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THE INTEGRATION OF RESEARCH AND EXTENSION IN FARMERS' FIELDS

The Terminal Report of the
INTEGRATED CEREALS PROJECT
~~of the~~
DEPARTMENT OF AGRICULTURE
MINISTRY OF AGRICULTURE
HIS MAJESTY'S GOVERNMENT OF NEPAL

June 1985

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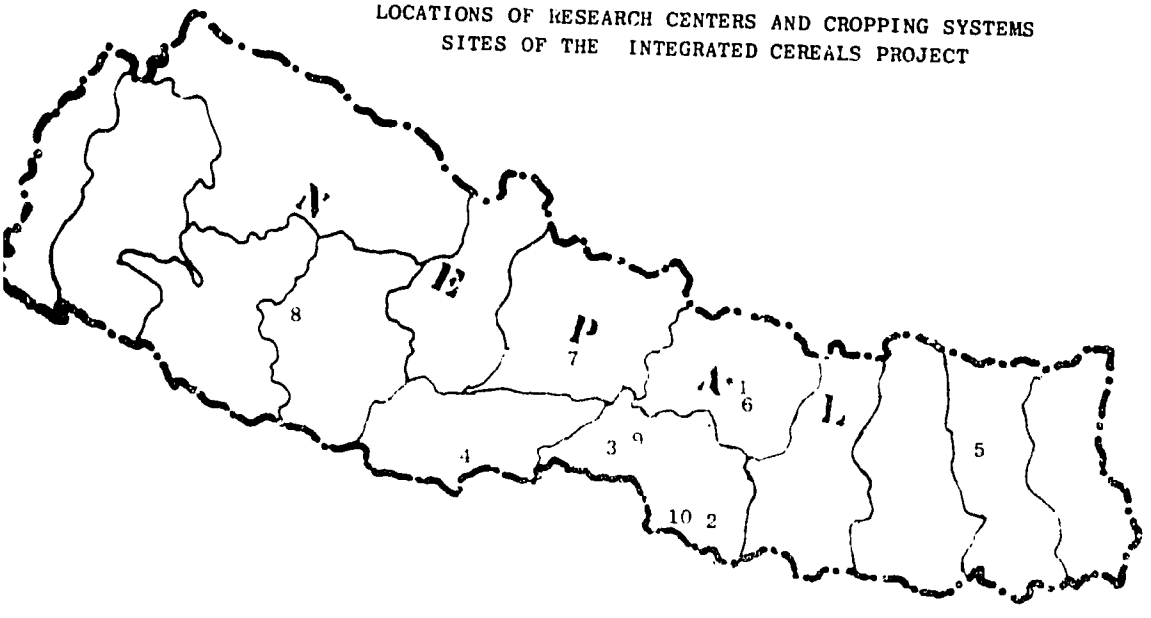
LOCATIONS OF RESEARCH CENTERS AND CROPPING SYSTEMS SITES OF THE INTEGRATED CEREALS PROJECT



Key:

* Kathmandu
1 Khumaltar Research Complex
2 Parwanipur, National Rice Improvement Program
3 Rampur, National Maize Development Program
4 Bhairahawa, National Wheat Development Program
5 Khandbari, Cropping Systems Site
6 Lele, Cropping Systems Site
7 Pumdi Bhumdi, Cropping Systems Site
8 Chauri Jahari, Cropping Systems Site
9 Ratna Nagar, Cropping Systems Site
10 Parsa District, Cropping Systems Site

Terminal Report

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ABBREVIATIONS AND ACRONYMS

ADO	-	Agricultural Development Officer in the district
AERP	-	Agricultural Extension and Research Project
APROSC	-	Agricultural Projects Services Center
AVRDC	-	Asian Vegetable Research and Development Center
CIMMYT	-	International Maize and Wheat Improvement Center
CSP	-	Cropping Systems Program
DFAMS	-	Department of Food and Agricultural Marketing Services
DOA	-	Department of Agriculture
FSWG	-	Farming (Formerly Cropping) Systems Working Group
GTZ	-	German Agency for Technical Assistance
ha.	-	Hectare
HFPP	-	Hill Food Production Project
HMG	-	His Majesty's Government of Nepal
ICARDA	-	International Center for Arid Land Research and Development
ICRISAT	-	International Center for Research in the Semi Arid Tropics
ICP	-	Integrated Cereals Project
IITA	-	International Institute for Tropical Agriculture
IPB	-	Impact Production Block
IRRI	-	International Rice Research Institute
IRTP	-	International Rice Testing Program
JT	-	Junior Technician
JTA	-	Junior Technical Assistant
KHARDEP	-	Koshi Hills Area Rural Development Project
M or m.a.s.l.	-	Meters above mean sea level
NMDP	-	National Maize Development Program
NRIP	-	National Rice Improvement Program
NWDP	-	National Wheat Development Program
PVT (or PPVT)	-	Preproduction Verification Trial
PCV	-	Peace Corps Volunteers of the U.S.A.
RAD	-	Rapti Rural Area Development Project
RAVC	-	Return above (or over) variable costs
RCUP	-	Resource Conservation and Utilization Project
SATA	-	Swiss Agency for Technical Assistance
SPISP	-	Seed Production & Input Storage Project
T and V	-	Training and Visit System of Extension
T	-	Metric ton
UPLB	-	University of the Philippines, Los Banos
USAID	-	United States Agency for International Development

ABSTRACT

After more than eight and one half years of project activities, the merits of a long term project have been noteworthy. This extended period of time provided for the development of a system of on-farm research that was useful to commodity programs and cropping systems as well as for use by extension in the establishment of production programs.

The adaptive cropping systems research in farmers' fields was a product of an interdisciplinary team involving socio-economists as well as agronomists and other biological scientists.

Methodologies of on-farm research had to be established to assess the farm environment of small farmers, then design research in cropping patterns to develop results based on reactions of farmers and technical data.

The result of this research effort is a set technologies for as many as 30 cropping patterns. These have been presented for extension use in a guidelines manual which sets forth how to determine the profile of a prospective site, how to establish preproduction trials with the patterns, the components of the pattern, and what to do once the technology is verified in a site.

The methodologies of technology transmission based on cropping systems developed in farmer field laboratories require a different extension approach to farmers and their farms. These have been tried and verified the same as the technologies themselves. Over a period of six crop seasons this methodology was perfected and a full scale production program was launched in the eighth crop season after pilot production started.

The essential ingredients of a successful production program have been determined, verified and documented and full scale production has led to additional government commitment to more production campaigns. These

production programs have been welcomed by farmers and production, based on productivity, has increased 15-20% in extensive areas.

Cropping systems adaptive research is dependent upon commodity research for supply of new varieties, the most dramatic of which have been early varieties of rice and maize. By contrast the lack of such varieties in the minor crops has been considered as one of the greatest detriments to more effective cropping pattern technologies for the Hills.

Commodity programs in turn can use the cropping systems methodology for on-farm research as a pattern of operation for research outreach being conducted on farmers' fields by research staff from the commodity research stations. Component technology trials on farmers' fields have increased significantly and hasten the varietal identification process. These trials can be superimposed on cropping pattern trials for more effective on-farm research leading to production programs.

A measure of commodity program research activity is the number of varieties released. During the project period, ten rice varieties, three maize varieties, and six varieties of wheat were released to farmers.

Minikits have become a standard extension tool to disseminate varieties to farmers so that a new variety, once accepted, is in a position to move into the farmer-to-farmer seed system. The program has provided a valuable link between the commodity programs, extension and the farmer.

Agronomic practices and cropping patterns have been effective in exploiting the potential of the new varieties but more information needs to be incorporated into extension literature. In other words, to effectively use new varieties a better set of agronomic practices and plant protection are required in order to exploit this potential.

Training programs to upgrade manpower in the Department of Agriculture have assisted 29 persons to get M.Sc. degrees and four to get Ph.D.s. Eighty two

persons have been provided training for six weeks to six months, and 133 have participated in study tours, workshops and conferences.

In-country training has been an active component and is essentially the only mechanism available for teaching indigenously developed methodologies and technologies.

Activities of the project have been well documented by reports on cropping systems, production programs, commodity program seminars and proceedings, site surveys, and guidelines to extension efforts for extrapolating the cropping systems technology. A popular version of the cropping systems program presented in "Through Farmers' Eyes" in English and in Nepali has been widely distributed.

Other activities have been in construction and experiment station development to upgrade research capabilities. Housing for staff has increased, office and laboratory space expanded, water and electrical utilities improved, and experimental fields partially improved except at Bhairawa where the work was successfully completed.

Equipment to improve the research stations have included field equipment, laboratory equipment, and vehicles with some motorbikes for stations and for production program activities.

Technical services to the project have been provided by resident specialists, Peace Corps Volunteers, and consultants who have worked as a team with the staff of the Department of Agriculture and others.

Problems encountered have been brought to the attention of administrators in an effort to obtain more effective manpower utilization, improved research administration, and policy changes to enable HMG to more effectively meet its obligations to enable farmers to produce more and improve their welfare.

I. SUMMARY

This report covers the activities of a USAID financed host country contract in the Department of Agriculture implemented by the International Agricultural Development Service. The Integrated Cereals Project (ICP) covered assistance to the rice, maize, and wheat coordinated crop improvement programs, cropping systems on-farm research in six selected sites (four of which were in the Hills), and production programs built upon the technologies generated.

To achieve all the objectives commodity research and on-farm cropping systems research was required and in addition the extension methodologies had to be developed to complete the continuing process of creation, dissemination and adoption of technologies.

The project at the outset aimed to develop technologies by non-traditional research systems with the integration of research and extension working with farmers in their fields. An additional unique feature was interdisciplinary team involving socio-economists to assist in the development of this field research; to conduct studies of the farmers to determine what the research problems should be; determine the comparative economies of farmers' patterns and improved patterns; and assistance in devising extension methodologies to transfer the technologies identified as a result of adaptive research in farmers' fields.

The Integrated Cereals Project has tried to achieve its objectives through an evolutionary process of socio-economic studies and agronomic adaptive research in farmers' fields where the farmers become an active component in the development of technology suitable to their conditions. Beginning in 1977, the Integrated Cereals Project used existing improved varieties and practices of the major cereal crops and fitted them into pattern research on farmers' fields so that the factors affecting farmers' decisions could be learned as they reacted to the technologies. Pattern trials and component trials of varieties, fertilizers and agronomic practices were established to improve existing patterns and create some new ones.

Four Hill sites, one in the Terai and one in the Inner Terai, were the field laboratories of the cropping systems program.

By 1980 technologies were beginning to emerge which were ready for trial on a production scale, first on a pilot basis, at the research sites themselves. The creation of technology was making progress. The next stages of dissemination and adoption of technologies required further study but in the fields of more farmers.

A. Production Programs started in 1980 with a small pilot production program at one cropping systems research site involving small scattered parcels of land owned by many farmers. Difficulties encountered in this first and subsequent attempts were many and with them came the realization that more than technology was required to achieve adoption and increases in production. Without any prior survey to determine farmers' practices, objectives and goals, these pilot production efforts had to regroup, conduct preproduction surveys, consolidate pilot production into "impact" blocks of contiguous land units involving several farmers using the same practices and patterns. These impact blocks were expanded slowly at the cropping systems sites until the wheat crop of 1982-83, when the two Terai sites had about 200 ha. each. The impact on officials and farmers alike led to significant decisions and commitments on the part of HMG. Lessons learned in the smaller pilot areas at the cropping systems sites indicate that in addition to field-proven technologies, dissemination and adoption would need -

1. Site surveys to determine production potentials and other characteristics of the area.

2. Preproduction verification trials are needed in the potential area, to verify the technology and acquaint extension personnel and farmers with the technologies.

3. Manpower to support programs requires a production team of one officer, two junior technicians and ten farmer-production leaders to manage an impact block of 1000 ha.

4. Training of the manpower to establish capability and credibility in the eyes of farmers.

5. Establishment of impact blocks bottom-up through farmers rather than top-down through targets by getting commitment of farmers, through a series of organized meetings and personal contacts, to agree to follow the technologies that had been identified in on-farm adaptive trials.

6. Establishment of a series of committees at national, regional, district and local levels to ensure understanding, participation, commitment and coordination of inputs, credit, and irrigation agencies.

7. Supervision and management personnel designated and provided mobility to function.

8. Availability of inputs restricting large scale campaigns to the Terai where assurances of supply were more positive.

9. Markets and market prices are critical factors determining the sustainability of a production program.

10. Rewards and recognition to farmers and staff making significant contributions.

11. A name for the campaign -
"Badhi Utpadan Karyakram" or "more production program" was revised to "Bali Pranali Utpadan Karyakram" or "Cropping Systems Production Program".

12. Lastly, commitment from leaders at all levels. Unless the will is there no matter how good the technology or how great the need the program will not succeed.

A production campaign on a targetted 17,000 ha. in five districts was initiated in the winter season 1983-84, sustained in the rice crop of the 1984 monsoon season and expanded to 35,000 ha. in 17 districts of the Terai in 1984-85.

Results of these production campaigns have shown yield increases in rice and wheat of about 15-20% even though use of fertilizer inputs have been below the recommended levels. On a pilot production scale, pattern yields have increased 20 to 140% under lowland conditions, either rainfed or irrigated. Under upland rainfed conditions increases of as much as 40% have been obtained. Economic indicators show similar impressive trends.

Attempts at pilot production in the Hills have not been successful even though the technologies are sound agronomically and economically. The present infrastructure is not dependable thus the necessary inputs are not available for use by farmers even on a pilot scale. Seed supplies can be generated locally but not fertilizers. It seems that additional research will be required to develop technologies that more effectively use existing resources available to farmers. Even the low-resource technology already developed is not appropriate to many situations in the Hills. In the meantime farmers at the research sites have quickly adopted improved varieties of wheat, rice, and maize wherever these crop varieties were fitting into existing patterns. More significantly, farmers changed patterns to make use of earlier maturity in varieties like Khumal 3 rice and Arun 2 maize so that a greater cropping intensity was possible for these farmers.

B. Cropping systems technologies have been developed at six sites during the project period. These six sites have six different major land types that are estimated to represent most of these types in 30 of the 75 districts of the Kingdom. Some sites have as many as three land types in the different topographic levels with different levels of water supply. Results have been accumulated over the 8-year period on over thirty different cropping patterns. At present those being used in production campaigns are primarily for irrigated or rainfed lowlands. Technologies have been developed and tried on pilot scales in other major land types but these have not been utilized systematically in production campaigns.

Chickpeas in some patterns have made a significant contribution to production and to increased economic returns. Green manure crops included in some patterns have provided the equivalent of 60 kg N/ha for the succeeding crop. Although the crop (dhaincha) used has serious limitations because seed production requires as much as nine months, the demonstrated value of a green manure crop in patterns has considerable significance to Hill farming situations where supplies of commercial nitrogen will be expensive, limited and unreliable.

C. Cropping systems methodologies were perfected for on-site research and later for use in transferring these cropping systems technologies to other sites. Basic considerations in both instances have been surveys to determine what the farmers' situations are, what cropping patterns they use and what the potential is for increasing production. The surveys make use of secondary data to describe the topography and climate and interviews of key informants and others to determine the crops, socio-economic conditions and other characteristics of an area.

Farmer-based technologies derived from these pattern and component trials are ready for pilot production at the research site or moved to other sites for preproduction verification by the extension staff. Preproduction verification pattern trials require essentially the same level of precision in conduct and information gathering as the site research trial. The new pattern is a result demonstration to extension but to verify it data must be collected from other adjacent fields where the same pattern or the one being replaced is grown by the farmers. Preproduction verification also provides opportunity for a seed multiplication phase because seed has been found as an early constraint to adoption if farmers are ready to adopt the pattern technology in a production program. A local seed source is critical to the success of production programs especially in the Hills.

Experiences in other project areas such as the Rapti Area Development Project where the methodologies of transfer have been used indicate

that the procedure of preproduction verification of patterns provides a step where extension personnel become acquainted with the technology and if the technolcgies have been truly verified, provides them with their own information which can be more effectively used in production programs. The impact production blocks as the next step in technology transfer is considered the best approach to effectively using technology to increase production.

D. A farming systems research program was established toward the end of the project period to broaden the scope of site research at Pumdi Bhumdi to include the livestock component in the research program. Feed production was included in pattern studies and component trials in which fodder production is evaluated and milk production recorded to measure the effects of this increased forage.

E. The rice program has released 10 varieties during the project period, seven for the Terai and three for the Hills. The Terai varieties have a range in maturity of 140-150 days for the latest to 110 days for the earliest and have a range of adaptation for irrigated lowlands and rainfed uplands and lowlands. The varieties for the Hills are earlier, more productive and more disease resistant than the Taiwan varieties commonly grown in Kathmandu valley, the only Hill area where improved varieties are intensively grown. Masuli, released in 1973, is adapted to rainfed lowlands and continues to be the most widely grown improved variety of rice.

F. The maize program has followed a system of cyclic improvement of open pollinated composite varieties. Improvements were continued in varieties released prior to 1976 and three varieties were released during the contract period. Arun 2 was the most significant release during this period because its earlier maturity made it the first improved variety to meet such maturity requirements of many farmers in the Hills and in some Terai cropping patterns as well.

G. The wheat program has identified six new varieties for release which have more resistance to leaf rust than RR 21, the mostly widely grown wheat variety in the Terai and in the Hills. UP 262 is replacing RR 21 in some areas of the Terai and along with the other varieties are effectively reducing risks to losses by leaf rust when RR 21 is grown.

H. The importance of other crops in Hill cropping systems have been recognized but limitations exist in the germ plasm available to replace local strains. The contributions of soybeans in the intercrop pattern, maize plus soybeans, have been documented but no varieties are available at present that are any better than the local varieties now used by farmers. In the Terai legumes such as Dhanush chickpea, have shown excellent yields and economic returns in pattern trials and this variety has already moved into a seed production program by farmers in Sukchaina. Recently new short duration cowpeas offer real opportunities for increasing cropping intensity.

I. Minikits are small quantities of seed sufficient for one tenth to one fortieth of a hectare, depending upon the crop and whether it is for the Terai or Hills. Minikits have proven a good means of widely disseminating new varieties of crops, and provide a valuable link between research center, extension service and farmers. Annually the commodity programs distribute about 30,000 minikits comprised of 20,000 for rice, 6,000 for maize, and 4,000 for wheat.

J. Training was a significant part of the ICP from the very beginning with academic programs, non-academic training programs, study tours, and local in-country training, supported by the project. Twenty nine staff have received M.Sc. degrees and four have received Ph.D. degrees during the contract period.

Training at the international agricultural research centers (IARC), primarily in crop production and cropping systems constituted the next most important training activity abroad. Eighty two persons received

318 person months or over 26 person years of training of this type.

Senior staff have attended numbers of conferences and seminars mostly at the IARCs, while junior staff were also able to participate in monitoring tours to various country programs in southeast Asia in cropping systems, rice, wheat, and maize, and some minor crops tours occasionally. One hundred thirty three persons participated in these programs over 54 person months.

In-country training was a built-in part of the ICP with a production agronomist to serve as a training officer as well. Training involved extension staff charged with the responsibility of disseminating technology to farmers. This was first done through the commodity programs, then emphasis shifted to higher level training for management skills and planning extension programs. Then as cropping systems technologies and methodologies, were developed training concentrated on transferring these technologies and methodologies through training the staffs of other projects in the principles of site description, preproduction verification trials, and organizing pilot production and production programs.

K. The effectiveness of the Integrated Cereals Project (ICP) to accelerate production has been primarily dependent upon the utilization by other projects and agencies of the methodologies and technologies developed by ICP. Through the pilot production stage ICP staff was vitally involved in implementing production programs. Beyond that stage it then had to be an HMG responsibility with this responsibility discharged through specific projects or programs such as the Badhi Utpadan Karyakram.

The merits of the technologies and methodologies have been variously accepted and tested. Where they have been tried they have proven acceptable and worthwhile. The methodology has been put to the most thorough test in the Rapti Area Development Project.

L. Women in extension have received increasing emphasis and a detailed study in 1984 was made to determine how to utilize women in extension and in production. With this and other background information it was possible to prepare a follow-up project which is yet to be put on the ground to implement a program for farm women by women extension workers.

M. Reports of the Project, in addition to the quarterly, and later semi-annual reports, include numerous papers to record the results and analysis of research trials, of socio-economic surveys, of site surveys prior to preproduction verification trials and pilot production, results of preproduction verification trials, results of pilot production and production campaigns, special projects such as women in extension, consultancy reports, and some papers on issues, concerns and strategies. These have been presented in various national workshops and seminars, in international conferences and symposia. A popular document, "Through Farmers' Eyes" was prepared in 1983 covering the work in cropping systems in Nepal. These reports are listed in detail in Appendices A, B, and C.

N. Construction and other activities under the project have created additional staff housing at the three commodity centers; a laboratory and office building at each center; and a seed plant for processing and storing seed at each center. These facilities have provided support for the increased level of activities of the commodity programs in crop improvement, foundation seed production, and seed for minikit distribution.

In an effort at further upgrading these centers improvements have been made in irrigation systems. Land shaping has been done at the wheat center at Bhairawa, partially completed at the maize center at Rampur, with field designs prepared for the remainder and for the rice center at Parwanipur. Improvements have been made in the irrigation system

at Khumaltar Research complex in collaboration with SATA. This facility should be functional for the winter season 1985-86. A large tractor and land shaping equipment was procured to enable these activities to be done.

Equipment has included improvements to the electrical systems, equipment for seed plants, and laboratory equipment for pathology, entomology, soils and rice quality determinations. Programmable calculators have been provided to enable more complete and timely analysis of data at the commodity centers and at the Agronomy Division at Khumaltar. To meet the vehicle needs to enable more field oriented research activities to be performed, additional vehicles were provided as support vehicles for the resident specialists became available. For production activities in the Terai, motor bikes were procured for production officers and a fleet of bicycles procured for the other members of the production teams.

O. Technical services supplied by IADS to the project included the seven specialists called for in the contract for a total of over 40 man years of technical services. In addition, the Rockefeller Foundation supplied the services of one anthropologist for two years. These specialists served as participating staff of the respective programs to which they were assigned. Resident specialists were assigned to the commodity research centers until these activities were phased down at the end of 1981.

The staff associated with the cropping systems programs were vital to the formulation and implementation of this new program which is yet to be institutionalized by the DOA. Functionally, it has probably succeeded even better than if it had been institutionalized. The flexibility and innovativeness would probably have been lost. This flexibility and innovation was also a significant factor in the creation and implementation of pilot production programs upon which full

scale production programs could be built and the patterns of operation adopted elsewhere.

Fortunately, generally amicable relations prevailed between resident specialists and their counterpart staff so the relationships have not been serious problems that could have affected performance of personnel and project. The concept of participating scientists serving as members of the HMG team has been an important ingredient in success of the programs supported by the project.

The activities of resident specialists and HMG staff have been supplemented by short term consultants in various specializations. They have served in program formulation, strategy development in research organization, production, implementation of experiment station development and operations support services, to special research disciplines and for training. These specialists have been world authorities from the International Agricultural Research Centers and elsewhere and other consultants that have been able to make specific significant contributions during the course of the project.

Peace Corps Volunteers (PCVs) have played a significant role in implementing the site research in cropping systems; in the socio-economic surveys for site descriptions; implementation of the pre-production verification trials conducted by other projects and ADOs; and monitoring and assisting in production programs. Thirteen PCVs served as middle level agronomists, mostly at the cropping systems sites. Two other PCVs, because of their expertise in socio-economics, were used at Khumaltar in the socio-economic unit of the cropping systems program. Recently one PCV was provided to work on finger millets to strengthen the activities of the Agronomy Division in minor crops

P. Problems -

The level of success achieved by the project was not without its

problems. Fortunately these have not been as bad as those experienced in some other projects and success may have been partially because of these problems as well as in spite of them.

1. Perhaps the one problem most seriously affecting programs, both cropping systems and the commodity programs, has been the instability of staff. Posts, if already created, may be filled with temporary staff. Temporary staff in their desire to become permanent employees seek other employment opportunities. Attending interviews is time consuming and disruptive. Those who have regular postings are unstable because the job opportunities, not career opportunities, do not lie with the post. Fortunately, serious proposals[1/] have been made that would address the whole personnel policy issue for civil servants in agriculture.

2. The lack of a socio-economic "faculty" in the Department of Agriculture created problems in supplying counterpart staff for the cropping systems research activities. This lack has not enabled the Department to attract and hold economists that could make a contribution in these aspects of agricultural research.

3. Another personnel problem has been the under-utilization of manpower trained under the ICP. Academic trainees return at the same level in the Department yet their training should make them more valuable for the position for which they were trained. This is not recognized in assigning them to posts, in number of merit points, or in a remunerative way. Uncertainties as well as disincentives create a very low morale among such staff who may have returned to Nepal with high hopes and ambitions for serving their country. The need for more and better trained manpower still exists. Their more effective utilization requires that more serious consideration must be given in order to more effectively satisfy that need.

1/ Nepal: Agricultural Research Project Identification Mission. FAO/World Bank Cooperative Program, Mission Note March, 1985.

4. A problem associated with the utilization of persons with advanced academic training is the fact that some do not return immediately after the course of study for which support from ICP was provided. Six persons are presently in this category. They have obtained funds from other sources and have remained for another degree. A seventh was in this category but received third country sponsorship and has returned and assumed duties in the program he had left. The unfortunate aspect is that others who may be equally worthy are denied such opportunities because of these few who abuse the opportunities provided them.

5. Periodically during the course of the project funds of the ICP have had to be used to carry on the timely activities of the program. HMG funds are not released in time and these occurrences seem to be a result of normal operating procedures for the Ministry of Finance. Without this cushion of resources, many seasonal activities of the program would have been completely lost or vastly curtailed.

6. "Services" have been recognized as being divisions which have some service functions in support of other divisions. The lack of bonafide support services in the Department affects vehicle and equipment operation and maintenance, procurement, experiment station operations, building and grounds (including electrical and plumbing services), library and statistical services. Many of these service activities have been performed as a part of the ICP logistic support to the resident specialists but in fact has developed into a more broad support to programs.

Recognition by the Department and Ministry of Agriculture and the Department of Administrative Management, of these services and upgrading the quality of staff and creating a division status for some services will be necessary in order to overcome many of those services and maintenance problems.

7. Institutionalization of the Cropping Systems activities has been proposed. In the short term this lack may not have been a serious problem. In the long term it is extremely serious, and will determine the continuity of the program which is now being expanded to Farming Systems.

8. The translation of research results to extension and farmer language is only slowly being recognized as a part of the continuum of technology transfer. Information presently is being generated which changes recommendations but this is not being incorporated in the recommendation development process or incorporated into the information dissemination system. Surveys have found farmers lack knowledge about technologies which would be more readily tried and adopted if they know about them.

9. In the new production programs problems of staffing have partially been resolved. Incorporating staff and production activities into the ongoing extension function of the Department is still to be achieved.

10. Another problem associated with production have been the matter of input supplies. These problems affect performance of extension personnel since they lose credibility in farmers' eyes and production losses occur for farmers and national targets become only paper figures.

11. Studies of the production programs recognized the importance of contact with farmers in the process of dissemination of information to increase production. These contacts were reduced from 64% of the farmers in one season to 36% the next season, indicating a serious trend away from effective extension systems.

Q. Evaluations of the project have been complimentary and supportive of the Integrated Cereals Project, especially the cropping systems

program. This has been viewed as a bottom-up approach to improving the well-being of small subsistence farmers, especially in the Hills. As a consequence, no major redirections of the project have been necessary. The three year extension gave opportunity to more firmly establish methodologies and to effectively use them in pilot production programs at several sites and in other projects. Full scale production programs were launched in the Terai after convincing performances of the technologies in pilot Impact Production Blocks in two districts.

II. INTRODUCTION

A. Concepts of an on—farm research — extension system

USAID has had a continuing concern for the development of Nepal's agriculture, and in various projects from the very beginning of the agreement in 1951 between HMG and the United States projects have consistently addressed Nepal's requirements to increase its food production. These have involved an early manpower education program to increase the manpower available for research and extension in agriculture.

In response to USAID's continuing concern over declining per capita food availabilities and falling export earnings and following an analysis of the major constraints to agricultural development in Nepal, United States Agency for International Development (USAID) and the Ministry of Food, Agriculture and Irrigation (MFAI) have designed a joint project focusing on the development and dissemination of improved production technology for the major foodgrain crops and the related cropping systems. Based on a USAID project paper and finalised in September 1976, the ICP was funded jointly by His Majesty's Government of Nepal (HMG/N) and by USAID funds granted to HMG/N for this specific project. The ICP was supported by a contract between HMG/N and IADS signed in September 1976. The project implementation was formally initiated in October of the same year.

The term 'Integrated' was applied to the project as it was one of the first USAID projects to formally link research for the development of technology; on-farm adaptive research to more accurately assess farmers' problems and to test the research generated at the research stations; and a linkage with extension to more rapidly disseminate the technologies of research centers and on-farm testing in cropping systems. It has integrated the biological disciplines of the commodity programs with social scientists into a team that considered not only

the crop production problems of the farmer but also his socio-economic problems as well. The project was to address primarily the problems of Hill farmers in order to increase productivity of their farms and the general well-being of the farmers and their families by more food of better quality and by improved economic conditions. An integrated approach was considered to be more effective in solving the problems of increasing productivity of Nepalese agriculture by improved technologies and accelerating the transfer of existing and new technologies to more quickly make an impact on production.

The Food Grain Technology Project that preceded the ICP was to "strengthen the functions of adaptive research and extension". In 1973 well before this project was to close, HMG invited the Rockefeller Foundation to undertake a study of Nepal's Hill Agriculture. This study was undertaken in late 1974 and created a new framework or concept upon which a new project could be developed.

At about this time, while some people were worrying about second generation problems of the "Green Revolution", others realized that the Green Revolution was by-passing a large group, the majority of Asian farmers. These farmers were small farmers at the subsistence level or often below the subsistence level. They were resource-poor. Many of Nepal's farmers, especially those in the Hills were among those being by-passed by the Green Revolution that was contributing so significantly to Asian food grain production. Among these farmers an intensive system of farming with strong interrelationships existed because -

1) the production system had so intensified that resources (physical, socio-economic) became limiting, and
2) the farming system provided for the majority of the needs of the farm family for food and shelter (a largely non-market system).

USAID in creating a new project was not proposing a traditional crop specific research program, (but) rather, attempting to develop new varieties and a new technology package for the major food grains (rice, maize, and wheat) -- based on a "farming systems" approach to research. This meant that work on these crops would be related or based on their relationships to other crops in the cropping system, major as well as minor, which precede or follow the major crops in the various systems occurring in Nepal.

This non-traditional research system required a different research setting. Commodity programs had been established on an interdisciplinary approach in the early 1970's for the purpose of maximizing production of the specific crop commodity. The technologies - varieties, agronomic practices, and plant protection were directed at that one crop under sole-crop conditions. To verify or adapt these technologies to the various farming systems and the many agro-physio-climatic conditions of the Hill farmers required a type of research which could only be done in farmers' fields.

This research system was indeed non-traditional. Likewise the transfer of the technologies developed in farmers' fields would require a different dissemination system. This system could also be considered a non-traditional system.

Generally three aspects or activities are considered in relation to technology creation, dissemination, and adoption. The interrelationships of these points are best stated by Dr. R. R. Harwood.[1/]

"The process of creation, dissemination, and adoption of new technology is best viewed as a continuum starting in laboratories of central research stations and continuing all the way to wide-spread adoption by farmers. Intermediate steps along the way include regional testing

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1/ Quoted in the Project Paper.

on government farms/stations, field trials in farmers' fields, and demonstration plots. In such a view of the process there is no clear dividing line between research and extension. At one end of the spectrum, the work in laboratories and research stations is clearly research, and at the other end, contact with large numbers of farmers is clearly extension. The large area in the middle is of much importance in improving technology for farming system - .... The researcher's job is unfinished until he has tested his new technology on farmers' fields and assessed whether or not it has performed according to his expectations. At this point it is still a research function, not an extension activity, even though the researcher may well get the extension workers involved, or at least aware of what he is doing."

The new project effort would "reach out to farmers to identify farm level problems, for testing and feedback evaluation of potential new production techniques and for the promotion of viable technologies. The primary objective would be to help the Ministry of Agriculture (then Food, Agriculture, and Irrigation) develop new technologies relevant to farm life in Nepal and to disseminate these new technologies to farmers in order to increase production".1/

To achieve these noble objectives the project paper gave for a short term project some very long term goals "to increase the average productivity of Nepal's food grain cropping systems, particularly on small Hill farmers, in order to address the national objectives of increasing food grain production, improving income distribution and raising the nutritional status".

This was to be achieved, as stated in the Project Paper, by assisting HMG to (a) "generate improved production technology and inputs for the major food grain crops and related cropping systems and (b) to transfer the technology to farmers in such a way that it is readily accepted".

1/ Project Paper.

The non-traditional research and extension systems were reduced to rather traditional statements because when the paper was being prepared, these concepts were new, the methodologies of cropping (farming) systems research were only being formulated and tried out and a "non-traditional" extension methodology, if such was needed, was yet to be created.

The end of project status expressed the hope that at the completion of this project --

"a) a creation/dissemination/adoption system of adaptive research would be established,

b) cooperating research farms/stations would have been upgraded,

c) capability to conduct small agriculture-specific social science research projects would exist."

The "integration" of this non-traditional project was to integrate the continuum of creation, dissemination and adoption in the farmers' fields.

This report seeks to tell how this process was developed, how it took place, the progress made, the problems encountered and the utilization of these "non-traditional" but integrated systems in Nepalese agriculture. Perhaps the experiences related here can be a guide and of value to others in similar situations where traditional systems have not reached farmers with limited resources. Above all it seeks to document the salient features of ICP which can be of continuing value to Nepal's agricultural research and extension system.

Although the designers of the project recognized the need to help resource-poor Nepal farmers, especially those in the Hills, the way this would be achieved was only vaguely understood, if at all. The experiences of eight years of the Integrated Cereals Project documented here seek to relate this transition from a traditional system to a non-traditional system and the creation of a research-extension linkage that includes the

creation/dissemination/adoption process into a model[1/] which involves -

1. Starting with a diagnostic procedure of learning from farmers,
2. Generating technology on the farm with farmers,
3. Evaluation of technology by its adoption or non-adoption.

These criteria are more easily stated after an additional decade of experience in Nepal and other countries of the world.

With these ambitious objectives in the original project paper it is not surprising that there was still work to be done at the end of the 5 year project period. The project amendment (June 1981) extending the project for an additional three-year period very logically stated, in part, "This recommendation for extension relates fundamentally to the need and opportunity for further work to develop and test a system of technology transfer to farmers."

B. Scope of a project to integrate the creation, dissemination and adoption of technology

The project was created to provide support to the three principal commodities - rice, maize and wheat, and to cropping systems involving those major cereal crops. As the project began the cereal commodities, along with potatoes and citrus, had been elevated to the status of coordinated development programs and crop coordinators identified. These leaders had professional teams of 11 to 15 people and a main center identified for each. The staffs were from various disciplines of agronomy, breeding, entomology, pathology, soils, and agricultural engineering. These were to provide an interdisciplinary team for each crop. Each crop center had a network of subcenters, in most cases a main center of one crop becoming a subcenter for one or more other crops and regional centers becoming subcenters for all three commodities and

1/ Chambers, Robert and B. P. Ghildyal, Agricultural Research for Resource-Poor Farmers : The 'Farmer-First-and-Last' Model, Paper Presented at Workshop on National Agricultural Research Management, Hyderabad, March 1984.

for crops and other trials from the Divisions at Khumaltar. These commodity programs had trials established and semiannual meetings (one for summer crops held in the winter and one for winter crops held in the late monsoon period) were being held, at which results for different crops from the previous season were reviewed and new trials and programs discussed and planned for the next crop season. Participation by extension personnel provided them opportunity to keep abreast of developments in varieties, agronomic practices, and plant protection.

The cropping systems program was based in the Agronomy Division of the Agricultural Research Complex at Khumaltar. The Division had a limited staff working in minor crops such as finger millets, buckwheat, grain legumes, and soybeans.

