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9. ABSTRACT

The most feasible avenues for increasing food grain and food crop production in Nepal are increasing cropping intensity, increasing the yield per crop, or preferably a combination of the two. One of the requirements for exploiting these avenues is continual development of improved, higher yielding, more efficient crop varieties adapted to the diverse eco-zones in the country. Another requirement is provisions for an adequate supply of the inputs needed by farmers to take advantage of the improved production technology to include seed, fertilizer, pesticides, water, and credit. The focus here is on input supply, especially the supply of seed of improved crop varieties. The report details discussions of the general agricultural background in Nepal, the seed production and supply background , the present status of the seed program in Nepal, and the proposed seed production and supply project. Expanding and improving the seed program in Nepal will require: more efficient and effective organization, more adequate facilities, more and better trained personnel, and a stronger commitment on the part of agencies involved to develop and improve seed production and supply. Long term technical assistance is proposed. There is a need for an external advisor experienced in the full spectrum of seed operations and their management under developing country conditions. There is also a need for a seed technologist or seed engineer experienced in harvesting, drying, processing, and storage operations, and in the maintenance of facilities. Adaptive, problem solving type research is required to resolve the many technical problems that plague the seed program in Nepal.

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REPORT TO USAID/NEPAL
HMG/N, AND AID/W

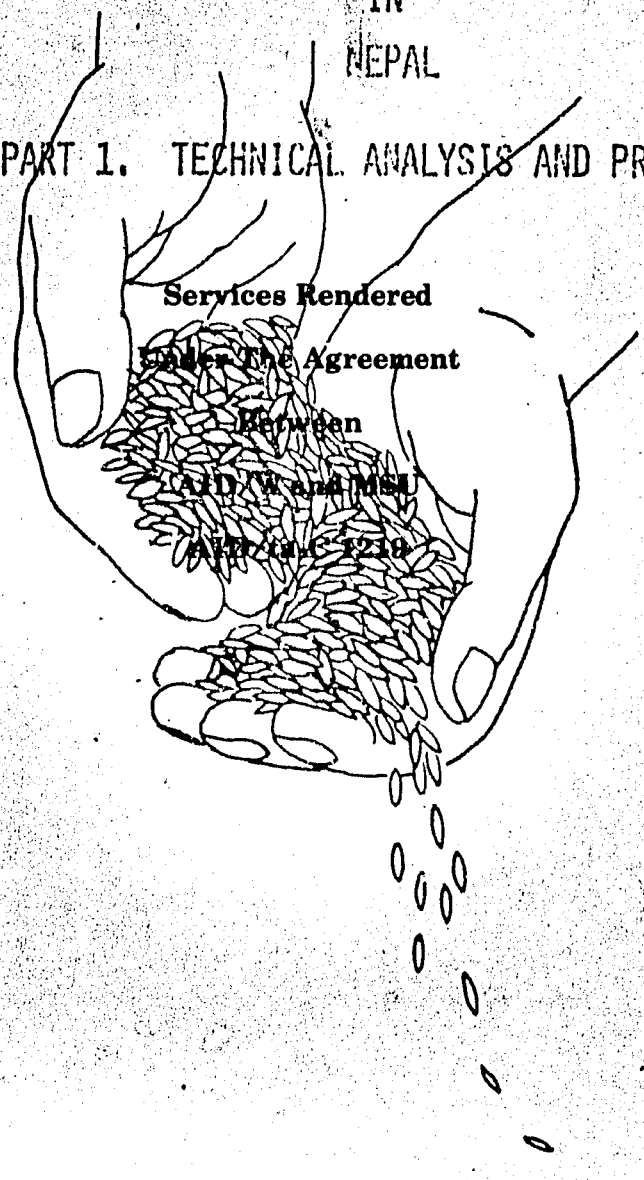
(Oct. 1977)

Return to Dave

SEED PRODUCTION AND SUPPLY IN NEPAL

PART 1. TECHNICAL ANALYSIS AND PROPOSAL

Services Rendered
Under The Agreement
Between
AID/W and MSU
AID/ta-C-1218



SEED TECHNOLOGY LABORATORY
MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE, MISSISSIPPI

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REPORT SUMMARY

TITLE: Seed Production and Supply in Nepal

Part 1. Technical Analysis and Proposal

CONTRACT: Services under AID/ta-C-1219

CONSULTANTS: James C. Delouche and Warren Couvillion, Seed Technology Laboratory and Department of Agricultural Economics, Mississippi State University

PERIOD OF CONSULTATION: July-November, 1977 (approx. 56 days in Nepal)

SUMMARY

1. Consultation was requested by AID/W and USAID/Nepal in connection with preparation of a PP on Seed Production and Input Storage.

2. Warren Couvillion was in Nepal in July-August and James C. Delouche followed in late August and September.

3. The seed program effort and accomplishments in Nepal were thoroughly reviewed with HMG/N officials and specialists.

4. Four previous review/studies of seed production and supply in Nepal (MSU, World Bank, IADS, Nepal Special Seed Committee) were examined and reviewed in detail to take maximum advantage of the recommendation and proposals advanced and the insights and preceptions of those involved.

5. On the basis of reviews of the background of the seed program in Nepal, analysis of on-going activities, contributions of other donors, and experiences in other developing countries proposals were made on:

(a) Expansion of seed production and supply to 7647 MT of seed by year 5 of the project.

(b) Facilities and equipment needed to augment those in-place or committed by HMG/N (AIC) and other donors, with special emphasis on the hills and mountains zones.

(c) Location of facilities proposed in (b).

(d) Training and technical assistance

(e) Organization and procedures.

6. Total proposed USAID contribution is $1,149,300, exclusive of working capital as might be required.

I. GENERAL AGRICULTURAL BACKGROUND

Nepal is an agricultural economy. More than 90% of the population are dependent on agriculture, and 75% of Nepal's total exports derive directly or indirectly from production in the agricultural section[1/].

Production resources for agriculture - especially for land use - are limited. The total area of about 14,000,000 hectares is classified as follows:

14%	-	Under cultivation
32%	-	Forests and forest land
15%	-	Perpetual snow
26%	-	Unreclaimable waste land and non-agricultural uses.
13%	-	Potentially reclaimable for agricultural uses.

A. "Natural" and Development Zones

Geographically, Nepal can be divided into three distinct zones (Figure 1).

Terai - A narrow strip of flatland along the southern border of the country. Much of this land is only a few meters above sea-level. The climate is sub-tropical and dominated by the monsoon rains which begin in mid-June and play out in late September. Paddy is the major food (and cash crop), while wheat, maize and barley are also important. Commercial crops include jute, tobacco, sugarcane, and oilseeds (mustard-rape). The terai is a surplus food producing area.

Hills - The hill zone comprises a broad strip of land extending from the eastern to the western borders through the central part of

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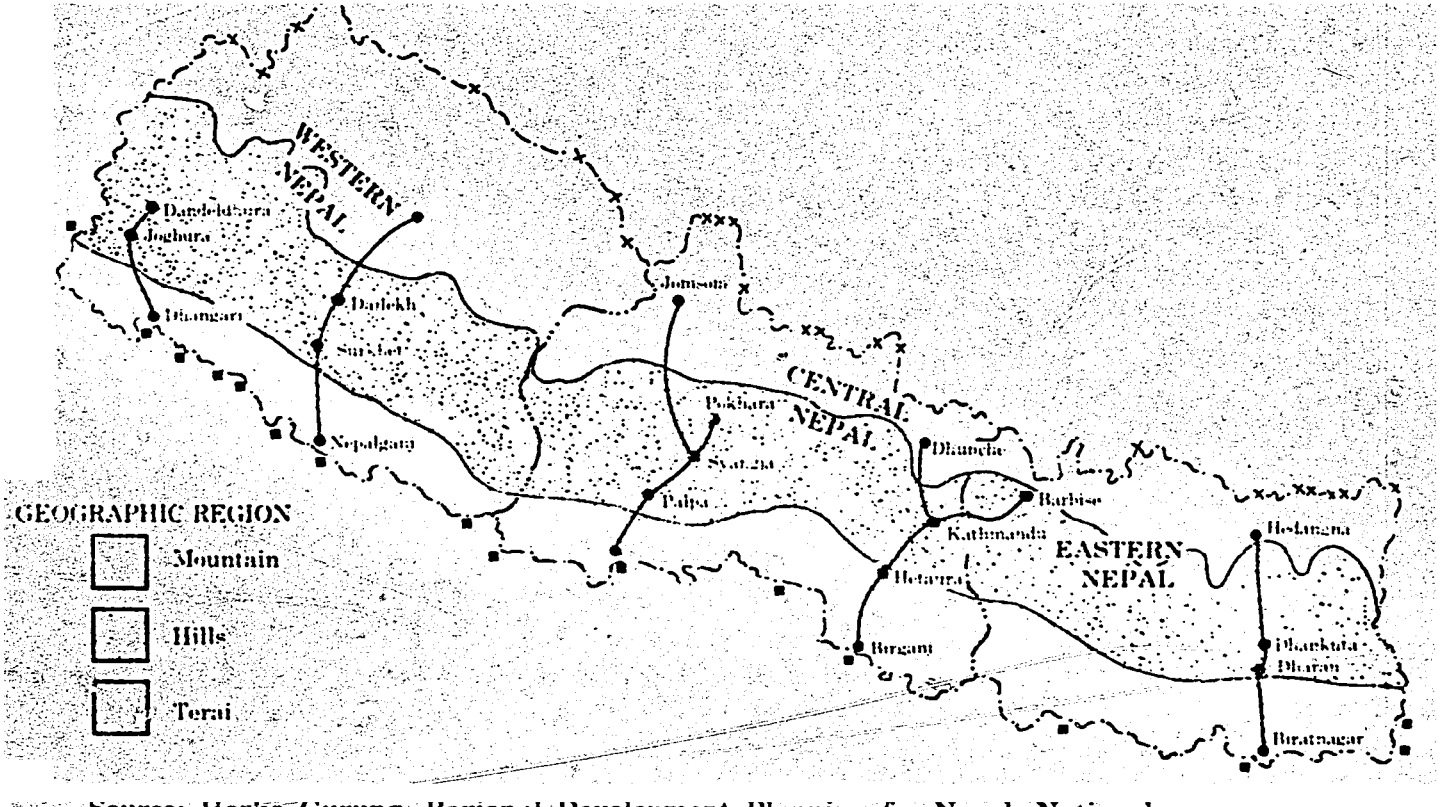
[1/] A.R. Hagen. 1976. The Agricultural Development of Nepal. Agr. Exp. Station, International Series II. Special Report 189. University of Missouri, Columbia, MO.



Source: Harka Gurung. Regional Development Planning for Nepal. National Planning Commission, His Majesty's Government, Kathmandu, 1969. (Page 10-11)

Figure 1. Geographic zones and established "growth axes" in Nepal.

Nepal. The dominant features of the zone are mountain ranges, canyons, inter-mountain valleys, and terraced mountain slopes. The valleys of which Kathmandu and Pokhara are the largest, are relatively fertile and are intensely cultivated as are the suitable mountain slopes. Food grain crops in order of importance are maize, paddy, wheat, millet (finger-millet) and barley. Oilseeds (mustard-rape) are also produced. Livestock play an important role in the economy providing milk and milk-products, meat, and manure. Except for the Kathmandu and Pokhara valleys the agricultural production "clusters" in the hill zone are generally isolated from markets and motorable roads. The hills are a food deficit zone.

Mountains - The mountain zone extends from east to west along the northern border of the country and includes the high Himalayas. This zone has only a very limited agricultural potential because of high altitude, low temperature, short growing season, limited rainfall, and little productive land. Livestock is the mainstay of the economy (yak, chauri, sheep and goats). Crops produced include rice, maize and wheat at the lower elevations, potatoes, barley, buckwheat and vegetables. The mountain zone is a food grain deficit area.

For development purposes, Nepal has been divided into four development regions: Eastern, Central, Western, and Far Western (Figure 2). Each of the regions encompasses terai, hills and mountains. Five north-south growth axes have also been established: The main purpose of these organizational arrangments is to "link" development activities in th terai, hills and mountains, so that the more difficult-to-develop hill and mountain zone will not be neglected.

B. Farm Size

Farm size in Nepal is small. According to a survey in 1971, average

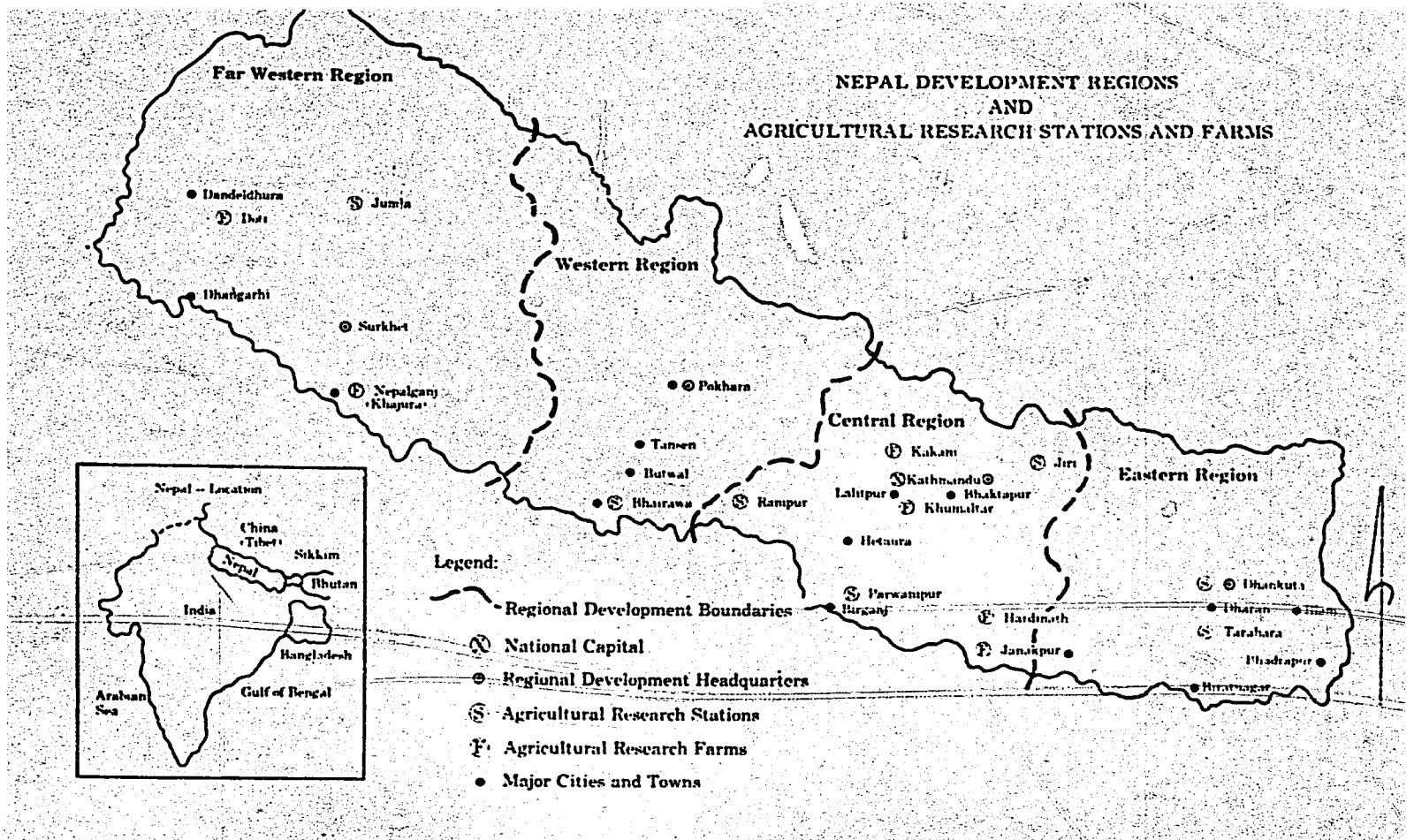


Figure 2. Development regions in Nepal.

farm size in the country is 2.17 ha. with the smallest farmers (63.5% of total) having holdings averaging 0.36 ha. In general farm size decreases from the terai to the hills and high hills (mountains) and from east to west across the country. The average cultivated farm holding is 0.66 ha. in the Kathmandu Valley, 0.59 in the Eastern hills, and 0.82 in the Western hills. Holdings in the terai are much larger - ranging from 3.19 ha. in the Eastern terai to 7.36 ha. in the Western terai.

The 1971 census estimated that there are 1.5 million farm families in Nepal (60-65% in the hills) farming about 2 million hectares. Since average family size is over seven (7), the per capita cultivated area is about 0.19 ha (0.13 ha. in the hills).

C. Agricultural Production

The area cultivated and production of major food grain and oilseed crops are shown in Table 1 by development region and geographical zone within each development region[2/].

The USAID Development Assistance Program (DAP) points out some disturbing trends in agricultural production in Nepal. During the periods 1966-69 and 1970-73, food grain production increased at approximately 1.2% p.a. while population growth was estimated at 2.0-2.4% p.a. In the hills zone, area under cultivation increased 2.5% p.a. from 1966-69 to 1970-73, but production increased only 1.5% because of an estimated 1.0% decrease in yield/ha. The situation in the terai zone is only slightly better. During the 1966-69 to 1970-73 periods the per annum increase in area under cultivation was 1.5%, production increased by 1.6%, and yield/ ha. increased by only 0.06% p.a.

[2/] Agricultural Year. Agricultural Marketing Information. HMG, MFAI, Food and Agricultural Marketing Services Department. Vol. VI. No. 1.

Table 1 . Area and production of six major crops in Nepal, 1974-75 (Area in 000 ha; production in 000 m.t.).

Region/Zone	Paddy		Maize		Wheat		Barley		Millets		Oil Seeds	
	Ha.	MT	Ha.	MT	Ha.	MT	Ha.	MT	Ha.	MT	Ha.	MT
Eastern												
Mountains	3.7	8.1	16.0	30.4	2.5	2.3	1.7	1.7	4.8	6.4	0.7	0.3
Hills	43.2	97.2	65.9	122.8	6.6	6.3	1.3	1.3	17.4	21.7	7.3	4.0
Terai	344.3	638.1	13.2	17.2	37.2	38.0	0.8	0.6	4.1	4.4	10.2	4.6
Subtotals	391.2	743.4	95.1	170.4	46.3	46.6	3.8	3.6	26.3	32.5	18.2	9.2
Central												
Mountains	6.0	13.7	14.6	28.1	3.4	3.3	0.8	0.9	4.1	4.7	0.3	0.1
Hills	63.8	179.0	68.6	147.1	35.6	44.0	0.6	0.6	18.4	20.3	11.6	6.0
Terai	352.4	673.2	54.9	93.8	65.2	89.7	4.8	3.3	8.1	7.1	33.0	18.8
Subtotals	422.2	865.9	138.1	269.0	104.2	137.0	6.2	4.8	30.6	32.1	44.9	24.9
Western												
Mountains	1.4	3.7	3.7	6.5	2.1	1.8	1.6	1.6	1.7	2.1	-	-
Hills	52.1	121.3	78.2	149.4	14.4	16.2	2.3	2.2	39.0	47.0	2.8	1.4
Terai	163.1	302.7	20.2	37.3	42.5	51.1	2.0	1.4	2.8	2.4	8.2	4.4
Subtotals	216.6	427.7	102.1	193.2	59.0	69.1	5.9	5.2	43.5	51.5	11.0	5.8
Far Western												
Mountains	8.9	18.3	7.5	13.1	15.5	14.2	5.1	5.5	6.1	7.2	0.9	0.4
Hills	37.3	85.6	51.4	97.1	36.5	32.6	5.9	6.0	13.9	15.0	4.4	2.1
Terai	164.2	314.1	52.7	84.0	29.1	31.5	0.4	0.3	4.5	4.0	33.4	22.6
Subtotals	210.4	418.0	111.6	194.2	81.1	78.3	11.4	11.8	24.5	26.2	38.7	25.1
TOTALS	1240.4	2455.0	446.9	826.8	290.6	331.0	27.3	25.4	124.9	142.3	112.8	65.0

Source: Agricultural Marketing Information. Special Issue. Vol. VI, No. 1. Jan. 1976. Food and Agricultural Marketing Services Department. MFAI

These statistics indicate a serious stagnation of agricultural production in the traditionally food surplus terai, and a deteriorating agriculture in the hills. The results of these situations are a decline in the per capita available food, and declining exportable surpluses from the terai.

