidence from elsewhere, may lead to serious pest problems in storage. Indeed the hill farmers already tend to limit their production of new varieties because of storage problems. The amount grown is generally dictated by:

(a) The quantity they can dispose of immediately after harvest;

(b) The quantity which they can safely store.

Farmers and planners have now recognized that increased production cannot be totally effective unless due consideration is given to the conservation of the crops produced. In present context Rural Save Grain Project can coordinate the different aspects of post-harvest work, especially in conducting the post-harvest research work by feeding the scientists with the farmers problems which it collects through the extension units. Similarly, it can help the other related organization like AIC, NFC, SAJA, ICP, K-BIRD, CIDA, IRDP on loss assessment, training, bin testing and distribution and providing pest control services.

In short this project in the long run intends to assists the farmers and other commercial agencies and interested parties, involved in grain business to save grains from being lost due to pest and defective post-harvest operations.

6. Strategies for Minimising the Occurring Losses in Storage

An effective storage system should stress on the use of preneutive methods integrating with the curative methods like timely harvesting, proper cleaning and drying, providing proper structures, regular checking, and maintaining the management discipline. By doing so, an agriculture commodity can be stored well over a period of any deterioration.

In addition, to above factors, training farmers, farm-women, JTs, JTAs, Volunteers, SAJA cooperative storekeepers, AIC seed handling personnel is a step in the right direction.

For control of common insect pests like Sitophilus oryzae, Rhizopertha dominica, Sitotrogs Cereallea, Tribolium Castenieum and Oryzal khillus Surinamensis, prophyletic and curative methods should be integrated and applied. Spraying/dusting with malathion on seed, and seed storages should be timely done. Fumigation with aluminium phosphide should be done when and wherever needed. As some pests start growing right from the field, spraying of Malathion 50 EC could be done right in field a week before harvest.

One fumigation after a week of seed storage with aluminium phosphide helps quite a lot in keeping the grains safe.

The common rodent causing problem in storage are:

(1) Rattus rattus

(2) Mus musculles

(3) Bandicola nengalensis: Rats and mice are one of the important pests of foodgrains and seeds in storage. They not only eat but also make large quantities unfit for consumption. They spread many diseases. The control measures for rats include:

- Prevention through rat-proofing of godowns/storage containers.

- Control by trapping and poison baiting with zinc phosphide.

7. Research

Research should be concentrated on:

(a) Integrated pest management stressing sanitation.

(b) Use of local material like wood ash, neem and different oils and rodent barriers like pine needles, and thorns should be investigated.

(c) Loss assessment and cost/benefit study.

(d) Use of local, simple and cheap materials for improving the existing structures.

(e) Development of better threshing, cleaning and drying equipment.

8. Conclusion

Let our slogan be "GRAIN SAVED IS GRAIN PRODUCED".

# REPORT ON LEGUME SEED PROGRAM

R.K. Neupane, GLIP, Khumaltar
and R.P. Chaudhary, Agronomy
Farm, Khumaltar

Grain legumes in Nepal include soybean, lentils, chickpea, pigeonpea, blackgram, mungbean, horsegram, cowpea, pea and lathyrus. Crop improvement on legumes was initiated during 1965-66 and at present it is limited to soybean, lentils, chickpea, pigeonpea, blackgram, mungbean and cowpea only.

In Nepal, legumes as such are considered a minor crop group and potential benefits seems to be either ignored or under estimated. According to the available statistics of 1971-72 (Table 1), 12 percent of the total cultivated area of the country is occupied by grain legumes, while 14 and 19 percent area is covered by wheat and maize respectively. It clearly indicates the importance of grain legumes in Nepalese agriculture. Besides legumes have been playing a very important role in human and animal nutrition, soil fertility maintenance and cropping systems of Nepal.

Realizing the importance of grain legumes, Grain Legume Improvement Program (GLIP) was started as a separate program under Agronomy Division during 1975-76 and it is run in cooperation with other farms and stations. GLIP has full responsibility of improving grain legumes in terms of varietal, cultural and other aspects including seed production in cooperation with other farms-stations and agencies and thus help to increase productivity and total production of grain legumes in the country. During the Sixth Plan period production of legumes excluding soybean is aimed to increase by 16 percent and that of soybean by 25 percent.

## Seed Production Situation;

Grain legume seeds are mostly produced and distributed from government farms and stations. Government farms participating in seed multiplication of legumes during 1982-83 were Parwanipur, Bhairahawa, Hardinath, Jhumka Seed Multiplication Farm, Agriculture Stations Surkhet and Nepalgunj, Agriculture Farm Kavre, Agriculture Centers Lumle and Pakhribas and Khumaltar.

Seed supply is a major constraint of GLIP. Whatever seed is produced at the government farms and station is not sufficient to meet demand. Production of quality seed and its maintenance is a big problem in legumes. Seeds stored under ordinary conditions until planting time often germinate too low. Inability to keep seed viable until planting time also results in seed shortage.

In the year 1981-82 there was a big demand for lentil, chickpea and mungbean seeds and 1.7 m.t. of lentils, from government farms and 5 m.t. of mungbean from AIC was distributed to the farmers. Similarly for 1982-83 demand for soybean, mungbean, lentil and chickpea was very high. 0.9 m.t. of soybean, 4 m.t. of lentils, 0.9 m.t. of chickpea and 2.4 m.t. of mungbean produced in government farms were distributed to the farmers. Besides 1.5 m.t. of soybean

variety Hardee was collected from Makwanpur district through Nepal Seed Company and made available to farmers of Chitwan district, 8 m.t. of mungbean seeds were distributed to Bara and Parsa districts through AIC.

Mungbean

Presently mungbean seed is multiplied at Parwanipur Agriculture Station, Hardinath Agriculture Farm, seed multiplication Farm Jhumka, Agriculture Farm Bhairahawa and Agriculture Station Surkhet and Nepalgunj, on a small scale. Besides seed multiplication is done in farmers fields in Bara and Parsa districts. But the collection of mungbean seeds at harvest has been a problem to both AIC and GLIP. Due to rainy weather during collection, it is difficult to collect good quality seed. Also due to the higher price of mungbean in the market, farmers are not willing to sell their graded produce to AIC at a premium price and as a result seed collection is poor. To overcome this problem there must be some changes in the pricing or premium policy.

Soybean

Seed production of soybean is restricted to government farms and stations. Popularization of improved cultivars was done through minikit distribution, but now supply is not enough to meet demand. To overcome seed shortage problem during 1982-83, seed of cultivar Hardee was collected from farmers of Makwanpur and distributed to farmers of Chitwan district. Since the newly established Nepal vegetable ghee industry at Hetauda is willing to buy soybean produced at Makwanpur and Chitwan, there is a need for a sound seed multiplication program.

Lentils

Presently, seed multiplication is launched in government farms and stations and seed is sold directly to the farmers. Seed demand for 1982-83 was 7 m.t. and only 4 m.t. could be supplied to the farmers. Seeds could not be sold to places where it was needed due to lack of funds for transportation. Seed produced in farms can be efficiently distributed if AIC is involved in this task.

Chickpea

At present seed is multiplied at different farms and stations. Seed demand for 1982-83 was 5 m.t., but only 0.9 m.t. was supplied. Seed shortage will no doubt increase in the coming years, unless it is done in farmers fields through AIC. It is clear from the above discussion that demand for legume seed is always increasing, but the supply is not enough to meet it. With more intensive extension activities the demand of legume seed will increase tremendously. It is high time that we give a serious attention for developing a big seed multiplication, distribution and marketing program of grain legumes. Following suggestions are presented for the betterment of grain legume seed program:

1. At present, the manpower involved in grain legume program is quite inadequate to handle research activities in half a dozen of legume crops. Hence, improvement in technical staffing is badly needed so that a research worker can work on a specific crop.

2. Since grain legume program is relatively a new program, more emphasis on extension activities in terms of demonstrations and minikits should be given so that technology generated by research could reach a larger number of farmers. At present the district extension offices are oriented towards cereals, they should start extension activities for grain legumes too.

3. Various government farms and station give less priority for legume seed multiplication. This tendency needs to be discouraged and these farms should be directed to produce legumes seed and thus overcome the problem of seed shortage.

4. GLIP should be well staffed, so that maintenance breeding program could be run efficiently.

5. Standards for breeder, foundation and certified seed should be fixed so that seed program could be run efficiently.

6. Agriculture Inputs Corporation should be fully involved in grain legume seed multiplication as in rice, maize and wheat seed multiplication program. An organized seed multiplication program in farmers' fields should be started through AIC.

7. Because of a number of crops to be handled, it is suggested that the Seed Division of AIC should have a sub-unit for legume seed program so that this program could be handled efficiently.

8. AIC should take the responsibility of taking over legume seed produced in government farms and distribute it to different parts of the country.

Table 1

AREA PLANTED, YIELD AND PRODUCTION OF FOOD LEGUMES OF MAJOR KINDS

| | Kind of Food Legume | Items | 1971-72 | 1976-77 |
|---|---|---|---|---|
| 1. | Total of all food legumes | A | 277.69 | 328.58 |
| | | Y | 334.00 | 346.00 |
| | | P | 9,275.00 | 11,410.00 |
| 2. | Soybean | A | 18.04 | 18.53 |
| | | Y | 600.00 | 650.00 |
| | | P | 10,824.00 | 12,044.00 |
| 3. | Black pulses (Mungbean, Blackgram, etc.) | A | 16.26 | 18.93 |
| | | Y | 280.00 | 306.00 |
| | | P | 4,553.00 | 5,798.00 |
| 4. | Horsegram | A | 25.47 | 29.62 |
| | | Y | 402.00 | 412.00 |
| | | P | 10,239.00 | 12,203.00 |
| 5. | Pigeonpea | A | 13.09 | 15.29 |
| | | Y | 265.00 | 275.00 |
| | | P | 3,469.00 | 4,205.00 |
| 6. | Lathyrus | A | 100.342 | - |
| | | Y | - | - |
| | | P | - | - |
| 7. | Lentil | A | 73.187 | - |
| | | Y | - | - |
| | | P | - | - |
| 8. | Chickpea | A | 33.806 | - |
| | | Y | - | - |
| | | P | - | - |
| 9. | Peas | A | 8.937 | - |
| 10. | Maize | A | 450.00 | (1975-76) |
| 11. | Wheat | A | 329.00 | (1975-76) |
| 12. | Total cultivated area of Nepal | A | 2,326.00 | (1975-76) |

Source: Agricultural Statistics of Nepal 1972 and 1977, Agricultural Statistics Division, Nepal and National Sample Census of Agriculture 1971-72, Central Bureau of Statistics, Nepal.

Note: A = Area planted in 1000 ha.
Y = Yield per hectare in kg., and
P = Production in metric tonnes.

# SEED ACTIVITIES OF THE NATIONAL POTATO DEVELOPMENT PROGRAM

B.K. Bhomi
National Potato Coordinator

## I. Objectives

NPDP has the task to continuously develop and improve the know-how for an efficient potato production in the country. Main emphasis is on increase of yields per unit area and on the intensification of cropping systems but not on the expansion of the potato crop at the expense of other crops.

## II. Program Components

### 1. Varietal Evaluation

Varietal evaluation is a permanently on-going activity. Every year a number of new, imported lines enter the evaluation system. The aim is to identify better varieties (e.g. higher yielding, disease resistant) for the different agro-climatic conditions of the country or to find varieties that have better acceptability than the already released ones.

### 2. Basic Seed Production

Basic seed production is a permanently on-going activity. The aim is to permanently produce limited quantities of highest quality, true to type seed of all released varieties in their area(s) of adaptation/use, so as to maintain released varieties and to guarantee a constant flow of quality seed into the seed multiplication program.

### 3. Seed Potato Production with Contract Farmers

NPDP is not in a position to produce larger quantities of seed on its own. Therefore, NPDP is producing seed potatoes together with contract farmers. NPDP's aid is not to satisfy the seed demand of the country but to make available a reasonable quantity of quality seed for further multiplication by individual farmers for their own use.

### 4. Seed Potato Marketing

Seed potato marketing is linked with the seed potato production with contract farmers to make sure that,

- the seed producers get adequate returns;

- the seed quality potatoes are not ending up in the cooking pots;
- new varieties spread faster among the farming community than they would through farmer to farmer exchanges.

At present, NPDP buys, stores and redistributes the seed which is produced under its supervision. Purchase, storage and marketing of seed potatoes are regarded as temporary activities of NPDP, as it involves too much manpower and other problems in the long run. However, the long term success of seed potato marketing and thus seed potato production, most probably is only achieveable if seed potato marketing is a commercially viable operation not depending on government subsides. Therefore, structure and economic viability of an autonomous organization for purchase, storage and marketing of seed potatoes are investigated.

5. Seed Certification

Technical supervision of seed multiplication and quality control of the produced seed are regarded as permanent activities. At present, there is no seed certification in the strict sense but only seed classification based on visual assessment of the standing crop (first step) and tuber samples grown at NPDP headquarters.

6. Improvement of Potato Agronomy

NPDP is permanently working on improving potato agronomy for the various agro-climatic conditions. Emphasis is on agricultural practices and inputs that are available to the farmers at the various places.

7. Improvement of Potato Storage

Storage space of the farmers is usually very limited. In addition the storage facilities and technologies are often far from being suitable for a bulky and perishable commodity like potatoes. Consequently, storage losses are often high. Therefore, NPDP's research is oriented towards loss reducing storage techniques available to farmers at nominal cost.

8. Research on Technology Transfer

The potato production technology which gives the highest yield is not necessarily also the most economic one. In addition, the most advanced production technology may require high cash expenses, be regarded by the farmers as too risky or sophisticated to be adopted. The aim is to identify by working together with farmers feasible and acceptable technologies.

## III. Areas of Operation

Due to the diversity of the country, communication difficulties, difficult accessibility of many areas and staff limitations, the activities of NPDP are concentrated in pocket areas in a number of districts. For logistic reasons, manpower efficiency and cost reasons pockets have been established in the districts mentioned below:

(a) Eastern Development Region:

Illam, Sunsari, Morang, Jhapa.

(b) Central Development Region:

Sindhupalchowk, Dolakha, Kathmandu, Bhaktapur, Kavre, Dhanusha, Mahottari, Sarlahi.

(c) Western Development Region:

Kaski, Rupandehi.

(d) Mid-Western Development Region:

Dailekh, Surkhet, Banke.

## IV. Experiences and Achievements

### 1. Varietal Evaluation

So far more than 250 lines have been evaluated. The evaluation identified 8 superior varieties namely -

2 varieties for high hills
5 varieties for mid hills
6 varieties for terai

### 2. Basic Seed Potato Production

Basic seed production of all released varieties has been established. Currently about 20 m.t. of basic seed are produced annually.

### 3. Seed Potato Production with Contract Farmers

Seed potato production with contract farmers started in FY 1978-79 and reached an annual output of 500 m.t. with 330 seed growers in FY 1981-82. In the beginning the identification of interested participants was difficult and was carried out with the support of the extension service.

After a trial and error period not only regarding farmers selection but also regarding the seed multiplication control conditions,

NPDP's seed production program has gained a reputation for reliability with the farmers. Consequently, there is nowadays a cadre of seed growers and in several pockets many interested participants have to be denied participation because of the limited manpower.

A more detailed description of the seed potato production principles and experiences is given in the technical paper on seed potato production and storage.

4. Seed Potato Marketing

NPDP buys, stores and resells seed produced under its supervision. For the seed marketing activities, a separate unit has been established, which is organized according to commercial principles. This allows to analyze the commercial viability of seed potato marketing. However, commercial viability of seed potato marketing has not been achieved so far.

The principles of and experiences with seed potato marketing are dealt with in more detail in the paper on seed potato marketing.

5. Seed Potato Certification

Based on visual inspections of the standing crops, the produced potatoes are provisionally classified into seed fit for further multiplication and seed for ware potato production. Based on the tuber samples grown at NPDP headquarters (Florida Test), the provisional classification is confirmed or the produce downgraded. So far, no real seed certification has been established. Before doing so, several years' experience is required regarding the qualities obtainable.

Based on the presently available experiences, the classification limits have been tentatively fixed as 3 percent cumulative virus for seed for further seed production and 10 percent virus for seed for ware potato production. Other serious diseases observed in the standing crop or during the Florida Test are considered too.

6. Improvements of Potato Agronomy

The improvements of potato agronomy have been focusing on seed size, presprouting, time of planting, manuring and fertilizing, and irrigation. According to yield assessments farmers reasonably following the NPDP recommended practices with NPDP's recommended varieties do get the following yields:

| | |
|---|---|
| Hills | 10 - 15 t/ha |
| Kathmandu valley: | 25 - 35 t/ha |
| Terai: | 25 - 30 t/ha |

7. Improvement of Potato Storage

Potato storage research has come up with storage improvement possibilities. However, they have not yet been introduced at farmers level, thus no experiences exist so far.

8. Research on Technology Transfer

Potato production packages have been assessed in farmers fields. The results showed that packages can be quite simple to obtain adequate output. The yields thus obtained are at the lower end of the yield brackets. These activities in farmers fields have an impact beyond the participating farmers and are used for training and demonstration purpose.

## V. Future Programs and Activities

Over the past five years, a lot of experiences have been gained on how potato production and profitability can be improved. Particularly important are the experiences regarding the implementation of such practices at farmers level and the farmers acceptance attitude.

Under NPDP, the following activities will continue:

- varietal evaluation
- basic seed production
- seed production with contract farmers
- seed potato marketing
- seed potato certification
- improvement of potato agronomy
- improvement of potato storage
- research on technology transfer

However, special emphasis will be on the following activities in the future:

- the seed producers assuming more responsibility for seed production and marketing

- introducing in collaboration with the extension service productive and profitable potato production techniques at farmers' level

- introducing in collaboration with the extension service seed production techniques at farmers level so as to produce their own seed requirement

- promoting in collaboration with the extension service the utilization of loss reducing and quality improving potato storage techniques at farmers level.

# GRASS AND FODDER SEED PRODUCTION ACTIVITIES

L.P. Sharma

## I. Objectives

(a) To produce seeds in the country and minimize importation of seeds including weed seeds.

(b) To be self sufficient and export excess seeds.

(c) Develop seed production technology including processing, packaging and storage.

(d) Ensure seed and planting material which is true to type.

## II. Area of Operation

Seeds produced in a given climatic environment do not necessarily perform better in another environment. From this point of view three areas should be identified for seed production:

(a) Terai - upto 300 meters elevation

(b) Mid-Hills - upto 4000 meters elevation

(c) High Hills - upto 8000 meters elevation

Biratnagar, Bhairahawa and Janakpur in terai, Kaski, Tanahu and Gorkha in mid hills, Rasuwa, Dolpa and Dolakha in high hills have been identified for different types of pasture and fodder herbage seeds production.

## III. Salient Feature of the Operation

Herbage seeds are mainly produced in government run livestock farms and very small amount is produced in private sector. It has not been very easy to produce seeds in farmers field.

## IV. Working Procedures

### 1. Arrangement of Foundation Seed

India, U.K., U.S.A., New-Zealand and Australia are the principal suppliers. Very little seed is obtained from these countries. Oats, Berseem, Desmodium, Stylo, White Clover, Siratro seeds are as samples only.

2. Contracting the Seed Growers for Seed Multiplication Program

Kaski, Tanahu, Bhairahawa, Biratnagar and Rasuwa farmers have been helpful to multiply and supply seeds for distribution to the other farmers. Oats, Berseem, Teosinte and White Clover are the principal seeds liked by the farmers to solve all of their stock feeding problem for the winter and very little seed is wanted for summer feeding.

3. Berseem (Trifolium alexandrium) Seed Production

This is an important leguminous tropical, winter fodder crop, provides protein rich nutrients throughout winter from November to May. 5-7 cuttings can be taken for green feeding, for seed production of berseem two cuttings can be taken and after February the crop can be left for seed production which can be harvested in April seed yield 2-3 quintal per hectare. Sufficient irrigation is required. 20 kg nitrogen, 60 kg phosphorous per hectare should be applied.

November is the right time of sowing berseem after the harvest of paddy. In February the crop can be sprayed with Planofix for extra seed yield.

4. Oats (Avena Sativa) Seed Production

Farmers are interested to grow oats next to Berseem in terai whereas hilly farmers grow only oats. Oats can be grown with very little irrigation or available mixture can be exploited.

Oats seed is best taken after first cutting. If the crop is poor looking even the first cutting is not desirable. Farmers have taken up this business because cultivation practices of oats are similar to wheat.

5. Harvesting

June is the right time of harvesting of berseem and oats. It is not very easy to protect the crop from rain. Rainy season starts at that time. Special attention is required while harvesting both berseem and oats.

So far as method of harvesting is concerned hand picking in case of pod-forming fodder is the best and where possible sickle should be used. Machines may not work efficiently in developing countries.

For cleaning and processing the seeds, our traditional method of winnowing by tossing seeds from a bamboo nanglo into the wind and catching the heavy seeds and passing the seeds through simple bamboo sieves and picking undesirable material is most practical.

Storing of seeds at right temperature and moisture is very difficult in our uncontrolled condition. Drying seed to maintain up to 12-15 percent moisture is desirable for immediate use. But for longer storing of more than a year needs much lower moisture up to 4 percent. Storing of seeds in a container having lid in a damp-proof store is ideal. But the seed container should be kept on wooden plank one foot above the ground.

## V. Future Action

His Majesty's Government used to supply fodder seeds for demonstration. The farmers have shown interest to have winter fodder seeds such as Oats (Avena sativa), Berseem (Trifolium alexandrium), White Clover (Trifolium repens) and Rye-grass (Lolium perenne) in large quantities, whereas summer fodder seeds like Napier (Pennisetum purpuream), Teosinte (Euchlaena maxicana), Stylo (Stylosanthes spp), Siratro (Maroptilium atropurpureum) are not demanded in large quantities.

About 25 m.t. winter and 5 m.t. summer fodder seeds are required to be distributed free for demonstration. Every year this quantity is going to be increased by 25 percent.

There is no program as such for seed production. We find great difficulty to obtain even certified seeds from India. Our farmers were contacted for the fodder seed multiplication but due to the poor response from them the government is just managing to produce seeds in livestock farms. There is an urgent need to produce fodder seeds in private sector.

Department of Livestock Development and Animal Health feels that the department and the Agriculture Inputs Corporation should have a common program and solve the shortage of fodder seeds in the country. This is a high time to take-up this program. Otherwise Nepal will have to face the shortage of milk and meat for years. How long should we depend on New-Zealand or China for milk and mutton?

## VI. Suggestions

1. To have continuous supply of seeds relationship should be established with reputed seed companies.

2. Training on seed production technology is necessary.

3. Plant breeding and seed production work similar to our country is undertaken at tropical to sub-tropical latitudes in the Philippines, Burma and Thailand. These places are suitable to train our people.

# FUTURE RESEARCH STRATEGIES ON QUALITY SOYBEAN SEED PRODUCTION IN NEPAL

Bishnu K. Gyawali
Assistant Industrial
Entomologist
Entomology Division
Khumaltar

Quality soybean seeds are difficult to produce. The constraints are pathological, physiological and mechanical. The interaction between the vulnerable stage of the plant and the favorable environments provides better opportunity to the pests to establish on the plant. Among the pathogens, fungi, bacteria and viruses are well recognized to reduce the quality of seeds produced. Preharvest and post harvest damage due to soybean insects effects the physiology of the grains which results in lowering the germination and viability of the seeds produced. Indirect effect is carried by the transmission of the pathogens on the seed through the insects feeding on the established plant. Economic thresholds needs to be determined for both insects and diseases. Mechanical damage to the seeds results during harvesting and the researchers should give due attention to this aspect.

## Past, Present and Future Activities of GLIP

The Grain Legume Improvement Program (GLIP) was initiated during 1975-76. Legume crops include: soybeans, mungbeans, pigeonpeas, cowpeas, blackgrams, chickpeas and lentils. It has not yet entered into seed production program. It is still maintaining the prerequisite for selection of different cultivars, though the demand for the quality seeds has increased. At present, most of the growers are enjoying the benefit of long open border of India for procurement of seeds. In future the GLIP needs recognition as a national program to meet the growing demand of the quality seeds through out the country. The program in future needs to establish a collaborative research effort with different departments such as agronomy and weed science, plant breeding and genetics, physiology and morphology, statistics, soil chemistry and micro-biology, pathology, entomology and agricultural economics.

## Pathological Problems on Soybean Seed Production

According to Sinclair (1982) all soybean seeds are capable of carrying many kinds of micro-organisms, including various fungi, bacteria and viruses many of which cause diseases in soybean plants. Some of the important effects of these micro-organisms are reduction in storage life, germination, emergence vigor and eventually, yield. Pathogens frequently play a major role in seed deterioration prior to harvesting or "weathering" (Kueneman, 1982). Weathering is usually a problem under warm moist condition and characteristics of "weathering" seeds often are identitical with symptoms caused by seed-borne micro-organisms (Sinclair, 1982). Soybean production is difficult to expand in the terai if the farmer is unable to get good plant stand. Opportunities still exists in developing cultivars less sensitive to the adverse conditions

that the grower has to encounter frequently during maturation and storage in the terai. The slow imbibition characteristic provides protection from the disruption of seed tissues that results from alternate wetting and drying of seeds matured under rainy conditions. Resistance character has been identified to different pathogens involved in field weathering of seed and resistance to deterioration of seeds during storage also seems to be identified (Kueneman, 1982). It is now time for the Grain Legume Improvement Program to explore these sources of resistance and provide cultivars to meet the needs of farmers in the terai.

## Entomological Problems on Soybean Seed Production

Todd (1982) has indicated that feeding by stink bugs during the early stage of seed formation can result in shrivelled, deformed, and undersized seeds. Feeding during later stages of endosperm development results in a sunken deformed area beneath the puncture marks where the stinkbugs have pierced the seed coat. The flesh of the damaged cotyledons is characterized by whitish chalky areas where the cell contents have been removed. Soybean seeds damaged by stink bugs have slightly higher protein content than non damaged beans. Qualitative changes in soybean oil also are observed as the severity of stink bug damage increases; linoleic, palmitic, stearic, and oleic acids increase while linolenic decreases. Germinability, emergence and seedling vigor are also reduced by seed damage resulting from heavy infestation of stink bugs during seed maturation. Jensen and Newsom (1972) showed that with regard to viability, location of stink bug puncture is probably more important than the number of punctures. These author stated that one puncture in the radicle-hypocotyl axis of the seed could prevent germination, whereas several punctures in the cotyledons may effect vigor of the plant but not prevent germination. Singh and Kogan (1982) indicated that healthy soybean seeds stand against attack by most potential pests of grains in storage. Problems arise when the integrity of the seed is violated either before or after harvest. Seed that has been injured in the field by insect pests or diseases is more vulnerable to additional damage in storage. Seed that has been mishandled at harvest, in transit to storage bins or in storage is also more likely to become more susceptible to insect pests in storage. Finally, moisture content is likely to be the ultimate limiting factor.

## Problems Associated with Management Aspect of Soybean Seed Production

Dharmasena (1982) found harvesting three weeks prior to normal physiological maturity did not cause any appreciable loss in seed viability. Early harvesting may be advantageous for the grower to cope with the turn over period desired in cropping system. Although early harvesting may give rise to a larger portion of smaller seeds, such seeds can still show good germination and may be used for planting. It was observed that early planting with consequently a larger growing period tends to give rise to a relatively high portion of larger seeds. Larger seeds are produced in the lower part of the plant canopy, and the seeds and pods get progressively smaller up in the plant canofy. Andrews (1982) stressed the necessity of handling the delicate soybean with care in view of its sensitive physiological and structural make up.

