367D114/17

PD-AAM-315
ISN 15754

367-D114

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THE INTEGRATED CEREALS PROJECT

- NEPAL -

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SUMMARY AND RECOMMENDATIONS

Agriculture in Nepal provides about 66 percent of the gross national product and 75 percent of the export earnings for the Kingdom. Approximately 94 percent of the 13 million people of Nepal depend on agriculture for their livelihood.

An estimated 60 percent of Nepal's population resides in the Hills, on small farms that are intensively cultivated for a subsistence-level production. Farmers are now extracting a maximum output from their land, labor and other input resources. Production of food grains and other agricultural products in Nepal has been increased in the past through expansion of acreage, primarily in the Terai but also in the Hills. The latter has caused serious deterioration of the nation's agricultural resource base, through excessive deforestation, accelerated erosion, and irreparable damage to the already limited arable soils resource base.

Agricultural productivity in Nepal, as measured in terms of yields per hectare, is declining for a number of major crops. It has become clearly evident in the past decade that improved production technology must be utilized if Nepal is to meet future needs for food grains and other agricultural commodities. This is true for the Terai as well as for the Hills.

Agriculture in the Hills of Nepal presents formidable limitations to improvement because of the varied and complex growing conditions. The numerous microclimates--with highly variable soil, moisture, temperature, and solar combinations prevailing within small farming areas--requires new production technology specifically suited to each farming site. This limits the usefullness of technology introduced from external sources, whether from international agricultural research centers or from neighboring countries.

Nepal has no alternative other than to establish a strong national capability for modern agricultural research, to generate a continuous supply of improved technology that will increase output from present arable lands. This was recognized in the planning of the Integrated Cereals Project (ICP) by His Majesty's Government (HMG) and USAID in 1973-75. In view of the need to improve production in the Hills the ICP is set up on a "farming systems" approach, to develop technology that will provide the fine tuning for already intensive farming practices. The Project is designed to work closely with farmers, to develop a better understanding of the biological, economic, and social constraints, in order better to plan research and develop technology to fit what farmers need, want, and can use.

Of the five cropping systems research sites that have been established four are in Hill areas, at Khandbari, Lele, Pumdi Bhumdi, and Chauri Jahari. The fifth, at Sukchaina and Dhobini, is in Parsi District in the Terai. This is consistent with the strong emphasis by HMG in recent years to improve productivity and levels of living for the 60 percent of the nation's people that live in the Hills.

The ICP is strongly production oriented, with attention to the generation of technology; its verification, testing and adaptation at the five cropping systems research sites, and evaluation--with cooperating farmers--in farmers' fields.

A major continuing deficiency in Nepal's agricultural research capability is the lack of experiment station facilities in the Hills. The four cropping systems research sites are helping to fill this gap, by furnishing an essential link in the process of evaluating and fitting new technology to the numerous agroclimatic conditions in the Hills.

The present evaluation of the ICP is essentially the mid-term review, in the third year of the five year term project. Considerable progress has been made in developing facilities, training manpower, staffing, establishing the cropping systems sites, and in realigning research objectives. The current evaluation, therefore, concentrated more attention on technical aspects of the project, with less consideration of operational matters.

The members and key participants in the review are listed in APPENDIX I, and the schedule of visits is presented in APPENDIX II.

1. Current Status--Progress Toward Project Goals

The ICP has been under way for only three years, a brief period in which to put into operation a system that is nationwide in scope and that embraces all functions from the research to produce new technology through its verification and adaptation to ensure its value and acceptability by farmers. This mid-term review of the Project took into account the magnitude of the task of putting together the staff, facilities, operational concepts and procedures, geographical linkages, and the multidisciplinary and multi-institutional relationships that must combine into a working system. The review also considered the soundness of the basic concept--to integrate attention to major commodity improvement programs and a more comprehensive farming systems approach.

Substantial progress has been made in establishing facilities and the five cropping system sites--which have been operating for two years--and the Project is beginning to function as the continuum that was intended. A minimum of three to four years is necessary to develop improved technology and to test its adaptation to specific farming conditions, to ensure that the new technology can be depended upon to improve productivity with minimum risks to farmers. The confidence of farmers in the new technology offered to them is critical not only to the ICP but, more important, to the HMG.

The concentration on the farming systems research and information base as the central point for identifying the kinds of new technology that will be useful--and for furnishing well tested, reliable materials and practices

to those responsible for extension--is a system that was conceived for Nepal. It is unique in agricultural development, and results to date provide assurance that the system will be effective. The studies on physical and socio-economic environments of the sites have led to land use classification within the sites that relates clearly to variations in farmers' cropping practices. This classification, together with the growing understanding of existing cropping patterns, their productivity, management practices used by farmers, and the potentials and constraints for use of improved technology, furnishes a base for agricultural growth and for accelerated production programs hitherto not available in Nepal.

There are continuing constraints with respect to manpower, the establishment of the cropping systems research in the institutional structure of the DOA to ensure its stability and permanence, and the inadequate research attention to improvement of varieties and production practices for crops such as grain legumes, oilseeds, finger millet, barley, potatoes, and others. However, the cropping systems component of the ICP is well launched, it is becoming the focal point for guiding the development and use of improved technology--as was intended--and it should be of increasing benefit to Nepal's agricultural development from this point onward.

The national commodity research and development programs for rice, maize and wheat have been strengthened substantially during the three years of the project. Facilities at the respective central research stations are coming up reasonably well on schedule and the improved multidisciplinary staff teams are producing research results that are markedly superior to those of only two years ago.

Four new rice varieties, ranging in maturity from 110 to 140 days offer greater potential for yield, disease resistance, and insect resistance than varieties now grown by farmers. Expanded breeding and testing programs for temperate zone rice varieties appear especially encouraging in providing new varieties for the Hills. The review team observed substantial spread of new rice varieties, not only in the Terai but also in the valleys and Hill locations between Bhairawa and Pokhara. The farmer field trials, cropping systems site research, and the minikits (distributed in 1979 to 3200 farmers), have combined to accelerate farmer interest and use of the new varieties.

The national maize program has been strengthened appreciably with improved facilities and manpower. Constraints persist with respect to completion of the laboratory building, staff housing, irrigation and drinking water supplies at Rampur--but good work is going on. There is a recognized need for shorter duration varieties and the task of breeding for resistance to downy mildew and other destructive diseases is being emphasized. Research on production practices is showing that a 45 to 90 Kg. application of nitrogen is sufficient and that the maize crop generally does not respond to phosphorus and potash applications during the Kharif season. Phosphorus is not needed for the Kharif maize crop, and potash is also unnecessary. The maize minikit program appears to be particularly well conceived and operated,

and the response from farmers is exceptionally good, with 70 percent or more of the farmers reporting back on their evaluation of the improved technology distributed in the minikits.

Wheat production has essentially doubled in Nepal in the past decade, from 233,000 metric tons ten years ago to the estimated current production of 454,000 metric tons. However, this results from expansion of acreage, and yields per hectare have remained low and relatively constant at about 1.2 tons over this ten year period. The introduction of early, disease resistant varieties has permitted expansion of the wheat area, particularly in the Terai where farmers sow wheat after the rice crop is harvested in October or November. One factor, however, that contributes to the constant low yield of wheat is the frequently delayed planting of the crop when rice harvest is late. It has been determined that wheat yields are reduced by about 20 percent if sowing is delayed to Decmeber 15 and by as much as 50 percent if sowing occurs on December 30.

There is an urgent need for further strengthening of the wheat research program to meet well recognized and particularly stubborn constraints to production. The high sterility of the wheat crop in the Eastern Terai persists and is particularly damaging to the improved variety NL 30. The causal factors are not understood and must be tackled through more intensive, multidisciplinary team investigations. The discovery of the Karnal bunt disease in the Western and Far Western Terai in 1979 poses a new serious threat to wheat production in Nepal since the variety UP 262 and many other promising new varieties are succeptible to the disease.

Progress in selecting varieties better suited to the Hills has been limited due to the lack of suitable research station facilities in the Hills. where selections can be made. This constraint is not unique to wheat but continues to limit effective development of improved crop varieties and management practices also for rice, maize and the numerous other crops important to Hill farmers.

In summary, the review team found the status of the program and the progress toward project goals to be good. The generation of new technology, its evaluation through the newly established cropping systems sites, and the potential extension of adapted, reliable new technology into appropriate channels for prompt farm use is becoming systematized to a degree that is very satisfactory for a project in the third year of operation. There are still growing pains and constraints but none that are unusual or that would be difficult to resolve. The base is being well established for a system that will be increasingly beneficial to agricultural production in Nepal in the next two years of duration of the project and that hopefully will provide for an expanded program to serve farmers throughout Nepal more effectively in succeeding years.

2. Recommended Immediate Emphasis of the Project

It is recognized that a period of five years, the time span of the ICP, is an inadequate period for establishing a fully operative and well staffed

research and development system. The term required for training and building a complement of qualified multidisciplinary manpower usually extends over 10 years or more. The information that is being developed through the cropping systems research sites is indicative but not sufficiently replicated over time to be fully reliable. At least two to three more years of results will be needed to build a base for recommendations with reasonable confidence.

Although the technology evaluation process is still in the development and early maturity stage the review team and ICP personnel are aware that there is urgent need to utilize the best information and materials now available to support efforts to increase Nepal's food grain production. The limited pre-monsoon showers and subsequent light monsoon in 1979 have caused serious food grain deficits. As HMG moves forward with accelerated crop production programs in the 1979-80 crop seasons the ICP should be expected to be involved in a supporting role to the agencies responsible for the production campaigns.