Socio-economists, if present in the Department of Agriculture were in extension or were utilized in the planning cell or for gathering statistical information. There was no separate "faculty" (and still is not) of agricultural economics in the Department of Agriculture. The main supply of agricultural economists was in the Department of Food and Agricultural Marketing Services or in the Agricultural Projects Services Center (APROSC). The main responsibilities of these agencies were respectively, reporting marketing data and developing project feasibility studies. To supply the socio-economic component local consultancy firms or other assistance agencies as the Agricultural Development Council were to be utilized.

The development of an interdisciplinary team in cropping systems even remotely comparable to the better staffed commodity teams was only theoretical as the project was being prepared for launching. The interdisciplinary team was to become a "Diagnostic Team" to improve the system of problem identification -

"1. gaining an understanding of farming systems used in the various geographic areas,

2. defining the pressure points in the system,

3. identifying which constraints present opportunities for improvement,
4. selecting those that are researchable, and
5. informing the national coordinated commodity programs or subject matter groups of problems needing solution".

The early efforts of the commodity programs had developed some varieties (Table 3). An early "seed kit" program was to be launched and reviewed after two years to assess its value as a technology dissemination tool. The question of seed production was discussed in the Project Paper but was later removed and a separate project created for support to this phase of the technology development and distribution system.

The extension system already had a series of result demonstrations and method demonstrations being established in farmers' fields by the Junior Technicians or Junior Technical Assistants in the extension system. The "seed kit" system was a means of reaching more farmers with new crop varieties, at less cost than with "result demonstrations". And it was a program directly involving the crop commodity research teams in determining varieties to include and supplying seed for the kit program.

This briefly was the "program" outlined for the project to undertake. Obviously the component which was expected to provide the main non-traditional research system was further from reality from the point of staff, research program, involvement of disciplines and access to the disciplines to be involved.

C. Mandates of the Project

The Project Paper states that the Integrated Cereals Project "will be the only large effort either in area of adaptive research and technology development for use on the basic food crops or to focus on the role of cereals in the production systems found in the Hill areas of Nepal".

The project, by reason of its national scope in agricultural research

and as an integral part of the Department of Agriculture, could be expected to have an impact upon defined area projects which were production oriented and which were supported in part by other funding agencies. There would be a need to develop relationships with these projects to enable the products of research to move more effectively and smoothly into production programs involving the national extension system and these defined area projects. It was a linkage that would have to be earned and would be one primarily of merit. The Integrated Cereals Project would have to establish credibility if it were going to merit the use of its results in other projects. Although research is national in scope and results would be expected to be utilized it was not something that could be taken as granted, especially with the technology developed in the cropping systems research where the adaptive research process could change varieties in cropping patterns or levels of fertilizer from those currently being recommended. Cropping systems research could be expected to develop more area-specific technologies by virtue of its adaptive research in farmers' fields. The technology would be appropriate in those areas where the adaptive on-farm research was being conducted and other areas having similar agroclimatic characteristics and other features which would make the new technologies appropriate for use by farmers.

D. Implementation of the Project

Implementation of the project was to concentrate on technical assistance and training for manpower development. There was no construction contemplated under the dollar funding component of the project. This was to come from rupee funds available to USAID/Nepal from PL 480 funds in India.

Seven external specialists were to be provided through a host-country contract. These persons would provide 348 person-months of services over the five year contract period. The project paper first called for a maize breeder but after review, this was changed to cropping

systems agronomist. The other posts were to include multiple cropping (team leader), rice breeder, maize agronomist, wheat agronomist, production agronomist (and trainer) and an agricultural economist for only 48 man-months.

Seventy five person months of consultancy time was provided to augment the services of the resident specialists and provide expertise in experiment station development, agronomy and soils, agricultural economics, and other related areas that might be required during the course of the project.

The Peace Corps was to provide four production specialists who would be involved in implementation of the Integrated Cereals Project. These initial four would provide 192 person months of services in supporting the project.

Participant training was to provide degree programs for 4 Ph.D.s and 24 M.S., while short term training, mainly at international centers, would be provided for 62 persons over the contract period. With the presence of a training specialist, these training activities were to be supplemented by more intensive in-country training programs for junior staffs in the crop commodities and other programs.

Funding also provided for "commodities" to be procured in support of contract personnel assigned to the project and for the commodity research centers involved in the project.

Other activities visualized included social science research in various aspects of the project that could develop during implementation.

The following table briefly summarizes the financial implications for implementation of the Integrated Cereals Project.

Items	US Funds (X 1,000)			HMG Rupees as Dollars	Total
	Dollars	Other	Rupees < Dollars		
Contractor Services	3,500		330	925	4,755
Participants	1,150			100	1,250
Commodities	300		200	275	775
Construction			487	295	782
Kit program			735	820	1,555
Social Science Res.			50	1	51
Production Specialists (Peace Corps Volunteers)		27	12	63	102
Other Costs	50				50
Total	5,000	27	1,814	2,479	9,320

III. ACTIVITIES

A. Background

A few observations concerning the agricultural situation may be in order before proceeding to present the activities and accomplishments of the project. Those aspects upon which the project could and did have an impact are presented. However national production and yields per hectare can not be used as an indicator of the success or failure of the project since many factors affecting production were beyond the scope of the project. These factors are more completely covered in other reports and no attempt is made to make a comprehensive review.

Overall production in Nepal has increased only marginally in the past eight years (Table 1) and this has been attributable almost exclusively to wheat. Paddy production has remained about the same and areas have increased by 6.0% but productivity has decreased by - 5.1% from the 1970-75 average yield per hectare. Total Paddy production has shown an average annual increase of only 11,000 T. Production in 1979 and 1982 dropped because of the weak monsoons of those two years. Yields compared to the preceding year were reduced by 11.4 and 23.4% respectively for those two years. Productivity based on the three-year averages during the project has remained almost constant. In 1983 productivity showed a good increase to 2 14 T/ha. but the 1984 yields dropped below the 2.0 T/ha. average again.

Maize has continued to decline in productivity perceptibly in each three-year period so that at the end of the project yields were 11.9% less than they were in 1970-75. In spite of a 5.6% expansion in area, maize production was 7.2% less at the end of the project period. Again two seriously weak monsoons affected the maize crop. The 1979 yields were less by 26.4% than they were the previous year and in 1982, yields were 10.8% less than the 1981 productivity. Aside from these obvious reasons, gradually reduced yields are generally attributed to the

decreased fertility of the maize growing areas as the result of erosion and general soil depletion. It should be noted there has been a significant expansion in the winter maize crop, which now stands at 30,000 ha. Since the crop is exclusively irrigated in this season, and with more sunlight, the winter maize crop responds well to fertilizers and maize hybrids from India are being grown in many instances.

The area under minor cereals has remained essentially the same throughout the project period but productivity is following the same trend as the maize crop, with a gradual decline during the project and the net change about the same as maize with a 10.4% loss in productivity and an production.

The wheat crop, by virtue of the potential of widely grown improved varieties, has been grown on an ever increasing area so that the average for the project period was a 45% increase in area, with the last three years averaging 67% more area in wheat than in 1970-75. The 1970-75 area was already almost three times the area in 1960 so this is not a new trend in wheat production. The really new trend is in productivity where there has been a gradual increase over the project period from 1.12 T/ha. in the first three years to 1.25 T/ha. in the second three years to 1.30 T/ha. in the last three years or a 16% increase in productivity by the end of the project for an average increase of 9.8% during the project period. The average annual increase in production has been 58% above the preproject period and in the last three years of the project the production had nearly doubled the production of the preproject period with a three-year average of 604,000 tons.

The area in wheat has expanded rather consistently during the more than 20 years since new varieties have been introduced and farmers started growing them. Only in 1984-85, when a low market price at harvest (April-May 1984) discouraged farmers and when there were poor moisture conditions in some areas at planting time, farmers planted about 10%

Table 1 - Area, Production and Productivity of Cereal Crops Prior to and During the Contract Period, 1976-84

Crop	Items	1970-75 Average	Three-year averages			Average 1976-84	Compared to 1970-75 increase or decrease %
			1976-78	79-81	82-84		
Rice	Area Million ha	1.213	1.263	1.276	1.319	1.286	6.0
	Prod. Million Tons (Paddy)	2.365	2.336	2.361	2.431	2.376	0.5
	Yield, T/ha (Paddy)	1.95	1.85	1.86	1.84**	1.85	- 5.1
Maize	Area Million ha	.450	.445	.455	.575	.475	5.6
	Prod. Million Tons	.794	.760	.683	.768	.737	- 7.2
	Yield, T/ha	1.76	1.70	1.502	1.46	1.55	-11.9
Wheat	Area Million ha	.278	.357	.386	.465	.403	45.0
	Prod. Million Tons	.312	.396	.481	.604	.494	58.3
	Yield, T/ha	1.12	1.11	1.25	1.30***	1.23	9.8
Other Cereals	Area Million ha	.149	.148	.149	.150	.149	0.0
	Prod. Million Tons	.163	.156	.144	.138	.146	-10.4
	Yield, T/ha	1.09	1.05	0.97	0.92	0.98	-10.1
All Cereals	Area Million ha	2.090	2.213	2.266	2.459	2.313	10.7
	Prod. Million Tons	3.634	3.648	3.669	3.941	3.753	3.3
	Yield, T/ha	1.74	1.65	1.62	1.60	1.62	- 6.9

* Includes poor monsoon season in 1979 reducing rice yields 11.4% and maize yields 23.4%.

** Includes poor monsoon season in 1982 reducing rice yields 26.4% and maize yields 10.8%.

*** Depressed markets which reduced area by 7.4% and winter rains in 1984-85, reducing yields an estimated 11.1%. All other figures for 1984-85 are preliminary estimates.

less total area than was planted in 1982-83, when the greatest area so far, was planted to wheat.

Like winter maize, wheat has more favourable growing conditions in general, and can respond to more fertilizers so that farmers may be encouraged to plant still more areas if demand justifies. The returns for additional fertilizer under these favorable growing conditions would justify still higher levels of fertilization, provided other agronomic practices are also improved and market conditions are favorable.

In view of the more favorable yields and the continued expansion in area and production, the wheat crop and winter maize may need to receive special market attention since these crops have the demonstrated potential for increased production. If market conditions are favorable the trends in these crops could well continue as they have in the past.

The changes in area planted to improved varieties, based on statistics provided by the Department of Food and Agricultural Marketing Services, show some relationship to the research development of new varieties and their continued use by farmers and promotion by extension and the Agricultural Inputs Corporation.

The area planted to improved varieties are plotted against the total areas grown of each cereal crop (Figures 1, 2, 3). The beginning of the project period is indicated in each figure to enable an easy comparison of trends before and during the project.

At the beginning of the project the percentage of each crop under improved varieties was 17.5, 14.5 and 73.0 % for rice, maize, and wheat respectively. In terms of area this was 221,000, 84,000 and 254,000 ha. respectively for rice, maize and wheat. At the end of the

FIGURE 1 · RICE, TOTAL AREA AND AREA PLANTED TO IMPROVED VARIETIES, 1964 - 1984.

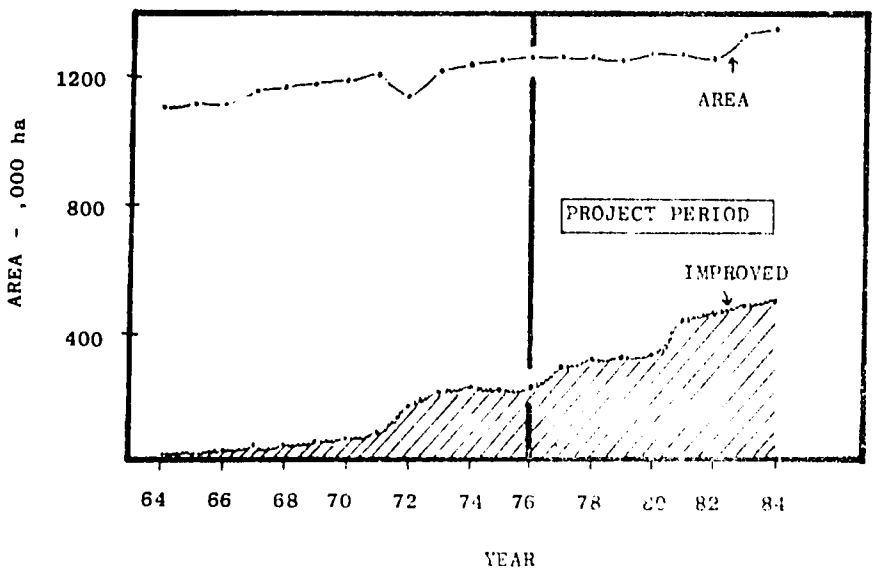


FIGURE 2 : MAIZE, TOTAL AREA AND AREA TO IMPROVE VARIETIES.

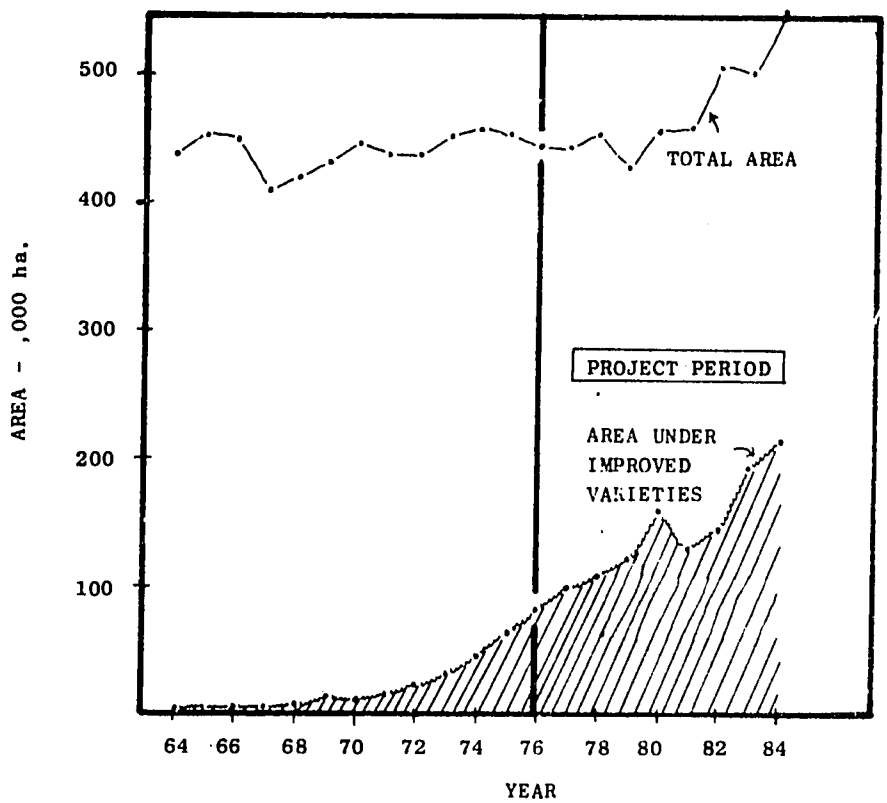
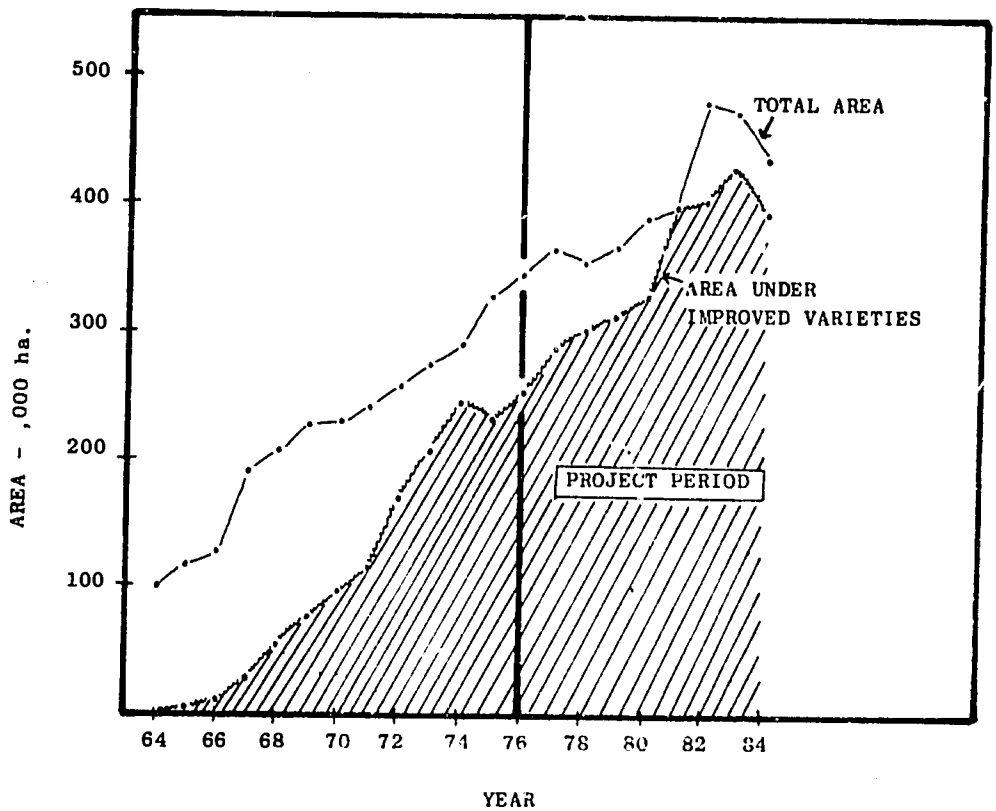


FIGURE 3 : WHEAT, TOTAL AREA AND AREA PLANTED TO IMPROVED VARIETIES.



1983-84 year these areas in improved varieties had changed considerably. Rice had more than doubled; the maize area was almost 3 times the area planted to improved varieties the year before the project; and wheat had nearly doubled in area. In terms of percentage of area covered at the end of the project they were 35.9, 38.4 and 92.1% for rice, maize, and wheat respectively.

Relationships of project activities to overall production can be considered tenuous since there are so many factors affecting production, but there may be some relationships worth noting. In the case of rice, Masuli was released in 1973 and from 1973 to 1980 there were increases from 15 to 26% of the area planted to improved varieties (Fig. 1). Masuli could account for much of this increase. From 1977 to 1979 five additional varieties were released with a range of adaptation and maturity. These could begin to account for some of the additional increase in area from 1981 to the present. Five more varieties have been released from 1981 to 1983 and these ten varieties offer farmers varieties covering a wide range of adaptation.

Maize, the second most important cereal crop up to the present, has an area growth curve (Fig. 2) in new varieties that is beginning to accelerate in rate. Rice has not reached such a stage to the present although the percentages of areas covered in the two crops are similar.

Wheat offers an interesting contrast in spread of the new varieties and in total area covered (Fig. 3). The new varieties initially offered farmers an opportunity to have more productive varieties of wheat which were of shorter duration and less disease susceptible. The shorter duration varieties offered opportunities to increase cropping intensity that were not possible before. Even before the project from 1965 to 1975, new varieties had spread to over 70% of the wheat area, and furthermore the area had increased more than three times the area planted to wheat in 1964-65, the year before national records began to

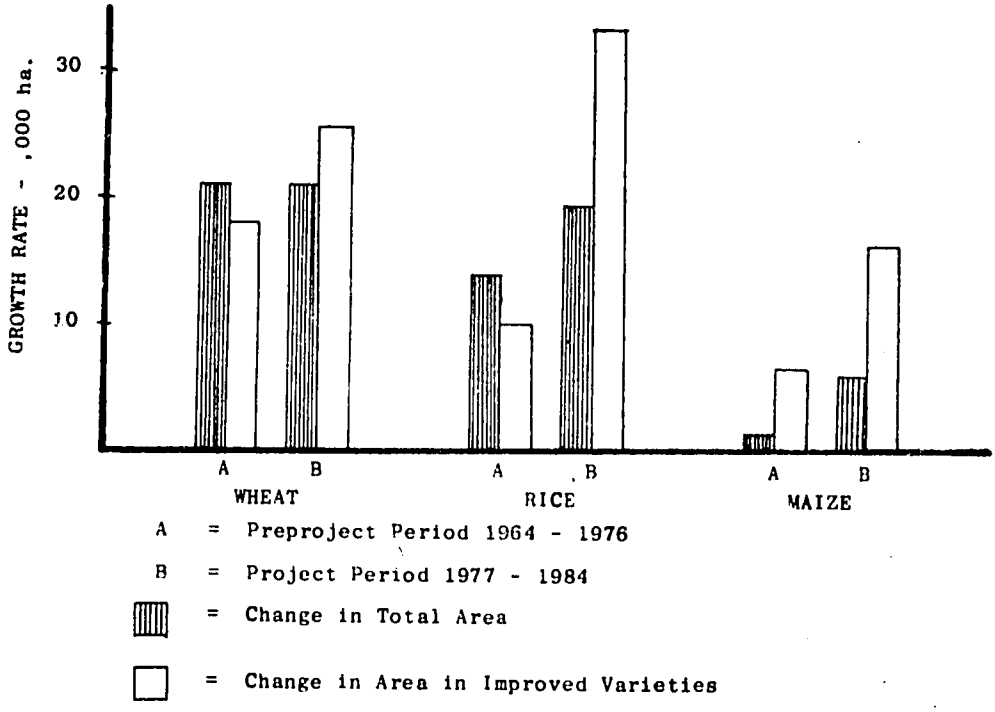
show the spread of improved varieties. During the project period, the area continued to expand and the percentage of improved varieties continued to increase but at a slightly more rapid rate than total area so that in 1981-82 the reported area was 100% in improved varieties. Two subsequent reporting periods would indicate this was not altogether correct and some areas, mostly in the Hills, continue to be planted with local varieties. The area in improved varieties still exceeds 90% of total area in this crop.

Figure 4 compares the annual rate of change in total area before and after the project with the rate of change for area in improved varieties. The area expansion rate before the project exceeded the rate of spread of improved varieties in wheat and rice. Maize had only moderate changes in area and slightly more change in the use of improved varieties. During the project period all three crops had a greater rate of spread of new varieties than increase in area, with rice having the highest rate of spread amounting to slightly more than 35,000 ha. per year.

Productivity improvement has not kept up with variety spread in any of the three crops (Table 1). Rice has shown marginal improvement in spite of two poor monsoons (in 1979 and 1982) that reduced yields appreciably in both years. Maize had a general declining productivity trend. Before the project, maize had five out of eight national production years exceeding 800,000 T. Since then none have exceeded 800,000 T. and in 1979 production dropped to 554,000 T. Productivity in maize has had a general decline over the entire 16 year period in spite of the spread of improved varieties at the rate of more than 15,000 ha. per year during the project period.

Wheat has shown small but apparently significant increases in productivity. Yields have increased from a low in 1976-77 of only 1.04 T/ha. to 1.33 T/ha. in 1983-84 or 27.9% increase. Area increased

FIGURE 4 : ANNUAL CHANGES IN TOTAL AREA AND AREA IN IMPROVED VARIETIES FOR WHEAT, RICE AND MAIZE, 1964 - 1984.



A = Preproject Period 1964 - 1976

B = Project Period 1977 - 1984

= Change in Total Area

= Change in Area in Improved Varieties

by 35.9% while total production increased by more than 70% for the same period.

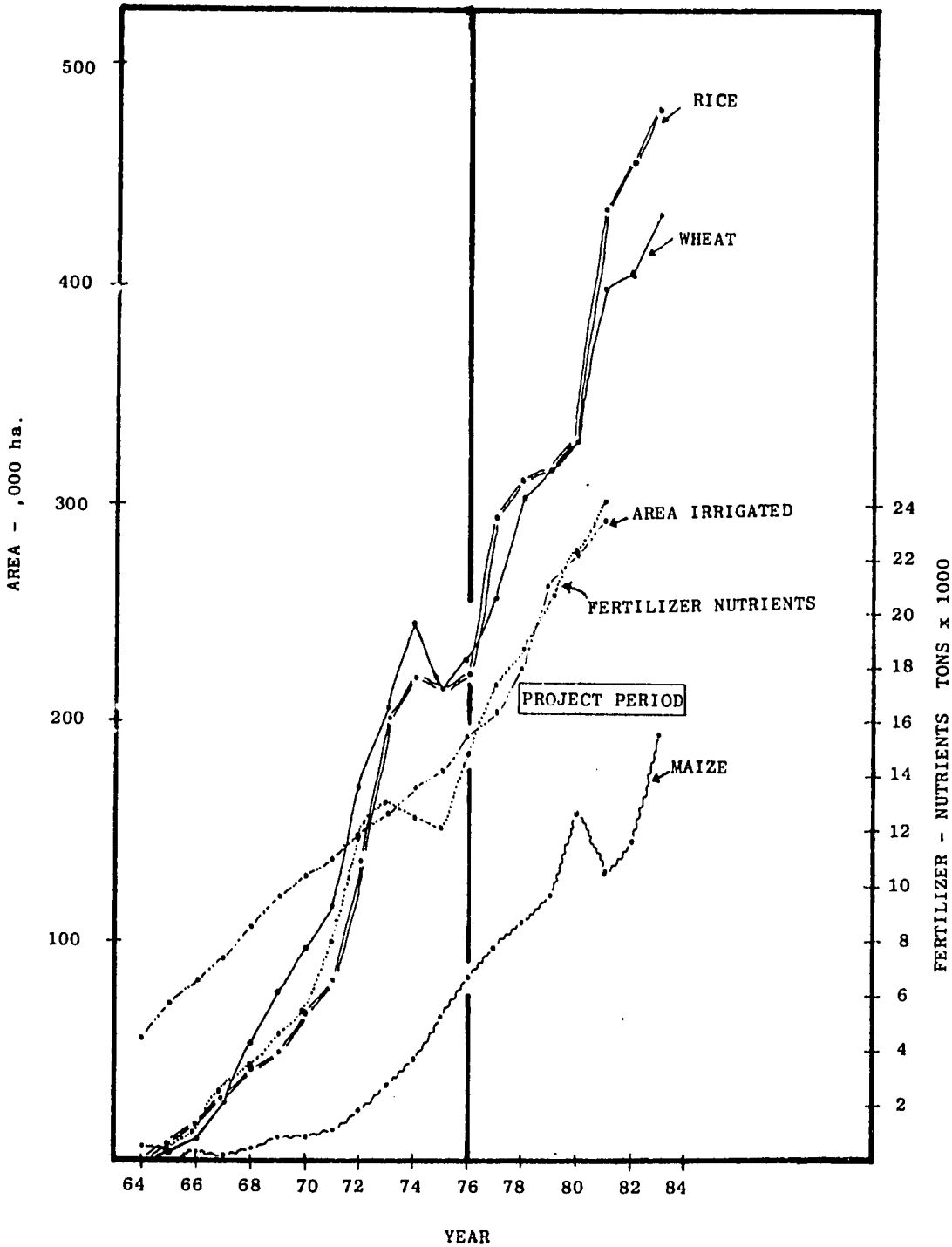
Figure 5 shows the very parallel relationships of a number of factors in development. The spread of improved varieties of rice and wheat show a very close relationship with each other and with the increased use of fertilizers and the increased areas irrigated in the country.

As might be expected, at the advent of improved varieties in 1964-65 there were already irrigation facilities on nearly 60,000 ha. Within 10 years the area covered by new varieties expanded and exceeded the expansion in area irrigated. At the end of the period for which records are available the area under irrigation was about 300,000 ha. while the area in improved rice varieties was over 400,000 ha, and wheat was at 400,000 ha. This is indirect evidence that merits of improved varieties were being utilized by farmers in rainfed areas, especially the rainfed lowlands of the Terai.

Increases in the use of fertilizers appears to have kept pace with the increase in the area irrigated. However, nutrient needs far exceed the amounts used. Based on surveys of fertilizer used in production programs on rice in 1983 and wheat in 1983-84 (N-P-K nutrient rates per hectare were 41-2-0 on rice and 58-23-2 on wheat) in the Terai and extrapolating the rates to the area in improved varieties of wheat and rice (over 800,000 ha) the requirement at that rate would be over 100,000 T. of nutrients or nearly 4 times the total amount actually used.

The known potentials of improved varieties are undoubtedly being assisted by the increase in irrigation facilities but by contrast the use of fertilizer nutrients is far from enough to enable these varieties to produce at any where near optimum levels.

FIGURE 5 : RICE, WHEAT AND MAIZE - AREA PLANTED TO IMPROVED VARIETIES.



—··—•—··= Total Irrigated Area - APROSC

····•····= Fertilizer Nutrients - FAMS

B. Development of technologies

1. Commodities

The coordinated cereal commodity development programs have made noticeable and significant advances during the project period. These have included variety development and other aspects of crop improvement research and in concept, and in manpower development. These accomplishments have been made while being always on the defensive to the charge that research is expensive and unproductive; with limited funding; with shifting manpower even though staff qualifications were supposed to improve.

Accomplishments were made in spite of these rather negative forces that were always operative to varying degrees.

As the project began functioning, seasonal crop workshops were already under way and built around the interdisciplinary crop commodity teams for rice and maize in the summer crops workshops and wheat in the winter crops workshop. Importance attached to these workshops has varied from year to year but they have been sustained except for one winter crops workshop that was cancelled in 1982. Since then a greater appreciation of their use has increased and support has improved with this greater level of appreciation. It is significant that Dr. M. M. Sainju, Honorable Member, Planning Commission, felt the workshop was of such importance as to participate during the Summer Crops Workshop in January, 1983.

The quality of papers has improved and reactions and discussions have been serious and stimulating. These workshops are the forums for the interchange of ideas between research and extension, when extension can be updated regarding research developments and research can keep abreast of changes in extension, and they can

relate reactions of farmers to various technologies. It also gives opportunity for closer collaboration for planning and review of results where research and extension overlap, that is in the adaptive research activities in farmers' fields. This includes reports on minikits, farmer field trials (FFT), and the research outreach program in general.

The project staff has played an important role in clarifying relationships between research and extension and how and where activities and programs overlap and are complementary and mutually supportive, not competitive.

The cropping systems program has become an important component of the workshops and workers have presented numerous papers covering cropping systems research. Again, the philosophic concept of cropping systems had to be presented as well as the results of adaptive research in farmers' fields. The workshop has provided a valuable forum so that commodity programs and extension developed an understanding of cropping systems and how it relates to other research activities and how both relate to the extension program in service to farmers.

The fact that proceedings of the workshops have been prepared and produced, with a minimum of assistance in final reproduction, is as significant as the workshops themselves. This has been well sustained in wheat and maize but the rice program has not been able to sustain this phase of its activities and proceedings have not been reproduced in recent years since direct support to the commodity's programs with resident specialists was stopped.

There has been a significant shift in emphasis in the commodity programs as a result of the "Production Oriented Service Program". Supervision of production at the district level is by Class I officers who are assigned one to two districts for which they are

responsible and have the powers of the Secretary for decision making as they visit their respective districts.

A third program change has been in the "Unified Planning and Implementation of Programs" and involves the classification of farmers' lands for extension activities into four categories for purposes of target development. Three of these relate to levels of irrigation facilities and the fourth covers the remaining areas. The commodity programs were involved in developing targets for these various areas of the country.

The Production Oriented Service Program was by far the most significant change in program activities of the commodity programs. This was to make agricultural research more farm oriented by doing more adaptive research in farmers' fields. The research would be more relevant and address farmers' problems and provide a support service to the extension programs through this adaptive research. To accomplish this the various research centers of the country, including the commodity centers, were assigned specific districts (2 to 4) where they were to address farmers' problems of those districts with location specific adaptive research in a "Research Outreach Program". Ultimately it was visualized that as much as 40% of staff time might be spent in farmers' fields.

To assist the stations to fulfill this task the World Bank in one of its extension projects included support to four centers, one in each development region. Two of these were the rice commodity center at Parwanipur in the Central Development Region and the wheat commodity center at Bhairawa in the Western Development Region. A Class II Officer and vehicles and some financial and logistic support were to be provided to assist in this expansion of activity for the research centers. The post was subsequently down graded to Class III since qualified persons could not be recruited for these positions.

The adaptive research in farmers' fields by the cropping systems group and the farmer field trials (FFT) of varieties served as a base for involving the centers in on-farm adaptive research. The early efforts at research outreach were undertaken very enthusiastically but soon had to be minimized because of failures at getting staff and transport facilities to carry out the work.

Even so, the national mandate of the commodity programs has enabled a significant expansion in on-farm variety trials probably far in excess of what research outreach visualized. Recent reports of these activities shows (Table 2) that trials, instead of being of only one category per crop as in the beginning of the project are now divided into five classifications in rice, four in wheat and three in maize, based on varietal maturities, adaptation, seasonal conditions, regional and land types.

In 1977-78 the variety trials (FFT) conducted in farmers' fields were - rice, 60, maize, 10, and wheat, 37, a total of 107. The 558 FFTs conducted in 1984-85 are an increase of more than five times the level of this activity at the beginning of the project.

It is rather obvious that the commodity programs have progressed immensely in their capability to conduct trials in farmers' fields. They are able to provide test materials for more specific environments and they are capable of handling more trials. They are in a much better position to more quickly identify areas of adaptation so that varieties can be proposed for release, or rejected, and provide a better service and trial materials for more farm environments.

Their service functions to the designated research outreach districts appear to be more effective in the case of the four districts served by the wheat center at Bhairawa than for the

Table 2 - Adaptive Research Trials in Farmers' Fields Conducted by the Respective Commodity Programs, 1984-85

Trial	No. of Locations	
	National	Research-Outreach Districts
Rice (1984-85)		
FFT, early irrigated	36	8
FFT, normal, rainfed	25	4
FFT, normal, irrigated	31	8
FFT, Upland	29	1
FFT, Hills	27	-
FFT, gall midge resistant varieties	-	2
Fertilizer Management	-	6
Direct Seeding	-	4
Total, Rice	148	33
Maize (1984)		
FFT, Hills, early season	18	3
" Full season	34	7
Terai, Full season	5	13
Agronomic Trials	-	21
Total, Maize	47	44
Wheat (1983-84)		
FFT, Hills, (khet)	69	3
FFT, Hills, (bari)	30	5
FFT, Terai, (irrigated)	83	11
FFT, Terai, (rainfed)	26	6
Other Research outreach, primarily cropping pattern	-	54
Total, Wheat	208	78
Total, all three crops	403	155

other commodity programs. This seeming imbalance has resulted from adopting the cropping systems approach by the wheat team. Thirty five of the trials are pattern trials. The other commodity programs need to adopt this approach to offer a more balanced farmer oriented approach to research outreach. At present, the trials are primarily trials of the particular crop rather than trials based upon cropping patterns which would in turn reflect the relative importance of all crops in the area.

The above figures on FFT reflect an improved capability in varietal development. In addition, capabilities have improved in other areas as well. In pathology and entomology, staffs have been able to develop screening procedures for problems such as leaf blight and blast in rice, leaf rust and sterility in wheat, stem borer, stalk rot, rust, and downy mildew in maize. Although some of these are still dependent on natural chance infection, others are screened by artificial inoculation so that more positive identification of resistant materials can be made under heavier disease or insect pressures so that better varieties can be released to farmers.

The old concept of chemical control of pests and diseases as the first resort is slowly giving way to the concept that chemical control is the last resort and part of an integrated approach to pest management. The concepts for and the capability to breed, screen and develop built-in plant protection in varieties is present in all the commodity programs as a product of the interdisciplinary team programs for these commodities. The effectivity of implementing these concepts will be discussed later.

Another measure of commodity activity is the varieties released by these programs. Since maize is an open pollinated crop the numbers of varieties for maize are not strictly comparable to the

varieties in the other crops. Cycles of selections in the varieties of maize are pursued and improvements are made but the variety designation remains the same.

a - Rice

Table 3 lists the varieties of crops in the cereal commodity programs and other crop improvement programs both before and after the creation of the Integrated Cereals Project. Ten varieties of rice have been released during the project period. All these varieties are nonsensitive to photoperiod and have specific adaptations for a number of different conditions in which rice is grown in Nepal. Five are adapted to the Terai and have a range in maturity of 30-40 days from the earliest to the latest. Two are especially for rainfed lowlands and are being grown in these conditions in the Terai and similar areas of the river valley besi areas in the Hills.