Soybeans have been produced in the northern regions of the temperate climatic zones of the world, where environmental stress were relatively minimal. As the world demand for vegetable oil and protein continued to increase, soybean production spread rapidly into the warm, humid production areas, and more recently into the tropical regions (Moore, 1966 and Moore et.at., 1950). Delouche (1974) documented poor seed quality in soybean seed and strongly contends that adverse whether conditions during the post maturation, pre-harvest period cause moderate to severe seed quality problems. Soybean seeds are very susceptible to extremes of wetting and drying, such cycles during the later stages of seed maturation are quite determental to seed quality and cause rapid deterioration. Alternate rehydration and dehydration in the field maturity caused necrotic areas in the radicle and the cotyledons and hairline fractures across the hypocotyl. Timely harvest of mature soybean seeds is extremely important in protecting and maintaining high seed quality.

Soybean seeds are very susceptible to mechanical injury (Tedia, 1982). The seed coat of yellow cultivars is relatively thin, and the radicle lies in an extremely vulnerable position.

The differences in germination were ascribed primarily to differences in seed coat damage. Harvest damage was least when moisture content of the seed was 13.5 percent. Work needs to be done on black seeded cultivar of soybean grown in Nepal need be harvested at a relatively high moisture percentage, that is 50 percent leaf fall stage. If these cultivar were allowed to stand in the field until the moisture decreases to 13 to 14 percent, the shattering losses would be more than 50 percent.

## Future Strategies on Crop Protection

The problem of insect pests represents a serious constraint to soybean quality seed production. They include, bean flies, stink bugs, leaf hoppers, hairy caterpillars, pod borers, and storage insects. Several experiments were conducted in 1982 and will continue in 1983 to evaluate the status of the hairy caterpillar as a pest which defoliates the soybean plant. The future research strategies of grain legume on crop protection should concentrate on beanfly, stink bug, leafhopper, hairy caterpillar, pod borer and storage insects.

### Beanfly

1. Research on behavioral studies in "wet" seasons.

2. Studies on possible biological control.

3. Information on the effect of cropping systems on beanfly development.

4. Reliable sampling methods.

5. Identification of resistant cultivars.

A team of entomologists, pathologists, agronomists and breeders should be formed to organize a network to identify and screen soybean lines for increased reisistance.

Stink Bugs

1. Studies on the possible interactions of fungi, bacteria and viruses and other insects with them.

2. A search of cultivars resistant to stink bugs.

The role of micro-organisms in stink bug damage should be clear.

Leaf Hoppers

1. The possible effects of leaf hopper activity on seed quality needs to be worked out.

2. Predictions of insect population levels and influencing factors like weather and crop management should receive due attention.

Soybean Hairy Caterpillars

1. Identifying the critical stages of soybean plants and the larvas.

2. Determination of economic threshold level for the hairy caterpillars is needed.

Pod Borers

1. With pod borers, the host plant preference and characterization of environments favorable to damage development should be studied.

2. Strengthening biological and chemical controls and their possible integration is required.

3. Works remains to be done on the identification and use of soybean lines resistant to pod borers.

4. Economic thresholds for implementing chemical or other controls should be determined.

Storage Insects

1. Screening of soybean lines for resistance, as well as insufficient identification of biological principles affecting resistance to such insects as saponia.

2. Needs to study on how grain susceptibility is influenced by storage time, condition of storage, and condition of stored seed.

3. Studies on control of storage insects with substances that are relatively cheap and available, such as talcum powders, bentonite clays, wood ashes and vegetable oils.

4. Economic threshold levels and seed thresholds are lacking for various pathogenic fungi, bacteria and viruses.

5. There is insufficient surveillance and monitoring of the area distribution and severity of soybean diseases throughout Nepal.

6. Studies of seed transmission and epidemiology be emphasized, aimed at the development of an economic threshold for seed infections.

7. Techniques should be developed to detect diseases plants and seeds without destructive samplings. Such techniques should help eliminating infected plants and seeds by roguing or seed separation.

Literature Cited

ANDREWS, C. HUNTER 1982. Preharvest Environment. Proc. Fonf. for Scientists of Asia. University of Illinois, Urbana (INTSOY Ser. 22).

DELOUCHE, J.C. 1974. Seed Quality and Storage of Soybeans. Proc. Conf. for Scientists of Africa, the Middle East and South Asia. University of Illinois, Urbana (INTSOY Ser. 6).

DHARMASENA, C.D. 1982. Soybean seed maturation at different levels in the plant canopy and viability of seed harvested at different stages. Proc. Conf. for Scientists of Asia. University of Illinois, Urbana (INTSOY Ser. 22).

JENSEN, R.L., and L.D. NEWSOM 1972. Effect of stink bug damaged soybean seeds on germination, emergence and yield. J. Econ. Entomol. 65:261-264.

KUENEMAN, E.A. 1982. Genetic difference in soybean seed quality: Screening methods for cultivar improvement. Proc. Conf. for Scientists of Asia. University of Illinois, Urbana (INTSOY Ser. 22).

MOORE, R.P. 1966. Weather fractured hypocotyls in great northern bean seed. Seed tech. Newsletter. 35 (3): 7-8.

MOORE, W.J., J.L. CARTER and E.E. HARIWIG 1950. Soybean production for hay and beans. USDA Farmer's bull. 2023: 15-16.

SINCLAIR, J.B. 1982. Seed-borne micro-organisms and viruses and seed quality. Proc. Conf. for Scientists of Asia. University of Illinois, Urbana (INTSOY Ser. 22).

SINGH, SANTHORN SIRI and MARCOS KOGAN 1982. Insects affecting soybeans in storage. Proc. Conf. for Scientists of Asia. University of Illinois, Urbana (INTSOY Ser. 22).

TEDIA, M.D. 1982. Harvest procedure and damage effect on seed quality. Proc. Conf. for Scientists of Asia. University of Illinois, Urbana (INTSOY Ser. 22).

TODD, JAMES W. 1982. Effect of stink bug damage on soybean quality. Proc. Conf. for Scientists of Asia. University of Illinois, Urbana (INTSOY Ser. 22).

# SEED CONDITIONING

Bill Gregg
Seed Division
Dept. of Agricultural
Extension
Bangkok, Thailand

As harvested, seed is usually not suitable for sale and planting. Many contaminants must be removed; inert materials and off-size seed influence seed quality, flowability and plantability, and contribute to storage problems. Weed seeds and seeds of other crops and cultivars reduce yields and quality and must be removed. High-moisture seed must be dried to safe moisture contents; seed often requires treatments to control insects and diseases attacking both seeds and seedlings; seeds must be packaged so they can be efficiently handled and delivered to the using farmers.

Seed conditioning --- or seed processing - is the seed industry component responsible for these operations.

Seed conditioning includes several definite steps that must be completed in a specific sequence. First is RECEIVING, when seed arrives at the processing plant. Seed then goes into PRE-CLEANING STORAGE to be held for later processing, or may go directly into processing for cleaning. DRYING may be necessary to remove excess moisture.

Next is CONDITIONING AND PRE-CLEANING. This includes removal of appendages, large pieces of trash, debearding to remove awns, hulling the seed, or shelling corn.

The first cleaning step is BASIC CLEANING. The air-screen machine, the most common basic cleaner, makes sizes separations and aspirates the seed. Seed lots from clean fields may be in good condition with few contaminants and require cleaning only on the air-screen machine. Most often, however, one or more special SEPARATING OR UPGRADING machines must be used to remove a specific contaminant. These machines separate crop and weed seeds by differences in specific physical characteristics.

When all possible undesirable material has been removed, seeds are ready for BAGGING. Sometimes a fungicide or insecticide TREATMENT is applied before bagging. The seed may then be SHIPPED directly, or held in STORAGE until they are needed.

Seeds are separated by differences in physical properties. If enough difference exists and a machine is available which can separate the seed at an efficient capacity, they can be separated. Separators are available which can separate seed differing in SIZE, LENGTH, SHAPE, WEIGHT, SURFACE, TESTURE, COLOR, AFFINITY FOR LIQUIDS, or CONDUCTIVITY.

A single machine cannot separate seeds that differ in all physical characteristics. A different machine must be used to separate seeds by

each characteristic. Complete seed cleaning usually requires using several machines in a specific sequence, each removing a certain portion of the contaminating material. Commonly used machines and their separating principles are:

| Physical Characteristic | Separator or Cleaner to Use |
|---|---|
| Size | Air-screen Cleaner (Width-thickness graders: Rockit, Precision) |
| Weight (Specific Gravity) | Gravity Separator |
| | Air-blast of Air-Screen Cleaner |
| | Aspirator |
| | Fractionating Aspirator |
| | Pneumatic Separator |
| | Stoner |
| Length | Disc Separator |
| | Cylinder Separator |
| Shape | Spiral Separator |
| | Draper Belt |
| Surface Texture | Roll Mill (Magnetic Separator) (Buckhorn Separator) |
| Color | Color Sorter |
| Affinity for Liquids | Magnetic Separator |
| | Buckhorn Separator |
| Conductivity | Electrostatic Separator |

SIZE is a common physical difference between seeds. The air-screen machine -- the basic seed cleaner -- uses a series of screens to separate seeds by differences in size. It also uses one or more air blast separations to remove light material.

Two types of screen sizings are made: (1) scalping: good seeds drop through larger screen openings, while larger particles pass over the screen

perforations and go to a separate spout; and (2) grading: crop seeds pass over smaller screen openings while small particles drop through the screen openings. A series of scalping and grading screens can remove all material larger or smaller than the crop seed.

WIDTH and THICKNESS dimensions are used to grade hybrid seed corn and to separate seed. Width and thickness separations are made by turning a seed on edge, or standing it on end, to present its width or thickness dimension to a screen perforation. Seeds below a certain width or thickness drop through the perforation; larger seeds will not fall through, and go out a different discharge spent.

LENGTH differences are used to separate crop seed from undesirable materials in the indented cylinder and the disc separator. The indented cylinder is a revolving cylinder with many small indents in it. All seeds fed into the revolving cylinder have an opportunity to fit into one of the indents and be lifted. Long seeds will not fit into the indents, and are not lifted. Shorter seeds are lifted, dropped into the liftings through, and carried out a separate spout.

The disc separator is a series of revolving cast iron discs with many small under cut pockets in their sides. As the disc turn through a mass of seed, each seed has a chance to sit in a pocket. Long seeds fall out; short seeds sit inside the pocket and are lifted up and dropped into a separate discharge spout.

A series of discs of different pocket sizes permits one machine to produce several fractions of different particles lengths, and remove material both longer and shorter than the good seed.

SHAPE varies widely among seeds. The size separation made by the air-screen cleaner uses some differences in shape, especially when triangular-hole screens are used; cylinder and disc separators also use shape to the extent that it is a function of length. The spiral separator specifically separates round-shaped from flat-shaped seed. This separator is a vertical series of spiraled flights. A mixture of flat and round seed is fed onto the top of the inner spiral, and slides down the spirals. Round seed roll faster and faster, and their velocity increases until they move, by centrifugal force, outward and drop over the edge of the inner spiral, into an outer spiral which carries them to a separate discharge spout. Flatter seed cannot roll fast enough to go into the outer spiral; they slide down the inner spirals to their discharge spout. Flat and round seed are thus separated by differences in ability to roll, as a result of shape.

SURFACE TEXTURE -- relative roughness or smoothness or the seed coat -- is used by the roll (dodder) mill and the draper belt to separate seed.

The basic unit of the roll mill consists of two long cylinder like rollers, covered with velvet or flannel, mounted side-by-side so that they touch down their entire length. They are mounted at a slight angle from end-to-end, with the feed end higher, A mixture of smooth and rough seed is fed onto the

high end between the rollers. As the rollers revolve up and out, rough seeds are pitched up against a curved shield mounted above the rollers. They strike the curved shield at an angle, bounce back and hit the roller at a higher point. The rollers continue to catch rough seeds and throw them against the shield. Smooth seeds are not affected, so they slide down to the lower end and drop into a discharge spout.

The draper belt is an adjustable inclined flat belt that moves uphill. When a mixture of rough and smooth seed is fed onto the center of the belt, smooth seed slide or roll downhill and fall off the low end. Rough or irregularly-shaped seed come to rest on the moving belt, are carried upward, and fall of the upper end of the belt.

Many seeds differ in COLOR and can be separated by the electronic color sorter. This machine passes each seed before an electronic sensing device which compares the seed with a set color. If the seed's color is not acceptable, a compressed-air nozzle blows the seed into a separate discharge spout.

AFFINITY FOR LIQUIDS, or the ability of the seed's surface to absorb liquids, is used by the magnetic separator and the buckhorn machine to separate seed. The magnetic separator adds a small amount of water or other liquid to the seed mixture in a mixing chamber. Some seeds absorb the liquid and become moist, while others do not.

Finely-ground iron powder is then fed into the mixing chamber and blended so that each seed has a chance to contact the iron powder. If the seed held moisture, its surface will hold iron powder. The seed then pass through a magnetic field, where seed which absorbed moisture and held iron powder are attracted by the magnet and go to a separate discharge spout.

Many seeds differ in WEIGHT or SPECIFIC GRAVITY. The gravity separator, stoner, aspirator, pneumatic separator, and the air blast of the air-screen cleaner all separate by weight differences.

Weight separations are made in a moving stream or air. Seed of different specific gravities are fed into the air stream, and the air is adjusted so that light seeds are lifted up while heavier seed settle down.

The gravity separator separates seed on a perforated deck with air moving up through it. The air is adjusted to lift light seed while heavier seed lie on the deck surface. This stratifies seed by weight into vertical layers which are then separated by the slope and vibrating motion of the deck. Light seed held up by the air move downhill and discharge from the low side of the deck. Heavy seed lie on the deck; the reciprocating motion them uphill toward the high side of the deck to a separate discharge spout.

The gravity separator makes a graduated separation from the lightest seed at the low side of the deck to the heaviest seed at the high side. The stoner, however, makes only a two-part gravity separation -- a heavy and a light

fraction. The seed mixture is fed onto the center of the deck. Air stratifies the mixture so that light seed flow to the downhill end. Deck motion moves heavy seed to the high end. The stoner separates rocks from beans, sand from clover, and salvages good seed from heavy waste products from the gravity separator.

Both the gravity separator and the stoner operate by passing air through a mass of seed. The aspirator and pneumatic separator make a similar separation, seed-by-seed, by lifting light seed up through an air column into separate discharge spouts. Heavier seed fall though the air blast into a discharge spout.

The aspirator pulls a negative-pressure air stream through a separating column. The pneumatic separator forces a positive-pressure air blast through a separating column.

Seed hold or CONDUCT AN ELECTRICAL CHARGE differently. Many conditions affect a seed's electrical properties, but a consistent difference in conductivity can be used to separate seed on the electrostatic separator. This separator consists of a conveyor belt on which a single layer of seed passes beneath an electrode. Either of two types of electrostatic separation is made: (1) In the "pinning" separation, the electrodes sprays a high-intensity electrical charge onto the seed. Poor conducting seed absorb and hold the charge, stick to the grounded conveyor belt and are carried to the discharge spout. (2) The "lifting" separation is made by passing seed through an electrical field where charges on the seed are rearranged by reaction to the electrical field. Some seeds are attracted to the electrode and are lifted into a different flight path as they fall from the belt. Other seed, which react less to the electrical field, follow a normal flight path to a separate spout.

These separators are the tools by which high seed quality is achieved during conditioning. A modern seed conditioning plant should have and use all separators needed to keep seed quality high. To separate seed efficiently and effectively, the proper separators must be used, and they must be set up properly, adjusted correctly, and used in the proper sequence.

Determining Processing Requirements

The seed processor cannot blindly put seed into the machines and expect to make a good separation. Such attempts waste time, use unnecessary machines, increase operating costs, waste seed, and seldom result in the best separation.

The processor or the quality control specialist should analyze the processing requirements of each seed lot before it is processed. To do this, a representative sample is examined as in a laboratory purity analysis. A precise purity analysis in not necessary; simply divide the sample into:

(a) Good seed which appear to be mature, full-size, healthy, and undamaged.

(b) Different types of undesirable particles and seed which should be removed.

Specimens of the good seed and all undesirable particles are then laid out in a row and compared. Any physical characteristic in which they differ sufficiently is noted, and the available machine which separates seed by that characteristic is selected for use. If undesirable particles differ from the good seed in several physical characteristics, several separators may be necessary, used in a specific sequence.

Most machines needed to separate the undesirable particles, and the sequence in which they should be used, an be determined from a thorough knowledge of:

1. Physical differences between good crop seed and the undesirable materials which must be removed.

2. Principles of separation of each machine, its operational performance, and the sequence in which it must be used.

3. Adjustment and operation of each machine, and the components -- screens, etc. -- which must be used for a particular separation.

4. The machine's capacity, installation requirements, and loss of good seed.

When the required machine is identified approximate adjustments and components -- screens, cylinders, deck, etc. -- can be determined.

Close examination and comparison of the seed, combined with experience and study, will indicate most separations and machines required. However, some test methods are available, including:

1. Screen selection for size separation in the air-screen cleaner: Hand test screens available with all screen perforations, and should be used to select approximately correct screen sizes. Every processing plant should have a complete set of hand screens.

2. Length separations: Close visual examination of seed will usually indicate whether or not it is possible to separate seed by differences in length. Lab models of the disc separator and the cylinder separator are available, although expensive.

3. Surface texture separations: Visual examination can identify differences in seed coat texture which can be used to separate the seed. A test model of the roll mill is also available.

4. Weight or specific gravity separations: A small table model of the gravity separator is available, as are models of the fractionating aspirator and some other weight separators. A simple method of determining if seed weight differences can be used to separate seed is the waterglass or liquid sodium silicate method.

5. Width-thickness separations: A test model of the precision grader is available, with a complete range of perforation sizes in cylinders. Seed can also be measured with a micrometer, or checked with hand screens.

6. Shape separations: Visual examination of differences in seed shape can usually determine the effectiveness of separation possible. A model of the spiral separator is available.

7. Color separations: Visual comparison of seed color differences can determine if a separation is possible. The regular color sorter can be used to pre-determine separation efficiency, machine settings, and adjustments.

8. Affinity for liquids separations: Test models of the magnetic separator are available. Simple tests can also be made, without special equipment, of differences in the ability of seed to absorb liquids and then hold iron powder.

9. Conductivity: Small electrostatic separators suitable for test use are available.

Example of Determining Processing Requirements for a Lot of Rice Seed:

1. When the sample is analyzed and the undesirable particles compared with the good seed, the following are identified:

   Larger particles to be removed:

   - Pieces of stems and leaves.

   Smaller particles to be removed:

   - Pieces of dried mud.
   - Pieces of stems, leaves, and hulls.
   - Weed seed.

   - Broken rice seed.

   Light-weight similar-sized particles to be removed:

   - Empty glums.
   - Light seed.
   - Pieces of trash.

2. All undesirable particles to be removed are thus larger, smaller, or lighter than the good seed. A size separation by screens in the air-screen cleaner, plus its air blast separations to remove light materials, should be adequate.

3. Using hand screens, the approximately best screen sizes to make the separation are determined.

4. Examining the "clean seed" fraction from the hand screen test, many cross-broken rice seeds are noted; this lot was apparently poorly threshed. It is decided that too many broken seed are still present for the seed to meet standards, and further separation is required.

5. Noting that the cross-broken rice seeds are shorter than unbroken seed, the cylinder separator is selected to make a length separation.

6. After cleaning, the seed will be treated and bagged. Therefore, the processing requirements of this lot, and sequence of machines, is:

   - Air-screen cleaner
   - Cylinder separator
   - Treater
   - Bagger-weigher

To process the lot, the screens selected by using hand screens are put in the air-screen cleaner, and the elevators and conveyor set up so that seed flow to the above machines in the proper sequence. The seed lot is fed into the air-screen cleaner bin, the machines prepared for use, and turned on.

The air-screen cleaner is adjusted as follows:

1. Upper and lower air blasts are adjusted to remove all light material -- light trash, dust, empty glumes, light immature seed, etc.

2. Screen pitch or slope is adjusted for the best seed flow for scalping and grading screens.

3. Screen shake speed is adjusted for the best separation, movement of particles through the screen openings.

The clean seed and all waste fractions discharging from the cleaner are examined to see if too much good seed is being lost, or if too many undesirable particles are left in the good seed. It is often necessary to change one or more screens to get a better separation due to differences in separation caused by the shaking motion of the cleaner's screens.

Good seed from the air-screen cleaner are fed to the cylinder separator. Since this machine is already set up with a cylinder whose indent size is suitable for rice, it is now only necessary to adjust cylinder speed and the liftings through to get the desired separation.

Quality Control in Seed Conditioning

In better-organized seed programs, specialized operators run the processing machines, while well-trained persons operate the program's quality control component. Since their training is more specialized and in-depth the quality control specialists are better-qualified to:

1. Examine the seed sample critically;

2. Identify undesirable particles;

3. Determine how much of the undesirable particles should be removed to bring the seed up to standards;

4. Estimate processing requirements;

5. Recommend machines, approximate settings, and separating sequence which should be used at the start, to save time and get the most effective separation.

The quality control specialists take samples, analyze them, and recommended initial processing requirements. They then monitor processing by regularly taking samples -- of clean seed and all waste fractions from each machine -- to see if the seed lot or processing conditions have changed and require changes in machine adjustments. One modern seed program requires its quality control specialists to sample clean seed and waste products from each machine once every hour during processing. If they find too much good seed being lost, or too much undesirable material in the good seed, the machines are changed.

Elevators and Conveyors

Seed conditioning is a series of operations performed by different machines to remove all possible undesirable materials, so that the final product is pure crop seed of high germination, in condition for easy planting, and in packages suitable for distribution and marketing.

During conditioning, seed must flow efficiently between the different machines. Seed cannot be carried by hard through these steps; mechanical seed movement is necessary to ensure maximum capacity, lowest cost, and shortest time. Elevators are used to move seed vertically; conveyors are used to carry seed horizontally or at an angle. Many different designs, models, and kinds of elevators and conveyors are used for many operations in seed conditioning plants.

The belt-bucket elevator lifts seed by carrying it in small buckets attached to an endless belt which moves vertically. The buckets are filled with seed at the bottom; at the top, seeds are dumped out into a spout to the desired machine or bin. Other elevators use various types of chain or links instead of a flat belt. Still other elevators convey seed in an air stream which flows through sealed pipes.

Various kinds of moving belts are used to convey seed horizontally or up inclines. Other conveyors move seed by vibrating the conveyor trough, by a drag-chain mechanism moving through the conveyor trough, etc.

Every seed conditioning plant uses several elevators and conveyors. Selection of the best kinds of elevators and conveyors for each need, crop seed, and capacity is an important part of the plant design process.

Bins

Proper use of bins in a seed conditioning plant maximizes bulk handling and flexibility in capacity, minimizes labor costs and operating delays, and reduces opportunities for contamination.

Holding bins mounted above machines automatically feed the machines at a uniform rate. Many cleaners normally used in sequence do not operate at exactly the same capacity; without holding bins, all must run at the capacity of the slowest. Some cleaners do not separate seed as effectively when operated below normal capacity. Holding bins absorb differences in capacity and permit each machine to operate at its most effective rate. Bins to receive reject material, and for "in-processing" storage of seed also greatly increase efficiency.

Every machine should be served by a bin large enough to permit efficient operation of bot that and the previous machine. The first bin in the processing line, and the elevator serving it, should be as large as possible, so workers can fill the bin rapidly with enough seed to supply the processing line for several hours. This releases workers for other duties. Also, the final bin, which receives processed seed and supplies the bagger-weigher, should be large enough to hold all seed cleaned during several hours. Since bagging output is usually high, seed processed during several hours can be bagged in a short period, thus freeing workers for other duties.

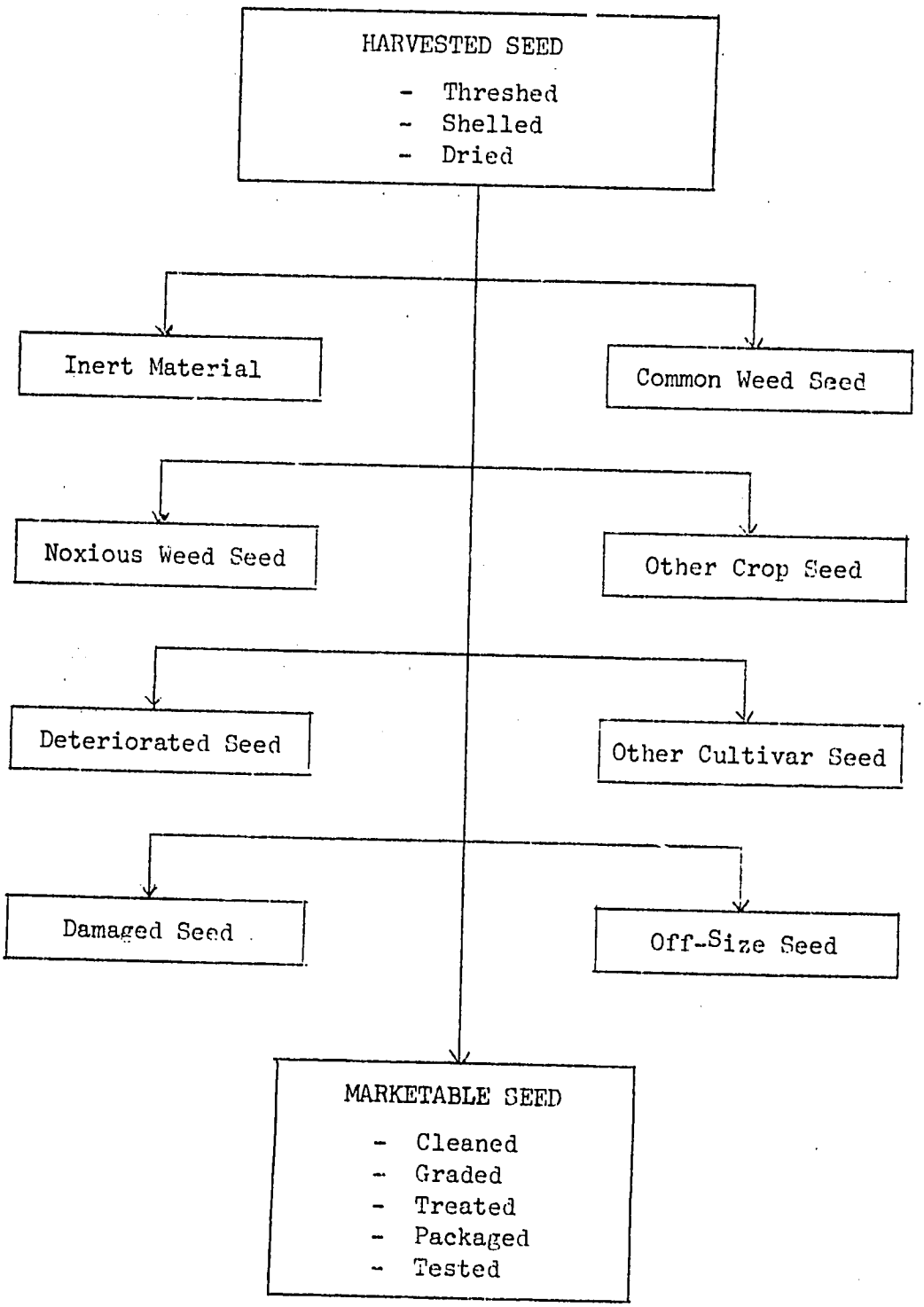


Figure 1: Types of materials removed from a seed lot during processing (from Mississippi State University handbook No. 1).