The report of the review team presents information on some of the types of technology inputs that might be furnished by the respective rice, maize and wheat research programs and through the cropping systems sites. The early use and application of technology that is still in the evaluation and verification stage--with respect to specific farming conditions--presents some risk, but risk that would be justified under the current critical food supply situation.

3. Future Directions of the Project

Many of the substantial investments to improve agriculture in Nepal during the past 25 years, by HMG and external agencies, have not had the impact or continuing benefits anticipated because the individual projects were not covered into the institutional structure of Nepal. Also, projects tended to be established and operated at a funding level that could not be continued with HMG resources as external support was diminished and withdrawn

The review team feels that the ICP is conceptually sound, well designed to meet Nepal's unusually complex and varied farming conditions, and should be seriously considered as a continuing base for agricultural technology generation and use. The current project will conclude its five year term in 1981. In order to ensure maximum effective continuity of a program for improving farming systems and productivity in Nepal through a sound, technology-based system it would be desirable for attention to be given promptly, jointly by HMG and USAID, to actions to be taken to ensure effective continuity of activities along the lines of the ICP.

4. Recommendations

The review report identifies a number of constraints to the Project as well as opportunities for redirection of research and accelerating the impact of the ICP on agricultural production in Nepal. The following actions should be considered for priority attention:

a. Actions should be taken to bring the ICP to its intended level of effective operation by expediting construction of facilities, the scheduling of manpower development, and provision of permanent HMG staffing for the project.

b. Give sepcial emphasis to the strengthening of the Cropping Systems Research Program (CSRP) at the five sites now established, to further improve the procedures for testing and adapting new technology to ensure its suitability for different agroclimatic situations and acceptance by farmers. The possibility of adding a new cropping systems field site in the Inner Terai, in the Chitwan Valley, also should be explored.

c. Expand the CSRP by establishing more effective linkages with selected area development projects, such as those at Lumle, Pakhribas, Gandaki, Janakpur, and others.

d. Expand the studies on soil fertility and agronomic research in the CSRP to relate fertilizer use more precisely to site requirements and to efficient fertility management in various cropping sequences.

e. Include attention to livestock in a broader approach to farming systems research, recognizing that animals are an integral component in farming throughout Nepal.

f. Set up a national coordinated Farming Systems Research Program (as a successor to the CSRP) with the same permanence as the national commodity research programs, with full-time coordinating leadership and full-time, permanent positions for the staff.

g. Give attention to research for improving varieties and production practices for barley, millets, grain legumes, oilseeds, potatoes, and other crops that are important in cropping systems in different areas of Nepal.

h. Concentrate greater attention on pilot production programs in a few selected farming areas, to determine the potentials for new technology to increase production and to gain further experience in working relationships with farmers, Regional Directors, DADO's, the AIC, ADB, AMS, IAAS and other concerned agencies.

i. Consolidate the information and experience of the ICP, and especially the CSRP site results, to furnish the base for accelerated crop production programs.

j. Place increased emphasis, and support, on the recent initiatives by the rice, maize, and wheat programs to develop varieties better suited to temperate zone conditions and to the various microclimates of the Hills.

k. Develop multipurpose regional stations for breeding, selection, and critical evaluation of new varieties and production practices for rice, maize and wheat, to serve farmers in the Hills. Guidance with respect to needs and potential sites is furnished in the report "A Study of Hill Agriculture in Nepal," of November 1974.

l. Continue to develop the interactions and cooperation between the CSRP, the National Commodity Programs, and the Discipline Divisions of the Department of Agriculture to maximize cross references with respect to critical problems and to new technology developments.

m. Strengthen those aspects of the national commodity programs as required to tackle continuing stubborn, high priority constraints, including the high sterility of wheat in the Eastern Terai, the threat of Karnal bunt of wheat, the downy mildew and other diseases of maize, and other problems as identified in the review report.

n. Take positive steps to ensure close collaboration with the Seed Production and Input Storage Project that is being established in the AIC, to ensure expeditious production of high quality seed of improved crop varieties adapted to the various farming areas of Nepal.

o. Arrange for prompt joint consideration, by appropriate representatives of the HMG and USAID, of actions to be taken for continuation of the ICP, with such modifications as may be desirable, to ensure maximum benefits from the experience and investments in strengthening Nepal's capabilities for technology-based agricultural development.

p. Give further careful consideration to the establishment of a Nepal Council for Agricultural Research, to provide the kind of national institutional capability that is serving effectively for agricultural development in India, Indonesia, the Philippines and other countries of Asia. These organizations provide for active involvement of all agencies concerned with agricultural development in the planning, implementation, and evaluation of research to increase agricultural production, and its prompt and effective use by farmers.

I. INTRODUCTION

A. Background of the Project

The Integrated Cereals Project (ICP) was designed to increase the productivity of Nepal's food grain cropping systems, particularly on small hill farms, and to assist in meeting the national objectives of His Majesty's Government to increase food grain production, improve income distribution, and raise the nutritional status. The Project was planned as a continuum--to generate technology, verify it, test it on farmers' fields, and carry it through to farmer application and use.

Nepal's agriculture, with 60 percent of the country's population residing in the hills on small farms that are intensively cultivated for a subsistence - level production, is unique because of the varied and complex growing conditions. This limits the prospects for introducing improved technology from outside sources and using it directly in Nepal hill agriculture.

The ICP is concerned with a "farming systems" approach. This provides for study of the farming practices, constraints, and potentials, taking into account social and economic factors as well as geophysical and bioclimatic ones. The better understanding of the farming systems throughout Nepal will guide the generation of improved technology - higher yielding, disease resistant varieties and improved production practices to fit more precisely the patterns of farming in specific localities.

Emphasis was placed, in initiating the project, on farming systems in the hills. Of the five cropping systems research sites selected four are in hill areas: Khandbari, Lele, Pumdi Bhumdi, and Chauri Jahari. The fifth, in Parsa District (at Sukchaina and Dhobini), is in the Terai. The headquarters for the three national crop improvement programs, for rice at Parwanipur, maize at Rampur, and wheat at Bhairawa were fixed by decision of HMG before the ICP was planned in 1973-75.

A principal objective of the ICP is to furnish a base for the strengthening of Nepal's agricultural research and technology generation capability, in a pattern that will ensure maximum attention and benefit to small farm production practices.

B. Procedures and Focus of the Evaluation

The ICP has been reviewed annually since its initiation, in 1977 and 1978. The present evaluation is essentially the mid-term review, in the third year of the five-year term project. Since substantial progress has been made in the development of facilities, manpower development and training, staffing, provision of consultants, establishing of cropping systems sites, etc. the current evaluation concentrated more attention on progress in technical aspects of the project, with less attention to operational matters.

The evaluation was facilitated by the compiled Review Papers, prepared by the cooperating project staff, by annual reports and special papers prepared by the national rice, maize, and wheat programs, and by the cropping systems staff. Discussions in which the review team, HMG representatives, cooperating IADS consultants and Nepali project personnel participated were held at the research stations at Parwanipur, Rampur, and Bhairawa, and at the cropping systems sites at Khandbari, Lele, Sukchaina, Dhobini, and Pumdi Bhumdi. The planned visit to the Chauri Jahari cropping system site had to be eliminated because of cancellation of the flight by the charter aircraft. The members of the evaluation team and key participants in the review are presented in APPENDIX I. The schedule is given in APPENDIX II.

II. CURRENT STATUS-PROGRESS TOWARD PROJECT GOALS

A. Project Concepts and Objectives

The Integrated Cereals Project (ICP) was designed "to assist in strengthening the Ministry of Food and Agriculture's (MFA) capacity to a) generate improved production technolgy and inputs for the major food grain crops and related cropping systems, and b) transfer that technology to farmers in such a way that it is readily accepted."

The ICP was not conceived as a "traditional research plus a traditional extension program"--but rather as a continuum involving the generation, verification, farm field testing and adaptation, and application and use of improved technology. A principal objective is the development of improved cereal production technology suited to the practices, potentials and constraints of the different farming regions of Nepal. This "farming systems' approach is recognized as essential in improving productivity for small farms in the hills.

The ICP provides for development of understandings of farming practices in the hills, with attention to social and economic factors as well as to agroclimatic ones. This information, fed into the rice, maize and wheat research programs, serves to guide the research in generating improved technology for the specific farming conditions and systems. It is recognized that only limited benefits can be expected from technology introduced into Nepal from external sources and that a technology - based capability for sustained growth in agricultural production must be designed as a system that will serve effectively Nepal's varied, complex and intensive farming conditions.

B. Cropping Systems Research

The Cropping Systems Research Program (CSRP) functions at present within the Agronomy Division. It tests the best available crop technology on farmer's fields and identifies improved production methods that fit into local farming systems and are acceptable to farmers. The program relies on the commodity and discipline oriented programs for improved materials and management techniques. The CSRP provides these programs with detailed specifications of the requirements that are to be met by new technological components. The CSRP also feeds back the performance of new technology in the farm setting. These activities make research results more relevant and more available to small farmers with limited production means. Attention is given to all components and factors in the system in order to increase productivity of the farm operations.