The high yielding varieties recently released for the Mid-Hills are Himali (IR 2298), Kanchan (IR 3941), and Khumal 3 (CH 1039 x IR 580), in order of maturity from the latest to the earliest respectively. They are resistant to blast and have good eating qualities. Seven varieties have been released for the Terai. Of these Sabitri (IR 2071-124-6-4), Durga (IET 2938), Laxmi (IR 2061--6-4-3), Chandina (IR 523) and Janaki (BG 90-2) are for lowland conditions, and Bindeswari (IET 1444) and Malika (Mala/J15) are for upland conditions as well as for lowlands. Laxmi, Bindeswari and Malika are suitable for early planting (March-April) in the Terai, and with irrigation it is possible to grow two crops of rice and one of wheat. Sabitri is a late maturing variety and would allow enough time only for a following wheat crop. Bindeswari sustains good yields when sown in mid- to late June under upland conditions as it is drought resistant. Masuli and CH 45 released before the project are contributing importantly to the area planted

to improved varieties. Masuli is suited to rainfed lowlands while CH 45 is an early variety for the Terai and mid-Hills. Taiwan varieties are grown in Kathmandu Valley and contribute significantly to production there but not elsewhere in the Hills.

A new variety approaching release is one from Sri Lanka that is resistant to gall midge and has proven valuable in Makwanpur district and other areas where this insect is a problem. It also has good agronomic performance under rainfed as well as irrigated Terai conditions. Another, IR 8423, has been tried in adaptive trials under rainfed conditions of the Sukchaina cropping systems site. Farmers have liked it so well they have already named it, Sukchaina 84. Another pre-release variety is IET 7251 which offers possibilities because it is similar to Masuli, one of its parents, and is earlier and less sensitive to photo-period than Masuli.

Its good market value and the fact that Masuli is a low input variety, well adapted to rainfed lowland conditions of the Terai, which constitutes the main area covered by rice, has made it a popular variety with farmers. The more recent releases are more fertilizer responsive but many lack the grain quality and the adaptation to rainfed lowland conditions.

One of the more significant aspects of the rice program was the establishment of a bonafide temperate zone rice improvement program which included a crossing program, introduction of varieties through IRRI's international yield trials, cold tolerance screening nurseries and disease screening nurseries. In addition to breeding materials and trials at Khumaltar, a substation was established at Palung Valley in a farmer's field to make selections under altitudes of about 2,000 m.a.s.l. This broadened the scope of the temperate zone program without appreciable cost. The key was transport to make effective use of the area by timely plantings and visits to

take disease readings, yields and other plot records, and maintain contact with farmers of the area.

The program has been effective in identifying three new varieties from the IRRI trials. Himali and Kanchan were released in 1982 and Khumal 3 in 1983. Other breeding materials coming from crosses involving the popular local variety, Pokhreli Masino, are showing considerable promise both in Khumaltar and in Palung.

Rice Dwarf Virus was identified in Kathmandu Valley and reported in literature in 1978 although it had been identified by IRRI scientists as early as 1966. It apparently persists at a low level and has never caused economic damage so far.

Under funding from the International Rice Research Institute, supported by the International Plant Genetic Resources Board, it was possible for the rice team to make collections of nearly 1,000 local cultivars, over a three-year period. Seed was shared with IRRI where it became a part of the extensive rice germplasm bank maintained at the institute.

b - Maize

Improved maize varieties released prior to the project include Kakani Yellow for the Hills, Khumal Yellow for the Mid-Hills, and Rampur Yellow, Rampur Composite and Sarlahi Seto for the Lower Hills and Terai. Janaki, Arun 2, and Makalu 2, have been released during the project period. All of these varieties represent marked improvements over many local varieties grown by farmers but are not up to some farmers' expectations for certain characteristics such as grain type, keeping and eating quality, husk cover, maturity, disease and insect resistance. Arun 2 is an early maturing variety (95 days) which was developed from a cross made between a tropical downy mildew resistant variety from the Philippines and a temperate

zone hybrid from France. It has proven to be extremely useful in the rice-wheat-maize cropping pattern because of its earliness and good yielding ability. Its earliness also makes it a valuable variety for the second maize crop in the maize-maize pattern found in the lower Mid-Hills and Inner Terai, and in the upland rice plus maize pattern in the Far Western Hills. Early maize was one of the specific objectives mentioned in the project paper and Arun 2, released in 1981, has in large measure met the requirements for an early maize variety. Its utilization and spread is now being restricted by the lack of seed in most seasons up to the present. This is no longer a problem in areas where farmers have large enough plantings where reasonably pure seed can be multiplied locally.

Maize improvement has kept pace with the improvements in other crops. The breeding procedures for improving an open pollinated crop have followed the methodologies developed by CIMMYT for varietal improvement by improvements within populations and by introducing limited percentages of germplasm into existing varieties or creating completely new populations to be selected and refined into varieties.

Two to four cycles of selection with Rampur Yellow, Khumal Yellow and Rampur Composite have provided some improvement in these varieties which have been the primary improved varieties used by farmers. In Arun 2, the new early yellow variety, several cycles of half sib selection have been followed in the development and further improvement of this variety.

Three new selections have been developed and have been tested in farmers' fields and are in the pre-release stage. These are two white varieties, Arun 1 and Manakamana 1, and a yellow variety, Manakamana 2. All three varieties have better yield performance than the old varieties with which they have been compared.

Table 3 - Crop Varieties Released by the Cereals Commodity Programs and Divisions - 1960 to 1973 and the Variety Release Committee Established in 1974 upto 1985

Crop	Name of the Variety	Origin	Year of Release	Region of Adaptation	Importance*
A. Rice Pre-Project Period					
	1 CH 45	China	1960	Early, Terai, mid Hills	1**
	2 H-136	India	1962	Terai	0
	3 BR-34	India	1962	Terai	0
	4 BR-8	India	1962	Terai	0
	5 Taichung-176	Taiwan	1966	Hills	2
	6 Chainung-242	Taiwan	1966	Hills	3
	7 Kaoshung-24	Taiwan	1966	Hills	0
	8 Chainan-2	Taiwan	1966	Hills	0
	9 Taichung Native-1	Taiwan	1967	Terai	0
	10 Tainan-1	Taiwan	-	Hills	3
	11 IR-8	IRRI	1968	Terai	0
	12 IR-5	IRRI	1969	Terai	0
	13 IR-20	IRRI	1970	Terai	0
	14 IR-22	IRRI	1972	Terai	0
	15 Khumal-1	Taiwan	1972	Hills	0
	16 Parwanipur-1	Taiwan	1973	Terai	3
	17 Jaya	India	1973	Terai	3
	18 Masuli (Mahsuri)	Malaysia	1973	Terai	1**
	19 IR-24	IRRI	1975	Terai	0
Project Period					
	20 Chandina (IR532)	IRRI	1977	Early, Terai	3**
	21 Laxmi (IR2061)	IRRI	1979	Early, Terai	2**
	22 Durga (IET2938)	India	1979	Terai, I.Terai	3**
	23 Sabitri (IR2071)	IRRI	1979	Terai, I.Terai	1**
	24 Janaki (BG-90-2)	Sri Lanka	1981	Terai, I.Terai	1**
	25 Bindeswari (IET 1444)	India	1981	Early, Terai	1**
	26 Kanchan (IR3941)	IRRI	1982	Hills	1**
	27 Himali (IR2298)	IRRI	1982	Hills	1**
	28 Malika (Mala/J15)	Bangladesh	1982	Early, Terai Rain. upland	2**
	29 Khumal 3 (Ch 1039 X IR 580)	India	1983	Hills	1**

Crop	Name of the Variety	Origin	Year of Release	Region of Adaptation	Importance*
B. Maize Pre-Project Period					
	1 Amarillo de Cuba		1959		
	2 Cubano Flint		1959		
	3 Khumal Yellow		1968	Mid-Hills	1**
	4 Rampur Yellow		1968	Terai, Inner Terai	2
	5 Kakani Yellow		1969	Hills	2
	6 Hetauda Composite	Nepal	1972	Mid-Hills	3
	7 Rampur Composite	Thailand	1975	Terai, Inner Terai and mid-hills	1**
	8 Sarlahi white	Philippines	1975	Terai and Inner Terai	3
Project Period					
	9 Janaki Makai		1979	Terai, Winter	3
	10 Arun 2	(UNCC X DMR)	1981	E. Terai Inner Terai mid-Hills	1**
	11 Makalu 2	(Amarillo del Bajio)	1984	Hills	1**
C. Wheat Pre-Project Period					
	1 Lerma 52	CIMMYT	1960	Hills	2
	2 Petic-62	CIMMYT	1967		0
	3 Lerma Rojo-64	CIMMYT	1967	Hills	3
	4 S-331	India	1969		0
	5 S-227	India	1969		0
	6 RR 21 (Sonatika)	India	1971	Terai, Inner Terai, & Mid Hills	1
	7 NL-30	India	1975	Western Terai	2
	8 HD-1982	India	1975	Centra, Western Terai	0

Crop	Name of the Variety	Origin	Year of Release	Region of Adaptation	Importance*
	Project Period				
	9 UP 262	India	1979	Central, Western Terai	1**
	10 Lumbini	India	1981	Terai	2**
	11 Triveni	India	1983	Western Terai	2**
	12 Siddartha	India	1983	Terai	2**
	13 Vinayak	India	1983	Terai	2**
	14 Vaskar	CIMMYT	1983	Western Terai	2**
D. Other Crop Varieties Released During the Project Period					
- Barley	1 Bonus		1974	Inner Terai Mid-Hills	0
	2 Galy		1974	Terai, Inner Terai	0
	3 CI-10448		1974	"	0
	4 HBL-56		1974	"	0
	5 Ketch		1975	"	0
- Finger Millet	1 Okhale 1		1980	Mid and High Hills	3
	2 Dalle 1		1980	Inner Terai Mid-hills	3
- Mung-bean	1 Pusa Baisaki		1976	Terai, Inner Terai	2
- Lentil	1 Sindur		1979	Terai, Inner Terai, Mid-Hills	3
	2 Simrik		1979	"	3
	3 Sisir		1979	"	3
- Chick-pea	1 Trisul		1979	Terai, Inner Terai	2
	2 Dhanush		1979	"	2
- Black-gram	Kalu		1979	Inner Terai, Mid-Hills	2
- Mustard	M - 4		1980		0
	T - 9		1980	Far Western Terai	3

Crop	Name of the Variety	Origin	Year of Release	Region of Adaptation	Importance*
- Peanut	B - 4		1980	Terai, Inner Terai	2
- Soyabean	Hill Hardee		1978 1978	Mid Hills Inner Terai	3 3

* According to FAO Seed Status Survey Report, 1981

1 - Very Important

2 - Important

3 - Less Important

0 - Grown only occasionally or not at all.

** In minikits in 1984-85.

Maize breeding has made notable advances because the program has used other sites where these populations could be grown. These Hill sites have been Pakhribas in the Eastern Development Region, Khumaltar in the Central Development Region and Lumle in the Western Development Region. This breeding system requires mobility of staff but it has certainly paid high dividends in the development of three new varieties in a short period of time.

Downy mildew resistance for maize in the Inner Terai has been emphasized during the project period and selections screened at Farm Suwan in Thailand for several years. It now appears that management of the maize crop can minimize the threat of this disease. Only under late-planted conditions does the maize crop have attacks of this disease. By avoiding these planting dates, farmers can escape most of the damage from this disease.

By the same token, the maize improvement program, by deliberate late plantings, could make effective selections for resistance to this disease so that resistance could be incorporated into varieties without the expense of going to Thailand.

- - Wheat

The wheat improvement program has had a productive breeding program which has expanded considerably during the life of the project. New selections have been successfully identified which have less susceptibility to leaf rust than RR 21 and six of these have been released. The one most widely grown is UP 262, released in 1979. At present in Rupandehi district it has replaced RR 21 as the predominant variety. In other Terai districts of the Central Development Region and westward it may occupy as much as 30% of the wheat area. In the Terai districts of the Eastern Development Region it has shown heavy spikelet sterility under some conditions making it risky for Eastern Terai farmers.

Other varieties that are important in area occupied include NL30, released before the project period, which is well adapted in the Terai and lower Hills of the Mid-Western Development Region. Siddhartha has proven very good in the Lumbini zone of the Western Development Region and in the Eastern Terai where sterility is a problem with many varieties. Triveni was released in 1982 for the whole of the Terai belt. It is comparable to UP 262 in maturity and yield. Lumbini, released in 1981, appear to have wide adaptability as it yielded reasonably well over a wide range of seeding dates. It performs better under low fertility and irrigated conditions. Vasker and Vinayak were found to be promising in the Terai and released in 1983. RR 21 is not any longer resistant to leaf rust so the new releases reduce the risk to rust. The old varieties Lerma 52 and Lerma Rojo 64 are grown in some parts of the Hills and RR-21 (Sonalika) is extensively grown both in the Terai and Hill regions. NL 297, a pre-release variety is also relatively free of the sterility problem. It is as early as RR 21, and has similar plant and grain characteristics of this variety, with definitely better yield potential.

During a recent visit of the CIMMYT's wheat breeder he was well impressed with the breeding efforts of the wheat team at Bhairawa.

d - Problems

Accomplishments in the commodity programs have been praiseworthy but the Acting Rice Coordinator[1/] recently pointed out some of the problems that affected the rice program and the other commodity programs as well.

Perhaps the most serious constraint is manpower which will be dealt with in more detail elsewhere. The staffing is being done by new graduates. Those who have been trained have been transferred to

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1/ Mathema, B. B., National Rice Report, Eleventh Summer Crops Workshop, Rampur, January 30 - February 2, 1985.

other posts so training has to be started anew. Only recently some appointments of gazetted officers have been made but again these are largely untrained.

With these manpower deficiencies it has been difficult, especially in entomology and pathology, to develop the technical aspects so that diagnostic laboratories can exist to help research outreach and extension in identifying problems and training staff in plant protection practices. These same deficiencies mean that screening for diseases and insects must still be on a chance basis using natural infections or infestations. These may or may not occur so that screening with adequate levels of pressure may not occur with sufficient frequency so that decisive selections could be made. As a consequence varieties could be advanced to the release stage without sufficient knowledge of their reactions to the more important diseases and insects.

All three programs suffer from these manpower deficiencies and to the extent of these limitations, greatly reduce the effectiveness of the entire program to generate new varieties with greater productivity potential and greater stability at the higher levels of productivity which are essential if agriculture is to have any real hope of keeping up with population increases.

Budget releases have greatly hampered the efficient operation of the research programs. Timely release of funds is essential to properly address the seasonality of crop culture and farmer needs.

Monitoring of research outreach trials, minikits, and farmer field trials is a more active component of the research centre operations. This is done on a nationwide basis and is in addition to the research outreach of the centers where they serve specific districts which have been assigned to them.

The commodity programs have often raised the question of centers in the Hills to do crop improvement work for certain conditions primarily of altitude. All three programs have used ad hoc arrangements which indicate what can be done to solve these problems. Rice has had an effective nursery arrangement with a farmer in Palung Valley at about 2,000 M elevation. They have been successful in identifying selections which offer better adaptation and performance than any of the older or more recently released varieties.

The wheat program has utilized facilities first at Marpha and then Nigalle to grow a summer crop of wheat, enabling rust screening to be done, and an advance of one generation in segregating material.

The maize program has used the centers at Pakhribas, Lumle, and the Agricultural Research complex at Khumaltar to effectively make half sib pollinations in these centers which could then be tested at Rampur and other locations. These facilities away from Rampur have enabled the development Manakamana 1, Arun 1, and Manakamana 2 as well as to make additional cycles of selection in Arun 2 and Khumal Yellow.

In the case of maize and wheat the sites used have been regular locations in the research network. For rice it has been in farmers' fields. The key to effective utilization of these centers has been the mobility of staff so they can make timely visits for evaluating materials, harvesting, collecting data etc.

The difference in this approach is the management of manpower which is based at a central research center but has the freedom to travel to these centers to carry out the necessary activities. It is deployment of program activities to testing sites rather than

scattering staff to be based at testing centers. The commodity programs have made the advances they did yet maintained a competent team of breeders, pathologists, entomologists, and agronomists at one center. As the needs occurred these staff could travel to the outlying trials and breeding materials to record incidence of diseases, insects, take yield and other agronomic data required to make intelligent decisions regarding crop performance, that can only be made by competent staff who have been able to see the field performance of the test materials themselves.

2. Cropping Systems

The cropping systems portion of the Integrated Cereals Project meant many different things to many people but was little more than a concept when the project was created. Dr. S. N. Lohani, Head of the Division of Agronomy had recently returned from a year at IRRI where he had an opportunity to work in IRRI's Multiple Cropping Program there. The IADS team leader had participated in an international symposium on Cropping Systems at IRRI before arriving in Nepal. The Rockefeller Foundation Team in its studies in Hill Agriculture in 1974 had reviewed cropping systems in the Hills and offered valuable guidance.

Still, cropping systems activities were yet to be fully conceptualized, a work plan developed, staff organized, field trials established and the program actually put in action.

The first work plan[1/] developed before the cropping systems agronomist had joined the project had the following statement regarding cropping systems -

> "Farmers in Nepal, especially those in the Hills are primarily subsistence farmers. Enabling such farmers to utilize new

1/ Integrated Cereals Project, Work Plan, 1976-77.

technology to increase productivity even for subsistence purposes will require more than has generally been provided to farmers in a package of practices developed from monoculture research in the commodity research programs, among which rice, maize, and wheat are components of the research system in Nepal, and of the international institutes which provide supporting technology to the commodity research programs.

An attempt will be made to try to increase productivity by more efficient utilization of resources of land, labor, and other inputs provided in the system. From an agronomic stand point this appears feasible through (a) improved varieties of cereal crops and other crops in the system, (b) improved culture, (c) increased cropping intensity, (d) new crops in the system and (e) soil and water conservation measures.

It has been found in research of small farmer situations in other countries 1/ that research beneficial to the small farmer must focus initially on his production system and identify the structural limitations with which he is faced, particularly those that could be advantageously modified or removed.

Other observations 2/ were that Hill agriculture of Nepal is characterized by 1) a production system that has become so intensified that resources (physical, socio-economic) become limiting, and 2) the farming system provides for the majority of needs of the farm family for food and shelter (a largely non-market system). These conditions are apt to prevail until alternative production enterprises are sufficiently attractive and until the assurance of a stable external food supply becomes a reality.

Since neither of the above conditions can be expected to occur in the near future, it appears that the development of a low-resource technology offers the greatest opportunity for improvement of subsistence agricultrue in the Hills.

The interdisciplinary ICP team of agronomist, breeders, and economists will seek to develop such low-resource technologies through cropping systems research.

1/ Zandstra, H. G., K. G. Swanberg, and C. A. Zulberti, Removing constraints to small farm production: The Caqueza Project, IDRC - 058e., 1976.

2/ A Study of Hill Agriculture in Nepal - Rockefeller Foundation, 1974.

'Basic to improvement of production potential for Hill farmers will be a series of baseline studies to try to understand the farm situations and what points in the farming system are more readily amenable to modification and improvement. Such studies are to be initiated with wheat in the Bhairawa area on the 1976-77 crop. Additional studies will be undertaken in other areas, especially in the Hills, during the monsoon and the ensuing 12 month period.

The objectives of the cropping systems research can be met most completely by initial studies of the farming system as a whole since animal and crop production are so interdependent. The initial activities of the production economist, the multiple cropping and cropping systems agronomists will focus attention on the farming systems, primarily in the Hills, which involve rice, maize and wheat. This effort will look at these crops as part of a system. In addition, early effort will attempt to identify varietal introductions which could increase production of minor crops in the system.

Identification of the major systems will be undertaken by consultants working with the IADS staff and their Nepalese associates early in 1977 in time for site studies to be identified for the 1977 crop season. This will be followed by activities to provide site characterization, determinant factors in establishment of the system, constraints to production, and relation of the system to the farmers' environment."

Since farming systems in the Hills involve not only a farm unit but adjacent grazing and forest lands as well, a comprehensive approach to the problem of Hill agriculture will be required. However, for purposes of improving the cereal crop components of the system, studies of the primary cropping systems would provide information to members of the team which would enable them to respond to those factors which impinge on production of these cereals, if they are amenable to modification by the research team."

The site studies referred to did not take place until August of 1977 when Dr. R. R. Harwood came as a consultant for six weeks to assist in site identification and in preparation of a work plan for cropping systems.

This first comprehensive work plan[1/] for cropping systems outlined the importance of cropping systems research as follows.

1/ Cropping Systems Work Plan, 1977-78, Integrated Cereals Project, Agronomy Division, Department of Agriculture.

"Nepal's crop agriculture has several characteristics which dictate the type of crop development programs necessary to make major change:

1. Its physical environments and crop requirements differ enough from other major crop growing areas of the world to require major crop introduction and breeding efforts.

2. Its physical environments differ widely across the country, making regional and local testing essential.

3. Its agriculture is highly intensive, creating strong interactions among various elements on the farm, making necessary "in site" evaluation of new crop technology which may require changes in other parts of the farm system.

4. Its farmers have little formal education and are served by few if any other field-oriented technical organizations such as agro-industry. Complex experiment station research results can be absorbed and transmitted to farmers by extension workers only with great difficulty (as was evidenced by comments from extension workers during the 1977 winter crops workshop). This problem requires that technology be taken a step beyond the experiment station by research workers."

"The basic cropping systems program (the step beyond) is research oriented, yet bridges the gap between experiment station research and extension. It places crop technology back in farm context for evaluation".

The report further stated the three major potentials of the program as follows:

1. Recommendations for new crops, varieties and ways of growing them will have widespread applicability in target zones.

2. Potential for exploiting the farmer expertise in evaluation of new technology through cooperative testing.

3. Potential for support of a more effective type of extension activity based on the first two potentials".

It was recognized that three to five years would be required to develop the methodologies required and the research results obtained so that the third potential could be utilized in production programs.

Three sites were identified in the Hills and a fourth near Kathmandu Valley was identified soon thereafter. The sites in the Terai would be in Parsa district where irrigated and rainfed lowland conditions could be studied, and, in the Inner Terai, Chitwan district was selected. The latter was not to be activated until 1980.

Some site research activities were initiated at two sites in 1977, but it was late 1977 before a team of agronomists, economists and others was developed to carry on the cropping system research activities to address all the various aspects of this new type of research activity. The participation of the socio-economists working together with the agronomists in farmers' fields with farmers was unique. Normally, economists have played the role of monitoring and evaluation rather than becoming involved in the planning and implementation phases of a research program.

The research activities of the team have been well documented and this documentation follows the evolution of the research methodology; the development of on-farm technology through adaptive research in farmers' fields; the development of a methodology for technology transfer; and the use of the technology in production programs. Although it may seem that some of these innovations have taken too much time or that a methodology would be obvious, the results obtained and recorded offer opportunities for other agencies and other projects to more easily adapt and adopt technologies and follow an extension methodology in technology transfer to implement production programs.

Many reports have been written on these various aspects of the cropping systems work and are listed in Appendix A, the intent of this report will be to identify those features that made possible the levels of success that have been achieved during the life of

the project. Hopefully others can use these as a guide and improve upon the methods, the technology developed and the transfer and adoption of the technology.

Basic to the operation of a cropping systems program has been the formulation of an interdisciplinary team involving primarily agronomists and economists. Other disciplines have been added to this team from time to time. In 1978-79 an anthropologist was a part of the team. In 1983 a rural sociologist replaced the agricultural economist for a time. Although a "faculty" of agricultural economics does not exist in the Department of Agriculture, a young agricultural economist with a post in extension was assigned to work on the team and continued as the HMG staff on the socio-economic side of the team until his departure for further studies at IRRI. Flexibility of funds allowed IADS to employ junior staff for surveys, data analysis and other socio-economic activities. The IADS agricultural economist joined the staff in October 1977, to take up the socio-economic portion of the project team. Because of the importance of the cropping systems component most of his effort was devoted to working with the cropping systems agronomists in site research activities.

Agronomists of the Agronomy Division along with the IADS agronomist were crucial in the conceptualization and implementation of the cropping systems program. Junior staff were assigned to the various sites to carry out experiments and supervise the field staff. Peace Corps Volunteers were assigned to the sites as well and performed yeoman service working with the site coordinators to carry on the cropping systems adaptive research program and later on, valuable assistance in the preproduction verification stage of technology transfer, and in production programs at a still later stage.

Because the program was new and different, HMG funding was difficult to provide as well as staff that could be assigned to the cropping

systems program. Funding flexibility provided by the project enabled many of the activities to be carried out in a more efficient and timely fashion. Otherwise data from sites would have been difficult to generate.

Mobility to service the sites was also critical to effective supervision and implementation. Although originally one of the site selection criteria was a location that could be contacted by the central staff for supervision purposes, it was still not easy to accomplish.

Four different categories of activities are identifiable as the croppings systems program evolved from mere concept to an established sustainable activity of the Department of Agriculture.

These included:

a. Methodologies for cropping systems research in farmers' fields.

b. Development of cropping systems technologies.

c. Methodologies for transfer of cropping systems technologies.

d. Use of the methodologies and the technologies in production (will be discussed under extension activities).

a. <u>Methodologies for cropping systems research</u>

First and foremost in methodologies was the use of surveys to get an appreciation of what farmers were doing; what their cropping patterns were; what varieties were being grown; what inputs were used; what the soil and other physical factors were; and above all the socio-economic and other questions relating to why the farmer was doing what he was doing; what his goals were for him and his family; how these relate to his village setting, to his resources, education, and other activities in his farming enterprise. The smallness of the farm

enterprise was almost inversely proportional to the complexity of his enterprise. Surveys also provided a means for assessing potentials for increasing production.

Experience would indicate that this site description is basic for both site research and for later extrapolation to other sites and even other closely related activities such as seed production and processing where farmers are an integral and vital part.

The criteria used in site selection were:

1) The sites as a whole should have nation-wide distribution among the four development regions, with the mid-hills (to 1,500 meters elevation) and the Terai to be covered.

2) Each site should represent a large agro-climatic zone from which extrapolation of test results can be readily accomplished.

3) The site must be readily accessible by road or year-round commercial flights from the coordinating center to permit intensive monitoring and technical input from the center and from the commodity programs.

4) The site must be located in an area deemed to be a priority for development.

5) Local staff and organizational infrastructure must be available to support site activities.

6) The site must have potential for crop intensification and improvement.

The surveys began with considerable detail for the five initial sites and later the Ratna Nagar site in Chitwan. Physical

characteristics of the sites have often been tabulated and are presented here in Table 4. These were factors determining what farmers were already doing. The cropping patterns themselves were identified and their varietal and crop composition determined. The surveys outlined what the potentials would be for improving production within patterns, increasing cropping intensity by changing patterns with other crops already in use or by introducing new crops in the pattern.

The criteria for site selection and surveys were modified in the extrapolation phase since the objective was to identify areas where the technology might be suitable and where there was potential for increasing production. Surveys have been conducted prior to preproduction verification trials and prior to the inauguration of production programs.

The survey is a basic prerequisite and integral to efforts to increase production with small farmers. Short cuts have been attempted. As a consequence sometimes pattern testing in new areas involved patterns, such as rice-rice-wheat, which could not possibly affect many farmers because limitations in supply of irrigation water did not allow for timely establishment of the first rice crop. As a consequence the results were negative. A systematic approach to learn the farmer's situation through surveys would have saved time and gotten the process of transfer of technology started much earlier.

b. Technology development for cropping systems

The surveys are an attempt to learn from farmers about farmers and their situations so as to have more problem-oriented research effort on the part of the cropping systems team as well as the backup research of the commodity programs or divisions. Farmer involvement does not stop with an interview. He is to continue as a vital part of the on-farm research

activities. He supplies land and labor but perhaps of more value is his assessment of the products of research. The farmer is a partner in the research effort to identify better technologies suited to his resource base, his cropping patterns, and his needs and goals. His reaction to varieties, to fertilizer practices, new crops, or other variables in the experiments on his farm are an essential part of the cropping system adaptive research effort.

Cropping systems technology development is a process of adapting commodity technology to the farmer's environment. This environment and the farmer become selection criteria to identify components of technology just as the screening nursery is a means of identifying suitable varietal strains that resist diseases or insects. This crop environment is a complex one which involves what the farmer plants preceding and following a given crop as well as what frequently happens, what the farmer plants as an intercrop or mixture with the crop under consideration.

Results of surveys identified the principal patterns in the various sites and research was designed to study crop varieties and other component technologies in these main patterns as well as pattern research itself. Results have been accumulated over the past eight years and have been used in pilot production programs since 1980 and in full scale production programs since the 1983-84 wheat crop season. A summary of the patterns that had been tested and which had technologies which would improve farmer production were presented in "Guidelines for Preproduction Verification Trials of Cropping Systems Recommendations" in 1981. This summary presented patterns for five different environments for the Hills and Terai. These were as follows -

1) Hills, Lowlands with supplemental irrigation, 4 patterns.

2) Hills, Rainfed Lowlands, 5 patterns.

3) Hills and Inner Terai, rainfed uplands, 6 patterns.

4) Terai, rainfed lowlands, 7 patterns.

5) Terai, Irrigated Lowlands, 9 patterns.

Six sites, five selected initially and the one in Chitwan added in 1980, were selected to cover many of the major agro-climatic and agro-economic situations in the country. At the project review in 1979 when Dr. Zandstra, from IRRI and one of the leaders in cropping systems research, was a part of the team, discussions indicated that as much as 50% of the country's different agro-climatic situations might be covered by these sites. These sites include at least five major land (water) classifications in the country as stated above.

The characteristics of these research sites are presented in Table 4 to illustrate the variation between and within sites regarding elevation, rainfall, months of more than 200 mm and the number with less than 100 mm of rainfall, soil characteristics and land types. These broad land-water classifications were expanded to six and the cropping patterns studied are summarized in Table 5. During the course of the project a total of over 40 patterns have been tried and as many as 32 improved patterns have agronomic and economic measures of performance to be able to say how they compare with farmer practices. Patterns for these broad land classifications include five patterns in the Hills under rainfed lowland conditions. Rainfed uplands have ten patterns for the Hills and Inner Terai while rainfed lowlands in the Terai are covered by six patterns. Ten patterns are available for the lowland irrigated Terai conditions. Where irrigation is

Table 4 - Description of Cropping Systems Sites in Nepal

Sites	Elevation m.a.s.l	Rain-fall	Rainfall Distribution*		Major Soil	Major Land Types	MCI**	LUI+	Average Farm size Ha/Farm
			Months Wet	Months* Dry					
Pumdi Bhumdi	750-1270	4000	6	5	Inceptisol	Upland, Rainfed Lowland, Rainfed	168	56	0.87
Bahuwari (Irrigated)	150	1500	4	7	Inceptisol	Lowland, Irrigated	185	65	0.85
Sukchaina (Rainfed)	150	1500	4	7	Inceptisol	Lowland, Rainfed	150	55	0.85
Chauri Jahari	700	1250	3	8	Alfisol	Upland, Rainfed Upland, Rainfed in Summer, Irrigated in Winter Lowland, Irrigated	179	61	0.91
Lele	1300-1500	1600	4	7	Inceptisol	Upland, Rainfed Lowland, Rainfed Lowland, Irrigated	186	71	0.63
Khandbari	460-1100	1500	4	7	Inceptisol Ultisol	Upland, Rainfed Lowland, Rainfed Lowland, Irrigated	139	48	1.10
Ratna Nagar	305	1900	4	7	Inceptisol	Upland, Rainfed Lowland, Rainfed Lowland, Irrigated	179	60	0.68

* Months wet refers to those months receiving more than 200 mm rainfall. Months dry means those receiving less than 100 mm, rainfall.

** MCI = Multiple Cropping Index : The sum of the areas planted to different crops harvested during the year divided by the total cultivated area times 100.

\+ LUI = Land Utilization Index : The number of days during the year which crops occupy the land during a year divided by 365 and times 100.

Table 5 - Appropriate Cropping Patterns for different topographic, land and water classifications at six cropping systems sites, 1977-84

Pattern	Hills Besi-Valley Irri-gated	Hills 800 - 1600 M Lowland Irri-gated	Hills up to 1600 M Lowland Rainfed	Hills and Inner Terai Upland Rainfed	Terai Lowland Rainfed	Terai Lowland Irri-gated	Total sites per Pattern
1. Rice-Rice-Wheat	K, CJ*					B	3
2. Rice-Rice-Fallow	K, CJ						1
3. Rice-Wheat-Maize	E**	E***				RN, B	2
4. Rice-Wheat-Fallow	K, CJ	L, CJ	K, PB		RN, S	B	9
5. Rice-Wheat-Dhaincha 1/						RN, B	2
6. Rice-Fallow-Dhaincha					RN		1
7. Rice-Wheat-Mung	E**	E***				RN, B	2
8. Rice-Maize-Mung						B	1
9. Rice-Fallow-Mung			K, PB			RN	3
10. Rice-Mustard-Maize						RN, B	2
11. Rice-Fallow-Fallow			K, PB			RN, S	4
12. Rice-Fallow-Maize			K, PB			RN	3
13. Rice-Chickpea-Fallow					RN, S ****		2
14. Rice-Mustard-Fallow			K, PB		RN, S		4
15. Rice/Lentil+Linseed+Mustard-Fallow					S		1
16. Rice/Lentil-Fallow					RN, S		2

Pattern	Hills Besi-Valley Irri-gated	Hills 800 - 1600 M Lowland Irri-gated	Hills up to 1600 M Lowland Rainfed	Hills and Inner Terai Upland Rainfed	Terai Lowland Rainfed	Terai Lowland Irri-gated	Total sites per Pattern
17. Rice-Potatoes-Fallow		L					1
18. Rice-Potatoes-Maize	E**	E***					2
19. Rice-Oats+Maize		E***					1
20. Rice-Oats+Peas-Fallow		E***					1
21. Maize+U. Rice-Wheat-F				CJ			1
22. Maize+U. Rice-Mustard-F				CJ			1
23. Maize+U. Rice-Wheat-Mustard				CJ			1
24. Maize-Maize-Fallow				K			1
25. Maize-Maize/Wheat-F				RN			1
26. Maize/Finger Millet-Wheat-F				PB			1
27. Maize-Finger Millet-F				K			1
28. Maize-Mustard-F				RN			1
29. Maize+Soybean-Mustard				L			1
30. Maize/Soybean-Fallow				RN			2
Total Patterns	3	2	5	10	6	10	

* Key to sites indicated in table, East to West and North to South

K	=	Khandbari	L	=	Lele
PB	=	Pumdi Bhumdi	CJ	=	Chauri Jahari
RN	=	Ratna Nagar	S	=	Sukchaina
B	=	Bahuwari			

** E - can be extrapolated to this land type.

*** E - can be extrapolated upto 1200 M in this land type.

**** Farmers generally sow mustard with chick pea.

1/ Dhaincha - Sesbania sp. as green manure crop.

F - Fallow

available in the Hills patterns are limited to three and two respectively with five additional patterns that could be extended to these situations.

Considering the patterns themselves, the rice-wheat-fallow pattern is represented at more sites than any other and is included in all the major land types except upland rainfed conditions in the Hills and Inner Terai. Cropping intensity is related to the availability of water. Where irrigation is assured rice-wheat-maize, rice-rice-wheat, and rice-wheat-mung occur as patterns in three, two and two sites respectively. Rice-rice-fallow, rice-potatoes-fallow, rice-fallow-maize, and rice-wheat-dhaincha are patterns which occur more than once and have only two grain crops in the pattern.

It is not the intent of this report to make a detailed analysis of the cropping systems data. Recent summaries of three years' data will serve to illustrate both agronomic performance and economic indicators for some of the principal patterns used in the major land types. These data are presented in Tables 6, 7, 8, and 9. Crop yields, pattern yields on an annual basis, the returns above variable costs (RAVC) and the gain of the improved pattern over the farmer practice is measured in percent increase of RAVC over the farmer practices and equivalent patterns.

Three sites (Table 6) have rainfed uplands, where annual pattern yields range from 3.7/ha for maize-mustard-fallow in Chitwan to 5.8 T/ha for maize-maize-fallow in Tumlingtar (Khandbari) and 7.8 T/ha for upland rice+maize-wheat+mustard at Chauri Jahari. The economic indicators would make two maize based improved patterns appear undesirable in Chitwan. In part, this is the result of farmers using improved maize varieties but not

commercial fertilizer. The so called improved patterns use 60-30-0 kg/ha of N-P-K but the use of fertilizer under these conditions does not provide satisfactory increases (only 11%) in yields to compensate for the added costs. The farmers have already learned the economics of the improved pattern and had rejected the uneconomic portion. Gains of 54, 65 and 113% in Tumlingtar, Chauri Jahari and Ratna Nagar respectively, indicate there are patterns which can be used under upland rainfed conditions which can make significant improvements over farmer practices.