# A CRITICAL LOOK AT THE SEED DISTRIBUTION SYSTEM IN NEPAL

B.N. Kayastha, Chief
Seed Division, AIC

Seed distribution is the last major sequential step in seed production - supply program. The major objective of the seed distribution program is to make available the required quantity of seed of desirable varieties in reasonable price in time for planting and producing high yields. The use of improved varieties has increased to about 20 percent of the total cultivated area of the crop in case of maize and rice and more than 80 percent in case of wheat. In Nepal, more than 90 percent of the seed used for planting are either farmer's own seed or seed from neighbors. Only a small percent of improved seed required for planting is supplied by public organizations like the Agriculture Inputs Corporation (AIC). The nationwide improved seed distribution program of AIC is controlled by the central office. In general, the AIC central office prepares a distribution chart about two months before the planting season. Regional offices and branch offices supply seed to meet the demand of the hilly remote regions. The distribution time and amount for each region depends on the total amount of seed available for the distribution. The seed made available for distribution should meet the minimum standard set for each crop. AIC distributes annually 4000 to 6000 m.t. of seed. This amount of seed must be distributed throughout the country within a short period of time (Table 1).

Table 1

TIME WHEN SEEDS OF DIFFERENT CROPS HAVE TO BE MADE AVAILABLE

| Crops | Collection period | Distribution period | Planting period |
|---|---|---|---|
| Paddy (early) | Mansir (Dec.) | Mansir (Dec.) | Magh/Falgun (Feb.-March) |
| Paddy (late) | Paush (Jan.) | Chaitra (March-April) | Jestha/Ashadh (June-July) |
| Maize (Autumn) | Falgun (Feb.-March) | Ashadh (July) | Shrawan/Bhadra (Aug.-Sept.) |
| Maize (winter) | Baisakh/Jestha (May-June) | Shrawan/Bhadra (Aug.-Sept.) | Bhadra/Aswin (Sept.-Oct.) |
| Maize (spring) | Jestha/Ashadh (June-July) | Paush (Jan.) | Falgun/Chaitra (March-April) |

| Crops | Collection period | Distribution period | Planting period |
|---|---|---|---|
| Maize (summer) | Shrawan/Bhadra (Aug.-Sept.) | Magh/Falgun (Feb.-March) | Baisakh/Jestha (April-May) |
| Wheat | Baisakh/Jestha/ Ashadh (April-July) | Shrawan/Bhadra Aswin/Kartik (Aug.-Nov.) | Aswin-Kartik Mansir-Paush (Oct.-Dec.) |
| Vegetables (summer) | Kartik (Oct.-Nov.) | Paush (Jan.) | Falgun-Chaitra-Baisakh (Feb.-April) |
| Vegetables (winter) | Baisakh-Ashadh (May-July) | Shrawan (Aug.) | Bhadra-Aswin (Aug.-Oct.) |

The main responsibility of improved seed distribution rests with AIC. But in practice, the distribution is only upto the district headquarters. Thereafter the responsibility is shifted to Sajha Sansthan (Coops.) who are supposed to take seed from district headquarter to the farmers gate.

Sometimes these channels are unnecessarily long. District Cooperative Union's involvement is for nothing but one percent commission that it receives. Distribution from the procurement center to the district headquarter is the responsibility of AIC, under the Ministry of Agriculture where as the important phase of distribution is carried out by not too efficient cooperative unions; Sajha Sansthan, under the Ministry of Land Reform, and they are responsible for taking the improved seed to the farmers. There is a poor linkage in the channels especially because of the lack of communication and sales promotion.

AIC's seed distribution program is centralized and all the communication is through the central office. The office with the processing plant facilities act as the distribution points to the relay centers and to the outlying secondary relay centers from where the seed is distributed to the hills and remote areas (Table 2).

Figure 2

SEED DISTRIBUTION CHANNELS

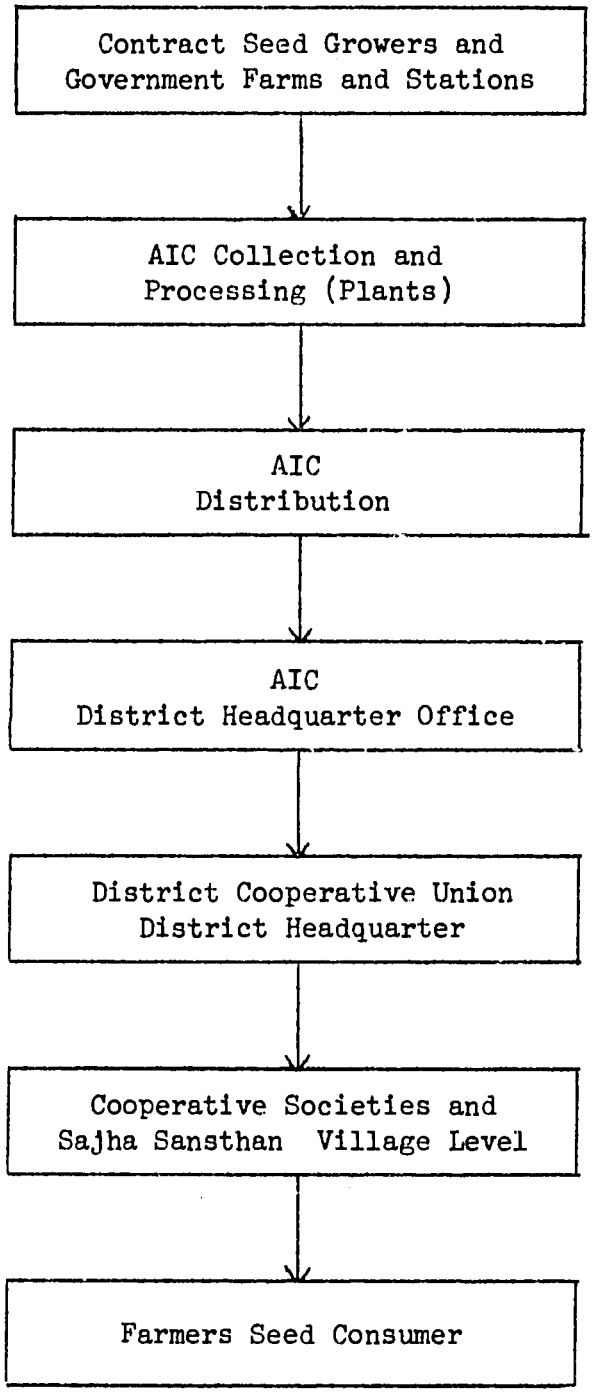

Table 2

AIC'S SEED DISTRIBUTION PROGRAM SHOWING RELAY CENTERS

| Distribution Center | Relay Center | District Headquarter | Days required to transport |
|---|---|---|---|
| Itahari | Bhadrapur | Ilam | 3 |
| | | Panchthar | |
| Itahari | Dhankuta | Sankhuwasabha | 21 |
| | | Tehrathum | 20 |
| | | Taplejung | 25 |
| | | Bhojpur | 25 |
| Itahari | Rajbiraj | Udaipur | |
| | | Khotang | 10 |
| Itahari | Lahan | Okhaldhunga | 8 |
| | | Solukhumbu | 15 |
| Janakpur | Sindhuli | Ramechhap | 7 |
| Hetauda | Kathmandu | Dolakha | 3 |
| Hetauda | Trishuli | Rasuwa | 7 |
| Hetauda | Damauli | Manang | 15 |
| | | Lamjung | 15 |
| Hetauda | Gajuri | Dhadingbesi | 3 |
| Bhairahawa | Taulihawa | Arghakhanchi | 7 |
| Bhairahawa | Palpa | Gulmi | 7 |
| Bhairahawa | Syangja | Parbat | 7 |
| | | Baglung | 15 |
| | | Myagdi | 15 |
| Bhairahawa | Pokhara | Mustang | 20 |
| Bhairahawa | Damauli | Lamjung | 15 |
| | | Manang | 15 |
| | | Gorkha | 3 |
| Ghorahi | Pyuthan | Rolpa | 12 |
| Tulsipur | Sallyan | Rukum | 8 |
| | | Jajarkot | 7 |

| Distribution Centers | Relay Center | District Headquarter | Days required to transport |
|---|---|---|---|
| Nepalgunj | Surkhet | Dailekh | 7 |
| | | Karnali zone | 25 |
| Dhangadi | Dandeldhura | Doti | NA |
| | | Achham | NA |
| | | Bajura | NA |
| | | Bajhang | NA |
| | | Baitadi | NA |

The amount of improved seed to be distributed for each districts is small (Table 3). It is even smaller for each Sajha Sansthan or Panchayat and hence less attention is paid. Seed supply is complicated by its viability in nature and need for safe handling. The distribution cost is also different depending on the season and availability of trucks and porter services. This is one of the factors affecting the timely distribution of seed. Taking seed to Arghakhanchi district can be presented here as an example. Taulihawa AIC office appointed a transport contractor Mr. Janardhan Subedi to take seed from Taulihawa to Sandhikharka, Arghakhanchi at the rate of Rs. 1420 per m.t. According to the contract the contractor was supposed to carry the seed straight to the destination in seven days. The transport contractor received the seed in time from AIC office but instead of taking it to the destination, stored the seed at a points upto which the truck could go (Patharkot). He then waited for a cheap porter service and by the time the seed arrived in the destination it was late. This had double disadvantage beside the seed reaching the farmers late. When the contractor stored the seed in a place in Patharkot where the storage condition was poor the quality of the seed could have deteriorated or spoiled.

Transportation of Seed

Transportation is a big bottleneck in the process of seed distribution in Nepal. Transportation services account for a significant percentage of the total distribution cost. Transportation of seed from the producing point to the consuming centers involves several handlings and different modes of transportation.

Transportation by road is the most important method. The length of roads is increasing (Table 4). Nepal also has two small sections of railways, which are not in use for seed transportation. Tractors are important in some areas where road access is poor.

Road transportation is mostly by trucks, the great majority of which are owned by private carriers. The Transport Corporation of Nepal (TCN) is the only public sector organization hiring out trucks. From the terai procurement

centers seeds are moved by trucks to relay centers such as Ilam, Dhankuta, Sindhuli, Kathmandu, Pokhara, Surkhet, Dandeldhura, etc. Truck load varies from 6 to 10 m.t. On the average truck load is 9 m.t. for the plains and 7 m.t. for the hills.

Table 4

LENGTH OF EXISTING ROADS IN NEPAL IN DIFFERENT PERIODS

| S.No. | Classification | Year | Total Kms |
|---|---|---|---|
| 1. | Democracy Year | 1950 | 376 |
| 2. | Before First Five Year Plan | 1956 | 624 |
| 3. | Before Second Three Year Plan | 1962 | 1193 |
| 4. | Before Third Five Year Plan | 1965 | 2049 |
| 5. | Before Fourth Five Year Plan | 1970 | 2504 |
| 6. | Before Fifth Five Year Plan | 1975 | 3173 |
| 7. | Before Sixth Five Year Plan | 1980 | 4940 |
| 8. | After the second year of the Sixth Five Year Plan | 1982 | NA |

Source: Department of Roads, Situation of Roads in Nepal (Nepali Text), Kathmandu, 1978.

Transportation charges paid by AIC in different routes for different roads are shown in Table 5. Truck usage and rates can vary considerably during the year and according to the distance. Trucks are used in the terai belt and in certain parts of the hills in the Eastern, Central and Western Development Regions. Most seeds are moved by private sector truck transporters.

Insufficient road infrastructure means that other more expensive forms of transport have to be used. Secondary transport is generally done by porters, animals and airways. Seeds are moved in Nepal on foot by porters, pack animals and bullock carts. Foot and cart transport are the most important methods of getting seed to the farmers. Few hill districts are totally dependent on foot transport for seed distribution. Foot transport is still of major importance for many other districts when it comes to getting seed to the farmers.

A large percentage of porters and pack animals are used particularly during the winter season when the hill people in the north go south to the terai or India to trade their surplus agricultural and cottage industry products or to work. Data on the length of the tracks used by them is variable and varies in length from few Km to hundreds of Km. Porters are cheap during the winter season and expensive during the rainy season and immediately after it when wheat seeds have to be transported.

Perennial rivers and their tributaries have to be crossed by porters many times along the trails. Suspension bridges which number more than a hundred according to the record of the Department of Roads have to be crossed. Besides these, many suspension bridges have been locally built. In many trails a porter either crosses the river or walks over stones or a timber log, both of which are slipping when wet. Most of the foot trails in Nepal are along the river banks so either the rivers have to be crossed so many times or their tributaries. For example a trail route from Syangja to Parbat, Baglung, Kyagdi and Mustang districts is along the stream called Andhikhola which has to be crossed more than thirty times. Similarly a trail route from Gorkha to Arughat is along the Budhi river from Khanchok to Arughat. The porters are found crossing Budhi Gandaki and its tributaries many times. This is quite common on many foot trails of Nepal.

Cost Relationship Between Different Modes of Transportation

It is difficult to compare the cost relationship between the various modes of transportation because the modes and rates of transportation vary according to the topography of a particular area and the season of the year. Porters and mules serve the mountain and hills. Aircrafts are usually used to fly seeds into a remote air-strip from where it is distributed to different points by porters. Because of the much longer time taken by porters to deliver seeds, aircrafts are used for emergencies. For example this year seed was transported to Khotang district air strip (Lamidanda) by aircraft and distribute to different points by porters.

Transportation charges paid by AIC in different routes for different means of transportation are shown in Table 5. The transportation charge is fixed according to the distance in miles and as same for seed and fertilizer. Fertilizer transaction is larger in volume compared to seed. Besides, seeds have to be transported more carefully. Sometime the difference in distance is not a true measure for fixing the transportation charge. The Bimalnagar-Sundarbazar-Besisahar road is presented as an example. The distance from Bimalnagar to Sundarbazar is 15 miles and from Sundarbazar to Besisahar 11 miles, i.e. from Bimalnagar to Besisahar 26 miles. The rate of transportation charge is fixed on the basis of the physical distance. The transport contractor preferred to transport seeds from Bimalnagar to Besisahar rather than from Sundarbazar to Besisahar. This is because of the transportation facilities from Bimalnagar to Kalimati in the route where seeds can be chargely transported by jeeps, pick-ups, and tractors for the same contracted transportation charge. But between Sundarbazar and Besisahar the only transportation facility available is porters or animals. His preference for the Bimalnagar-Besisahar route is self-explanatory.

Table 5

SEED TRANSPORTATION CHARGES PAID BY AIC ON DIFFERENT ROUTES FOR DIFFERENT MEANS OF TRANSPORTATION

| Seed Distribution | | Transport Charge Rs/m.t. | No. of days required |
|---|---|---|---|
| From | To | | |
| Ilam | Panchthar | 178.00 | 15 |
| Biratnagar | Dharan | 55.10 | 3 |
| Itahari | Dharan | 37.50 | 3 |
| Biratnagar | Itahari | 37.50 | 3 |
| Biratnagar | Bhadrapur | 68.00 | 3 |
| Biratnagar | Rajbiraj | 79.80 | 3 |
| Biratnagar | Janakpur | 214.00 | 3 |
| Dharan | Taplejung | 5193.00 | 25 |
| Dharan | Tehrathum | 2150.00 | 20 |
| Dharan | Chainpur | 3150.00 | 10 |
| Dharan | Khandbari | 3100.00 | 21 |
| Dharan | Dhankuta | 325.50 | 15 |
| Dharan | Bhojpur | 2810.00 | 25 |
| Rajbiraj | Diktel | 2320.00 | 10 |

Table 6

TRANSPORTATION CHARGES ARE FIXED ACCORDING TO THE DISTANCE IN KILOMETERS WITH ADDED PERCENTAGE FOR SHORT DISTANCE

| Route | Distance Km | Rate per Km (Rs.) | Additional percentage | Rate per m.t. |
|---|---|---|---|---|
| Bhairahawa to Tansen | 61 | 0.972 | 75 | 103.76 |
| Bhairahawa to Aryabhanjyang | 98 | 0.972 | 40 | 133.36 |
| Bhairahawa to Garlyang | 98 | 0.972 | 35 | 128.60 |
| Bhairahawa to Waling | 116 | 0.972 | 30 | 146.58 |
| Bhairahawa to Syangja | 142 | 0.972 | 25 | 172.52 |
| Bhairahawa to Naudanda | 151 | 0.972 | 25 | 183.46 |
| Bhairahawa to Pokhara | 176 | 0.972 | 25 | 213.84 |
| Bhairahawa to Damauli | 224 | 0.972 | 10 | 239.50 |
| Bhairahawa to Majuwakhaireni | 259 | 0.972 | 10 | 276.92 |
| Bhairahawa to Kathmandu | 376 | 0.972 | - | 365.47 |
| Bhairahawa to Parasi | 49 | 0.972 | 20 | 57.15 |
| Bhairahawa to Taulihawa | 50 | 0.972 | 125 | 109.35 |
| Bhairahawa to Krishnanagar | 108 | 0.972 | - | 104.98 |

Fertilizer could be carried in advance for the season whereas the seed, a living thing, has to be carried in season especially in districts where no storage facilities exist.

Recommendation I

The main responsibility of improved seed distribution rests with AIC. AIC's seed distribution program is centralized and all the communication is through the central office. Inadequacy of the information communication system is one of the important factors which hampers the distribution process. When we carefully examine the distribution pattern and flow of seeds in Nepal, we can roughly divide the country into seven different distribution centers. The amount of seed to be distributed between the distribution centers will be very limited except for the Hetauda center from where the seeds will be distributed to other centers.

Table 7, gives the recommended seven distribution centers where the processing plants exist or are planned and the seed production program is concentrated.

Recommendation II

These distribution centers should be supplemented by relay centers with storage facilities. These relay centers should be developed. The possible sites for relay centers and secondary relay centers are suggested in Table 8.

Recommendation III

The unit volume of seed transaction is very small. During seed collection many farmers should join to make a truck load full and it takes a long time. The recommendation is either to concentrate the seed production program in compact areas or to introduce the concept of cooperative marketing by the farmers themselves. During the process of distribution a truck has to make several stops in many places to distribute a truck load of seeds. The unavailability of trucks for a small amount of seed to be dropped in different locations and other forms of transportation are a major constraints to AIC and still more to Sajhas. The economy of scale can be achieved by increasing the size of handling. It is recommended that AIC trucks be used for the seed collection and distribution in the season.

Recommendation IV

Movement of seed has to be done well before the planting season. Easy accessibility and timely supply are the two most important aspects in the marketing of seed. Seeds have to be used within a certain period in a particular season for a crop. In-so-far-as timely supply is concerned AIC's direct responsibility extends to the stage of timely storage of seeds in its district headquarter godown. The responsibility then is shifted to AIC's dealers (Sajha Sansthan) who are supposed to lift the materials in time and store in their own facilities.

Table 7

RECOMMENDED DISTRIBUTION CENTERS WITH THEIR PROCUREMENT AND DISTRIBUTION AREAS

| Distribution Centers | Procurement Sites | Distribution Zones | Storage capacity in m.t. | |
|---|---|---|---|---|
| | | | Fertilizer | Seed |
| 1. Itahari | Morang<br>Sunsari<br>Jhapa<br>Saptari | Mechi<br>Koshi<br><br>Sagarmatha | 3000 | 1000 |
| 2. Janakpur | Dhanusha<br>Sarlahi<br>Mahottari | Janakpur | 4000 | 900 |
| 3. Hetauda | Bara<br>Parsa<br>Chitwan<br>Makwanpur | Narayani<br><br>Bagmati | 500 | 1000 |
| 4. Bhairahawa | Rupandehi<br>Nawalparasi<br>Kapilvastu | Lumbini<br>Gandaki<br>Dhaulagiri | 4000 | 500 |
| 5. Dang | Dang<br>Deukhuri | Rapti | 500 | 125 |
| 6. Nepalgunj | Banke<br>Bardia | Bheri<br>Karnali | 2000 | 500 |
| 7. Dhangadi | Kailali<br>Kanchanpur | Seti<br>Mahakali | 1000 | 100 |

Table 8

RECOMMENDED RELAY CENTERS AND SECONDARY RELAY CENTERS IN THE DISTRIBUTION NETWORK

| Distribution Center | Relay center | Seed storage capacity in m.t. | Secondary relay center | Seed storage capacity in m.t. |
|---|---|---|---|---|
| 1. Itahari | Ilam | 125 | Bhadrapur | - |
| | Dhankuta | 90 | Biratnagar | 600 |
| | Udaipur | 125 | Rajbiraj | 500 |
| | | | Lahan | |
| 2. Janakpur | Sindhuli | 125 | Sarlahi | |
| 3. Hetauda | Daman | 125 | Chitwan | 500 |
| | Kathmandu | 500 | Gajuri | 100 |
| | Ranipauwa | 100 | Trishuli | 100 |
| | | | Charikot | 40 |
| 4. Bhairahawa | Palpa | 250 | | |
| | Syangja | 125 | Parasi | 0 |
| | Pokhara | 500 | Gorkha | 40 |
| | Damauli | 125 | | |
| | Taulihawa | 250 | | |
| 5. Dang | Pyuthan | 40 | Sallyan | - |
| 6. Nepalgunj | Surkhet | 125 | Dailekh | 40 |
| | | | Bardia | - |
| 7. Dhangadi | Dadeldhura | 125 | Doti | 40 |
| | | | Patan | 40 |

Movement of seed in time is sometimes difficult because of the distance and time constraints. It could be solved by developing storage facilities in different places. This will enhance the probability of timely distribution. The Seed Production and Input Storage Project (SPISP) is planning to help in this aspect in the hill areas (Table 9).

Table 9

SELECTED SITES AND THEIR STORAGE FACILITIES PLANNED UNDER SPISP

| Site | District | Storage facility in m.t. |
|---|---|---|
| 1. Ilam | Ilam | 125 |
| 2. Pakhribas | Dhankuta | 40 |
| 3. Phidim | Panchthar | 40 |
| 4. Bhojpur | Bhojpur | 40 |
| 5. Jirikhimti | Terhathum | 40 |
| 6. Chainpur | Sankhuwasabha | 40 |
| 7. Diktel | Khotang | 40 |
| 8. Rampur | Okhaldhunga | 40 |
| 9. Sindhulimadi | Sindhuli | 125 |
| 10. Charikot | Dolakha | 40 |
| 11. Dhadingbesi | Dhading | 40 |
| 12. Arughat | Gorkha | 40 |
| 13. Sundarbazar | Lamjung | 40 |
| 14. Waling | Syangja | 125 |
| 15. Damauli | Tanahu | 125 |
| 16. Marpha | Mustang | 125 |
| 17. Gyandi | Parbat | 40 |
| 18. Galkot | Baglung | 40 |

| Site | District | Storage facility in m.t. |
|---|---|---|
| 19. Majuwa | Gulmi | 40 |
| 20. Ghorahi | Dang | 125 |
| 21. Chaurjhari | Rukum | 125 |
| 22. Surkhet | Surkhet | 125 |
| 23. Dailekh | Dailekh | 40 |
| 24. Bijuwar | Pyuthan | 40 |
| 25. Patan | Baitadi | 40 |
| 26. Dipayal | Doti | 40 |
| 27. Sanfebagar | Achham | 40 |
| 28. Chainpur | Bajhang | 40 |
| 29. Dandeldhura | Dandeldhura | 125 |
| 30. Daman | Makwanpur | 125 |
| 31. Tansen | Palpa | 250 |
| 32. Jajarkot | Jajarkot | 40 |
| 33. Udaypur | Udaypur | 125 |
| | | 2465 |

The SPISP is trying to shorten the distribution distance by increasing the number of production areas, processing centers and seed storage facilities. Our regional self sufficiency concept is also guided by the same goal of shortening the distribution distance.

It is recommended that seeds be distributed before and after the monsoon season and the schedule be developed for each distribution center and relay center.

Recommendation V

Transportation costs can cause the price to be prohibitive for some farmers. In remote hill areas the farmers should be either taught how to multiply and

save their own good quality seeds or considered for transport subsidies. The seed production program in such remote areas should be supplemented by replacing their seeds with foundation seeds every three years.

Transportation from the district headquarter to the interior villages is costly because of the lack of good roads. Sajha Sanstha and cooperatives are not operating successfully at the grass root level and the private dealers do not find much scope of sale at the village level.

Transport subsidy from district headquarters to remote interiors may help seed dealers to market seeds in remote areas. Construction of storage facilities for dealers must be considered.

Recommendation VI

Foundation seeds are produced in government farms mostly in the terai region. These seeds have to be transported to certified seed multiplication areas which are found mostly in the terai and some in the hill remote sites. Foundation seeds should be transported not only in time but also at a reasonable price. We are not in favor of subsidies in general but until the supply and demand factors influence the seed market in the Hills transport subsidies for foundation seeds should be continued.

Recommendation VII

Air transportation of seed is done only in a emergency cases. Bur air transportation may turn out to be less expensive than porters for longer distances. Besides, in certain remote areas such as Humla, Mugu, and Dolpa air transportation is probably the best mode of transport and should be used. However for shorter distance for which porters are easily available portering may be less expensive than air-lifting.

Air transport of seeds in the remote hills where air strips exist is so far limited due to the shortage of air crafts with RNAC. Plans should be prepared to utilize some of its aircrafts for chartering cargo goods consisting mainly of seeds to the mountain and hill districts.

Recommendation VIII

Quality loss during transportation is generally believed to be low but it has been reported to be quite high on some occasions. This loss could be reduced by improving the bag quality and bag size according to the need of porters as well as consumer farmers.

Table 10

A COMPARISON BETWEEN THE AIR TRANSPORTATION COST AND THE COST OF PORTERING IN 1978-1979

| Aeroplane | Capacity | Cost of transportation |
|---|---|---|
| Twin Otters | 1.5 m.t. | Rs 10/m.t./Km |
| Pilatus Porters | 0.5 m.t. | Rs 16/m.t./Km |
| Porter | 0.05 m.t. | Rs 15.63/m.t./Km |

Source: Department of Civil Aviation.

Note: The cost of per hour operation of Twin Otters (DHC-6) = Rs 3250. The cost of per hour operation of Pilatus Porter (PC-6) = Rs 1820. Thus the Civil Aviation Department comparison shows that it is cheaper to use Twin Otters but costlier to use Pilatus Porter when compared with human porters.

Table 11

SEED PACKAGING BAGS MADE AVAILABLE BY AIC IN DIFFERENT REGIONS IN 1982-83 (039/40)

| Development Regions | Hession bags 40 kg capacity | Jute bags 75-100 kg capacity |
|---|---|---|
| Eastern | 50,000 | 26,700 |
| Central | 77,875 | 43,000 |
| Western | 41,450 | 22,500 |
| Mid-Western | 15,250 | 8,400 |
| Far-Western | 6,375 | 3,400 |
| Total | 191,250 | 104,000 |

# PLANNING FOR SEED BUSINESS IN NEPAL

Shyam K. Upadhyaya
Agriculture Officer
AIC

Seed business in Nepal is still at an embryonic stage. Until now there is a very little participation of private sector enterprises in this business. In public sector too, Agriculture Inputs Corporation (AIC) is the only agency engaged in production, procurement and distribution of improved seeds in the country. Besides seeds AIC deals also with other agricultural inputs like fertilizer, agricultural chemicals and tools. To be more explicit, seed constitutes a very small part of total business volume of AIC. To add further, the role of AIC is limited only to the handling of seeds of three major cereals crops (paddy, maize and wheat) and few vegetable crops. A review of statistics of seed sales through an institutional source for the last 16 years shows that the average annual sale of paddy, maize and wheat seeds are 247, 82 and 1334 m.t. respectively. AIC sold about 2218 m.t. of wheat seed during the fiscal year 1981-82 which would cover only 5.54 percent of the total area of 399890 hectares under wheat cultivation. Similarly, the amounts of paddy and maize seeds sold during 1981-82 are about 243 m.t. and 134 m.t. which would cover only about 0.37 percent and 1.4 percent of total area under paddy and maize respectively. The amount of vegetable seeds sold by AIC during that year was 8.5 m.t. Though various agricultural projects working inside the country and some government farms are playing a supplementary role in the dissemination of improved seeds the total acreage covered by improved seeds in Nepal is still unsatisfactory. It would, thus, be clear that there is a bright scope for an emerging seed industry in Nepal even without thinking of export market.