Increases in food production during the past 10 years or so have been achieved largely by increasing the area under cultivation, e.g., land clearing and development in the terai. While substantial investments in land development could increase the cultivatable area in the terai by an estimated 20-30%, the hill and mountains zones are being utilized about to the maximum.

Considering the limitations of land resources in Nepal the only long term avenues for increasing food production appear to be: (1) increasing the intensity of land use, i.e., number of crops grown per year per unit area; (2) increasing the production (yield) per crop per unit area; and (3) combination of (1) and (2).

Cropping intensity is presently estimated at 132% in the terai and 135% in the hills (100% = one crop per unit area per year). These cropping intensities are relatively low - especially in the terai. As water is the major factor limiting cropping intensity (in the terai), substantial developments in irrigation will be needed to increase cropping intensity up to 200% and 150% in the terai and hills, respectively, which appear feasible. Other donors are providing substantial assistance to help Nepal increase cropping intensity through improved irrigation.

The USAID/Integrated Cereals Project (ICP) is mainly concentrating on increasing the yield per unit area through development of higher yielding varieties (and with more stable yields), and improved cultural, pest

control and management practices. Another important objective of the project is to identify cropping systems that will produce high total yields per unit area p.a.

II. BACKGROUND - SEED PRODUCTION AND SUPPLY

The most feasible avenues for increasing food grain and food crop production in Nepal are increasing cropping intensity, increasing the yield per crop, or preferably a combination of the two. Exploitation of these avenues for agricultural development will require: (1) continual development of improved, higher yielding, more efficient crop varieties adapted to the diverse eco-zones in the country; (2) the development and/or identification of appropriate production technology (including levels of inputs) that will permit the most efficient realization of the genetic potential of the improved varieties; (3) the dissemination of the improved varieties and production technology among the farmers and their adoption of same; (4) provisions for an adequate supply of the inputs needed by farmers to take advantage of the improved production technology to include seed, fertilizer, pesticides, water (irrigation), and credit; and (5) equitable marketing arrangements that provide an incentive to farmers to adopt the improved production technology and rewards them sufficiently for their efforts.

The focus here is on input supply, especially the supply of seed of improved crop varieties. The importance of seed production and supply for agricultural development was recognized by HMG in the mid 1960s, when seed of the three major crops -- rice, wheat and maize - began to be multiplied, procured from India, and distributed/marketed to farmers. These early efforts were concentrated in the Central and Eastern terai and in the Kathmandu valley. Although drying, cleaning and processing facilities were limited or non-existent, the program was supplying

nearly 500 metric tons (mt) of seed by 1970-71, some of which - mostly wheat seed - was imported from India.

The IADS Seed Team Report[3/] reviewing seed production and supply in Nepal recognized several noteworthy changes that had occurred in this area during the past 10 years, i.e., 1966 to 1976.

"1. Several wheat and rice varieties from outside the country have been tested and introduced. Similarly, new maize composites have been introduced. Increased effort is being made to maximize the results of research through the various coordinated programs, and to select and breed varieties especially adapted to the country's needs.

"2. The Agricultural Marketing Corporation has been superseded by the Agricultural Inputs Corporation (AIC), which assists in the supply of seeds, fertilizers, pesticides, and farm equipment.

"3. A major shift has been made from depending upon substantial exports of wheat seed from India to more indigenous productions. The amount of maize and paddy seed available through AIC has been slowly increasing.

"4. A number of farmers have been identified who are now interested in growing seed, a situation which did not exist a few years ago.

"5. Quality levels have been established for seed, and more systematic attempts are being made to achieve them.

"6. The number of samples being tested in the seed-testing laboratory has been increasing, and plans are afoot to provide more seed-

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[3/] Report of the IADS Seed Team, Oct. 4-23, 1976 (to HMG/Nepal and USAID/Nepal).

testing services in various regions.

"7. A major seed processing facility and a few small cleaners are now in use where none existed ten years ago.

"8. The future needs of the seed program are more fully recognized by leaders, and new mechanisms have been worked out to increase communications among concerned groups in planning and implementing seed program activities."

The IADS report also noted that a limited but most significant number of opportunities for training in seed technology (India and U.S.) had been provided by USAID and UNDP, and that the trained participants were playing important roles in the seed program in Nepal.

A. Previous Projects, Studies and Recommendations

The importance attached to seed production and supply in the agricultural development of Nepal by HMG and major donors and international development institutions is evident in the several significant projects, studies and reports related to the seed program in Nepal and improvements thereof.

1. UNDP/FAO High Yielding Varieties Project

This progect which terminated about a year ago was mostly concerned with demonstrating the use of high yielding crop varieties with adequate levels of fertilizers. One objective, however, was the establishment of a seed drying/processing/storage facility. The seed facility was located at Hetaura in the inner terai zone of the Central Development Region.

The Hetaura seed facility represents a prime example of inappropriate technology. Essentially, the most modern middle-European seed processing technology was transplanted to an industrial park in Hetaura, Nepal at an estimated cost of RS. 600-800,000.

Apart from the inappropriateness of the technology used and a few technical deficiencies, the major problems with the Hetaura seed facility are: (1) operational costs are high, thus increasing the upward pressure on seed prices; (2) the facility has a capacity of about 5000 MT seed/year, but its location and the poorly developed and high-cost transportation in Nepal will probably restrict its output to about 2000 to 2200 MT per year.

The UNDP/FAO project provided a consultant to "start-up" the plant and train the Nepalese personnel in its operation. The plant is now fully operational.

The Hetaura seed facility is reviewed and discussed in detail in Annex A.

2. USAID/Mississippi State University Consultation

In October, 1973, USAID/Nepal requested services of Mississippi State University (MSU) seed specialists (under MSU's contract with AID/TAB), to "review current status of seed production and supply in Nepal, to identify needed improvements and to develop recommendations"[4/]. Two MSU specialists undertook the seed program consultation during the period November 14 to December 12, 1973.

On the basis of their on-site review of the seed program in Nepal, the MSU consultants made the following recommendations:

"1. The Ministry of Agriculture/HMG should develop within the Evaluation and Project Analysis Division a Seed Need and Use Reporting Service.

"2. The Ministry of Agriculture/HMG and Agricultural Marketing Corporation/N should give highest priority to the selection of personnel for and implementation of training programs outlined.

[4/] Seed Program Consultation in Nepal. Report No. TA 74-02 to USAID/Nepal and AID/W. Mississippi State University, Mississippi State, MS. Feb. 1974.

"3. The Ministry of Agriculture/HMG should obtain the services of a seed specialist consultant for a period of 2-4 years. The consultant's services should be made available to the Department of Agriculture/HMG, Agricultural Marketing Corporation/N, and the new Seed Reporting Service.

"4. The Department of Agriculture/HMG should implement a thorough review of present and projected Breeder and Foundation seed operations to identify needed improvements in facilities and production arrangements.

"5. The Agricultural Marketing Corporation/N should implement measures to correct apparent deficiencies in existing seed facilities.

"6. The Department of Agriculture/HMG and Agricultural Marketing Corporation/N should implement a thorough review of seed production and usage areas to determine numbers, location and size of future Agricultural Marketing Corporation/N seed handling installations. Consultant services should be obtained as outlined.

"7. The Ministry of Agriculture/HMG and Agricultural Marketing Corporation/N should make clear to external organizations (donors) concerned the specific areas in which technical and/or financial assistance is needed to develop Nepal's seed program.

"8. Foundation seed production and supply for all crops should be integrated into a single program or section in the Department of Agriculture/HMG, including management, personnel, and facilities.

"9. The Department of Agriculture/HMG should organize a working study group (Advisory Board) consisting of representatives from the Department of Botany, Agricultural Marketing Corporation/N, Agricultural Extension, cooperatives, grain industry, farmers association, etc., for the purpose of formulating recommendations to the Department of Agriculture/

HMG on: (a) a general, rational seed certification policy; (b) a national certification program realistic in organization, scope, standards, and objectives; and (c) a time phased schedule for implementation of a certification system by crop species and agricultural region.

"10. The Department of Agriculture/HMG, as the seed breeding agency, and the Agricultural Marketing Corporation/N, as the seed procurement and distribution agency, should cooperatively adopt and implement a scheme that will assure an adequate production of seed of known genetic identity and purity.

"11. Seed production for any given year should exceed estimated needs by approximately 20%.

"12. The Agricultural Marketing Corporation/N should establish a separate, semi-independent seed branch. Leadership positions should be filled by best available personnel on a temporary basis until technically qualified personnel can be obtained.

"13. The Department of Agriculture/HMG should charge the study group considering seed certification with the additional task of determining the type and scope of seed legislation which would be most beneficial to agricultural development. The study group should enlist and utilize knowledgeable, experienced personnel and technical assistance in formulation of its recommendations on seed legislation."

These recommendations of the MSU seed consultants addressed the most critical weaknesses of the seed program in Nepal as it was operating in 1973: (1) inadequate provisions for estimating seed requirements; (2) lack of trained personnel and technical-managerial assistance; (3) poorly organized and ineffective breeder and foundation seed production program;(4) inadequate facilities and the lack of a "plan" for needed expansion of the seed program; (5) poor organization of seed production

and supply operations in the Agricultural Marketing Corporation (predecessor of the Agricultural Inputs Corporation); and (6) inadequate arrangements for control of the quality of seed produced and marketed.

Several of the recommendations were adopted and implemented: quality control procedures were improved; the Agricultural Inputs Corporation established a Seed Division; a study group was formed to develop a plan for expansion of seed production and supply; training of personnel was expanded and accelerated. The most important recommendation not implemented in the time-frame proposed (1974-76) was use of consulting services and technical assistance to, "determine numbers, locations, and size of future Agricultural Marketing Corporation/N seed handling installations," (recommendation No. 6).

Over-all the MSU Consultants recommended reasonable approaches for improvement and expansion of the seed program, approaches that have been and are being followed, although several years later than recommended.

3. World Bank Project Identification Mission[5/]

An "Identification Mission Report - Seed Project Nepal" was prepared for IBRD by Dr. D.P. Singh (India) on basis of a consultation visit March 11-25, 1975.

The Mission identified, "an urgent need and adequate justification for establishing a seed project for the production of certified seeds of high yielding varieties of cereals, pulses, oilseeds, potatoes, vegetables and commercial crops, in order to tap the immense possibilities opened up by the new seeds for the transformation of agriculture through a new strategy based on science and technology." It stressed that, "it is neither desirable nor possible (for Nepal) to depend solely on the

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5/ Seed Project Nepal - Identification Mission Report. South Asia Projects Division, IBRD. March 11-25, 1975.

imported seeds from India...", and that, it also would not be, "desirable to depend on the 'natural spread' of superior varieties on a farmer-to-farmer basis," as "this is not working in any other country and is not working in Nepal."

The IBRD Mission stated that the goal of the seed project should be, "(a) complete self-sufficiency and self-reliance to meet the full effective demand for seed; (b) an adequate buffer stock to meet the flucuation of demand and production; and (c) building up an export potential to the extent possible," (primarily potato and jute seed).

Following a review and critique of previous recommendations and studies, and deficiencies in the existing seed program in Nepal (1975) the Mission advanced the following recommendations (in part):

"1. Development of the physical infra-structure in the selected area of 40,000 hectares by way of irrigation, reclamation, land shaping, electrification, organization, communications, etc.

"2. Provision of machinery and equipment for farming operations.

"3. A larger sized modern seed processing plant". (for 60,000 MT seed!!)

"8. Strengthening of research facilities including the feasibility of a full-fledged college/university of agriculture or land grant institution.

"10. Establishment of a large size farm (about 4000 ha) for production of foundation seed.

"11. Establishment of a national seeds corporation.

"12. Establishment of an independent and technically competent seed certification agency.

"13. Seed legislation.

"14. Establishment of an enforcement agency."

These recommendations closely followed the development pattern of the Terai Development Corporation, (TDC), Pantnagar, India which developed a very successful seed enterprise. The TDC is a share company with shares held by the Agricultural University at Pantnagar, the TDC, and private farmer seed producers - in about equal proportions. Its base is some 4000 ha. of excellent land owned by the Agricultural University, and much good land newly brought under cultivation in a rather compact zone surrounding the University. The "compact zone" characteristic and association with one of the best of India's agricultural universities undoubtedly contributed in a major way to the TDC success. Technical guidance is always available and the management and supervision of operations are facilitated by the "compactness" of the area.

Successful as it is, the TDC is <u>not a good model for a seed program in Nepal</u>, or for that matter, <u>most other developing countries</u>. Concentration of seed production in one compact area in Nepal would place impossible burdens on meager communication, transportation, and marketing resources. It would subject seed production and supply in Nepal to the special risks of having all of one's "eggs in a single basket". Unseasonal rains in the seed production area during harvest - such as happened in some parts of India and in Nepal's central and eastern terai in April and May, 1977 - could ruin the entire seed supply in a few days. Finally, the single "compact zone" approach would create a host of difficulties in trying to produce seed of varieties developed for the diverse eco-zones in Nepal under one set of conditions.

Fortunately, the IBRD Identification Mission proposal did not progress further.

4. IADS Seed Team Study[6/]

The International Agricultural Development Service (IADS) organized a three man "seed team" for a study and review of the seed program in Nepal. The team visited in Nepal during the period October 4-23, 1976.

Observations and recommendations of the IADS Seed team can be summarized as follows:

(1) The team recognized significant and noteworthy changes that have taken place in seed-related activities in Nepal and commended those responsible for such achievments. (see page 7).

(2) It concurred in draft plans for small seed production and supply units in the hills, but felt that initial steps in this direction should be limited to 5 to 6 locations on an "experimental basis".

(3) It supported the proposal of the Seed Committee that private farmers and groups of farmers in the terai be encouraged in seed production, processing, storage and marketing and gradually take over more of the responsibilities for commercial seed now handled by AIC.

(4) The team emphasized that the climate, topography and transportation system in Nepal will greatly influence the kind of seed production, processing, storage, and distribution/marketing needed for the country. High relative humidity during and following the monsoon was singled as a major technical problem that must be overcome.

(5) The widespread acceptance of new wheat varieties was recognized but the team pointed out that the situation was very different in the case of maize and paddy. It felt that more adequate arrangements for supply of seed of improved varieties of paddy and maize,

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6/ Report cited in footnote 3/

and a more effective and resourceful demonstration/extension effort could greatly increase the acceptance and use of improved maize and paddy varieties. The USAID/ICP project was pointed out as a good beginning in the right direction.

(6) Better organization and greater effort were recommended to improve varietal maintenance, breeder and foundation seed production at the crop research centers. The team proposed that one section be charged with responsibility for coordinating initial seed increases and breeder and foundation seed production on a national basis.

(7) The farmer-to-farmer system of improved seed distribution was recognized as most important in Nepal and the team encouraged efforts to expand and accelerate the process. For the hill communities, the team felt that a series of seed producers was needed to serve as a "pipeline" for the introduction of new varieties into the communities.

(8) A "go slow" gradual approach was suggested for implementation of a seed certfication scheme.

(10) The team envisioned AIC evolving into an organization with a greater role in the development of the seed as more and more seed production, processing, and marketing are shifted to local seed grower-marketing groups. AIC should play two roles: as a major contractor for seed production; and as a "development" and "technical assistance" agency for private farmers interested in establishing private seed operations.

(11) Consultant/advisors for 3 to 4 years were recommended to assist in further development of the seed program in Nepal.

(12) Finally, the team pointed out that foreign exchange should be used to finance purchase of seed equipment, generators, and vehicles for the seed program, and that substantial local funds would be needed to construct buildings for the seed equipment and seed storage warehouses and depots.

Although the IDAS Seed Team report was rather general, and more "reachy" than substantive, four major recommendations were advanced:

(1) Improvements in breeder and foundation seed production to include a better coordinating mechanism and development of adequate facilities at the experiment stations.

(2) Gradual transfer of seed production, processing and marketing from AIC to private sector enterprises, especially in the terai (this was essentially a strong endorsement of proposal by the "Special Seed Committee" formed to draft a seed program plan for Nepal).

(3) Provisions for recruitment and funding of a seed specialist (presumably expatriate) with experience in seed production and general management of a seed enterprise to assist AIC in its seed operations for an extended period of time.

(4) Increased emphasis on training of technicians and workers for positions in the seed program/industry.

The first recommendation is being implemented under the USAID/ICP - IADS project. The second raises an issue which is dealt with elsewhere in this report. The third and fourth recommendations emphasized a need expressed in most reports and studies of seed production and supply in Nepal.

5. <u>USAID/ICP-IADS Project</u>

In connection with the USAID/ICP-IADS project, IADS obtained the

services of a consultant agricultural engineer to plan and design small seed drying, processing, and storage facilties for the Agricultural Experiment Stations at Rampur, Bhairawa, Parwanipur, and Nepalgunj. These would be used primarily for the multiplication and production of breeder and foundation seed and for seed to be used in "demonstration kits".

For each of the four stations the following facilties were recommended:

(1) A 3-6 MT/day sack dryer.

(2) A 6-8 MT processing plant consisting of a 0.5-0.8 TPH basic air-screen cleaner, seed treater, packaging system, with necessary elevators and conveyors.

(3) Maize sheller and threshers for wheat, rice and similar crops.

(4) A 200 MT storage unit with 50MT conditioned space at Parwanipur and Rampur and 100 MT conditioned space at Bhairawa and Nepalgunj (to maintain conditions of 65°F and 65% relative humidity)

For drying several Siebring dryers already available are being converted from gasoline engine to electric motor operation. The heater units burn fuel oil. The consultant also proposed the procurement of an IRRI type rice hull fired dryer and a cob fueled dryer from India. These will be evaluated on an experimental basis and if successful - and there's no reason to believe that they won't be successful - additional units can be fabricated in Nepal for use at other stations. The main advantage of such "cob" and "rice hull" fueled dryers is, of course, the savings on cost of fuel. Fuel oil or diesel oil is very expensive in Nepal.