Rainfed lowlands constitute by far the largest land type in Nepal. These land types are represented in Pumdi Bhumdi and Khandbari in the Hills and Sukchaina in the Terai. Several improved patterns (Table 7) under these conditions offer farmers considerable potential for grain production and for economic returns especially in the Terai where availability of inputs provides opportunity for these patterns to be used extensively in production. Only rice-lentil at Sukchaina showed an uneconomic return compared to the farmer pattern. Rice-chickpea showed an excellent gain of 131% and rice-fallow-mung bean showed 176% gain over the prevailing farmer pattern of rice-fallow-fallow.

Irrigated or partially irrigated lowlands are present in the Hills at Khandbari, Lele, and Chauri Jahari (Table 8); in the Inner Terai at Ratna Nagar, and at Bahuwari in the Terai (Table 9). Economic gains are good in the Hills and Inner Terai but the pattern opportunities are more restricted than they are in the Terai. Among the patterns in the Terai site, annual yields are generally above 7.0 T/ha for a pattern but economic improvements are marginal for some and even negative for rice-wheat-mung bean. Since in any one site the potential is limited to have water available for high intensity patterns like rice-

Table 6 - Agronomic and Economic Performance of Improved Cropping Patterns Compared to Farmer Patterns in Rainfed Uplands, 1982-84

Pattern	Crop Yield (T/ha)				Returns over variable costs	
	Summer	Spring	Winter	Total	Thousand Rs/ha	Gain 1/ (%)
a) Hills - Tumlingtar (Khandbari), Sankhuwasabha						
Farmer						
Maize-Maize-Fallow	2.0	1.7	--	3.8	6.8	-
Improved						
Maize-Maize-Fallow	3.1	2.7	--	5.8	11.2	65
b) Hills - Chauri Jahari, Rukum						
Farmer	2/	3/			4/	
Upland rice+Maize-Wheat+Mustard	3.1	2.3	--	-	5.3	15.4
Improved						
Upland Rice+Maize-Wheat+Mustard	4.9	2.9	--	7.9	23.4	54
c) Inner Terai - Ratna Nagar, Chitwan						
Farmer						
Maize-Mustard-Fallow	2.8	0.6	--	3.5	7.0	-
Improved						
Maize-Mustard-Fallow	3.1	0.6	--	3.7	5.7	-5
Upland rice+Maize-Mustard-fallow	3.1 2/	0.8	--	3.9	6.5	-8
Maize-Maize/Wheat	2.6	2.6	2.5	7.8	14.9	113

1/ Compared with farmer pattern.

2/ Combined yield of Upland rice and maize.

3/ Combined yield of wheat and mustard.

4/ Labor and power costs omitted at this site.

Table 7 - Agronomic and Economic Performance of Improved Cropping Patterns compared to Farmer Patterns and practices in rainfed lowlands, 1982-84

Pattern	Crop Yield (T/ha)				Returns over variable costs	
	Summer	Winter	Spring	Total	Thousand Rs/ha	Gain 1/ (%)
a) Hills - Khandbari, Sankhuwasabha						
Farmer						
Rice-fallow-fallow	2.0	--	--	2.0	3.0	-
Improved						
Rice-Wheat-Fallow	3.3	2.4	--	5.7	13.1	338
Rice-Fallow-Maize	2.6	--	2.8	5.4	12.2	309
Rice-Fallow-Mungbean	3.0	--	0.7	3.7	8.2	176
b) Hills - Pumdi Bhumdi, Kaski						
Farmer						
Rice-Wheat-Maize	2.6	1.6	2.0	6.2	11.1	-
Rice-Fallow-Maize	2.4	--	2.3	4.6	8.5	-
Rice-Fallow-Fallow	2.4	--	--	2.4	6.1	-
Improved						
Rice-Wheat-Maize	4.7	1.7	2.7	9.2	15.2	37
Rice-Fallow-Maize	4.1	--	2.4	6.5	11.3	33
Rice-Fallow-Fallow	3.3	--	--	3.3	8.5	41
c) Terai - Sukchaina, Parsa, Limited Production Potential						
Farmer						
Rice-Wheat-Fallow	2.2	1.3	--	-	3.6	-
Improved						
Rice-Wheat-Fallow	2.7	1.8	--	4.5	5.4	27
Rice-Mustard-Fallow	2.8	0.4	--	3.2	5.0	15
Rice-Lentil-Fallow	2.4	0.6	--	3.0	3.5	-19
Rice-Chickpea-Fallow	3.3	1.2	--	4.6	9.9	131

1/ Compared with farmer pattern.

Table 8 - Agronomic and Economic Performance of Improved Cropping Patterns compared with Farmer Patterns and Practices on partially irrigated and irrigated Hills Sites, 1982-84

Pattern	Crop Yield (T/ha)				Returns over variable costs	
	Summer	Winter	Spring	Total	Thousand Rs/ha	Gain 1/ (%)
a) Hills - Partially Irrigated Lowlands - Khandbari, Sankhuwasabha						
Farmer						
Rice-Fallow-Maize	2.4	--	1.0	4.3	9.8	-
Improved						
Rice-Wheat-Maize	3.9	2.8	3.0	9.7	22.6	131
Rice-Wheat-Mungbean	3.4	2.4	0.7	6.6	14.8	52
b) Hills - Irrigated Lowlands - Lele, Lalitpur						
Farmer						
Rice-Wheat	3.4	2.4	--	5.8	10.5	-
Improved						
Rice-Wheat	5.3	2.2	--	7.5	16.5	57
c) Hills - Irrigated Lowlands - Chauri Jahari, Rukum						
Farmer		2/			3/	
Rice-Wheat+Mustard-Fallow	3.9	2.2	--	6.1	19.9	-
Improved						
Rice-Wheat+Mustard-Fallow	4.9	3.2	--	8.1	28.5	43
Rice-Wheat+Mustard-Rice	[illegible].3	3.2	3.8	9.3	27.2	37

1/ Compared with farmer pattern.

2/ Combined yields of wheat and mustard.

3/ Labor and power costs omitted at this site.

Table 9 - Agronomic and Economic Performance of Improved Cropping Patterns compared to Farmer Patterns and Practices, irrigated lowlands, 1982-84

Pattern	Crop Yield (T/ha)				Returns over variable costs	
	Summer	Winter	Spring	Total	Thousand Rs/ha	Gain 1/ (%)
a) Inner Terai - Ratna Nagar, Chitwan						
Farmer						
Rice-Wheat-Fallow	3.4	1.9	---	5.3	7.8	-
Improved						
Rice-Wheat-Mungbean	4.3	3.5	0.6	8.3	13.1	69
Rice-Wheat-Maize	4.0	2.8	2.5	9.3	14.0	81
Rice-Mustard-Maize	3.2	0.6	3.1	7.0	11.1	43
Rice-Wheat-Dhaincha 2/	3.9	3.3	---	7.3	10.0	29
Rice-Wheat-Fallow	3.5	3.2	---	6.7	10.0	29
b) Terai - Bahuwari Tubewell, Parsa						
Farmer						
Rice-Wheat-Rice	1.7	2.2	3.5	7.4	10.3	-
Rice-Wheat-Fallow	3.4	2.4	---	5.9	11.6	-
Improved						
Rice-Mustard-Maize	4.0	0.9	2.6	7.6	13.7	18
Rice-Maize-Maize	4.7	5.6	3.0	13.3	24.3	109
Rice-Maize-Mungbean	3.6	5.1	0.3	9.0	13.2	14
Rice-Wheat-Mungbean	3.4	3.0	0.3	6.6	8.2	-29
Rice-Wheat-Dhaincha 2/	4.5	3.3	---	7.8	13.0	12
Rice-Wheat-Fallow	4.0	3.3	---	7.3	12.4	6
Rice-Wheat-Rice	2.6	2.7	4.3	9.6	14.0	36

1/ The improved version of rice-wheat-rice is compared with the same pattern under farmer practice. All other improved patterns are compared against the farmer practice of rice-wheat-fallow.

2/ Green manure crop.

wheat-rice and rice-maize-maize, other patterns such as rice-maize-mung or rice-wheat-dhaincha offer definite possibilities for good crop yields and the opportunity to use beneficial legumes in the pattern at the same time.

This summary of patterns and pattern performance illustrates an important portion of the cropping systems network activities in farmers' fields. The other research activity is component technology testing where new varieties, fertilizer rates, cultural practices and plant protection measures can be studied under comparable conditions. Perhaps the most significant among these component trials are the variety trials conducted under farmers' conditions. These types of trials have notably increased in number toward the end of the project and have provided an opportunity for farmers to become acquainted with new varieties, fertilizer rates etc. This has provided a significant means of accelerating technology transfer.

The commodity programs have farmer field trials (FFTs) of varieties which are distributed to be tested in many locations but this linkage with the cropping systems program provides an excellent opportunity for results to be obtained as these new varieties relate to the environment and other crops in the pattern. The noticeably increased use of FFTs by the cropping systems research team is especially worthy of note in this report.

The creation of a field research methodology was necessary to enable the collection of data on patterns, on component technology, on the surveys that provide site description, site reconnaissance, and later a basis for moving technologies to other locations are all a part of the research effort that the cropping systems team have made during the project period. These research methodologies were put together for the purpose

of utilizing these methodologies in the transfer of the cropping systems technology through extension to farmers. The manual which was created was entitled "Guidelines for Pre-production Verification Trials of Cropping Systems Recommendations".

Linkages with IRRI's cropping systems network provided many types of support regarding methodology and seeds of new crops or minor crops in the patterns, but by and large this has been a team effort within Nepal itself. Staff had to be trained to conduct the pattern and commodity trials and the training frequently repeated because staff transfers made it necessary to do so.

Results have been systematically summarized and presented to the workshops for summer crops and winter crops and to the international meetings of the Asian Farming Systems Working Group which meets in one of the Asian countries on a semi-annual basis. Nepal was host to one of these meetings in 1979.

A testimony to the technologies and their development in farmers' fields has been the rapidity with which some have been accepted by farmers so that at present, comparing improved pattern results with farmer patterns and practices would appear that the improved practices are not so good when actually the comparisons are being made with improved practices which farmers have already adopted. This has necessitated an adjustment in identifying and collecting data from farmers not yet adopting the technology.

This early acceptance of course is one of the virtues of working with farmers' in their fields. Their acceptance or rejection of technology at the testing stage is the determinant of future

action. If farmer evaluation is favorable the spread of technology in the research site begins to happen very rapidly and often without serious organized extension effort. This is perhaps most true of improved varieties. Improved varieties of wheat spread very rapidly in Chauri Jahari so that within three years of the beginning of the site research program, a large percentage of the wheat area was planted to RR21 and NL30. Yield records at this site indicated a gain for yield by change of variety alone was at least 20%. In Pumdi Bhumdi and Khandbari, Khumal Yellow maize spread without very much extension effort so that the majority of the area in normal season plantings of the maize based patterns are now made with this variety.

More recently the use of Khumal 3 (K 39) rice in Pumdi Bhumdi has begun to spread very rapidly. Its earliness, productivity, and acceptable straw characteristics has offered farmers an opportunity to have productive rice crops with greatly reduced hail risk because of the earlier harvest and in addition the opportunity to utilize residual moisture in their fields with a subsequent crop. Similarly in Khandbari, Khumal 3 has made a significant impact and the area planted with this variety is rapidly increasing wherever farmers have irrigation facilities to grow two crops of rice with Khumal 3 as the first crop.

Documentation of all these changes in an area is difficult but one series of studies[1/] in particular illustrates the farmer adoption of technology. Sukchaina is a village area in Parsa district which was selected to represent rainfed lowlands common in the Terai region.

1/ Singh, B. K. and K. D. Sayre, Impact of Cropping Systems Program at Sukchaina, Cropping Systems Program, Agronomy Division, Department of Agriculture, January 1985.

At the outset in 1977 the adaptive research program started with a survey to develop a site description of the area and the farmers. In 1981 as a part of a preproduction survey, Sukchaina was again surveyed and in 1984, the same farmers interviewed again to determine changes that had occurred in rice varieties, the use of fertilizer on rice, cropping patterns, cropping intensity and rice yields. The following shows the change in rice varieties grown:

	Percentage of rice area planted		
	1977	1981	1984
Local varieties	80	46	2
Improved varieties	20	54	98

Varietal composition among the improved varieties shifted from a predominance of Masuli and CH 45 when only 20% of the area was covered to over 40% covered with early varieties composed of CH 45 and Bindeswari in 1981. By 1984 the percentage of early varieties increased to nearly 70%, composed of 60% Bindeswari and 40% CH 45. Although the parcels surveyed in the two periods, 1981 and 1984, included only Bindeswari, CH 45, and Masuli as improved varieties, six other improved varieties were being grown by farmers in the village.

One of the objectives of a production program in an area is to create local sources of seed to augment the supplies available from AIC. The farmers in this village have provided a good seed source and demand for their seed has spread throughout Parsa district and six other districts in the Terai. Seed sales totaled over 9,000 kg in 1984 and over 19,000 kg were available for sale in 1985. The bulk of this was Bindeswari but one new early variety, IR 8423, was named by the farmers as Sukchaina 84 and nearly 2,000 kg were available for sale in 1985 while only 15 kg were sold in 1984.

In other ways cropping systems as an extension methodology has helped the farmers in Sukchaina. Fertilizer rates were determined which were economical but were not to be considered as maximizing production. Furthermore the study of fertilizer practices as a part of cropping systems led to the determination that phosphorous, if applied to the upland crop in the pattern, did not need to be applied to rice the succeeding monsoon season since there was no response to this fertilizer nutrient when applied to rice.

The use of fertilizers in the village as a consequence of the production program increased from an average of 27.7 kg/ha of nitrogen in 1981 to 40.2 kg/ha in 1984 or a 45% increase. In 1981, 25% of the parcels received no fertilizers at all and nitrogen, where used, was only applied as top dressing. In 1984 farmers were using nitrogen as a basal application as well as a top dressing. The use of compost remained the same throughout the period under study at about 2 T/ha.

Results of increased use of the new varieties of rice and the increase in fertilizer use was reflected in increased rice yields. In 1981, improved varieties were yielding only 18% more than the local varieties, while in 1984 yields were 79% more than locals with an average yield of 2.5 T/ha.

Cropping intensity has increased as a result of the use of early maturing improved rice varieties. These varieties have also allowed farmers to spread out work loads so the peak labor period of rice harvest and land preparation for winter crops can be accomplished in a more timely period. Releasing land from the rice crop earlier has provided opportunity for other crops. The patterns tried in research plots identified rice-chickpea-fallow which farmers liked and which (Table 7) has provided productive and especially economical returns, with an

increase of 131% over variable costs. The pattern was further modified by farmers who sowed mustard with the chickpeas and this pattern occupied 16% of the parcels studied in 1984 while none were growing the mixture in 1981. Seed production of the chickpea variety, Dhanush (G 332) is becoming a part of the village seed enterprise.

c. Methodologies for Transfer of Cropping Systems Technologies

It has been noted how easily technology transfer has occurred in areas around the cropping system adaptive research sites. Farmers who observed the new varieties and practices and recognized their benefits were quick to adopt them. They knew the team working at the sites and these men had credibility along with the technology at hand. Seed was more readily available if a new variety was involved since farmers were quick to save the seed from these promising varieties, and the seed moved from farmer-to-farmer in the existing seed exchange system.

The adaptive research phase of technology development was ready for use by the extension services. The problem would be how this was to be accomplished. It was obvious that the whole process of adaptive research from site selection, site description, agronomic trials to be compared with local practices both agronomically and economically, and farmer reaction to the trials seemed a long process which had been necessary for evolution of suitable technology. How could the adoption process be accelerated in view of significant favorable results and favorable farmer reaction and early adoption in the research sites? The research system was yet to evolve into an extension system.

Basic steps to technology transfer are:

1) site selection, 2) site description, 3) preproduction verification trials, and 4) extension strategies which would lead to an accelerated adoption by farmers. These steps, if the technology proved feasible, would be followed by pilot production and full scale production.

To assist in this phase the Cropping Systems program prepared "Guidelines for preproduction Verification Trials of Cropping Systems Recommendations" in 1981 which described in detail the methodologies to use in the four steps above. Details included questionnaires for site surveys and preparation of site descriptions, cropping patterns for five major land types and detailed instructions on over 30 different cropping patterns which included varieties of each crop, cultural practices to use, rates of fertilizer, and plant protection. Instructions were provided for trial establishment, the type of data to collect and how to monitor the farmer practices with which to make comparisons.

Site selection is a reconnaissance process to identify an area or areas where new technologies have not been widely adopted so that there is a potential for increasing production when adoption takes place. At this point there should be commitment from the implementing agency to follow successful PVTs with the necessary resources to make the subsequent production programs successful.

In many cases the necessary information is not available to enable proper identification of those cropping pattern technologies to use in PVTs. Site descriptions involving the use of secondary information are developed once the sites are selected. A rapid site description can effectively collect information and has been followed as a part of the methodology for transferring technology. The site description is constructed

around information from key informants of the area. These key informants include knowledgeable farmers, individuals of the various agricultural service agencies, the Agricultural Development Officer, and credit and input supply agents. The site description report will include -

a) climatic and soil characteristics of the area

b) predominant cropping patterns

c) major crops and varieties of these crops

d) level of inputs presently used

With this information it is generally possible to move to the next stage. The preproduction verification trial (PPVT or PVT) phase has been intentionally called "preproduction" since it presupposes that what follows verification is a production program to accelerate the adoption process. In many cases designing the preproduction verification trial can be done using improved versions of patterns which farmers are already using. The actual PVTs are conducted with at least five farmers growing one specific pattern. More than one pattern will be required to cover the major patterns of an area but experience indicates it is advisable to try no more than 4 patterns (involving 20 farmers) to enable proper management of the trials. Along with the 1000 m^2 trial plot which is to be monitored, an equal number of plots of the existing farmer practice are monitored with which to make comparisons. Information is recorded on variety, inputs used, and yield sampling, for both the pattern trial and farmer practices, five farmers for each.

Extension strategies to accelerate adoption include farmer field days at strategic periods in the crop growth to enable farmers to see what the new technology is and how it is

performing in their area. Participating farmers are encouraged to discuss the trials with their neighbors and in the case of new varieties, to save seed for sale to or exchange with their neighbors.

It was obviously impossible for the Cropping Systems staff to expand its activities to cover all the potential areas that might be available for this cropping systems extension phase. They did offer to train staff of other projects to enable these various steps to be carried out. Since Nepal has at least eleven major area development projects, the cropping systems staff have been involved in training the staffs and in several cases, on a contract basis, have helped in site surveys and other ways to establish this extension methodology. In 1983 twenty districts involving these 11 agencies were conducting PVTs involving fourteen different cropping patterns.

Surveys for site descriptions and monitoring directly or indirectly involving the cropping system staff, number over fifty and are listed in Appendices B and C.

Results of Preproduction Verification Trials have been compiled in at least three reports covering 1981 spring and summer crops, 1981/82 winter crops, and 1982/83 results. The latter report covers trials in which major responsibility for the trials rested with the ADOs of the concerned districts.

In order to achieve this transition the cropping system program shortened site description reports; instructions for the PVTs were translated into Nepali; forms for data collection were reduced; local farmer practices were obtained by collecting yield data from those farmers' fields rather than have a specific plot in the PVT; and training instead of being conducted at a central point was conducted at the district headquarters.

A pooled analysis[1/] of data from the pattern, rice-wheat-fallow, which is one of the predominant patterns, can illustrate the results obtained. The average annual yield (rice plus wheat) was 7.0 T/ha while the farmer practices produced only 5.43 T/ha, or an average annual production increase of 1.6 T/ha or 29% over the farmer practices. This pattern involved at least sixteen sites and 80 farmers and serves to demonstrate the value of the PVTs and their use as a means of technology transfer.

These types of data have already provided a basis for pilot production programs in several different project areas of the country.

Many problems have attended these attempts at using the cropping systems approach as an extension methodology in technology transfer. Staff in the cropping systems team were not adequate to meet the training demands. Local staff once trained were often transferred and trials established by one officer may have not been attended by replacement staff or because they were untrained did not collect data properly.

This methodology has not been officially accepted as an extension approach so progress has been made on the basis of personal relationships and interest of individuals.

The site description as a prerequisite has not been fully accepted, partly because socio-economists are not available to support the activity and partly because staff, even though they may have been trained in the use of the surveys, may still not

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1/ Semi-Annual Report, Cropping Systems Program of the Integrated Cereals Project, April-September 1984, Agronomy Division, Department of Agriculture, 1984.

understand their usefulness. Experience has indicated that where this step has been ignored, arbitrary selection of patterns which were not appropriate has resulted in loss of seasons and time of staff in conducting trials that were of little or no value.

The value of information on local farmer practices to use as a measure of how well the new technologies are doing has also been a component difficult to understand.

The general lack of appreciation of trials as a step in identifying improved technologies for use in those areas identified by the site description is also a deterrent to the adoption of this methodology as an extension tool.

Nevertheless results in the transfer of technology at the cropping systems sites and information from surveys[1/] of farmers find they are receptive to this approach. They have benefitted in areas where it has been used and the methodology could be used to advantage in every project area in place of the routine result demonstration which it can effectively replace.

3. Development of Farming Systems Technologies

Socio-economic studies[2/], [3/] (and others) have shown the importance of livestock in the farming systems of small subsistence farmers; especially in the mid-Hills. Hill farmers derive a significant amount of their subsistence from livestock and a substantial portion of their cash income as well. Because livestock are so important there is a significant interaction of livestock activities with crop

1/ Lipinski, David, Matrika P. Risal, Babu Ram Gurung and Kenneth D. Savre Nepali Hill Farmers' Evaluation of the National Cropping Systems Pre-production Verification Trial Program, A Cropping Systems Report, Agronomy Division, Department of Agriculture, July 1984.

2/ Mathema, S.B. and M.G. Van Der Veen. Socio-Economic Research on Farming Systems in Nepal : A Key Informant Survey of Five Cropping Systems Research Sites. Technical Report No. 1, Sept. 1978.

3/ ..... The Role of Livestock in Farming Systems in Two Cropping Systems Sites of Nepal. Technical Report No. 4, Feb. 1980.

production activities. Changes in cropping intensity could change the availability of labor for livestock care. Or a change in variety of rice could affect the amount of straw available for livestock feed.

This initial concern about these interactions had to remain dormant because other priorities were more demanding and personnel were not adequate to supply the additional staff that would be required for a more complete farming systems approach.

In 1983, a consultant in fodder legume trees emphasized the role of legumes in animal feeds and the potential that changes in fodder supplies could have on the livestock component of farming systems. Subsequently a Peace Corps Volunteer was shifted to Pumdi Bhumdi where there appeared to be real potential to affect the livestock component of farming systems. Pumdi Bhumdi farmers were milk producers supplying milk to the Pokhara milk processing facility.

IRRI had changed the Cropping Systems Network to the Farming Systems Network in recognition of the role which livestock play in rice-based farming systems.

Although some significant developments have taken place in production programs in the Terai, the same level of achievement and impact has not occurred in the Hills, partly because of a lack of knowledge concerning the interactions between the different components of farming systems. It appeared more research would be necessary to acquire the necessary knowledge and understanding.

In consideration of this anticipated expanded on-farm adaptive research activity a strategy paper[1/] was prepared setting forth

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1/ Sayre, K. D., B. K. Singh and S. L. Shrestha, Strategy for Farming Systems Research in Nepal, Cropping Systems Program, Agronomy Division, Department of Agriculture, Nov. 1984.

the background considerations leading to a decision to pursue a farming systems research on a preliminary basis. These were stated as follows:

"Although the Cropping Systems Program has been active in its efforts to understand the relationships between crop production activities as practiced by farmers in the Cropping Systems sites with other components of their Farming Systems to assure that new crop technologies are relevant, there is evidence that more attention must be given. Studies that have been conducted by the socio-economic unit of the Cropping Systems Program and observations of researchers working with farmers at the sites consistently have shown that many decisions that farmers must make which involve changes in some aspect of their crop production activities to improve crop production are largely conditioned by how these changes interact with other farm activities. The interactions that appear to exist between crop production and livestock production activities in the mid-hill sites are so numerous that it can be argued that only minimal improvements can be made in one without corresponding attempts to improve relevant aspects of the other. This is particularly apparent as it relates to:

a) Increasing cropping intensity through growing additional crops in land normally left fallow during parts of the year because of potential shortages of both farmyard manure from livestock to apply to the additional crops, thereby maintaining soil fertility and bullock power for land preparation for additional crops.

b) Increasing labor requirements involved with new crop production technologies and/or more intense land use that may compete with existing labor requirements for caring and providing feed for livestock.

c) The importance of land currently being left fallow during part of the year and used as a source of livestock feed through grazing as opposed to cropping the land and keeping livestock out of the fields. (Many times this involves a community level decision because of general unrestricted grazing.)

d) The adoption of new crop varieties that may have higher food grain yields but lower total straw yields or poorer quality straw which is an important part of the livestock feed ration.

e) The trade-off in the use of scarce capital resources for adopting improved crop production technologies which may be more costly than traditional technologies versus their use for livestock production activities.

f) The general shortage of high quality green fodder, especially during the pre-monsoon dry months (from January to June), which results in reduced livestock production and performance and high labor requirements to collect what green fodder is available. This may be alleviated by production of fodder crops within cultivated crop land areas and by improving fodder crops/trees in non-cultivated areas thereby reducing current labor requirements for fodder collection."

In order to pursue an expanded research program the report stated -

"This will involve some modification in the research methodologies currently used with participating farmers for Cropping Systems Research at the sites. Initially the primary research activities involving livestock will concentrate on improving fodder and feed availability within the context of improving whole crop and livestock production. Close farm monitoring of farmers participating in the research program will be emphasized to better understand the linkages between crop and livestock production activities and to determine where improvements can be made to increase fodder production at critical times during the year which are complementary with maintaining or increasing food crop production."

To achieve these modifications required a complete revision of the on-farm research program. It also meant a broadening of the manpower base to carry out the on-farm research. This meant involvement of the Department of Livestock and Animal Health as well as the Department of Agriculture. It also developed a collaborative arrangement with the French Technical Assistance Agency. The same team spirit of the ICP has enabled these changes to take place and an effective team developed to pursue this much more complex on-farm research activity. This included a change in cropping patterns to include forage crops, and with livestock included it required a more selective process of identifying and working with farmers,

both those using new patterns and the non-participant farmers. The livestock component involved numbers of animals, stage in lactation, measures of feed inputs, when to record milk output and the interactions of all these changes as they were affected by size of farm, total farm production, labor requirements, and cash returns, to mention only a few of the factors that a study of farming systems would involve.

The farming systems research was initiated in November 1984, and a recent technical report,[1/] the first, presents the methodologies used, and detailed profiles of the farms and farmers involved in the study. The continuation of this study could have some significant and far reaching effects on research and extension in the Hills in order to be of assistance to small farmers through a better understanding of them, their farming systems, and their communities.

1/ Delobel, T. C., R. B. Shrestha, B. K. Singh and K. D. Sayre, Initial Results of Farmer Monitoring for Crop-Livestock Farming Systems Research at Pumdi Bhumdi, Cropping Systems Program, Agronomy Division, Department of Agriculture, May 1985.

C. Extension Activities

1. Production

Although the extension of the project listed production campaigns as one of five project activities it had been a built-in component of the project from the beginning. A full thrust in production was dependent upon several factors the farmer-based cropping systems technology was to be developed, cropping systems extension methodology organized, pilot programs initiated and components of a production program identified. All these were necessary before production programs could be intelligently pursued.

The pilot production programs were first organized in Pumdi Bhumdi in 1980 monsoon season with 3.7 ha. of maize involving 60 farmers and two cropping patterns (maize/finger millet - wheat and rice-wheat-maize).

In August 1980, based upon the performance of the small pilot production effort at only one site and cropping pattern data from four Hill sites a proposal was prepared for submission to the Ministry of Agriculture for the development of pilot production programs at each of the Cropping Systems research sites. In addition to the agronomic data, socio-economic studies had provided site profiles and had identified several constraints that could affect the extent and level of success of a production campaign. These included short seed supplies of the tested and accepted varieties; limited availability of fertilizers both organic and inorganic, seasonal labor and bullock power shortages; farmers' lack of knowledge about the improved varieties and practices; farm management and off-farm employment; poorly organized farmer groups; lack of consideration of women in the agricultural programs; animal and pest damage to crops; and lack of credit and markets.

The list appeared formidable but strategies to carry out production

programs were outlined in the proposal which sought to overcome these constraints or adjust to them. These programs involved scattered parcels and farm at each site, taking those farmers who showed interest as a result of farmer meetings and prior contact.

Pilot production programs were to -

a) utilize the newly proven cropping systems technology adapted and developed in farmers' fields (i.e. the incorporation of the cropping systems approach to farm production as the extension approach),

b) identify problems and constraints to implementing the technology on a whole farm basis, and

c) establish a base for full scale production in defined areas (or in national programs).

Strategies and requirements for implementation covered leadership, supervision; the availability of the technology, seed, credit, and inputs; manpower availability and training; transfer of technology information to farmers, organizing farmers, agencies and institutions involved; and commitment on the part of staff of these agencies and institutions.

Mr. B. B. Khadka, (then Secretary of the Ministry of Agriculture) on a visit to the Lele site in April 1981, observed the very scattered, small parcels (22.5 ha. among 104 farmers or 0.22 ha. per farmer) and suggested that for effective demonstration these should be consolidated so as to create areas of 5 ha. or more. This was the beginning of the concept of the Impact Production Block.

In 1981, production blocks were organized at three cropping systems

sites. Khandbari had 25 ha. of maize and 156 farmers in a maize-maize pattern. Lele had 14 ha. with 87 farmers and Pumdi Bhumdi had nearly 11 ha. with 137 farmers.

During the winter crop season of 1981-82 a more serious effort was made to implement the Impact Production Block as a pilot production program.

Based on other experiences at Pumdi Bhumdi, the socio-economic group had conducted preproduction surveys in all four cropping systems sites in the Hills.

The surveys indicated that -

a. Farmers were aware of the variety, RR 21, being recommended and judged it to be suitable to their wheat growing areas.

b. Adoption of the improved variety and practices had already begun as a result of their contacts with the CS program in the research phase.

c. The CS staff had been in contact with farmers and a good percentage wanted to participate and devote most, if not all, of their wheat areas to the pilot production program.

d. The package of technology did not appear complicated nor expensive in terms of cash costs.

e. Output marketing did not appear to be a serious problem in the early phases of such a program.

f. Seed demand from the Agricultural Inputs Corporation would be less than the total seed requirements because farmers would use their own seed or could barter or purchase it locally.

g. Credit did not appear a constraint in these early phases.

h. Inputs (seed and fertilizer) required for pilot production appear to be generally available at the sites.

While these survey results favored a successful pilot production program other factors could make the program less successful. There was a lack of -

a. Understanding of the package of practices.

b. Knowledge of relationship of yields to input use and how yields could and would be affected by input use.

c. Full adoption of recommendations even after understanding the package of practices.

d. Credit from formal institutions especially for fertilizer.

e. Seed quality control; and

f. Shifting organic manures to other parcels.

As will be noted in Table 10, Pilot Impact Production Blocks were established at only three sites in 1981-82.

Pilot impact production blocks offer considerable merit in moving technology into production programs. Some of these are the demonstration effect; the ease of servicing by the extension staff; the training of farmers for production; the transmission of the information; the mobilization of other agencies involved in production; irrigation management; supply of inputs; the use of a contiguous block as local seed multiplication; organizing farmers themselves; and easier assessment of the economic benefit of the block. The area could serve as a training base for extension personnel and from this experience they could develop strategies for large scale production based on cropping systems as a means of transferring technology to small farmers.

2. Pilot Production Period - 1980 to 1983

Based on data collected at five cropping systems sites from 1977 through the 1979 monsoon season, it appeared that technologies were

Table 10 - Areas and Farmers involved in production programs at Cropping Systems Sites and in districts and regions 1980 to 1984-85

Locations	1980	1980-81	1981	1981-82	1982	1982-83	1983	1983-84	1984	1984-85
Khandbari, ha	-	3.7	25.0	-	66.0	-	36			
No. Farmers	-	27	156	-	166	-	NA			
Ha/Farmer	-	0.14	0.16	-	0.40	-				
Lele, ha	-	26.5	14.0	5.5	56.0	72.0	72.0			
No. Farmers	-	156 *	87	47	112	168	168			
Ha/Farmer	-	0.17	0.16	0.12	0.50	0.43	0.43			
Pundi Bhumdi, ha	3.7	34.7	10.9	6.0	23.0	-	5			
No. Farmers	60	316	137	18	87	-	NA			
Ha/Farmer	0.06	0.11	0.08	0.33	0.26	-				
Chauri Jahari, ha	-	17.8	-	-	22.5	60.0**	21.0	-	-	100
No. Farmers	-	174			52	NA	NA	-	-	
Ha/Farmer	-	0.10	-	-	0.43	-	-	-	-	
Parsa, ha	-	23.0	-	4.7	27.0	166.0	513	5411	8948	6061
No. Farmers	-	47	-	15	52	291	762	8025	8441	7569
Ha/Farmer	-	0.49	-	0.31	0.52	0.57	0.67	0.68	1.06	1.07
Chitwan, ha	-					212.0	434	1724	1628	2104
No. Farmers	-					144	271	1172	NA	1851
Ha/Farmer	-					1.47	1.60	1.47	-	1.14
Dhanusha, ha										1190
No. Farmers										1108
Ha/Farmer										1.07
Sarlahi, ha								2276	1660	2338
No. Farmers								2099	1415	2906
Ha/Farmer								1.08	1.17	0.80
Rautahat, ha								1675	1396	2004
No. Farmers								1951	826	3499
Ha/Farmer								0.86	1.69	0.57
Bara, ha								5436	6934	7096
No. Farmers								5552	5120	7247
Ha/Farmer								0.98	1.35	0.98
Central Region, Total, 6 District and CS sites										
Hectare	3.7	105.7	49.9	16.2	194.5	450	1081	16520	20566	22794
No. Farmers	60	720	380	80	469	603	1244	18799	15802	24180
Ha/Farmer	0.06	0.15	0.13	0.20	0.41	0.75	0.87	0.88	1.20	0.94
Eastern Region, 5 district										
Hectare										5472
No. Farmers										2757
Ha/Farmer										1.98
Western Region, 2 district										
Hectare										2557
No. Farmers										2915
Ha/Farmer										0.88
Mid-Western Region 2 district										
Hectare										2095
No. Farmers										NA
Ha/Farmer										-
Far Western Region 2 district										
Hectares										2049
No. Farmers										1207
Ha/Farmer										1.70
Total, ha	3.7	105.7	49.9	16.2	194.5	450	1081	16520	20566	34967
Farmers	60	720	380	80	469	603	1244	18799	15802	31059
Ha. per Farmer	0.06	0.15	0.13	0.20	0.41	0.75	0.87	0.88	1.20	1.06

* Failed due to leaf rust on RR 21

** Targeted Inputs failed to arrive

available which had been adapted to the respective site conditions and would be acceptable to farmers. Yields were higher and, more importantly, the varieties and practices fitted into the existing farmer patterns. The economics of the patterns were also generally favorable.

A proposal for a pilot production program for 1980 was prepared in February of that year to initiate a program at Pumdi Bhumdi in Kaski district. Technical data were presented, an operational plan outlined, an organizational setup developed, and budgetary requirements estimated. A farmer meeting on National Day in February launched the program. Farmers who had been participating in the research program and others were presented the information and encouraged to participate. Sixty farmers with only 3.7 ha. (or 0.06 ha. per farmer) agreed to try the variety and other technologies in maize production, in a maize/finger millet-wheat pattern.

The parcels were scattered and because of poor seed germination it appeared the production program would fail. However, by July some parcels were quite promising and field days were held to acquaint other farmers with new varieties and technologies. Results at harvest were very encouraging. The maize crop of the participating farmers averaged 2.78 T/ha. as compared to 1.5 T/ha. for non-participating farmers, an increase of 85% in the yield of this one crop in the pattern.