Visualizing such an enormous prospect of a seed industry one might be curious to know why the private investors are not interested in this business yet and why the existing public corporation is not able to produce and distribute targeted amount of improved seeds.

Table 1

SALES OF SEEDS BY AIC

m.t.

| Year | Quantity of Seed Sold | | | |
|---|---|---|---|---|
| | Vegetables | Paddy | Maize | Wheat |
| 1965-66 | - | - | - | - |
| 1966-67 | - | 140 | - | 161 |
| 1967-68 | - | 231 | 30 | 508 |
| 1968-69 | - | 253 | 49 | 426 |
| 1969-70 | - | 210 | 40 | 411 |
| 1970-71 | - | 102 | 47 | 326 |
| 1971-72 | - | 265 | 56 | 814 |
| 1972-73 | - | 163 | 50 | 1873 |
| 1973-74 | - | 414 | 46 | 1366 |
| 1974-75 | - | 328 | 51 | 1555 |
| 1975-76 | - | 184 | 145 | 1727 |
| 1976-77 | 3.7 | 359 | 105 | 1811 |
| 1977-78 | 4.8 | 300 | 145 | 2098 |
| 1978-79 | 5.3 | 256 | 93 | 2073 |
| 1979-80 | 5.0 | 306 | 149 | 2470 |
| 1980-81 | 7.8 | 204 | 104 | 1516 |
| 1981-82 | 8.5 | 243 | 134 | 2217 |

Private Sector

The reality of inadequate supply and the consumption potentiality of improved seeds has been explained. An analysis of the seeds offered for sale by AIC, the amount actually sold and the amount left unsold indicates that inadequate supply, is limited with lack of demand for improved seeds (Table 2). Out of about 3345 m.t. of wheat and 300 m.t. of maize seeds offered for sale during 1981-82 only about 2218 m.t. of wheat and 135 m.t. of maize seeds were sold. The amounts of wheat and maize seeds which were left unsold at the end of their sales seasons are about 320 m.t. and 78 m.t. respectively.1/ According to statistics collected from 30 out of 63 AIC offices a total of about 457 m.t. of wheat seeds, 14.2 m.t. of paddy 1.30 m.t. of maize and 3.5 m.t. of vegetable seeds were dumped by those offices during FY 1982-83.

This clearly indicates that although the amount of improved seeds supplied by AIC was far short of the targeted amount, it still was adequate to meet the existing demand of the Nepalese farmers. A common reason attributed to this state of poor demand is the poor quality of seeds produced by AIC. This might be partly true, but this could not be the sole reason. The experience of this year on the demand of wheat seed could be cited as a testimony for the above statement. While there was only a moderate demand for wheat seeds prior to the reduction in seed price the demand showed a dramatic rise immediately after the price was reduced. The farmers were clamousing to buy even the ordinary quality wheat seeds collected from flour mills and grain market. Moreover, the demand was greatest (30 percent) in the eastern region where higher discount was given on seed price. This proves that our farmers are more conscious of seed price rather than of seed quality.

Table 2

REGIONWISE SALES OF WHEAT AND MAIZE SEEDS AND QUANTITY LEFT UNSOLD IN 1981-82

m.t.

| | Region | Quantity sold | | Amount of viable stock left unsold at the end of season | |
|---|---|---|---|---|---|
| | | Wheat | Maize | Wheat | Maize |
| 1. | Eastern Region | 686 | 28 | 71 | 17 |
| 2. | Central Region | 793 | 63 | 55 | 35 |
| 3. | Western Region | 544 | 31 | 27 | 17 |
| 4. | Mid-Western Region | 130 | 10 | 155 | 5 |
| 5. | Far-Western Region | 65 | 2 | 12 | 4 |
| 6. | Nepal | 2218 | 135 | 320 | 78 |

1/ The untreated seeds and the seeds which received a germination drop are not considered here.

The farmers seem to prefer to buy seeds from other sources only when such seeds are cheaper then the seeds they have saved from their own produce. An average Nepalese farmer adopts all precautionary measures to save a part of his produce to be used as seed for the next crop season. This is just like the banking habit of the people of the under developed nations which has to be changed. This tendency of the farmers is a source of risks in seed business that compels a private invester to be cautions.

The high fixed cost for setting up seed business and the absence of seed processing and drying facilities may be other reasons why a private investor should hesitate to make investment in it. Last year the Nepal Seed Company was worst hit on its first venture on hybrid maize seed production. The hybrid maize seeds produced by this company at Jitpur (Bara district) were spoiled by rain during the harvesting period as this company had no storage facilities. In the absence of proper transportation facilities movement of seed stock from one part of the country to another especially hilly regions, is very difficult and it would be hard for any private entrepreneur to bear the anticipated loss.

The reasons discussed above might be few of the numerous reasons of a private entrepreneur for not wanting to participate in the seed business of Nepal.

Public Corporation

The public institution, Agriculture Inputs Corporation was started during the first year of third five year plan. In the beginning, AIC simply procured and distributed improved seeds in Nepal. But now it has a well-defined seed production system and produces improved seeds on contract farmers fields, collects and distributes through cooperative and, in some cases, through private seeds dealers. It has, however, already been stated that the amount of seeds handled by AIC is insignificant. Let us consider the possible causes why AIC is not able to produce and supply improved seeds in desired quantity and quality. They could be enumerated as follows:

1. Manpower and Facilities

As stated earlier the role of this public corporation at the beginning was limited simply to the procurement and distribution of improved seeds. Later on, in the year 1973, it started seed multiplication program in contract farmers' fields and began to produce and procure seeds inside the country itself. By now it has increased its seed production program to near about 5000 ha. acreage per year. However, manpower and other essential facilities needed to run the program could not increase to match the increase in the volume of the program. As a result the field inspection and supervision became difficult. One technician of AIC is supposed to look after more than 400 ha. of scattered production plots with very limited means of mobility. The vehicles allocated for the inspection of seed programs are rarely available for the work due to some reason or other.

2. Priority Concern

Fertilizer constitutes more than 95 percent of the total business volume of AIC. It is natural for the management to concentrate its major attention on fertilizer which often leaves very little time for them to look after seed business. Many personnel in AIC hold the opinion that seed business is the job of a handful of AIC technicians alone and many others have a feeling that it is this seed component that has been ruining AIC. The most important point is that AIC technicians are entrusted with a very little authority needed to execute seed program and most of the time a non-technical person would be handling seeds. It is highly necessary that seed consciousness be developed in every worker of AIC involved in seed business.

3. Seed Quality Control

Seed quality is a relative term which should be judged against our available technology, storage facilities and other conditions. Let us consider some of the constraints in the production of quality seed and maintenance of seed quality.

(a) Source Seed

The unavailability of adequate and good quality source seeds for multiplication program has been a major constraint the quality seed production venture of AIC. In case of wheat, improved grade seeds which are often degenerated, are used to produce seeds. Due to shortage of source seeds the certified and improved standard program are being conducted at the same locality which has created discontent among farmers because of the variation in their premium. It imposes problems during processing and there are more chances that they would get mixed up. Last year there was a drought at Rampur which hampered foundation seed production program. As a result AIC had to run its maize seed multiplication program by using certified seeds from its own collection. Till now rice seeds are being produced by the government farms. But many farms do not want to grow early variety rice seeds as they do not have irrigation facilities. The government farms are more interested on undertaking trials for varietal development and are paying less interest in the dissemination of already released varieties among the farmers.

(b) Inspection

Timely inspection of the seed production fields is very essential in order to produce quality seeds. But both Agriculture Botany Section (seed certifying agency) and AIC do not have adequate technical manpower to do that. The lower level technicians in AIC seem to have some sort of frustration and are not giving their best. Moreover, there is very limited mobility available for field inspection work.

(c) Storage Facility

Proper storage facilities are very important in order to maintain the seed quality.

AIC has seed storage godowns of 500 m.t. capacity each at Biratnagar, Janakpur, Birgunj and Bhairahawa. Other godowns which are being used for seed storage are not suitable for the purpose of seed storage. There are some spaces attached with each processing plant for the temporary storage of raw and processed seeds. In total AIC has a capacity for storing about 2500 m.t. of seeds.

At present, AIC deals with seeds of 4 crop groups and a minimum of 15 varieties. If we are to store different varieties of seeds without getting them mixed up the actual seed storage capacity of AIC would be lesser than that stated above. Moreover, in many of those seed godowns agriculture tools and chemicals are also stored. The seed collection and distribution target of AIC during FY 1982-83 was 6010 m.t. and next year it would be more than that. It is thus clear that the seed storage capacity of AIC is far inadequate as compared to its increasing program and this is a major constraint in seed quality control.

Processing

Timely processing of seeds is very essential in order to protect seeds from insects and pests attack and maintain seed quality. AIC has five processing plants each at Itahari, Janakpur, Hetauda, Bhairahawa and Nepalgunj. The processing plant at Janakpur and Nepalgunj have a rated capacity of 1.2 m.t./hr but are actually turning out only of 1 m.t./hr. Provided there is adequate manpower to operate the plants and enough overtime budgets these plants could be operated for a maximum of 15 hours per day in 3 shifts (1 shift = 5 hrs). At this rate about 450 m.t. of seeds could be processed within 30 days. Seed collection and processing starts during the month of May which leaves only about one and a half months for seed processing work before the rainy season starts. In this way if everything goes smooth, about 600 m.t. of seeds could be processed by those plants before rainy season. Considering the present volume of seed programs near these plants it is appearant that the processing plant at Janakpur has the capacity which is enough to finish processing before rainy season. Even then it has been observed that processing work at Janakpur has to be continued throughout the rainy season because of the following reasons:

(a) The plans would be in disorder many times and there are no trained personnel to repair it in time.

(b) Spare parts are not available in time.

(c) There is a lack of trained personnel to operate the machines.

(d) There is often a budgetary problem to run the plant extra hours.

In Nepalgunj area, because of transportation constraint, only the seeds produced at Banke and few parts of Bardiya district could be brought and processed at the processing plant in Nepalgunj. It would not be economical to bring seeds produced at Dang and other districts of that region to Nepalgunj and process there. It is difficult for AIC to increase seed production programs in Banke and Bardiya districts as the farmers in that area seem less interested to participate in seed multiplication. As a result the processing plant at Nepalgunj is under utilized.

The processing plants at Itahari and Bhairahawa have double cleaners and hence, would process about 2 m.t. of seeds per hour. At this rate at best 1200 m.t. of seeds could be processed at these plants before the start of rainy season. Even at the present volume of seed programs of AIC, more than 1500 m.t. of seeds would be collected at Itahari and Bhairahawa each. Hence even with regular and full operation of the plants a considerable quantity of seeds would still be left unprocessed during rainy season and it has been observed that it is almost impossible to protect unprocessed seeds from insect infestation during rainy season. Moreover, even if the overtime budget be managed somehow there is a lack of trained personnel to operate plants for full hours. Besides the plants are not in a proper condition so as to provide continuous service.

The processing plant at Hetauda is sophisticated and has a larger capacity of 4 m.t./hr. The seeds collected from Bara, Parsa and Chitwan which are the major seed production areas both for wheat and maize seeds are processed at this plant. At the present level of seed production about 2000 m.t. of seeds could be collected at Hetauda in year. The time for wheat and maize seeds collection coincide. Altogether 5 varieties (3 varieties of maize and 2 of wheat) are being grown in this region. After processing a variety the plant has to be cleaned thoroughly in order to avoid varietal mixture. This further delays processing work. Due to this varietal problem a farmer who has already prepared his seed may have to wait for more than one month before his turn for seed delivery comes. It has often been observed that the longer the period seeds remain in farmer's storage more are the chances for deterioration of quality. This is often the case for maize seeds as the farmers are unable to dry such seeds properly before storing them. For the reasons stated already for other processing plants the seed processing work at Hetauda seed plants is continued up to September every year.

## Conclusions

No one else knows where the shoe pinches except he who wears it. Likewise, anyone working in seed business would know that this business is an extremely intricated affair. However, no business is devoid of risks. It is necessary to formulate a long term plan of seed industry with consideration of existing situation and careful projection into the future of this industry. The basic managerial problems and infrastructural constraints should be taken into account. A strategy for the development of a viable seed industry in Nepal could be as below:

1. A strong seed division in AIC with competent technical manpower and authority is of vital importance. This seed division would monitor all the seed program in the country. The seed division of AIC should be strengthened for this reason. It should have specialized units for production, processing, storage, quality control, planning and coordination. The seed division should plan seed program and should have the authority to recommend facilities needed to run such program. The national target set by National Planning Commission and the Ministry should be the basic guideline while formulating seed program. Separate budget should be allocated for running the seed program. The AIC should also coordinate the seed production activities of other agencies like different agricultural project, private enterprizes, government farms etc.

2. Private sectors should be encouraged to participate in seed business. The role of seed division should be complementary rather than competitive to the private enterprizes. At the present stage, the handling of bulky seeds like paddy, wheat and maize (composite varieties) may not be attractive for a private entrepreneur. Private entrepreneur's participation may be expected in case of vegetable seed production and to some extent, production of hybrid maize seed. However, the activities of private enterprizes should be guided by AIC.

3. Seed certification and overall quality check both in private and public sectors, should be done by an independent certifying agency. But the organization which produces and distributes seeds should itself be responsible for the maintenance of its seed quality. The Agriculture Botany Section should have adequate manpower so as to make timely inspection of the seed production plots.

4. Seed production program should be concentrated in areas where there are already established processing and storage facilities and in new areas where they are needed most.

5. Regular servicing of processing plants should be made and the spare parts should be available in time.

   The corn cob drier at Hetauda seed processing plant should be repaired. All other seed plants except the Hetauda seed processing plant have no precleaning facilities. Precleaners may be added on those plants. Premium should be paid to the seed growers on the basis of their unprocessed seed sample. Small scale solar drier system may be introduced for drying maize seeds. Provision of regular training should be made to the mechanics and plant operators working on seed plants.

6. Seed storage godowns should be constructed at the seed processing centers and at the major relay centers. Larger godowns are needed at Itahari, Hetauda, Janakpur, Bhairahawa and Nepalgunj. Godowns should also be constructed at major seed distribution points like Dhangadi, Surkhet, Dang, Palpa, Syangja, Pokhara, Damauli, Dhankuta, Rajbiraj and Bhadrapur, it has been found that germination drop in maize seed is better checked

if the maize seeds are stored in cool places like Daman. Hence it is necessary to explore such centers in every region and construct godowns there. Fumigation sheets and other storage accessories should be made available in time. Researches may have to be undertaken on developing more suitable bags for packing seeds.

7. There should be clear cut policies regarding price subsidies so that private entrepreneurs should not suffer. Effective demand collection procedures should be developed. AIC should forecast a reasonable range of seed varieties that would be available for sale at least six months ahead of the sowing season. Reliable demand should be collected and reported to the concerned channels well ahead in time.

8. A reasonable buffer stock may have to be maintained in order to meet possible shortage in emergency. Such buffer stocks should be properly stored at the major seed relay centers.

9. It is clear that no organization will succeed in its business unless its employees work to their best. The test of good management depends on how much it can exploit out of its employees. In order to take most out of any employee he should be assured that the organization cares for him. It has often been seen that the technicians in AIC feel somewhat alienated in their own organization. A basic conflict of values is seen between them and the management officials. It is very essential to eradicate this sort of feelings for successful management.

Seed component in AIC differs from other components in that seed business, actually, is a sort of industry and not simple trading. The growth of an industry is always difficult then a trading business. But seed industry is a must for the development of the country.

# SEED PRODUCTION ACTIVITIES IN IHDP

M.D. Bhatt and
J.S. Gaudin

## 1. Introduction

The Integrated Hill Development Project, one of the oldest rural development projects in Nepal, aims at the multi-disciplinary development of a rural society in the centrally hilly region of the Kingdom.

Six sectors out of twelve in the project are connected with agricultural development. They are collectively called the Green Sector and are organized into input and infrastructive producing sectors who assist an extension sector. This extension sector works in close collaboration with the ADOs of the two districts in which the project has its programs.

The agricultural inputs produced by the Trials and Production (T+P) sectors of Horticulture, Agriculture and Livestock are distributed to farmers by the extension services mainly through leader farmers called Tukis. The Water and Energy sector builds and maintains irrigation schemes in suitable areas. The Forest sector develops fodder trees in Panchayat forest programs.

### a. Seed Production Program Objectives

Cereal seed inputs are organized by the agronomy T and P sector from within the region as far as possible.

The main aim is to make the area self sufficient in seed inputs.

This goal was adopted for 3 reasons:

i. Because transport from other parts of Nepal is time consuming costly and uncertain.

ii. Because crops grown in other regions are not always suitable for the project area.

iii. Because to do these seed production with higher standards of crops husbandry and seed selection is in itself a form of extension, and a demonstration to other farmers.

For Potato the objectives are to produce improved varieties of the crop in as much of the project region as possible. This limits transport costs and encourages the entry of improved varieties into the traditional trading circuit.

## 2. Area of Operations

Grain seed is produced on farmers fields in localities confined to within one days walking distance from the district headquarters in the

case of Dolakha district and around the project headquarters in Sindupalchok district.

Due to staff limitations the programs are concentrated in 6-8 specific areas.

3. Salient Features of the Programs

a. Production:

We could produce the following in the last 5 years:

| | Production of seed (Kgs) | | | | |
|---|---|---|---|---|---|
| | 34-35 | 35-36 | 36-37 | 37-38 | 38-39 |
| Wheat | 760 | 5700 | 5800 | 12000 | 14000 |
| Paddy | 1000 | 2000 | 1180 | 4160 | 8000 |
| Maize | 200 | 1200 | 453 | 1853 | 2000 |
| Potato | 19000 | 25000 | 77000 | 40000 | 67000 |

b. Features of the programs at their present stage of development:

| | Areas | No. of Farmers | Yield | Yield/Farmer |
|---|---|---|---|---|
| Wheat | 8 | 34 | 14000 | 412 |
| Paddy | 6 | 24 | 8000 | 333 |
| Maize | 8 | 20 | 2000 | 100 |
| Potato | 4 | 80 | 67000 | 838 |

c. Comments on the programs:

All the staff were based either at Charikot or Dandapakhar (IHDP headquarters). The yield per staff and per man hour of staff time is higher for wheat and paddy than for maize probably because isolation requirements are easier and so is large scale production on khet land.

Potato takes a great amount of time mainly because of the long distances involved and because of the more exacting roguing requirements for this crop.

d. Working Procedures:

i. Arrangement of Foundation or Source Seed:

a. Kabre government agricultural farm-Dolakha District

b. AIC - both foundation and source seed

c. Government farms at Bhairahawa and Rampur

d. Own seed selected from the previous year.

Our main aim in this connection is to help build up Kabre farm as an official producer of foundation seed. The quality of their seed is already excellent and the improved road facilities (a road is being built by a sister SATA project) should permit a closer working relation with the Botany Division at Khumaltar, essential for the maintenance of seed quality.

ii. Contracting the seed growers:

The farmers are given a contract which sets down conditions of initial seed purchase, quality control rules and purchasing procedure for both the pricing and the delivering of the harvest. These contracts are not binding. The grower is free to sell us or not his harvest. We rely on a fair pricing system, a 20 percent premium and cash on delivery to attract the farmer.

The drop-out rate varies according to the locality and the year but normally for the grain crops it varies between 1:2 and 1:3 of the farmers who take seed for multiplication.

In our potato program the drop-out rate is almost nil due to the limited market opportunities that exist for the lekh farmer outside our program. Because of their good marketing possibilities outside the program, the farmers near Charikot more easily refuse to sell if the seed price is not high enough.

iii. Seed Collection:

Previously seed was bought on the farm and transported by our labour to the project sub-centers. But the seed quality was poor. There was high percentage of chaff and foreign matter which took a lot of labor to clean out, also weighing was not accurately done. The result was up to 16 percent weight loss after reweighing and cleaning. Last year we changed the system. The farmer himself is responsible to bring his seed to one of the IHDP stores where it is weighted, tested for cleanliness and payment is made. Transport is paid from the area to the store.

This change was made principally to bring us into line with AIC procedure but it had the effect of vastly improving the seed cleanliness.

In some areas farmers found it difficult to find porters to transport their seed and this lead to some areas being dropped from the program.

iv. Seed Processing, Treatment and Packing:

After purchasing, samples of the seed are sent to the Botany Division - Khumaltar for analysis. In the case of potato 80 tubers are collected from each grower and stored in a bansi area to break dormancy. The tubers are then planted and virus infection, diseased and off - type plants are measured. Future seed is kept according to the results.

Fumigation of the grain seed is done sparingly and BHC is applied if necessary. Before the seed is delivered to the extension service it is treated (Vitavax) if necessary.

Cleaning used to be necessary when the seed was bought on the farm but now, except for odd lots, the chaff and foreign matter does not exceed 1 percent by weight and it is not thought necessary to clean the seed before distribution through the extension service.

v. Storage:

Grain seed is stored directly into 600 kg drums that are left outside.

Potatoes are stored in rented houses in the lekh areas where the crop is grown. The rooms are partitioned and the producers seed is stored singly or in pairs. The stocks are heaped no more than one meter high and are turned and inspected 2-3 times during the first 3 months of storage.

vi. Transportation:

Transport costs are paid to the farmer for transporting his seed to our stores. Costs paid range from 11-14 paisa per kg per kos. This arrangement gives us a greater choice of areas in which to grow seed. We are not too dependant on places just around Charikot. These places are the least reliable for seed production due to the other market opportunities that exist for selling seed.

The bulk of our potato is grown 12 koses from the nearest point on the road. Transport costs which are paid by the project come to 5 paisa/kg./kos.

vii. Pricing and marketing procedures:

The price for each crop is fixed in the District Agricultural Committee. Farmers representatives from as many of the producing regions as possible are invited to attend.

The seed we produce is sold through the ADO to the farmers, very often through the intermediary of the Tukis, leader farmers trained by the project.

Pricing both for selling seed and for distribution to farmers is made difficult because of the lack of direction we get from the center. Our policy is to keep our prices as much as possible in line with those of the AIC. We find that our biggest problem is not so much the price difference, although prices have risen sharply over the last two years. The main problem is that the price is never known early enough. It is very difficult to get a realistic demand from farmers if they do not know how much they will have to pay. There should be a long term pricing policy which would give confidence to administrators of seed and extension programs as well as farmers. Yearly prices for the particular crops should be fixed at least 2 months ahead of the earliest sowing date.

Furthermore, there appears to be a move to establish zonal or even nationwide prices. This will only lead to anomolies in the seed production of a country like Nepal, which is agriculturally so widely diversified. This tendency could seriously affect seed production in the hills which has other reasons for its existance than pure economics.

4. Experiences

Our experience with seed production programs in the last 5 years has lead us to a number of conclusions:

a. It is not easy to distinguish a good seed growing area at first sight. There must be a good area of khet or bari land and farmers must be above the subsistance level. Persistance is needed over several years to seed if farmers respond to a seed production program. This persistance is also appreciated by the farmers, who gain confidence that their crop will be bought at a fair price.

b. In potato seed production it is most important that the farmers live near their fields, and that they do not have too many animals. In most lekh areas the potato fields are several hours walk away from the village and during the summer most of the household is away grazing their animals in the high pasture lands.

c. Farmers can be very hard bargainers and will bluff upto the last minute in any negotiations. On the other hand most seed program

administrators have targets to achieve and are tempted to relex their conditions or raise their prices. The best answer we have found is careful preparation before any meeting. If an official is sure of his facts and offers a fair deal it will not often be refused. The only problem is that a lot of time is needed for such negotiations.

d. Once a farmer has crop seed for sale a major incentive a program can offer is payment in cash. Apart from exceptional cases, food grains can only be sold in the village in small quantities and very often only on credit. The recognition of this fact can contribute a lot to the smooth running of a seed program.

5. Future Plans

In the future our seed production programs in Dolakha will be taken over by the AIC. A store cum treatment center has nearly been completed and a JT from the ADO's office has been appointed as In-charge. The program will be run in conjunction with the ADO whose JTAs in the program areas will do most of the crop inspection and harvest supervision.

The role of IHDP will be first and foremost to ensure the smooth running of the established program by technical support to the ADO and trainings for farmers and field staff. Efforts will be made to develop the farmers in various areas into groups that could eventually supervise their own crop quality and marketing.

Besides this, efforts will be made to develop seed multiplication programs in minor crops such as millet and soyabean.

# SEED PRICING, SUBSIDY AND RELATED ISSUES

B.N. Kayastha,
Chief, Seed Division
AIC.

It is sometimes said that one of the reasons as to why a limited number of farmers use AIC seeds is that the seed price is much higher than the local grain price. This feeling may be true in some areas where an awareness about the value of good seed and new varieties is behind schedule because of weak extension service. A good quality seed certainly pays rich dividends and it is definitely going to be a little more expensive than ordinary grain. However, the price of the seed has to be kept down so that farmers may afford to buy when they are convinced of the value of the high yielding seeds. A price policy aimed to balance the economic interest of seed producers and farmers consumers has to reconcile two conflicting interests. A satisfactory price to the seed producer would generally mean a higher cost to the seed consumer, while a satisfactory price for the seed consumer may become a lower return to the seed producer.

## Objectives of Seed Price Policy

1. to increase the consumption of seed,

2. to allow sale agents a reasonable profit margin to enable and encourage them to provide effective sales promotion and services,

3. to provide improved seed in adequate quantities.

The demand for the improved seed is ever increasing. To meet the demand an effective production system has to be developed. Seed growers are selected and are asked to use foundation seed and other inputs to have quality seed produced. Obviously, their product should cover their increased costs and leave some profit. Therefore as recommended by the Central Seed Production Committee, AIC fixes the base price in advance for the seed growers. It is fixed at least a month before the planting season. For example, in terai the base price for wheat seed growers is fixed in second week of Aswin (September) and also the same time for the winter maize seed growers. This ensures a minimum price of their product. This has encouraged more farmers to participate as contract seed growers and it has also encouraged the seed growers to use recommended inputs and improved cultural practices.

In order to reduce the field supervision cost and to ensure proper utilization of limited manpower AIC is trying to concentrate seed production program in compact blocks or in a few selected pockets. These pockets should be the potential good cultivated area of the region. The base price fixation system facilitates to develop pocket areas for seed production program and it also encourages all the farmers of the pocket area to participate in the seed production campaign.

The seed produced by the seed growers should be collected in time for both quality control and timely availability. Adequate arrangement must be made to procure the seed in time. This will involve some price incentive. If the base price fixed before planting is same or higher than the local market price at the time of seed procurement (collection) then the incentive provided by the base price will be enough. But if the market price at the time of collection is higher than the base price fixed, a new price has to be fixed as collection price at the time of seed collection. For example, in terai this price for wheat is fixed in first week of Baisakh (April) if necessary. This helps in seed collection.

Who fixes the base price as well as the collection price? These prices are fixed by the committee of managers from the AIC and ADB and two representative farmers. The local ADO chairs the committee and fixes the price. On top of this collection price, improved seed growers are entitled to receive 10 percent premium as the first installment and may later get upto 20 percent premium on the basis of quality seed produced. For certified seed growers the first installment of premium is 15 percent. This could be higher upto 20 percent for foundation seed growers. The second 20 percent premium is calculated on the basis of seed laboratory test results as shown in Table 1 and 2.