1. Major achievements

a. Five cropping systems research sites have been established in the four development regions of Nepal. Each site has different land types and agroclimatic conditions representative of common production situations in the country. This has permitted accumulation of information on the needs of farmers and the potentials for improved crop production technology that can be fitted, with minor adaptation and adjustments, to different farming areas of Nepal.

b. The physical and socioeconomic environments of the different sites have been studied and have led to a land-use classification within the sites that reflects observed variations in farmers' cropping patterns. This classification will be employed by extension agents to better adjust recommendations to variations in land qualities. Particularly in the hill areas, this approach to research and extension will greatly improve benefits farmers can derive from new technology.

c. For the land classes of each site, the existing cropping patterns, their productivity, and the management methods used by farmers have been described. Attention has been given to the farmers' criteria used for the selection of different patterns. This has led to answers to "why's" and "hows" about farmers' practices.

d. Improved varieties of rice, maize and wheat released by the commodity programs have been tested in different physical environments. Results have been provided to the concerned commodity programs.

e. Fertilizer dosages, seed rates and plant densities have been adjusted to the different environments. This fine tuning will reduce misallocation of inputs and increase benefits to farmers from their cropping patterns.

f. The link between research and extension has been strengthened through the enthusiastic participation of extension workers in the cropping system research sites, and the development of future program directions.

g. Crop production projections were made for the Panchayats in which the CS sites are located. These are based on extensive testing of improved cropping patterns under farmer's management. Projections indicate a clear potential for doubling food crop production in these areas in a reasonable time, provided adequate support exists for inputs such as seeds, credit and extension services.

h. An extensive survey was initiated in collaboration with the Animal Science Division to determine the role of livestock in the farming systems at the CS sites. This will lead to the identification of methods to improve the animal production component of small farms.

2. Conceptual development

a. The CSRP has gained confidence in its on-farm research methods. Their results are now used in commodity programs to provide dependable estimates of production levels that may be obtained by farmers, to understand the management techniques used, and to identify constraints to increased production.

b. The land classification approach for targeting recommended cropping patterns is finding acceptance by commodity and disciplinary researchers as well as collaborating extension agents.

c. Whole-farm description has led to an increased understanding of the role of animal production in small farms, particularly in the hill areas. The whole-farm context is also required to improve methods for comparing performance of different cropping patterns.

d. The CSRP is now formulating pilot production programs based on their research findings. It has also developed research methods on farmers' adoption that will be employed to monitor progress in future pilot production programs.

3. Current constraints

a. Administrative. The CSRP has not been accorded a recognized place in the structure of the Department of Agriculture. This threatens future program continuity and affects staff morale. The manner in which the CSRP is incorporated into the department should recognize the following:

- The program is multidisciplinary, including social scientists.
- The program is multi-commodity.
- The program must be flexible, to respond to geographical shifts in emphasis and to address new farm problems or components--such as animal production.
- The program should participate fully in research planning activities of commodity and disciplinary programs.

For these reasons it is recommended that the program be established as the Coordinated Farming Systems Program. This recommendation was also made by the 1978 program review team.

b. Manpower. At present most CSRP staff members are on deputation from other Divisions, or are on "temporary" appointments. This leads to high staff turn-over and a loss of trained staff--CSRP trainees often do not return to the program. Cropping Systems Agronomists and other professional staff, Site Coordinators and support staff, should be given full time, permanent posts in the Coordinated Farming Systems Program.

Development of initially planned studies on fodder production, grazing methods, bund stabilization, vegetable and fruit tree introduction, and compost management have advanced very slowly because of limitations of manpower. Site staff was recently reinforced through the use of ICP funding for some graduates and junior technicians. Continued priority should be given to completion of the staff complement of the five CS sites.

c. Technical. The research results involving minor crops have been discouraging. The program has not been able to identify genetic material that out yields farmers' varieties. To effectively contribute to the improvement of farmers' cropping patterns, screening and crop management research should be strengthened for crops such as chickpea, pigeon pea, finger millet, lentil, peanuts, soybean, mungbean, linseed, mustard, barley, potatoes, and buckwheat, giving priority to the crops that occur more frequently in the hills.

d. Operational. The limited number of trained staff in the sites has led to a major processing and interpretation of research results by central program staff at Kathmandu. This has reduced the participation of site staff and their contribution from detailed farm observations. It also inhibits the processes through which knowledge of the existing and experimental technology accumulates at the site. The review team recommends that internal site reviews (2 days per site, twice yearly) be employed to incorporate all information into an overall understanding of the site and a definition of future research priorities at the site.

On farm research seeks to capture farmer's experience about the production environment and his judgement of new technology. The CSRP researchers have effectively studied the farmer's production system and his motivation for it. This approach should be extended more broadly to experimental cropping patterns and management trials. Whenever possible cooperating farmers should be informed in more detail about what is tested in on-farm trials. Methods should be developed that allow more farmer participation in cropping pattern design. For this purpose CSRP site staff may require additional training in methods of communication with farmers.

Demonstrated interest by extension workers indicates an excellent potential for using the CSRP sites to train extension staff. This should be encouraged through on the job training.

4. Interaction with commodity and disciplinary research

There has been a growing mutual awareness of research activities by the commodity and CSRP programs, especially in the past two years. This has led to improved collaboration in research. There are, however, some aspects that can still be improved further, such as:

a. Minikits. The minikits are distributed by the commodity programs to provide information on acceptability of new varieties to farmers and to create foci for the spread of improved seed materials. Generally, these objectives are only partially achieved. It is therefore recommended that the minikit trials cover a slightly greater yield area and be considered as part of the extension program. Minikit trials should be targeted to major land types (e.g. irrigated wetland, rainfed wetlands, uplands at low, medium and high altitudes, intermountain valley bottom lands) and to crop sequences. For each of these production situations a reasonable sample of farmers who receive minikits can be usefully associated with on-farm research projects in CSRP sites and integrated development programs. As soon as the CSRP has identified extrapolation areas, these should be included on the minikit trials. The cropping systems program should participate in the design of the minikit trials and their analysis, and the discussion of results.

b. Cluster trials and farm field trials. These test out technological components (varieties, fertility aspects, plant densities, insect pest control, etc.) for the management of the major commodities. Part of this research is also conducted by CSRP site staff, generally as trials superimposed on the cropping pattern test field. The cluster trials should be designed in collaboration with the CSRP and incorporated into CSRP site activities where possible. Commodity programs should continue to participate in the planting and harvesting of their cluster or farm field trials, but CSRP staff can take care of day to day supervision. The treatment design of cluster trials should be carefully revaluated, and trials should be placed in fields representative of important land types.

c. Supportive research at research stations. On-farm research results obtained from cropping pattern trials, input management trials, and crop cutting surveys, identify important constraints to increased crop production. These management components often require in depth study by discipline or commodity oriented researchers. The CSRP staff should expand their participation in the research planning of the commodity and disciplinary research programs during the summer and winter workshops. This would achieve greater correspondence of this research with the needs identified in the CSRP.

d. Extrapolation of CS results to other sites, and the identification of pilot production program areas, requires the intensive study of climatic and soil conditions in major production regions of

Nepal. Such studies should use existing information and should be correlated with on the ground observations. These studies should be conducted jointly by the CSRP and disciplinary divisions of the Department of Agriculture.

C. National Rice Improvement Program (NRIP)

1. Progress and developments

The review team visited the headquarters of the National Rice Improvement Program at Parwanipur and were briefed on the recent developments, staffing, and constraints to implementation of the project. Significant developments during the year include:

a. The release of four varieties ranging in maturity from 110 days to 140 days. These varieties offer greater potential in yield, disease resistance, and insect resistance than varieties now grown by farmers.

b. Two varieties have been identified in field trials for upland rainfed conditions. These have been tested in the CS sites and are being favorably received by farmers.

c. Blast screening has been expanded to include new progenies in the breeding program. New problems identified include a rice dwarf virus and suspected sulfur deficiencies in the Bhairawa area.

d. Linkage with IRRI's Genetic Evaluation and Utilization program, and a plastic house and glass house, have expedited production of new crosses and rapid advancement of breeding material.

e. New facilities for officers and laboratories are nearing completion and will fill a long felt need. A seed processing and storage unit is under construction.

f. Expanded breeding and testing programs at Khumaltar and Palung for temperate zone rice varieties are especially encouraging and should begin to provide new varieties for the Hills.

g. Cooperation with the IRRI International Rice Testing Program (IRTP), in advancing earlier generation material at IRRI, has helped to accelerate development of improved varieties through the NRIP in Nepal. The four newly released varieties came from the IRTP cooperation. These trials are being expanded to include tests in fertilizer efficiency.

h. The use of improved varieties continues to increase, largely as a result of spread from minikits distributed in 1978 to about 4000 farmers. The minikit program was expanded in 1979 and included varieties for early season and regular season crops. Seed multiplication of the four new varieties released in 1979 will encourage further rapid spread in farmers' fields through the minikits in project areas and in pilot production programs at CSRP sites.

i. Farmer Field Trials have been established in several areas where it is expected that seed, fertilizer, and water will be more nearly assured so that early production increases can be expected. Special focus is also being given to the CSRP site areas.

j. New FFT's in 1979 included varieties from the Khumaltar program on temperate varieties and the performance of some entries was most encouraging.

2. Major continuing constraints

The very great diversity of rice growing agroclimates and cropping systems in Nepal places a heavy demand on the NRIP for varieties with better adaptation for specific environments and for greater stability of performance at higher levels of productivity.

The NRIP must give concurrent attention to development of improved varieties and production technology for the large areas of lowland rainfed rice, for the temperate zone conditions and variable micro climates of the hills and for the Tars and river bottom areas. Varieties that are shatter-resistant, with earliness to escape hail damage,and that are suited to cropping systems with wheat, must be developed.