In August, the experiences with maize were reported to the Ministry and the Department of Agriculture in a meeting, the main purpose of which was to submit "Production Programs for the Hills, a Proposal". The report covered all four cropping systems sites in the Hills. The technical data that were accumulated were presented; giving in detail the yield results by pattern for each location and extrapolating these results to the areas at the site covered by each pattern to indicate the increase in production that could be

expected if the technologies were adopted. The objectives of the proposal were -

1. Utilize the superior technologies to increase production,
2. Incorporate the cropping systems approach to farm production into the extension system, and
3. Identify and if possible solve constraints from the technological, socio-economic and other aspects so that these problems could be solved or overcome prior to the adoption of a production program on a regional or other defined area scale.

To successfully implement a new program the following strategies were presented.

1. The results of the on-site research of cropping systems to the officials to obtain a commitment to proceed with pilot production programs at the cropping systems sites.
2. Potentials for production at the sites were outlined.
3. Inputs required to achieve these potentials and coordination of input agencies to assure the availability of inputs at the sites.
4. Organizational structure including committees at the regional, district and panchayat levels to implement the programs.
5. Use of site personnel in production programs.
6. Organization of farmers to introduce the programs.
7. Use of extension literature to inform farmers.

The limited experience at Pumdi Bhumdi indicated that more information regarding farmers was required to enable the creation of a production program that would have greater chances of success. To

make the program more effective, preproduction surveys were conducted by the socio-economic group before pilot production programs were launched for the wheat season of 1980-81. At the four sites in the Hills a total of 66 ha. of wheat were included and a total of 505 farmers involved.

A Pilot Production Program Report was prepared in November 1980 giving the progress of production programs at various sites. In spite of follow-up it appeared that nearly everything that could cause the production effort to fail was happening. Farmer organization was weak, and farmer meetings not well organized. Credit was a problem in three out of four sites. Committees were not functioning. Information dissemination of the technology was not effective. Lack of communication from the DOA to the Regional Directors resulted in failure to inform them of these pocket programs. And, finally initial implementation, including seed distribution, fell during the long Dasain holidays so little could be accomplished.

In retrospect it would seem that these problems would surely lead to failure. However, it was precisely these types of problems which needed to be identified in a pilot phase so that larger production programs could be more effectively implemented in the years to follow.

Pilot programs continued in three subsequent seasons. In an attempt to implement Mr. Khadka's suggestion of a compact block approach, attempts were made a Khandbari with maize in 1981 when 156 farmers grew 25 ha. of Khumal Yellow maize in a compact block.

These pilot programs continued through the monsoon season 1982 when there was a significant expansion of area of maize in all the Hill sites and rice in the sites in Parsa district. Nearly 195 ha. were covered and involved 469 farmers.

With these added areas in "Impact" blocks, the coming wheat season, 1982-83, offered an opportunity to really demonstrate the effects of impact blocks. Two Hill sites and two Terai sites were expanded. The other two Hill sites had limited areas of wheat (Khandbari) or the wheat variety (RR 21) was susceptible to rust (Pumdi Bhumdi).

The areas under production programs at the 4 sites increased about 30 times from the wheat area in 1981-82 and involved Chitwan district for the first time. (Chitwan was the location of the sixth Cropping Systems site established for Inner Terai agro-climatic conditions.) A total of 603 farmer at 3 sites had 450 ha. (Chauri Jahari failed because inputs failed to arrive so 60 ha. and probably 100 farmers had to be abandoned).

Seasonal conditions were more favorable and supervision and other management factors were more effective in the Terai sites. The impact production blocks were visited by DOA officials and repeat visits were made to include the Minister of Agriculture, representatives of USAID and others. As a consequence of the performance of the wheat crop in making an "impact" on administration, the government took decisions that elevated the Block Production Program from the pilot level to full scale production.

Over the six seasons from 1980 to 1982-83, efforts at getting production programs under way ranged from 3.7 ha. in the first year at Pumdi Bhumdi with 60 farmers to 450 ha. and 603 farmers at four locations in 1982-83. This period served the previously stated objectives of -

a. Demonstrating the feasibility of the cropping systems technology.

b. Assess the extension approaches and the factors that would have to be built into a larger full scale production program.

c. Identify problems that would be encountered in developing an expanded program.

Did this pilot production period offer answers and guidance upon which full scale production could be built? The answer is a definite "Yes", but not without qualifications as the following discussions will indicate.

Each year the production was monitored and yield records obtained as to performance. These have been chronciled in various reports of the project. Table 11 presents a summary of informatior from the 1982 and 1982-83 production blocks, 1983 rice production blocks and 1983-84 wheat production. The pattern yields are related to whether the area was rainfed or irrigated. Pattern yields of the main pattern, rice-wheat-fallow (R-W-F) were only 4.6 T/ha under rainfed lowland conditions but with the same pattern under irrigated conditions, yields ranged from 6.4 T/ha in Parsa to 7.6 T/ha in Chitwan district.

An economic measure of pattern performance is presented as the percentage increase of the pattern "returns over variable costs" above the same "returns over variable costs" for the farmer practices. Again comparing the R-W-F pattern the increase ranged from 20% in Chitwan irrigated lowland to 110% in the rainfed lowland conditions in Parsa.

One of the best pattern yields was obtained at Chauri Jahari under irrigated conditions with Rice-Wheat+Mustard with 9.2 T/ha or 80% increase over the same pattern under farmer practices. Even under upland conditions with Rice+maize-Wheat+mustard the yield was 7.6 T/ha or 46% above the farmer practices.

Table 11 - Pattern Yields in Production Blocks and Increases over Farmer Practices[1/]

Location	Year	Pattern*	Pattern Yield T/ha	Increase over FP %	% RAVC**
from Bolo[1/]					
Parsa-Irr. Lowland	1982-83	R-W-F	6.4	64	60
Parsa-Rainf. Lowland	1982-83	R-W-F	4.6	142	110
Chitwan-Irr. Lowland	1982-83	R-W-F	7.5	21	20
Lele, Lalitpur, Irr. Lowland	1982-83	R-W-F	7.2	36	40
Chauri Jahari, Rukum, Irr. Lowland	1982-83	R-W+Mus	9.2	80	66
Chauri Jahari, Rukum, Irr. Upland	1982-83	R+M-W+Mus	7.6	46	37
from Mergen and Gurung[2/]					
Rice Production	1983		3.3	14	20
Wheat Production	1983-84		2.5	19	87

* R-W-F = Rice-Wheat-Fallow.

R-W+Mus = Rice-Wheat+Mustard.

R+M-W+Mus = Upland Rice+Maize-Wheat+Mustard.

** RAVC = Returns over variable costs.

1/ Bolo, I. C., Cropping Systems Pilot Production Programs in Nepal, Agronomy Division, Department of Agriculture, Nov. 1983.

2/ Mergen, David J. and Babu Ram Gurung, Evaluation of the Cropping Systems Production Program in the Nepal Terai, 1983-84, Agronomy Division, Department of Agriculture, Dec. 1984.

The economic data show close relationships with yield data but vary somewhat because of differentials in grain prices and input costs for the different crops and patterns. This percentage improvement in economic returns varied from only 20% under irrigated lowland in Chitwan to as high as 110% in rainfed lowlands in Parsa.

Data from Mergen and Gurung for rice in 1983 and wheat in 1983-84 are added to the table for comparisons. These data show rather modest percentage increases in yields with only 14% in rice and 19% in wheat. However the increased economic returns shows a 20% increase over returns above variable costs for rice and 87% increase over the same economic measure in wheat.

3. Production Campaigns

The pilot impact production blocks in two districts in 1982-83 led to an expansion of these activities to five districts in the wheat season of 1983-84 (Table 10) covering nearly 17,000 ha. and involving nearly 19,000 farmers, a 30 fold increase over the wheat campaign the previous year. Five of the six Terai districts in the Central Development Region were covered with Parsa and Bara each having over 5,000 ha. Additional staff were recruited and assigned and the other components of the production program were expanded accordingly.

With this very rapid expansion some of the production principles that had been established and enumerated could not be effectively followed. New staff had to be trained, the coordination of activities with the credit and input agencies, and farmer organization and contacts were necessary to organize the production on the lines of impact blocks and to acquaint farmers with the technologies they were to use. Supervision would become especially critical as the program expanded so much.

In addition to routine monitoring by supervisory personnel Mergen and Gurung studied this winter wheat production campaign of 1983-84 in some detail. The areas were monitored, surveys made to determine levels of recommended practices used and yields obtained and extension approaches used in the production campaign. Their study provides answers to the feasibility of the technology, the effectiveness of extension methods and problems of implementation that are constraints to similar or larger production programs.

Their studies showed that the large production program covering over 16,000 ha. and nearly 19,000 farmers in five districts of the Central Development Region had several beneficial effects. There was a significant but modest increase of 19% in yield, as a result of a somewhat greater use of fertilizer and other recommended practices such as increased seed rate. The average use of nitrogen fertilizer was only 75% of the recommended level and only 11% of the farmers used the recommended level. Reasons given for the increase in fertilizer use was that the participant farmers received preferential treatment and with fertilizer in short supply they were better able to get fertilizer than the non-participant farmers.

Twenty four percent of the participating farmers received production loans which enabled them to get the fertilizer, providing a measurable increase in yields. The third reason was the greater access to technical information through the extension staff working in the production program and having a regular visitation system to acquaint farmers with the technology. The frequency of visitation as well as regularity increased. The fact that visits of extension staff are attributed by farmers to help them increase yields provides a very strong endorsement of the T and V system which was functioning in some districts.

The production program encouraged farmers to shift to the rice-wheat cropping pattern when they had customarily used rice-fallow or rice/lentil or rice-mustard as a pattern.

The production program was scale neutral as far as size of farm was concerned. The average area in wheat was only 0.87 ha. and the average size of farm was 2.67 ha. Among the farm size classes ranging from those with less than 0.34 ha. to these with more than 4.00 ha. there were no significant differences in yield whether small, medium or large.

The level in nitrogen fertilizer used was reflected in yield, a corresponding increase of 150 to 500 kg/ha. of grain for each increment of 10 kg. of N up to the recommended level, with an average increase of 290 kg. of grain per hectare for each incremental increase, or a return of 29 kg. of grain for each kilogram of nitrogen used.

Supervision and support of DOA officials in Kathmandu were considered as major factors in improved performance of the extension staff.

Another benefit of the extension block production program was the influence on farmers not in the program who learned of the recommended technologies from their neighbors and began using some of these practices. This could partially account for the small nineteen percentage increase in yields of participant farmers over their neighbors' yields.

The initial benefits of the contiguous compact block were still valid. The impact on other farmers and on officials was greater, management was easier, extension services were more effective and delivery of inputs and credit was more efficient.

Variety is a key component of the package of technology for effective implementation of production programs. The source of seed, the quality, and, if procured, timely availability are all

factors. The survey indicated that in four districts out of five, 78 to 96% of the farmers used their own seed. Only in Chitwan did the farmers (79%) rely on the cooperatives for the main supply of seed.

With the rapid expansion in block production programs, the responsibility for what seed farmers use rests with the Production Officer. For those procuring seed the matter is simple but as noted the majority of farmers will be using their own seed. This presumes that the production program is following, after some years, the spread of the variety to be used in the package. If, as should be, a new variety is being introduced it almost certainly would not and should not be introduced on 100% of a 1,000 ha. block. Introduction should be possible on smaller areas even with the agricultural assistant and his demonstration plot. Then if acceptable, seed could be saved and grown and expanded in subsequent seasons.

The introduction of pure seed of the main variety could also be handled in this way. Farmers who grow the seed for subsequent distribution are assisted by provision of seed storage bins at a slightly subsidized price. The ultimate aim is a local reliable seed source for the farmer-to-farmer seed network.

With farmer-produced seed the Production Officer would need to physically examine the seed lot to determine its condition and could instruct the farmer on how to conduct a simple germination test to determine viability. These prerequisites have been required for farmers seeking loans.

Selling farmers seed bins which will improve storage conditions and seed quality can contribute substantially to the local supply of seed. Subsidies to encourage this seed bank offer possible

incentives to participation. As production efforts move to the Hills, seed storage could provide a key input to a successful production program.

The experience gained over the pilot production period resulted in a group of production specialists who had worked with farmers, knew the technologies and could provide leadership in association with other service agencies. They had a level of credibility that has been reflected in their work with farmers to establish blocks and provide all the services necessary to implement production programs.

Expansion of activities means that more people are needed who have this concept and can apply the concept in other areas. Training is not a complete substitute for experience but in an effort to accelerate the program, training of new staff will be required and refresher courses for older staff will be essential to keep them abreast of developments.

The training centers functioning under the sponsorship of the Training and Visit System and training centers elsewhere can provide the sites where much of this training can be done. Trainers will have to know the training objectives that are required in implementing production programs. This will include technical content, the preproduction surveys, management of production blocks, supervision, collaboration with other agencies, organizing farmers, follow-up to evaluate production changes.

To develop more competence among Production Officers it has been suggested by the Task Force Team[1/] that a complete season be devoted

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1/ Malla, M. L., S. U. Khan, and B. R. Subedi, A Report on the Strategy of Implementation of the Production Program, 1983-84. Paper Presented at the Twelfth Summer Crops Workshop, Rampur Agriculture Station, January 28 - February 1, 1985.

to training production officers to enable them to learn the methodology, technology and the art of working with farmers. In order to achieve this type of training, new production officers would have to serve as apprentices or associates with experienced production officers.

Weaknesses in the program were apparent very early in the program. Supplies of fertilizer were not going to arrive in time to be available in the quantities needed in the five districts. This reason was given by farmers for not using the full recommended fertilizer level of 80-40-0 kg/ha. of N-P-K.

Several administrative weaknesses surfaced during implementation. Budgets were not released on time, ignoring the seasonality of field activities in extension. Differential pay of Agricultural Assistants and Panchayat Level Agricultural Assistants working in the same area was against the program. Staff transfers and a lack of mobility for production officers affected the program. Some Agricultural Development Officers viewed the special program as not a part of their extension duties and while not antagonistic, did not give the program full support.

Perhaps of prime importance, next to the short supply of inputs was the lack of consideration by HMG of market prices and their effect on farmers' welfare and on production in subsequent seasons and years. At harvest time (May 1984) farmgate prices were 70-80% of what they had been in the same period the previous year. These lower prices resulted from an over all good crop in Nepal and in India, and a lower market demand because of carry over stocks which government procurement agencies had from grain obtained through food aid programs.

During the Pilot Production period and the first large scale production program what has been learned? It seems that much has been learned and can be used in similar programs in the future.

1. Experience gained by the staff during the pilot period was vital to the successful implementation of the first full scale production program. The seeming chaos of 1980 was not repeated since people knew what needed to be done and how to go about doing it. Overstaffing during a pilot production period is an advantage as more people are trained and gain experience. Then as production programs expand the trained people will be available for new areas.

2. Without the Impact Production Block (IPB) there would have been no decision by HMG to expand into a 5 district production program. Implementing this IPB concept on a pilot scale provided the essential ingredient to demonstrate the effectivity of the technology. The additional impact of the IPB on other farmers, manageability by extension, servicing by input agencies, supervision by other officers are all plus factors for the IPB.

3. Once the Impact Production Block had served its purpose, commitment by government was critical to the effective implementation of a production program.

4. Production can be increased with the present packages of technology. Factors which have held productivity at stagnation levels were systematically overcome through the application of known technologies along with the other components of the extension program and input supply. Increases of 20% are not dramatic as compared to those reported[1/] where production block yields are compared with district averages but they are dramatic compared to the long term productivity trends for wheat, rice, and maize.

1/ Malla, M. L., et al A Report on the Strategy of Implementation of the Production Program, 1983-84. A Paper Presented at the Twelfth Summer Crops Workshop, Rampur Agriculture Station, January 28 - February 1, 1985.

5. A whole farm or farming systems approach was the basis for developing the technology and was used as a basis for extending the technology to farmers by extension personnel.

6. A prerequisite to successful use of the package is the pre-production survey. Again based on experience and using experienced personnel, a period of six weeks was used[1/] to survey the potential sites for the expansion of the program to 17 districts and 35,000 ha. for wheat in 1984-85.

7. Manpower requirements were an important consideration. Personnel experienced in the pilot production programs were deployed in the program and assigned area responsibilities. The ratio of one production officer for each 1,000 ha., one Junior Technician for each 500 ha., and one Agricultural Assistant for each 100 ha. was a deployment strategy that was effective. As staff become more experienced and better trained these ratios can change to some extent. In the Seventh Five Year Plan one Block Production Officer may be responsible for 1,000 - 3,000 ha.

8. Using the block approach to production makes the extension of technology easier but does not eliminate the vital point of contact with farmers by extension personnel. The pilot period enabled staff to gain experience and with experience credibility with farmers. This credibility once established has to be maintained by visits with farmers. A key ingredient of the block approach has been the increased frequency of contact with farmers, a point which has been stressed repeatedly by Benor and implemented through the T and V system.

1/ Malla, M. L., et al A Report on the Strategy of Implementation of the Production Program, 1983-84. A Paper Presented at the Twelfth Summer Crops Workshop, Rampur Agriculture Station, January 28 - February 1, 1985.

9. Without doubt a critical component has been supervision. Staff assigned national and regional responsibilities were frequently visiting production blocks to acquaint themselves with progress and problems, encourage staff and farmers, and maintain linkage contacts with input agencies, credit agencies, and irrigation project personnel where these were involved.

10. Active supervision by senior personnel has required a level of mobility not normally provided or available to staff. It also requires that these personnel not have to travel and supplement TA/DA with personal funds. The ICP provided the extra mobility that enabled supervision to be effective. Without supervision many points in the production system would soon become non-functional.

11. To make the production program functional (and relate it to other activities of the DOA extension program) a series of committees have been established. At the national level a national management committee and a national task force team have been created. In the region a management and a technical committee and at the district level a management committee were created. Functions and duties have been presented so that within committee structure functions are well understood. Even so committees from the very beginning have tended to be nonfunctional indicating much of this structure may be unnecessary.

12. Incentives so far have amounted to recognition and some cash awards to outstanding production officers, Junior Technicians, Cooperative (Sajha) managers, and agricultural assistants. The awards are nominal but recognition per se is a significant deviation from the more common denigrating treatment given to staff regardless of performance.

13. Linkages with research have been important. To strengthen the linkage, production officers have been assigned to the Agronomy Division. The Regional Technical Committee is under the chairmanship of an officer of the respective regional center and members of the Central Task Force team attend the bimonthly meetings of research centers and Production Officers are based at the Agricultural Services Centres in the area where they are assigned.

14. Over all management is critical to the success of any program and it is even more true of a forced-pace production program which seeks to accelerate the rate of production increases to keep pace with population growth and attendant food needs. Coordination with other agencies which service farmers; planning the production programs; and supervision and follow through are important aspects of effective management. The role of the staff of the DOA as leaders in this process cannot and should not be minimized.

15. Farmers are the building blocks of any program. The numbers of farmers contacted by the production teams in the 1983-84 production program were only 36%, a reduction from 64% in 1983. Yet contacts are essential if effective changes are to be made in production. The number that need to be contacted and the trained staff available support the strategy of special and pocket programs based on potential of an area and the technology available, consistent with the capability of manpower and availability of inputs.

16. Farmers dictate that the program has to be a bottom-up program taking into consideration his welfare and that of his family. A close monitoring of change is essential to determine the effects and HMG must have a degree of flexibility to respond

and change according to need because ultimately government in many instances must change if lasting change is to be effective with farmers.

Is it sustainable? Considering the needs and the demonstrated benefits and effectiveness, the real question should not be is it? but how is it to be sustained? and what is to be sustained?

A review of the components of the production program would indicate that it would be difficult to place them in an order of priority. So many are so completely essential that to leave out one is going to make all the others less effective or lead to complete failure of a project. An enumeration of what is important and which is essential would only lead to a repetitive listing.

One thing seems certain. It was not the target that increased production. It was the technology, the block approach, the trained manpower and their credibility in the eyes of farmers, the leadership of the DOA staff in organizing, managing and supervising, and the availability of inputs. These were what increased productivity and production. Will the lack of markets made it only a one time increase? It would appear so.

One single ingredient would appear essential and upon which all the others rest and are allowed to function, and that is commitment of HMG. This was lacking in the early pilot production period. It was only after a production impact was made that commitment was generated. Wortman and Cummings (p. 224) very simply summarize by stating "most nations <u>can</u> increase their agricultural production and raise the standards of living of their rural areas if they <u>will</u>."

It has been demonstrated that production can be increased and, if replicated, could make significant increases in national production. Political <u>will</u> will be a determining factor.

Thought has been given to replication and the Seventh Five Year Plan outlines how this is to be done. Manpower for production has been outlined and requested so that in every district in the Terai there can ultimately be five production officers, one at the district level and four block production officers responsible for blocks of 1,000-3,000 ha. each. Even these numbers will be inadequate if the officers are not well trained and lack or lose credibility in farmers' eyes.

It would appear that preservation of the block approach is an essential ingredient. This concept fits very well the HMG/MOA "Unified Planning and Implementation of Programs" which was inaugurated in 1980-81.

With the use of the cropping systems technologies and methodologies of survey, preproduction verification and pilot production, potentials have been and are being explored in many project areas where production programs can be undertaken.

Because the research results are based on a bottom-up approach to develop technology in farmers' fields, the technologies are tailored or adapted to local conditions and are sensitive to farmers' conditions which include not only agronomic performance but economic feasibilities which ultimately relate to family welfare.

Production programs are also bottom-up in concept, relying and dependent on group action among farmers for the creation of production blocks which can be the management focus of all other inputs-extension services, cash inputs, credit, markets. The decentralization act in essence is striving to achieve the same bottom-up approach to development.

Of considerable consequence is the effectiveness of the production team in technology transfer through contacts, which farmers credit

with enabling them to increase their production. During the rice season of 1983, there were production blocks in Chitwan and Parsa, with 1244 farmers involved. During that season 64% of the farmers were contacted one or more times. The more effective program was in Parsa where 70% had been contacted while in Chitwan only 58% had been contacted one or more times by members of the production team.

It is rather alarming to realize that in the next season when five districts and over 18,000 farmers were involved, the average percentage of farmers contacted dropped to 36% and in Sarlahi district only 12% were contacted one or more times in the crop season.

The study does not say how many were contacted in their fields which is stressed as an extension methodology but the change in frequency of contacts is significant and focuses on the difficulties of expanding the program.

Could this reduced number of farmers contacted be a factor in the limited increase of only 19% in average yields, when with the full package of recommended technology, some farmers in the program were getting double the national average yield of wheat? Is it a portent of future and even larger "targeted" production programs if the ingredients of success are ignored?

As the project closes May 1985, another wheat campaign has been completed. The program was expanded to 17 districts and the targeted area was 35,000 ha.[1/] The problems that were studied and reported in the 1983-84 campaign were generally to be magnified in this larger campaign. Measures of performance and problems encountered will be forthcoming.

1/ Malla, M. L., S. U. Khan and B. R. Subedi, A Report on the Strategy of Implementation of the Production Program, 1983-84. Paper Presented at the Twelfth Summer Crop Workshop, Rampur, January 28 to February 1, 1985.

4. Minikits as an extension tool for variety dissemination

The "kit" program envisioned in the project paper was estimated to cost about $ 20 (Rs. 250) per kit. Experience indicates that the costs ranged from as low as Rs. 7-12 per kit for rice to Rs. 25-35 per kit for wheat to Rs. 200-250 for maize. Maize included fertilizers and pesticides as a part of the "kit" package which accounts for the greater overall cost. In view of the experience of the project this may not be necessary or even advisable and was certainly more subject to abuse.

Minikits have been an integral part of the Integrated Cereals Project from the first year (1977 monsoon crop) when the rice program distributed 3,000 minikits. From the second year (1977-78) seed of rice, maize and wheat was available for distribution as minikits to farmers. The minikit was a new term but was essentially a result demonstration which had been in use by extension for a long period of time in Nepal. Three differences set the minikit program apart. One was that the source of seed and ingredients of the minikits were primarily determined by the commodity programs. Second was the smaller size of the minikit compared to the result demonstration (which was about three times larger). And third was the much greater number so that more farmers were contacted.

It could be said that the minikit had another and perhaps much more significant difference and that was in objective. Its main objective was a seed dissemination tool. With widespread distribution of seed new varieties, which, if accepted, would become a part of the farmer seed network of farmer-to-farmer distribution. This network still supplies well over 90% of all seed used in Nepal. The minikit program would enable new varieties to be included at many loci in this network and provide possibilities of wider scale adoption if the variety was accepted.

A second feature was a more certain feedback system to extension and research. This should enable determination of regional acceptances and performance of the varieties introduced in this way.

Seed distribution has been made in eight fiscal years (nine for rice) from 1977-78 to 1984-85. Table 12 gives the distribution by crop and other main categories in each year. In maize, varieties are now distributed in three seasons - summer (monsoon), winter, spring. In rice the distribution is by normal crop season, early season, and Hills (which is also "normal" but varietal composition is different). During the 8-year period a little more than 200,000 minikits of the three major cereal crops have been distributed. About 60% of the minikits were in rice, 25% in maize and 16% in wheat.

The economy of the minikits enabled a larger scale program than was envisaged and over a much longer period of time than originally scheduled. Instead of a little over 50,000 over a 5-year period, as provided in the project paper, the commodity programs distributed almost this many in the first two years. (Some calculations would put this number over 50,000 but delivery of wheat minikits the second year was faulty and many packets never reached their destinations in some instances.)

Management of minikits has varied considerably. In wheat, the program deliberately distributed only one variety to a farmer, but might have several different varieties in a district. In maize, fertilizer and pesticides were a part of the minikit supplied by the commodity program, while with rice and wheat these components were to be supplied by extension, if at all. Otherwise, it was assumed that farmers would provide these ingredients. In other words, the variety could be superimposed on to the farmer's existing crop culture and fertilizer practices.

Table 12 - Number of packets of crop varieties distributed as minikits during the life of the project, 1976-84

Crop	Year									Total
	1976-77	1977-78	1978-79	1979 - 80	1980 - 81	1981 - 82	1982 - 83	1983-84	1984-85	
Rice - Normal		11679	7145	7650	8700	12890	NA	14923	15395	
Early		745	4500	4550	3500	1275	NA	3724	3719	
Hills		-	-	50	50	0	0	1354	1860	
Total	3000	12424*	11645*	12250	12250	14165	17454	20001	20974	124163
Number of Varieties										
Terai - Normal	NA	NA	8	8	8	7	5	11	13	
Terai - Early	0	0	0	5	3	5	4	6	8	
Hills	NA	NA	4	1	1	0	0	2	3	
Maize - Monsoon		6550	4347	5695	6190	3275	3327	4299	4600	
Winter		440	1400	2630	1162	930	1185		2200	
Spring		0	0	0	513	355	345	1000	1000	
Total	0	6970*	5747*	8325	7865	4560	5057	5200	7800	51524
Number of Varieties										
Monsoon		7	8	5	6	3	3	4	9	
Winter		3	1	2	2	2	1			
Spring		-	-	-	1	1	1	1	1	
Wheat - Total	0	3048*	8220*	3865	2263	3955	4697	4400	3161	33609
Number of Varieties		4	3	4	6	7	10	13	8	
				57%RR21 29%UP262	39%RR21 30%UP262	46%UP262	33%UP262	50%Triveni	50%Triveni	
Total	3000	22442	25612	24440	22378	22680	27208	29601	31935	209296

* Earlier reported in ICP progress report 1976-79

Foot Notes: Rice Minikits - Hills 2 kg, 1 ropani (500 sq.M) Terai, 1.5 kg/katha (335 Sq.M.)

Maize Minikits - Rabi and Spring 1 kg/1000 sq.M, Monsoon 500 sq.M ½ kg

- Minikits also included urea and/or complexal, and Sevin

Wheat minikits - Hills, 2.5 kg/one half ropani (250 Sq.M.); Terai, 3.5 kg/katha (335 Sq.M.)

All crops included instruction booklet (in Nepali) and reaction cards.

In rice the practice of putting varieties together varied considerably but mainly they followed the wheat system of only one variety per farmer although the district agricultural officer could put these together with one farmer. Where this was done judiciously as in Bara district, farmers favored the opportunity to make comparisons.

In wheat about 50% of the minikits have gone to Hill districts. This is probably true of the maize minikits but these data were more difficult to isolate. In the case of rice, the minikit program for the Hills has been very limited. Some varieties for the Hills were included from 1978 to 1980 but then not again until 1983-84 when new varieties for the Hills were released. These have numbered less than 2,000 annually. These varieties had had limited distribution among farmers in Kathmandu valley, Nuwakot district and elsewhere for the previous three or four years. Even with limited distribution it is estimated that there are over 3,000 ha. of these new varieties being grown. In Nuwakot alone over 150 ha. is grown, having spread from one kilogram of seed to a farmer in 1980.

Varietal composition of the minikit program followed a rather regular pattern in wheat. For the first four years RR21 (Sonalika) was a component making up 30% in the fourth year (1980-81). Since RR21 was already widely grown by farmers and its resistance to leaf rust was breaking, it was dropped from the minikit program. UP 262 was introduced in 1977-78 when 29% of the minikits were UP 262. It continued to be the largest single variety for five years (up to 1982-83) when Triveni was introduced as 50% of the minikit program. It has been in this position for two years.

By contrast, the rice program has had CH 45 and Masuli in minikits every year for the entire eight years and no single variety has constituted a large percentage of the minikits available. An average of 1,500 to 2,000 minikits are distributed for each variety.

Maize started out with 9 different varieties in the minikit program. These have been reduced to four varieties in the monsoon season and one, Arun 2, in the spring, and one or none in winter.

Table 3 indicates which of the released varieties of the three crops were in minikits in 1984-85. Minikits are also used to distribute prerelease varieties to farmers.

Composition of the minikits includes a leaflet (in Nepali) giving the cultural practices to follow, and a "report" card to be returned with the farmer's reaction to the variety and some quantitative measure of yield and qualitative measure of other characteristics of the variety compared to the farmer's own variety.

After three years of operation the minikit program was reviewed by APROSC[1/] in contract with the ICP. Four districts in the Terai and four in the Hills were included in the study. Farmers, extension staff and crop coordinators were interviewed to determine the effectiveness of the minikit program. Feedback cards received at the commodity stations were evaluated to assess acceptance and spread of varieties and other technologies, and to evaluate the delivery system.

The numbers of farmers interviewed in the 8 districts totalled 612. Other farmers interviewed included 61 who had not received minikits and 106 key farmers totalling 779 altogether. In addition the three crop coordinators, four regional directors, eight agricultural development officers and 91 JT/JTAs were interviewed.

Results of farmer interviews were generally very positive and encouraging. Farmers viewed the overall program as good and

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1/ Evaluation of Minikit Performance, Two Volumes, Agricultural Projects Services Centre, Kathmandu, 1983.

favourable. The crop yield results were extremely impressive, farmers often estimati g their yields were double what they got from their local varieties. The range in increases of course varied greatly from district to district, farmer to farmer, crop to crop, and variety to variety within a crop. Farmers' estimates of yield increases ranged from 25-200% with the majority estimating 25-50% better yields with the minikit varieties. The regional adaptation of varieties was not particularly noted as a result of the interviews.

Varieties included in minikits generally showed better yield performance than the local varieties. Laxmi and CH45 rice varieties and NL 88 wheat proved to be exceptions. Rice varieties had received widest dissemination among the districts sampled. Although the maize varieties were less generally distributed, wherever distribution was made the varieties were superior to locals with which they were compared. Rampur Yellow had the best yield followed by Sarlahi Seto and Khumal Yellow. The wheat varieties had been distributed in only two of the four (now five) development regions. RR 21 and NL 30 were superior in yield in sampled districts except Chitwan where the "local" wheat variety was probably an improved variety since wheat is a relatively new crop in the area. (It is interesting that the sterility in NL 30 which has been observed in farmers' fields in the districts of the Eastern Region was not reported in these studies.)

Farmers felt the minikit program was successful and would like to see it continued. In fact an answer to another question indicated a majority would be willing to purchase minikits for their use.

Since one of the objectives of the program was to utilize minikits as a seed dissemination system an assessment of what farmers did with the crop they produced is of value. In all instances, except for wheat in the Terai (48%), the majority of farmers would save

seed from the crop grown from the minikits. Whether the exception in case of wheat reflected a negative reaction to the varieties or was because farmers have difficulty in storing wheat seed in the Terai is not known.

In addition to saving seed for themselves farmers indicated they shared seed with their neighbors. In the Terai, 123 farmers receiving minikits supplied seed to 443 other farmers (or 3.6 farmers for each farmer receiving a minikit). In the Hills 82 farmers shared seed with 629 of their neighbors, or 7.7 farmers per farmer receiving a minikit.

The value attached to minikits by extension personnel and administrators was less than expressed by farmers. There are probably reasons other than varietal performance which were affecting judgement of the RD's, ADO's and JT/JTA's.

It is of interest that the report cards that had been returned to the crop coordination centers were not fully utilized by commodity programs in evaluating farmer reaction in a detailed way. An analysis was made of percentages of cards returned and some reports have been made to various workshops but the information does not appear to have been well utilized (at that time or since).

In the sampled districts, returns of report cards were variable, yet the percent received nationally and even from the sample districts provides an adequate sample to assess crop performance and farmer reaction.

There was a rather large discrepancy between the number of minikits earmarked by the commodity programs and those received by the respective ADO for distribution. Apparent reasons were that the channels of distribution and timing of distribution allowed for diversion of the minikits to other districts. Yet this should

have been compensated in reporting from those districts actually receiving the minikits. There is always a question of whether minikits refers to numbers of packets or whether it refers to numbers of farmers. One farmer can receive one to three or more varieties in "one" minikit.

For the 8 districts sampled, only 37% of the minikits were received while in 47 other districts, the percentage received was reported as much more. Of 26,000 minikits distributed over 97% were received and of those received 99.4% were distributed to farmers.

Timeliness of receipt of minikits and condition of the packets received have been a concern since the chief objective is to have quality seed in farmers' hands at the proper time.

To the credit of the commodity programs, farmers who received minikit seed were generally of the opinion that condition of the seed was good. Only 1 to 4 percent reported that condition of the packets was poor. On the other hand the ADOs reported a higher percentage receipt of minikits in poor condition. This is especially true if the delivery route and time were longer. In one year, Kailali district reported 100 percent damage of the maize minikits. However, damage reported was generally less than 10 to 15 percent. This then accounts for the different reaction of farmers and ADOs. ADOs and their staffs naturally would not pass on to farmers those minikits which have been damaged and farmer reaction would not reflect the true percentage of minikits damaged in the distribution process.

Maldistribution of minikits has brought statements of alarm from many quarters. These malpractices include minikits lying in offices after the sowing season; political pressure on agricultural officers to distribute seed to favoured farmers; officers taking minikits to their home districts; some families obtaining enough minikits to

sow their entire crop area; and some farmers receiving minikits year after year.

These malpractices have generally gone unrecorded and might account for some of the discrepancies between minikits distributed by the coordinated programs and the number received in the district. Since these were unrecorded it was only the verbal reports of respondents, off-the-record, that enable some estimates of these channels of minikit use. Although all defects are acknowledged probably the greatest defect in the system would be the late receipt of minikits so that they could not be effectively used in any way.

Perhaps the minikits most subject to abuse are the maize minikits which contain fertilizer and pesticides as well as seed. Fertilizer could be used for other crops which farmers have and on which they place higher value.

As indicated above the commodity programs have not utilized the information on the returned cards to any great extent. However, a recent report of the wheat program shows they have studied the feedback cards. Out of 4400 farmers receiving minikits 1050, or 23.8%, returned cards providing information on the performance of the variety they received. These returns are better than the percentage of farmers reporting on wheat in the first 3 years (in the sampled districts of the APROSC study).

Out of the total number reporting, 782 or about 75%, were saving their own seed for use in the succeeding year. This is a more significant figure than the 48% found in the APROSC study and may indicate the earlier figure was a reflection of low varietal preference.

The numbers of farmers saving seed was especially high in the Mid-Western and Far-Western Regions where 85% and 90% of the farmers

respectively, saved seed from their plots. It would still appear that this is an effective seed dissemination tool. The assessment of the feedback cards showed that Triveni which constituted 50% of the minikits supplied was liked by many farmers and had a wide range of adaptability, especially in the mid-hills.

During the course of the APROSC study a lengthy discussion of the minikit program ensued at the 1980 summer crops workshop which led to the preparation of a statement on minikits which sought to clarify objectives, relationships between research and extension, budgeting, allocation of minikits etc. This was the first time that the Department of Agriculture had really tried to develop on overall statement which would clarify the program.