The third part of incentive is to arrange processing and storage facilities. Processing of seed has to be done immediately at the time when the farmers bring seed to the processing plant. All seeds should be processed before rainy season. This may end up in running two or three shifts per day. Here beside the processing cost and other logistics, depreciation charges of the seed plant equipment and their maintenance cost must be considered. The storage facilities for the unprocessed seed as well as for the processed seed have to be adequately arranged. Dependence on hiring private godowns and buildings to meet storage requirements leads to losses in seed quality. Majority of the hired godowns are usually of poor and substandard quality. The rents paid are also high for the poor storage space mainly because of urgent hiring usually during peak seasonal demand for storage capacity.

Seed Pricing System of AIC (Table 3)

Production cost

1. Procurement cost: This cost includes base price or collection price and premium percentage given to the seed growers according to their seed quality. This will also include loading and unloading.

2. Processing cost: This cost will include labour, electricity agro-pesticides used to treat the seed and seed packaging material. At present the depreciation cost and maintenance cost of the equipments are not included in the processing cost.

3. Storage cost: No storage cost or maintenance is added in seed by AIC.

4. Transportation cost: Transportation cost is added on actual cost basis. Transportation cost is subsidied in the remote hills upto the district headquarter. This cost also includes loading and unloading in subsequent godowns.

5. Other costs: Refer to shortage (losses) at the rate of 2 percent incidentals 2 percent and administrative expenditures 3 percent.

6. Dealers commission: This is 6 percent of the seed selling price.

7. Sales promotion and interest rate: No cost is added for sales promotion and no interest is added.

In this margin control pricing policy the prices vary from area to area reflecting differences in costs, primarily transportation. Margin control pricing policy has the following advantages. (1) It ensures fair prices of seed (2) Seed demand increases in areas where returns are greatest (3) It avoids the problems in setting the best uniform price. Disadvantages include different prices of a crop seed in a district according to the lot receive from other AIC offices. Checking is difficult because the sellers are allowed the change from place to place. The real danger is that margin set may either be too low and discourage sales. This procedure appears superior to other alternatives if margin controls are set wisely with sufficient emphasis on encouraging sales as well as a fair price to the consumer. The margins for both wholesalers and retailers should be based on costs incurred. Retail margins should also be based on costs incurred to the point of delivery at the retail godown.

It is recommended that the AIC should also be the logical authority to police price margin regulations and quality control. AIC personnel should constantly spot check the retailers of the area. The suggested number is ten retailers per person. Samples of products being sold should be collected on spot check basis and analyzed to detect adulteration. Weights and measures would also be examined for accuracy. Demand and supply of seed should also be controlled by AIC field staff on a spot checking basis.

Alternative Pricing Policies

Fixed uniform price:

The policy of charging a fixed price for seed, uniform throughout the country, was tried with maize seed in 1982-83. The price was fixed to cover costs of production and distribution. The chief advantage in fixing prices at uniform levels is encouraging seed use equally throughout the country. The price is known and easier to deal and uniform. The chief disadvantage is that the use of seed is reduced in the potential areas of terai.

No control price:

The private companies or institutions involved in seed activities are given complete freedom to set their prices. This policy is superior in bringing about increases in sales and consumption. The advantages of such a policy are that the sellers are able to charge prices that provide attractive profits. The sellers will try to expand sales by using sales promotion and servicing technique.

Price subsidy:

A program for public sector foodgrain distribution at subsidized prices is implemented by Nepal Food Corporation. The volume distributed has been increasing steadily. Distribution prices are heavily subsidized with the largest subsidy being paid for the remote hills sector. The subsidy rate on selling price ranges from 57 percent for Kathmandu to 96 per cent for the lower Hills and 142 percent for the mountain and remote hills. For the remote hills, therefore, NFC selling price does not even cover the cost of transporting the foodgrains. It should be assumed that the remote districts have the lowest productivity and the lowest capacity to purchase seeds. The remote areas need to have much higher subsidy element in the price.

Seed use can be increased tremendously by subsidizing prices. The most recent evidence of the effectiveness of a large subsidy was observed in the case of wheat seed sale in the Eastern Development Region in 1982-83.

Transportation from the district headquarter to the interior villages is costly because of lack of good roads. Transport subsidy from district headquarters to remote interiors may help in penetration of the dealers inside the villages.

Credit Facilities

Farmers purchase improved seed through the cooperatives either on cash or on credit and the cooperatives get a 5 percent commission. Agriculture Development Bank (ADB) and cooperative Sajha Sanstha are the two institutions providing agricultural credit to the farmers. Funds are reported to be sufficient for loans to farmers for seed production. But few farmers complain on complexity of the procedure. ADB should be requested to provide storage loans or seed industry loan to the seed grower-marketing groups of farmers and private seed entrepreneurs. A mini-metal bin program initiated by ADOs in some districts should be considered for storage loan. The amounts they individually need are of course small but this does not make their need less urgent.

Now the question is "can seed be sold at a price level that will ensure suitable incentives? One of the ways to reduce the cost of production is to increase the efficiencies in procurement and processing. Transportation cost could be minimized by developing regional self-sufficiency.

Field inspection cost and collection cost can be reduced to a extent by concentrating the seed production area in a pocket or two. Timely procurement of equipment and spare parts, bags, agro-pesticides, and maintainance of the efficiency of processing plants will reduce the cost. Building seed warehouses at strategic points will certainly reduce the cost of the seed and preserve the quality. Seeds have got to be transported and stored until the planting season leading to heavy storage cost. By rough calculation, AIC rented godown cost accounts for more than 2 percent of the selling price. This cost could be reduced by building warehouses at strategic points. Construction of storage facilities for dealers must also be considered.

Initially however transportation costs and other factors should not limit seed use. Subsidy on transport for more remote areas should be considered. Government must insure the availability of a large quantity of seeds along with effective extension services. Finally I will stress that pricing should be related to the local situation.

Table 1

PRESENT PREMIUM PROCEDURE FOR WHEAT SEED COLLECTION

| | Item | Minimum Standards (percent) | Range Range | Points to be divided | Points given |
|---|---|---|---|---|---|
| 1. | Purity | 97 | 97-100 | 100 | 0.1 = 3.3 |
| | | | | | 1.0 = 33.3 |
| | | | | | 3.0 = 100 |
| 2. | Other Crops | 3 | 3-0 | 100 | 1 = 33.3 |
| | | | | | 2 = 66.6 |
| | | | | | 3 = 100 |
| 3. | Weeds | 0.05 | 0.05-0 | 100 | 1 = 50 |
| | | | | | 2 = 100 |
| 4. | Inert Matters | 2.0 | 2-0 | 100 | 1 = 50 |
| | | | | | 2 = 100 |
| 5. | Moisture | 12 | 12-10 | 100 | 1 = 50 |
| | | | | | 2 = 100 |
| 6. | Germination | 85 | 85-100 | 100 | 1 = 6.7 |
| | | | | | 10 = 67.0 |
| | | | | | 15 = 100 |
| | Total | | | 600 | 20 = 600 points |
| | | | | | 1 = 30 points |

Note: One percent premium for each 30 point,
Seed Growers should score 600 points to receive 20 percent premium.

Table 2

SUGGESTED PREMIUM PROCEDURE FOR WHEAT SEED COLLECTION

| | Item | Premium % | Points to be given | Range in % | Points given |
|---|---|---|---|---|---|
| 1. | Purity | 4% | 80 | 97-100 | 1 = 27 points<br>2 = 54 points<br>3 = 80 points |
| 2. | Other Crops | 4% | 80 | 3-0 | 1 = 27 points<br>2 = 54 points<br>3 = 80 points |
| 3. | Weeds | 1% | 20 | 0.05-0 | 0.01 = 4 points<br>0.05 = 20 points |
| 4. | Inert Matter | 1% | 20 | 2-0 | 1 = 10 points<br>2 = 20 points |
| 5. | Moisture % | 5% | 100 | 12-10 | 1 = 50 points<br>2 = 100 points |
| 6. | Germination | 5% | 100 | 85-100 | 1 = 7 points<br>10 = 70 points<br>15 =100 points |
| | Total | 20% | 400 points | | 1 = 20 points<br>20 =400 points |

Note: One percent premium for each 20 points.
To receive 20 percent premium seed grower should get 400 points.

Table 3

SELLING PRICE FIXATION PROCEDURE OF AIC

(Example One Hundred Kilogram of Processed Seed in FY 1980-81)

| | Items | Cost in Rs |
|---|---|---|
| 1. | Product cost (including premium) | 254.16 |
| 2. | Transportation charge | 4.92 |
| 3. | Loading and unloading | 0.53 |
| 4. | Seed treatment | 11.69 |
| 5. | Processing and packaging | 15.50 |
| | Sub-Total | 286.80 |
| 6. | Shortage or losses (@ 2%) | 5.85 |
| | Sub-Total | 292.65 |
| 7. | Incidental (@ 2%) | 5.85 |
| 8. | Administration (@ 3%) | 8.78 |
| | Sub-Total | 307.28 |
| 9. | Dealer commission (@ 6%) | 19.61 |
| | Total | 326.89 |

# PRODUCING SEEDS IN THE VILLAGE

M.L. Malla, and
I.C. Bolo,
(Cropping Systems
Program)

## Introduction

Seeds of new varieties of rice, corn, wheat and other crops are probably the most important "low cost technology" available in Nepal today, which if made available to farmers could spur a more rapid growth of agriculture. There are now several new high yielding varieties of rice suited for the conditions in the terai and in the hills. Among which, to name a few, are: Janaki, Sabitri, Laxmi, Durga, Bindeshwari for the terai; and K-39, Manchan and Himali for the Hills. These new varieties have the same production performance as the local varieties when grown under the present farmers practices but have higher yield potential than the local as more nutrients (compost and/or fertilizer) are applied into the soil. Most of the new varieties yield almost twice more than local varieties at moderately higher level of fertilization and care.

Likewise, several high yielding varieties of corn acceptable to farmers are now available for the Hills and the terai.

For wheat, there are now available four varieties: RR 21, UP 262, Triveni and Lumbini - all with potential yield of 3 m.t. per hectare or more. Nepal has now selected varieties of soybean, barley, finger millet and other crops which can out-yeild the varieties presently grown by farmers.

By changing the seeds alone of the above crops into new varieties and with moderate improvement in cultural practices, Nepal can substantially increase its present level of production. Experience of the cropping systems program in its pilot production program in six different locations indicates the potential of increasing present level of grain production by about 30 percent or more using the seed of the new varieties.

Unfortunately, large segments of the farming population have little access to the seeds of the new varieties. And when they do have the chance to buy these new seeds, it is often inadequate and late for its timely planting. The present facilities available to the Agriculture Inputs Corporation, confounded by the poor and inadequate infrastructure in many parts of Nepal does not permit adequate and timely supply of the seeds of the new crop varieties to the farmers.

There is an urgent need to develop strategies to supplement the present seed production and distribution capacity of AID.

The cropping systems program has, in its effort to supply adequate seed of recommended varieties to the farmers participating in the Badhi Utpadan Karyakram, has initiated a seed production program in the village called Seed Production and Exchange Program. The program involves supplying seeds of new varieties of rice, corn, wheat and other crops to selected farmers in the village and providing them guidance on how to grow the crop, rouging of off-types, drying, cleaning and storage of the harvest. As incentive for farmers to participate in the program loans were advanced to farmers to purchase the necessary fertilizer, insecticide, seed bins, sacks and plastic bags. A loan equivalent to 75 percent of the value of the seed was also provided to some farmers by ADB/N to encourage them to keep their harvest for seed instead of consuming it or selling it as grain.

Our experience in three sites: Parsa, Lele and Chaurijahari is every encouraging. From a small amount of seeds of the new varieties brought into these sites in 1982, for seed production, adequate supply is now available to provide seeds up to 50 hectares this year in each site. By next year, there would be sufficient seeds of the new varieties of rice, corn and wheat in these areas to supply the total need of the area and for the adjoining Panchayats of the district.

Chaurijahari

Chaurijahari is one of the villages in Rukum district. All seed that have to be brought here by AIC has either to be flown by RNAC or by porters from Nepalgunj or Tulsipur. It takes 4 days travel by mule to Chaurijahari from Tulsipur. It is not only difficult to transport seeds to Chaurijahari, it also is expensive. It cost Rs. 225 to 250 to transport 100 kg seeds from Tulsipur to Chaurijahari. To supply 20 percent of the wheat seed needed in the area, the government have to spend Rs. 25,000 each year just for transport cost alone. This cost can be reduced by transporting into Chaurijahari only 40 kg seeds every year (at a transport cost of only Rs. 125) to produce the seed for the area.

In 1982 wheat season, eight farmers were asked to grow seeds of UP 262 for two purposes: 1) for demonstration and 2) for seed. The total area of about 2.00 hectares was planted to UP 262. Agronomists and Field Assistants of the CSP assisted the farmers in growing the crop. Off-types were removed from the plots before harvesting.

At harvest, the eight farmers were asked to keep their harvest for seed. The CSP informed the farmers that they would be given the following a assistance if they keep their harvest for seed until the winter of 1982.

- Plastic bags and sacks for keeping the seeds,

- Celphos tablets to treat the seeds,

- Assistance to market the seed to farmers in the area or adjoining Panchayats,

- Loan upto 75 percent of the value of seed to be re-paid back immediately after sale of the seed.

- Assistance to treat the seeds with insecticide before storage.

Only four of the farmers finally agreed to keep their harvest for seed. Two of these are Field Assistants of CSF. All the four farmers received a loan for 75 percent of the value of their seed.

A total of 4.5 m.t. of UP 262 seeds was kept for seeds. The three farmers allowed their seeds to be treated with Celphos, one did not allow their seeds to be treated with any insecticide.

Polyethylene bags (300 mil.) were used to line the local Bhakaris or clay jars. The seeds were immediately kept inside the polyethylene bags after harvest. The average moisture content of the seeds was 11-12 percent at harvest time.

Germination test conducted on the seeds before seeding showed a high germination percentage of 90-95 percent on all the treated seeds. The untreated seed was heavily damaged by grain weevils, thus had only 70 percent germination.

No exact figure was available at the time of the writing of this report on the amount of seed sold but it is estimated that 95 percent of the treated seeds were sold. The untreated seeds were all sold for food.

The seeds were sold in cash, some in exchange for corn or rice equivalent to the value of the seed averaging Rs. 3.75 per kilo. The value of the seeds at harvest was about Rs. 1.80 - Rs. 1.90/kilo.

The farmers who engaged on the seed exchange consider it profitable but are faced with the question - "will they be able to sell the seed of UP 262 if they again grow it for seed?" "Will the ADO staff help them distribute the seed to other Panchayats?" "Will AIC compete with them in selling seeds to the farmers in the area?".

Parsa

Four farmers of Parsauni village of Parsa district were assisted to store their UP 262 harvest. These four farmers are participants in the pilot production program of CSF at Parsa. One of the farmers is a PLA of the ADO.

Assistance given to the farmers included: seeds of UP 262, fertilizer, technical assistance in growing the crop and in storing the seeds, plastic bags and Celphos tablets. All of those were given as loan to the farmers.

A total of about 2 m.t. were stored in plastic bags and treated with Celphos. The seeds had about 11 percent MC at harvest.

All the seeds were sold to farmers participating in the Badhi Utpadan Karyakram this winter. The germination of the seed was good - more than 90 percent.

A check made on the wheat seeds stored by farmers in the village had very high insect damage - about 40 per cent damage. Farmers complained high insect damage while seed is in storage as the main cause of the poor germination of their seed. To compensate for the damage, the farmers use about 50 percent more than recommended seeding rate, sometimes more. Consequently, many of them have to buy their seeds every planting season.

Most of the farmers in the area are small, poor farmers and could not afford to store their harvest and sell it for seeds 8 months later. Only two of the farmers keep seeds for sale in the future - one of them is the present Pradhan Pancha of the village who is better-off than the other farmers in the village, the other one is the PLA of the village.

Lele

Eight farmers who participated in the Badhi Utpadan Karyakram during the wheat crop of 1982 were encouraged and assisted to keep seeds of RR 21 wheat for seed purpose. A total of 4.5 m.t. of seeds were stored in metal bins and treated with Celphos tablets. The moisture content of the seed was high at harvest time (about 14 percent) and had to be sun dried for a few days to bring down the moisture content to 12 percent MC.

The farmers had difficulty drying the seeds as it was cloudy for about a month after harvest. Luckily, the farmers had only about 0.5 m.t. each to dry. Any amount more than 0.5 m.t. each farmer would have been impossible for them to sun-dry well to be kept as seed.

The assistance given to the farmers included: loans for seed and fertilizer, technical assistance to grow the crop, metal bins to store the seed and Celphos tablets. The metal bins used were provided by the Rural Save Grain Program of HMG and FAO. A loan equivalent to 75 percent of the value of the seed was also provided to two farmers by ADB/N.

The seed had 90-95 percent of germination at seeding time. About 4.4 m.t. were sold as seed, the rest were used for food.

Recommendations

This one year experience of growing seed in the village makes us confident that this is one strategy which could be used to spread rapidly to more farmers of Nepal the seeds of the new varieties of rice, wheat, corn and other crops.

We are confident that some of the farmers in the villages of Nepal could be trained to grow the new varieties and store their harvest for seed. The use of metal bins and polythylene bags to maintain the moisture content of wheat seeds at about 12 percent has worked well. And the use of Celphos tablets has proved effective in keeping the seeds free from insect damage. Furthermore, the practice is simple enough for the ordinary farmers to adopt. And inexpensive. Similar simple, effective and inexpensive methods of storing seeds are now available and could be used.

The strategy has provided the seed supply needed by the farmers in the villages at the time the farmers needed the seed and at less expense to the government. The same strategy could be tried in other villages of Nepal and should succeed provided the following support is provided:

1. AIC should provide to the farmer cooperators timely supply of good seeds of rice, wheat, corn or other crops appropriate to the area. The quantity of seed to be provided would be dependent on the expected demand of the new variety the succeeding year. This means then that the varieties to be sent to different areas for seed multiplication in the village will be determined by the local ADO staff and the local seed producers and not by the centre.

2. Provide loans to the participating farmers who need loan for (a) fertilizer, insecticide and sprayer; (b) seed bins or polyethylene bags, jute bags, Celphos, etc. and (c) a consumption loan equivalent to about 75 percent of the value of the seeds.

3. As incentive to the farmers, the government should subsidize the cost of the seed by 50 percent, cost of insecticide (Celphos or Malathion, etc.) by 50 percent, and cost of seed bin.

4. Train all the JTs, JTAs, who will be engaged in the program.

5. Give incentive cash award to all the JTs and JTAs who successfully organize and run a seed production program which produce at least 10 m.t. seed per year.

6. The AIC will not compete with the local seed producer. This means that AIC may stock some seed in the area, if needed, but should never sell seed in the area until the seed produced by the farmers are all sold out.

This strategy of producing seeds in strategically selected villages in the district (may be one village for every two to three Panchayats) should provide the following benefits:

1. Provide timely availability of seeds in the village.

2. Reduce the cost of producing and transporting seeds especially to villages which are difficult to reach.

3. Accelerate the spread of the new high yielding varieties of crops to more farmers.

Table 1

NUMBER OF WHEAT SEED PRODUCERS, QUANTITY OF SEED AND GERMINATION

SEED PRODUCTION AND EXCHANGE PROGRAM, 1982

| Location | Variety | Area (Ha.) | No.of Seed Producers | Quantity of Seed Stored (m.t.) | Germination % before Seeding |
|---|---|---|---|---|---|
| Chauri Jahari | UP 262 | 2.0 | 4 | 4.5 | 90% + |
| Parsa | UP 262 | 2.0 | 4 | 2.0 | 90% + |
| Lele | RR 21 | 5.5 | 8 | 4.5 | 90% + |

Table 2

QUANTITY OF SEEDS SOLD, SEED PRODUCTION AND

EXCHANGE PROGRAM, 1982

| Location | Variety | Quantity Stored (m.t) | Quantity Sold/ Exchanged (m.t.) | % Sold Exchanged |
|---|---|---|---|---|
| Chauri Jahari | UP 262 | 4.5 | 4.2 | 93% |
| Parsa | UP 262 | 2.0 | 2.0 | 100% |
| Lele | RR 21 | 4.5 | 4.4 | 97% |

## SEED PRODUCTION AND EXHCANGE PROGRAM

### Introduction

This is a program to produce quality seeds of corn, rice and wheat in the village and exchange in kind to the farmers in the village. Some 3-5 farmers in each of the selected villages, who are participant in the cropping systems pilot production program, will be selected and assisted to grow, process and store for seed purposes new variety or varieties of rice, wheat and corn.

### What is the Objective of the Program

The main objective of the program is to develop a system to grow in the village sufficient quantity of high quality seeds of newly recommended varieties of rice, wheat and corn. Specifically, the program aims to:

1. develop seed growers in the villages who could grow season after season seeds for the other farmers in the village or adjoining villages.

2. develop the skills of selected farmers on the appropriate procedures for harvesting, threshing, cleaning, drying, seed treatment with insecticide and/or fungicide, bagging and storage of rice, wheat and corn for seed purpose.

3. provide farmer participating in the cropping systems production program quality seeds which they could obtain by merely exchanging their own harvest at a reasonable exchange rate.

4. provide additional income to farmer leaders in the villages.

### Who can be Cooperators for the Seed Exchange Program

1. Farmer who is a member of the production program.

2. He must own and operate at least 1 hectare of land (for terai) and 0.6 hectare of land (for hills).

3. He is a respected farmer leader in the community.

4. He is a known "innovator" in the village, and

5. PLAs or production leaders. (These farmers should be given priority).

### How will the Seed Production and Exchange Cooperators be Selected

The JTAs or Agronomist working in the area should carefully select the cooperators for the program. Here are some suggested steps which should be done in the selections of cooperators:

1. Ask farmers in the village who in the village would they go to exchange or buy seed if they need seeds. There are at least 2 and 3 farmers in every village who have a reputation of keeping good seeds.

2. Meet individually with these farmers and determine their capability (knowledge and skills in farming and seed storage) and the suitability of their farms for seed production.

In the terai, a farmer who owns at least 1 hectare of irrigated land and is using new recommended technology would be a good prospect.

In the hills, a farmer also owns 0.6 hectare and is how using new varieties of rice, wheat and corn and uses compost and fertilizer would be preferred.

The farm should be inspected and checked for accessibility distance from irrigation canals (for the terai) problem on monkeys, stray animals rats etc.

3. The prospective cooperators should be individually interviewed to determine their interest and willingness to engage in a seed exchange program.

<u>What are the Benefits to the Cooperator</u>

1. He will be given special technical assistance by the JT, JTA in the area and/or the Cropping Systems Agronomist to help him in increasing his total farm production.

2. He will be always the first receipient in the village of any of the new seed or rice, wheat and other crops.

3. He will be given loan assistance for production and for engaging in the seed exchange program.

4. He will get higher price for his produce of rice and wheat thus giving him bigger profit. A farmer who will produce and exchange 2 m.t. of seed will have at least Rs. 1,000 additional income.

<u>Wheat are the Rules for Growing and Storing Corn, Rice and Wheat for Seed</u>

1. Farmers who are interested to join as seed exchange cooperator must register with the JT, JTA or Cropping Systems Agronomist in the area, as seed production and exchange cooperator.

2. Seeds used in the production program should be foundation seeds or seeds from cropping systems research or production blocks certified by the cropping systems agronomist in the area.

3. The farmer uses the package of technology recommended by the cropping systems program in growing his crop.

4. The local JT or cropping systems staff supervises rouging of all the off-types at flowering time.

5. Harvesting, threshing, drying and cleaning is supervised by the JT or CSP staff. Seed should be dried to less than 12 percent M.C. for wheat and 13 percent M.C. for rice and corn.

6. The CSP Staff or JT will supervise seed treatment and bagging. Rice seeds will be treated with Malathion and wheat seeds will be treated with Malathion + Vitavax. Only recommended plastic bags should be used. Bagged seeds should be kept in dry storage room. Storage room will be sprayed with insecticide before storing bagged seeds. Or, the seeds should be stored in metal bins designed for seed storage.

7. The CSP staff or JT will check seeds for insect damage and take moisture content test of the seed every month. Seeds should be re-dried and re-treated if moisture content exceeds 13 percent M.C. for rice and 12 percent M.C. for wheat.

8. Germination test will be conducted before storages and two weeks before sale or distribution of seeds. Seed with less than 80 percent germination should not be sold or distributed.

Packaging and Tagging of Seeds

The seeds will be treated and bagged immediately after drying. A 0.3 mm gauge poly-bag will be used. The bag will be tied tightly to reduce the entry of moisture inside the bag. Each bag of wheat will contain 12 kilos of seeds and for rice, 12.5 kilos. Each bag will be tagged with name of cooperator, variety, seed treatment, date harvested and percent of germination indicated in the tag.

Metal bins will be also used to store at least 1/3 of the total seed handled by each cooperator. This is done to compare the efficiency of metal bin storage vs. plastic bags.

How and When Should Seed Exchange be Done

Seed exchange can be done soon after seeds are bagged after harvest or anytime before seeding time.

The JTA, PLA or CSP staff in the area will inform the other farmers in the village of the name of the seed exchange cooperators and encourage them to exchange their produce with the treated seeds of the seed exchange cooperator.

The role of the local JTA, PLA or CSP staff in encouraging the farmers to exchange seed would be vital in the success of the program. It is important that all the treated seed must be disposed to encourage the cooperator to continue with the seed exchange activity the following year. They must inform the farmers in the village and the adjoining villages of the high quality of the seed.

The exchange rate shall be fixed by the seed cooperators themselves but it should be equivalent or less than the price of the AIC. As a general rule, the seed exchange rate should provide the cooperator a 20-25 percent net profit if he keeps the seed for one year and 5-10, percent net profit if he exchange the treated seeds at harvest time.

Loan Assistance to Seed Production and Exchange Cooperator

Farmers usually consume most of their produce. Or, if they have excess, they usually sell the grain immediately or sometime after harvest.

To encourage farmers to keep their harvest for seed exchange, a loan equivalent to 75 percent of the value of their seed will be granted to them by ADB/N when they need cash but the loan should not exceed Rs. 3,850 per farmer.

In addition to this, they will be assisted in acquiring seed bins. They will be given 25 percent subsidy by the government on actual cost of bin and a loan from ADB/N equivalent to 50 percent of the cost of the bin.

PROGRAM FOR 1983

Targetted Seed Production
(Metric Tons)

| | Rice | Wheat | Corn | No. of Cooperators |
|---|---|---|---|---|
| Parsa | 6 | 6 | - | 6 |
| Khandbari | 2 | - | 1.5 | 3 |
| Chaurijahari | - | 4.5 | 1.0 | 6 |
| Lele | 2.5 | 6 | 0.5 | 10 |
| Pumdi Bhumdi | 2 | - | 1.0 | 8 |
| Total | 12.5 | 16.5 | 4.0 | 33. |

# FARMERS SEED BANK

## A SUCCESS STORY IN PRIVATE SEED BUSINESS

Purna B. Bajracharya
ADO, Nuwakot

Improved and high quality seed plays an important and major role in crop production program. If we cannot maintain high quality seed supply the costly imported fertilizer may give negative return.

In the hills, every farmer keeps his own seed either individually or collectively. But his seed keeping conditions are local and traditional. Technically, a farmer handles seed and grain in almost same pattern. He is unable to maintain true type of variety seed, storage condition is bad and no insecticide/fungicide treatment is given. So his seed is almost insect and disease comtaminated, lacks germination and is poor yielder. Farmers generally use high seed rate to ensure poor seed germination compared to recommended seed rate. They practice thinning in dense plantation and sometime do double sowing or adopt mixed sowing to safeguard against crop failure.