The proposals and recommendations relating to breeder and foundation seed facilities are excellent and should be implemented under the USAID/ICP-IADS project as soon as feasible.

6. Nepal Special Committee Report[7/]

The MFAI/Nepal established a special committee to review previous studies and recommendations relating to seed production and supply in Nepal and to develop plans for expanding and improving the present effort. The committee was chaired by Mr. A.M. Pradhanag, Chief, Agricultural Botany Division. Other members were: Mr. I.R. Regmi, ASPC, Mr. J. Wison, USAID, Dr. P.S. Rana, Chief, Seed Division, AIC, and Mrs. Kamlesh L. Rajbhandary, Agricultural Botanist (Seed Unit), Agriculture Botany Division.

The committee addressed itself to the needs for improved seed of paddy, maize, wheat, barley and some vegetables as envisaged in the 2nd Five Year Plan, as well as longer term needs. As a major guideline, the committee established the principle of regional and localized seed production and distribution. It felt that minimizing the movement of seed from one region to another would reduce tranpsortation costs, lower seed prices, and permit closer control of the quality of the seed.

Targets for the seed program were established for a five year period (1977-78 to 1981-82). The "end of plan" targets (1981-82) are as follows:

Development Region	Metric Tons of Seed				
	Paddy	Wheat	Maize	Barley	Totals
Eastern	470	1245	50	--	1768
Central	350	1920	450	600	3320
Western	600	1535	60	--	2195
Far Western	225	960	45	--	1230
TOTALS	1645	5660	605	600	8510

[7/] Seed Program Draft. Prepared by Special Seed Committee, A.M. Pradhanag, Chief, Agricultural Botany Division, Chairman. Undated.

The targets established for vegetable seed production by 1981-82 are:

Year	Metric Tons of Seed	
	Winter Vegetables	Khariff Vegetables
1981-82	11.5	4.0

As the "long term potential" or goal the committee felt that supply of 25% of the total seed needed for planting should be given consideration. Achievement of this goal would require the production and marketing of about 26,000 MT seed per year.

Proposed seed multiplication districts are:

(1) Eastern Region

(a) Terai - Morang, Jhapa, and Sunsari

(b) Hills - Kotang, Illam, Dankuta

(2) Central Region

(a) Terai - Chitwan, Makwanpur, Barsa, Parsa, and Dhanusha

(b) Hills - Kathmandu and Sindhuli Madi

(3) Western Region

(a) Terai - Rupandehi and Kapilvasta

(b) Hills - Pokhara, Baglung, and Tanahu

(4) Far Western Region

(a) Terai - Dang Deokhuri, Banke and Kailali

(b) Hills - Baitadi, Doti, Jumla and Rukum

To accomplish the targets established the committee recommended the establishment of seed processing units for the terai and hills zones as follows:

Region	Processing Units	
	Terai (6-8 MT/day)	Hills* (3-4 MT/day)
Eastern Region	Biratnager	Dhankuta
Central Region	(Hetaura-existing)	Kathmandu

Western Region	Bhairawa	(Pokhara-existing)
Far Western Region	Nepalgunj or Kailali	Surket and Baitadi

*In addition, the Seed Committee proposed seven mini-plants with hand operated, low capacity equipment for selected "pockets in the hills."

Recognizing the need for better located and improved storage/depot facilities for the seed before and after processing and during distribution and marketing the committee proposed development of seed storage facilities as follows:

	Seed Storage Proposed By 1980/81 (numbers in ( ) are capacity in MT)	
Region	Terai	Hills**
Eastern	Siraha (50)	Dhankuta (50)
	Saptari (300)	Khotang (50)
	Sunsari-Moranj (1000*)	Illam (50)
	Jhapa (100)	
Central	Makwanpur (1000*)	Chitwan (200)
	Bara and Parsa (600*)	Sindhuli (50)
	Dhanusa (400)	Kathmandu (150)
	Rautahat (100)	
Western	Palpa (100)	Pokhara (200*)
	Kapilvastu (250)	Baglung (50)
	Rupandehi (1000)	Tanahu (50)
Far Western	Banke (1000*)	Surket (100)
	Kalali (150)	Dang (100)
	Kanchanpur (50)	Baitadi (50)
		Jumla (50)
		Rukum (50)

*Constructed or under construction
**In addition to "main" hill storage units indicated, the Nepal Seed

Committee suggested a need for 25 additional sub-units (10 MT) in hill pockets.

The Nepal Seed Committee also addressed itself to some aspects of organization of the seed program, and the development of supporting services.

Organization -- The orderly release of varieties should be through the recently established Variety Release Committee. The Variety Release Committee should not only evaluate the merits of new varieties proposed for release, but also catalogue popular, existing varieties and make determination of which of these should be maintained and set-up for breeder and foundation seed production.

The breeder and foundation seed programs at the agricultural experiment stations should be provided with adequate processing and storage facilities so that insufficient supplies of these basic classes of seed will not be a constraint on the production and supply of seed to farmers.

A seed production specialist should be posted in each seed production region to coordinate assistance to seed producers and private seed enterprises from the various research, extension, and other service agencies in the region. The specialist would also be coordinator of the total seed production effort in the region involving the joint efforts of the regional and district officers and staffs of AIC, ADB, and Agriculture Department farms, stations and regional seed testing and certification laboratories.

The Seed Committee recognized the many technical,economic, and management problems involved in producing, processing, storing and marketing seed on a "mass" scale and that government and "semi-government" agencies would have to take the lead in establishing seed production and supply on a economically viable basis. It strongly urged, however, that "considerable room" be left for private sector developments.

"Shifting of responsibilities to private sectors", however, should not be undertaken until it (the private sector), "is prepared and experienced enough." Emphasis should always be on "quality seed" and seed enterprises public or private - which are doing good jobs should be, "strongly supported technically and should also be protected from competition by the ordinary seed suppliers". The Department of Agriculture should register and recognize seed enterprises (including nurseries) who wish to do seed business in a scientific way. The criteria needed for registration should be that the seed sold by the organized enterprises should be processed, packaged and labelled with information on kind, variety, purity and germination.

Private seed enterprises should be fully supported by seed testing and inspection services, advisory services and technical support from the crop coordinated programs and other specialists of the Department of Agriculture, through long and short term loans from ADB for needed investments, and through free and full access to the latest information developed by research on new varieties, production practices, etc.

AIC should contract seed production with private seed enterprises on a first priority basis.

Supporting Services -- The Seed Technology and Development Unit of the Agriculture Botany Division should be developed and adequately staffed to enable it to make prompt and timely field inspections and seed tests. Four regional seed testing/inspection branches should be established - one in each region. The Seed Unit will have to further develop and refine the techniques of field inspection, sampling and seed testing so important in quality control. Workers will have to be trained and periodically provided with opportunities for "refresher" training. A committee should be established (Agr. Dept., AIC, and other

concerned agencies) to review, approve, and authorize implementation of all standards and regulations relating to seed production and supply.

In view of the many technical problems associated with production, storage, and distribution of seed in Nepal, the Seed Unit must also be provided with resources to do the adaptive "problem-solving" research needed to resolve the problems to the extent possible.

The Extension Service must step-up its efforts to persuade farmers to adopt improved seed through convincing, realistic demonstrations and all other means. J.T. and J.T.A. workers must be trained so that they can assist with the selection and supervision of seed growers.

Personnel -- at full development, the Seed Committee envisaged a need for 20 "Gazetted Level" and 40 "Non-gazetted Level" personnel (excluding semi-skilled and common laborers). These personnel would have to be trained at various levels: 4-8 weeks study tours, 3-6 month training courses, advanced training and advanced degree training.

Operating Procedures -- The Seed Committee proposed the following general operational procedures and policies:

(1) The Variety Release Committee should be the designated final authority on release and maintenance of varieties in the seed program.

(2) A Central Seed Multiplication Committee should be established and charged with responsibilities for formulating and approving all quality control standards.

(3) Seed multiplication and production should be on a regional basis under the guidance of a "Seed Multiplication Execution Committee" chaired by the Regional Director and consisting of representatives of AIC, ADB, Seed Technology Unit of the Agriculture Botany Division, Research and Extension Stations, and other Agencies. A Regional Seed

Production Officer should be appointed and serve as secretary of the committee. Sub-committees should be formed as needed at district level.

(4) The research stations should be responsbile for varietal maintenance and the production and supply of breeder seed and foundation seed.

(5) Certified seed production should be carried out by selected farmers as usual. Attempts should to be made to involve the village cooperatives in the production of seed.

(6) Every effort must be made to involve the private sector in the seed program.

(7) The AIC should continue to shoulder the responsibility for selection of seed producers, collection of harvested seed, processing, storage, distribution and marketing, and develop the necessary facilities to carry out these functions.

(8) The Seed Technology and Development Unit of the Agriculture Botany Division should continue with responsibility for all quality control aspects of the seed program and provided with additional staff and facilities as required.

(9) Major seed multiplication, processing and distribution programs should be in the terai areas. For the hills smaller programs in a few selected areas should be carried out.

The Seed Committee obviously spent a lot of time and effort in formulating its proposals. They are, in general, quite reasonable and provide a suitable framework for developing more specific plans for expanding and improving seed production and supply in Nepal.

7. <u>German Assistance for Seed Processing Equipment</u>

German assistance has agreed to supply HMG (AIC) with complete sets of equipment for four moderate size seed processing plants. In turn AIC

has agreed to provide "housing" for the equipment in new warehouse construction at four sites. It has been decided to locate the four seed plants in the terai - one plant in each region.

The locations of the seed processing plants are (will be):

Biratnagar (Eastern terai)

Janakpur (Central terai)

Bhairawa (Western terai)

Nepalgunj (Far Western terai)

Each set of equipment includes a dryer, precleaner, two basic air screen cleaners with matched capacity length graders, seed treater, packaging system, necessary intake elevators and handling/conveying equipment, and an electric generator. The hourly capacity of each plant should be about 1.5 to 2.0 MTH.

The equipment being provided and other related items are more fully described in ANNEX A.

German assistance is also providing an engineer for a 6 month period beginning o/a November 1, 1977, to supervise the installation and start-up of the plants, and to give on-the-job training to the personnel who will operate the plants.

B. Present Status of Seed Program In Nepal

1. Features and Characteristics

Presently, the seed program in Nepal is rather loosely organized and poorly coordinated. Pertinent organizational features and operational procedures are described and discussed below.

-Recommendations for the release and maintenance of varieties in the "seed program" is made by a Variety Release Committee.

-The Crop Coordinating Units for the major crops, i.e., paddy, maize, and wheat maintain the varieties and produce breeder and foundation

seed. Foundation seed are also produced at certain farms operated by the Department of Agriculture.

-A Central and Regional Seed Committees composed of representatives of the Department of Agriculture, AIC, and ADB establish annual seed production targets for paddy, maize, and wheat.

-These targets are often reduced by AIC because they are "too high". AIC does not want to bear the risk of investing in seed that cannot be marketed, hence, its production schedules tend to be very conservative.

-AIC has the main responsibility for the production, processing, storage and distribution of seed. For the most part seed are produced under contractual agreements with private farmers. AIC provides "foundation" or "certified" seed and some supervision, then lifts the seed after harvest for processing, packaging and storage. Some seed are also produced by the experiment stations, demonstration farms, etc., and are transferred to AIC for processing, storage and marketing.

-Seed growers are paid a premium of up to 30% over "grain price" for the seed subject to discounts for the various quality factors as determined by seed tests. The average premium after discounting is slightly over 20%.

-In times when there is a short-fall in scheduled seed production because of adverse weather on unanticipated demand, AIC selects and purchases grain stocks from farmers for use as seed.

-The Seed Technology and Development Unit of the Agriculture Botany Division operates an inspection and testing service. Its specialists try to inspect seed production fields, and sample harvested seed which is then tested to determine if its meets established standards.

-AIC processes seed at the Hetaura facility or at a few other sites

equipped with small cleaners. The seed are then stored until distributed

-Distribution channels are from the AIC main storehouses to regional or branch storage units and then to the cooperatives or private traders, at which point sales are made to farmers.

-The Agricultural Devleopment Bank grants some credit to farmers who purchase seed through the cooperatives.

-In the last year or so, AIC has also became involved in distribution and marketing of some vegetable seed, and seed of crops other than paddy, maize, and wheat such as mung bean and sesbania.

-Seed prices are apparently established on the basis of actual costs and are uniform for each crop despite wide differences in the quality of seed distributed and marketed.

-AIC seed operations and activities are supervised and coordinated by its Seed Division.

Despite limited resources and facilities, poor coordination, and a rather loose organization the seed program in Nepal has made substantial progress. One measure of this progress is evident in the data on distribution and marketing of seed from 1966-67 to 1975-76 in Table 2. These data, of course, show quite clearly that most of the progress has been made for wheat. Paddy and maize seed distribution have been very low and stagnant.

For 1977, the seed situation in Nepal is not good. Unseasonable rains during the harvest for wheat and winter maize caused severe deterioration of the seed and rendered some of it unsuitable for planting purposes. About 1200 MT of wheat seed of uncertain quality were located for planting the wheat crop in Oct.-Nov., 1977, while there is a ready demand for at least 2200 MT, and with a little effort the effective demand could be pushed to 2500-3000 MT.

Table 2 . Seed distributed and marketed in Nepal, 1966-67 to 1975-76.

Year	Metric Tons Seed Distributed		
	Paddy	Wheat	Maize
1966-67	140	162	-
1967-68	231	508	30
1968-69	253	426	49
1969-70	210	411	40
1970-71	102	326	47
1971-72	265	814	56
1972-73	164	1873	50
1973-74	434	1236	46
1974-75	326	1642	50
1975-76	183	1739	132

Source: AIC

The 1977 production target for maize seed was 225 MT while the paddy seed target was 400 MT. The production of maize and paddy seed, however, were poor because of unseasonable early rains and droughts during the monsoon period. Thus, the targets will probably not be achieved.

2. Facilities

With the exceptions of the Hetaura seed processing center, the small seed processing unit at the Gandaki Anchol Agricultural Development Project, the Central Seed Testing Laboratory of the Agriculture Botany Division (Kathmandu) and an increasing cadre of private contract seed producers, the facilities and resources for seed production and supply in Nepal have been extremely limited. This situation, however, will be substantially improved when new facilities under development and programmed come on-stream in 1978 and 1979. These have been discussed previously, and will be considered again under the Project Proposal Section.

3. Personnel

The Seed Division of AIC is headed by a Division Chief and headquartered in Kathmandu. There is an Agricultural Officer (AO) for seed production with several Junior Technicians (JT), an Administrative Officer (vacant) with office staff, an AO for plant protection and the regional and district AOs and JTs at field level. Regional and Branch staff is as follows:

Regional Offices	Personnel
Biratnagar	I AO & I JT
Pokhara	I AO & I JT
Nepalgunj	I AO & I JT

Main Branch Offices	
Dhangari	I JT
Birqunj	I AO & 2 JTs
Junakpur	1 AO & 1 JT
Kathmandu	1 AO & 1 JT
Bhairawa	1 AO & 1 JT
Hetaura Seed Facility	3 AOs & 1 JT

The personnel listed have responsibility for seed production, processing, distribution and marketing in addition to other duties. In other words, most of them do not devote full time to seed.

The Seed Technology and Development unit of the Agriculture Botany Division is headed by a senior AO and has a staff of 3-4 AOs, a few JTs and some part-time workers. Responsibilities include adaptive, problem-solving research, seed testing, field inspection, and development of quality standards.

The AIC Seed Division has 3 agricultural officers well trained in seed technology, while the Seed Technology and Development Unit, Division of Agriculture Botany also has about 3 well trained seed specialists.

Over-all, staffing of the various units involved in seed production and supply is inadequate in terms of numbers, training, and experience.

4. Deficiencies, Inadequacies, and Problems

Some of the deficiencies and inadequacies of the present seed program in Nepal were pointed out in previous discussions. These are identified more specifically here along with others not previously mentioned.

(a) Poor Coordination -- There appears to be rather poor coordinatio among the several operational components of the seed program.

(1) Breeder and foundation seed supplies are often inadequate

for the seed production goals established.

(2) Annual seed production targets are established and then often scaled down by implementing agencies.

(3) Seed production plans are so loosely coordinated that no one person or office appears to know the location and number of hectares under seed production until harvest or even later.

(4) Demand estimates and orders for seed originating in the districts are often too late to take into account in production plans, and to permit timely distribution and delivery.

(b) Ineffective Organization -- "On paper" the seed program is quite well organized: the Department of Agriculture research stations produce and supply foundation seed; AIC's Seed Division contracts for seed production, processes and stores the seed; AIC's Marketing Division distributes and markets the seed produced; the Division of Agriculture Botany's Seed Technology Unit establishes quality standards, inspects fields to determine if standards are met, samples and tests the seed to establish quality and determine the premium to be paid to seed growers, and approves seed lots as "certified" or as "improved seed"; the cooperative societies and private traders take delivery of seed from AIC and sell them to farmers.

In practice, however, this organization is relatively ineffective. AIC's Seed Division has the responsibility for seed production and supply, but lacks the authority and personnel to make the timely decisions and take the timely actions required for the production of good quality seed. The experiment stations often produce substantial quantities of "certified" and "improved" seed but not enough foundation seed of the varieties in the seed program. The Seed Technology Unit of the Agriculture Botany Division doesn't have the personnel or transportation to

inspect all seed production fields, and at the proper time. Similarily, over-loading of the testing laboratory results in long delays in establishing the quality and premium for seed. AIC's Marketing Division often delivers seed too late for planting, and/or of the wrong varieties. The cooperative societies "book" very limited amounts of seed and when the supply is exhausted, reorder too late for delivery. The results are shortages of seed.

(c) Poor Quality Seed -- The seed produced and marketed are often of very low quality. Farmers complain about varietal mixtures, mislabelled varieties, and, most frequently, about poor germination in the field. The causes of these quality problems are climatic, inadequate supervision of production and processing, lack of technical knowledge, poor and careless transportation and storage.

(d) Inadequate Facilities -- Existing facilities are inadequate (and/or poorly located) for even present levels of production. As previously mentioned this situation will substantially improve when facilities now being developed come on-stream.

(e) Insufficient Personnel -- The personnel assigned duties in the present seed programs are too few, some are not well trained, and all are handicapped by lack of transportation, and decent living quarters. As a consequence, the personnel are often immobilized at times when they need to be visiting and working with seed producers. Many also maintain homes in Kathmandu, view field posts as temporary, and spend a lot of their time and energy trying to get posted back in Kathmandu.

(f) Poorly Developed Transportation System -- The poor development of the transportation system in Nepal severely impedes supply operations of all types. This is a "fact-of-life" which must be taken into consideration in planning for and implementing seed operations to a much greater

extent than in the past or even at present.

(g) Adverse Climatic Conditions -- Climatic conditions in Nepal are not favorable for seed production and storage. They are not, however, any more unfavorable than in the Eastern States in India, Bangladesh, Thailand, and countries in Central America, all of which have or are developing resonably effective seed programs. It should be recognized, however, that generally unfavorable climatic conditions (monsoon rains, high humidities from May to January, warm temperatures from April to October) combined with a poorly developed transportation system and difficult terrain, do create problems that are especially - almost uniquely - severe.