The statement though brief was quite complete and comprehensive and helped to clarify the relationships of the commodity programs and the extension services and their areas of responsibility.

Even so, the extension service still feels that minikits are an added responsibility over and above their normal result demonstrations.

Since the evaluation by APROSC the minikit program has improved during the planning stage which is done at the time of the regional working group meetings. The numbers of varieties in the case of rice and wheat have increased. There has been a gradual increase of minikits in rice so that there are presently about 50% more rice minikits distributed than in 1979-80. Minikits in wheat and maize have been reduced to some extent and range from about 5000 to nearly 8000 and maize and in wheat from a little more than 2000 in 1980-81 to nearly 5000 in 1982-83. These variations are dependent on seed supply, how many varieties are to be distributed and the demand from the ADOs as they meet in the regional planning sessions.

The abuses of the first three years of the program were to be corrected by the policy statement issued by the Department of Agriculture. This will require a level of supervision within the extension service and in the commodity programs.

Basically, the objectives of the minikit program are still valid. Weaknesses reported in the APROSC evaluation and more recently are not weaknesses of the minikit program but in implementation. They are not peculiar to the minikit program and could be found in the regular result demonstration program.

Minikits have provided an excellent means of seed dissemination. If 50% of the 200,000 plus minikits reached different farmers and each farmer gave, sold, or exchanged seed with at least five of his neighbors the program has reached half a million farmers in the course of the project.

The program needs to keep the objectives of the minikit in mind, which are as follows:

"1) To help increase production by quick dissemination of improved varieties,

2) To popularize the varieties and component technologies,

3) To give a choice of varieties among farmers,

4) Evaluation of the selected varieties and technologies and to maintain a feedback system for researcher and extension." (from DOA policy statement).

The minikit program is dynamic and continues to change. Weaknesses now may be less apparent than in 1980-81. Evaluation should include the system itself. Weaknesses still apparent include -

1. The single variety minikit which gives the farmers a choice

between his variety and the new one. It does not give a choice between or among minikit varieties. Two or three varieties each with 100 different farmers in the same region could lead to the demand for all varieties from the same region yet if all varieties were given to 100 farmers this number would narrow to some number less than those two or three because the 100 farmers would have an opportunity to evaluate all varieties and the choices of the majority would identify one or two as most acceptable. The wheat program, in the initial years, had a deliberate one-variety minikit program to create genetic diversity by getting farmers to adopt more varieties in a region to reduce the problem of genetic vulnerability of RR 21. This to a measure has been achieved and may no longer be a valid reason. Presently it does not appear possible to identify regional adaptability from minikit performance. This continues to create problems for follow-up seed programs as well as varietal maintenance of too many varieties by breeders. Some enterprising ADOs assembled the minikits into groups so that farmers could make comparisons and be more likely to show a preference for a small number of varieties in a given district or region.

Resolution of the problem can be partially achieved by determining regional adaptions or preferences before widespread dissemination of one-variety minikits. Farmer field trials and some minikits of more than one variety which are closely monitored by the commodity staff would establish which varieties could be used in one-variety minikits.

2. Clinging to varieties for a period of eight or more years would appear to be a product of stagnation or not getting the areas of adaptation well enough identified which necessitates a longer period for a variety to be in a minikit program. It could also

mean a lack of dynamism in the breeding program. The fact that a variety like Masuli is still spreading in Saptari and Siraha districts indicates a problem of lack of focus in the distribution of minikits.

3. The minikit is a result demonstration and can serve in place of the old result demonstration. The extension services could well afford to eliminate the less effective of the two systems. The minikit serves for seed dissemination. The production program utilizes seed multiplied from minikits (and Preproduction Verification Trials) so the result demonstration would appear to lack a place in the overall extension strategy. Where a defined area (pocket or special) program is under way, the minikit should be concentrated in other areas of the district or region.

4. The minikit program has provided a useful linkage between extension and research so that both can be involved with the farmer in a continuing process of creation-transmission-adoption of technology.

5. Uneven financing seems to have deterred the rice minikit program for the Hills. With new varieties there are excellent opportunities to get these varieties disseminated through minikits.

   Other financing problems appear to be the travel restrictions imposed on the staff at the research centers. Better deployment, not as a large team but several teams going in different directions might enable the commodity programs to monitor the minikits more effectively.

6. Keeping the minikit report card evaluations up to date if researchers are to take advantage of the information provided. The reaction of farmers and extension are valuable guides to the

research program. If these report cards are ignored it means research is not keeping abreast of the farm-level situation or the data because of faulty card design or reports are not valid or relevant. If the latter, then the commodity programs need to change the cards to make them relevant and the data meaningful.

7. It appears that it would be appropriate for the DOA to review the policy statement of 1980 and the practices that have been involved in order to maintain the minikit program as a relevant program for extension, research, and farmers.

The recommendation of the USAID review of ICP in January 1983 are relevant to the review and are presented below for guidance, administration and implementation of the minikit program.

a) The minikit program should continue and the commodity programs should direct the programs but with more consultation of the ADO's and the Cropping Systems Program in designing minikits for specific areas.

b) The minikit program should be directed more to areas where improved varieties are not grown, those areas to be identified by surveys.

c) As the minikits are distributed JT/JTAs should instruct farmers about the complete management package: variety, fertilizer and other cultural practices, plant protection, and how the variety fits his cropping system.

d) The farmer feedback on reaction to varieties should be obtained by surveys conducted from the district office. Sampling farmers rather than a voluntary response would give more valid information on varietal performance.

5. Linkages with other projects for technology transmission

The "mandate" of the ICP included production but since the project was nationwide the means of influencing production by the limited staff and funds available to the project had to be managed in such a way as to make the resources of funds and manpower effective.

The expansion into production at sites where cropping systems research work was being done was natural and straightforward. The relationships to other areas required different arrangements since many districts were covered in the mandates of other development projects.

The question would be, how could the cropping systems technology and extension methodologies be transferred to the other projects and be accepted by them. Two seminars in 1981 gave an opportunity for the ICP to present information on these various aspects of the cropping systems program. The first, "Nepal's Experience in Hill Agriculture" in March-April 1981, a paper[1/] presented some of the economic results of the Cropping Systems program with implications of these potentials for Hill Agriculture. In the seminar on "Appropriate Technology for Hill Farming Systems" (June 1981), five (Appendix B.) out of 14 professional papers presented covered the various aspects of the cropping systems technology. Representatives of donor agencies and projects were participants in these seminars so that there was a good opportunity for them to become acquainted with concepts, the technologies, and methodologies of on-farm research and technology transfer. The recommendations of the second seminar were quite specific in addressing the needs of Hill farmers and supported the farming systems approach to development and transfer of technology for small Hill farmers, and endorsed the technologies and methodologies of the Integrated Cereals Project, especially the cropping systems research and extension approach.

1/ Rana, Prithu N. and Sudarshan B. Mathema, Changes in Relation to Productivity and Income in Hill Farming Systems, Nepal's Experience in Hill Agriculture, ADC, 1981.

The participation of the staff of ICP in the crop commodity semi-annual seminars and the participation of personnel from other projects gave good opportunity for an exchange of information and ideas related to the utilization of the information by other projects. The projects most logically to take early advantage of this information would be sister projects funded by USAID, and this opportunity was probably the first real effort to have another project utilize the methodologies and technologies in their project production activities. The following report on a sister project illustrates the collaborative effort to utilize the manpower, technology, and methodology of the Cropping Systems Program in other projects.

Because national production was beyond the scope of ICP the best way to assist in production aside from the small areas adjacent to the cropping systems site research centers was by training. The manual "Guidelines for Preproduction Verification Trials of Cropping Systems Recommendations" was prepared and training courses organized for all groups and agencies that could be accommodated by the staff of the Cropping Systems team. Training was continued from 1981 to the end of the project period. These training programs have reached staff in the Rapti Zone project, the Resource Conservation and Utilization Project (the most recent in May 1985), the Hill Food Production Project, the Agricultural Extension and Research Project, CARE/SFDP, the KHARDEP, as well as staff of the Department of Agriculture's Badhi Utpadan Karyakram production campaigns in the Terai, first with five districts and then with 17 districts.

The training was first attempted at more centralized locations but ultimately was taken to the districts themselves wherever the trainings could be organized.

After training and prior to the preproduction verification trials,

Cropping Systems staff assisted, sometimes on a contract basis, in the site surveys and preparation of site description reports. These are listed in Appendix C, and include nearly 50 sites in 36 districts, mostly in the Hills.

The ICP staff followed up with monitoring the performance of the Preproduction Verification Trials and prepared several reports covering data collected in 1981, 1981-82, and 1982-83 (Appendix B).

a. Rapti Rural Area Development Project

The Rapti Rural Area Development Project organized training programs for their district officers in Nepalgunj in 1981, where the ICP staff were the main resource persons. After receiving the information the officers felt that the JTs/JTAs responsible for implementation would also need training and another training program for this group was held at Khumaltar. To provide further support two Peace Corps Volunteers with ICP were transferred to the RAD project to assist in conducting preproduction verification trials in the project districts. The training programs were held in March and April 1981 and the transfer of the PCVs took place in August 1981.

The real cropping systems zonal program began with the winter season of 1981-82 with the objective of utilizing the cropping systems approach to agricultural extension in this new project in the Hills. The PCVs worked for one year until the end of their tour, October 1982, and then returned to the project under contract to PADCO as Cropping Systems Specialist in April 1983.

The cropping systems methodology of site survey, preproduction verification trials and production was followed, with good results. In addition to the earlier training, twenty five of the JT/JTAs staff and others were trained in a 3-weeks course in 1985 in cropping systems methodology for site description for organizing production programs.

Surveys have been completed in 27 panchaysts in the five districts. Production programs in 1984 Kharif were organized in 12 panchayats but involved at least two sites and farmers groups since an upland and a lowland pattern was involved in each panchayat. The total area in maize and rice was 215.5 ha. involving 567 farmers or only 0.38 ha per farmer.

Two maize production blocks involving about 25 ha. in Dang were failures. For the other maize production blocks yields averaged 3.96 T/ha. There are no records of farmers in adjacent areas but the PPVTs showed good percentage increases in yield.

In the following wheat season, 1984-85, 52 sites had a little over 1000 ha. in production blocks and a similar area for rice is projected in 1985, Kharif.

Based on reports,[1/] results and benefits of the program include -

1. A much more active extension program of on-farm demonstrations, an increase in activities of three to four fold.
2. Surveys completed in 24 of the 27 panchayats in four districts. Reconnaissance indicates that it may not be necessary to make surveys in every panchayat since other panchayats may be similar to some which have already been surveyed.
3. Saving seed from PPVTs has enabled farmers to have seed available for production programs. Farmers have had active support from the ADO's through a seed storage bin program.
4. Because new varieties have been in the PPVTs, farmers' acquaintance with these varieties may be as much as 5 years ahead of other districts in the Western Hills.

1/ Smith, Sandy. Project completion Report. Rapti Integrated Rural Development Project, April 1985.

5. Introduction of new wheat varieties reduced risk to farmers since the project zone had had almost 80% of the wheat area planted to RR 21 which has become susceptible to leaf rust.

6. Rice varieties which were more productive and had acceptable straw production were identified.

7. Instead of the general fertilizer recommendations for maize, lower, more appropriate levels were verified and were adjustable to the level of compost farmers use.

8. Surveys identified Pyuthan as a district more like Terai and PPVT components were more appropriate than those use in the traditional result demonstration.

9. Although just beginning, block production programs are considered the only way the extension service can conduct realistic production programs.

10. Development of extension visual aid materials should continue to be based on the results of the PPVTs.

11. Staff training in refresher courses should be an annual program.

12. A production program can be initiated when only one crop in the pattern has the appropriate technology.

This effort by a sister project is probably the most completely documented and provides excellent support to the cropping systems approach as an extension system as well as an adaptive research system in farmers' fields.

b. Resource Conservation and Utilization Project

The RCUP's most recent report indicates that they have PVTs with 25 farmers in Myagdi district and 34 farmers in Gorkha District with some additional PVTs in Mustang. The linkages with RCUP have been good, again partially the result of the common funding agency.

c. Koshi Hills Agricultural Program

The Koshi Hills Agricultural Program (KHAP) of KHARDEP has taken advantage of the cropping systems approach developed by ICP. Operating out of 12 service centers in four districts, the process of site description and preproduction verification trials has been established preparatory to production programs to follow. They have drawn heavily on the cropping systems methodologies and seek to use these for more specific recommendation domains for different agroclimatic situations which occur in that zone. Keys to implementing the on-farm cropping systems trials and the extension programs are a) local staff selected from local people who have a high level of credibility and integrity and b) fortnightly meetings held at each sub-center. They consider "Farming Systems research methodologies are the basic entry point in developing integrated program technologies for crops, livestock and forestry appropriate to the diverse situations of hill farmers."[1/]

d. Small Farmer Development Projects/CARE

CARE in collaboration with the Small Farmer Development Projects of the Agricultural Development Bank/Nepal have utilized the assistance of the Cropping Systems staff in training, site surveys and descriptions. Personnel trained in the program are active in implementing methodologies developed by the ICP. The technologies introduced have had a definite impact on "increasing crop yields of the many hundreds of farm families"[2/] of the SFDP.

e. Agricultural Extension and Research Project

The activities of the Agricultural Extension and Research Project

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1/ Willett, A.B.J., Koshi Hills Agriculture Programme, an outline, September, 1984.

2/ Personal Communication from Tom Alcedo, CARE, April, 1985.

included support to four regional research centers, especially in the area of research outreach from these centers and in the organization of meetings of research and extension staffs on a bimonthly basis as a part of the Training and Visit System of the Project. This gave opportunity to introduce concepts for adaptive research in farmers' fields and the cropping systems approach to technology development. The Guidelines manual was abridged and used as a guide for the staffs of the various centers. Limited success was achieved from the efforts, but the socio-economic components of site surveys, prior to preproduction verification, were largely ignored.

Production programs were initiated in the AERP districts which necessitated some effort to synchronize the T and V system with the production effort. The Project Coordinator as well as production staff made sincere efforts to accommodate both concepts and staff to endeavor to make the production program and the T and V system integral parts of the program of the Department of Agriculture. Since production is the ultimate aim of the T and V System of extension the incompatibilities are primarily administrative concerning staff salaries and the use of "contact" farmers in the production program.

f. The Hill Food Production Project (HFPP)

The HFPP had support of the Cropping Systems Program personnel in training staff in the initial stages of the project in 1981. Although the methodologies were not followed explicitly, results of on-farm trials radiating from the agricultural services centers (ASC) where they were under the management of the Senior Subject Matter Specialists created good information[1/] on varietal performance in wheat (UP 262), rice (Khumal 3), maize in upland (Khumal Yellow)

1/ Gorrez, F.D. Jr. End of tour report, Hill Food Production Project, Nep/80/019, Department of Agriculture, December, 1983.

and lowlands (Arun 2). These results were related to land types and patterns in which these varieties were best fitted. Based on these results decisions were made to proceed with the Impact Production Block as a means of increasing production and farmer welfare. In 1983-84 wheat production was programmed on 230 ha.

g. Initiatives of individual Agricultural Development Officers

Perhaps of greatest significance in the linkage story is what can happen in the case of individual initiative in a non-project district. Mr. Vinod Sharma, an Agricultural Development Officer of Kaski district had attended IRRI's Cropping Systems training program in 1980-81. The activities and results of the cropping systems site at Pumdi Bhumdi in Kaski district were familiar to Mr. Sharma. When it appeared that results of Khumal 3 (then K 39) rice and Arun 2 maize were showing promising results he became interested in utilizing this technology in other areas of the district. A site survey (Appendix C) was conducted at Ghachok with assistance from the Cropping Systems staff. Pattern trials of three patterns, five farmers with each, were established in 1982-83 based on the survey and trial information from Pumdi Bhumdi. Since new technologies had not been widely adopted by farmers there was an opportunity for an increase in production to occur. PVTs were continued through 1982-83. Results indicated the patterns could provide yields of about 10 T/ha per year with increases in yield over the local farmer practices of, 85, 91, and 117% for the rice-wheat-maize, maize/finger millet-wheat; and maize-rice-fallow patterns respectively. Varieties contributing to these increases were Khumal 3 in rice, UP 262 in wheat, and Arun 2 in the lowland rice-wheat-maize pattern and Khumal Yellow in the rice-maize and maize/finger millet-wheat pattern.

Pilot production with Khumal 3 and Arun 2 started after the first pattern trials were conducted. Areas continued to expand in these

and the other new varieties. In 1984 there were 20 ha. of Khumal-3 and in 1985 it is estimated the area will be 50 ha. In 1985 Arun 2 will nearly saturate the 70 ha. maize area devoted to the rice-wheat-maize pattern and Khumal Yellow in the other two pattern areas. UP 262 and RR 21 were the predominant wheat varieties in the 1984-85 crop occupying 10 and 40 ha respectively.

The enthusiasm of the farmers has created considerable interest among other farmers and field days in the wheat season and the rice season are attended by farmers from many surrounding panchayats. The Ghachok farmers have became a seed village and are a source of supply to the neighboring panchayats. Even though the ADO has changed the interest in Ghachok has been sustained by the new ADO who is instrumental in organizing the Farmer Field Days which are so well attended.

It would appear that this type of activity could be replicated in many districts and areas within districts so that small scale production programs could emanate from the surveys and preproduction verification trials conducted by farmers in their fields.

h. Summary

Although the above instances do not cover all the project areas of Nepal they serve to illustrate how linkages can be developed and what can be accomplished when the technologies and methodologies are utilized. It is significant that the ICP is a part of the Department of Agriculture and it is thus the Department of Agriculture that has the technologies and methodologies to provide to the projects and project areas of the country. Although the technologies are subject to verification, the methodologies for doing so have been developed and these further extended into the means of implementing production programs.

D. Women in Extension

Based largely on need and on the detailed study[1/] of Women in Nepal the work plan for ICP 1982-84 dwelt in some detail on the development of and utilization of women in extension activities.

In an initial step women were assigned as production leaders in three of the cropping systems sites where production efforts were underway. Four women were assigned in Chitwan, two in Chauri Jahari and two in Khandbari.

The ICP annual report, October 1982 to September 1983 states "This endeavor to use farm women as production leaders was only partially successful since the women were not adequately trained and personnel at the sites were not sufficiently briefed as to the manner in which the women assistants could be of most use to the program." The women served for periods of 6 to 10 months and the report concludes "In retrospect, it might have been better if more senior women agricultural officers had been assigned to the sites, as a first step. They could then train the women production leaders and women JTAs and assist in establishing liaison between the women extension agents and the farm women of the communities."

In the meantime the ICP commissioned a project on "Planning Extension for Farm Women." This was a detailed study, surveying farm women in four different districts of Nepal. The purpose of the study was to 1) define how female farmers can most effectively be reached and what is the information they need, and who at different levels in the extension system should deliver the information, 2) give extension personnel and trainers a better basis for designing programs and training and placing female JTs, JTAs and AAs, and 3) recommend an implementation proposal in which female extension agents can be trained, placed, and monitored.

1/ Acharya, Meena and Lynn Bennett, The Rural Women of Nepal, Center for Economic Development and Administration, Tribhuvan University, Kathmandu, 1981.

This study was conducted primarily by a team of women consultants for six months from December 1983. In addition to 240 women farmers interviewed, the ADOs, JT/JTAs and AAs were also interviewed. In addition policy makers and program planners in the Ministry of Agriculture, Department of Agriculture, the ICP staff, the USAID staff and others were interviewed. The main portion's of the summary and recommendations from this valuable and interesting study are as follows -

"A major finding, which was not directly sought but certainly made this analysis more difficult, is the fact that neither farmers nor extension agents have given much thought to the optimal style and content of extension for female farmers. Most female farmers had difficulty even articulating the problems they face in agriculture, though the problems may be central to their very existence. Likewise, male extension agents, who make up the majority of the extension labor force, were often hard put to define major areas in which female farmers need information. Male extension agents talk primarily to male farmers. Thus, how much weight to assign to their suggestions and/or perceptions of how to reach female farmers? Given this, it became important in the data analysis to balance what the respondents said with impressions from the field and other data sources. It also convinced the researchers that before conclusive recommendations can be made for a long-term national strategy, some of the tentative conclusions drawn from this study must be tried and tested in the field. As an implementation phase was anticipated at the outset of this study, the recommendations seek to be as specific and detailed as possible with respect to follow-up action research."

Following these findings and observations, in conclusion the report made these recommendations.

"1. Improvement of the Extension System

a. The ideal extension agents to reach women farmers are grassroots level (AA) women who are recruited locally, so that they will be familiar with the farmers and the local area. These women should have some education (7-8 class) so that they will be more easily trained, but not so much that they are over-qualified and have high aspirations beyond the village. They should be respectable within the community in terms of age and marital status. The incentive to become AAs should be great enough to encourage such women to become AAs vs other grassroots kinds of workers for whom basic education is also a prerequisite.

b. Ideally the WAA's should be supervised by a female JT/JTA or a male JT/JTA who is aware of and sensitive to issues concerning women farmers and women extension agents.

c. Female AAs should be assigned to smaller working areas so they can more effectively cover their territories.

d. The most effective way to contact female farmers is probably to organize them into informal groups through which women can share information and give each other mutual support.

e. Women, if recruited locally, need not be assigned in teams, since they should be familiar with the territory and farmers. Teams have not always been successful in the past and are an added expense, if not successful.

f. Meeting places for groups should be in accessible locations which will not be too disruptive or distracting for information dissemination. Meeting times should take into account women's work schedules which may vary according to location and season.

g. Childcare arrangements may need to be made to allow for women's participation in extension activities. This may be a simple arrangement whereby a local woman who perhaps is older or landless is hired to tend the children while their mothers are engaged in various activities or meetings.

h. The salaries of AAs should be carefully examined to determine if it adequately compensates their expected workload.

2. Curricula/Training

a. In general, male and female extension agents should receive the same training and this training should be mostly practical, hands-on information.

b. In all of the courses on rural sociology, communications, etc., more emphasis should be placed on the role of women, cultural and social factors influencing women's adoption of new ideas, and the importance of women's participation in extension activities.

c. Extension education courses should include components on identifying and mobilizing female leaders, development and use of audio-visual aids, group organization, and the need to contact more female farmers.

d. Irrigation ranked as the largest problem of female farmers, yet it is not included in much detail in training courses. More training is needed in how to develop small-scale irrigation,

how to mobilize groups to carry out an irrigation project, and where to refer farmers to obtain assistance and information.

e. Kitchen gardening is a major information need of female farmers. Although it is covered in training courses, more detail is necessary with respect to disseminating information to women, who are primarily responsible for the kitchen gardens.

f. Housing facilities need to be provided for female students in a secure location. In the long term, hostels should be constructed. In the short term, other arrangements must be made.

g. Scholarships for women would encourage more participation in training because families are less likely to support daughters in school. Quotas for enrollment should also be set to ensure having women in training courses.

h. Childcare arrangements need to be made available at training centers so women can participate. The arrangements need not be complex or difficult, but may entail the hiring of someone to look after the children. How to set up a simple daycare system for women should also be included in the training curricula.

3. Phase II - A Proposal

A proposal for a two year phase II implementation study is also included herein. This study would include the recruitment, training, and placement of female AAs in the field. Studies would be conducted comparing 1) the effectiveness of AAs who had been supervised by women vs. those supervised by men, 2) those who used an individual visit approach to extension vs. those using a group approach and 3) a comparison between those working in the Terai and those in the Hills. The study would also include a detailed review of all training curricula and development of audio-visual materials for training.

With so much insight regarding women farmers and the who, what, and how questions answered the next question to answer is when. Phase II hopefully will be taken up and everyone can come a few steps closer to effectively reaching this important segment of the farming community.

E. Training

1 - The academic training component sent a total of 33 candidates for degree programs (Table 13). Seventeen were selected for M.Sc. in the USA, six for the Philippines, five in India and one in South Korea. Four candidates were selected for Ph.D. programs. Two went to UPLB in the Philippines and one each to the USA and India. These numbers were more than originally scheduled but sending some to India where most of them were supported by non-dollar funding and some to the Philippines enabled a greater number to be accommodated in this program.

Irrespective of country of training, the students required a greater number of months to complete their degree programs than originally scheduled. M.Sc. programs averaged 31 person months for completion against the 24 months originally programmed or 6 to 8 months more time required. Only two candidates completed their programs in the allotted 24 month period. For Ph.D. degrees the average additional time required was only 3 months more than the 36 months scheduled.

The primary objective for academic training was to improve the capability of the commodity programs and the cropping systems programs. Although one Ph.D. and two M.Sc.s were selected specifically for cropping systems agronomy, none of these are now directly related to the cropping systems program based at the Agronomy Division at Khumaltar.

There is only one Ph.D. now associated with the crop in which he received training. The one trained in grain legumes has a post as jute agronomist in Tarahara. The one with a Ph.D. in extension has a post as ADO but is serving as Executive Director at APROSC. The fourth was selected from extension to pursue an agronomic degree in cropping systems. He has returned to extension where hopefully his cropping systems training will be valuable in implementing extension programs based on cropping systems.

Table 13 - M.Sc. and Ph.D. degrees completed under the Integrated Cereals Project - 1976-84

	Name	Program	Degree	Completed	Institution
	1976 SELECTIONS				
1.	Thaneshwar Pokhrel	Wheat Breeding	M.Sc.	Feb. 1979	New Mexico State University
2.	Rajman Choudhary	Soybean Agronomy	M.Sc.	Feb. 1979	Tuskegee Institute, Alabama
3.	Ganesh K.C.	Entomology	M.Sc.	April 1979	University of California, Davis
4.	B.R. Adhikary	Rice Breeding	M.Sc.	June 1979	Texas A & M University
5.	Shiva K. Chaudhary	Soybean Agronomy	M.Sc.	Not returned	University of Illinois
	1977 SELECTIONS				
6.	Ragvendra Misra	Soil Microbiology	M.Sc.	Sept. 1980	University of Missouri
7.	J.R. Baral	Extension	Ph.D.	Nov. 1981	UPLB, Philippines
8.	Kedar Upadhya	Extension	M.Sc.	Aug. 1980	Punjab Agric. University, India
9.	D.N. Choudhary	Cropping Systems Agronomy	M.Sc.	July 1981	Himachal Pradesh Agric. Univ., India
10.	C.R. Yadav	Maize Agronomy	M.Sc.	April 1980	Punjab Agri. Univ., India
11.	B.K. Gyawali	Entomology	M.Sc.	Dec. 1981	UPLB, Philippines
	1978 SELECTIONS				
12.	Gyan Lal Shrestha	Rice Breeding	M.Sc.	Sept. 1981	Seoul National University, S. Korea
13.	Kaushal K. Lal	Maize Breeding	M.Sc.	Jan. 1982	Kansas State University
14.	K.K. Sherchand	Maize Agron./Breeding	M.Sc.	Not returned	Kansas State University
15.	B.B. Mathema	Rice Breeding	Ph.D.	Oct. 1982	UPLB, Philippines
16.	N.A. Khan	Cropping Systems Agronomy	Ph.D.	June 1984	Himachal Pradesh Agric. Univ.
17.	M.L. Sah	Wheat Breeding	M.Sc.	June 1983	Punjab Agri. Univ., India
18.	R.N. Shah	Soil Science	M.Sc.	Not returned	University of California, Davis
19.	D.N. Manandhar	Rice Entomology	M.Sc.	Oct. 1982	University of California, Davis

	Name	Program	Degree	Completed	Institution
	1979 SELECTIONS				
20.	B.P. Upadhyaya	Rice Plant Pathology	M.Sc.	Dec. 1982	UPLB, Philippines
21.	M.P. Upadhyaya	Wheat Breeding	M.Sc.	Not returned	Kansas State University
22.	R.C. Munankarmi	Wheat Agronomy - Soils	M.Sc.	Aug. 1983	Ohio State University
23.	D.N. Sah	Maize Pathology	M.Sc.	Not returned	University of Wisconsin
24.	B.K. Baniya	Maize Breeding	M.Sc.	Dec. 1982	University of Florida
25.	R.S.L. Karna	Wheat Pathology	M.Sc.	Dec. 1982	Alabama A&M University
26.	S.L. Shrestha	Cropping Systems Agronomy	M.Sc.	April 1983	UPLB, Philippines
27.	J.D. Rana	Agric. Engineering	M.Sc.	Sept. 1983	Utah State University
	1980 SELECTIONS				
28.	K.K. Shrestha	Cropping Systems Agronomy	M.Sc.	June 1984	Arenata U., Philippines
29.	M.P. Bharati	Grain Legumes Agronomy	Ph.D.	Dec. 1984	Iowa State University
30.	M.L. Jaiswal	Oilseed Breeding	M.Sc.	May 1984	North Dakota State Univ.
31.	N.K. Rajbhandari	Soil Science	M.Sc.	May 1984	UPLB, Philippines
32.	B.M.S. Basnet	Agronomy	M.Sc.	April 1984	UPLB, Philippines
33.	R.P. Shah	Grain Legumes Breeding	M.Sc.	Sept. 1982	Punjab Agric. Univ., India

Five of the staff supported for M.Sc. have arranged their own financing and will have received a Ph.D. degree when and if they return. One person sent for a one-year training program also has received a Ph.D. degree. Another received a Ph.D. degree, after an ICP supported M.Sc., under financing from the government of South Korea. Including the Ph.D. from South Korea eight more people should have Ph.D. degrees in addition to the four supported by ICP funds. These personnel with additional training should make a significant contribution to programs but because of the long periods away from Nepal it is questionable how these can be accommodated in the ongoing programs so that their training can be effectively utilized.

Long term academic training is long range in its effect on man-power development and is an essential part of manpower development for the over all needs of research, extension and administration of research and extension. Because of normal attrition, transfer, even retirements, this is a phase of manpower development that requires continuing attention. Hopefully this phase of manpower development can be programmed beyond the limitations of project-oriented support or needs.

2 - As academic training has a role the role of short term training is also important. In support of time bound projects short term training has an earlier payoff. Staff are selected more specifically to undergo training related to what they are doing. They come back to the same post after a two to six or seven month program and hopefully can utilize their training experience immediately.

The training programs of the IARCs are designed for such personnel so experiences of trainees are relevant to their own assignments. IRRI and CIMMYT primarily, and to a lesser extent, ICRISAT and IITA have provided significant levels of training to the staff of the Department of Agriculture. Other training programs have been provided by the universities in the USA and US Department of Agriculture.

During the life of the project 82 persons have received nearly 318 person months of training. Related to academic training, these 82 persons were about 2½ times the number of academic trainees and received 30% of the amount of the training time.

Training concentrated on crop breeding, crop production, soil fertility and cropping systems. Lesser numbers were trained in plant protection disciplines, in agricultural economics, agricultural engineering and extension.

Because of regulations, trainees were almost exclusively staff holding only regular appointments. This meant that quite often personnel holding critical Class III positions, especially in production, were denied this training that could have made them more effective in their roles as production agronomists or extension staff.

3 - The third category of training activities includes conferences, workshops, and monitoring tours. Some, like the research policy seminar at the University of Minnesota have provided opportunities for Ministry staff to participate in strategy seminars. More frequently, research personnel who are leaders in their respective commodity or program participated in conferences and working group meetings while in addition more junior staff participated in monitoring tours.

These activities gave an opportunity for staff to present results of research and extension activities in Nepal and in return they had an opportunity to learn what other countries were doing as well. These peer groups provided an opportunity to share ideas as well as research results and these interchanges, as in the case of IRRI's cropping systems network, have had a significant effect on the activities of programs in member countries.

This category of training was not always funded by ICP but did relate to ICP activities and was counted in determining that 133 persons were

provided these opportunities over the course of the project for a total of 54 person months of time.

4 - In-country training through the ICP was to provide support and strengthening to the ongoing training programs of the Department and to provide ad hoc programs that would augment these ongoing programs. The IADS production agronomists were also training officers who had had their initial experience at IRRI as staff members of IRRI's rice training program.

The earliest training was for the commodity programs. For rice these special programs were handled by the IADS staff. For maize and wheat, CIMMYT staff joined in some of the training programs. These programs were short one to two week sessions concentrating on practical production agronomy. All three commodity programs had regular training programs in which the IADS staff participated. The trainees for these programs were generally staff in extension or in the respective commodity programs.

As these training programs continued to function, training by the IADS staff shifted to the officers of extension and programs were designed for skills training in organizing extension programs and personnel management skills to achieve these extension activities. Consultants from the UPLB, Philippines participated in two of these training programs. This led to a third, primarily sponsored by GTZ which was a more extended six-weeks program in 1980, also with Filipino trainers.

The trainees were required to spend time developing their own individual "reentry plans" which was a plan to show how they would utilize the training they had received. The training period was to be followed by an evaluation of the effectiveness of the training in actually assessing changes that took place in trainee performance. This ultimately took place two years later instead of in about six months

as visualized. The overall reaction of the trainees was that training had been useful and improved their work performance.

The consultants also developed a comprehensive proposal to the DOA for manpower training to be organized on a more systematic and long range basis. This report provided a base for a specific manpower development project funded by GTZ which encompassed in-country training and training facilities at Khairenitar, an academic training program, and long range manpower planning for development.

During the extension of the ICP two other aspects of in-country training emerged as particularly significant. The cropping systems program had developed technologies of value not only in the sites where the program did its research but could also be used elsewhere. They had also developed methodologies for conducting on-farm research which with slight modification could be used by others in extrapolating these technologies to other potential areas. Since these methodologies were new to extension there was a clear need for training extension personnel in conducting site surveys to identify farmers' constraints, their cropping patterns and other relevant information and for training personnel in conducting preproduction verification trials. This constituted an important training activity in the last years of the project.

The pilot production programs taught the importance of trained personnel in managing production programs. Training for production was conducted on a pre-(crop) season basis and on a repetitive basis during the crop season in order to keep contact with farmers' problems and have relevant seasonal technology to take to farmers who were participating in production programs.

The numbers of trainees in these situations were extensive in the last year as the production program expanded into 17 districts. Records are not readily available of numbers of training sessions and numbers of

participants involved. However surveys indicated that farmers valued the assistance of knowledgeable agricultural staff and attributed some of their increased production to the knowledge and help they received from the extension staff. The training program should be a built-in component of every production program, beginning with the training for site surveys and preproduction verification trials prior to the production phase itself.

F. Linkages with other national and international agencies

A glance at Table 3 giving variety releases by the commodity programs will demonstrate the linkages that exist and the importance of these linkages to the ongoing crop improvement programs. The ten rice varieties released during the project period are introductions through the International Rice Testing Program (IRTP) or as breeding material in observation nurseries from which selections could be made. IRRI material is represented in four releases, India in three, Bangladesh in two, and Sri Lanka in one. In the case of wheat the varieties are related to CIMMYT materials but were primarily from crosses made in India at various breeding centers. Only one was from CIMMYT material. The varieties were received as a part of CIMMYT's International variety testing program which has been a continuing part of CIMMYT's participation in the national program. The varieties of maize are more dependent on local breeding efforts but most of them have a base in CIMMYT breeding material. One, Rampur Composite, was a downy mildew tolerant variety from Thailand. Another, Sarlahi Seto, was from a similar type of material from the Philippines.

This brief account attests to the linkages with these two international centers. The fact that rice and wheat have not developed their own indigenous varieties could raise the question why this has not been. The answer would lie in the fact that personnel policies do not allow continuity in breeding effort by breeding personnel to enable them to cross, develop, screen for diseases and insects, evaluate agronomically and release such varieties. Such a program requires sustained effort over an extended period of 8 to 10 years. The present status of breeding effort in rice illustrates the need for a continued linkage with IRRI. In 1983 two transfers took place that affected the sub-tropical program leadership in Parwanipur and the temperate zone program leadership in Khumaltar. The last two years have witnessed an almost complete loss of the temperate zone breeding program and a markedly diminished effort in Parwanipur. Both will have to be rebuilt

under new leadership. In the meantime even more reliance will be required on the variety exchange mechanisms of IRRI.

IRRI has provided excellent support to the national program in other ways. Nepal is a part of IRRI's Cropping Systems Network and through it IRRI has provided encouragement, guidance, literature, seed materials, personnel participation in international seminars and monitoring trips, and invaluable training opportunities for the staff of the cropping systems program and extension personnel related with these activities.