Management practices suited for the minikits, to boost production on a dependable basis as confirmed in the verification trials,to be used later in production campaigns, continue to be a deficiency. Associated with this is the lack of information on rice varieties and production practices which can be popularized through extension services and mass communication media. Major constraints of the rice program include:

a. Lack of manpower. This has been accentuated by the fact that four staff members have departed for degree programs in the past

eight months and two others have been selected to go abroad in the next 12 months. The latter two are from Khumaltar and will adversely affect the temperate rice research program. Another serious constraint is the lack of production agronomists in the NRIP to work with the on-farm testing program.

b. More equipment is needed to operate the research stations efficiently and the new laboratories must be equipped promptly to make them effective functional units of the research program.

c. Targets for seed production interfere with areas required for research at the various stations and farms.

d. Accomodations for staff are a continuing problem which is reflected in the work attitudes and motivation of the staff.

e. Budget cuts in funds for travel, petrol, and labor impose very serious constraints on productivity of the NRIP.

3. Assessment of the program

The National Rice Improvement Program has moved forward most effectively since it was established and is making significant contributions to rice improvement and production in Nepal. The coordinated program is functioning increasingly as a multidisciplinary team effort. The NRIP has well organized research plans and annual workshops with good participation. The research farm has a more well managed appearance than in the previous two review periods, reflecting over all better management and team spirit.

Cooperative work with special project areas should prove especially effective in linking research with production programs for defined areas. The NRIP continues to suffer from some lack of understanding and cooperation with the discipline divisions and other units of the national research system. This situation is improving but persists to some degree with all of the commodity programs. In order to improve relationships and effective program implementation it is recommended that a memorandum of understanding be prepared between the discipline divisions and the national coordinated commodity programs which would define areas of responsibility, sources of funds for trials, and staffing to be provided.

The network of stations and farms, and the trials conducted at these locations, provide reasonably good coverage of the agro-climatic conditions of Nepal. There is an urgent need, however, to improve the evaluation of new varieties and production technology in the hills at altitudes of 2500 to 3500 feet. These requirements may be met by existing or future cropping sy tems sites, or by Farmer Field Trials managed from nearby stations or farms.

D. National Maize Development Program (NMDP)

1. Progress and developments

Maize production has been declining during the last decade, particularly in the hills and the mountains (High Hills). Weather has often been unfavorable.

A sound basis is being laid, however, for a research capability to arrest this trend and to reverse it. There has been an appreciable improvement in the past two years in the quality and focus of research in the maize research stations and in farmers' fields.

Appreciable progress has been made in creating an awareness of the need to integrate the components of the agricultural production system. The NMDP annual workshop in January -- at which time representatives from Rampur, Khumaltar, IAAS, AIC, Exten sion, ADB, and from other agencies gather to report on the past year's results, exchange views, and plan for the next crop year -- is one of the best workshops of its kind in the Asian region in terms of breadth of participation and exchange of ideas.

2. Major continuing constraints

Fertility, moisture and diseases continue to be major production constraints requiring carefully focussed and executed research efforts. More efficient varieties of shorter duration, with built-in disease resistance, are urgently needed to maximize the return from scarce fertilizer supplies, uncertain moisture supply, and widespread disease problems. The past concentration on long duration, gross plant type varieties, requiring adjustments in the prevalent cropping patterns, is being modified but emphasis by the NMDP on developing varieties which will immediately fit into prevalent cropping patterns should be further accelerated.

Plant pathologists and breeders have shown that they can dramatically improve varieties for disease resistance. This work

needs to be systematized and intensified, and the breeding for disease resistance should be done on site insofar as possible in order to achieve a tolerable level of field resistance. Artificial inoculation should be done for the more important diseases for which techniques have been worked out. For downy mildew resistance, the most immediately useful procedure would be to take the varieties developed in Thailand and Philippines, which have a high degree of resistance, and to select for local adaptation and for traits which are important in Nepal. Of the many determiners of stability the ones about which breeding can do something are diseases (almost always), and insects (on rare occasions). Risks from uncertain moisture can be reduced with shorter duration varieties.

Abundant data has been accumulated to indicate that a 45-90 Kg. level of nitrogen application is sufficient, that phosphorus can be reduced in the kharif maize crop, and that potassium provides little if any benefit. There is no point in conducting extensive trials to reconfirm such well known results. Maize production is presently limited in Nepal because of the insufficient supply of fertilizer. The responsibility for augmenting fertilizer supplies is not a function of the NMDP but several agencies of HMG share responsibility for using whatever supplies are available in the most efficient manner possible. This needs to be researched further.

Chemicals for insect and disease control are used only to a limited extent for maize and these are constraints of a very low order of priority. There may be some justification for seed treatment with fungicides and insecticides, but since less than 5% of the seed used in Nepal is treated -- and treatment procedures and chemicals are well known -- there is no need for research in this area.

Moisture is often a problem, sometimes overly abundant but frequently insufficient. Nepal's soils, when augmented with available compost, can provide enough nutrients to an efficient maize variety to produce 2.5 tons of grain, with near optimum weed and water management.

Weed control studies have indicated that keeping the maize crop weed-free until tassel emergence is sufficient for the maize crop. This is well known so there is no need to conduct more research on weed control unless it is decided that Nepal should place more emphasis on chemical week control. However, since other crops are grown in sequence with maize, weed management studies on a cropping systems basis would be useful.

Availability of improved, quality seed is a major constraint deserving priority consideration. The annual seed requirement of the maize growers of Nepal, at an estimated rate of 30 Kg per hectare on 440,000 hectares, is 13,200 tons. The NMDP and the AIC produce and distribute between 200-500 tons of seed of released maize varieties. Even 500 tons is only 4% of total requirement. This, in itself, is not bad. If the seed had good germinating ability, was of reasonable purity, was carefully selected for trueness to type, and the variety were really acceptable to the farmers,500 tons of seed well distributed annually would be sufficient to cover the country in a few years.

Seed quality, however, must be improved. Genotype is important, but germination is crucial. If the farmer can not get a good stand everything he does subsequently will not make up for it. In general, farmers who are saving their own seed do a reasonably good job of preserving germination capacity. Private seed companies would not long survive if they did not do at least as well. A government seed corporation can do no less if it's to retain its credibility and usefullness to the country.

3. Assessment of the program

The outreach program of the NMDP is particularly well conceived and substantial progress is being made in improving its focus and execution. The budget for outreach activities appears to be adequate.

All researchers involved in the NMDP should become involved in outreach and training because these activities provide an essential means of learning for the researchers as well as extending research results. The researchers must be continually aware of the needs of farmers in order effectively to plan and conduct research to serve them.

In this connection, as is spelled out in the project paper, it is essential that the NMDP form a strong linkage with the Cropping Systems Research Project. The maize workers have much to learn from the CS agronomists and social scientists -- to increase relevance of the maize research trials -- and the cropping systems people are dependent on the maize workers for improved, more productive technology. This relationship is developing, with a small trial of varieties with relevant maturities planned at each CS research site. These trials will furnish the base for other cooperative research projects, as needed, specific to each site and to each situation at each site.

Additional manpower must be mobilized and trained to enhance the effectiveness of the NMDP. Particularly important is creation of positions for a pathologist, an entomologist, a production agronomist-cum-trainer, an agricultural engineer specializing in water management, and a breeder. The overseas training load to develop these people will be high.

A multidisciplinary team can only be established if the right components are developed, adequate facilities are provided for each, and there is dynamic leadership to provide encouragement, direction, recognition, and critical evaluation of the needs and progress of the work.

Facilities under construction and planned for the project at Rampur appear to be adequate, but equipment and support staff to make maximum use of the facilities should be assembled as rapidly as possible. Adequate housing is especially important at Rampur where alternatives are absent.

Regionalization of research work takes on two dimensions. The first is for varietal development. No main research station is sufficient unto itself for this purpose under any circumstances and this is particularly true in a country with such diverse agro-climatic and socio-economic environments as Nepal. Staff and facilities must be improved for maize improvement work at agriculture farms in the different regions. Approximately one hectare for selection work, yield trials, and small scale seed increase for local farmer field testing, is needed at each station in each region. Ideally, each region should have an appropriate location in the terai, the mid-hills and the high hills. While crossing can be done anywhere, the selection and improvement work should be done in the ecological zone where the variety is to be grown. The Rampur Station could be used for generating material for testing and for recombining selections made at the regional sites.

The other dimension of regionalization is agronomic research. In this case, agricultural stations and farms usually serve as the base from which the agronomist can radiate out to conduct simple agronomic trials designed to answer specific questions of relevance to maize growers in his area of concern. Coordinated trials with treatments determined by scientists at the main station should be limited and major emphasis placed on studies of maximum benefit to the region or locality.

Linkages with various other groups such as the Khumultar Divisions, the CSRP, AIC, IAAS, the various technical cooperation agencies and area development projects, etc. should continue to be sought and strengthened. The NMDP appears to be quite active and successful in this regard, with decided improvement in the past two years.

E. National Wheat Development Program (NWDP)

1. Progress and developments

Wheat production has been increasing substantially over the past ten years. The current production in Nepal is estimated at 454,000 metric tons as compared to 233,000 tons ten years ago and only 139,000 tons 15 years ago. This increase has occurred primarily as a result of increased acreage, with the average yield per hectare remaining constant at 1.1 to 1.2 tons per hectare over the past ten year period.

The expansion of the wheat area has occurred primarily in the Terai, in new areas and with farmers that were traditionally rice growers. The interest and expansion in these areas became possible because of the development of early maturing, disease resistant wheat varieties. This allowed farmers to sow wheat after the rice crop had been harvested in October or November. Until the development of the semi-dwarf wheats this cropping pattern was not possible because the traditional varieties were too late in maturity and often susceptible to local diseases.