C. Summary and Conclusions

The "background" of Nepal's seed program - with emphasis on relevant projects, studies and reviews - was reviewed in some detail to take maximum advantage of ideas and preceptions of the several individuals and teams who have closely examined seed production and supply in the country.

Although the studies and reviews differ substantially in recommendations regarding location, scope, and general organizational structure of the seed program in Nepal, there is unaminous agreement on several key aspects:

(1) Nepal has made noteworthy progress in development of seed production and supply, but much remains to be done. The seed program needs to be expanded and improved so that it can adequately support agricultural development efforts.

(2) Inadequacies and inefficiencies in the seed program are acting as a contraint to agricultural development, i.e., improvement of crop production. Conversely, improved seed are not being used as

effectively as they should to improve agricultural production.

(3) Expanding and improving the seed program in Nepal will require -

(a) More efficient and effective organization.

(b) More adequate facilities.

(c) More and better trained personnel.

(d) A stronger committment on the part of HMG Agencies involved to develop and improve seed production and supply.

(4) The services of experienced consultants - long and short term - are needed to assist the operational agencies involved in seed production and supply to increase their capability, efficiency, and effectiveness.

III. PROPOSED SEED PRODUCTION AND SUPPLY PROJECT

The project proposed here is a modification of the proposal in the Project Review Paper (PRP) "Seed Production and Input Storage" as developed by USAID/Nepal, dated December 17, 1976. It takes into account: (1) the findings and recommendations of several individuals and teams who reviewed and studied the "seed situation" in Nepal since 1973; (2) the findings of the authors during their consultations in Nepal in July-September, 1977; (3) the experiences in seed program development in other countries in the region; and (4) recent actions and committments in Nepal that have occurred since the PRP was developed.

A. Project Background

The general agricultural situation in Nepal and the background and present status of seed production and supply were reviewed and discussed in detail in Section I and II. Only the most relevant recent and ongoing activities are repeated here.

1. USAID/ICP-IADS Project

The goal of the ICP project is: "To increase the average productivit

of Nepal's foodgrain cropping system, particularly on small hill farms, in order to address the national objectives of increasing food grain production, improving income distribution, and raising the nutritional status". The project purpose is: "To assist in strengthening the Ministry of Food, Agriculture and Irrigation's (MFAI) capacity to (a) generate improved production technology and inputs for the major food grain crops and related cropping systems, and (b) to transfer that technology to farmers in such a way that it is readily accepted."

By the end of the ICP it is envisaged that:

"(a) a creation/dissemination/adoption system of adaptive research will be established which draws heavily on the experience gained by using the research-cum-demonstration kits on the farmers land.

"(b) cooperating research farms/stations (will) have been upgraded so as to serve as basic facilities to be used in the continuation of the project.

"(c) research (will have) been completed on the domestic production, processing, quality control, and distribution of newly recommended seed varieties and a decision made as to how the seed industry should be organized and administered, drawing upon research done and experience gained in a pilot seed processing plant established in the Far Western Region.

"(d) capability to conduct small agriculture-specific social science research projects (will have been) enhanced in private research organizations and HMG Corporations and Departments."

With the assistance of the IADS external specialist staff, the ICP is concentrating on adaptive varietal and production technology research, and "cropping systems" that will permit greater cropping intensity and

higher levels of production. On-farm testing and evaluation of new varieties production technology, and cropping systems are key elements of the ICP strategy. Success in this approach will permit development of the most effective mechanism(s) for translating research developments and findings into increased production in the farmers' fields.

2. German Assistance for Seed Processing Equipment

German Assistance has agreed to provide Nepal (AIC) with equipment sufficient for four moderate-size (1.5-2.0 TPH) seed processing plants. A decision has been made to locate the four seed plants in the terai zone of each of the four development regions:

Biratnagar (Eastern Region

Janakpur (Central Region)

Bhairawa (Western Region)

Nepalgunj (Far Western Region)

The equipment is to be located in a portion of new seed storehouses constructed at the four sites above. A German engineer is being assigned for a 6 month period beginning o/a November 1, 1977, to supervise installation of the equipment, start-up operations and train personnel. The plants are scheduled to begin operation in April-May, 1978.

The German-assisted seed plants are described in more detail in ANNEX A.

3. UNDP /FAO Assisted Facility at Hetaura

The modern, high capacity seed facility established at Hetaura with UNDP/FAO assistance is described in detail in ANNEX A . It will, of course, be a major component of any seed program in Nepal.

4. AIC/Seed Storage Warehouses

AIC has constructed or has under construction seed warehouses as follows:

Location	Rated Capacity (MT)	Status
Biratnagar (Ithai)*	1000*	Completed
Birganj	500	Early, 1978
Hetaura**	1000	Completed
Napalgunj*	1000	Dec., 1977
Janakpur*	1000	Mid-1978
Pokhara	600	Early-1978
Taulihawa	250	Late 1978

*German assisted seed equipment for drying-processing-packaging will be located in storehouses reducing capacity to about 500-600 MT.

**Integral part of UNDP/FAO assisted Hetaura seed facilty.

The new seed storage houses listed above are of good quality with elevated reinforced concrete floors to facilitate rodent control and loading-unloading, ventilating fans, plastered brick walls, a partition dividing storehouse into two portions, and a treated wood slat (solid) roof covered with metal roofing.

The AIC has additional seed storage of a much less satisfactory type at:

Bhairawa----------300 MT

Kathmandu----------300 MT

Bharatpur----------300 MT

Janakpur----------300 MT

Biratnagar----------300 MT

This storage is part of existing AIC sales/distribution facilities. It is envisaged that it will be used mainly as intermediate and sales point storage.

AIC is also supervising the construction (under World Bank project) of 8 general storage godowns of 50 MT each for the Nuwakot District Panchayats and 2 general storage godowns in Rasuwa District. These will be used for fertilizer, small implements and seed.

5. Regional Seed Testing/Certification Laboratories

The Department of Agriculture's Division of Agriculture Botany (Seed Technology Unit) has made the decision to establish four regional seed testing/certification centers. This will greatly facilitate and expedite the timely implementation of field inspections, sampling, and seed testing.

Most major items of equipment have already been procured and are in storage at the Central Seed Testing Laboratory at Kathmandu. Space is to be made available in existing units of the Department of Agriculture within each region. The locations of the four regional seed certification/testing laboratories are:

-Biratnagar (at small experiment station)

-Hetaura (UNDP/FAO assisted seed center)

-Bhairawa (at wheat research station)

-Nepalgunj (at experiment station)

6. Breeder and Foundation Seed Facilities

Facilities for production, processing and storage of breeder and foundation seed are being provided under the USAID/ICP-IADS project. The IADS obtained services of an engineer-consultant in May-June 1977, to review facilities for handling breeder and faoundation seed and to make appropriate recommendations.

Four facilities were recommended to be located at:

Rampur (main maize research station)

Parwanipur (main rice research station)

Bhairawa (main wheat research station)

Nepalgunj (main research station in Far Western region)

The facilities proposed are to be housed in new construction and include (at each of the four stations):

(1) A 3-6 MT per day sack or bag dryer under shed. Modified Sebring heat-fan units (oil-fired) will be used for drying. However, an IRRI type "rice hull" dryer, and a "cob-burning" dryer from India will also be brought in, and if satisfactory, will eventually be substituted for the oil-fired Sebring units.

(2) A processing-cleaning plant with equipment for capacity of 6-8 MT seed/day. The plants will be equipped with a basic seed cleaner, necessary elevators and holding bins, a seed treater, and a packaging system. The building housing the processing plant will have sufficient space for additional equipment such as a very small seed cleaner and length grading machine when and if needed.

(3) A 200 MT capacity seed storage house divided in four equal units of 50 MT each. At Parwanipur and Rampur one of the 50 MT rooms will be insulated and air-conditioned to about 18°C and 60 to 65% relative humidity, while at Nepalgunj and Bhairawa two of the 50 MT rooms will be air-conditioned.

(5) A threshing/drying floor and threshers.

(6) An electric generator of sufficient capacity to power the air-conditioning system (for storage) and basic cleaners.

(7) Miscellaneous equipment such as sampling devices, a germinator, hand screens, moisture tester, bag trucks, etc.

In addition to breeder and foundation seed, the facilities will also be used to process and package the seed used for trials and the "demonstration" kits.

B. Project Goal and Purpose

1. Project Goal

The goal of the project is to assist HMG to achieve the national objectives of increasing food grain production, raising the nutritional status of the people, and improving income distribution.

2. Project Purpose

The purpose of the project is to assist the MFAI and AIC in establishing an effective, responsible and responsive program/industry for producing, processing, and supplying good quality seed of improved varieties to farmers.

C. Project Concept

The project is designed (1) to provide a mechanism for the integration of existing seed operations in Nepal into an effective and efficient seed program/industry, (2) to provide for improvements in operational components and supporting services required to achieve seed production/supply targets for the next five years, and (3) to establish a sound base for expansion of the seed program as may be needed in later years. The period of the project is five (5) years.

D. Scope of Program and Production Targets

Persons and teams who have studied reviewed agricultural development in Nepal agree - without exception - that insufficient supplies of seed of improved varieties, inefficient distribution, and low seed quality act as a constraint to improvements in crop production. Those who were concerned specifically with seed production and supply have recommended expansion and improvements of Nepal's seed program. There has not been general agreement, however, on the "scope" of the improved seed program needed in Nepal, or on the quantities of seed required.

1. Scope of Seed Program

The present seed production and supply effort in Nepal is concentrated in the terai zone and the Kathmandu and Pokhara valleys. These are the most accessible areas. The Nepal Special Seed Committee recommendations emphasize the terai zone but also provide for expansion of activities in the hills. Similarly, the IADS Seed Team pointed out that there was much greater potential for developing an effective seed program for the terai, but that "seed streams" also had to be established into the hills. The IBRD Identification Mission envisaged a single, compact seed production/ processing area in Nepal, which in effect also emphasized the terai.

Cropland in Nepal (paddy, maize, wheat, barley, millet and oilseeds) is divided among the terai, hills, and mountain zones as follows:

Zone	Hectares (000)	%
Mountains	113.1	5
Hills	678.5	30
Terai	1451.3	65

From the standpoint of specific crops the division among the three zones is:

	Terai		Hills		Mountains	
	Ha 000)	%	Ha 000)	%	Ha(000)	%
Paddy	1024.0	82	196.4	16	20.0	2
Maize	141.0	32	264.1	59	41.8	9
Wheat	174.0	60	93.1	32	22.5	8
Barley	8.0	30	10.1	36	9.2	34
Others (millet & oilseed)	104.3	44	114.3	48	18.6	8

The dominance of cropland in the terai is very evident in these statistics. The terai also has the greatest potential for increasing the area under production, yield per unit area, and cropping intensity. Furthermore, transportation and the other infrastructure for input supply are much better in the terai than in the hills and mountains. For these several reasons, the proportion of the seed program effort in Nepal devoted to supplying seed in the terai is, will be, and should be greater than its proportion of cropland.

While the terai zone will consume the biggest portion of the seed produced in Nepal, the hills zone, which includes the Kathmandu and Pokhara valleys, are important and cannot be neglected. The project provides for a feasible and reasonable level of seed production and supply in the hill and mountain zones.

2. Seed Production Targets

Projections on the effective demand for seed in Nepal, which are based mostly on experiences in other developing countries, vary considerably among the individuals and teams who have reviewed the situation. The IBRD Project Identification Mission envisaged development of a program to produce 60,000 MT of seed p.a. The IADS Seed Team cited a "theoretical need" for an annual replacement of 25% of seed needed which would require about 23,000 MT/year, but then stated that the "effective demand" in the next 5-10 years would probably be much lower. The Nepal Sepcial Seed Committee also cited a "theoretical need" for 25% annual replacement of seed (about 26,000 MT) but projected a target of 8500 MT/year by 1981-82.

In our view, assessments of the "effective demand" for seed in Nepal during the next five years must take into account (1) the present levels of acceptance of improved varieties for each major crop, i.e., %

of total crop area planted to improved varieties; (2) the quantities and kinds of seed marketed in the different regions and zones during the last several years; (3) the mode of pollination of the crop and the rapidity of varietal deterioration; (4) the ease with which farmers can save seed; (5) the present and projected intensity of the varietal development effort; (6) transportation and delivery system; (7) and experiences in other countries.

Most of these factors involve subjective judgements; a few can be quantified. For our assessment of seed needed in Nepal during the next five years, we started with those factors could be quantified and then added in judgements based on technical considerations and experience.

Estimates of the present level (% area) of acceptance and use of improved varieties of paddy, maize, and wheat are:

Region	% Area under Improved Varieties		
	Paddy	Maize	Wheat
Eastern	10.9	8.8	66.0
Central	21.6	20.1	100.0
Western	28.7	21.3	100.0
Far Western	12.4	16.2	35.6
Over-All	17.9	17.0	78.0

Improved varieties of wheat have achieved rather high levels of acceptance throughout Nepal except in the Far Western Region. This situation can probably be attributed to the fact that wheat is a relatively new crop in Nepal, hence improved varieties were more-or-less used from the beginning. For example, substantial quantities of seed of improved wheat varieties were imported from India in the late 1960s and early 1970s. Presently more than 90% of the wheat acreage in planted to the RR-21 variety. RR-21 is a variety from India of the "Mexican wheat" type.

Levels of acceptance of maize and paddy varieties are very low considering the period of time improved varieties have been available. And, they have changed little over the past several years. Many local varieties are grown reflecting tradition and taste preferences. Presently, however, two rice varieties appear to have substantial potential in increasing the level of acceptance of improved varieties among farmers. These varieties are Masuli, an Indonesian variety with good grain quality and good yield under low to moderate fertilization, and CH 45, a Chinese variety with high yield potential.

Several good varieties of maize are available and should gain widely in acceptance with the impetus provided by the field-trial and demonstration kit programs under the USAID/ICP-IADS project.

The quantities of seed distributed and marketed in Nepal from 1966-67 through 1975-76 are at Table 2. Wheat seed distribution reached a peak in 1972-73 probably as a result of a "saturation of capacity" rather than a "saturation of demand". For example, the wheat seed demand in 1977 based on actual requests and orders is about 2200 to 2500 MT, whereas, only 1300 MT is available. The low levels of paddy seed distribution undoubtedly reflect farmers' taste preferences for traditional varieties, ineffective and inadequate production, and the limited number of suitable improved varieties available until recently. In the case of maize, the evidence is very strong that only limited quantities of seed have been distributed because only limited quantities have been produced. Production problems, lack of adequate facilities, low seed quality, poorly organized distribution have all plagued the maize seed production and supply effort.

The distribution of seed (average for 1973-74 thru 1975-76) by zone

and region are even more revealing especially when expressed as a percentage of the total seed requirement (Table 3.)

The average quantities of paddy seed distributed during the period 1973-74 through 1975-76 did not except 0.7% of the total seed requirement in any region or zone. Maize seed distribution was somewhat better ranging from a high of 2.6% of the total seed requirement in the terai zone of the Eastern Region to 0% in the Western Region mountain zone. Relatively high levels of wheat seed distribution were acheived in the Eastern Region terai (11.8%) and hills (5.7%), Central Region terai (6.6%) and Western Region hills (14.2%).

The greater use of improved varieties of wheat and dependence of farmers in Nepal on the seed supply program as compared to paddy and maize are not surprising. The same situation exists in India, Pakistan, and other countries. Farmers throughout South Asia have accepted the high yielding wheat varieties to a much greater degree than the high yielding paddy varieties. They have also learned through experience that unless "new" wheat seed are procured periodically, yields decrease as a result of increases in the incidence of seed infested with seed borne diseases. It is also more difficult for farmers to maintain quality of "saved" wheat seed than paddy seed. Wheat seed are harvested before the monsoon but have to be stored over the monsoon period under the very adverse condition that prevail during this period. Paddy seed, on the other hand, are harvested at the end of the monsoon, stored during the coolest, driest months of the year and sown at the beginning of the next monsoon. Paddy seed are also biologically longer lived (more resistant to high temperature and humidity) than wheat seed. In these connections, it should be noted that the generally higher levels

Table 3. Average quantities of seed distributed during period FY 73-74 thru FY 75-76 by region and terrain zone in metric tons and as a % total seed requirements

Region/Zone	Seed Marketed					
	Paddy		Wheat		Maize	
	MT	%	MT	%	MT	%
Eastern Region						
Terai	75.9	0.4	438.2	11.8	9.0	2.6
Hills	4.3	0.2	37.7	5.7	5.4	0.3
Mountains	---	0.0	2.0	0.8	0.8	0.2
Subtotals	80.2		477.9		15.2	
Central Region						
Terai	73.4	0.4	430.2	6.6	13.0	0.9
Hills	23.1	0.7	81.4	2.3	17.8	0.9
Mountains	---	0.0	3.4	0.8	2.5	0.8
Subtotals	96.5		515.0		33.3	
Western Region						
Terai	60.5	0.7	150.5	3.5	2.0	0.4
Hills	13.2	0.5	206.2	14.2	24.9	1.3
Mountains	---	0.0	---	0.0	---	0.0
Subtotals	73.7		356.7		26.9	
Far Western Region						
Terai	46.9	0.6	144.8	4.9	3.7	0.3
Hills	5.8	0.3	33.9	1.0	2.5	0.2
Mountains	0.6	0.1	3.1	0.2	0.7	0.4
Subtotals	53.3		181.8		6.9	
TOTALS	303.7		1531.4		81.7	

Source: From SEED PROGRAM DRAFT prepared by HMG's MOAI, DA.

of wheat seed consumption in the Eastern Region terai and hills in Nepal as compared to other regions and zones (except Western Region hills) probably reflect the greater difficulties of "saving" seed in Eastern Nepal (climate becomes progressively more adverse for seed storage from West to East).

The highest level of seed usage in Nepal during the period 1972-73 through 1975-76 was for wheat in the Western Region hills. The only explanation offered for this situation was the rapid extension of wheat cultivation in the Dang Valley.

Wheat, paddy and barley are self pollinated species. Maize is open pollinated. Wheat is more difficult to "save" than paddy, and deteriorat more rapidly because of increases in the incidence of seed borne diseases Farmers who save maize seed generally produce it during the monsoon season. The seed program produces maize seed during the winter or late rabi season when climatic conditions are good, but most of the seed come off too late for distribution for the early monsoon sowing so it has to be stored over the monsoon for nearly 12 months. Since maize crosses and intergrades with local maize varieties, the potential of the improved varieties progressively deteriorates as the number of generations from foundation seed increases. For technical reasons, therefore, farmers should replace maize seed more often than for paddy and other self-pollinated species.

Experiences in other developing countries show that relatively high seed replacement rates (10 to 25%) can be achieved with the high yielding varieties of wheat. Usage of paddy seed, however, seldom exceeds the 5% level. Simarily, replacement of seed of maize composites is much less than the technically desirable 25% level - more on the order of 5 to 15% in most developing countries.

In Nepal, the terai zone, Kathmandu and Pokhara valleys are most accessible. The other hill zones much less accessible, and the mountain zones are the least accessible.