IRRI has provided opportunities for short term training in rice production, socio-economics, cropping systems, soil fertility, and agricultural engineering. Trainees have been attending these programs even before the ICP began and many more have been trained during the project period. In addition to short term training academic trainees at UPLB had IRRI staff members as advisors and facilities and other logistics were provided for conducting their thesis research.

Letters of agreement between IADS and CIMMYT and IRRI were a part of the host country contract from the very beginning.

Almost three years ago IRRI proposed that a formal arrangement be developed between IRRI and the Ministry of Agriculture that would provide a more systematic approach to the types of support that IRRI was providing to Nepal's national programs. Finalization of this agreement is still pending with HMG although approval is assured.

This agreement would include opportunities for administrative staff to develop a closer working relationship with IRRI and Nepal would benefit from more technical guidance by visits from IRRI's staff to the Nepal program. This could be particularly valuable in the next Agricultural Research and Production Project period.

CIMMYT had a resident maize specialist in Nepal in the early 1970's and two CIMMYT staff were available as the ICP began, providing an opportunity to accelerate activities in maize and wheat. CIMMYT staff have provided valuable guidance during field visits of their senior staff in maize and wheat and by more frequent visits of their regional staff members who participated in the wheat and maize workshops as well as in field visits and in-country training.

CIMMYT provided opportunities for short term training in maize and wheat as well as study tours for leaders of the wheat and maize programs. Opportunity for training and for evaluation of maize breeding materials was provided in Thailand by Thailand's Farm Suwan, the Rockefeller Foundation and CIMMYT staff.

During the course of the project linkages were established with ICRISAT and testing materials for chickpea, pigeon pea, and ground nut have been provided. Training opportunities have been provided in chickpea and pigeon pea and for one academic trainee, funding was channeled through ICRISAT and field research facilities were provided. ICRISAT staff have visited trials in Nepal and have made germplasm collections in Nepal of chickpea and other grain legumes in collaboration with staff of the ICP and the Agronomy Division.

ICARDA also has working relationships with Nepal and supplies regional wheat nurseries and chickpea nurseries for the Nepal programs in these crops.

INTSOY has annually provided soybean trials to be conducted in Nepal and Dr. Carl N. Hittle while serving with INTSOY in Sri Lanka was a consultant to the soybean program two different times.

Diplomatic problems have prevented strong linkages with AVRDC in Taiwan. Even so AVRDC staff have made field visits to Nepal and have supplied trial materials of mung bean for testing. IRRI's activities in minor

crops have enabled trial materials to be channeled through IRRI and (more recently) an AVRDC center in Thailand has improved functional linkages with this center.

India has many crop conditions similar to Nepal and Nepal could profit by stronger relationships with crop commodity programs in India. Some attempt has been made to strengthen these linkages by the Indian Council of Agricultural Research which invites rice, wheat, and maize scientists to participate in their crop seminars of the All India Coordinated Crop Improvement Projects. Continued effort needs to be made from the Nepal side as well to strengthen these linkages.

India's seed quarantine policies have virtually stopped the flow of seeds for trials organized by the All India programs. Still, effort should be made here in Nepal to acquire these seed materials for trial purposes. These trials have provided a rich source of germ plasm for the major cereal crops.

G. Physical Developments

1. Buildings

This was probably the most difficult and least satisfactory component of the entire project. The buildings and some equipment were to be financed by PL 480 Indian rupees allocated to Nepal. Buildings were to be contracted and constructed with local architects and contractors. Unrealistic architectural plans, fragmented contracting to supply first civil works, then electrical fittings, then plumbing made the completion of construction a near impossibility. Linking this with generally poor contractor performance and any achievement in this area was a noteworthy accomplishment.

Initially IADS was not to be involved in the construction activities. As time went on more and more involvement became necessary to assist in supervision of construction activities, in clearing contractors billings, and trying to get additional building plans approved and money budgeted. PL 480 funds were allocated to the centers and payments could be made only after certification of running bills by the architect and USAID. Funds would become frozen at the end of the HMG fiscal year and much difficulty was experienced in the course of construction. It would have been much better to have had a turn key construction operation with clearcut financial, architectural, contracting, supervision and management arrangements. Table 14 gives a listing of the construction undertaken during the course of the project. Maintenance problems now that the buildings are turned over to HMG will make longevity a question. Nevertheless the research centers at the moment have definitely better facilities now than at the beginning of the project.

Each center has added officers and staff quarters to accommodate more of people assigned to the center. Offices and laboratory facilities are marginally adequate for the present level of staffing. Seed plants are operable which can greatly improve the handling of

seed for minikits and foundation seed to be supplied to the AIC. Workshop facilities have been improved at two centers and equipment and tools supplied to all three centers so that better machinery maintenance is possible. The electrical and water supplies have been improved at the centers to improve the level of crop management and improve the supply of domestic water for the housing colonies.

2. Equipment

Equipment for the seed plants (Appendix D) were to be procured from India with PL 480 rupees and early on an IADS consulting engineer and Nepali engineer with AIC went to India to survey available equipment prior to soliciting bids. The consequence was different types of equipment procured but no one to integrate the items into a working unit. A great amount of consultancy time toward the end of the project has been devoted to making the equipment operable and trying to train staff to utilize the equipment. Even then commitment and funds may be lacking to make the three units useful to the research centers for processing the breeder and foundation seed which each center produces.

Other equipment items (Appendix D) were procured to enable laboratories to function or provide better field equipment, or land shaping equipment. The soils, pathology, and entomology laboratories of the commodity centers are only marginally functional. Lack of use rests to some extent with the unavailability of manpower. There is also a question of whether too high a level of sophisticated equipment was procured for some activities. Items such as those used in running routine milling tests on rice samples are largely unused since the resident specialists departed. Part of the problem is the reliability of electricity at the research centers and part is a lack of plumbing to provide water to laboratories such as soils and pathology. At the close of the project funds have been committed for procurement of vehicles, tractors, additional laboratory equipment,

visual aids, field equipment, photographic equipment typewriters and additional spare parts for existing equipment.

3. General upgrading of research centers

Upgrading the research centers was undertaken at the three commodity centers and at Khumaltar. Bhairawa received first attention and the IADS consultant had a good Nepali engineer to work with so that land shaping and extension of the irrigation system was accomplished to everyones general satisfaction. With better water control along with better crop management, production at Bhairawa has significantly improved.

Plans were developed for Rampur, Parwanipur and Jumkha but only Rampur was partially reshaped to make use of an irrigation system which is still to become a functional reality. Without local initiative the services of the good engineer were lost to a graduate program and for other purposes when he returned.

Improvement and reactivation of an irrigation system at Khumaltar was jointly attempted with SATA but to date the system is still inactive because pumps (supplied by SATA) have not yet been installed. Once operational, the development will be only partially complete. The initial creation of fields, with bunds, for upland crops did not provide for adequate drainage and the problem will be aggravated once irrigation water is available to these fields. Khumaltar could ultimately be worse, not better off, for the creation of an irrigation system which will supply greater amounts of water.

This irrigation problem at Khumaltar is only a part of the obviously apparent need for an overall development, operation and management plan for Khumaltar.

The buildings in the Hill centers were to supply better seed storage facilities and other warehousing needs at these centers.

Table 14 - Summary of Construction and Station Improvement Activities under the Integrated Cereals Project at the close of the project, May 1985

Activity

1 - National Rice Improvement Program and Agriculture Station, Parwanipur

Office/Laboratory Building
Threshing Shed
Seed Plant/Storage
Workshop
Advisor's Quarters

Greenhouse
Generator House
New Transformer and electrical wiring
New irrigation well and pump
Pump house cum guard house

2 - National Maize Development Program and Agriculture Station, Rampur

Office/Laboratory Building
Advisor's Quarters
Farm Water Supply
Farm Electric Supply
Seed Plant/Storage/Generator House
Officer Quarters

Staff Quarters
Workshop
Threshing Shed
New Transformer with electrical wiring
Irrigation well with electric pump, fully activated, landshaping completed on 50% of the command area of the new irrigation well

3 - National Wheat Development Program and Agriculture Farm, Bhairawa

Office/Laboratory Building
Staff Housing
Workshop
Seed Plant/Storage

Generator Shed
Soils Laboratory
Irrigation system extended for the entire farm

4 - Agricultural Research Complex, Khumaltar

New Transformer and new electrical wiring to all buildings
Irrigation system, civil works, incomplete, pumps to be supplied by SATA yet to be procured and installed
Renovated water supply system to offices and laboratories
Maintenance painting of Agronomy Building
Assisted Agricultural Engineering Division in construction of workshop building

5 - Hill Storage Buildings at

Daman
Kakani
Jumla
Jiri (Kavre)
Doti
Dhankuta

IV. EVALUATIONS

For the first two years there was an annual in-country project review conducted by USAID, HMG and IADS, including representation from the Ministry. These activities helped to keep these agencies acquainted with progress of the project, the direction in which it was going, and problems encountered.

In 1979 the first external mid-term review was held when representation from IRRI and CIMMYT and IADS along with representatives from HMG and USAID reviewed the technical progress and prepared a report giving 16 recommendations. Seven of the sixteen related to the cropping systems program including pilot production programs, expansion to farming systems to include livestock, and stronger linkages with soils and agronomic research. A proposal was made regarding the creation of a Farming Systems Program with the status and permanence of the crop commodity programs. The latter may finally coming to fruition in the project to succeed ICP.

More focus on minor crops, which are important crops in Hill cropping patterns and as food for subsistence farmers, was stressed as well as more problem specific research in the major commodity programs.

In 1980, the Ministry of Agriculture Commissioned APROSC to conduct an evaluation of the project. The report independently supported recommendations of the 1979 evaluation regarding minor crops research. The report recognized the need for good verification trials as results are moved to other locations. The ICP has now developed a full methodology of technology transfer by cropping systems extension methods.

In connection with cropping systems the six study areas identified in the first work plan were noted and the report suggested that emphasis should be given to these as research activities. Fodder and fodder trees are now being addressed by ICP in Pumdi Bhumdi as a part of an

[illegible] farming systems research program. Manpower limitations have been a continuing constraint which required that priorities had to be established so as not to dissipate this resource.

Land classification should be on a more "scientific" basis which, with a stronger linkage with soils as noted in the other report would be achieved. In the meantime the land capability classifications that have been established provides a farmer-related base which is usable by extension and understandable by farmers.

Two good points related to the cropping systems research activities and the extension staff and to farmers. As time progressed much of these problems have been overcome. Familiarity of activities by ADOs and acceptance of methodologies has enabled ADOs to move technologies to their districts for verification and production. Farmer acceptance of new varieties at a more rapid rate in the site research areas indicates farmers are being consulted and are a more active part of the evaluation team and as a consequence take early advantage of technologies that are acceptable to them.

The comments regarding commodity research were related to crop conditions in cropping patterns, an indication of an in-depth perception of cropping systems that the commodity programs could emulate.

Welfare of small subsistence Hill farmers caused the report to re-emphasize the need for developing suitable technologies for the Hills, meaning that these would be less input intensive. This same position has been stated in recent reports from ICP. Presently there are varieties like Arun 2 maize and Khumal 3 rice that are able to make an impact with limited inputs. Even Khumal Yellow maize has been able to make significant yield increases with only compost as a source of nutrients. It still remains for extension to adopt these low input technologies as part of the extension recommendations.

The question of sustainability of minikits and cropping systems verification trials was raised in the report. It was pointed out that the inputs for these trials were supplied free to farmers and if the program expanded, costs to HMG would increase. Since these are result demonstrations they should fall under the existing budgeting process and replace the more sterile components of the existing extension system. The question is more than sustainability and is a question of what to sustain as a part of the extension system. The new methodology offers a viable mechanism of technology transfer and with a built-in seed component as well. The production phase to follow requires management of staff, collaboration with other agencies and organization of farmers into impact block production. The production program should be self-financing since farmers are supplying their own inputs. The merit of the new technology should be that it does not require government subsidy for it to be adopted and be effective in improving production and farmer welfare.

The next external review was held early in 1983. In conclusion the evaluation rated the ICP as a successful project, especially when compared to other research projects in other countries which have been financed by USAID. With the availability of farm-proven improved technologies the evaluation rated Nepal on the front edge of a major increase in agricultural productivity. However, there are basic reasons, primarily in the area of administration, why this may not happen. An effective management system capable of setting priorities and overseeing programs for research and extension and a significant improvement in the input delivery system for fertilizer and seeds, credit facilities and extension services, are essential if a major increase in agricultural productivity is to occur.

In view of the value of the technologies developed and proven methods of transfer demonstrated in pilot production programs, it was apparent to the evaluators that other projects and district personnel should take advantage of this information and use it in their areas of

responsibility. The ICP staff would then be more free to concentrate on training other project and district staffs to enable them to effectively utilize the technology and methodologies.

Special emphasis was placed on research management, strengthening the commodity programs, including the minor crops especially those in the Hills. Creating an effective evaluation and screening facility for variety testing in the Hills was stressed.

Minikits should be continued but the role of the commodity stations for producing foundation seed was questioned because of its competitive relationship to research itself. Additionally, the wisdom of having seed plants at the commodity stations which were inoperable because of lack of operating funds and trained manpower was justifiably questioned.

Research management, accommodation of an effective socio-economic component in the DOA and institutionalizing cropping systems into an expanded farming systems research program were dealt with in detail. Since these recommendations came toward the end of the project and just in advance of the development of the project implementation document and the project paper for the Agricultural Research and Production Project, many features were incorporated in that project. USAID's continuing concern for agricultural development had the performance of the ICP on which to build another project that would further strengthen HMG capability in research and extension.

The evaluators expressed the opinion of the majority of individuals contacted that the cropping systems program was good but they themselves doubted its continuity beyond the end of ICP without outside support. The opportunity for this continuity appears assured over a period long enough to enable a satisfactory transition to an institutional and financial base within HMG.

Endorsing this continued support can be gathered from other reports. The

World Bank[1/] cites the work of the Cropping Systems Program of ICP as a means of overcoming difficulties in transferring experimental results to farmers' fields. The CSP overcame these difficulties by carrying experimental results to farmers' fields where the technology was adapted for the specific socio-economic and agro-climatic conditions. Additional steps were taken to verify the technology in multi-location (preproduction verification) testing and then to use the technology on a wide scale in production programs. Referring to production efforts in the Narayani Zone the report commended the Cropping Systems staff for "ingenuity and dedication" and the district staffs for "competence and dedication". They stated that such production programs need to be "implemented through the institutional base that is being created under the research and extension (World Bank) projects."

The Asian Development Bank[2/] in its sector study made special emphasis of the on-farm research of the cropping systems programs.

While endorsing the technology development of the cropping systems program they were analytical in their assessment of the causes for stagnation in agriculture in Nepal. They stated "the underlying causes responsible for the present lack of progress in agriculture are mainly organizational and institutional. Administrative bottlenecks and limitations to progress include:

"(i) lack of a well-defined operational strategy for agricultural development;

(ii) inadequate planning and the establishment of unrealistic and unattainable targets given limited resources;

1/ Nepal, Recent Developments and Selected Issues in Trade Promotion, Report No. 4663-NEP, World Bank, Oct. 1983.

2/ Nepal Agriculture Sector Strategy Study, Vol. I and Vol. II, Asian Development Bank, Dec. 1982.

(iii) poor systems for monitoring and program evaluation leading to an inability to ascertain causes of failure or to apportion responsibility;

(iv) overemphasis on the construction of physical facilities with little attention to how these facilities are to be used for service delivery;

(v) inadequate service delivery of essential inputs and insufficient resources made available to required institutional supports for research, extension, credit, and adoption of new technologies;

(vi) inconsistent and, at times, contradictory policies with respect to the pricing of inputs which are often based on short-term considerations and frequently restrict rather than accelerate agricultural growth; and

(vii) ineffective deployment of existing trained manpower which are not being fully utilized due to a lack of financial resources, proper work organization and incentives for performance."

Perhaps the best evaluation of a project are the reactions of the host country personnel and organizations. In an analysis of agricultural sector planning[1/] the author considers that the ICP is one of the projects that are truly farmer oriented. At the time of preparing the report the author noted that the ICP strategy of implementation was 1) trials directly in farmers' fields, 2) on-farm research on a farming systems basis rather than single crops, and 3) the socio-economic analysis of agronomic research results. Seed dissemination by minikits was considered another vital component since seed is an input that is easiest to spread even to remote regions. The project was viewed as a bottom-up project wherein the farmer and his circumstances are taken into consideration in developing research and the resultant technology for farmer use. By contrast, the top-down approach of agricultural

1/ Pradhan, Bharat B. The Overlooked Link in Agricultural Planning - The Farmer. A report to the World Bank, 1981.

planning "obviates the need for proper study and understanding of the micro-situations (in which farmers exist). On the basis of a limited survey or study, generalizations are made and projects are formulated on this basis, and in the process the farmer is treated at best as a beneficiary and at worst as a variable like any other input. That he is a principal actor in agricultural development has not at all been appreciated, despite rhetorics of participation". It is of interest that the author considered another project which was a farmer-oriented program was the Small Farmer Development Program (SFDP) of the Agricultural Development Bank. The activities of the C SP of ICP and the credit program and other features of SFDP are being merged by CARE into one program.

In a seminar on Foreign Aid and Development[1/] ICP was presented as a project that developed appropriate technology through innovative planning and execution to provide continual adjustments to fit local situations so that appropriate technologies were developed which could be transferred to farmers where it could be quickly and easily adopted. The cropping systems research organized at only five sites (at that time) was considered representative of prevailing conditions in 30 out of the 75 districts in Nepal. The author considered "The project achieved a major breakthrough in developing a package of technology capable of significantly increasing foodgrain production under various farm conditions and in demonstrating agronomic and economical potential to farmers utilizing these innovations". The author raises the question of sustainability of such a system since donor funds have been instrumental in providing technical and logistic backstopping to ensure success of both the research phase and pilot production activities which followed research.

In the keynote address at the Seminar on Appropriate Technology[2/] the Secretary of Agriculture stressed the complexity of farming systems as

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1/ Pant, Thakur Nath. Foreign Aid and Agricultural Development in Nepal. In Seminar on Foreign Aid and Development in Nepal, Oct. 4-5, 1983.

2/ Khadka, B. B Keynote Address, Seminar on Appropriate Technology, June 22-26, 1981.

practiced in the Hills. Even though improvements could be brought about by identifying components that need improvement, a full understanding of the total system is essential. Otherwise, an improvement in one component could lead to disruptions in the system.

At the same seminar the Minister viewed the seminar as a move toward formulating a new strategy and policy on Hill development. (It would appear that the ICP/CSP technologies and methodologies have taken a step toward this strategy for Hill farming that could become a part of policy as visualized in the new Agricultural Research and Production Project.) In the concluding address the Honorable Member of the Planning Commission spoke among other things to the policy issue stressing that much is dependent on the policy makers — commitment and will; incorporation of those experiences of the past into strategies for the future; coordination of activities and agencies affecting farmers rests with the center; and to be achieved will require a change in thinking of development officers which will change attitudes so they become learners of rural knowledge so that this knowledge could be utilized in strategies for development. In so doing the farmer is a partner, not just a beneficiary or a variable in development.

The Deputy Director General of the Department of Agriculture[1/] supported the activities of Cropping Systems research and recognized that very valuable contributions have been made by this activity. He further pointed out that departmental recommendations in the past have been very general. In Nepal, because of the many variations that exist in soils, topography, climate, social and economic conditions, these local problems make application of these blanket recommendations very difficult to apply and often inappropriate. Research efforts that address these local problems are essential to create an adapted technology that is more or less location specific that can be recommended to farmers under these local circumstances.

1/ Pradhanang, A.M. Report of the Agriculture Research and Technology Development in Nepal. Dept. of Agriculture, Nov. 1984.

The comprehensive Nepal Agricultural Research Review Mission[1/] of which the Deputy Director General was a member, cited the cropping systems research activities of the ICP and endorsed the use of this approach in conducting research in the future so that differences in the various agroclimatic zones could be more properly studied. This should be the basic research approach of the major agricultural centers in the country in order to develop technology more apt to be adopted by farmers. Major components of cropping systems research would include varietal improvement, cultural practices, plant nutrition, and water management and soil conservation.

Many of the reports cited gave strong support to the concepts of cropping systems research as a basis for developing technologies appropriate to small farmers. This was essentially the basis for this component of the ICP when it was conceived and was initiated more than eight years ago. It is important that the activities of the ICP in developing methodologies of on-farm research; identifying technologies that were adoptable and have been adopted on a pilot scale and the methodologies developed for transferring cropping systems technologies has not caused any of the evaluators to raise a question of direction. Instead, the program has been endorsed and expansion of these activities urged to include farming systems and the procedures for on-farm trials should be adopted by more components of the research system in Nepal. Development projects should adopt the methodologies of technology transfer that have been formulated and proven in the pilot production and the more extensive Badhi Utpadan Karyakram.

1/ Report of the Nepal Agricultural Research Review Mission, Food and Agriculture Organization of the United Nations, Rome, Aug. 1983.

V. TECHNICAL SERVICES AND COUNTERPART STAFFING FOR PROJECT IMPLEMENTATION

1. Technical Services

The Integrated Cereals Project was the first contract which IADS obtained after its creation by the Rockefeller Foundation. The Foundation's activities in country programs had been built around the use of resident specialists as participants in programs, not as advisors or consultants. Their performance was as much a part of the success or failure of a program as the performance of the scientists with which they worked. This philosophy formed a basic concept of the staff of the ICP. In so far as HMG facilities could provide, the staff occupied office space in the divisions where they worked. This enabled close day-to-day contacts and built a stronger team effort in carrying out the programs developed and undertaken. To a great extent it has been this team effort which has enabled whatever measure of success the ICP has been able to achieve during the project period. To that extent all have succeeded and to the extent that failures were experienced all have failed.

The IADS was to provide resident specialists for the seven positions called for in the project. Difficulties were experienced in recruiting an agricultural economist in the early stages of the project and it was not until the project had been in operation one year that it was possible to identify someone.

Likewise the posts of agronomist for maize and for wheat had several gaps in service with three agronomists serving in maize and two in wheat.

Aside from the team leader position the post with the greatest length of services (Table 15) was the cropping systems agronomist. Except for a short two month period there has been a continuous service

Table 15 - Technical Services supplied by IADS, CIMMYT, Rockefeller Foundation and the Peace Corps from October 1976 through May 1985

Position and Name	Service Period		Person Months	
	Joined	Through	Individual	Total
Team Leader				
Carl N. Hittle	August 1982	May 1985	33	
Wayne H. Freeman	Oct. 1976	Jan. 1983	76	109
Cropping Systems Agronomist				
Kenneth D. Sayre	Oct. 1981	May 1985	44	
A. Hugo Manzano	March 1977	July 1981	53	97
Cropping Systems Economist				
Marlin G. Van Der Veen	Oct. 1977	May 1983	67	67
Production Agronomist				
I.C. (Bong) Bolo	Nov. 1981	Sept. 1984	34	
Eduardo R. Perdon	May 1977	June 1981	50	84
Rice Breeder				
Man Hue Heu	June 1977	May 1979	24	
S. Samato	Jan. 1980	Dec. 1981	24	48
Maize Agronomist				
Kenneth D. Sayre	March 1980	Sept. 1981	18	
Robert L. Beacher	April 1979	Mar. 1980	12	
Donald R. Schmidt 1/	March 1976	Feb. 1978	24	54
Wheat Agronomist				
M. Akram Khan	April 1979	July 1981	27	
Torrey Lyons 1/	March 1976	May 1977	15	42
Anthropologist				
Robert F. Schroeder 2/	Jan. 1978	Dec. 1979	24	24
Total, Resident Specialists				525
Short term Consultants, 150 persons				95
Total				620

1/ Supplied by CIMMYT, reimbursed by the Project.
2/ Supplied by Rockefeller Foundation, logistic support from ICP.

from March 1977 to May 1985. Considering the importance of the position it has been most fortunate that there has been such a long period, 97 man months, of service to the project. This has enabled the early on-farm research to be followed and modified, a methodology of cropping systems research established and a good set of technical data accumulated which could be utilized in the production programs organized in the pilot and full scale production phase of the project.

From point of service the production agronomist (and trainer) was third in length of service. This position enabled the strengthening of in-country training and later simultaneous training and production to be undertaken. Pilot production and later full scale production used the methodologies formulated in cropping systems for technology transfer, including the Impact Production Block approach.

The cropping systems economist was second to the team leader in total man months individual service and fourth in length of service for a position. This position proved to be extremely critical to the perception and foundation of an active socio-economic component of the cropping systems program. Without a regular appointee from the Department of Agriculture almost the entire burden of planning fell on one individual. The foundation of the socio-economic component, the interaction with the agronomists in cropping systems, the active preparation of socio-economic reports, and assistance to other projects in socio-economic studies created a wealth of socio-economic methodology and information which can be used in future cropping/farming systems activities.

Support to the commodity programs was valuable in supplying guidance to the programs as well as active participation in research itself. The creation of a breeding program for temperate Hill rice is an illustration of the contribution that the resident specialist could make. In maize, the most recent specialist actively assisted in the

creation of new composites which by the end of the project were providing a demonstrated superiority of these new composites over those already in production. The concept of research outreach was actively promoted in the maize program from the very first resident specialist supplied by CIMMYT. The importance of this activity led to the creation of posts of production agronomist in the maize program well ahead of the other two commodity programs.

Continuity of service was a key factor provided by the Peace Corps Volunteers serving in the program (Table 16). These volunteers served at the cropping systems sites and made valuable contributions as volunteers, as scientists, in implementing the on-farm research activities of cropping systems and later in the production phase of the program. Two of the volunteers used their socio-economic training and were important in their assistance to this phase of the cropping systems production programs. Their services have been vital to the whole gamut of cropping systems technology development and the creation of methodologies of technology transfer. Some have already built upon their Peace Corps experience and have entered graduate studies in cropping systems or related fields. Two of the PCVs were wives of PCVs who were among those serving the ICP. A third woman served as site agronomist in the early stages of the project.

The services of short term consultants (Table 15) were used in a variety of ways depending upon areas of need. Very early in the first year of the project, a seed team considered the seed needs and organizational needs to supplement the ICP. The next year a team working with an HMG committee formulated a proposal for an Agricultural Research Council. Other special assistance in formulating the cropping systems research put the ICP on good footing so that progress could be made without much loss of time in false starts, in pursuit of the development of adapted technologies and methodologies to use.

Table 16 - Technical Services provided by U.S. Peace Corps Volunteers as middle level production agronomists and economists, August 1977 to May 1985

Name	Service Period		Person Month Through May 1985
	Joined	To	
John P. Tamulonis	Dec. 1984	May 1985	18
John T. Wiseman	Jan. 1983	Dec. 1984	24
Mark W. Jenner	Aug. 1982	July 1984	24
David J. M rgen	Aug. 1982	July 1984	24
David J. Lipinski	Aug. 1982	July 1984	24
Keith R. Roesler	Aug. 1982	July 1984	24
Patty Smith	Oct. 1980	Sept. 1982	24
Sanford Smith	Oct. 1980	Sept. 1982	24
Tim Lang	Oct. 1980	Sept. 1982	24
Shane Philips	Oct. 1980	Sept. 1982	24
Duane McClain	May 1980	Mar. 1982	21
Cathy McClain	May 1980	Mar. 1982	21
Tim Kelly	Aug. 1977	Apr. 1978	9
Craig Smith	Aug. 1977	June 1978	11
Tom Morris	Aug. 1977	July 1979	24
Karen Dingler	Oct. 1977	Sept. 1979	24
Total, 16			344

Commodity assistance came for all the cereal crops and very systematically from CIMMYT and IRRI. These consultancies were based on letters of agreement between IADS and these international institutes and formed a part of the overall contract between HMG and IADS. Soybeans and grain legumes were other commodities helped through consultancies from INTSOY and ICRISAT respectively.

Special consultancy time was used in formulating in-country training programs to fit staff for the Peoples Participation visualized by the HMG planners. In collaboration with and support of GTZ this grew into a more comprehensive manpower development project of the DOA.

Although premature, the services of a library consultant provided guidance to British volunteers who assisted the DOA in organizing the library facilities of the Department as well as at APROSC

The services of a special consultant in field experimentation design and analysis helped the commodity programs and cropping systems and built upon the services of a similar consultant from Rothamsted who was supplied by the United Kingdom. Experiment station development work was carried out with good effect and results at Bhairawa Farm demonstrated the value of more precise farming in improving crop production and precision of field experiments.

The services of a Leucaena specialist provided a basis to reorient the cropping systems site research activities at Pumdi Bhumdi to encompass livestock as a part of farming systems with concentration on feed production in the system.

The former president of IADS in 1980 serving as advisor to the President, The Rockefeller Foundation was effective to create an awareness of technology developments and urged a much stronger

commitment to production on the part of staff of the Ministry and Department of Agriculture.

A total of 95 person months of consultancy services have been provided by 150 persons during the life of the project. These persons have been able to supplement the continuing services of the DOA staff and the resident specialists of the project.

2. Staffing

Table 17 presents a brief summary of the staffing situations at the commodity improvement centers and in the Agronomy Division. The total number of posts at the centers have increased in the class III positions as a result of more production agronomists and research outreach agronomists at Parwanipur, Bhairawa and in the Agronomy Division. Of those presently in position at the commodity centers, about 60% are new to the crop to which they have been assigned and many are new to the service. In fact, to fill two Class II posts in the maize program, one man was promoted from oilseeds, and the second was chief wheat breeder from the wheat program.

Presently in all three commodities the crop coordinators are in an "Acting" capacity, and one of these has had little previous experience in the crop where he is assigned to lead the program.

Degree programs have been completed by five to six in each of the centers so there has been an upgrading of staff capability even though it may not be in the crop to which they are now assigned. In rice there are now two Ph.Ds., in maize, one, and in wheat none active in the program.

The problem of leadership in these programs is illustrated by the fact that of the posts in the class I and class II grade only 50%

Table 17 - Posts in the National Crop Improvement Programs and in the Agronomy Division* in 1977 and in 1985

	Year	Class I	Class II	Class III	Total
Rice	1977	2	3	14	19
	1985	2	4	19	25
	" Vacant	1	2	2	5
Maize	1977	2	3	12	24
	1985	2	3	19	24
	" Vacant	1	1	2	4
Wheat	1977	1	2	13	16
	1985	1	2	19	22
	" Vacant	0	2	1	3
Total	1977	5	8	39	59
	1985	5	9	57	71
Vacant	" Vacant	2	5	5	12
Agronomy Division and Cropping Systems, Khumaltar	1977	1	2	3	6
	1985	1	4	10**	15
" Sites	1985	0	0	10***	10
" Production	1985	0	0	17	17

* Classification of staff by commodity (or division) or farm/station is ignored here since in service the staff generally serve as a team in implementing the programs. At Parwanipur there are class III posts in fisheries, horticulture, and poultry.

** (3 Temporary).

*** (4 Temporary).

are presently filled and four out of the five class II officers lack experience in the crop (or position) they are now serving. Three of the five "vacant" posts are held by staff serving in other positions elsewhere, on leave, or in higher studies.

Because there are staff under the commodity program and under the station, inconsistencies arise in addition to the fact that staff are not serving in the crop in which they were trained. The principal rice breeder, aside from the acting crop coordinator, is serving against the post of agronomist in the station staff. Likewise, the wheat breeder is in the farm staff since the post of wheat breeder is held by a staff member serving elsewhere.

In the Agronomy Division there have been three changes in the Head of the Division during the course of the project and there have been numerous changes in posts of the class II and class III level. None of the class II posts are filled by the same persons. Among the class III personnel there are none who had academic training especially in cropping systems who are now serving in that capacity.

In 1983 there were posts created for an additional class II officer for Agronomy and for Socio-economics. However, no one has been selected in the socio-economic post to serve in that capacity. In the same year posts of site coordinator were created for the six cropping systems sites. These posts have been augmented by temporary posts at four sites to assist in production programs and other activities at the sites.

To meet the additional staff needs for the expanded production program of 1983-84, 17 additional posts were created in the Agronomy Division. These were to be production agronomists in charge of 1000 ha. blocks. These would serve as a subject matter specialist in extension terms. This linkage of extension staff based in the discipline division is an additional effort to link the research

and extension activities more closely together as a means of serving farmers. The same could be said of the research outreach staff operating from the commodity stations. In each case there is a need to more clearly delineate functions of each so that they can be complementary rather than antagonistic in their efforts.

Although numbers of counterpart staff indicate there have been counterpart staff available and their numbers have increased, the frequent changes in personnel have not made for an effective continuity of program activity, either at the Division headquarters or at the cropping systems sites.

ICP, with some flexibility, has been able to bridge the inconsistencies in staff by temporary employment of staff to serve as site coordinators, JT/JTAs, and in some cases field assistants.

This has been useful in maintaining a momentum to the project and in collection of much needed data, it does not offer a long term solution which an institutional structure could provide. Perhaps this is most true of the socio-economic activities. With one resident specialist and an ad hoc socio-economist on deputation, the socio-economic unit at one time numbered about 15 people, all on temporary status under the project. The results attained have been one of the more significant components of the project. The merits of this activity were justification for proposing a socio-economic unit in the new ARPP. Had nothing been done beyond the presence of the resident specialist there would not have been an "impact" to get commitment to such an organizational structure and hopefully the creation of a "faculty" for the staff. Again, the end would appear to justify the means. Using project flexibility, it was possible to demonstrate the value of socio-economics in research and production programs to serve small farmers.

Appendix A

Integrated Cereals Project Reports - General

1. Five Year Action Plan and Work Plan and Quarterly Report 1976-77
2. ICP Work Plan, 1977-78
3. Cropping Systems Work Plan - 1977-78
4. Quarterly Reports, 1977-78
5. Cropping Systems Work Plan - Winter 1978-79
6. Quarterly Reports, 1978-79
7. Integrated Cereals Project Progress Report, 1976-79
8. Integrated Cereals Project Review Papers, 1979
9. Quarterly Reports, 1979-80
10. Cropping Systems Work Plan, Winter Season, 1980-81
11. Annual Report 1980-81 (includes Quarterly Reports for first three quarters)
12. Cropping Systems Program Activities in Nepal, 1981-82
13. Semi-annual Report Oct. 1981 to March 1982
14. Semi-annual Report May 1982 - Sept. 1982
15. ICP Work Plan - 1982 to 1983
16. ICP Annual Report - October 1982 - Sept. 1983- 82 pages
17. ICP Semi-annual Report - October 1983 - March 1984 - 28 pages
18. ICP Semi-annual Report - April 1984 - Sept. 1984 - in press
19. ICP Semi-annual Report - October 1984 - March 1985 - in process
20. Cropping Systems Program of the ICP-Annual Report - Oct 82 - Sept. 83 - 245 pages
21. Cropping Systems Program of the ICP Semi-annual Report Oct. 83 - March 84 - 210 pages.
22. Cropping Systems Program of the ICP Semi-annual Report - April 84 - Sept. 84 - 213 pages
23. Cropping Systems Program of the ICP Semi-annual Report - Oct. 84 March 85 - in press
24. Supplement to the Integrated Cereals Project Work Plan, Oct 1984 - May 1985, Sept. 1984
25. Finger Millet Development 1984 Work Program, Aug. 1984
26. National Finger Millet Development Program Work Plan, 1985.

Appendix B

Reports and Papers of the Integrated Cereals Project

1977

1. Report of Cropping Systems Research in Nepal - 1977 Presented at 6th Cropping Systems Working Group Meeting, December 1977, Sri Lanka.

2. The Integrated Cereals Project, Presented to IADS Board of Trustees Meeting 11-12 November, Wayne H. Freeman, 1977.

1978

1. In the Seventh Cropping Systems Working Group Meeting October 1978.

   a - Report of Cropping Systems Program in Nepal, by Cropping Systems Staff
   b - First Survey of Cropping Systems Research Sites " ". "
   c - Socio-Economic Research in Farming Systems in Nepal " " "

2. On-Farm Trials - Their Objectives and Uses to Achieve Accelerated Production, by W.H.Freeman and S.B.Nepali, Summer Crops Workshop, 27 February 2 March, 1978.

3. Cropping Systems Rice Research. Report Presented in the 6th Summer Crop Workshop, Kathmandu February 26 - March 1,1978, by Cropping Systems Staff.

4. Socio-economic Research on Farming System in Nepal: a key Informant Survey in Five Cropping Systems Research Sites by Sudarshan B. Mathema and Marlin G. Van Der Veen, Agronomy Division, Dept. of Agriculture, 1978.