The practice of sowing wheat after rice presents a number of problems. Even with the new early maturing varieties of wheat the average sowing date in the Terai area is too late for maximum wheat yields. This is reflected in the national average remaining constant, with expanding acreage. The soil structure is destroyed in the puddling process for rice and has a depressing effect on wheat yields. In the Terai there are also serious disease problems which are limiting.

The extension of RR 21 and the associated technological package has been the principal reason for the doubling of wheat production over the past ten years. However, the adoption of RR 21 on such a vast scale has been a source of concern. If the variety were to become susceptible to a new race of a disease virtually all of the farmers in the Terai area could be affected. The NWDP has evaluated thousands of wheat lines from other national

programs and international agencies, and a number of varieties have been identified and released. The principal objective behind the release of the varieties is to diversify the acreage sown to RR 21, and minimize the impact of any "new" problem which may arise.

The improved varieties released for growing in the Terai are: HD 1982 (Janak) and NL 30 in 1977, and UP 262 in 1979. Two of the varieties were developed in India and the third (NL 30) was selected from germplasm received from the International Maize and Wheat Improvement Center (CIMMYT). This points out the value of the close international cooperation that exists with the NWDP.

The newly released varieties do not satisfy all of the requirements encountered in Nepal's diverse agricultural areas In the Eastern Terai sterility is a problem frequently encountered. The sterility problem is more prominent in some varieties than others. NL 30 is sensitive and should not be extended into that area. The factors that cause sterility are not known and will require further investigation. Currently, this can be accomplished only through multi-location testing that will, hopefully, identify sensitive varieties before they are released for commercial production.

The variety UP 262 has been found to be susceptible to a disease called Karnal Bunt (Nevossia indica). This disease has been reported previously from the Punjab and Terai area of Uttar Pradesh in India. This year Karnal Bunt was identified in the Rupendehia and Doti Districts in the West and Far Western Terai. One sample of Karnal Bunt from Rupendehia was from a farmer who had purchased seed from the Terai Development Corporation at Haldi, UP. Arrangements were made to replace this farmer's wheat seed so that his crop would not be a source of spread. Karnal Bunt was also detected at Doti Government Seed Farm and it was decided not to use this crop for seed.

The NWDP Farm at Bhairahwa purchased 10 tons of seed of UP 262 from the Terai Development Corporation. This seed was intended for use in minikit Trials, but Karnal Bunt was discovered so eight tons of seed were returned to the Terai Development Corporation and two tons were destroyed.

Plans have been made to continue monitoring the Karnal Bunt situation. Samples will be collected and sent to Khumaltar for analysis so the significance of the disease to Nepal can be determined. Efforts will be increased to identify resistant and tolerant varieties.

A number of new promising lines of wheat are being evaluated and it is hoped that they will be useful in further varietal diversification. The variety RR 21 has a large white bold grain which has helped to popularize it with the farmers. This distinctive feature makes it difficult to convince farmers of the value other varieties -- until a difference becomes readily visible such as disease resistance or a dramatic yield increase.

A number of varieties are being evaluated for the Hill areas but progress toward this end is limited due to the lack of a suitable research station where selection work can be exercised. Currently only the evaluation of advanced lines in varietal trials is possible. In this group some of the triticale look promising for the hills and higher hills where acid soils prevail. The yields of triticale have been excellent and they are resistant to the important diseases found in the Hills.

The results of Farm Field Trials (FFT) and fertilizer experiments at Bhairawa indicated that phosphorus is important to yields and limits the response of nitrogen when in short supply This situation appears to be wide spread in farmers' fields. There has been little or no response of wheat to potash. The continued application of potash is an unnecessary expense to the farmer and a major cost to the Government of Nepal. Better soil and water management practices are needed in the Terai to improve wheat yields. A number of new practices are being evaluated and the technique of ridging appears to be promising and within reach of the small farmer.

Some progress has been made in understanding the causes of the widespread leaf firing and Helminthosporium attacks that occur in much of the Terai. The spraying of Kithane M-45 at flowering time has increased yields significantly and improved the 1000 kernel weights. The improvement of drainage has also reduced the amount of leaf firing, suggesting that the problem has a complex origin.

The optimum seeding date for currently recommended wheat varieties has been established to be mid-November. The reduction in yield is approximately 20 percent when sowing occurs on December 15th and as much as 50 percent if sowing occurs on December 30th. These results emphasize the difficulty of improving wheat yields when the rice crop is harvested at such late dates.

2. Major continuing constraints

The development of varieties to stabilize and improve yields, continues to be a major objective of the NWDP. The lack of Agriculture Farms and Stations with adequate staff responsible for wheat research restricts progress in developing varieties for the Hills and High Hills. The only location where selection of segregating populations can now be carried out is at Bhairawa. But this site represents only one specialized ecological area. The initial evaluation of wheat lines for the Hills was to be done at Kathmandu but the shortage of staff, budgets, land, and water for irrigation has not permitted the use of this site for selection work.

There are four sites in the Terai and four in the Hills which will be used for evaluation of selected varieties. The areas available are limited and the budgets to manage the trials are also inadequate. These constraints reduce the effectiveness of the testing and evaluation program.

Another constraint to effective varietal development is the lack of a Hill Station which can be used as a summer nursery. Without a summer nursery the advancement of generations is limited to one per year. This drastically increases the time it takes to develop a variety from a segregating population.

The establishment of a Hill Station for wheat breeding work would make it possible to produce new varieties of different maturity classes which would satisfy more precisely the varying needs of different ecological zones. A Hill Station also would facilitate identification of varieties with adequate resistance to the important diseases found in the Hills. Resistance to yellow rust (*Puccinia striiformis*), powdery mildew. bunt, and loose smut cannot be adequately accomplished at Bhairawa. The advancement of generations could also be realized and a Hill Station would allow wheat research staff to be fully active professionally throughout the year. With only the current central research program at Bhairawa there is the period of May to October -- almost a five month period — when no active field work for wheat research is being conducted.

The need for multi-location testing in Nepal is self-evident. Funds should be provided to the NWDP so that costs for the field trials at the selected testing sites can be covered as an integral part of the national program.

The production of breeders', foundation, and certified seed requires proper supervision. Until a national seed project is underway the use of production agronomists of the NWDP, with some specialized instruction to ensure effective supervision, could provide a means by which good seed could be obtained from contract growers and government seed farms. The supervision and care of quality seed production is essential to increasing yields at the farm level. These demands will multiply as more acreage is sown to wheat and more varieties become available.

The role of good seed is vital to production. The current level of seed production is stated at 2500 tons. This accounts for approximately 5.5 percent of the wheat acreage. The remainder must be maintained at the farm level. The condition and quality of seed storage is often inadequate and results in insect infested wheat. This drastically reduces germination and vigor which in turn has a strong influence on stand establishment. Poor stands are a major contributor to lower farm yields. The technology and information for proper seed storage at the farm level is available from numerous sources. The NWDP should undertake a campaign to inform farmers on proper seed storage methods.

The increasing activities of the NWDP places pressure on the currently available land, facilities, and equipment. There is need for additional plot equipment. The effective use of the experimental fields at Bhairawa is limited by lack of equipment and a mechanic is badly needed at the Farm if delays to research efforts are to be avoided.

Better agronomy is essential to increase production and the supply of inputs is a vital factor. The level of fertilizer applied, or available, is very low in the Terai and virtually no chemical fertilizer is used in the Hills. It is important to encourage minimum uses of nitrogen and phosphorus if increases in yields are to be achieved.

3. Assessment of the program

Technically the individual experiments have been providing valuable information on constraints restricting wheat yields. There are several areas which will require further in-depth research before complete answers can be achieved. There has been an increasing awareness of the need to look more critically at the types of experiments that are of priority importance to production.

Information and improved technology from the research stations, farm field trials and the CSRP should be collected and applied in intensive production programs in selected areas. Sufficient knowledge is now available to allow the formulation of sound recommendations for a number of areas and the accelerated production programs would help to focus research priorities on current limitations in production practices.

Manpower for expanded activities continues to need review and adjustments. A mechanic to maintain equipment for the Bhairawa farm has high priority. In the not too distant future an additional breeder will be necessary. There is also an urgent need for several production agronomists to conduct the farm field trials and to strengthen the interactions with the CSRP. The additional production agronomists could also supervise seed production at government farms and by contract growers.

The selection of personnel for short term training from the NDWP program should be organized in a phased plan. The Wheat Coordinator should be a major participant in the planning and selection of nominees for training, including the selection of candidates for higher degree training abroad.

There is an increasing demand on the staff time at Bhairawa to train Junior Technicians (JT's) and Junior Technical Assistants (JTA's). Organizing and handling of these groups may require a Training Officer (TO), or a TO cum production agronomist who could conduct and use farmers field trials as part of the training process. This would greatly relieve the professional staff to conduct their research with minimal disruptions.

The facilities at Bhairawa are improving now that the new office laboratory building has been completed but furnishings are still needed. The seed processing building has been erected but the machinery has not yet been delivered. There is need for additional staff housing and residential quarters for the overseas adviser. In order to better store germplasm an air conditioned seed storage facility is necessary.

Land for experimental and seed production purposes will come under increasing pressure. The current area of 25 hectares of cultivatable land will soon be a serious constraint to the program.