Taking into account both objective and subjective factors, we have projected the need for seed of five crops ("others" are primarily mustard/rape and millets) by region and zones for the five years of the project. These projections are at Tables 4, 5, 6, 7 and 8.

E. Location of Seed Centers and Storage Units

There is general agreement among those who have studied and reviewed seed production and supply in Nepal that - to the extent feasible and practical - seed should be produced, processed and distributed within the different regions and zones so as to facilitate timely distribution and reduce transport costs as much as possible.

Other factors that have to be taken into account in locating seed production/processing centers include: locations already determined, i.e., existing or committed centers; seed needs as projected in Tables 5, 6, 7, and 8; area of adaptation of varieties in program; cropping area around the center and its suitability for seed production i.e., is there enough cropland and progressive farmers for contract production of seed?; availability of advisory services (extension, experimental farms, etc) and other inputs; crop area that can be practically served by seed center; the transport system; and the availability of power (electric).

Taking into account the factors mentioned above and, especially, the recommendations of the Nepal Special Seed Committee, seed production/processing/storage centers proposed for development under this project, or in the case of existing/committed centers, for integration into the project effort are given in Table 9 along with the proposed "capacity" for each center.

Table 4. Total national seed requirement for major crops in Nepal, estimated demand for improved seed, and projected production during 5th year of project.

Crop	Total Area ha.	Planting Rate kg/ha	Total Seed Requirement mt/yr.	Estimated Seed Demand % b/	Est. Clean Seed Yield mt/ha c/	Seed Production Needed mt	Seed Production Needed ha
Paddy	1,240,000	50	62,000	3-5	2.0	2786	1393
Maize	460,000	25	11,500	5-15	1.8	788	438
Wheat	291,000	100	29,100	5-20	1.4	3694	2638
Barley	28,000	60	1,680	3-10	1.0	68	68
Others	250,000 a/	30	7,500	3-5	0.8	311	389
					TOTALS	7647	4926

a/ Based on area planted to millet and mustard/rape.

b/ Based on previous marketing experience; type of crop; experience in other countries; terrain.

c/ Based generally on national average yields. Assumes better farmers will be seed producers.

Table 5. Projected seed needs in the Eastern Development Region over a 5-year period.

Terrain/ Crop	Area Planted ha (000)	Seed Replace. %	Current Program mt	Project Year: Year 1 mt	Year 2 mt	Year 3 mt	Year 4 mt	Year 5 mt	Year 5 ha.
Tarai									
Paddy	344.3	5	76	86	172	344	646	861	430
Maize	13.2	15	9	10	15	20	38	50	27
Wheat	37.2	20	438	500	550	600	700	744	531
Barley	0.8	10	---	.5	1	2	3	5	5
Others	18.0	5	---	2	5	11	20	27	34
Subtotals			523.0	598.5	743.0	977.0	1407.0	1687.0	1027
Hills									
Paddy	43.3	3	4	7	13	26	49	65	33
Maize	65.9	5	5	8	16	33	62	82	46
Wheat	6.6	15	38	40	50	65	80	99	71
Barley	1.3	3	--	.5	.5	1	2	2	1
Others	25.0	5	--	2	7	15	28	38	48
Subtotals			47.0	57.5	86.5	140.0	221.0	286.0	198
High Hills									
Paddy	3.7	3	--	.5	1	2	5	6	3
Maize	13.2	5	1	2	4	7	13	17	9
Wheat	2.5	5	2	3	4	5	9	12	9
Barley	1.7	3	--	.2	.6	1	2	3	3
Others	5.5	3	--	.5	1	2	3	5	6
Subtotals			3	6.2	10.6	17.0	32	43	30
TOTALS			573.0	718.0	840.1	1134.0	1660.0	2016.0	1255

Table 6. Projected seed needs in the Central Development Region over a 5-year period.

Terrain/ Crop	Area Planted ha (000)	Seed Replace. %	Current Program mt	Project Year: Year 1 mt	Year 2 mt	Year 3 mt	Year 4 mt	Year 5 mt	Year 5 ha.
Tarai									
Paddy	352.4	5	73	88	176	352	661	881	441
Maize	54.9	10	13	15	27	55	103	137	76
Wheat	65.2	15	430	500	600	700	860	978	698
Barley	4.7	5	-	1	3	5	10	14	14
Others	45.0	5	-	1	7	20	40	68	85
Subtotals			516.0	605.0	813.0	1132.0	1664.0	2078.0	1314
Hills									
Paddy	63.8	5	23	25	32	64	120	160	80
Maize	79.8	5	18	20	25	40	75	100	56
Wheat	35.6	10	82	90	100	142	267	356	254
Barley	0.6	5	-	-	.5	1	1	2	2
Others	30.0	3	-	1	4	8	12	27	34
Subtotals			123.0	136.0	161.5	255.0	475.0	645.0	426
High Hills									
Paddy	6.1	3	-	1	2	4	6	9	5
Maize	14.6	5	3	4	5	7	14	18	10
Wheat	3.4	5	3	4	5	7	14	17	12
Barley	0.8	5	-	-	.5	1	1	2	2
Others	4.5	3	-	.5	1	2	3	4	5
Subtotals			6	9.5	13.5	21.0	38	50	34
TOTALS			645.0	750.5	988.0	1408.0	2177.0	2773	1774

Table 7. Projected seed needs in the Western Development Region over a 5-year period.

Terrain/ Crop	Area Planted ha (000)	Seed Replace. %	Current Program mt	Project Year: Year 1 mt	Year 2 mt	Year 3 mt	Year 4 mt	Year 5 mt	ha.
Tarai									
Paddy	163.1	3	61	70	80	98	184	245	122
Maize	20.2	10	2	8	16	32	57	76	42
Wheat	42.5	15	151	160	200	255	478	638	455
Barley	2.0	5	-	-	1	2	4	6	6
Others	12.0	5	-	1	3	8	14	18	22
Subtotals			214.0	239.0	300.0	395.0	737.0	983.0	647
Hills									
Paddy	52.1	3	13	15	20	32	59	78	39
Maize	78.2	5	25	30	35	50	73	98	54
Wheat	14.5	20	206	210	230	250	270	290	207
Barley	2.3	3	-	-	.5	1	2	4	4
Others	42.0	3	-	1	3	12	26	38	48
Subtotals			244.0	256.0	288.5	345.0	430	508	352
High Hills									
Paddy	1.4	3	-	.5	1	1	2	2	1
Maize	3.6	5	-	.5	1	2	3	5	3
Wheat	2.1	5	-	1	2	5	7	10	7
Barley	1.6	3	-	-	.5	1	2	3	3
Others	1.7	3	-	-	.5	1	2	2	3
Subtotals			0	2.0	5.0	11.0	16.0	22.0	17
TOTALS			458.0	497.0	593.5	751.0	1183.0	1513.0	1016

Table 8. Projected seed needs in the Far Western Development Region over a 5-year period.

Terrain/ Crop	Area Planted ha (000)	Seed Replace. %	Current Program mt	Project Year: Year 1 mt	Year 2 mt	Year 3 mt	Year 4 mt	Year 5 mt	Year 5 ha.
Tarai									
Paddy	164.2	5	47	55	82	160	300	410	205
Maize	52.7	10	4	13	26	45	99	132	73
Wheat	29.1	10	145	160	180	200	230	291	208
Barley	5.1	5	-	1	2	4	10	15	15
Others	40.0	5	-	3	12	24	45	60	75
Subtotals			196.0	232.0	302.0	433.0	684.0	908.0	576
Hills									
Paddy	37.3	3	6	8	11	21	42	56	28
Maize	51.4	5	2	6	12	24	48	64	36
Wheat	36.5	5	34	40	45	72	137	182	130
Barley	5.9	3	-	1	2	4	8	11	11
Others	20.0	3	-	2	4	8	14	18	23
Subtotals			42.0	57.0	74	129	249	331.0	228
High Hills									
Paddy	8.8	3	1	2	3	5	9	13	7
Maize	7.5	5	1	1	2	4	7	9	5
Wheat	15.5	5	2	7	15	32	58	77	55
Barley	0.4	3	-	-	.5	1	1	1	1
Others	7.0	3	-	.5	1	2	4	6	8
Subtotals			4.0	10.5	21.5	44.0	79.0	106.0	76
TOTALS			242.0	299.5	397.5	606.0	1012.0	1345.0	880

Table 9. Proposed locations of seed production/storage centers in Nepal.

Region/Zone District	Status[a]	Type[b]	Projected Capacity(MT)[c] Processing	Storage
I. Eastern Region				
A. Terai				
1. Morang (Biratnagar)	GA-Committed	B	1000	600
B. Hills/Mountains				
1. Dhankuta	USAID-Proposed	C	200	100
2. Kotang	USAID-Proposed	D	25	25
3. Illam	USAID-Proposed	D	25	25
II. Central Region				
A. Terai				
1. Dhanusa-Mahotari (Janakpur)	GA-Committed	B	1000	600
2. Makwanpur (Hetaura)	UNDP/Existing	A	1500	500
3. Bara (Parwanipur)	USAID/ICP Committed	C/F	200	200(50)
B. Hills/Mountains				
1. Chitwan (Rampur)	USAID/ICP Committed	C/F	200	200(50)
2. Kathmandu Valley	USAID Proposed	C and C/F	300	200(100)
3. Sindhuli	USAID Proposed	D	25	25
III. Western Region				
A. Terai				
1. Rupandehi (Bhairawa)	GA-Committed	B	1000	600
2. Rupandehi (Bhairawa)	USAID/ICP Committed	C/F	200	200(100)
B. Hills/Mountains				
1. Pokhara	GA-Existing	C	300	100
2. Baglung	USAID-Proposed	D	25	25
3. Palpa	USAID-Proposed	D	25	25
IV. Far Western Region				
A. Terai				
1. Banke (Nepalgunj)	GA-Committed	B	1000	600
2. Banke (Nepalgunj)	USAID/ICP-Committed	C/F	200	200(100)
3. Kailali (Dhangarh) or Tikapur Farm)	USAID-Proposed	C	200	200
B. Hills/Mountains				
1. Surket	USAID-Proposed	C	200	100
2. Baitadi	USAID-Proposed	D	25	25
3. Jumla	USAID-Proposed	D	25	25
4. Rukum	USAID-Proposed	D	25	25

Table 9. Continued

Region/Zone District	Status[a]	Type[b]	Projected Capacity(MT)[c] Processing	Storage
V. Location to be determined (in hills and mountains)				
1.	USAID-Proposed	D	25	25
2.	USAID-Proposed	D	25	25
3.	USAID-Proposed	D	25	25

a/ GA = German Assistance; existing means operational; committed means under development or programmed for completion by end of 1978; USAID-proposed means seed centers proposed under this project.

b/ Type A is high capacity plant like UNDP plant at Hetaura; Type B refers to moderate size seed processing/storage center of type being provided by German assistance; Type C refers to small size seed processing center of same general type proposed for foundation seed operation under USAID/ICP-IADS project; Type C/F refers to foundation seed facilities proposed under USAID/ICP-IADS project; Type D refers to "mini-plants" with hand operated, very low capacity equipment.

c/ Center capacity based on capability of seed center to handle indicated quantities of seed in the 60-65 day processing season (April, May, part of June) before the onset of the monsoon. Numbers parentheses under storage refer to portion of total storage of existing or committed status units programmed for "air-conditioning". Conditioned storage for USAID-proposed units is considered later (Table 10).

There are ten (10) existing and committed seed centers: the existing UNDP seed center at Hetaura; an existing German assisted seed center in the Gandaki Zone (Pokhara); four German Assistance committed seed centers (Biratnagar, Janakpur, Bhairawa, Nepalgunj); and four USAID/ICP-IADS project committed foundation seed centers (Rampur, Parwanipur, Bhairawa and Nepalgunj). These have an estimated seasonal processing/handling capacity of about 6600 MT of seed. However, most of the capacity of the four USAID/ICP-IADS centers will be used for breeder and foundation seed and for seed for demonstration and trials rather than for marketing to farmers. This reduces the seasonal capacity of the existing-committed centers to about 5800 MT of seed for distribution/marketing to farmers. Since there are two seasons in Nepal (khariff and rabi) the annual capacity could be about 11,600 MT if the seed processed and handled were equally divided between the two seasons.

With the exception of the German assisted seed center at Pokhara the existing and committed seed centers are located in the terai zone or in the adjacent inner terai, easily accessible to the terai.

Fifteen additional seed production/processing/storage centers are proposed under this project. Four small centers of about 200 MT each seasonal capacity, and eleven (11) mini-plants of 10-25 MT capacity each. The proposed locations for all of these centers are in the hills and mountain zones.

Storage for seed is available or proposed for each of the seed production/processing/storage centers (Table 9). Additional storage units and some improvements in storage facilities will be needed to improve the efficiency and effectiveness of distribution and marketing. The proposed locations for these additional storage units and improvements, and the locations of existing/committed storage units are given in Table 10

Table 10. Proposed locations for distribution and marketing seed storage units (additional to storage units connected to seed production/processing/storage centers proposed in Table 9).

Region/Zone District	Status[1/]	Quality [3/]	Storage Capacity (MT) Ventilated	Storage Capacity (MT) Conditioned
1. Eastern Region				
A. Terai				
1. Morang (Biratnagar)	AIC-Existing	Adequate	300	
2. Morang (Biratnagar)	USAID-Proposed [2/]	Excellent		100
3. Saptari	USAID-Proposed	Good	100	
4. Jhapa	USAID-Proposed	Good	100	
B. Hills/Mountains				
1. Bhojpur	USAID-Proposed	Adequate	10	
2. Taplejung	USAID-Proposed	Adequate	5	
3. Udaipur	USAID-Proposed	Adequate	10	
4. Terhatum	USAID-Proposed	Adequate	5	
5. Solukumba	USAID-Proposed	Adequate	5	
2. Central Region				
A. Terai				
1. Dhanusa-Mahotari (Janakpur)	USAID-Proposed	Excellent		
2. Bara-Parsa (Birgunj)	AIC-Committed	Good	500	
3. Rautahat	USAID-Proposed	Good	100	
4. Makwanpur	USAID-Proposed [2/]	Excellent		200
B. Hills/Mountains				
1. Kathmandu	AIC-Existing	Adequate	300	
2. Bharatpur	AIC-Existing	Adequate	300	
3. Rasuwa-Nawakot	IBRD-Committed (several go-downs)	Adequate	10-20	
4. Dhading	USAID-Proposed	Adequate	10	
5. Ramechap	USAID-Proposed	Adequate	10	
3. Western Region				
A. Terai				
1. Rupandehi (Bhairawa)	USAID-Proposed [2/]	Excellent		100
2. Kapilvastu	AIC-Committed	Good	250	
B. Hills/Mtns. 3. Pokhara	AIC-Committed	Good	600	
4. Tanahu	USAID-Proposed	Adequate	10	
5. Parbat	USAID-Proposed	Adequate	10	
6. Myagadi	USAID-Proposed	Adequate	10	

Table 10. Continued

Region/Zone District	Status 1/	Quality 3/	Storage Capacity (MT) Ventilated	Storage Capacity (MT) Conditioned
IV Far Western Region				
A. Terai				
1. Banke (Nepalgunj)	USAID-Proposed	Excellent		100
2. Kanchanpur	USAID-Proposed	Good	100	
3. Dang-Deokhurt	USAID-Proposed	Good	100	
B. Hills/Mountains				
1. Bajhang	USAID-Proposed	Adequate	10	
2. Bajaura	USAID-Proposed	Adequate	10	
3. Doti	USAID-Proposed	Adequate	10	
4. Achchan	USAID-Proposed	Adequate	10	
5. Sallayan	USAID-Proposed	Adequate	10	

1/ AIC refers to Agricultural Inputs Corporation; existing means in use; committed means scheduled for completion by end of 1978; USAID-Proposed refers to storage units proposed under this project.

2/ Excellent means air-conditioned; good means relatively new construction designed primarily with seed storage in mind; adequate means about best that can be constructed under existing conditions (terrain, transport difficulties, etc.)

3/ Conditioned storage proposed for existing or committed storehouses; conditioning will involve partitioning off portion of existing/committed storehouse, installation of insulation and proper doors, and provision of "window-type" self-contained air-conditioning units, and a dehumidifier to condition environment in room to about 18-20°C and 60% relative humidity

It is proposed that a total of 500 MT of conditioned storage be provided at Biratnagar, Hetaura, Bhairawa, and Nepalgunj by converting a portion of newly constructed warehouses. This will involve partitioning of a section of the warehouse, installation of insulation, good doors, and air-conditioning and dehumidification equipment. Conditioning of this space to about 18-20^{0}C and 60% relative humidity or less will provide an environment favorable for storage of seed for 12 to 18 months. Carry over seed and reserve stocks can be safely stored in such units.

Six hundred-fifty MT of distribution and marketing place storage are proposed under this project: five 100 MT storehouses and fifteen 10 MT units.

AIC's existing and committed seed storage units have an estimated capacity of 2250 MT.

Implementation of these proposals would provide seed storage capacity as follow:

	MT
-At seed production/processing/storage centers------	3870
-Distributing/Marketing units----------	2990
TOTAL	6770

This total is exclusive of the 800 MT storage programmed for foundation seed (USAID/ICP-IADS). Five-hundred MT would be conditioned.

Since the average storage period for seed will be about 6 months the effective storage capacity of the existing/committed and proposed units would be at about 6760 X 2 = 13,520 MT. This should be adequate for anticipated needs in Nepal over the next 10 years or so.

F. Personnel Requirements

Insufficient manpower resources in terms of both numbers and training are a constraint at the present level-of-effort of the seed program in Nepal. The highest priority, therefore, will have to be given to development of the manpower that will be required to adequately man the expanded and improved seed program proposed for Nepal.

Personnel requirements will be somewhat higher in Nepal per ton of seed targeted than other developing countries. Small seed centers are simply less efficient than larger facilities (economies of scale). However, given the topography and poorly developed transport and communications systems in Nepal, there is no practical alternative to "scattering" small seed production and processing centers throughout the country.

1. Agricultural Inputs Corporation

The Seed Division of the Agricultural Inputs Corporation will require the following staff (essentially full-time) by year 5 of the project:

15 Gazetted Level Officers

31 J.T. and J.T.A. level workers

plus, clerk-typists, drivers, peons, etc.

This staff will provide for a Headquarters unit in Kathmandu, four Regional Seed Production Offices, Seed Production/Processing Officers for the larger seed centers, Junior Technicians and Junior Technical Assistants for the small seed centers, and larger supporting storage units. Staff and stations are detailed in Table 20 in ANNEX B.

2. Department of Agriculture

The Department of Agriculture will also have to increase its staff

assigned to the Division of Agriculture Botany's Seed Technology and Development Unit in order to provide the testing and inspection services required for successful implementation of the project.

By the 5th year of the project, it is envisaged that the following fulltime staff will be required by the Seed Technology and Development Unit (see Table 19, ANNEX B for details).