1979

1. In the Proceedings of the Seventh Winter Crop Workshop, August 1979.

   a - Cropping Systems Studies in Winter Crops, by Cropping Systems Staff
   b - Varietal Performance of Different Winter Crops at Cropping Systems Sites, By Cropping Systems Staff

c - Response of NPK on Wheat in Farmer's Field at Different Cropping Systems Sites. By Cropping Systems Staff

d - Wheat Yields Under Farmers' Management at Cropping Systems Sites, By Cropping Systems Staff.

2. Cropping System Program Maize Trials, S.N.Lohani, A.H.Manzano, R.N. Mallick D.S. Pathic, B. . Uprety, C. Smith & P.K.Rajbhandary

In the Proceeding of the Fifth National Maize Development Workshop, Rampur, Nepal - January 15-19, 1979.

3. Cropping Systems Rice Research Report - 1978. By S.N. Lohani, A.H.Manzano, R.N. Mallick, D.C. Pathic, V.N. Uprety, S.Shrestha, T. Morris, R.K. Karna, P.N. Pabhandari, and F.B. K.C., 6th Summer Crops Workshop, Kathmandu, February 1979.

4. The Short Term Cropping Systems Potential of Five Sites of Nepal and Its Relevance to Similar Environments, A Preliminary Report, 1977-79 Presented at the 5th Cropping Systems Working Group Meeting, May 1979.

5. Report on the Cropping Systems Key Informant Survey: Ratnagar Village Panchayat, Chitwan District, by S.B. athema, H.G. Van Der Veen, G. Pradhan, B.R. Gurung, D.B. Gurung and R.K. Subba, C.S. Technical Report, August 1979.

6. Wheat Yield Under Farmers' Management at Cropping Systems Sites, by Cropping Systems Program, Socio-economic Group. Winter Workshop, August 1979.

7. Farmer Rice Preference Research: Pundi Shurdi, Nepal, by Robert F. Schroeder, October 1979.

8. Kinikits - an Extension Approach to Varietal Dissemination, by E.R. Perdon, Nepal Journal of Agriculture, 1979.

1980

1. In Proceedings of the Sixth National Maize Development Workshop, Jaunary, 1980.

a - Report on Maize-Based Cropping Systems Program 1979, By M.L. Malla, R.N. Mallick, A.H.Manzano, D.S. Pathick, B.N.Uprety, R.K. Karna, B.B. K.C and S.Jha,

b - Factors Affecting Differences in Maize Yields Under Farmers Management at Three Cropping Systems Sites, by CSP, Socio-economic Group.

c - Maize Yields and Costs of Production Under Farmers' Management at Three Cropping Systems Sites, by S.B. Mathema, M.G. Van Der Veen, G. Pradhan and G.S. Gurung.

d - Rice and Maize-Based Cropping Pattern Studies 1980-81. A Preliminary Report, by Cropping Systems Staff,

e - The Integrated Approach to Research and Production in the Integrated Cereals Project, Wayne H. Freeman, in.

2. The Adoption of New Agricultural Technologies at Three Cropping Systems Sites in Rural Nepal: A Look at Socio-Cultural Receptivity to Change by Robert F. Schroeder, January 1980.

3. Parcel, Farm and Community Level Variables Influencing Cropping Intensity: Pundi Bhumdi, Nepal, by S.B. Mathema and M.G. Van Der Veen, C.S. Technical Report 03. February 1980.

4. Constraints for Multiple Cropping in A Rice Based Cropping Pattern: Pundi Bhumdi, Nepal, by S.B. Mathema and M.G. Van Der Veen, Rice Workshop, February 1980.

5. The Role of Livestock in the Farming Systems in Two Cropping Systems Sites of Nepal, by S.B. Mathema and M.G. Van Der Veen, C.S. Technical Report 04, February 1980.

6. Production Programme in the Hills: A Proposal, by ICP and CSP Staff, February 1980.

7. In the Proceedings of the Eighth Winter Crops Program and Planning Meeting, September 1980.

a - Cropping Systems Studies in Winter Crops, by Cropping Systems Staff.

b - Yields and Costs of Production of Winter Crops Under Farmers' Management at Four Cropping Systems Sites, by S.B. Mathema, M.G. Van Der Veen, G. Pradhan, D.P. Bhattari and G.S. Gurung.

c - Integration of Commodity and Cropping Systems Approaches to Production Programs, by W.H. Freeman.

8. Data Collection Methods For Initial Site Descriptions, by S.B. Mathema and M.C. Van Der Veen, C.S.P. Technical Report 05, December 1980.

9. Rice Yields and Costs of Production Under Farmers' Management at Four Cropping Systems Sites, by S.B. Mathema, M.C. Van Der Veen, G.Pradhan and G.S. Gurung, December 1980.

10. Cross Site Comparisons of Farming Systems in Nepal: Initial and Tentative and Results, Workshop in the Economics of Cropping Systems, Nepal, 1980.

11. Socio-economic Research in Cropping Systems Program in Nepal, by S.B. Mathema and M.C. Van Der Veen, Workshop on the Economics of Cropping Systems, Nepal, 1980.

12. Rice Based Cropping System Programme, Cropping Systems Staff, Agronomy Division, 1980.

13. Cropping Pattern Testing in Nepal, M.L.Nalla, A.H.Manzano, D.S. Pathic, M.C. Van Der Veen and S.B. Mathema, 1980.

14. Pilot Production Program Report, November 1980.

1981

1. In the Proceeding of the Eight Summer Crops Workshop Rampur Agriculture Station - January 25-30, 1981.

   a - Arun Evaluation Trial, by D.V.Vishwa, K.D. Sayre, M.M. Palikhe and G.B. Thapa.

   b - A Guide For Multilocation Testing of Cropping Patterns, by Cropping Systems Staff.

   c - Maize-based Cropping Pattern Studies - A Preliminary Report, by Cropping Systems Staff.

   d - Notes on the Economics of the Use of Inorganic Fertilizer in Nepal - S.B. Mathema, M.C. Van Der Veen and G.Pradhan 'Anjan'

2. The Pre-Survey For Eight Pilot Production Programs in Nepal, by, S.B. Mathema and M.C. Van Der Veen, C.S. Technical Report 06 February 1981.

3. The Pre-Survey For Maize Pilot Production Programs in Nepal, by S.B. Mathema and M.G. Van Der Veen, C.S. Technical Report 07, March 1981.

4. Potential Impacts of Desirable Changes in Relation to Productivity and Income in Hill Farming Systems, by Prithu N. Rana and S.B. Mathema, Seminar on Nepal's Experience in Hill Agricultural Development, March 1981.

5. Strategies for Accelerating the Development of Improved Rice Varieties and their Transfer to Farmers' Fields, W.H. Freeman, D.V. Seshu, and T.R. Hargrove, Paper presented at the International Rice Research Conference, IRRI, April 27-May 1, 1981.

6. Cropping Systems Research and Production Program Activities in Nepal, 1980-81, by Cropping Systems Staff. Report Presented to the Eleventh Cropping Systems Working Meeting, Indonesia, May 18-22, 1981.

7. Case Studies: Pundi Bhundi Chait Pilot Production Program (1980-81), by M.G. Van Der Veen.

8. Cropping Systems Production Program: A suggestion for Making Use of the New Technology Designed from Cropping Systems Research in Nepal. By Integrated Cereals Project and Cropping Systems Staff, May 1981.

9. In the Seminar on Appropriate Technology for Hill Agriculture in Nepal, June 1981,

   a - "Agronomic Technology for Hill Farming Systems in Nepal" by M.L. Malla and A.H. [illegible]

   b - "Adoption and Constraints to Adoption of New Technologies" by B.N. Mallick and D.S. Pathic

   c - Socio-Economic Aspects of Hill Farming Systems" by S.B. Mathema and M.G. Van Der Veen.

   d - "The Integrated Cereals Project Experiences with Technology Transfer-Minikit and Pilot Production Programs" by P.C.P Chaurasia and E.R. Jordon.

   e. - "Methodologies of Technology Transfer" by A.N.Rana and W.H. Freeman.

10. Cropping Systems Winter Crops Results, 1980-81, by Cropping Systems Staff, Proceedings of Ninth Winter Crops Workshop Bhairawa, Sept. 1981.

11. Progress Report, Problems and Future Plans, Nepal, 1981, by Cropping Systems Staff. Presented at 12th Asian Cropping Systems Workshop, December 1981, Burma.

1982

1. In the Proceeding of the Ninth Summer Crops Workshop Parwanipur Agriculture Station - January 25-29, 1982.

   a - Progress Report, Problems and Future Plans, Cropping Systems Program, Nepal M.L.Malla.

   b - Sites Ratna Nagar, Chitwan, Inner Terai, Cropping Patterns Studies (11 Cropping Patterns), 1981, by Cropping Systems Staff, Paper Presented at Summer Crops Workshop'January 1982.

   c - Report on the WUDP Farmers' Field Trials for the 1981 Monsoon, Maize Crop in Chitwan, by A.K. Karna, D.L. Shrestha and K.D. Sayre

   d - Report on the WUDP Spring Maize Farmers' Field Trials in Chitwan, 1981 by A.K. Karna, D.L. Shrestha and K.D. Sayre.

2. Cropping Pattern Testing in Nepal, M.L. Malla, K.D. Sayre et al, Cropping Systems Program, Presented at the International Rice Research Conference, IRRI, April 1982.

3. Guidelines for Preproduction Verification Trials of Cropping Systems, Recommendations by Cropping System Staff, May 1982.

4. In the Proceedings of the Tenth Winter Crops Workshop, August 1982

   a - Cropping Systems Studies in Winter Crops, 1981-82 by Cropping Systems Staff.

5. b - Plan for Implementing Cropping Systems Pilot Production, Cropping Systems Program, Division of Agronomy, Dept. of Agriculture, 1982.

5. Cropping Systems Program Activities in Nepal, 1981-82. By CS Staff. Presented at 13th Asian CSWG Meeting, Oct. 11-15, 1982 in Thailand and included as Chap. II in CSP/ICP Annual Report - Oct. 82-Sept. 83. 16 pages.

1983

1. In the Proceedings of the Tenth Annual Summer Crops Workshops, January, 1983

   a) Cropping Systems Studies in Spring & Summer Season Crops, 1982. By CS Staff. Presented at 10th Summer Crops Workshop, Rampur, January 1983, and included as Chap III in CSP/ICP Annual Report - Oct. 82-Sept. 83. 65 pages.

   b) Pre-production Verification Trials 1981/82 Winter, Spring and Summer Crops -- By M.L. Malla, P.M. Shrestha, M.G. Van Der Veen and D.J. Lipinski. Presented at 10th Summer Crops Workshop, Rampur, January 83, and included as Chap. IV in CSP/ICP Annual Report - Oct. 82 - Sept. 83. 42 pages.

   c) A Report on Badhi Utpadan Karyakram ("More Production Program") By M.L. Malla, David Morgen, I.C. Bolo and CS Staff. Presented at 10th Summer Crops Workshop, Rampur, Jan. 83, and included as Chap. V in CSP/ICP Annual Report - Oct. 82 - Sept. 83. 60 pages.

   d) Training and Visit (T and V) of Extension and Research Out reach, Wayne H. Freeman, Tenth Summer Crops Workshop Rampur, Jan. 1983.

2. Impact of Cropping System Pilot Production Program Parsa District, Nepal Martin G. Van Der Veen, Cropping Systems Program, April 1983.

3. Cropping Systems Studies in Winter Crops for 1982/83. By CS Staff. Presented at 10th Winter Crops Workshop, Bhairahawa, August 1983 and included as Chap VI. in CSP/ICP Annual Report. Oct. 82 - Sept. 83. 32 pages.

4. Production Programs in the Hills and in the Terai Using the Cropping Systems Approach. By M.L. Malla, D. Mergen, I.C. Bolo and CS Staff. Presented at 10th Winter Crops Workshop, Bhairahawa, August 1983 and included as Chap VII in CSP/ICP Annual Report Oct. 82 - Sept. 83. 26 pages.

5. Cropping Systems Pilot Production Program in Nepal. By I.C. Bolo. Sept-Nov. 1983 - Included in ICP Annual Report Oct. 82 - Sept. 83. Also mimeographed and Widely distributed as a separate in Nov. 83. 28 pages.

6. Cropping Systems Program Activities in Nepal, 1982-83. By C.S. Staff. Presented at 14th FSWG Meeting, China, Oct. 83 and included as Chap I in CSP/ICP Semi-Annual Report, Oct. 83 March 84. 23 pages.

1984

1. Cropping Systems Studies in Spring and Summer Crops, 1983. By CS Staff. Presented at 11th Summer Crops Workshop, Parwanipur, February 1984 and included as Chap II in CSP/ICP Semi-Annual Report, Oct. 83 - March 84. 72 pages.
(Also published and distributed as a separate).

2. Pre-production Verification Trials in Nepal. By David Lipinski and M.P. Rizal. Presented at 11th Summer Crops Workshop, Parwanipur, February 1984 and included as Chap III in CSP/ICP Semi-Annual Report, Oct. 83 - March 84. 39 pages. (Also published and distributed as a separate).

3. Report on the Cropping Systems Production Program in the Central Development Region. By S.N. Sarkar and P.L. Chitrakar. Presented at 11th Summer Crops Workshop, Parwanipur, February 1984 and included as Chap IV in CSP/ICP Semi-Annual Report, Oct. 83 - Mar 84. 9 pages.

4. Results of the Cropping Systems Pilot Production Program Activities in Chitwan and Parsa, Summer Crops, 1983. By CS Staff. Presented at 11th Summer Crops Workshop, Parwanipur. Feb. 1984 and included as Chap V in CSP/ICP Semi-Annual Report, Oct 83 - March 84. 9 pages.

5. Management Support to Production Programs (A Discussion Paper). By I.C. Bolo. Written in May 1984 and included as Chap VI in CSP/ICP Semi-Annual Report, April - Sept. 1984. 18 pages. (Also mimeographed and distributed as a separate).

6. Planning Extension for Farm Women, June 1984. By Padma Shrestha, Laurie Zivetz, Bimala Sharma and Susan Anderson Published and distributed as a separate report. 147 pages.

7. Through Farmers' Eyes. By Steven A. Breth. Multicolored Brochure. 28 pages. (The English Version was distributed in June 1984. Translated into Nepali and the Nepali version was distributed in May 1985.)

8. Nepali Hill Farmers' Evaluation of the National Cropping Systems Pre-production Verification Trial Program. July 1984. By David Lipinski, M.P. Rizal, B.R. Gurung and K.D. Sayre. 42 pages.

9. Progress Report on Cropping Pattern Testing in Nepal for 1983. By S.L. Shrestha, B.K. Singh and K.D. Sayre. Presented at the 15th Asian FSWG Meeting, Sri Lanka, June 1984, and included as Chap. I in CSP/ICP Semi-Annual Report, April-Sept 84. 39 pages

10. Status of Multi-Location Testing and Pilot Production Program in Nepal. By K.D. Sayre, S.L. Shrestha, N.L. Malla, I.C. Bolo, David Lipinski, David Mergen and M.P. Rizal. Presented at the 15th Asian FSWG Meeting, Sri Lanka, June 1984, and included as Chap II in CSP/ICP Semi-Annual Report, April-Spet 84. 28 pages.

11. Long Term Cropping Pattern Cum Fertilizer trial for Rainfed Upland Crops in Nepal. By S.L. Shrestha, K.M. Singh and K.D. Sayre. Presented at the 15th Asian FSWG Meeting, Sri Lanka, June 1984 and included as Chap. III in CSP/ICP Semi-Annual Report, Apr-Sept. 84. 4 pages.

12. A Peace Corps Volunteer's Experience with the Production Program in Chitwan District, Nepal. July 1984. By Keith R. Roesler, PCV. 49 pages.

13. Cropping Systems Studies in Winter Crops, 1983-1984. By Cropping Systems Staff. Presented at 11th Winter Crops Workshop, Bhairahawa, Sept. 1984 and included as Chap IV in CSP/ICP Semi-Annual Report, April-Sept. 1984. 74 pages.

14. A Report on the Strategy of the Implementation of the Cropping Systems Based Production Program in 17,000 Hectares in the Terai. By I.C. Bolo and M.L. Malla. Prepared in Sept. 1984 and included as Chap V and CSP/ICP Semi-Annual Report, Apr-Sept. 1984. 43 pages.

15. The Results of Rapti Zone Pre-production verification Trials (PPVTS) by K.B. KC et al, Rapti Integrated Rural Development Project, Tulsipur. In Proceeding of the 11th Winter Crops Workshop Bhairawa, September 3-5, 1984.

16. Strategy for farming Systems Research in Nepal. By K.D. Sayre, B.K. Singh and S.L. Shrestha, November 1984 Published as a separate but also included as Chap. I in CSP/ICP Semi-Annual Report Oct. 84-March 85. 23 pages.

17. Evaluation of the Cropping Systems Production Program in the Nepal Terai, 1983/1984.
By D.J. Mergen and B.R. Gurung. December, 1984.
Published as a separate, also included as Chap. II in CSP/ICP Semi-Annual Report, Oct. 84-March 85. 55 + pages.

18. Cropping Systems Research in the Eastern Mid-Hills of Nepal - A Review -- (1977-1984) By S.L. Shrestha. Presented at the 2nd National CSWG Meeting, Agronomy Division, Khumaltar, December 1984 and included as Chap. III in CSP/ICP Semi-Annual Report, Oct. 84 - March 85. 40 + pages.

19. The Farming Systems Program in the Seventh Five Year Plan.
By D.B. Tamang. Presented at the 2nd National CSWG Meeting, Agronomy Division, Khumaltar, December 1984 and included as Chap IV in CSP/ICP Semi-Annual Report, Oct. 84 - March 85. 5 pages.

20. Report on Bali Pranali Utpadan Karyakram (Cropping Systems Production Program). By Sagar P. Shrestha, Presented at the 2nd National CSWG Meeting, Agronomy Division, Khumaltar, December 1984 and included as Chap. V in CSP/ICP Semi-Annual Report, Oct 84-March 85. 6 pages.

<u>1985.</u>

1. Cropping Systems Studies in Spring and Summer Crops, 1984.
By CS Staff. Presented at 12th Summer Crops Workshop, Rampur, January 1985, and included as Chap VI in CSP/ICP Semi-Annual Report, Oct. 84 - March 85. 50 + pages.

2. Impact of Cropping Systems Program at Sukchaina. By B.K. Singh and K.D. Sayre. Presented at the 12th Summer Crops Workshop, Rampur, January 1985 and included as Chap. VII in the CSP/ICP Semi-Annual Report, Oct. 84 - March 85. 12 pages.

3. The Role of Green Manure Crop in Rice Farming at Ratnanagar. S.P. Shrestha, Presented at the 12th Summer Crops Workshop, Rampur, January 1985 and included as Chap. VIII in the CSP/ICP Semi-Annual Report, Oct. 84 - March 85. 4 pages.

4. A Report on the Strategy of Implementation of the Production Program, By M.L. Malla, S.U. Khan and B.R. Subedi. Presented at the 12th Summer Crops Workshop, Rampur, January 1985 and included as Chap. IX in the CSP/ICP Semi-Annual Report, Oct 84 - March 85. 50 + pages.

Appendix C

List of Baseline Surveys and Site Description Surveys at Different Sites
(Surveys Conducted by the Socio-economic Group of Cropping Systems Program)

No.	Site	Nature of Survey	Survey Conducted for	Publication Date	Purpose
1.	Bidur Village Panchayat (Nuwakot District) By Dilli Prasad Bhattarai	Base Line	SPISP	Nov. 30, 1981	Seed House Survey
2.	Tarku Village Panchayat (Lamjung District) By Paul F. Kaplan	"	"	Dec. 11, 1981	"
3.	Birendra Nagar/Surkhet Dist. By Paul F. Kaplan	"	"	"	Ware House Survey
4.	Marpha/Mustang District By Paul F. Kaplan	"	"	"	"
5.	Gyandi/Parbat District By Paul F. Kaplan	"	"	"	Mini Seed House Survey
6.	Cherikot Village Panchayat (Dolakha District) By Dilli Prasad Bhattarai	"	"	Mar. 20, 1982	Seed House Survey
7.	Mastamandu Village Panchayat (Achham District) By Shibesh Chandra Regmi	"	"	Apr. 10, 1982	"
8.	Nilkanth Village Panchayat (Dhading District) By Bharat B. Karki	"	"	May 9, 1982	"
9.	Tarang Village Panchayat By Dilli P. Bhattarai	"	"	June 2, 1982	"
10.	Kot Bhairab Village Panchayat By Bharat B. Karki	"	"	June 9, 1982	"
11.	Arughat Village Panchayat (Gorkha District) By Krishna Bahadur K.C.	"	"	July 20,1982	"

No.	Sites	Nature of Survey	Survey Conducted for	Publication Date	Purpose
12.	Chainpur Village Panchayat (Bajhang District) By Badri Nath Dahal	Base Line	SPISP	May 9,1982	Seed House Survey
13.	Rakhee Village Panchayat (Kaski District) By Shibesh C.Regmi Babu Ram Gurung & David Lipinski	Site Description	ICP	July 1982	PPVTs
14.	Arghoun Village Panchayat (Kaski District) By S.C.Regmi	Site Description	ICP	July 1982	PPVTs
15.	Bhalam Village Panchayat (Kaski District) By Babu Ram Gurung & David Lipinski	"	"	"	"
16.	Nala Ugrachandi Village Panchayat (Lavre District) By Roshan B.Pandey and David Lipinski	"	"	"	"
17.	Panchkhal Village Panchayat (Kaski District) By Devi Gurung and David Lipinski	"	"	"	"
18.	Bijuwar Village Panchayat (Pyuthan District) By Bharat B. Karki	Base Line	SPISP	July 25,1982	Seed House Survey
19.	Khairahani, Ratna Nagar & Birendra Nagar Village Panchayat (Chitwan District) By S.C.Regmi, L.B.Rana & David Nergen	Site Description	ICP	Aug. 1982	PPVTs
20.	Dasauli, Walling, Ghorahi, Dadeldhura & Sindhulimadi By Dilli Prasad Bhattari	Base Line	SPISP	Aug.10 1982	Ware House Survey

No.	Sites	Nature of Survey	A Survey Conducted for	Publication Date	Purpose
21.	Patan Village Panchayat (Baitadi District) By Dilli Prasad Bhattari	Base Line	SPISP	Sept. 2,1982	Seed House Survey
22.	Ghachowk Village Panchayat (Kaski District) By Devi Gurung and David Lipinski	Site Description	ICP	Sept. 1982	PPVTs
23.	Lalbandi & Hariwan Village Panchayat (Sarlahi District) By S.C.Regmi	"	"	Sept. 1982	PPVTs & Pilot Production Program
24.	Bhojpur Village Panchayat (Bhojpur District) By Krishna Bahadur K.C.	Base Line	SPISP	Nov.27,1982	Seed House Survey
25.	Chainpur Village Panchayat (Sankhuwasabha District) By Shibesh Chandra Regmi	"	"	Dec 2, 1982	Mini Seed House Survey
26.	Mohamadpur Village Panchayat (Rautahat District) By Babu Ram Gurung and David Lipinski	Site Description	ICP	Dec 1982	PPVTs
27.	Semari, Sundi & Behaliya Village Panchayat By David J.Lipinski & D.L.Gurung	Site Description	"	Dec. 1982	PPVTs & Pilot Production Program
28.	Baruneshwar Village Panchayat (Okhaldhunda District) By Dilli Prasad Bhattari	Base Line	SPISP	Dec 15,1982	Seed House Survey
29.	Phidim Village Panchayat (Panchthar District) By Purusotam Singh	"	"	1982	"

No.	Sites	Nature of Survey	A Survey Conducted for	Publication Date	Purpose
30.	Ilam/Ilam District By Dilli Prasad Bhattari	Base Line	SPISP	1982	Mini Seed-House
31.	Lipani Birta V.P. (Parsa District) By Devi B. Gurung	Site Description	ICP	Dec. 1982	PPVTs
32.	Lekhanath V.P. (Kaski District) By Shibesh C.Regmi and M.G.Van Der Veen	"	"	1982	"
33.	Hatiya Village Panchayat (Baglung District) By Dilli Prasad Bhattari	Base Line	SPISP	Feb 15,1983	Seed House Survey
34.	Jirikhimti Amphuwa Village Panchayat (Terathum District) By Dilli Prasad Bhattari	"	"	Mar 1, 1983	"
35.	Pakhribas Village Panchayat (Dhankuta District) By Krishna B.K.C	"	"	Mar 8, 1983	"
36.	Chitwan District Site Reconnaissance 5 Panchayats By David Merrem, Keith Roester, Ganesh Pant	Site Description	ICP	March 1983	Production
37.	Yamkha Village Panchayat (Khotang District) By Dilli Prasad Bhattari	"	SPIS	4 Apr. 1983	Seed House Survey
38.	Dailekh/Dailekh District By Dilli Prasad Bhattari	"	SPISP	Apr.25, 1983	Mini Seed-House
39.	Khalanga Village Panchayat (Jajarkot District) By Dilli Prasad Bhattari	"	SPIS	30 May 1983	Seed House Survey
40.	Raniswarna Village Panchayat (Gorkha District) By Devi B. Gurung	Site Description	RCUP	Aug 1983	PPVTs

No.	Site	Nature of Survey	A Survey Conducted for	Publication Date	Purpose
41.	Thee & Patlekhet Village Panchayat (Myadgi District) By Krishna KC and L.B.Rana	Site Description	RCUP	August 1983	PPVTs
42.	Parsa, Rautahat and Sarlahi District By David Mergen, etal	Site	ICP	Aug. 1983	Production Program
43.	Narayanpur V.P (Dang District) By Rabindra K. Subba, Nembang	Site Description	PADCO	Sept. 1983	PPVTs
44.	Chailahi V. P (Dang District) By L.B. Ranamagar	"	"	"	"
45.	Shisahania V.P (Dang District) By Babu Ram Gurung	"	"	"	"
46.	Dunche and Syabru V.P (Rasuwa District) By David Lipinski, S.L Shrestha and Rabindra Subba	"	ICP	Nov. 1983	"
47.	Daman (Makwanpur District) Palpa (Palpa District & Gaighat (Udayapur District) By Krishna B. K.C.	Base Line	SPISP	Sept.19, 1983	Ware House Survey
48.	Bahuwari, Bhaudatar, Meshihani Manihari, Hariharpur and Pipra Village Panchayats (Parsa District) By David Mergen, Devi B. Gurung Rabindra K. Subba, Shyam K. Thapa and Lekh Bahadur Rai	Site Description	ICP	July 1984	Production Program
49.	Namtar V. Panchayat (Makwanpur District) By Devi B. Gurung and Ratna Bhuban Shrestha	Base Line	CARE	"	APVT and Production

Appendix D

Field, Laboratory and Office Equipment purchased under the Integrated Cereals Project, 1977-85

Item	Location				
	Parwanipur	Rampur	Bhairawa	Khumaltar Agronomy Division	Other
a. Laboratory and Office					
Hewlett Packard Calculator Model 91	1	2	1	1	
Hewlett Packard Calculator Model 97	-	1	1	1	
Calculator, Cassio	-	-	-	4	
Filing Cabinets, Indian	2	1	5	-	
Wireless, Northern No. 420	1	-	1	-	2
Airconditioner, Indian	2	2	2	-	1 unassigned
Airconditioner, US	-	1	1	-	
Generator, Katolight, 25 kva	-	-	1	-	1 unassigned
Generator, Indian, 25 kva	1	1	-	-	
Generator, E 300, Honda	-	-	1	-	
Microscope, Binocular	-	-	1	-	
Microscope, Stereozoom	1	1	1	-	
Microscope, Compound	1	1	1	-	
Centrifuge, Clay Adams	1	1	1	-	
Hygrothermograph, recording	1	2	1	-	3
Leonte Balance, 5 kg	-	-	1	-	
Top loading balance, Sartorius	1	1	1	-	
Platform balance	2	1	1	5	
Avery Scale, 10kg	2	3	2	5	
Avery Scale, 2kg	-	-	1	-	
Avery Scale, 1kg	-	-	1	-	
Seed Blower, Burrows	1	1	1	1	

Item	Location				
	Parwanipur	Rampur	Bhairawa	Khumaltar Agronomy Division	Other
Laboratory Timer	1	1	2	-	
pH Meter, Model 399	1	1	1	-	
Digital pH meter	1	1	1	-	
Kjeldhal digestion apparatus	2	2	2	-	
Distillation unit, Micro-Kjeldhal	1	1	1	-	
Water Demineralizer, Barnstead	1	1	2	-	
Sieve Shaker, with 12 sieves, receiver and cover	1 set	1 set	1 set	-	
Shaker, Burnell	1	1	1	-	
Water Bath, Model 185	1	1	1	-	
Drying Oven, Boekel	1	1	1	-	
Laboratory Mill, Wiley	1	1	1	-	
Vacuum pump, Gelman	1	1	1	-	
Microslide Drier	1	1	1	-	
Microslide cabinet	1	1	1	-	
Flame Photometer, Coleman	1	1	1	-	
Spectro photometer, Coleman	1	1	1	-	
Desiccator cabinet	1	1	1	-	
Dessicator	3	2	1	-	
Refrigerator, Marvel	1	1	1	-	
Freezer, Laboratory Model	1	1	1	-	
Incubator, Model 815	1	1	1	-	
Hot plate	5	4	4	-	
Steam sterilizer, auto clave	2	1	1	-	
Water Bath, Model 185	2	1	1	-	
Dalite screen 8' x8'	1	1	1	-	
Slide Projector, Carousel	1	1	1	-	
Opaque Overhead Projector	1	1	1	-	

Item	Location				
	Parwanipur	Rampur	Bhairawa	Khumaltar Agronomy Division	Other
Transformer, 500W. to 2000W.	6	3	3	-	
Blender, Osterizer	1	1	1	-	
Colony counter	1	1	1	-	
Rice Polisher, Kett	1	-	-	-	
Rice Pearler, Kett	2	-	-	-	
Rice, Testing Husker, Satake	1	-	-	-	
Rice sizing Machine	1	-	-	-	
Sample sheller, rice	1	-	-	-	
Moisture Tester, US	-	6	1	5	
Moisture Tester, Indian	2	2	2	5 (for CS sites)	
Cork Boring Machine	1	1	1	-	
Plastic Rain gauge	1	1	1	6 (for CS sites)	
Magnifying reading glass	1	1	1	-	
Magnifier, Triplex, Hastings	4	4	4	-	
Sling Psychometer	-	1	-	-	
Officer chair	1	-	-	-	
Office Table	1	-	-	-	
Bookcase	1	-	-	-	
Typewriter, Remington, English	2	1	2	-	
Typewriter, Remington, Nepali	1	1	1	-	
Altimeter	-	-	-	2	
Sunshine Recorder					
- Quantum Sensor	1	1	1	1	2
- Integrator	1	1	1	1	2
Soil moisture tester	-	-	-	1	

Item	Location				
	Parwanipur	Rampur	Bhairawa	Khumaltar Agronomy Division	Other
b. Field Equipment					
Wheat Thresher, Shirpur	-	-	1	-	
Wheat Thresher, Pusa	1	1	2	-	
Mold board Plough	-	-	1	-	
Sugarcane ridger	-	-	1	-	
Wheat ridger	-	-	1	-	
Chisel plough	-	-	1	-	
Barber Fertilizer Spreader	1	1	1	1	
Howard Rotavator	1	1	1	1	
Planet Jr. Seeder, Model 912	-	-	4	-	
Planet Jr. Seeder, Model 300A	-	-	2	-	
Seed Drill, Oyjord	-	-	1	-	
Power Tiller	-	-	2	-	
Power Tiller IRRI	1	-	-	1	
Small Vogel Head Thresher	1	-	1	1	
Vogel Plot Thresher	1	1	1	1	
IRRI Plot Thresher	1	-	1	1	
IRRI Portable Thresher	-	-	-	1	
Kirloskar Pump	-	1	2	-	
Thresher Rice Union (Indian)	1	1	2	-	
MF 275 Tractor	-	1	-	-	For land shaping
Land Plane, Marvin	-	1	-	-	"
Maize Planter, Cole Tractor Mounted	-	2	-	-	
Maize Sheller 7-8 hp	-	2	-	-	
Maize Shellers Hand operated	-	3	-	-	

Item	Location				
	Parwanipur	Rampur	Bhairawa	Khumaltar Agronomy Division	Other
c. Seed Processing Plant					
Seed Drier, Indian	-	1	-	-	
Bag Truck, 2 wheel, Indian	2	2	2	-	
Bag Truck, 4 wheel, Indian	2	2	2	-	
Bag closing Machine, Revo, Indian	2	2	1	1	
Seed Drums, 55 gallon	25	25	25	25 (all divisions)	
Dehumidifier, Indian	1	1	1	-	
Avery Scale, 500kg	2	1	1	-	
Seed Treater, Gustafson	1	1	1	1 (Botany Division)	
Seed Cleaner Ensco	1	1	1	-	1 unassigned
Seed Elevators	4	4	4	-	
Dust collector	1	1	1	-	1 unassigned
Fire extinguishers	2	2	2	-	
Impulse Sealers	5	5	5	-	
Exhaust Fans	2	2	2	-	
d. Vehicles					
International Scout	1	1	1	1	
Motor bike, Rajdoot, Indian	1	-	2	-	
Motor bike, Honda	-	2	1	15	for production
Diesel Truck, Tata, Indian	1	-	-	-	
e. Workshop and Miscellaneous					
Snap-on Tools	1 set	1 set	1 set	1 set	
Drill Press	1	1	1	1	

Item	Location				
	Parwanipur	Rampur	Bhairawa	Khumaltar Agronomy Division	Other
Barrel Stand	1	2	1	1	
Transformer, 150 kva	1	1	-	1	
Maize Planter, Hand	-	107	-	1	
Submersible Pump	1	2	1	-	
Sprayer, power	-	-	-	1	
Seed Treating drums	-	-	-	2	

f. Major items Ordered since January 1985

	No.
Vehicles - (Toyota - 2 Landcruiser - 2 Hilux)	4
Tractors - MF245 (From India)	4
11 tine Tillers (From India) MF	3
Disc Harrow (From India) MF	1
Head Threshers (From Philippines)	2
Vacuum Emasculators (From Philippines)	2
Impulse Sealers (From Taiwan)	12
Xerox copiers	5

DOLLAR BUDGETS FOR THE INTEGRATED CEREALS PROJECT AND PRELIMINARY EXPENDITURE FIGURES FOR THE LIFE OF THE PROJECT

Line Item	Original Budget 9/10/1976	AMENDMENT No. 3 11/6/78	No. 4 9/28/79	No. 7 8/23/81	No.10 1/22/82	No. 12 8/16/84	No. 13 8/23/84	No. 14 11/1/84	No. 15 3/10/85	Total Budgeted	Estimated Expenditures Thru May 1985
I. Technical Assistance:											
A-Resident Specialists	1,310,000	-30,000	287,300	1,091,262	20,000	20,000	-	80,000	30,000	2,768,562	
B-Consultants	299,000	-27,000	70,727	21,273	-		-	30,000	15,000	449,000	
Sub-Total:	1,609,000	-57,000	358,027	1,112,535	20,000	-	-	110,000	45,000	3,217,562	
II. International Training:											
A-Academic	-	-	-	-	19,937	-	-	-	-	681,629	
B-Non-Academic							10,000			685,308	
Sub-Total:	344,000	-	488,300	484,700	19,937	20,000	10,000	-	-	1,366,937	
III. Equipment & Materials	180,000	209,000	123,000	214,000	75,000	15,000	30,000	-	-	846,000	
IV. IADS Headquarters	53,000	-	39,700	82,300	-	5,800	4,200	10,000	5,000	200,000	
V. Logistic Support	-		460,000	443,000	182,583	10,000	30,197	72,000	10,000	1,207,780	
Total Direct Costs	2,186,000	152,000	1,469,027	2,336,535	297,520	35,800	69,397	232,000	60,000	6,838,279	
VI. IADS Management Fee/ Overhead	328,000	23,000	300,973	571,465	62,480	7,000	13,000	45,944	15,000	1,366,862	
VII. Pre-Contract Expenses	10,000	-	-	-		-	-	-	-	10,000	
TOTAL :	2,524,000	175,000	1,770,000	2,908,000	360,000	42,800	82,397	277,944	75,000	8,215,141	8,137,803