Hence, due to these seed problems farmers come to agriculture extension office to complain that their seed is giving poor yield, more disease and insect attack and poor response to fertilizer and sometimes results in lodging. Finally they ask ADO to get new high yielding variety seed. If ADO has some good new variety minikit seed, he gives that seed to satisfy the farmer, if not ADO advises to go to AIC office to change the seed stock. From AIC he gets nicely bagged and colourful fungicide-treated seed with full confidence of germination and variety type to get high yield. But unfortunately he is not satisfied with that seed too and comes again to complain that he got many off type plants, disease problem and sometimes poor germination. He fails to get any difference between the costly purchased seed and his own seed. So every time it is a tricky problem for us to deal with.

Rasuwa-Nuwakot is the integrated rural development project area. It has to cover more than 10,000 ha land with improved wheat seed. But if we see the improved wheat seed sale, it hardly covers 5 percent of the target area. So it has lead to a pressure to improve certified seed sale or to improve farmers' locally preserved seed. Almost all co-operatives are inactive in seed sale and it is not in our hand to strengthen the seed sale and distribution through co-operatives. The traditional local small scale seed production, storage and farmer to farmer exchange in the hills is the only sound mechanism for seed supplies of new improved varieties. So there is a felt need for maintaining the genetic, physiological and physical quality of farmer to farmer supplied seed in the hills which covers 90 to 95 percent of improved wheat seed area.

Non-availability of high quality foundation seed, lack of well-managed infrastructure of seed production, and an ineffective seed quality control and certification system are the main problems in the hills. However, good seed production and distribution is a vital activity for the success of the crop production program.

In Nuwakot district, SPISP and ADO office are trying to develop seed business as a private farmers' enterprise. This time we have farmers' seed banks in different farm areas, which are locally-managed farmers own seed deposits banks within a command area of a model extension farm where one or more groups of functionally homogenous farmers produce, process and store the seed to maintain genetic, physiological and physical quality of seed in close supervision and control of the farm experts. Finally this type of bank also serves as a seed exchange and sale counter of a village.

With the implementation of this model, this wheat season we have no problem of wheat seed. Farmers stored more than 35 m.t. of wheat seed with close supervision of farm experts.

The physical facilities provided to the farmers seed bank are:

1. Subsidized metal seed drum.
2. Fumigation material (Celphos).
3. Vitavax and other treating chemicals
4. Seed cleaner
5. Foundation seed/certified seed/minikit seed
6. Seed treating drum
7. Germination test and moisture tester
8. 25 percent packing charge with farmers own trade mark
9. Close technical supervision in the field and storage
10. Rigorous training in seed production and storage
11. Transportation of seed.

<u>Silent Impact of seed bank model:</u>

1. Timely availability of seed
2. Cheap rate
3. Good quality seed

4. Assured germination
5. Less transportation, storage and handling problem
6. Matching demand and supply
7. Fast saturation of the area with improved seed
8. Increase in production per unit area.

# HOW TO PRODUCE HEALTHY RICE SEED: A PROPOSAL

Bharat P. Upadhyay
Parwanipur

## Introduction

Almost 90 percent of all food crops grown on earth are propagated by seed. Nine crops are of major importance; wheat, rice, maize, barley, sorghu, sugarbeet, common (phaseolus) bean, soybean, and groundnut, representing by far the greater part of food production in the world (Neergard, 1977). All these crops are attacked by devastating seedborne diseases. In Nepal, rice seeds have been reported to be attacked by a number of pathogens (shrestha, 1978 and 1979). Some of them are known to cause considerable losses (Upadhyay and Thapa, 1978 and 1979, Thapa, 1983). Case studies and field survey reports of Plant Pathology Division indicate that the economic significance of such seed-borne diseases of rice can not be overlooked.

## Objectives

The objectives of this paper are:

1. To review seedborne diseases of rice of economic importance;

2. To present a proposal for producing healthy seeds of rice;

3. To recommend some measures against the background of presently available information to control seedborne diseases of economic importance;

4. To highlight problems and some suggestions to solve them.

## Suggested Operational Procedures

This paper aims at suggesting how to produce healthy rice seed rather than how to test the health of rice seed. Therefore, an attempt is being made through this paper to put forward some measures of producing healthy rice seeds which will be beneficial to the seed growers. Since available information with us on this aspect is at present incomplete, these operational procedures will naturally possess some limitations, which we have to consider in the future.

Agro-climatic conditions prevailing during rice growing season in Nepal are such that rice crop and later rice seeds become vulnerable to many kinds of fungi, bacteria and nematodes. Pyricularia oryzae causing rice blast, Drechslera oryzae causing brown spot and Xanthomonas oryzae causing bacterial blight are the three major seed-borne pathogens of rice. Besides them, Cercospora oryzae causing narrow brown spot,

Rhynchosporium oryzae causing leafscald, Aphelenchoides oryzae causing white tip and Sclerotium oryzae causing stem rot are some other seedborne pathogens whose occurrence is often reported but they are not known to cause economic losses in Nepal.

Among the above mentioned three major diseases, bacterial blight (X.oryzae), although reported to be seedborne, is more airborne than seedborne and is not reported to harm the rice crop from seedborne inoculum as the causal bacteriem is unable to survive in seeds for more than 60 days. Therefore, major efforts are directed towards developing strategy of producing healthy seeds by controlling two most notorious fungi infecting rice in Nepal, Pyricularia oryzae and Drechslera oryzae (Helminthosporium orzae) which cause both direct and indirect losses. The direct loss is due to seedling blight in the nursery and the indirect one due to impaired seed quality. Very recently, Tulachan (1983), Shrestha and Bhardwaj (1983) and survey reports of Plant Pathology Division have shown that rice blast can cause upto 90 percent mortality of seedlings of Masuli variety in the nursery. Damage due to seedling blight caused by Helminthosporium oryzae has been serious, specially in Bhairahawa and Parwanipur areas (Upadhyay and Thapa, 1977, 1978 and 1979). In Bhairahawa, this fungus is known to impair seed quality to a greater extent. Considering the economic significance of these two fungi under our field conditions, the following measures are proposed to control them:

Measures of producing healthy rice seed can be categorized into three:

1. Seed crop management,

2. Management of seed storage, and

3. Seed treatment.

The responsibility for the seed crop management solely lies with the seed grower, whereas the concerning seed agency (AIC) has to take care of managing seed storage and treating of seeds.

1. Seed crop management

   a) Location of seed production - It is suggested here that blast susceptible varieties Masuli, Bindeswari and CH 45 should not be grown for seed production in areas such as inner terai, river basins and foot hills because of prevalent climatic conditions conducive for blast development.

      Soils with poor drainability, poor nutrition and heavy structure should be avoided for seed production due to higher incidence of brown spot in such soils.

b) Cropping pattern - Plots where rice-rice-wheat pattern is followed should be avoided for seed production. Such plots have higher incidence of brown spot, sheath blight and bacterial blight due to continuous availability of same and/or related hosts. Some of the suggested cropping patterns for rice seed are mung-rice corn, vegetables-rice-wheat, mung-rice-mustard, rice-wheat-follow, etc. The main point to be considered is that continuity of rice-rice, or rice-wheat should be broken.

c) Selection of cultivars - In blast prone areas like inner terai, river basins and foot hills, blast resistent cultivars Janaki, Laxmi, Sabitri, Durga, Kanchan, Himali should be grown. So far resistent cultivars against brown spot are not available.

d) Reduction or elimination of seedborne inoculum - A seed grower should make seed treatment with recommended chemicals a regular procedure before seeding. The recommended chemicals for rice seed treatment are as follows:

| Pathogen | Treatment (dosage per 100kg |
|---|---|
| Drechslera oryzae | Organomercurials 250 g.; |
| (Brown spot) | Thiram 200-250 g. |
| Pyricularia oryzae (Rice Blast) | Benomyl 400 g. |
| Other seedborne diseases | Thiram 200-250 g. |

e) Adjustment of cultural practices - For seed production, some suggested adjustments of cultural practices to be followed are:

i) avoiding dry seedbed to prevent rice seedlings from blast. Wet seed bed is to be preferred.

ii) avoiding selection of plots with wind barrier plants for seed bed preparation,

iii) earlier planting is preferred,

iv) wider spacing of plants

v) avoiding acidic soils to minimize bacterial blight or alkaline soils to minimize brown spot and zince deficiency; neutral soil preferable,

vi) applying only recommended dose of fertilizers; a combination of N, P, and K, must be applied to create nutrition-balance in soil.

f) Chemical protection of seed crop - This is the most important aspect that a good seed grower must consider in order to produce disease - free seed. This is the step which distinguishes normal rice crop from the seed crop. The concept governing this recommendation is "healthier seeds grow from healthier plants". This aspect is not at all followed at present for rice seed production. Of course, a compromise between the cost of this practice and quality of seed produced has to be made. The suggested schedule for chemical protection is given below:

| Stage of the crop | Treatment | Purpose |
|---|---|---|
| Before transplanting | apply 15-20 kg Zn as $So_4$ per ha. as basal | control zinc deficiency |
| Maximum tillering | for terai | |
| | spray Dithane M-45 twice @ 0.3% solution at an interval of 10 days | control brown spot and other foliar diseases |
| | for hills | |
| | spray Hinosan 50-EC once @ 0.1 percent solution | control leaf blast. |
| Flowering stage | Repeat the same practice as recommended for maximum tillering stage | same as above |

The above schedule of chemical protection must be adopted as a regular practice by a seed grower and the seed inspector should supervise.

g) Precautions to be taken at harvesting and processing of the seed - This step is also crucial from the point of view that seeds obtained by adopting above practices may be contaminated with fungi and bacterias if proper precautions are just not taken at and after harvesting.

2. Management of seed storage

Conditions for proper storing of seeds are to be determined by concerning agency and its staff. This is not within the subject of this paper. However, the basic concept is: the longevity of seed kept in storage is predominantly dependent on the moisture content of the seed, and the temperature and relative humidity in the store room. High moisture content in the seed provides

conditions favourable for spread and establishment of fungi and bacteria in the seed and for establishment of an escalating process involving increase in respiration, water content, and temperature of the seed causing accumulation of toxic waste products, resulting in a rapid decline of seed vitality and germination capacity. Naturally, higher temperatures in the store room will enhance this process. When seeds are kept at temperatures of about 20°C, the relative humidity of the atmosphere must not exceed 60 percent. At temperatures between 4°C and 10°C, which are favourable for storage of most kinds of seed, humidity may be maintained at a level not exceeding 70 percent.

3. Seed treatment

Seed treatment is probably the cheapest and often the safest method of direct plant disease control. Relatively small quantities of plant material are handled, and in principle there is every possibility that all the seeds are in fact treated (Neergard, 1977).

In fact the seed marketing agency (AIC) must adopt the policy that whatever seeds are sold to the farmer must be treated as recommended. However, some general principles of seed treatment must be considered:

a) Seeds should be treated with proper does of the recommended chemical,

b) Suitable method should be followed for seed treatment,

c) Seeds to be treated must be of high quality meaning that they should satisfy all the requirement for seed certification.

The chemicals for rice seed treatment are organomercurials such as Agroran GN, Ceresan dry, Thiaram such as Thiride 80 WP and Benomy l (Benlate 50 WP). The recommended dosage for these chemicals is given in earlier discussion.

A Case of Masuli

If there is any case of success that our varietal development effort can boast of it is the Masuli. Today, this is no longer an exotic cultivar, rather a local one. Because of wider adaptability, moderately higher yield and better quality, it has spread to its greater extent. The situation is that we cannot control its spread. Unfortunately, this spread may be detrimental as this cultivar is suceptible to blast. In fact, very recently several reports of severe blast incidence in Masuli are coming to our notice. Most of these cases are related to leaf blast in the nursery bed. In view of the popularity of Masuli and its susceptibility to rice blast, a compulsory seed treatment scheme is being proposed. All the seeds being sold to farmers must be treated with Benlate 50 WP. at the rate of 8 gm/kg. This recommendation is based on our field evaluation test done by adopting seed treatment with systemic fungicides. The result of our experimentation is summarized below:

Table 1

EFFECT OF SEED TREATMENT WITH SOME SYSTEMIC FUNGICIDES FOR LEAF BLAST CONTROL, KHUMALTAR, 1981

| Treatment | Fungicide per kg/seed | Masuli lesions (no/seedling)[a] | Sankharika lesions(no/seedling)[a] |
|---|---|---|---|
| Control | - | 35.4 | 42.8 |
| CGA 49104 | 40 g | 0 | 0 |
| | 32 g | 0 | 0 |
| | 16 g | 0 | 0 |
| PP 389 JF 5816 | 40 g | 0. | 0 |
| | 32 g | 0.8 | 1.2 |
| | 16 g | 0.6 | 1.8 |
| Benlate | 40 g | 4.3 | 5.6 |
| | 32 g | 5.0 | 4.8 |
| | 16 g | 5.3 | 6.2 |
| | 8 g | 7.8 | 11.6 |
| Vitavax | 3.2 g | 34.6 | 35.2 |
| | 2.8 g | 44.3 | 46.7 |
| | 2.4 g | 38.4 | 42.0 |

[a] Mean of 25 seedling. Data recorded at 3 weeks after seedling.

## Problems and Suggestions

The following suggesties can be made:

1. Seed certification scheme for rice should be started.

2. More trained manpower should be made available for field and laboratory evaluation.

3. Existing manpower should be trained.

4. The Plant Pathology Division should strengthen efforts on seed health and seed pathology research.

## Literature Cited

1. Neergard, P. (1977). Seed Pathology VSI. I. Macmillan Press Ltd.

2. Shrestha, S and L. Bharadwaj (1983). Effect of sowing dates and nitrogen level on leaf blast. Paper presented during 10th Summer Crops Workshop, Rampur, Jan. 23 - Jan 29, 1983.

3. Tulachan, P. (1983). Some notes on paddy cultivation in Chitwan District - A Case of Sharadanagar Panchayat, 1982, A Paper presented during Summer Workshop, Rampur, 1983.

4. Upadhyay, B and B. Thapa (1977, 1978 and 1979). Disease Reports Presented in Summer Workshops.

# SEED PATHOLOGY AND ITS ACTIVITIES IN NEPAL

Krishna Shrestha,
Plant Pathologist,
Plant Pathology Division
Khumaltar.

## Introduction

In recent years, there has been a great realization among the agriculturists, seed growers, seed traders and other concerning agencies around the world that the testing of seeds for purity and germination is not adequate and, alongwith this, some appropriate methods for testing the presence of infectious seed-transmitted organisms are needed to determine the quality and health of seeds. It is known that seed-borne pathogens (fungi, bacteria, nematodes, viruses and mycoplasma) affect directly or indirectly the quality and germination of the seeds due to the following effects:

1. Killing the seeds or damaging the embryo.

2. Attacking the seedlings before or immediately after emergence (pre- or post emergence attack).

3. Spreading from seedling to seedling along the rows.

4. Contaminating soild with the pathogens.

It is difficult to detect the symptomless internal seed-borne diseases with visual examination. To solve this problem routine seed health testing program has to be established in each seed development laboratory of the country. Dr. S.B. Mathur, Director of Danish Government Institute of Seed Pathology for Developing Countries, Denmark has also emphasized in his "Visiting Report, Nepal" that more plant pathologists should be trained in seed pathology and seed health testing to fulfill the requirement of trained personnels in each seed development laboratory of the country.

The pioneer seed pathologist, L.C. Doyer (1938) had developed many different techniques and rules for investigation of seed-borne diseases. According to her, seeds could play a vital role for production of healthy crops. While studying the sanitary condition of a seed sample, it is advisable to look at the sample wheather it contains any visually recognizable carriers of diseases or symptom of infection on seeds. Neergaard (1977) mentioned that about 90 percent of all food crops grown on the earth are propagated by seeds and may be attacked by devastating seed-borne diseases.

The importance of seed pathology in Nepal was recognized for the first time in 1972 when the Plant Pathology Division, Department of Agriculture, initiated a program on the investigation of major seed-borne diseases and their economic importance with possible control measures. At that time, former chief plant pathologists, Bed Bahadur Khadka and S.H. Shah had encouraged and guided me in this field. During my research period, I noticed that a number of pathogenic organisms were introduced in the country along with the introduction of high yielding improved seeds from other foreign countries. As a consequence, many new dangerous diseases had been spread in the country causing significant losses in production. In fact, it also disturbed the equilibrium in host parasite relationships. A few instances are cited below: bacterial leaf blight (Xanthomonas oryzae) of rice, Karnal bunt (Neovossia indica) of wheat, white blight (Sclerotinia sclerotiorum) and downy mildew (Peronospora parasitica) of cauliflower, Alternaria leaf spot (Alternaria brassicicae and Alternaria brassicicola) of crucifers etc.

With a view to detect important seed transmitted diseases, I have been trying to investigate such pathogenic seed-borne organisms in cereals, vegetables and other important crops which are commonly grown by our farmers. The first list of seed-borne organisms was published in 1977 (Shrestha 1977). Other works on seed health testing were also reported from time to time. So far 80 organisms representing 30 genera have been recorded as seed-borne organisms in the various crops of Nepal. Some of them have been observed to be considered as economically important in the country. Much work has to be done as far as testing of seed for health is concerned.

## Seed Health Testing and Recommendation

Representative seed samples received from Agricultural Botany Division, Agricultural Input Corporation, seed growers, farmers, seed traders etc. are being tested following the modified rules mentioned in International Seed Testing Associations' Proceedings (ISTA, 1966). After testing the samples, if necessary, we recommend the respective seed senders to use suitable control measures before seeding in their fields. Besides, we used to publish booklets, pamplets regarding seed-borne diseases, seed health testing and seedtreatment fungicides etc. regularly for the benefit of the farmers.

## Present Seed-Borne Disease Problems in Crop Production

Various crops in Nepal suffer heavily from important diseases outbreak. Although efforts in increase productivity through the introduction of high yielding improved varieties and implementation of advanced technology have been pursued but some of the major diseases such as blast, brown spot and bacterial leaf blight of rice; loose smut, bunt, and karnal bunt of wheat, downy mildew and white blight of vegetables and beans are threatening the present economy of the country. However, it is rather difficult to establish a direct relation between looses at harvest and the amount of inoculum present in the seeds. So far, actual

crop looses due to seed-borne diseases has not been calculated statistically, but according to a survey report, crop losses have been estimated from 10-15 percent annually in the country. Further, I would like to mention a few examples of crop losses due to seed-borne diseases reported in other countries. The most notorious case was the outbreak of Brown spot (Drechslera Oryzae) in Bengal, India in 1942 by which 50-90 percent of rice crops were destroyed (Padmanabhan, 1973). In 1961-71, the losses in wheat production due to loose smut were encountered upto 40 percent in north-western India (Joshi et al, 1973). Sinclair (1979) mentioned that bacterial pustule of soybean is quite conspicuous in Nepal and probably causes limited losses in yields due to leaf damage. According to him, it may cause more than 50 percent yield loss. Late wilt of maize, a major disease in India and Egypt has not been reported from Nepal and is seed-borne. It represents a definite threat but is probably already present in the terai as it is prevalent in adjacent areas of India. (Renfro, 1982).

Seed Treatment

The main objective of seed treatment is to prevent infection of seeds, seedlings and the subsequent crops by killing or inactivating the seed-borne organisms in or on the seeds. Normally seed treatment is a cheap as well as an easy measure to control seed-borne diseases in the field conditions. Since 1980-81, Plant Pathology Division has launched a loose smut control campaign in certain areas in coordination with Agricultural Input Corporation and concerned District Agricultural Offices. In the same year, certain quantities of Vitavax-200 were distributed to the farmers free of cost in the following districts and also used in demonstrations:

| S.No. | Districts | Quantity of Vitavax-200 distributed in (kg) (81-82) | Quantity of seeds treated by farmers (m.t.) | Approx area covered with treated seed (ha) | % of disease control |
|---|---|---|---|---|---|
| 1. | Kathmandu | 500 | 250 | 2080 | 75-100 |
| 2. | Lalitpur | 72.5 | 29 | 240 | 70-90 |
| 3. | Bhaktapur | 177 | 88 | 740 | 50-80 |
| 4. | Kavre, Dhulikhel | 250 | 120 | 1040 | 70-100 |
| 5. | Nuwakot | 24 | 12 | 100 | 50-80 |

From this table, it is clear that the result is quite effective. Loose smut disease was controlled 50-100 percent in seed treated fields. The farmers from all the districts were quite impressed with this program. Likewise, other seed dressers such as Thiride, Captan, Dithane M-45 etc. are also effective fungicides in controlling external seed-borne disease and seedling blights of cereals, vegetables and other crops. With this experience, if we guide and train the farmers practically with seed treatment technology, production could be increased tremendously.

At the end, I would like to call attention to certain points which I think, must be brought into focus to minimize the problems due to seed-borne diseases:

1. A regular survey and surveillance should be carried out to know the incidence and losses caused by seed-borne disease in the cultivated areas.

2. Establishment of national and international co-operations for investigation of seed-borne diseases and their control measures in the country.

3. Strengthening plant quarantine policy and its implementation (Plant Quarantine Act and Rules, HMG/Nepal.)

## REFERENCE

Anonymous (1966). International Rules for Seed Testing Proc. (31 (1), 107.110).

Anonymous (1972) Plant Protection Act and Rules, HMG/Nepal

Dover, L.C.(1938) Manual for the determination of seed-borne diseases Holland.

Joshi, L.M., S.D. Gera and E.E. Saari (1973). Extensive cultivation of Kalyansona and disease development. Indian Phytopath. 26:370-373.

Mathur, S.B. (1982). Follow-up Report on Institute' former Scholars from Nepal.

Neergaard, Paul (1977). Seed Pathology. The MacMillan Press Ltd. London.

Padmanabhan, S.Y. (1973). The great Bengal famine. Ann. Rev. Phytopath. 11:11-26.

Shrestha, K. (1977). A list of seed-borne organisms in Nepal. Nepal.J. Agric. 12:217-224.

Shrestha K. (1971-76). Seed-borne microflora on local rice seed. Nep. J. Agric. 6-11:145-152.

Shrestha, K. (1977). Seed-borne organisms in some crops of Nepal. Seed Sc. and Tech. 5:111-121.

Shrestha, K. (1979). Seed-borne organisms of rice on Blotter. Nep. J. Agri. 14:133-139.

Sinclair, J.B. (1979). A report on Pathological problems of Soybean, in Nepal. Soybean Pathologist consultant. ICP.

Renfro, R.N. (1982). Strategy for the control of Maize disease in Nepal. IADS consultant for the ICP.

# ON PROTECTION AND STORAGE OF SEEDS AGAINST INSECTS

K.C. Sharma
Head
Division of Entomology
Khumaltar

## Introduction

Seed is a vital input for crop production. Crop yield is the function of seed quality and other requirements such as water, fertilizers pesticides etc. in response to specific needs of the seed variety. Even agronomic practices have to run according to the seed used. Healthy and vigorous seeds are therefore the first solid foundation on which a successful agriculture rests. Seed is alive material, hence it is influenced by factors such as temperature, humidity as well as its own physical and physiological state. Thus the micro environment where the seed is kept and it physical state have a great bearing on its storage.

Insects and other micro-organisms all work under a set of biological factors. These factors have to be regulated without affecting the seed quality.

Insecticides are often used to safeguard the seed against insects. Safe insecticides which do not poison the seed and keep the viability intact are few specially in our stage of seed keeping. Farmers have little opportunity to apply even these where the seed availability is limited and storage requirements are minimal. Use of local plant derivatives should be considered. Local environmental factors such as solar radiation, environmental aridity and coolness could also be utilized.

## Maintaining Seed Quality

The basic reason to store seeds is to retain their physiological quality through out the storage period by minising deterioration (The two most important factors which influence seed deterioration are relative humidity and temperature). Seed should be kept in inactive but viable condition if its viability is to be preserved. High moisture content and high temperature speed up the life processes of seed. For this reason the fundamental requirement for preservation of seed is low moisture. Low temperature is also helpful but not indispensable.

Factors that speed up the life processes of seed similarly accelerate the growth of infesting insects. Within certain limits, higher the moisture content of the seed and higher the temperature the faster these insects reproduce. Seed that is cool, dry, and free from dockage (dust or broken kernels) is unfavourable for insect development.

Rice and the maize weevils (Sitophilus oryzae and S. Zeamays) the most serious pests of the stored grain cannot breed in seed with a moisture content of 8 percent or less, and they soon die if restricted to such seed condition; mites require even higher moisute content, they are not troublesome in seed unless the moisture content is above 12 percent, Moths such as the Indian mealmoth (Corcyra cephalonica), the mediteranean flour month (Ephestia Kuehniella) and the almondmoth (Ephestia cautella) and the flour beetles (Tribolium spp) are capable of breeding in seed almost devoid of moisture. Flour be tles are not troublesome in dry clean seed if free from broken kernels since the young larvae find it difficult to attack the undamaged seed.

Temperatures above 35°C are not favourable for the development of most seed infesting insects and temperatures below 20°C greatly retard their development. A temperature of 18°C prevents the reproduction of flour beetles and 15°C is approximately the lowest temperature at which the rice and maize weevils reproduce. Tyroglyphid mites are somewhat more hardly; they are reported to breed in seed kept between 5-10°C but only when the seed moisture is above 12 percent. Reproduction of confused flour beetle (Tribolium confusion) in wheat increases with the increase in temperature, grain moisture and amount of dockage.

## Source of Infestation

Most of the insect pests of seed are good fliers, and infestation may occur in the field before harvest. Infestation in the field is of considerable importance with seeds of legumenous crops. These seeds are attacked in the field by bruchid beetles and most of the species continue to breed after the seed is harvested and placed in storage.

Usually, however, infestation occur after the seed is harvested and placed in storage. The insect pests of stored seed are rather general feeders. They breed in feed and grain. Broken grains and dusts near Dhikhi, Jantho and Gatta as well as storage harbour them. Infestation results from storage in bins that are not thoroughly clean and are in the area near the sources of infestation.

## Bin and Warehouse Sanitation

After harvest, the seed should be sun-dried thoroughly and moisture content reduced to around 11 percent. Storage must be done in clean and insect-free premises. Care should be taken for surrounding area sanitation which also is a source of insect infestation.

Besides many types of seed storage methods one can see in villages, seeds are stored in Kothi (mudbin) Ghyampo (teracota bin) metal bin and in warehouses (only by Agriculture Inputs Corporation). The bins should be thoroughly cleaned and the walls and floors treated with residual spraybefore they are refilled. This will kill most of the insects that emerge from cracks and crevices of the mud bins and from ledges of the other bins.

The warehouses in which bagged seeds of the Agriculture Inputs Corporation are stored are of varying standards. Some of them are good and can be cleaned easily and tight enough for fumigation while others are poorly constructed. Every efforts should be made to eliminate dead spaces in walls and floors; they be kept clean of dust or accumulations of seeds. There should be adequate ventilation and light. Most insect pests of seeds need dark corners in which to hide.

Strict sanitation in the warehouse is imperative. Bagged seed should be stacked on wooden platform; one foot space should be left between the first stack and the wall. Enough space should be left clear to allow inspection and cleaning. As with the bins, preventive residual sprayings are periodically needed.

Spraying and Dusting

A. Protection spraying of the walls, roofs, floors

1.5 percent Malathion water dispersible powder suspension to the point of run off. Three to five litres per 100 sq. meter is about the right quantity.

In addition, Fenetrothion 50 EC in recommended dosage (0.05 percent) is currently allowed for treatment even for edibles (FAO and WHO). This could be tried in protective spraying.

B. Preliminary conditioning of the grain

Moisture affects the break down rate of the insecticide. Effective use of Malathion could be obtained when moisture is below 14 percent if the storage period is to be more than three months.