A major critical requirement is a Hill Station that can be used for the development of better varieties for the Hills. The breeding and selection of varieties resistant to the numerous diseases found in the Hills is greatly restricted when selections cannot be made in the area. A Hill Station could also serve as a summer

nursery to advance lines from the Bhairawa Farm. As demands for improved wheat, triticale, and barley varieties grow, a greater degree of regionalization will be required.

The need to strengthen the linkages with the CSRP is growing rapidly. The increasing complexities of rotations, input supplies, alternative crops, and various economic factors require a strong interaction between the CSRP and all commodity and discipline research groups. This relationship is essential to bridge technology transfer to the farm, to serve as a feed-back mechanism in furnishing direction to researchers, and to insure better utilization of existing information. These linkages also provide a better and more current base for gathering statistical information regarding production trends and constraints that is invaluable in research planning.

III. RECOMMENDED IMMEDIATE EMPHASIS OF THE PROJECT

A. Support for Campaigns to Increase Crop Production

The drought conditions in the 1979 crop season, caused by the limited pre-monsoon showers followed by a light monsoon, have resulted in serious food crop deficiencies. Steps are being taken by HMG to increase crop production during the 1979-80 winter season. It is probable that accelerated crop production programs or campaigns will be undertaken also during the following crop season.

The ICP has functioned only a relatively short time, particularly with regard to the cropping systems research approach. However, reasonably dependable information is becoming available on technology that will increase production substantially in a number of farming areas. As the HMG moves forward with accelerated crop production campaigns, the ICP can furnish essential inputs to the agency or agencies responsible for the production campaigns.

The cropping systems research experience of the past two years is particularly relevant to efforts to intensify production. The research of the national coordinated rice, maize, and wheat programs also should be utilized, and during the next two years research on those varieties and production practices that will be most critical in accelerated food grain production efforts should be given highest priority.

B. Cropping Systems Research

The immediate emphasis recommended for the CSRP covers activities that have already been planned for the coming two years, 1980-1981. Most of these arise out of results obtained during the first three years of project activities, and represent further pursuit of project goals described in the original ICP project paper. Specific proposals for administrative and technical emphasis are as follows:

1. Consider the establishment of a National Farming Systems Program, with status equivalent to the present coordinated commodity programs. This program should be clearly linked with the commodity programs, and with the divisional organizations of the Department of Agriculture. The program offices should be located together to encourage communication between the complementary activities involved. All program staff should be encouraged to frequently visit the on-going cropping systems research sites.

2. The CSRP should be given permanence and its structural and functional position should be reinforced within the Department of Agriculture by expanding staff functions and members as described in APPENDIX III. It should be noted that the present national staff of the CSRP is either on deputation or on temporary appointments, and the program coordinator has additional responsibilities that preclude his full attention to direction of the program.

3. The capability of the CSRP should be strengthened through training of staff from within the program and their more active participation in meetings and monitoring tours. The intermediate staffing structure as proposed in APPENDIX III represents the complement required for a coordinated national cropping systems program. The longer range staffing complement is designed to accomodate future involvement of animal production and horticultural activities.

4. Continue work at the existing CS sites, and expand content to include work on the more important minor crops and on the role of livestock in the farming system. Also, the possibility of adding a new cropping systems field site in the Chitwan Valley (Inner Terai) should be explored. This will require employment of additional staff.

5. Complete the descriptive analyses of typical farming systems within the operating field sites and continue research on the description of land and climate and their roles in the determination of varietal usage and agronomic practices in the various farming areas.

6. Improve the feedback from the minikits of the commodity programs to provide an understanding of the factors most important in limiting production in the different agroclimatic environments throughout the country. This is essential not only for planning and redirecting research but also in designing and carrying out accelerated production programs.

7. Increase the range and depth of farm family involvement in the research conducted at the CS field sites, with particular emphasis on effective two way communication of purposes, procedures and findings, and attitudes.

8. Select a small number of suitable target areas for future production programs, and plan and implement outreach programs within these areas, designed to verify project findings and test their relevance to local conditions. The CSRP should guide and assist in setting up an umbrella organization for each pilot area project, headed by the extension division and with representation of the AIC, ADB, local leaders, and cooperatives. This organization would be responsible for preparation of project plans, the involvement of the complementary agencies, and for problem solving and monitoring during project execution. The use of a consultant for early guidance in design of the pilot area projects should be considered.

C. National Rice Improvement Program

The adoption of improved varieties by farmers has been gaining momentum as demonstrated by the rapid acceptance of the variety Masuli. The release of the four rice varieties Luxmi, Durga, Janaki and Sabitry, in 1978-79, offers a very wide range of suitable varieties even for rainfed conditions which occupy a major share of the total rice area. The project should place emphasis on increasing supplies of breeder and foundation seed stocks to accelerate availability of improved seed to farmers where the varieties are recommended. This will require close cooperation between the ICP and the Seed Production and Input Storage Project (SPISP) that is being developed by the AIC.

Yield increases in the past were mainly attributed to a single major factor such as the change of varieties. In order to further raise rice yields greater emphasis should be given to management aspects such as spacing, seeding rates for the Hills, levels of fertilizer use, etc. Zink deficiency in many locations in the Terai and sulphur deficiency around Bhairawa have been observed to be limiting factors. Popularization of techniques to correct these deficiencies needs to be emphasized.

Fertilizers are important in increasing yields of rice. High costs -- for fertilizer materials as well as for transportation -- have been a major constraint for adequate application on a wider scale. The efficiency of fertilizer use must be increased in the various rice growing areas, such as rainfed uplands and lowlands. This work should be supplemented by research to develop more efficient techniques for making organic manures. Another related area of research which requires greater attention is water management.

In the plains 75 percent of the rice is lowland rainfed, about 9 percent is upland, and the rest is irrigated. Whereas irrigated rice has received more attention so far, further research should take into account the importance and requirements of the rainfed and upland areas.

The breeding program has supplied a wide range of varieties for the Terai area but has not been able to supply new temperate varieties for the Hills. During the last two years efforts have been made to strengthen the program for the Hills and this will receive continuing emphasis. Research should be directed to generate a much greater volume of breeding materials to be screened under a range of agro-climatic conditions for yield, blast resistance, cold tolerance, and grain quality.

In many Hill areas, especially lowland valleys and tars, mainly local varieties are grown. In many such valleys, where double cropping of rice is practiced, farmers use CH 45 for the first crop but no improved varieties are available for the second crop. These areas are of considerable importance in overall rice production in the Hills and greater emphasis should be given to selecting suitable varieties for the second crop of rice. The breeding of more suitable mid-season rice varieties would provide sufficient time for the growing of wheat as a second crop in many of these areas. The number of varieties adapted for the second rice crop for the Terai area also should be increased so that farmers can select varieties according to quality as well as for adjustments in cropping patterns.

Greater emphasis should be given to obtaining varieties resistant to major diseases and pests such as paddy blast, bacterial leaf blight, plant hoppers, gall midge, and mealy bugs. Screening for rice dwarf viruses has been established in the green house at Khumal and such work should be expanded.

Cropping systems research on farmers' fields has been effective in evaluating new rice varieties and practices and offers an effective channel for promoting the transfer of new rice technology. In cropping systems sites and project areas where new varieties have been evaluated in farmer field trials and minikits, HMG should undertake accelerated production programs, using the accepted varieties along with improved management practices.

D. National Maize Development Program

Maize improvement research has been under way in Nepal for many years and there is a good understanding of the kinds of problems and limitations faced by maize growers in different areas of the country. The NMDP was set up to address such limitations in a systematic, coordinated, multi-disciplinary approach, to speed up progress in developing more productive varieties and cultural practices.

The current pressure to increase crop production in Nepal furnishes an added incentive to focus the NMDP research more sharply in the immediate future to supply improved technology at the earliest possible date for use in intensive production campaigns. The following actions should be taken:

1. The breeding and selection research should be assessed thoroughly in order to give appropriate attention to needs of farmers in the different agroclimatic regions of Nepal. The location of the National Maize research headquarters station in the Terai has resulted in selection of longer duration varieties that are well suited to growing in the Terai but not acceptable for the intensive farming systems in the Hills.

   The NMDP has given greater emphasis to selection of shorter duration varieties in recent years. These should be multiplied and tested intensively through the NMDP outreach trials, the CSRP, and in minikits to determine their suitability for different agroclimatic areas. The selection and availability of seed supplies of adapted, higher yielding short duration varieties is essential for an accelerated National Maize production campaign.

   In order to make lands available for the vigorous multiplication of shorter duration varieties there is need for critical decisions with respect to further multiplication of the older, longer duration varieties. Rampur Composite includes germ plasm which went into the older varieties such as Khumal Yellow, Kahani Yellow, and Rampur Yellow. Since Rampur Composite is distinctly superior to the other varieties the seed multiplication efforts should be concentrated on this variety. There is no need to multiply four varieties to fill the same ecological niche that one will fill.

   The NMDP should concentrate efforts on further breeding work to select more varieties suited to the various cropping patterns of Nepal. The best current local varieties representative of each region and each cropping systems research site should be used in crossing with selected germ plasm stocks at the maize research station. With two generations per year -- one at the

regional site and one at Rampur -- this intensified breeding program should develop improved varieties for most agroclimatic areas within three to five years.

In order to expedite the accelerated breeding program there is urgent need to provide the dryer and air conditioned seed storage at the Rampur maize research station.

2. Agronomic research should be redesigned to furnish information more relevant to the variable farming areas of Nepal. Soil fertility and management problems are highly specific to site, situation, and season so must be conducted to a greater extent at the regional stations, CSRP sites, and in outreach studies on farm fields.