10 Gazetted Level Officers

17 J.T. and J.T.A. level workers

This staff will man the Headquarters of the Seed Technology and Development Unit and Central Seed Testing/Inspection Laboratory in Kathmandu, four Regional Seed Testing/Inspection Laboratories, and the Seed Production/Processing/Storage Center (type C and C/F) proposed for Kathmandu. During the field inspection periods, additional J.T. and J.T.A. level personnel will probably have to be drawn from other units of the Department of Agriculture to provide for timely inspections and supervision.

3. Training

The staff required for the seed production and supply program by the 5th year of the project will have to be trained. Much of the training required can be provided by the several trained and experienced seed officers in the Division of Agriculture Botany and AIC, especially if aided by an external consultant/advisor (see G. to follow), and consultant/instructors available under the AID/TAB GTA Contract with Mississippi State University.

Longer term, more specialized, and more indeptn training, however, will be required for leaders and potential leaders. This training can best be obtained in India and the U.S.

Training programs of the following types and periods are proposed:

a. Inservice, on-the-job training. This type of training should be provided for all new personnel until they attain the necessary proficiency and expertise in the assigned duties, and periodically (refresher training) for all personnel. It should be an integral part of personnel development and management.

b. In-country training courses. Organized, intensive training courses should be conducted with the assistance of the external consultant/advisor, and consultant/instructors obtained under the AID/TAB GTA Contract with Mississippi State University. Duration of the courses should be 3-weeks, 15-20 participants per course. The courses should cover seed production, quality control, processing and storage. Two courses are needed: one the 1st year (or before), and one the 3rd year.

c. Participant training-India. Eight scheduled participants should be programed for 3 months training in India, preferably at the Agricultural University, Pantnagar and associated Terai Development Corporation. Training should be of the on-the-job type (apprentice-like). Suggested schedule is:

Year 1	Year 2	Year 3
2	4	2

(Seed production-3; seed processing/handling/storage-3; field inspection/certification-2.)

d. Participant training-US. Nine participants should be selected for participant training in U.S.

Type	Starting Year		
	Year 1	Year 2	Year 3
Ph.D.	1	-	-
M.S.	2	2	-
Acad. Short Term	2	2	-

The Ph.D. should be trained in seed technology/physiology. On return this person should become the leader in adaptive, problem solving research. Ph.D. training will require 3 years. Training emphasis for the four M.S. participants should be in quality control (2), and processing (2), all with secondary emphasis on management. M.S. training will require 2 years. The four academic short term trainees should be enrolled in the 10 week "Seed Improvement Course" sponsored by AID/USDA each summer (June-August) at Mississippi State University. Following the course, they should enroll for one-semester's work at MSU. Total length of training course will be about 8 months.

G. Technical Assistance

Experience in the technical and operational management of seed production and supply is very limited in Nepal. Climatic conditions, topography, and poorly developed transport/communications system also interact to cause especially severe, almost unique, seed production/processing/storage/marketing problems. For these reasons, long term technical assistance is proposed. There is need, first of all, for an external advisor experienced in the full spectrum of seed operations and their management under "developing country" conditions. A second need is for a seed technologist or seed engineer experienced in harvesting, drying, processing, and storage operations, and in the maintenance of facilities.

To fulfill these needs, external advisors/consultants are proposed as follows:

Type	Person Months
(1) Seed technology/management specialist (1st 36 months)	36

(2) Seed processing advisor 24
(1st 24 months)
(drying, processing, storage)
(3) Specialized advisors (short term) 8
(vegetable seed - 3 months) (1st year)
(certification - 2 months) (2nd year)
(adaptive research - 1 month) (1st year)
(marketing - 1 month) (2nd year)
(management - 1 month) (2nd year)

The seed technology/management specialist should advise both AIC's Seed Division Management, and the Division of Agriculture Botany's Seed Technology and Development Unit. The seed processing advisor should work primarily with AIC.

H. Adaptive Research

Adaptive, problem-solving type research is needed to resolve - to the extent possible - the many technical problems that plague the seed program in Nepal. Some good work has been done (and is underway) in the Seed Technology and Development Unit (Central Seed Testing Laboratory, Division of Agriculture Botany, Kathmandu). The work, however, is limited in scope and timliness because of insufficient personnel, inadequate space and equipment.

The staffing plan proposed for the Central Seed Testing/Inspection Laboratory at Kathmandu includes a senior Seed Research and Development Officer. This person should be trained in seed technology <u>at least to the equivalent of the M.S. degree</u>. The Seed Testing Officers, and J.T.'s of the laboratory would assist with the adaptive research and development work during slack periods, as well as the regional seed testing/inspection staffs and officers at cooperating research stations.

Establishment of an organized and expanded adaptive research effort in the Central Seed Testing/Inspection Laboratory would require additional space, facilities and equipment. The projected needs for adaptive

research and associated improvements in the Central Seed Testing/Inspection Laboratory are detailed and costed in Table 16 , ANNEX B. The type of adaptive research needed is discussed in ANNEX C.

I. Transport

The efforts of the limited number of personnel presently engaged in seed production and supply operations in Nepal are hampered by lack of transport, i.e., they are immobilized at times when they need [illegible] visiting seed producers, inspecting fields, and gathering samp[illegible].

The staffing proposed in III. F. will be adequate only if provided with a reasonable level of transportation. If transportation is not provided even twice the number of personnel proposed will not be able to properly supervise and manage operations. Funds therefore must be provided to improve the mobility of both the AIC and Seed Testing/Inspection staffs.

Organization	Type of Transport	No. Required
AIC	Jeep (Indian)	6
	Motorcycle	6
Seed Testing/ Inspection	Jeep	4
	Motorcycle	6

J. Other Requirements/Needs

1. Vegetable Seed

Climatic conditions in Nepal appear to be favorable for production of vegetable seed. The hills and mountain zones are suitable for production of seed of many of the bienniel crops such as radish, cauliflower, carrot, cabbage, while the terai zone during the dry season (irrigation) is suitable for production of seed of warm season vegetable crops, i.e., tomato, pepper, okra, eggplant, melon, squash, etc.

UNICEF has provided some equipment for drying, handling and processing of vegetable seed in Nepal (one dryer, 1 small cleaner, and 6 hand operated mini-cleaners). The Vegetable Crops Division of the Department of Agriculture has organized a vegetable seed production program with private farmers and seed are being produced, packaged in small plastic envelopes, and distributed/marketed through AIC. The program project production of about 10,000 Kg. (10 MT) of vegetable seed by 1981/82.

The most critical need for the vegetable seed program (apart from a vegetable seed consultant) appears to be an airconditioned, dehumidified storage room at the Vegetable Crops Division, Central Research Station, Kathmandu. Vegetable seed require good storage conditions to maintain quality and are a low volume/high value product. Conditioned storage, therefore, is used for vegetable seed in most of the developed countries and in many of the developing countries (India, Pakistan).

A 25 M^2 room 4 M high equipped, insulated and equipped with refrigeration system to maintain 5-10C and a dehumidifier to maintain relative humidity at 50% or less would provide the Vegetable Seeds Division with good storage for its seed program. Details are at Table 17 in ANNEX B.

2. Genetic Materials Storage

The Department of Agriculture (DA) is heavily involved in the collection of local genetic strains of crops and in the introduction of genetic materials from the International Research Centers, India, and many other countries. These materials are tested for adaptability, resistance to diseases and insects, and other stresses, and used in the various breeding programs. The DA, however, does not have a facility for long term storage of these valuable genetic stocks. The conditioned

storerooms programmed under the USAID/ICP-IADS project will be suitable for breeder seed and active breeding lines for 2-3 years, but not for the 5 to 10 years or longer storage period needed for efficient maintenance of genetic stocks.

In order to provide DA with a badly needed facility, a genetic stocks storeroom is proposed for the Central Research Station at Kathmandu. A 30 M^2 insulated room, 4 M high, equipped with a refrigeration system to maintain 5-10C and 50% relative humidity or less would be adequate. Details are at Table 18 in ANNEX B.

K. Inputs Projected

1. Proposed USAID Contribution

(a). Seed Production/Processing/Storage Center

Four small and eleven (11) mini-seed production/processing/storage centers are proposed (see Table 9) to augment the centers already established and/or committed, especially in the hills and mountains zones. Estimated investments costs (by item) and proposed investment schedule are at Tables 12, 13 and 14 in ANNEX B.

The estimated investment costs for the centers are:

Type	Est. Cost* (US $)	No. Req'd.	Total Cost (US $)
1. Small, 200 MT, Type C	66,000	3	198,000
2. Small, 200-300 MT, Type C & C/F	76,000	1	76,000
3. Mini-centers, 10-25 MT, Type D	4,620	11	50,820
	TOTAL		324,820

*Includes civil works and equipment

The costing above is based on procurement of most of equipment items from India. India has developed a substantial manufacturing/fabrication

industry for seed and grain handling and cleaning equipment and many models and capacities are available. Most of the items are essentially copies of older models of U.S., West German, and Austrian equipment. For most items, Indian manufactured equipment is considerably less expensive than comparable U.S. equipment and, of course, shipping is also much less. In the case of a few items, the U.S. does not manufacture models of the type and/or capacity needed. Another advantage of Indian made equipment is proximity to spare parts and service. The preferred source of equipment items is indicated in Tables 12, 13 and 14 in ANNEX B.

(b) Seed Storage Units

Development of additional storage capacity was proposed (Table 10) to bring total seed storage capacity up to the level needed: one 200 MT conditioned storage unit (Hetaura); remodelling of new AIC warehouses at Biratnagar, Bhairawa, and Nepalgunj to provide 100 MT conditioned storage each; 100 MT ventilated storage at Saptari, Jhapa, Rautahat, Kanchanpur and Dang Deokhurt, and 10 MT storage units at 15 locations in the hills and mountains.

Estimated investment costs for the proposed storage units are detailed in Table 15 , ANNEX B, along with proposed construction schedules. The estimated costs are:

Type	Est. Cost (US $)	No. Req'd	Total Cost (US $)
1. 200 MT, conditioned (Hetaura)	32,600	1	32,600
2. 100 MT, conditioned (remodelling of AIC existing/ committed units)	8,400	3	25,200
3. 100 MT, ventilated	10,650	5	53,250
4. 10 MT unit	1,500	15	22,500
TOTAL			133,550

*Includes civil works and equipment as needed

(c) Seed Testing/Inspection/Adaptive Research

Improvements of the Central Seed Testing/Inspection Laboratory (Kathmandu) to upgrade testing/inspection services, and to support an adaptive, problem-solving research effort are proposed (III. H., and Table 16 in ANNEX B. These are estimated to cost $31,000.

(d) Transport

Organic transportation required for seed production officers, seed testing officers, seed processing officers and others of proposed staffs of AIC and the Division of Agriculture Botany's Seed Technology and Development Unit is estimated to cost:

No.	Type	Unit Cost (US $)	Total Cost (US $)
10	Jeep	5,000	50,000
12	Motorcycles	1,100	13,200
		TOTAL	63,200

Suggested Schedule	1st Year	2nd Year	3rd Year
Jeep	3	4	3
Motorcycle	4	4	4

(e) Participant Training

Estimated costs of participant training proposed (III, F.3.(c) & d)) are as follows:

Place	Person Years	Cost Per Year (US $)	Total (US $)
India	2 (24 months)	3,600	7,200
U.S.	11 (Degree)	12,000	132,000
U.S.	4 x 8 mos. (acad. non-degree)	8,000	32,000

Table 11. Estimated USAID Contribution to Nepal Seed Project.

ITEM	Estimated Cost ($000) by Project Year 1	2	4	5
1. Seed Production/Processing/Storage Centers				
a. Type C centers	132.0	66.0		
b. Type C and C/F center	76.2			
c. Type D center	18.5	18.5	13.9	
2. Storage Units				
a. 200 MT conditioned	36.6			
b. 100 MT conditioned (re-modelled)	25.1			
c. 100 MT ventilated		32.0	21.3	
d. 10 MT natural ventilation		12.0	10.5	
3. Seed Testing/Inspection/Adaptive Research	30.9			
4. Vegetable Seed Storage Unit	11.0			
5. Genetic Stocks Storage Unit	13.0			
6. Vehicles and Transport	19.4	24.4	1.8	
7. Participant Training				
a. India	1.8	3.6	1.8	
b. U.S.	52.0	76.0	36.0	
8. Technical Assistance				
a. Long term	140.0	140.0	70.0	
b. Short term	32.5	32.5		
TOTALS	589.0	405.0	155.3	

(f) Technical Assistance

Estimated costs of technical assistance (personal services) proposed are:

Type	Period (yrs)	Cost per Year ($)	Total Cost
(1). Seed Technology/Management Specialist	36	$70,000	210,000
(2). Seed Processing Specialist	24	70,000	140,000
(3). Short-Term Consultant(s)	8	---	65,000
TOTAL			415,000

(g). Vegetable Seed Storage Unit

The conditioned seed storage unit proposed for vegetable seed is estimated to cost $11,000 for civil works and conditioning equipment (Table 17, ANNEX B).

(h) Genetic Stocks Storage

The conditioned storeroom proposed for storage of genetic seed stocks at the Central Research Station (Kathmandu) is estimated to cost $13,000 for civil works and conditioning equipment (Table 18, ANNEX B).

2. HMG/N Contribution

Agencies of HMG/Nepal will incur substantial increased costs as a direct result of the project activities. Major costs will be for increased personnel in the Seed Division, Agricultural Inputs Corporation, and the Seed Technology and Development Unit, Division of Agriculture Botany, Department of Agriculture (see Tables 19 and 20 in ANNEX B.)

	Estimated Incremental Personnel Services for 5 years of Project ($)
Department of Agriculture	51,300
Agricultural Inputs Corporation	89,800
TOTAL	$141,100

In addition, AIC has constructed or has under construction seed storage warehouses costing an estimated $200,000, which will play a crucial role in the proposed project.

Since on-going crop improvement research will provide the new varieties for the seed program, and extension will play a key role in promoting the use of improved seed among farmers, i.e., developing markets, and in estimating demand, HMG/N contributions in these aspects will be substantial, but impossible to quantify.

3. Other Donors

UNDP/FAO: The UNDP/FAO financed seed center at Hetaura ($480,000 estimated investment) will be an integral part of the project.

German Assistance: German Assistance has established a small processing plant in the Gandaki Development Zone (Pokhara) (estimated cost, $25,000), and is providing equipment for four medium size processing centers (estimated value $200,000). Additionally, a German engineer will be provided to assist with installation of the equipment and in training of personnel (6 months, $35,000).

L. Proposed Courses of Action

1. Organization

As previously discussed, the over-all organizational frame of the seed program even down to the individual component is good. The relative ineffectiveness of the organization stems mainly from inadequacies and deficiencies at the implementation level.

(a) Seed Councils - A National Seed Council and four Regional Seed Councils need to be established or re-activated. These councils should (1) collect information from field sufficient to establish a realistic seed demand for each region and the country as a whole; (2) establish seed production priorities by crop and variety; (3) develop recommendations for the resolution of problems that arise in the program; (4) ensure that the several components of the program cooperate and coordinate their activities; and (5) review seed program operations and accomplishments annually to determine weaknesses and improvements needed. The Councils should consist of high-level representation from AIC, DA-Research, DA-Extension, DA-Division of Agriculture Botany (Seed Technology and Development Unit), Agricultural Development Bank, and private or cooperative farmer associations:

(b) Responsibilities and Functions

(1) AIC

-Seed production, processing and storage for all seed produced in compact areas around the Hetaura seed center, the four German assisted seed centers, and the four Type C seed centers proposed for USAID financing.

-Seed distribution and marketing

-Market promotion

(2) Selected Sajhas/private farmers

-Production processing and marketing of seed produced around the 11 proposed mini-seed centers (type D installation), and operation of same.

(3) DA-Research

-Production, processing and supply (to AIC) of adequate quantities of foundation seed; maintenance of varieties, and production of breeder seed.

-Demonstrations designed to show farmers the advantages of using improved seed.

-Technical assistance to seed program as needed.

(4) DA-Extension

-Assistance in forecasting seed demand

-Promotion of use of improved seed.

-Technical assistance to seed program as needed.

(5) DA-Seed Inspection and Development Unit

-Field inspections of seed.

-Sampling and testing.

-Development of quality standards for seed.

-Adaptive research to resolve technical problems.

2. AIC Seed Division

AIC's Seed Division should be provided with headquarters staff proposed in Table 20 (ANNEX B) as soon as practical. The proposed Seed Distribution and Marketing Officer is most important. He should be posted in AIC's Marketing Division and assume responsibility for coordination of seed distribution and marketing with those of other inputs. He must also develop and implement a market promotion plan for seed in

concert with other promotion activities of AIC.

The Seed Division must also be given greater powers of decision than at present. Along with greater authority, the Seed Division must accept greater responsibility for seed production and supply. It must be aggresive and actively seek to build-up the volume and quality of seed produced and marketed rather than act in its present rather passive capacity.

Most importantly, perhaps, AIC must come to view its role in seed production and supply as a challenge/opportunity rather than a troublesome burden. Acceptance of the seed production and marketing component in this light would be a major step toward resolution of many of the problems in the seed program.

3. DA Seed Technology and Development Unit

The Division of Agriculture Botany's Seed Technology and Development Unit has performed its functions (testing, inspection, adaptive research) as well as can be expected considering limited staff and facilities and lack of mobility. The development of four regional laboratories and the assistance proposed here should enable the Unit to serve the seed program effectively and efficiently.

Adaptive research efforts should be expanded and accelerated. Initial efforts should be directed at identifying a suitable package for seed which will retard the re-absorption of moisture. Seed package size also needs to be evaluated. In India, maize, sorghum and millet seed are packaged in small packages - enough to plant ½ ha, ¼ ha., etc. In Nepal all seed are presently packaged in 40 kg. bags. This is satisfactory for wheat (100 kg/ha planting rate), but not very satisfactory for maize (20 kg/ha planting rate).

Quality standards should be reviewed. In some instances it appears that standards are too high considering the stage of development of the seed program in Nepal, and climatic conditions. Standards must be realistic and achieveable.

AIC presently treats all of the seed it markets. Is this necessary? Adaptive research should look into this question in cooperation with the crop research units. Careful production of foundation wheat seed, for example, to minimize infection with smut, and treatment of foundation seed with Vitavax (smut control) might eliminate the need to treat all wheat seed with Vitavax, and reduce seed prices accordingly.

The adaptive research consultant proposed under the Technical Assistance Component should assist in developing a variety of high priority adaptive research projects.

4. DA-Research

Establishment of breeder/foundation seed facilities at four major research stations as proposed under the USAID/ICP-IADS project will provide the means to overcome a serious deficiency in the seed program, i.e., chronic shortages of high quality foundation seed. DA needs to appoint a Foundation Seed Coordinator to coordinate production of foundation seed at the stations with AIC's needs for foundation seed and distribution of the seed to the various centers.

A Foundation Seed Officer should also be designated/appointed at each of the four research stations involved and provided with assistance and funds as needed to produce, process and store high quality foundation seed in the quantities needed.