Use of Dusts For Protecting Seed

Of many dusts used to control insects some are inert which cause breaks in their waterproof fatty covering; their body moisture then evaporates through these breaks. Over 12 percent seed moisture retards the effectiveness of such dusts.

Poisonous dusts are effective regardless of the moisture content of the seed. Because surplus seed stocks often are fed to animals, poisonous dust are not very popular.

Fumigation

Fumigation is a rapid and effective method of destroying insect life in stored seed. Unfortunately many fumigants affect the viability of seed, particularly high doses and with high seed moisture and temperature and longer duration of exposure.

To avoid damage and loss of viability due to fumigation, seed should be fumigated only if the moisture content is less than 14 percent. Seed should be in bags to facilitate aeration, exposures should not exceed 24 hours and fumigation temperature should not be high, preparably 85°F or less.

The most commonly used fumigant in Nepal is Aluminium Phosphide and is used at the rate of 2-3 tablets/m.t. or seven tablets per $m^3$.

All fumigants are toxic to human beings if breathed in concentrated form. They should be applied only by professional fumigators or employees trained in their use and familiar with the precaution necessary to protect themselves and others in the establishment from exposure to disasterious contamination.

In conclusion one must stress that any single method of pest control is not perfect. Therefore chemical control must be in collaboration with sanitation and pest management in all levels of seed storage in Nepal.

# QUALITY ASSURANCE PROGRAM WITHIN A SEED ENTERPRISE

C.M. Manandhar,
Senior Agriculture
Officer, AIC.

## The Need for Quality Assurance Within AIC

If a seed program is to succeed, the seed of improved varieties supplied to the farmers must constantly be better than the ones the farmers produce themselves. For neither good quality seed of inferior varieties nor poor quality seed of superior varieties can serve the farmers well.

Also seed is not just some thing planted by farmers. It is the carrier of the genetic potential for higher crop production which needs to be maintained for subsequent years through multiplications. Because of the biological pressure on seed to alter its traits through subsequent generations the identity and desirable attributes of a superior variety of seed bred by the breeder as a result of years of hard work can soon be lost, if careful supervision and necessary quality control measures are not taken in the seed field. Because seed field is the birth-place of seed quality, strict quality control measures should begin from the seed field itself.

Besides, the concern for purity (genetically and physically pure seed) and concern for the physiological quality (Germination, vigour, test-weight etc.) should also begin from the seed field.

Seed is a living things. Like all living things seed degenerates with time and eventually dies. However in the life cycle of every kind of seed, between the development of seed and actual harvest, there is a certain stage when the physiological quality of seed is at its highest peak. (Highest germination, highest vigour and highest dry matter weight or test weight). This stage is known as the stage of physiological maturity and is usually attained long before we harvest the crop when the moisture content of seed is still fairly high and not suitable for mechanical harvesting and threshing operations with ease and safety. However with drying and aeration of seed such operations are possible.

With the objectives of harvesting seed corn at physiological maturity stage and maintaining its peak quality by immediate drying to moisture contents considered safe for storage, the corn-cob dryer in Hetauda seed Processing Plant was installed. The corn-cob dryer which is not operational at present, should be put to operation as soon as possible as a matter of priority and by doing so much of the quality problems we are facing now in corn seed will be lessened if not solved altogether.

The eventual death of seed is inevitable. However the rate of deterioration of the seed can be greatly minimized by proper seed drying and by providing proper storage environment. The purpose of proper seed storage is not to improve the quality of seed put in the storage but to minimize the rate of deterioration.

The point I want to stress at this stage is that the moment after the seed of any crop attains its physiological maturity, the deteriorative process starts. The process of seed deterioration is greatly accelerated by the temperature and moisture content of the seed. So one can well imagine as to what degree of seed deterioration must have been going on in seed between the time it is physiologically mature (40 percent moisture content in case of wheat) to the time it is actually harvested (the time of field maturity of crops), under the exposed field environment affected so much by the vagaries of the weather. During this period the seed is actually stored in the field and thus is in field storage. It is in this period of field storage that seed loses much of its quality. The deterioration of seed as a result of the field storage is not always reflected in the standard germination tests conducted on freshly harvested crops. It is, however, often reflected in vigour-rating of the seed in the form of uneven stand establishment under stress conditions, reduced storability over a period of time, increased susceptibility to disease organisms.

This is not surprising because standard germination tests are conducted in the seed testing laboratory by providing ideal or favourable conditions of temperature, moisture and light, that are not always readily available in the adverse conditions of the field. Thus the results of the standard germination test are not always a fool-proof index of quality in field conditions. That is why many of reputed seed companies conduct vigour testing as a part of their regular seed testing programs.

During farm level drying and threshing operations seed might physically be mixed between crops/varieties and the efforts made to ensure gentically and physically pure seed become futile. The mechanical damage inflicted on seed as a result of improper threshing/shelling machine adjustments (specially at too high or too low moisture contents) may render the otherwise good seed useless for planting purposes. Same is true after seed is brought in to the seed processing plant. The excessive speed of the elevators, excessive drying temperature all have significant bearing on the quality of the seed. Physical admixture between crops/varieties in the seed processing plants as a result of improper lot identification and carelessness in handling can ruin tons of good seed.

Improper drying of seed prior to packaging, inadequate packaging material and unsuitable storage conditions all help degenerate the seed in short period of time. Even during transportation, if proper care is not taken so as to avoid excessive humidity and heat the quality of seed can easily be deteriorated. The reason behind my pin-pointing of the many possible causes and places where seed is deteriorated/contaminated is that the seed quality control measures just do not begin or end in one particular place or time. Quality control covers a series of processes that should be followed.

Internal Quality Control

And maintaining good seed quality through all these steps requires knowledgeable and dedicated persons. Thus, leaving the concern for seed quality to one person or one organization only becomes a serious mistake. It must pervade every aspect of seed program. Especially the seed enterprises (in this context AIC) that emphasize seed quality in their activities should not be without their own quality control system. Since the success or the failure of a seed enterprise is dependent so much on the quality of seed it supplies and since the intricate nature of seed business which takes years to build reputation but takes only one season of bad seed supply to lose the reputation, the need for a quality control program within the seed enterprise cannot but be exaggerated. Self-control by a seed enterprise is the first line of defence against bad seed supply and the first line of defence can work only by a regular quality control program of its own.

And, obviously, a quality control program is meaningless unless it is backed by reliable seed testing and analysis.

At this point I feel it is worth while to try to draw a line of demarcation between what is called the official or formal quality control program and the quality assurance program (quality control within the seed enterprise) lest we might misunderstand it as one and same thing. The official or the formal quality control program which is usually implemented by official seed certification, seed testing and seed law enforcement is existent in most every seed program of the world in some form or the other. The kind of quality control program that I am going to outline in this paper is, however, different; it is about the interal control within AIC.

Some Measures for Consideration

1. AIC field staff and Agriculture Botany Section field staff should be well-acquianted about a crop variety to be multiplied. This will facilitate seed field inspections and certification. This is very important because a variety bred is a plant breeder's baby and he or she best knows how he or she bred it.

2. In major seed production/processing centres of AIC in terai, the existing technical manpower is not adequate for the kind and amount of work to be handled. Nor are the physical facilities adequate for the same. In a situation like this expecting results from the AIC technicians for the quality of seed they produce, receive, process, package and distribute is almost impossible.

3. The official certification tag is good only for one season and when seed is stored under proper storage conditions. The term "proper storage conditions" is vague and irrelevant unless those conditions are actually created. In the normal course, unless the seed stored is infested with insects prior to the validity

period of the quality tag, most AIC technicians have tendency to go ahead and distribute the seed to the farmers taking the quality for granted. But insect infestation is not the only cause of seed quality deterioration and a lot of other factors are also responsible. However, if AIC technicians are fully made responsible for the quality of seed they supply with their own quality assurance program, in conjunction with the official quality control tag, some of the present seed quality problems can be checked to the large extent.

4. For any seed enterprise, proper seed lot identification so as to be able to retrace the history of the seed lot is very essential. The managers of a seed enterprises should have a sound basis as to which seed lots to be distributed first and which seed lots to be carried over. AIC should establish proper procedures in this regard.

5. Varietal mixture is something which cannot be detected, reliably by the laboratory testing of seed (expect for few crops, and that too with spohisticated testing equipment).

6. As regards receiving of field inspected seed at seed processing plants, some reliable means to test the germination of seed should be introduced prior to receiving of the seed. This can be done by quick viability test, such as tetrazolium test which AIC staff should be able to perform.

7. In order to avoid delay in paying of premium to the seed growers, they should be paid premium based upon the quality of raw seed they have delivered and not upon the quality of their processed seed. Because in the later case the premium the seed grower gets is based largely on the efficiency of seed processing.

8. Seed samples for testing for fixation and paying of premium need not necessarily be sent to the official seed testing laboratory. Instead AIC's internal quality control program should be made responsible for it. The quality tag of the official seed testing laboratory is going to be there any way, once the seed is processed and ready for distribution.

9. Another area where AIC's internal quality control activities should be strengthened is in the seed processing plants. Seed processing is not just running of seed through some pieces of seed processing machines. Seed processing can upgrade or degrade the quality of the same lot of seed depending upon its efficiency. Besides giving due care to cleanliness and sanitation of seed processing machines so as to avoid mechanical admixtures, a seed processor has got to be careful not to inflict mechanical and heat damage during seed processing, handling and drying. These are all part of an internal quality control program within a seed enterprise.

10. The last but not the least area where the quality assurance program of AIC should concentrate is on Sajha co-operative warehouses. Sajha co-operatives are the grass root level distributors of AIC seed. The seed remains quite for some time in their warehouses before it finally reaches the farmer. But the Sajha co-operatives often do not have adequate warehouse spaces to store seed as it should be stored. As a result seed, fertilizer, insecticide, fungicide, are all stored in the same place. Moreover, Sajha co-operatives do not have necessary technical man power to handle seed safely. Thus a part of AIC's concern for quality assurance program should be improvement of Sajha seed stores. The Sajha managers/or storekeepers should be well educated by way of special trainings on seed handling, seed storage management and seed marketing.

11. Let me once again stress the need of reputation for a seed enterprise as a supplier of quality seed if it is to remain in seed business. For good reputation, AIC should deal only with the supply of certified seed whose genetic, physical and physiological quality is assured and should avoid handling of uncertified seeds. Even at the time of acute shortages, AIC should not come into picture for the distribution and supply of grain seed (grain seed collected from grain farmers and warehouses). In a situation like this, some other non-seed organization such as Nepal Food Corporation, Salt Trading Corporations etc. might be asked to distribute grain seed with truthfulness in labelling. The dealing of the so-called Improved seed (Yellow tag) by AIC may be necessary for a while but the quality of the improved seed should be assured if not officially certified.

Finally the present AIC seed set up (both manpower wise as well as physical facility wise) is not adequate for the kind of job it is to do. Thus, timely thought might be given to whether the present AIC seed set up itself is to be strengthened or a subsidiary organization for seed under AIC management is to be created or an all together new organization is to be set up exclusively for seed.

# VARIETAL DEVELOPMENT, MAINTENANCE AND INITIAL SEED-MULTIPLICATION OF WHEAT

Ravindra N. Devkota
National Wheat
Development Program
Bhairahawa

## Objectives

The principle objective of varietal development work of National Wheat Development Program is to evolve wheat varieties (for terai, the plain region of Nepal and hills) that have:

- high yield potential in the farmers' field.
- short duration to fit into the cropping pattern of the country
- resistance to diseases and pests.
- semi-dwarf growth type to withstand a high dose of fertilizers
- bold and amber grains.
- good chapati making quality for general consumption.
- wide range of adaptability under different agro-climatic conditions of Nepal.

## Area of Operation

With these objectives in mind, National Wheat Development Program has broadened its area of work in wheat research in Nepal giving due attaintion to specific problems. Incorporation of genes of desirable traits through crossing program in *Triticum aestivum L* using local land races as well as improved varieties as parents is one of the major fields in which NWDP is working at present. Beside, this, multi-locational testing of the materials of high yielding agronomic types for both terai and hills, screening against major diseases like Leaf rust caused by *Puccinia recondita Rob.*, Helminthosporium leaf blight caused by *Helminthosporium tritici repentis Died* and Karnal bunt caused by *Neovossia indica* (Mit.) Mund., screening against sterility, identification of better wheat genotypes for dryland and low fertility conditions, identification of better triticale lines, maintenance of breeding materials and seed increase at initial stage are some of the other areas of work. To cover those areas, NWDP operates its varietal development work and initial seed increase in most of the HMG farms and stations scattered all over the kingdom. In this way, wide spectrum of the agro-climatic

regions of Nepal are covered by the testing materials. The varying agro-climatic conditions and the topography of the kingdom assists the plant breeder in selecting spots for specific wheat research program in terms of disease resistance, growth duration and yield in different regions.

The eastern terai region of the country normally receives more annual precipitation and hence the environmental conditions are excellent for the selection of leaf rust and screening against sterility. Kankai Irrigation Project in Jhapa district, Tarahara Agriculture Station and Jumka seed multiplication farm in Sunsari district of this region cooperate with NWDP in varietal development work and initial seed increase program. Some of the locations in central and wester terai regions have very favourable environment for the development of various wheat disease specially Helminthosporium leaf blight and leaf rust. Hardinath agriculture farm in Dhanusa district, Parwanipur agriculture station in Bara district, Rampur agriculture station in Chitwan district and, of course, Bhairahawa agriculture farm in Rupandehi district are the principle testing sites in those regions. The mid-western and the far-western terai regions have usually warm climate and receives lesser amount of annual precipitation. Hence these conditions are better suited for testing and evaluating materials for dryland conditions as well as for selecting for stem and leaf rust resistance. Nepalgunj agriculture station at Banke district falls in this region and cooperates with NWDP regularly in the varietal development work and initial seed increase program.

As in terai, the agro-climatic conditions and the topography of various locations in the hills almost specify the type of research work for that particular area. Testing of wheat lines/varieties and their evaluation is done in most of the NWG farms and stations located in mid and higher hills. Besides this, specific type of research related to local problems is also being investigated at various locations. Doti agriculture farm in the far-western region is considered as a hot-spot for screening against Karnal bunt. Likewise, Jumla agriculture station in Karnali Zone of the mid-western region has been utilised as a testing site for long cycle materials and screening for powdery mildew caused by Erysiphe gramins DC., and stripe rust caused by Puccinia striiformis West. Environmental conditions at Khumaltar are favourable for the development of leaf rust, powdery mildew, loose smut (Ustilago tritici (Pers.) Rostor.), hill but(Tilletiaspp.) and to some extent stem rust caused by Puccinia gramins tritici Eriks and Henn. NWDP also deals with triticale (Triticum x Secale) and almost all the testing of the triticale materials is restricted to Kavre agriculture farm in Dolkha district. For the past couple of years, NWDP has been using the nucleus seed potato production farm at Nigale as a spot for growing off-season nurseries specially generation lines of wheat.

Working Procedures:

National Wheat Development Program has been accelerating its varietal development work by adopting two types of strategies:

- Direct introduction of wheat lines/varieties developed elsewhere and testing and making selections in our local agro-climatic conditions.

- Incorporation and manipulation of genes of desirable traits through own crossing program.

1. Direct introduction of wheat lines/varieties developed elsewhere and testing and making selections in our local agro-climatic conditions.

For the rapid development of wheat varieties, NWDP collaborates with many national and international programs and institutions around the world. They send us their wheat materials in the form of segregating generation lines, screening nurseries and yield trials to be tested in our environments. Different sets of $F_2$ segregating materials, International Bread Wheat Screening Nursery (IBWSN), International Spring Wheat Yield Nursery (ISWYN), International Triticale Screening Nursery (ITSN), International Triticale Yield Nursery (ITYN) from CIMMYAT, Mexico are some of the important and regular sources of wheat and triticale varietal introduction to the program. Similarly, different sets of Uniform Regional Trial (URT), National Genetic Stock Nursery (NGSN) from All India Coordinated Wheat Improvement Project (AICWIP), India, Bread What Observation Nursery (BWON), Regional Disease Trap Nursery (RDTN), Regional Disease and Insect Screening Nursery (RDISN), Regional Rainfed Wheat Yield Trial (RRWYT) from ICARDA, Syria and International Winter Wheat Performance Nursery from Nebraska, USA are the other good sources. NWDP has been benefitted in many ways from these nurseries and yield trials introduced from outside. This has helped the plant breeder in identifying the superior genotypes in a short duration of time either for release or for using in the breeding program. Varieties identified and released in this manner in the past are Sonalika, HD 1982, NL 30, UP 262 and Triveni which was released last year. By the same token, NL 292 HD, 2204, Vaskar and NL 370 for terai and AL 84, HS 94, HS 84 for hills have been identified and are ready for release next year.

2. Incorporation and manupulation of genes of desirable traits through own crossing program:

Direct introduction of varieties from outside and testing and evaluating them in Nepalese conditions is quicker method of varietal development. But despite our untiring efforts put on for selections and evaluations, it is hard to get enough genotypes of wide adaptibility to our agro-climatic conditions. For this reason, NWDP has initiated its own crossing program in Triticum aestivum L. in order to incorporate genes of desirable traits. As a result, we are now in the fourth generation stage of wheat crosses done in Nepal. In this way, we have materials resulting from the crosses between improved vs improved and improved vs local land races. The major

sources for Nepal crossing block comprises of local genotypes collected mostly from the western hilly regions of the country and many other promising and high yielding lines selected for specific characters from different nurseries and trials. The idea of using local land races as parents in crossing is to incorporate some important genes from them like high tillering, drought resistance and prolonged period of seed dormancy. A number of segregating plant types with characters of earliness, disease resistance, tillering, grain size and colour were observed in second and third generations. The results are very encouraging and we hope to come up with several better genotypes in the near future.

Whatever the strategy, the usual pattern in the process of varietal development comprises a series of multi-locational testing of various stages of screening nurseries and yield trials. At each step, the testing materials are exposed to high disease epidemics through artificial inoculation.

a) Screening of segregating generation lines:

NWDP receives regularly each set of $F_2$ Massa Irrigated, $F_2$ Massa Dryland, $F_2$ massa Helminthosporium and $F_2$ Massa Spring x Winter from CIMMYAT, Mexico every year. All these materials in addition to addition to our own materials coming from the crossing program are space-planted at Bhairahawa, the headquarter of NWDP. A pre-harvest individual plant selection in the field is focused on early maturity, disease resistance and good agronomic plant type. The final post-harvest selection is accomplished on the basis of bold and amber grains. Each selected individual plant is then advanced to the next generations $F_3$, $F_4$, $F_5$ and $F_6$. Except in $F_6$, the method of planting and method of selections in each generations are same as that of $F_2$. In $F_6$, instead of space-planting, all the materials are planted in a continuous fashion. The most uniform and homozygous lines are selected and bulked at this generation. The bulked lines are then promoted to screening nurseries. For the first time in the history of National Wheat Development Program, two generations of wheat are being grown successfully within a year. Nucleus seed potato production farm in Nigale at an altitude of 8000 ft has been used for this purpose. Farmers around this area commercially grow wheat in the month of July-August. This has enabled us to harvest double crop of wheat in a year. After harvesting the materials at Bhairahawa in the month of April-May, we take them up to Nigale and plant there in the month of July-August. We harvest them in the month of November-December and bring them down to Bhairahawa again to plant in the normal season. This has got two distinct advantage-firstly it just halves the duration required to develop a variety and secondly it imparts the ability to withstand adverse agro-climatic conditions.

b) Screening nurseries:

$F_6$ materials after bulking are promoted either to Nepal Screening Nursery or to Nepal Advanced Lines, depending upon the amount of seeds. In addition, IBWSN and Helminthosporium screening nursery from CIMMYAT, Mexico and BWON, RDISN from ICARDA, Syria are screened and selected for better agronomic types and disease resistance. The selected lines from these nurseries are promoted to Nepal Advanced Lines, also a nursery containing all the materials in bigger plot size. Beside screening, procurement of more seeds for multi-locational testing in replicated yield trials next season is the main objective of this nursery.

c) Yield testing:

Materials selected for disease resistance, better agronomic types and wide adaptability from various screening nurseries are then advanced to replicated yield trials to be conducted at different locations throughout the country.

i) Initial Evaluation Trial (IET) for terai and hills:

This is the first step in which multi-locational yield testing of the materials selected from various screening nurseries is performed in replicated form. Each line entering into this trial from various nurseries and trials are designated with new name in NL series (Nepal Lines Series). Based on the results of statistical analysis of the grain yield and other agronomic characters, the superior genotypes are promoted to Advanced varietal trial for further testing.

In addition to IET, several other international trials like ISWYN, URT are also conducted for yield evaluation. The promising genotypes from these trials are promoted to either Advanced Varietal Trial or Initial Evaluation Trial or to Advanced Lines depending upon the amount of seeds available.

ii) Advanced Varietal Trial (AVT) for terai and hills:

This is the last step of yield trials to be conducted in HMG farms/stations. Better genotypes selected from IET, URT, ISWYN undergo a wide multi-locational yield testing in this trial. At this stage we have a small plot seed multiplication (SPSM) program of each variety included in the experiment at Bhairahawa. The objective of SPSM program is to have a small amount of seed stock for the Farmers Field Trials to be conducted next season. High

yielding genotypes from AVT are scrutinized through statistical analysis. Beside the result of statistical analysis, disease resistance and better agronomic types are also considered for evaluation. Superior genotypes performing the best in all aspects, are extensively tested in Farmers Field Trial next season.

d) Farmers Field Trial (FFT) for terai and hills:

The best genotypes selected from AVT are further tested in non replicated bigger plots in the farmers field over two hundreds locations throughout the country. This is the last step of testing lines or varieties before they are released. This trial is of great importance as it helps in collecting information regarding performance in different localities and farmers reaction towards that particular variety.

e) Minikit distribution:

This is another way of collecting information regarding varietal performances and farmers reaction towards that variety. But minikits differ from FFT in the following aspects:

- a minikits are distribut d in thousands but only one kit of a single variety is given to a farmer.

- minikit could be either of any promising lines identified from AVT and FFT just before release or it could be of recently released variety to know farmers reaction and to popularise them among the farmers.

In addition to wheat seed to cover half a ropani in the hills and a kattha in terai, a packet of minikit consists of an instruction sheet for cultivation and a printed return mail post-card for collecting farmers reaction and varietal performance. The necessary fertilizer for the minikit is supplied by the related districted agriculture development offices.

f) Varietal release:

Based on the farmers preferences and overall performances of a particular variety, a proposal of release supported by necessary yield and agronomic data is forwarded to the National Varietal Release Committee. The committee calls a meeting, discusses the proposal and if satisfied allows the variety to be released. While writing the proposal, the variety could either be given a new name or the original name by which it was introduced. Variety UP 262 was released with the same original name by which it was introduced from Indian Uniform Regional Trials while HP 1209 and HD 2189 were released by the new names Lumbini and Triveni respectively to make easily identified by the Nepalese farmers.

## Maintenance and Initial Seed Multiplication of a Pre-Release or Released Variety

Development of a high yielding variety alone can not break the production barrier. Maintenance of large quantities of pure seed of the variety concerned which has a demand must exist to boost up the productions. So, first breeding high yielding varieties and then maintaining them true to the type are the two factors of vital importance to stabilise the production.

As the development of a wheat variety and its maintenance are both vital, NWDP looks after the initial seed increase program like breeder and foundation seed production. In addition, maintenance of selected pre-released varieties is also done at Bhairahawa. A flow-chart showing the production of successive generations of seed is diagrammed in figure 1.

The maintenance and seed multiplication program of any recommended wheat variety is begun with a number of spikes selected from the field at NWDP, Bhairahawa. In the following season, each of these selected spike are planted individually in separate progeny rows or lines. The rows that are not uniform are outrightly rejected where as the uniform ones are bulked as breeder seed after selecting few heads for next year's head to row progeny evaluation. The next step is to produce mother stock seed from breeder seed at NWDP, Bhairahawa. This mother stock seed is used in producing foundation seed in various HMG farms and stations at different regions of the country. After this, the production of certified seeds from the foundation and the distribution to the general farmers is taken care by the Agriculture Inputs Corporation (AIC).

Figure 1 A flow- chart showing maintenance breeding and seed multiplication program at NWDP, Bhairahawa.

| | | |
|---|---|---|
| Head to row progeny | From the selected lines | |
| | Spike selection | at NWDP, Bhairahawa |
| | and Lines selected for uniformity | at NWDP; Bhairahawa |
| | Breeder seed | at NWDP; Bhairahawa |
| | Monther stock seed | at NWDP, Bhairahawa |
| | Foundation seed | at various farms/stations |
| | Certified seed | at farmers fields through AIC |

Experiences

At present wheat varieties are no more a limiting factor for raising up the production in terai regions of the country. But the hills still lack suitable varieties for increased production. Hence, a suitable sub-station of National Wheat Development Program in the hilly part of the kingdom at present is a most urgent need. The station must be easily approachable the year round so that is is convenient to move the research materials and personnel.

To bring uniformity in the research activities all over Nepal, a short term training program prior to each season should be conducted for all the personnel involved in wheat research from various farms and stations.

Future Plans and Program

Our plan in the future is to flood both hills and terai with high yielding wheat varieties of wide adaptability through an efficient breeding program, and better sales and distribution of improved wheat varieties through AIC.

Better field and seed testing in the districts and regions is needed to maintain genetic purity. Crossing program in Triticum aestivum L will be continued. In addition to high yielding agronomic types, our efforts will be towards the incorporation of more resistant genes for leaf rust caused by Puccinia recondita Rob. and Helminthosporium leafblight caused by Helminthosporium tritici repentis Died, the two major wheat diseases prevailing at present in the country.

We will make an efficient use of our four production agronomists to raise wheat production in the country through the cooperation of Regional Agricultural Directorates, Agriculture Development offices and the farmers of Nepal.

## REFERENCES

Anonymous - Wheat Research Program, 1979-80. National Wheat Development program.

Anonymous - Wheat Research Program 1982-83. National Wheat Development Program.

Devkota, R.N. - Report on International Trials and Nurseries, 1981-82. Wheat Research Reports (Proceedings), 1981-82. National Wheat Development Program.

Kayastha, B.N. - Wheat Breeding Report, 1978-79. Paper presented in Winter Crops Workshop, August 20-23, 1979.

Kayastha, B.N. - Report on International Nurseries, 1978-79. Paper presented in Winter Crops Workshop, August 20-23, 1979.

Pokhrel, T.P. - Report on Wheat Breeding, 1980-81. Paper presented to 9th Winter Crops Workshop, 30 August - 2 September 1981.

Pokhrel, T.P. - Report on International Yield Trials and Nurseries, 1980-81. Paper presented to the 9th Winter Crops Workshop, 30 August - 2 September, 1981.

# COMMENTS ON THE QUALITY PROBLEMS

Bhadra B. Pant
Lecturer, IAAS
Rampur

Seed is a biological entity and the series of events that take place in its life from the time it is formed in the ovary to the time it is actually planted in the field greatly influences its quality. If these events are favourable the seeds maintain their viability and vigor at a satisfactory level and establish well in the field. On the other hand, if they become unfavourable seeds would die out before the intended time of planting.

Since the dawn of civilization seed has been a material of great concern to mankind. The primitive man learned how to domesticate it. Thereafter, generation after generation he continued to learn how to save and use it. Man is still trying to and is engaged in breeding, improvement, and even creating new species of plants. The more we learn about seed the more we will appreciate its value.

Both Frederic Nobbe, a German and E. Moller Holst, a Danish botanist are regarded as the fathers of the seed testing. They established their laboratories in 1869, independently. Reports from Denmark, Germany, France, Switzerland, England and the Netherlands indicate that in those days adulteration and falsification of seed was widely practiced. The objective of a seed testing laboratory, therefore, was to guide, counsel and serve the farming community by providing useful information as to analytical purtiy, germination capacity, moisture percentage and 1000 grain weight of a seed sample. By and by many countries realized the importance of seed testing and consequently testing of seed was a requirement by law.