Maximum efficient use must be made of scarce and costly fertilizer materials -- and of compost -- in Nepal. Soil fertility studies, together with trials on rates and dates of planting of improved varieties should be carried out at regional experiment stations and at the CSRP sites. Promising agronomic and fertilizer practices should be extended to farm field trials for precise evaluation and to provide farmers an opportunity to observe responses and potential benefits of the new practices.

3.

The strengthening and reorientation of the NMDP research should be undertaken with the objective of moving vigorously toward development of improved technology that can be used as soon as possible in accelerated crop production campaigns. The NMDP staff should participate fully in the planning and implementation of such campaigns.

E. National Wheat Development Program

Wheat research in the next two years must focus on increasing production in farmers' fields. There has been sufficient research on a number of problems limiting wheat production. Current new technology should be assembled for intensive field testing and to identify those problems requiring additional research in the next one or two years. By drawing together data from both the NWDP and the CSRP it will be possible

to determine areas in Nepal where production increases will be possible through intensified campaigns. Factors or actions that could help to increase wheat production, apparent from the present review, include the following:

1. The upgrading of the quality of seed at the farm level. This can be accomplished by dissemination of information on proper storage procedures and structures.

2. Improving the efficiency in use of inputs. The general fertilizer levels used are too low and should be in better balance. The new wheat varieties should produce an average of 30 to 40 kilograms of grain for each kilogram of nitrogen and half a kilogram of phosphorus applied under favorable growing conditions. In a few areas higher rates of phosphorus may be required. The application of potash cannot be justified.

3. In some areas minor elements may be a limiting factor. Usually zinc is one of the first elements to become limiting. Where zinc is deficient the application of 20 to 25 kilograms of zinc sulfate will usually eliminate the problem.

4. Seed bed preparation can affect stand establishment. If the top few centimeters of soil become too dry seed germination will be uneven. If the seed quality is poor the stands will be poor.

5. The most critical time of irrigation for wheat is at the crown root initiation stage, usually about three weeks after sowing. If there is sufficient water for only one irrigation farmers should be advised to apply it at this time. If two irrigations are possible the second should be applied at flowering time. Where canal irrigation is practiced the closure of the canals should be adjusted to the farmers' needs.

6. The date of sowing is a critical factor in maximizing wheat yields and farmers should be encouraged to sow as close as possible to the middle of November to optimize yields. If rice harvests are delayed beyond the end of November, and wheat cannot be sown by the end of December, then the sowing of barley should be encouraged.

A number of research efforts currently underway will contribute to wheat production in the near future and should be intensified, including the following:

1. There are a number of earlier maturing rice varieties which have promising potential. The growing of such varieties -- ensuring an early rice harvest -- would allow the timely sowing of wheat, providing a substantial boost to wheat production.

2. The research on barley improvement is complementary to wheat research. The delivery systems are the same and similar research procedures and equipment are required. It would be advisable to determine the advantages of barley over wheat in saline or high pH soils, in short seasons, and at higher altitudes.

3. Seed production capabilities for both wheat and barley can be increased by employing production agronomists with some specialized instruction to supervise contract seed growers and insure quality seed production.

4. Other limiting factors should be identified and assigned research priorities for the next two years. Many research subjects are not site specific and can be conducted at the research station at Bhairawa. Subjects that are site-specific can be solved effectively only at the geographical location representing the agroclimatic conditions. In such instances the research should be conducted cooperatively with other research groups, such as the CSRP, and outreach tests should be conducted on farmers' fields. Serious consideration should be given to the establishment of multipurpose regional research and development centers to serve special regional needs for agricultural development. These centers should be strongly oriented to problems of farming systems and staff should include subject matter specialists to strengthen liaison between research and extension through cooperative work on farmers' fields.

Certain aspects of program planning, and research facilities and support, are common to different commodity programs. Program planning requires identification of significant problems and constraints to production, and feedback from farmers and extension workers. For this purpose interactions should be further strengthened between the commodity programs, and cropping system and socio-economic investigations on farmers' fields. Consultation with extension and development agencies through the Regional Coordination Committees is necessary to get feed back on the performance of new technology as well as on production problems.

IV. FUTURE DIRECTIONS FOR THE PROJECT

A. General Considerations

During the past 25 years HMG and numerous technical assistance agencies have made substantial investments in agricultural development in Nepal, including area development projects, research and extension activities, and agricultural education. Many of these investments have not had the desired or anticipated lasting effects or impact because they were not well integrated into the HMG institutional structure -- and steps were not taken sufficiently in advance of the termination date of the projects to ensure reasonable continuity.

The ICP was planned to furnish a base for the strengthening of a technology generation and application system that would become a permanent and expanding capability for ensuring sustained agricultural growth in Nepal. Attention should be given promptly, jointly by HMG and USAID, to actions to be taken sufficiently prior to expiration of the current project in 1981 to ensure maximum effective continuity of activities for improving farming systems and productivity in Nepal through a sound technology-based system. A number of specific actions should be considered at an early date to further strengthen the ongoing project.

B. Organization and Management

The cropping systems activities of the ICP should be given a recognized institutional status and be established as a coordinated National Farming Systems Program. This work is strongly multidisciplinary and must have effective linkages with the research or technology generation organizations, with the Regional Directors and District Agricultural Development Officers, and with farmers. The present CSRP is giving priority attention to Hill agriculture and this emphasis should be continued. The staffing for an expanded Farming Systems Research Program is shown in APPENDIX III

Increased attention should be given to livestock improvement and development. Livestock is generally recognized as an integral component of farming systems throughout Nepal. But there is only limited specific information on the significance of livestock in the farm level economy, in providing power, cash income, and meat, milk, and manure. Steps should be taken to develop such information, and to include attention to livestock, as soon as feasible, in the proposed Farming Systems Research Program.

Consideration should be given to facilities and sites for expansion of the Farming Systems Research Program in the future, including linkages with area development projects such as those at Lumle, Pakhribas, Gandaki,

Janakpur, etc., as well as to the continuing close liaison with national crop and livestock improvement programs.

Special attention should be given to improvement of agricultural stations in the Hills to serve the technology generation and evaluation of the crop research units, and also the farming systems activities. Suggestions for strengthening selected Hill stations, including proposed staffing patterns, are provided in the report "A Study of Hill Agriculture in Nepal," conducted by the Rockefeller Foundation team in November 1974.

Increased attention should be given to generation of improved technology for crops in addition to rice, maize, and wheat that are important in farming systems in the hills. It should be noted that the Project Paper for the ICP, as drafted in 1974-75 stated "the Integrated Cereals Project will focus on adaptive research and related production linkages for the principal food grains (rice, wheat and maize) and related minor crops (such as millet, barley, potatoes, and the pulses)." Experience with these latter crops in cropping systems site research in 1978-79 demonstrates the critical need for stronger research emphasis in developing adapted varieties and improved production practices. (See page 26 of APPENDIX I, "Sections of Project Paper". in the ICP REVIEW PAPERS).

C. Coordination of Activities of Complementary Agencies Concerned with Agricultural Development

The ICP as initially conceived and drafted provided for a seed production capability to be created as an integral part of the project. This was not retained in the final decisions on scope of the ICP. The current plans to set up a Seed Project, with USAID support, under the AIC will be an important factor in the future success of the ICP and related projects and agencies in increasing crop production in Nepal.

There is need for closer cooperation between the DOA and the related agricultural agencies such as the AIC, AMS, ADB, and IAAS. The latter is of special significance since the IAAS, under the Ministry of Education, will have an increasingly important role in manpower training and development.

The ICP is developing effective working relationships with farmers through the on-farm research at the cropping systems sites, and with the Regional Directors and District Agricultural Development Officers (DADO's) through the national crop improvement programs and the cropping systems activities. These cooperative efforts should be further strengthened as the work of the ICP progresses into further local testing and farmer use. The Regional Directors and DADO's will have increasing responsibilities as the project provides technology and support for this critical extension and production phase.

It has been recognized increasingly that national agricultural research and technology production capabilities should be established in a manner that will provide for active involvement of representatives of all agencies concerned with agricultural development in the planning, implementation and evaluation of research designed to increase agricultural production -- and its prompt and effective use by farmers. The Indian Council for Agricultural Research (ICAR), Philippine Council for Agricultural and Resources Research (PCARR), and Indonesian Agency for Agricultural Research and Development (AARD), have been established and/or strengthened in recent years and are making significant contributions to agricultural production in the respective countries. The Pakistan Council for Agricultural Research (PCAR) and the Bangladesh Agricultural Research Council (BARC) have been set up more recently but are moving forward in development.

Due and timely consideration should be given to establishing a Nepal Council for Agricultural Research, along the lines recommended by the Joint Review Team in March 1978, to provide a strong national institutional base for agricultural research and development in Nepal.

V. SELECTED ITEMS FOR SPECIAL ATTENTION

A. Facilities

1. Construction activities at the national crop improvement program headquarters at Rampur, Parwanipur and Bhairawa were accelerated in 1979 and are continuing. The office-laboratory building at Parwanipur was completed and turned over to the station. The building at Bhairawa is 98% complete while construction at Rampur is 70% complete. Construction of buildings at the hill stations has gone on satisfactorily. The godowns at Daman, Kakani and Dhankuta have been completed. Construction at Jiri is under way but has not been started at Doti and Jumla. The seed plant at Bhairawa is complete and ready for installation of equipment. Seed plant construction at Parwanipur is in progress while the seed plant building at Rampur is held up by lack of cement.

2. The preliminary plan for the training facilities at Bhairawa has been completed. Tender for the architectural design of the building has been awarded.