5. Seed Production Procedures

Seed production should be undertaken in as compact an area as possible around the seed production/processing centers. Production will

be predominately through contractual arrangements with private farmers. Contract seed producers should be selected on basis of farm size, level of management (i.e., "good" farmers needed), and proximity to seed center. Insofar as possible, seed production should be contracted with larger farmers (in terms of number of hectares). Experiences in India, Pakistan and other countries clearly show that it is difficult and often impossible to supervise and control the quality of seed when production is on small areas (less than a hectare) because of the great numbers of farmers involved. For example, management/quality control of 100 ha. of seed production is much easier and can be more rigorously controlled when fifty 2 ha. seed producers are involved than two hundred 0.5 ha. producers.

The production contracts between AIC and the individual farmers should be for a specified number of hectares, and it should be binding on the part of both AIC and the farmer. AIC should obligate itself to lift the seed if it meet quality specifications, and the farmer should be obligated to deliver the seed on the same terms.

Seed producers should receive a premium over grain price of 18 to 24% depending on the quality of the seed delivered (as determined by tests). The producer should receive <u>grain price</u> for the seed accepted by AIC on basis of preliminary tests as soon as possible, and the premium after it is established by definitive seed tests.

AIC should require contract seed producers to purchase foundation seed (from AIC), and provide supervision and assistance to the seed producer until the seed is delivered. This will involve periodic visits of AIC staff to the contract seed producers.

Inspectors of the Seed Testing/Inspection Service (Seed Technology and Development Unit) should make at least two field inspections, the

last when the seed are essentially field-mature and varietal characteristics most evident. Samples should be drawn after harvest and threshing is completed.

6. Seed Processing

Maize seed should be delivered on-the-ear to the seed centers for drying and shelling. Other kinds of seed that require drying should also be delivered to centers within 24 hours after harvesting/threshing, preferably sooner. Payments to seed producers should be discounted to a standard moisture content (13%) so that they will not have any incentive to harvest at high moisture contents to "sell-the-water".

Generally, seed should not be processed during the hot, humid, heavy rainfall months. This means that double-shifting of processing operations might be required to complete wheat and maize seed processing before the monsoon season.

7. Seed Distribution Marketing

Dispersal of seed production/processing/storage in the different regions and zones will minimize physical difficulties in distribution/marketing to the extent possible, but will also increase the need for good management of these activities. The Sr. Seed Distribution and Marketing Officer proposed for AIC's Seed Division must develop an adequate distribution/marketing plan and over-see its implementation at the regional and sub-regional levels.

8. Training

The urgency of the need for more trained seed workers in Nepal requires the highest priority for the training program proposed. If the proposed program falls much behind schedule, the program will be beset by problems of even greater magnitude than at present.

9. Technical Assistance

The external technical assistance proposed should be provided by competent, experienced seed specialists. The Seed Technology/Management Specialist (36 mos.) should be from U.S. The Seed Processing Engineer (24 mos) could be recruited from India. India has several well trained, experienced seed processing specialists who could make great contribution to the seed program in Nepal.

The short term consultants proposed should be carefully selected on the basis of experience and reputation.

M. Working Capital

A seed program industry is characterized by a relatively low capital investment and relatively high requirements for working capital. The working capital is primarily needed to finance seed in inventory and variable costs associated with processing.

Under contract seed production arrangements (with private farmers) seed delivered to the processing center is purchased from the grower at an established premium above the price of equivalent grain. Since growers need cash as soon after harvest as possible, payment has to be prompt. Thus, the seed operation ties up a lot of working capital in seed.

The seed have to be dried, cleaned, often treated and packaged. Packaging materials, chemical seed treatments, power and fuel also tie up a lot of funds as suppliers of these materials usually require prompt settlement of invoices.

After a period of storage - until the next planting season - revenues are generated from seed sales. Hopefully, all costs and a modest profit will be realized.

In Nepal there will be two seasonal needs for working capital:

(1) May-October - working capital needed to finance payments to growers for wheat, barley, and some maize seeds, and variable processing costs. Sales will commence in September and be completed by end of October. Thus, 6 month/term working capital is required.

(2) November-April - working capital needed to finance payments to growers for paddy some maize, millet and other kinds of seed. Sales season will be March to May. Six months term credit, therefore, is needed for financing of these operations.

Working capital requirements based on proposed 5 year seed production schedules (Tables 5, 6, 7 and 8) were calculated. Since wheat seed are more valuable and will be produced in the greatest quantities, the need for working capital will be greatest from May-October.

The estimated working capital requirements given below are based on a 20% premium over average grain price during the period 1974-76, and also includes production/processing variable costs, and marketing/distribution expenses. It is assumed that "fixed" costs such as fixed labor and supervision/administration, office expenses, maintenance of equipment and facilities, etc., will be budgeted by AIC and DA.

	Working Capital Required by Years ($)				
	1	2	3	4	5
May-Oct.	90.3	149.9	275.9	506.6	682.7
Nov.-Apr.	471.1	552.5	663.3	912.9	1,098.7

The working capital required can be provided by the Agricultural Development Bank at a preferential interest rate, or it could possibly be financed from AIC's cash flow generated from fertilizer sales. Another alternative, of course, would be to include the required working capital under the USAID financing of the project. If so, it would have to be

added to the proposed USAID contributions shown in Table 11.

IV. Some Issues Raised in PRP

1. Private Sector Participation

The IADS Seed Team proposed the gradual transfer of seed production/ processing and some of the marketing operation to the private sector. The same issue was raised during the PRP review. These suggestions assume private sector entrepreneurs are willing and eager to develop seed businesses, and that the seed business is as lucrative as other opportunities for investment.

The major kind of seeds produced in Nepal, i.e., self-pollinated wheat, paddy, barley, and composite varieties of maize have not proven to be very profitable items in seed businesses in the developing countries and until recently, even in the U.S.

On the other hand, seed of hybrid varieties of maize, sorghum and millet, vegetables and forage crops are generally competitive in terms of profitability with many other agri-business ventures. In India, for example, a substantial private seed industry has developed over the past 15 years (over 100 private companies) for the production of hybrid sorghum, maize, millet (pearl), and cotton seed. Production of wheat and paddy seed has been left to the National Seeds Corporation (NSC), a quasi-government operation. The NSC has made a good profit on wheat and paddy seed only because of India's food zones and double pricing policies (now mostly abandoned). Wheat seed for example was produced under contract in Punjab and Haryana (food surplus states) for about RS 130/quintal (20% above established grain price), processed, shipped to Orissa, Bihar and West Bengal and sold at about RS 290-300/quintal, which was only about 40% above the established grain price in these food deficit states. The

same type of situation existed for paddy seed - production in Andra Pradesh and Tamil Nadu, sales in Kerala.

A rigorous economic/financial analysis of seed industry opportunities in Thailand, made in connection with an AID loan proposal, revealed that the internal rate of return on investments in a paddy, maize (non-hybrid), mung bean, soybean, and peanut "business" would be on the order of 4% or less, far below the returns from other private sector agri-businesses.

In our view, there is really no alternative to AIC in production and supply of the major kinds of seed needed in Nepal. And, AIC will have to be satisfied with a very modest return in investment.

The most favorable role of the private sector in the seed program in Nepal is as proposed, viz., as contract seed producers for AIC at an average 20% premium over grain price.

These are probably a few opportunities for private sector seed businesses based on wheat in the terai. These would be of a very limited scale (20-40 MT) and scope, serving only neighboring farmers.

Limited opportunities do exist in Nepal for private sector involvement in vegetable seed production and supply. Vegetable seed are a high value commodity, labor intensive, and require rather limited facilties. Since farmers and home-gardeners often prefer to buy rather than go to the trouble of saving vegetable seed, the market can be readily developed and is quite stable.

2. Beneficiaries

Good quality seed of improved varieties are expected to increase the yield of the farmer consumer. The farmer who buys seed, therefore, is the primary beneficiary of the program. Since contract seed producers receive a premium over grain price over and above the increase in

yield from planting foundation seed of an improved variety, they also are primary beneficiaries.

Seed are also different from other inputs, e.g., fertilizer. They are not consumed in the production process but rather are multiplied. If a farmer takes reasonable precautions to prevent mixtures with other seed, the seed he saves of an improved variety will yield essentially the same as the previous year. The farmer, therefore, benefits from the purchase of improved seed the first year, the second year, and for successive years until the variety becomes mixed, intercrosses with local varieties (maize), or the incidence of seed borne diseases begins to cause a reduction in yield. In the case of wheat, the experience of Indian farmers in that "saving seed" does not reduce yield potential until the third planting and then by about 5-10%. Additional reductions in yield potential the 4th and 5th plantings economically justify the purchase of new seed at that time (i.e., every 4 to 5 plantings).

Finally, there is a "diffusion" of "spread" effect with seed that contributes enormously to crop production but is difficult to quantify. Witness the rapid spread of RR-21 wheat variety through the terai in Nepal (over 90% of present area) with only limited quantities of seed supplied. The spread of the high yield varieties in India, Pakistan, Turkey, etc., and the high yielding rice varieties in the Philippines, Korea, Bangladesh, etc., are other examples. This spread or diffusion is effected through farmer-to-farmer trade of seed, cash or barter. While the "spread" effect benefits of a seed program are secondary, they are over-all of much greater magnitude than the primary benefits.

ANNEXES

ANNEX A

ANNEX A

Existing and Committed Seed Facilities in NEPAL

1. Hetaura Seed Facility

The Hetaura Seed Facility was financed and constructed under UNDP/FAO "High Yielding Varieties Projected" now terminated. The facility is located on relatively spacious grounds in the Hetaura Industrial Area, easily accessible to the Kathmandu-Birganj highwa which connects with the east-west highway through the Eastern ter and the Hetaura-Bharatpur road which is under improvement for all-weather traffic. The latter traverses the Chitwan Valley - an important new agricultural area.

The facility, which became fully operational in early 1976 is representative of modern, high capacity seed plants used in Northern and Middle Europe. The facility consists of the following units:

(1) A drive-thru dump or intake pit connected by belt conveyor to the main receiving elevator.

(2) An ear maize sorting, drying and shelling unit for handling maize on the ear - the preferred method. The dryer consists of 6 bins of 20 MT capacity each. The drying air is automatically reversed on a 6-hour cycle - throug a damper in the duct connecting the heater-fan unit with the drying bins. The dried ears are belt-conveyed to a 5TPH sheller with cob-blower. The shelled maize is then dropped into the dump pit. An inclined drag-chain convey is used to lift the ear maize to the top of the bin and over a sorter belt before loading of the bins.

(3) A pre-cleaning drying unit for pre-cleaning of all incoming seed and drying of all shelled-threshed seed. The main elevator leg and pre-cleaner have a capacity of about 20 TPH. The dryer is of the continuous flow type and has a capacity of about 4 TPH for wheat seed, 3TPH for paddy seed, and 2TPH for shelled maize seed (based on 4% moisture removal). Seed not requiring drying by-pass the dryer and are conveyed directly to the bulk-storage tanks.

(4) The bulk-storage unit consists of six 100MT and four 50MT round metal bins. The bins are floored with concrete inclined at 45^0 angle toward unloading port (gravity flow). There is no provision for aeration. The only openings in the bins are spout port at the peak, the discharge post at the base, and an access opening about 1 m. from the base which is covered with bolted-on metal plate. Each bin is provided with two thermo-couples (centered about 1 m. from base and 1 m from top) for monitoring temperature. The bins are loaded from an overhead drag-flight conveyor and unloaded by gravity flow into a horizonal return conveyor which empties in elevator feeding the basic cleaner.

(5) A cleaning/grading unit which consists of a basic cleaner (3-screen, 2 air) with 4, 3, and 2 MT capacity for wheat paddy and maize. After basic cleaning wheat and paddy seed pass through matched capacity indent cylinder length graders, then width/thickness graders then over a gravity table and to the treater or packaging unit. For maize seed the length grader is by-passed and a special ring grader is used for width-thickness grading. The maize is also graded over the

gravity table, and then moves to the treater and/or packaging unit. The cleaning plant unit is multi-story and most of conveying is by gravity flow.

(6) A flat storage unit for bagged seed with a capacity of about 500 MT.

(7) A "central" room with display circuit and control panels for control of all operations and monitoring of temperature in bulk storage unit.

Units (1) through (7) are in essentially one complex or building. The building(s) are exceptionally well constructed All outside elevators and conveyors have all-weather covers.

(8) An office and laboratory building with two spacious, well equipped seed testing rooms.

The major technical deficiences of the Hetaura facility are:

(1) The bulk storage bins are not provided with an aeration system and are exposed to direct radiation from the sun. As a result, temperature of the seed stored in the bin becomes quite high (up to 40C or 104F). The seed can be "turned" as grain is turned in a grain elevator, i.e., transferred from one bin to another which can reduce the temperature, but this is hardly a satisfactory practice for seed.

(2) The processing sequence is too inflexible. All the seed for example, have to pass through the width and thickness graders and over the gravity table regardless of the need

(3) Flat (bagged seed) storage space is inadequate. And, there is no provision for "conditioned" storage of carry-over or foundation seed stocks.

The capacity of the Hetaura facility is about 4MTH for wheat, 3MTH for paddy and 2MTH for maize. Based on wheat (the principal seed cleaned), the daily one-shift capacity is about 25MT. Since wheat and maize are harvested in April and processing should stop during the monsoon (mid-June to mid-September) to minimize re-absorption of water during high humidity periods, the pre-monsoon processing season for wheat and maize is only about 60 days. Another 15-20 days can be added in late September for a total processing period for wheat seed of about 75 days. On a single shift basis, about 1600 to 1800 MT of wheat seed could be processed.

Maize seed produced in late rabi (winter-spring) cannot be processed and distributed in time for the May-July planting. Therefore, processing cleaning could be halted during the moonsoon and then started up again in October. Rice seed is also harvested in the period September-November and, thus, a long processing season is available (October-April, about 150 days). On a single shift basis, about 3000 MT of rice and maize seed could be processed during the period.

Over-all, the plant rates at about a 5000 mt/year facility.

The usual practice at the Hetaura facility is to treat all seed before packaging and to package in 40 kg jute bags bonded with a 1 mil polyethylene film on the inside. Paddy and maize seed are treated with thiram and malathion, while wheat seed are treated with Vitavax and Malathion.

The direct costs associated with processing (excluding administration, supervision, depreciation, and interest) are said to be as follows:

Item	Rs per Metric Ton		
	Paddy	Wheat	Maize
Basic Cleaning/handling*	173	126	177
Drying (per 4% moisture removed)	(30)	(22)	(44)
1 time		30	
2 times	60		88
Treatment			
Thiram/malathion	160		160
Vitavax/malathion		290	
	393	446	425

* Includes 1/2 cost (Rs 6.25) for 40 kg. jute poly-lined seed bag. The other half is "added" to price of seed and farmers keep bag. Since there are 25 forth kg. bags/mt, the cost of the bags alone is Rs 156.25/2 = Rs 78.12.

2. German-Assisted Seed Plants

West German assistance has provided a small 1MTH capacity seed plant for the Gandaki Development Project (near Pokhara). It is also providing equipment for four additional seed facilities. The equipment will be installed in a section of new warehouse construction by the Agricultural Inputs Corporation at:

Birtnagar (Eastern Region)
Janakpur (Central Region)
Bhairawa (Western Region)
Nepalgunj (Far Western Region)

The German assisted processing plants will be relatively simple and of a type suitable for conditions and stage of development in Nepal.

Each processing plant will consist of:

(1) A simple floor level intake pit with double elevator which can load the dryer or the cleaners directly when drying is not necessary.

(2) A pre-cleaner for rough cleaning of seed before drying or cleaning.

(3) A "tilting flat bed dryer" consisting of three shallow bins (6.5 x 6.5 x 1.8 ft. deep) which have a capacity of about 1.5 MT each. Although air flow rates are not known, drying capacity should be about 1 to 1.5TPH with 4% moisture removal.

(4) Two basic air-screen cleaners arranged in parallel with matched indent cylinder graders; capacity of each unit is about 1TPH.

(5) A treater for application of fungicides and insecticides to the seed.

(6) Dust collectors and necessary elevators.

(7) A diesel generator with sufficient power for plant in event of power failure.

The equipment is to be installed in one section of a 34 x 16 m newly constructed "warehouses" and will occupy a section of the warehouse about 9.5 x 16 m. This will leave about 24.5 x 16 m. for flat storage (about 600 MT).

German assistance will provide a technician for about 6 months (November, 1977 - June, 1978) to assist in installation of equipment initial start-up, and to train Nepalese workers in operation of the processing facility. The plants are scheduled to begin operation in April-May, 1978.

The processing plants are strategically located along the terai and together with the Hetaura facility should serve the needs of the terai zone for seed.

3. USAID/ICP-IADS Foundation Seed Facilities.

These are described in detail in: J. D. Traywick. Planning of seed drying, processing and storage facilities for four agricultural experiment stations. Report, IADS Consulting Assignment to Nepal. June, 1977.

Table 12. Estimated investment costs for Type C seed processing/storage center, 200 MT capacity/season. (Dhankuta, Surket, Dhangarh or Tikapur).

ITEM	UNIT	Unit Cost (US$)	No. Units Required	Total Cost (US$)	Expected Life (yrs)
A. Civil Works					
1. Land	Ha.	4000	0.3	1,200	
2. Site preparation, utilities fencing, roadway	-	-		3,400	
3. Offices and lab.	M^2	100	60	6,000	25
4. Processing bldg.	M^2	90	80	7,200	25
5. Storehouse	M^2	80	135	10,800	25
6. Drying floor (hard surface)	M^2	30	100	3,000	25
7. Sack/box dryer under shed (4-5 MT/day)	M^2	70	90	6,300	25
8. Electric generator plant bldg.	M^2	70	12	840	25
9. Fees for designs, construction drawings, (about 4%).				1,500	
Subtotals				40,240	
B. Equipment					
1. Drying-fan unit, IRRI type, for rice hull, corn cob fuels, 5 h.p. motor, 90 M^3, Air/Min. (Philippines).	No	800	1	800	15
2. Furnace unit for IRRI drier, local construction.	No.	500	1	500	15
3. Vertical belt and bucket elevator (2-3TPH) (India)	No.	800	3	2,400(3600)	15
4. Air-screen seed cleaner, 2-screen, 2-air, all metal construction, 0.5TPH. (OSAW 2-screen seed cleaner, model Delux, India)	No.	2400	1	2,400(4500)	15
20 screens for air-screen cleaner	No.	30	20	600(1200)	15

Table 12. Type C plant continued.