In the first quarter of this century, new cultivars of several crops were developed due mainly to the breakthroughs in plant breeding techniques. Since then, management responsive, high yielding, insect, disease and drought resistant, and a host of other desirable types of cultivars have been developed and many more would be joining the list in future. The development of cultivars of specific adaptation has substantially augmented our resources. To seedsmen they pose a challenge. These developments have greatly contributed to our understanding and lead to formation of seed enterprises.

As has been pointed out earlier, the need for testing seed for mechanical purity and germination was already in existence. Later on as the number of varieties (cultivars) available for use by farmers increased, the responsibility for maintaining them also increased. These responsibilities were mainly of two types.

1. maintaining the genetic purity, and

2. checking against the falsification used in marketing especially those exploiting the ignorance of farmer.

Since these duties could not be performed effectively by regular seed testing laboratories, a mechanism of inspecting seed in each step of multiplication became necessary. Seed certification schemes and agencies, therefore, came in existence. Such an agency is involved in (a) determination of eligibility and verification of source of a variety. (b) field inspection as to isolation, fertilization, weeding roguing, harvesting, threshing and drying, (c) sampling processed seed lots (d) testing for quality, (e) seed health testing (f) genetic purity and (g) labelling. In many countries such programs charge the seed grower for their service. Certification is not binding, however, for the individual seed grower.

Partly through the experience of others and partly our own, in Nepal too we have created seed testing laboratories, seed certifying program; plant quarantine; seed production organizations both in public and private sectors; crop breeding and introduction programs; and modestly organized marketing and distribution systems. In the past 10 years, we also have greatly augmented our processing facilities. Though not yet fully exploited and utilized, we have developed infrastructure for a giant leap forward.

As we develop, our needs expand and sometimes exceed the limits imposed by resources. These resources may be in terms of (a) money, (b) manpower (c) physical facilities and sometimes might just be the right environment to do a better job. Let us examine the following points:

1. <u>Traditional Farmer:</u>

According to Agricultural Statistics of Nepal (1972), 92 percent of the farm holdings are less than 3 hectare in size and a large number of them (75 percent) are even less than 1 hectare. Those people who cultivate these lands are generally known as traditional and subsistance farmers. It is believed that subsistance farmers eat practically everything they produce; live largely outside the money economy; add very little to country's wealth, and are uneducated.

Basically, these farmers are intelligent. Through years of observation based on their own experience they know how to produce good seed equal in quality to that of regular trade channels. They are also aware that there is no difference between seed and grain except for hybrids.

2. Extension and Education:

In Nepal a vast majority of farmers are in subsistence level and, very few, if any, are able to own a radio or purchase a newspaper. Therefore, efforts made to use mass communication as a method of extension have not been very successful. Extension personnel lack desirable mobility and for that matter individual contact and family visits, too, are limited. The only effective method is that of demonstration.

Therefore, it is very difficult to educate the farmer. Unlike the developed countries of the world, we not only have many mouths to feed but also have many heads to teach, minds to convince and problems to solve.

3. Physical Facilities:

In the first place, most farmers do not have a room to store the most important farm product the seed. Second, their lands are fragmented and they cannot maintain isolation. Third, they do not have access to technology required for the production of improved varieties. Therefore, they cannot maintain the genetic characters which are so important.

4. Loans and Minikits:

Getting a loan sanctioned is a difficult job. Whenever it is available, it is made in kind and not in cash. If the poor farmer wants loan for improved seed, most likely he may not get it.

Minikits are successful for seed dissemination only if the farmers know and like the variety. But again due to lack of isolation seeds saved from minikit plots do not last long except for self-pollinated crops.

5. Distribution and Availability:

A number of problems are associated with seed distribution, such as, (a) lack of motorable roads, (b) inadequate and inappropriate storage, (c) inexperienced and untrained dealers, (d) distantly located dealers or cooperatives, and (e) uncertainty of seed availability.

6. Saving Attitude:

Everyone of us wants to save stones by killing two birds at a time. The farmer invests in fertilizer, pesticide, herbicide, farm equipment in terms of money. Seed being the input produced by him he would naturally try to cut his expenses on it. New

seeds are, therefore, purchased whenever a new variety is introduced or when the existing variety deteriorates due to seed-borne disease or mechanical mixture. The small farmers in remote villages often get their seed supplies from the village merchant or middle man who might have inferior stock of poor planting value. Such people make a lot of money and rely on the ignorance of farmer for their success.

7. Testing Facility:

Unlike the farmers of developed countries who can have all types of information for the seed sample they send, our farmers can judge the seed quality based only on visible attributes such as color, size and insect damage. It is next to impossible for most of them to be able to get a sample, have it tested, and get the information just prior to planting.

Suggestions

Let us ask ourselves how can we help the subsistence farmer. Obviously, by giving quality seeds on time and in quantities demanded by the farmers. Nepal cannot produce fertilizer or pesticides without massive investment. But Nepal can produce quality seeds in the real sense merely with more emphasis on this input than we have today. This means that the following should be our goal:-

a. to make the marketing and production agencies aware of the importance of seed quality:

b. to facilitate the establishment of reputable seed enterprises;

c. to ensure the flow of good quality seeds;

d. to safeguard the interests of the farmers against those of hoarders and speculators;

e. to safeguard the interest of breeder against the introduction of unknown variety;

f. to control spread of harmful weeds, and

g. to regulate the unrestricted import of low quality vegetable seed.

Table 1
COMPARISION OF LABORATORY GERMINATION AND FIELD EMERGENCE PERCENTAGES OF SAMPLES FROM 94 SOYBEAN SEED LOTS*

| Field Emergence % | Laboratory Germination (%) | | | |
|---|---|---|---|---|
| | 90-94 | 85-89 | 80-84 | Total No. |
| 90 + | 5 | 0 | 0 | 5 |
| 80 - 89 | 9 | 12 | 0 | 21 |
| 70 - 79 | 10 | 14 | 6 | 30 |
| 60 - 69 | 2 | 8 | 4 | 14 |
| 50 - 59 | 3 | 6 | 6 | 15 |
| 40 - 49 | 0 | 3 | 2 | 5 |
| 40 - | 0. | 4 | 0 | 4 |
| Total No. | 29 | 47 | 18 | 94 |

* Delouche, James C., Seed Vigor in Soybeans, Proc, of 3rd Soybean Seed Research Conference, Chicago, Illinois, 1973.

# INCREASING THE USE OF HYV SEEDS IN NEPAL: IMPLICATIONS FOR MARKETING AND PRICING POLICIES

Manohar Sharma, and
Shiva Sharma
Economists, APROSC

## Introduction

Given the limited scope of further-extending agricultural land, any significant increase in agricultural production will have to be achieved through increase in yield rates in Nepal. This basic premise underlines the important role of modern agricultural inputs, since it is mainly through the use of such inputs that any appreciable increase in yield rates can be realized.

One important aspect of modern input-intensive farming is the use of High Yielding Varieties (HYV) of seeds. Yield increase after the use of HYVs on irrigated land has been reported to be as much as 44 percent for large farms, 53 percent for medium farms, 70 percent for small farms, and 95 percent for marginal farms (NRB 1980). Despite such productivity-augmenting potential, use of HYV seeds in Nepal is still not large and is mainly confined to improved varieties of wheat, rice and maize. In 1975-76, the latest year for which data on area planted with HYV seeds are available, the proportion of land under HYVs was, except in the case of wheat (71 percent), very low for both rice and maize (15 percent) (Annex 1). In 1981-82, total consumption of improved seeds as distributed by Agricultural Inputs Corporation (AIC) amounted to 2597 m.t. of which 2218 m.t. (85.4 percent) was wheat, 244 m.t. (9.4 percent) rice and 135 m.t. (5.2 percent) maize. Given that rice and maize account for the bulk of agricultural output, the above figures indicate a very slow penetration of HYVs in Nepalese agriculture. The case of wheat is different mainly because this is a comparatively a new crop in Nepal and was introduced after the development of HYVs.

The reason for the low adoption rates in the case of rice and maize can be found in constraints now present in both the demand for and the supply of improved seeds. Just as an inadequate delivery system prevents farmers from using HYV seeds, there is also not much point in delivering improved seeds at the farmgate if the farmer is not prepared to use them.

One aspect of HYV use is that improved seeds become adequately remunerative only if they are used in combination with other complementary inputs, notably water and fertilizer. One survey (NRB 1980) indicated that increase in productivity after the use of HYVs on unirrigated land was very limited - 2 percent for large farmers and 8.7 percent for marginal farmers. Acceptance and use of HYVs depends

on farmer perception of benefits associated with the use of HYV seeds. Profitability depends on several factors such as availability of complementary inputs, the degree of extensive services provided, prices and costs related to the use of HYV seeds, and the efficiency of marketing channels that delivers improved seeds to farmers. Hence, it is important to note that an aggresive marketing policy per se will not guarantee the proper use of HYV seeds. Further, given that seed cost forms only a small part of total farm cost, nor will a highly subsidized supply of improved seeds make the use of such seeds remunerative.

Seed Requirement in the Future

Planning for a marketing strategy requires, among other things an estimation of the magnitude of the delivery of improved seeds that would have to be made in the future. This magnitude should refer to the amount of improved seeds needed to sow all lands suitable for the use of HYVs. Return on land will not be maximized as long as actual consumption of HYVs falls below this quantity. The objectives of the marketing strategy should, therefore, be to spread the use of HYVs to every hectare of potential land. One determinant of this potential is the availability of an important complementary input, an assured supply of water through irrigation. We are not implying here that availability of irrigated water determines the upper limit of HYVs use. All we are saying is that while a 100 percent adoption of HYVs might be feasible on irrigated land, such a high rate of adoption is not likely to be remunerative on rainfed land.

Estimation of the quantity of improved seeds required by the year 1990 is made here. This estimate is based on projected cropped areas of three major crops - wheat, rice and maize (Annex 2); the estimated proportion of land under irrigation by 1990; and the estimated feasible rates of adoption of HYVs during the next decade.

Area under wheat cultivation is expected to grow at a rate of 7.7 percent per annum during the next decade so that by 1990, its cropped area would be 252 thousand hectares in the hills and mountains, and 714 thousand hectares in the terai. Since the proportion of wheat area under HYVs is already quite high (71 percent), it will not be unreasonable to assume that with the enlargement of the supply of other agricultural inputs (including extension services) during the next decade, all of the terai and most of the hill and mountain wheat area (including rainfed land) would be under improved variety. Using a seed rate of 120 kg./hectare, annual requirement of wheat seeds would be around 30,240 m.t. in the hills and mountains, and 85,680 m.t. in the terai. Given that these seeds would have to be renewed every five years, seed requirement from off-farm sources would be 6,048 m.t. in the hills and mountains, and 17,136 m.t. in the terai.

Unlike as in the case of wheat, rate of adoption of improved paddy seeds is anticipated to vary considerably between irrigated and unirrigated lands. By 1990, out of the total area of 1220 thousand hectares under paddy in the terai, only 323 thousand hectares (20 percent) is estimated to be under irrigation. In the hills and mountains, only 40 percent of the total of 241 hectares under paddy is expected to be irrigated. While the assumption of a 100 percent adoption rate would be feasible on irrigated lands, we can provide, at best, an estimation of seed requirement based on two variants concerning the rate of adoption of HYVs on rainfed lands.

The two variants used here are:

a. that all of irrigated area and 50 percent of the rainfed area would be under HYVs; and

b. that all of the irrigated areas but only 25 percent of the rainfed area would be under HYVs.

Under the first variant, annual seed requirement (at a seed rate of 40 kg./hectare) in the hill and mountains belts would be 6,750 m.t. and 30,803 m.t. in the terai. This would mean that annual seed requirement from off-farm sources would be 1350 m.t. and 6173 m.t. in the hills and mountain belts and in the terai belt respectively (Annex 3).

Under the second variant (Annex 4), annual seed requirement from off-farm sources would be 4379 m.t. in the terai and 1061 m.t. in the hill and mountain belts.

Annual maize seed requirement from off-farm sources has also been calculated by using the same variants as those used in the case of rice. Thus, by 1990 maize seed requirement is likely to be around 756-458 m.t. in the hills and mountain, and 380-300 m.t. in the terai.

Total off-farm seed requirement by 1990 would be around 29,382-31,843 m.t. per year by 1990. About 74 percent of this requirement would be for terai and the remaining (26 percent) for the hills and mountains.

Give these requirements the next two sections outlines the pricing and marketing strategies to maximize the spread of HYVs use in the production of rice, maize, and wheat.

Marketing Policy

AIC is the only institutional source involved in the marketing of HYV seeds in Nepal. It procures seeds from the appointed contract seed growers, from the government farms and, if necessary, from abroad. Over time, the dependence of AIC for HYV seed procurement

from the contract growers has increased. AIC supplies HYV foundation seeds and other necessary complementary inputs to the contract growers. The output (seed) is procured by AIC at pre-negotiated price. After the test of the quality of seed, the growers are paid premium prices depending on quality. It is reported that the prices received by seed growers are higher than the prices of ordinary grains. The cost of cultivation of seed, on the other hand is said to be higher by 10 to 20 percent. The inputs needed in seed production is supplied by AIC on credit, deductable at the time of seed procurement by AIC. If AIC requires HYV seeds in large amounts at an increasing rate over time, more and more contract farmers will have to be contracted for seed production. This, obviously, requires that production of seed crop be remunerative compared to the production of ordinary grains. This can, however, be done either by increasing the prices of seeds to be procured or by the supply of complementary inputs at lower prices or with a mix of both. On the other hand, farmers owning large holdings will have to be contracted as technical know-how and irrigated land, generally, belongs to these farmers. Also that such farmers can set aside land for seed production previously used to produce surplus grains for sale. Even if remunerative, small land holders may not be able to spare land for the purpose as they would first ensure the supply of foodgrains for consumption.

AIC processes the seeds procured from the contract growers in five plants located in terai. The seed then is supplied to the farmers through AIC field offices. Hills and mountains get seed supplied from terai. However, the Seed Production and Input Storage Project envisages to establish seed processing plants also in 25 hill districts. If this is accomplished, hill areas will be able to get seeds that have been produced within the hills. This will reduce both the magnitude of transportation subsidy and will make the task of seed distribution more smooth. Production in the hills itself is also expected to increase the environmental adaptibility of seeds and reduce susceptibility to local diseases.

Optimally, HYV seeds should be produced in all leading production pockets in hills and mountains and in terai so as to make distribution of HYV seeds smooth. Such a production scheme will also enhance substitution of HYV seeds for local variety seeds that moves from farmers to farmers. AIC can appoint contract growers, provide technical back-stopping, and procure enough seed for its own distribution program and at the same time encourage farm-to-farm distribution too.

Marketing of seeds through non-institutional sources is traditional and customary. Generally farmers save seed from their own produced grains. Other sources of seed supply are through borrowing or through exchange. These, essentially, are limited to a narrow periphery of the area where the seed is produced. In the terai, HYV seeds spill

over from across the Indian border too. Local traders and merchants bring HYV seeds from India and sell in local weekly and bi-weekly markets. Such practices are widespread specially in the case of wheat and maize.

Easy availability of HYV seeds is a fundamental requirement for increasing adoption. Existing marketing channels of AIC do not seem to be adequate as distribution or sales are limited to easily accessible areas to the district headquarter. The peripherial area under each sales depot is necessarily narrow specially in the hills. Beyond the periphery, transaction cost in terms of transportation can be prohobitively high. This limits the use of HYV seeds to only a limited area. For the widespread use of HYV seeds, delivery mechanism should be rationalized and delivery centres increased in number. For this, again, transaction of HYV seeds from farmers to farmers needs to be encouraged.

Pricing Policy

In Nepalese agriculture use of purchased inputs is insignificant. CBS (1978) reports that the proportion of purchased inputs in total inputs used is 5 percent in case of paddy, 2 percent in case of maize and 12 percent in case of wheat. This reveals the underdeveloped nature of inputs-market in Nepal. In fact, in subsistence and traditional agriculture all inputs including seed is provided from within the household. The same study reports that value of seeds constitutes a very low proportion of the total value of inputs used in production of paddy (15.4 percent), maize (4.4 percent) and wheat (12.2 percent). The value of seed is the imputed value as farmers, largely, use own produced seeds.

Prices of seeds supplied through non-institutional sources are determined by market forces. It has been found that seed obtained on credit are charged interest rates as high as 100 percent. Borrowers pay in grains after the harvest when the prices are low. However, borrowing is made when the prices of ordinary grains are also high. This reduces the effective rate of interest giving an indication that prices of ordinary grains. There is, however, no information available which indicates the actual prices of locally traded seeds.

Transaction of HYV seeds supplied through institutional sources is in money terms. Farmers are required to pay in cash for the seeds. AIC fixes prices of HYV seed on a mark-up basis, which includes all expenses incurred till the seed reaches the farmers. Government subsidizes the transportation cost and often directs to fix prices substantially below the mark-up prices reached by AIC. In such cases AIC supplies seed at less than mark-up prices and recovers the loss from the government.

There is a widespread belief that lower prices of modern inputs including HYV seed encourage the adoption of such inputs. However, Nepal's experience in sales of HYV seed is not much encouraging. Inspite of substantial subsidization, distribution of HYV seed from AIC has remained almost stagnant since the last decade. In absolute

terms, wheat area seems to respond favourably but this is probably because wheat is a new crop in Nepal. Every addition in area under wheat is found adopting HYV seed. For paddy and maize, rate of increase of area under HYV seed is negligible. Existing data on area under HYV seeds, however, do not fully reflect the proper use of improved seeds. One rough estimate made by ADB/Manila indicates that even the widely used figures for area under HYV seed is doubtful. Relating the annual off-take of HYV seed to the area under HYV, the estimate is that farmers replace paddy seeds every 50 years, maize seed every 10 years and wheat seeds every 17 years. If the estimate is approximated as true, the extent of use of HYV seed is at doubt. This in turn raises question whether prices play significant role in decision process of the farmers to adopt HYV seeds.

It is argued here that level of prices may not be of much importance in the special circumstances that prevail in Nepal. Nepal's rural economy is only partially monetized and level of monetization is yet low. Average farmers earn very little cash income which is spent on procuring necessities. Hence, little is left for obtaining inputs involving cash transaction. Probably because of this, average farmers buy less of HYV seeds and rely on seeds saved personally or procured locally (without involving money).

If prices of seed matter at all, it may not be the apparent prices set by AIC, but may be the actual prices the farmers have to pay to obtain the seed. In the actual prices, premium for risk is very important. Instances of failure of HYV seeds in augmenting yield are rampant. If yield reduces substantially after the use of HYV seeds - be it in the farmers' own field or in his neighbours or if he happens to learn of it somehow, the farmer will avoid the use of it, as its use may put his survival at stake. As farmers in general and subsistence farmers in particular area necessarily most averse to risk, it will be increasingly painful to the farmers to substitute HYV seeds for own produced seeds which are long tested and which are well adapted to local conditions.

But then, should there be no pricing policy for HYV seeds? Of course there should be one. If AIC fixes prices below the prices of locally produced and available seeds or that of ordinary grains, HYV seeds may be put into alternative uses. If AIC fixes prices at a higher level, few will purchase them and the phenomenon of using local seeds will continue. It is argued that AIC should fix money prices of seed not only considering the prices of ordinary grains but also should attempt to develop a mechanism in which non-monetary pricing is possible. Seeds can be exchanged for ordinary grains; ordinary grains then can be sold locally or to Nepal Food Corporation, for example. This will encourage the farmers who are, with the exception of a few, essentially non-cash income earners, to adopt HYV seeds. This can be achieved by AIC itself and/or through Sajha. The present practice of appointing contract growers may be multiplied so that every Panchayat will eventually

contain contract growers who will act as local supplier of seeds under flexible terms and conditions. However, technical considerations that third or fifth generation of HYV seed is no longer of HYV, and that HYV seeds are effective only when used with complementary inputs and so on, will have to be brought to the knowledge of farmers. Changes in farmers attitude and perceptions in favour of HYV seed, are of course pre-requisites for increased use of improved variety of seeds in general.

## Annex 1

## USE OF HIGH YIELDING CEREAL VARIETIES - 1975-76

| | Area Under HYVs '000 ha | Total Area Under Crop '000 ha | % of Area Under HYVs % |
|---|---|---|---|
| Rice | 183.6 | 1256 | 15 |
| Wheat | 233.5 | 329 | 71 |
| Maize | 6.3 | 453 | 15 |

Source: ADB (1982)

## Annex 2

## ESTIMATED CROPPED AREA UNDER RICE, MAIZE AND WHEAT BY 1990

(000 ha)

| | Terai | | Hills | |
|---|---|---|---|---|
| | Irrigated | Rainfed | Irrigated | Rainfed |
| Rice | 323.27 | 896.61 | 96.42 | 144.63 |
| Wheat | 209.13 | 504.63 | 72.09 | 179.99 |
| Maize | 55.15 | 79.57 | 39.92 | 298.39 |

Note: a) Irrigated land includes both area under perennial and monsoon irrigation.

b) Proportion of area under irrigation has been adopted from IFAD (1979).

c) Growth rates of areas under different crops were obtained by using equation of the form $Y = Ae^{bt}$. Data from 1966-67 to 1977-78 were used for the purpose. The estimated growth rates are 1.12 percent, 0.48 percent and 7.75 percent per annum for rice, maize and wheat respectively.

## Annex 3

## ESTIMATED HYV SEEDS REQUIREMENT - 1990

(Under Variant 1)

(in m.t.)

| | Terai | Hills | Nepal |
|---|---|---|---|
| Wheat | 17136 | 6048 | 23184 |
| Rice | 6173 | 1350 | 7523 |
| Maize | 380 | 756 | 1136 |
| All | 23689 | 8154 | 31843 |

## Annex 4

## ESTIMATED HYV SEEDS REQUIREMENT - 1990

(Under Variant 2)

(in m.t.)

| | Terai | Hills | Nepal |
|---|---|---|---|
| Wheat | 17136 | 6048 | 23184 |
| Rice | 4379 | 1061 | 5440 |
| Maize | 300 | 458 | 758 |
| All | 21815 | 7567 | 29382 |

## REFERENCES

1. ADB (Asian Development Bank), 1982, Nepal Agricultural Sector Strategy Study, Working Draft, Manila.

2. CBS (Central Bureau of Statistics), 1978, National Accounts Project, The Agricultural Sector of Nepal (1976-77), Kathmandu.

3. IFAD (International Fund for Agricultural Development), 1979. Report of the Special Programming Mission to Nepal, Rome.

4. NRB (Nepal Rastra Bank), 1980. Agricultural Credit Review Survey Vol. II, Kathmandu.

# SEED MULTIPLICATION PROBLEMS AND SOLUTIONS

B.P. Rijal
Regional Manager
AIC

## Problems

The following problems are being experienced in multiplication, handling and sale of seed:

1. Inspection

As per the central policy on seed multiplication program, there is a division of responsibilities among the offices involved in agricultural sector. The agriculture branch office of DOA, for example, is responsible for selection of farmers, field inspections, extension and information on new varieties and disease control in crops. However, the inspection and extension jobs have not been done effectively. AIC rarely receives information from the agriculture branch regarding improved seed varieties. AIC with its own staff performs the job of field inspection. Since AIC also has limited resources and technical difficulties, the inspection job has not been done in an effective manner. The certified seed multiplication program has also suffered due to this problem. AIC is not getting proper help from Botany Division for inspection of seed fields.

2. Wide Area of Seed Multiplication

The farmers fields are spreaded over a long distance. It is very difficult to inspect the whole area and it is very expensive. Unless fields are inspected properly we cannot expect good seed. Seed condition is determined just from the sample brought at the processing plant.

3. Expensiveness

Due to large area of the seed multiplication, it takes a long time to inspect every field. Further, transportation is very expensive which has to be paid either by AIC or by the farmers.

4. Processing Plants

The processing plants being run for more than five years have become very old. The machines do not work well and at any moment may stop. No spare parts are available. Personnel concerned in handling machines have received no training. The result is low output.

5. Warehouse Facility

In many places there are inadequate storage warehouses. AIC and seed growers are facing difficulties in storing their seed. In the hilly region there is no warehouse facility as yet.

6. Seed Testing Laboratory

The seed testing result is the main source of payment of premium. It takes one to four months to obtain this report from the laboratory. The farmers feel uneasy waiting for such a long period.

7. Bag for Packaging

There is no uniformity in the bag used. Sometimes the bags are so weak that whole seed would be damaged in the process of loading. The weak lamination causes deterioration of seed due to outside moisture.

8. Pallets, Weighing Machines, and Other Related Equipment

In many AIC offices and in Sajha offices there is a lack of proper equipment and facilities and hence there are many chances of seed deterioration.

Solutions

1. Inspection

There is no separate unit for field inspections only. The Botany Division inspects certified seeds. It is impossible to perform all the jobs required with the existing resources.

AIC is handling the seed business, it looks justificable for AIC to do the job of field inspection and only the final inspection should be made by the Botany Division. For this purpose, it is essential to depute one technician in each site and provide a jeep for travelling. It will help in timely inspections. The available manpower should be fully used.

2. From many points of view it is necessary to limit seed multiplication program nearer the seed plant and in pockets where irrigation facility is available.

3. Processing Plant

If AIC imports necessary spare parts for the machines the existing machines could work regularly. Further arrangements should be made for training to handle the machines.

4. Warehouse facility

Additional construction of warehouses can remove the problem of storage. AIC has warehouse facility in some places but in Itahari there is a lack of storage capacity.

5. Hessian laminated bags are being used at present but every year the quality of these bags is different. This problem can be solved by ensuring uniformity in the bags imported.

6. Seed multiplication program is useful for the nation. There is a need to coordinate with the related programs in order to derive maximum benefits.

7. We are in a position to supply processed seeds as per the requirement and also export to other countries. Adequate attention should be paid in this respect. If our objective is to export, we can successfully conduct seed multiplication program in suitable regions of terai and hills making the program profitable to farmers, AIC and the nation by earning foreign currency.

The following are additional benefits for the farmers from an organized seed multiplication program.

(a) Farmers get better market price for their produce.

(b) Incentive price for the seed growers.

(c) Facility of loan from bank is available to seed growers.

(d) More often agricultural technicians inspect the crop and guide the farmers.

(e) As more farmers are involved and a large area is brought under improved seed production while results in more production and more profit for more farmers.

Demand and Supply Projections

The Agriculture Inputs Corporation is regularly providing seed. Each year AIC is, as per the program, collecting, storing and selling the seed in a planned manner.

The following table of the eastern sector clearly shows that the demand for improved and processed seed is increasing in the country.

Eastern Development Region

| F.Y. | Seed consumed (m.t.) |
|---|---|
| 2029-30 | 482 |
| 2030-31 | 424 |
| 2031-32 | 530 |
| 2032-33 | 758 |
| 2033-34 | 911 |
| 2034-35 | 926 |
| 2035-36 | 958 |
| 2036-37 | 917 |
| 2037-38 | 696 |
| 2038-39 | 777 |
| 2039-40 | 1989 |

In 2029-30, seed consumed was 482 m.t. and in 2039-40 it was 1989. We can easily expect that the quantity will definitely increase in the years to come.

In order to meet the growing demand for seed, the processing and storage capacity should also increased. Otherwise change in demand can cause difficulties.

Now-a-days the farmers are habituated to plant improved and processed seed. The farmers are demanding more seed which is free from diseases and can give a good yield. This means the farmers are improvement oriented and very conscious. Hence, the basic requirement is to provide improved and processed seed.