ITEM	UNIT	Unit Cost (US$)	No. Units Required	Total Cost (US$)	Expected Life (yrs.)
5. Seed treater, slurry type, 2-2.5 TPH, with fiber glass lined chemical tank (India)	No.	550	1	550(2000)	15
6. Automatic bagger-weigher, 5-50 kg. (India)	No.	600	1	600(1200)	15
7. Bag closer (portable sewing machine); with suspension attachment, for paper and textile bags (Fischbein Model D, India or U.S. distributor)	No.	600	1	600	15
8. Maize sheller, suitable for seed maize, 2 MT/hr., electric motor, all attachments and supporting frame (India).	No.	1500	1	1,500(2500)	15
9. Maize sheller, hand operated, 50 kg/hr. (India)	No.	75	10	750(750)	15
10. Platform scale, metric system, 400 kg capacity (India).	No.	500	1	500(600)	
11. Exhaust fans (for store rooms); heavy duty (15 M^2/min.) (India)	No.	70	4	280(300)	15
12. Conveyor, portable aluminum type, with flights, inclination up to 45°; for ear maize and free flowing seeds; 3-5 TPH; electric motor; 16 ft. length. (U.S.).	No.	600	1	600	15
13. Moisture meter, electric, Universal type (India)	No.	350	1	350(800)	15
14. Sampling triers (U.S.)	No.	40	2	80	15
15. Bag truck, 2-wheel (local or India)	No.	50	2	100(200)	15
16. Bag truck, 4-wheel platform type (India)	No.	200	1	200(300)	15
17. Electric generating set, with diesel engine, complete, with rated capacity of 25 KVA.	No.	6000	1	6,000(10,000)	15

Table 12. Type C plant Continued

ITEM	UNIT	Unit Cost (US$)	No. Units Required	Total Cost (US$)	Expected Life (yrs.)
18. Holding bins, sheet metal, 1.2 MT, with hopper bottom and cut-off slide, supporting angle iron frame (local fabrication)	No.	400	2	800	15
19.. Miscellaneous items	-	1000		1,000	15
20. Spare parts and supplies (10%)				1,900	
Subtotals				22,510	
Shipping and crating for imported items (15%) (from India)				3,256	
TOTAL - civil works and equipment				66,006	

Schedule	No/$ First Year	2nd Year	3rd Year
	2	1	0
	(132,012)	(66,006)	

Table 13. Estimated investment costs for type C and C/F seed processing/storage center (Kathmandu, Central Research Station).

		Cost (US$)
Costs same as those for Type C Seed Center as specified in Table 12. Except:		
	Type C Seed Facility	66,006
Add:	(1) 80 M^2 civil works @$90/$M^2$	7,200
	(2) $2,500 additional for larger and more efficient seed cleaner (OSAW 4-screen, Model FSG, India)	2,500
	(3) One additional vertical bucket elevator (India)	800
	(4) Materials and construction costs (extra) for conditioning 100 MT of storage unit	
	a. rigid foam insulation (thermocole, India)	1,200
	b. air conditioners (2), thru-the-window type (18,000 BTU) (India)	1,600
	c. dehumidifier, chemical desiccant type (USA)	2,200
	d. polyethylene sheeting for vapor barrier (Nepal)	180
	e. additional labor and materials	600
	(5) Additional holding bin, metal hopper bottom, 1.2 MT capacity (local)	400
	Heavy duty casters for bin (India)	125
	(6) Hygothermograph (U.S.)	300
	(7) Additional miscellaneous items	200
Less:	(1) Land	- 1,200
	(2) Two exhaust fans	- 140
	(3) 25KVA electric generator set	- 6,000
	TOTAL	75,971
	Additional crating and shipping	190
		76,161

Schedule: 1st year ------$76,161

Table 14. Investment costs for Type D mini-seed facility (eleven (11) facilities proposed).

ITEM	UNIT	Unit Cost (US$)	No. Units Required	Total Cost (US$)	Expected Life (yrs.)
A. Civil Works					
1. Land	Ha.	4000	0.1	400	
2. Site Preparation				200	
3. Processing and receiving shed (open sides, wood construction, roof of local materials, packed dirt floor over polyethylene sheeting).	M^2	20	60	1,200	25
4. Drying floor, packed soil	M^2	2	60	120	-
5. Seed Storehouse	M^2	80	20	1,600	25
Subtotals				3,520	
B. Equipment					
1. Air-screen cleaner, hand operated with 16 screens. 0.1 to 0.2 TPH capacity (U.S.)	No.	300	1	300	15
2. Seed treater, 55 gal. steel drum modified for diagonal shaft, hand turn crank, discharge opening, with stand. (local).	No.	100	1	100	15
3. Beam-balance scale (up to 100 kg.)	No.	25	2	50	15
4. Maize shellers, hand operated (50 kg/hr.) (India)	No.	75	4	300	15
5. Miscellaneous items (local) (inc. plastic sheeting).				200	
Subtotals				950	
Crating and shipping items (25%)				150	
				1,100	
TOTAL: Civil works and equipment				4,620	

Schedule for mini-plants:	Year 1	Year 2	Year 3
	No/$		
	4	4	3
	(18,480)	(18,480)	(13,860)

Table 15. Continued

Capacity/ Location		Type/Item	Unit	Unit Cost (US$)	No. Units	Total Cost (US$)	Expected Life (yrs.)
100 MT (Saptari, Jhapa Rautahat, Kanchanpur, Dang Deokart)	(1)	Ventilated storage; same specifications as per AIC specifications for 250, 600 and 1000 MT store houses recently constructed or under construction.	M^2	80	100	8,000	25
	(2)	Site and site preparation, utilities hook-up.				2,500	
	(3)	Hygrometer, dial type (USA)	No.	2	50	100	15
	(4)	Dial thermometer, recalibrating type (USA)	No.	2	25	50	15
		TOTAL 100 MT ventilated storage				10,650	
10 MT (15 locations in hills and mountains)	(1)	Naturally ventilated storehouse; concrete floor over plastic film vapor barrier, or brick/packed soil over vapor barrier; brick walls; metal or asbestos cement roof; secure door.	M^2	100	15	1,500	25
		TOTAL 10 MT storage unit				1,500	

	Year	Type	No.	Cost (US$)
Schedule:	1	200 MT/conditioned	1	32,620
		100 MT/conditioned	3	25,125
				57,745
	2	100 MT/ventilated	3	31,950
		10 MT/natural ventilation	8	12,000
				43,950
	3	100 MT/ventilated	3	21,300
		10 MT/natural ventilation	7	10,500
				31,800

Table 15. Estimated investment costs for seed storage units.

Capacity/ Location		Type/Item	Unit	Unit Cost (US$)	No. Units	Total Cost (US$)	Expected Life (yrs)
200 MT (Hetaura)	(1)	Conditioned storage house for seed; to maintain conditions of about 20C and 60% relative humidity; elevated concrete floor (1 meter) with vapor barrier underneath; double course brick walls, plastered both sides; pitched roof on solid wood decking; ceiling of wood with plastic film vapor barrier and 10 cm. rigid foam insulation; tight fitting doors; exterior and interior painted with moisture vapor retardant paint.	M^2	130	150	19,500	25
		site preparation, utility hook-up				3,000	
	(2)	Air conditioner, self-contained for thru-the-wall installation; 12,000 BTU, (from India)	No.	800	4	3,200	15
	(3)	Dehumidifier, chemical desiccant type, 400 CFM (from USA)	No.	2200	2	4,400	15
		spare parts for dehumidifer				400	
	(4)	Hygothermograph, recording, 7 day with 500 charts and ink (USA)	No.	400	1	400	15
		spare parts for recording hygrothermograph				100	
	(5)	Hygrometer, dial type (USA)	No.	2	50	100	15
	(6)	Sling psychrometer, plastic case, with slide-rule converter, with extra set of thermometers (U.S.)	No.	2	50	100	15

Table 15. Continued

Capacity/ Location		Type/Item	Unit	Unit Cost (US$)	No. Units	Total Cost (US$)	Expected Life (yrs.)
	(7)	Dial thermometer, recalibrating type (U.S.)	No.	4	25	100	15
		TOTAL 200 MT conditioned storage				31,300	
		Plus, shipping for imported items (15%)				1,320	
						32,620	
100 MT (Biratnager, Bhairawa, Nepalgung)	(1)	Conditioned storage unit; to be developed in existing, newly constructed seed store houses (AIC) by re-modeling; to consist of installation of 2-course (layer) brick partition walls, plastered both sides to provide area of 80 M^2; installation of wood ceiling with plastic film vapor barrier and 10 cm rigid foam insulation; tight fitting doors; conditions 20C-60% r.h..	M^2	40	80	3,200	
	(2)	Air conditioners, self contained for thru-the-wall installation 12,000 BTU (India)	No.	800	2	1,600	15
	(3)	Dehumidifier, desiccant type, 400 CFM (U.S.)	No.	2200		2,200	15
		Spare parts for dehumidifier				200	15
	(4)	Hygrothermograph, recording, 7 day with 500 charts and ink (U.S.)	No.	400	1	400	15
		Spare parts for hygothermograph					
	(5)	Combination thermometer-hygrometer, dial type (2)	No.	50	2	100	15
		TOTAL, 100 MT conditioned storage (remodelled)				7,700	
		Plus, shipping for imported items (15%)				675	
					TOTAL	8,375	

Table 16. Facilities and equipment needed in the Seed Technology and Development Unit (Central Seed Testing/ Inspection Laboratory), Division of Agriculture Botany, Kathmandu, for adaptive research and improvements in testing/quality control services.

ITEM	UNIT	Unit Cost (US$)	No. Units Required	Total Cost (US$)	Expected Life (yrs.)
1. Additional Space					
a. Store room (supplies)	M^2	150	16	2,400	25
b. Receiving/dividing room	M^2	150	14	2,100	25
c. Seed sample storeroom	M^2	180	14	2,520	25
+ Air conditioning (India)	No.	600	1	600	12
+ Small dehumidifier (U.S.)	No.	300	1	300	12
d. Walk-in germinator room	M^2	150	12	1,800	25
+ Air conditioner	No.	600	1	600	12
+ Racks for trays	-	-	-	300	12
+ Small electric heater (U.S.)	No.	75	1	75	
+ Timer control and thermostats	-	-	-	250	
e. Research laboratory w/store rooms	M^2	150	80	12,000	25
Subtotals				10,945	
2. Additional Equipment					
a. Double unit germinator (U.S.)	No.	5500	1	5,500	15
b. Drying oven (U.S.)	No.	550	1	500	15
c. Moisture tester (India)	No.	350	1	350	15
d. Torsion balance (U.S.)	No.	300	2	600	15
e. Gram scale (U.S.)	No.	90	2	180	15
f. Seed divider, motor driven (U.S.)	No.	450	2	900	15
g. Set hand testing sieves (30) (U.S.)	No.	320	1 set	320	15
h. Fractionating aspirator, 6 in.(U.S.)	No.	1200	1	1,200	15
i. Desiccators, bowl type, plastic (U.S.)	No.	60	10	600	15
j. Small model seed cleaner, motor driven (U.S.), w/full assortment of screens.	No.	450	1	450	15

Table 16. Continued

ITEM	UNIT	Unit Cost (US$)	No. Units Required	Total Cost (US$)	Expected Life (yrs.)
k. Components for small electric heated seed dryer (U.S. and Nepal)	-	-	1 set	2,500	15
l. Heat sealer	No.	300	1	300	15
for plastic bags	No.	100	1	100	15
m. Hygrothermograph, recording, 7 day; w/500 charts, ink and spare parts (U.S.)	No.	450	2	900	15
n. Hygrometer, dial type (U.S.)	No.	75	2	150	15
o. Psychrometer, sling type, cased, w/slide calculator (U.S.)	No.	60	4	240	-
p. Thermometers, glass, mercury (India)	No.	10	12	120	-
q. Thermometers, dial type	No.	20	10	200	15
r. Miscellaneous items	-	-	-	500	
Subtotals				15,660	
3. Supplies					
a. Chemicals (U.S./India)	-	-	-	1,000	
b. Miscellaneous	-	-	-	500	
Subtotals				1,500	
TOTAL				28,105	
Plus, shipping imported items (15%)				2,800	
				30,905	

Schedule: All first year of project

Table 17. Conditioned storage required for vegetable seed program (Vegetable Crops Division, Kathmandu).

ITEM	UNIT	Unit Cost (US$)	No. Units Required	Total Cost (US$)	Expected Life (yrs.)
A. Storage room, brick or re-inforced concrete construction, 10 cm. of plastic foam insulation (thermocole, India) in floor, walls, ceiling, 6 mil plastic film vapor barrier on exterior side of insulation; tight fitting, insulated door with vapor barrier.	M^2	180	25	4,500	25
B. Refrigeration system for room (about 100 M^3) to maintain temperature of 5 to 10C, not to exceed 10C (India)	No.	3000	1	3,000	15
C. Dehumidifier, chemical desiccant type, 400 CFM, air flow rate, to maintain humidity at 50% or less in 100 M^3 well insulated space with plastic vapor barriers (U.S.)	No.	2500	1	2,500	15
D. Racks and shelves for room (local)	-	-	-	500	25
Subtotals				9,500	
plus 20% shipping, imported items				1,500	
TOTALS				11,000	

Table 18. Conditioned storeroom for storage of genetic seed stocks (Central Research Station, Kathmandu).

ITEM	UNIT	Unit Cost (US$)	No. Units Required	Total Cost (US$)	Expected Life (yrs.)
A. Storage room, brick or re-inforced concrete construction, 10 cm of rigid foam insulation (thermcole, India) in floor, walls, ceiling; 6 mil plastic film vapor barrier to exterior of insulation; tight fitting, insulated door; with vapor barrier.	M^2	180	30	5,400	25
B. Refrigeration system for room (about 120 M^3) to maintain temperature of 5 to 10C, not to exceed 10C (India)	No.	3000	1	3,000	15
C. Dehumidifier, chemical desiccant type, 400 CFM air flow rate, to maintain relative humidity at 50% or less in 120 M^3, insulated space, with vapor barrier (U.S.).	No.	2500	1	2,500	15
D. Racks and shelves for room (local)	—	—	-	500	25
Subtotals				11,400	
Plus 20% shipping, imported items				1,600	
TOTAL				13,000	

Table 19. Estimated staffing requirement for the Division of Agriculture Botany's Seed Technology and Development Unit by 5th year of project

Position	No.	Est. Salary (Rs/Yr.)	Total Cost (Rs/Yr.)
Hqs. Central Seed Testing/Inspection			
Chief Officer	1	15,000	15,000
Sr. Research and Development Officer	1	9,600	9,600
Sr. Testing/Field Inspection Officer	1	9,600	9,600
Seed Testing Officers	2	7,200	14,400
Junior Technicians	3	5,400	16,200
Clerk-cum-typists	2	3,600	7,200
Driver	1	3,000	3,000
Peons	3	1,800	5,400
		Subtotal	80,400
Regional Seed Testing/Inspection Laboratories (4)			
Regional Seed Testing/Inspection Officers	4	7,200	28,800
Junior Technicians	4	5,400	21,600
Junior Technical Assistants	8	3,600	28,800
Clerk-cum-typists	4	3,600	14,400
Drivers	4	3,000	12,000
Peons	8	1,800	14,400
		Subtotal	120,000
Kathmandu Seed Center (Type C&CF Plant)			
Seed Production/Processing Officer	1	7,200	7,200
Junior Technician	1	5,400	5,400
Junior Technical Assistant	1	3,600	3,600
		Subtotal	16,200
		TOTAL	216,328
			(17,328)

		Year 1	Year 2	NO Year 3	Year 4	Year 5
Schedule	%	30	37	50	79	100
	Rs.	64,980	80,142	108,300	171,114	216,600
	$	5,198	6,411	8,664	13,689	17,328

Table 20. Estimated staffing requirements for AIC seed operations by 5th year of project

Region/ Station	Position	No.	Est. Salary (Rs./Yr)	Total Cos (Rs./Yr.)
I. Headquarters				
A. Kathmandu	Chief of Division	1	22,000	22,000
	Sr. Seed Production Officer	1	12,000	12,000
	Sr. Seed Processing Officer	1	12,000	12,000
	Sr. Seed Distribution & Marketing Officer	1	12,000	12,000
	Administrative Officer	1	7,200	7,200
	Junior Technicians	2	5,400	10,800
	Accountant	1	5,400	5,400
	Typists and Clerks	3	3,600	10,800
	Driver	1	3,000	3,000
	Peons	2	1,800	3,600
	Subtotal			98,800
II. Eastern Region				
A. Biratnagar	Regional Seed Production Officer	1	9,600	9,600
	Seed Production/Processing Officer	1	7,200	7,200
	Junior Technicians	2	5,400	10,800
	Clerk-cum-typist	1	3,600	3,600
	Driver	1	3,000	3,000
	Mechanic (for processing plant)	1	2,800	2,800
	Peons	2	1,800	3,600
B. Dhankuta	Junior Technician	1	5,400	5,400
	Junior Technical Assistant	2	3,600	7,200
C. Saptari	Junior Technical Assistant	1	3,600	3,600
D. Jhapa	Junior Technical Assistant	1	3,600	3,600
	Subtotal			60,400
III. Central Region				
A. Hetaura	Regional Seed Production Officer	1	9,600	9,600
	Seed Production Officer	1	7,200	7,200
	Seed Processing Officer (Hetaura Plant)	1	9,600	9,600
	Junior Technicians	3	5,400	16,200
	Clerk-cum-typist	1	3,600	3,600

Table 20 Continued

Region/ Station	Position	No.	Est. Salary (Rs/Yr.)	Total Cost (Rs./Yr.)
	Mechanic (processing)	1	3,200	3,200
	Driver	1	3,000	3,000
	Peons	2	1,800	3,600
B. Janakpur	Seed Production/Processing Officer	1	7,200	7,200
	Junior Technicians	2	5,400	5,400
	Clerk-cum-typist	1	3,600	3,600
	Driver	1	3,000	3,000
	Mechanic (processing)	1	2,800	2,800
	Peons	2	1,800	3,600
C. Kathmandu	Kathmandu Type C&CF Center should be staffed by Department of Agriculture			
D. Rautahat	Junior Technical Assistant	1	3,600	3,600
	Subtotal			85,200
IV. Western Region				
A. Bhairawa	Regional Seed Production Officer	1	9,600	9,600
	Seed Production/Processing Officer	1	7,200	7,200
	Junior Technicians	2	5,400	10,800
	Clerk-cum-typist	1	3,600	3,600
	Driver	1	3,000	3,000
	Mechanic (processing)	1	2,800	2,800
	Peons	2	1,800	3,600
B. Pokhara	Seed Production/Processing Officer	1	7,200	7,200
	Junior Technicians	2	5,400	10,800
	Clerk-cum-typist	1	3,600	3,600
	Peons	2	1,800	3,600
	Subtotal			65,800
V. Far Western Region				
A. Nepalgunj	Regional Seed Production Officer	1	9,600	9,600
	Seed Production/Processing Officer	1	7,200	7,200

Table 20 Continued

Region/ Station	Position	No.	Est. Salary (Rs./Yr.)	Total Cost (Rs./Yr.)
	Junior Technicians	2	5,400	10,800
	Clerk-cum-typist	1	3,600	3,600
	Driver	1	3,000	3,000
	Mechanic (processing)	1	2,800	2,800
	Peons	2	1,800	3,600
B. Kailali District	Junior Technician	1	5,400	5,400
	Junior Technical Assistant	2	3,600	7,200
C. Surket	Junior Technician	1	5,400	5,400
	Junior Technical Assistant	2	3,600	3,600
D. Kanchanpur	Junior Technical Assistant	1	3,600	3,600
E. Dang Keckhurt	Junior Technical Assistant	1	3,600	3,600
	Subtotal			69,400
	TOTAL			379,600
				(30,368)

		Year				
		1st Year	2nd Year	3rd Year	4th Year	5th Year
Schedule	%	30	37	50	79	100
	Rs	113,860	140,052	189,800	299,840	379,600
	$	9,109	11,204	15,184	23,987	30,368