3. Land development and improvement of irrigation facilities at Bhairawa farm is completed. The irrigation pipes and risers have been laid out.

4. The planning for construction of the CSRP office facilities and training facilities at Khumaltar has not been started, pending approval of the Amendment to the ICP.

B. Manpower Development and Staffing

1. A full time wheat agronomist has been employed by the ICP since April 1979.

2. A full time maize agronomist has been employed at Rampur since March 1979.

3. A replacement for the rice breeder will be joining the project about January 1980.

4. The posts for four HMG rice production specialists and four wheat production specialists have been requested by the respective commodity programs.

5. Five full time cropping systems site coordinators from HMG are now assigned to the different cropping system sites. However, these staff are only on deputation to the sites and are not carrying permanent cropping systems posts. The request for the posts has been made and is now under consideration.

6. The four PCV's for the project have been requested from Peace Corps/Nepal. The earliest date these PCV's can join the program, according to PC/Nepal, is January 1980.

7. The upgrading of station development and operations has been started. Bhairawa station was the first to take advantage of a full time consultant in land development and a well trained agriculture engineer on land development at the station. A master plan for land development at the other stations has been prepared. Implementation is pending finalization of a Project Agreement and arrival of new land shaping equipment.

C. Training

1. Satisfactory progress has been made in the training program. Because of the already limited staff available to the project it is difficult to send more people for academic training without seriously jeopardizing ongoing programs.

2. As soon as the earlier trainees begin to return it will be possible to release others to proceed for training. A long term plan and schedule should be developed for academic training since the identification of personnel for future training would

provide incentives to those who may otherwise be attracted to posts elsewhere. It would also ensure priorities in manpower development that are related to urgent program needs and continuity of priority research.

3. The project has made good use of short term training to provide staff for program implementation without crippling ongoing programs. These types of training should be continued.

4. In-country training is developing on a more substantial basis and is providing skills and management capabilities, especially in extension, that can accelerate effective production programs based on technology developed by the ICP.

D. External Consultants

1. Short term consultants have proved useful to the project, especially where they have been able to return periodically to follow up on recommendations made or to train personnel to carry out special functions such as experiment station development.

For the next two years special attention will be given to consultants for pest control and management, experiment station development, equipment repair and maintenance, minor crops in cropping systems, and the role of livestock in farming systems.

E. Finances

1. Dollar expenditures were available for the period from September 1976 to August 1979, one month less than the three year period. Expenditures for that period were 68 percent of the total $2,699,000 budgeted. The total for international training exceeded the budget by about 3 percent, while other line items were between 60 and 80 percent of the budgeted amounts.

2. USAID rupee financing for the project includes construction, logistic support, program support for the minikit program, and special social science research.

The construction funds have not been utilized as scheduled because of delays brought on by shortages of supplies such as cement.

Of a total of Rs. 20,703,904 provided for construction, equipment and seed kits a total of Rs. 7,051,615 or 34% had been spent up to the end of the HMG 1978-79 fiscal year (July 15, 1979). Approximately Rs. 11,000,000 had been committed for construction. Most of the construction that is planned -- except the training facility at Bhairawa and the cropping systems building at Khumaltar -- has been initiated.

Remaining funds are in the process of being reallocated and incorporated into amendments to Project Agreements relative to the ICP. Rupee funds for logistic support terminated in September 1979 and future support funds will be provided from dollar funds available in the contract. The summary of rupee expenditures for the three year period is as follows:

1976-77	Rs. 901,448.18
1977-78	1,961,780.48
1977-78 (Social Science Research)	62,291.34
1978-79	1,988,114.57
1978-79 (Social Science Research)	297,867.62
Total	5,211,502.19

3. The contribution of HMG to the project includes staff support for the three coordinated commodity programs and the cropping systems program. This includes staff for the cropping systems work at the headquarters and the five sites where research is under way with farmers. HMG also provides the research station facilities and operating costs at Khumaltar and the coordinated commodity program headquarters, as well as the 15 to 18 substations where regional trials are conducted. The HMG support represents about 30 to 35% of the total cost of the project.

F. Commodities (dollar funded)

1. Land shaping equipment and some items of field equipment are on order. Some replacement vehicles are also on order.

2. Instrumentation plans for the laboratories are being finalized and equipment will be ordered early in 1980 after quotations have been obtained.

PARTICIPANTS IN THE EVALUATION

I. Team Members:

A. HMG

1. K. P. Khatri, Ministry of Finance
2. Jagdish Upadhyaya, Planning Commission
3. B. K. Thapa, AIC
4. S. B. Nepali, Director General, Department of Agriculture, and Project Director
5. A. M. Pradhanang, Deptuy Director General, Crop Science
6. A. N. Bhattarai, Deputy Director General, Extension and Training

B. AID

1. D. R. Pickett, Agriculture Officer, USAID/N
2. Jack Ryan, Asst. Program Officer, USAID/N

C. INTERNATIONAL INSTITUTES

1. E. E. Saari, CIMMYT Regional Wheat Representative, Cairo
2. T. Izuno, CIMMYT Regional Maize Representative, New Delhi
3. H. G. Zandstra, IRRI, Head Cropping Systems Program, Los Banos

D. IADS

1. D. S. Athwal, Program Officer, New York
2. A. H. Moseman, Representative, New York, Review Team Leader

3. C. C. Gray III, Assoc, Director for Agricultural Sciences, The Rockefeller Foundation, New York

4. W. H. Freeman, ICP Project Supervisor, Kathmandu

II. Key Participants

A. Parwanipur Station

1. B. B. Shahi - Rice Program Coordinator
2. R. P. Sah
3. S. P. Singh
4. S. K. Pradhan
5. Mr. Sakya
6. Miss Pradhan
7. B. R. Adhikari
8. Mr. Bhattarai

B. Rampur Station

1. G. R. Rajbhandary - Maize Program Coordinator
2. V. P. Sharma
3. T. N. Mishra
4. G. P. Shivakoti
5. D. N. Sah
6. M. M. Palikhe
7. K. N. Dahal
8. I. B. Choudhary
9. Krishna Adhikary
10. A. K. Karna
11. J. D. Rana

C. Institute of Agriculture and Animal Science (IAAS)

1. N. K. Mishra - Assistant Dean, IAAS
2. Rex Ray - Head, MUCIA Team, IAAS
3. H. K. Bittenbender
4. Jesse Williams

D. Bhairawa Farm

1. P. S. Rana - Wheat Program Coordinator
2. B. N. Kayastha
3. M. P. Panth
4. T. P. Pokharel
5. M. P. Rajbhandary
6. R. P. Satyal
7. R. C. Munankarmi
8. M. L. Shah
9. R. N. Devkota
10. P. L. Karna
11. S. S. Shrestha

E. Department of Agriculture Staff

1. M. L. Pradhan - Regional Director, Western Region
2. D. S. Pathic - Agronomist, Cropping Systems
3. S. B. Mathema - Economist, Cropping Systems
4. S. B. Shrestha - Cropping Systems Site Coordinator, Parsa

5. B. B. K. C. - Cropping Systems Site Coordinator, Phumdi Bhumdi

6. R. K. Karna - Cropping Systems Site Coordinator, Khandbari

7. R. C. Sharma - " " " " , Lele

8. N. A. Khan - ADO, Kaski District

9. D. N. Mishra - Acting Chief, GADP

10. Ashok Shah - ADO, Bara District

11. S. S. Shrestha - ADO, Kapilvastu

F. IADS Staff

1. M. A. Khan - Wheat Agronomist

2. R. L. Beacher - Maize Agronomist

3. A. H. Manzano - Cropping Systems Agronomist

4. M. Van Der Veen - Crop Production Economist

5. E. R. Perdon - Production Training Specialist

6. R. Schroeder - Anthropologist, Cropping Systems

SCHEDULE and PRINCIPAL DISCUSSANTS

Monday	22 October	Holiday - Arrival in Kathmandu	
Tuesday	23 October	0900 - 1300 - Visit Lele Cropping Systems Site	A. H. Manzano D. C. Pathic M. Van Der Veen S. Mathema
		1300 - 1430 - Lunch	
		1430 - 1530 - Review of Project Objectives	- S. B. Nepali, DG & Project Director
		1530 - 1700 - Slide presentation of project activities	- W. H. Freeman
		1700 - 1730 - Discussion and team assignments	- A. H. Moseman, Review Team Leader
Wednesday	24 October	0700 - Helicopter trip to CS site at Khandbari	H. G. Zandstra S. B. Nepali A. H. Moseman A. H. Manzano
		0830 - 1000 - Khandbari	
		1000 - 1100 - Khandbari - Kathmandu	
		1300 - 1320 - Kathmandu/Simra RA 343	
		1400 - 1800 - Visit Sukchaina CS site	D. C. Pathic S. Mathema A. H. Manzano Van Der Veen Sagar Shrestha
		1930 - 2200 - Dinner at Sa-'hana Hotel Discussion with Agriculture Officers	

Thursday	25 October	0800 - 1200	- Visit Dhobini/Langari Parsa District CS site	
		1230 - 1330	- Lunch	
		1330 - 1800	- Visit Rice Station Parwanipur	- B/ B. Shahi NRIP staff
			- Night halt at Samjhana Hotel, Birganj	
Friday	26 October	0700 - 1200	- Enroute Rampur by road	
		1200 - 1300	- Lunch	
		1300 - 1800	- Visit Maize Research Station Rampur	- G. R. Rajbhandary R. L. Beacher NMDP staff
			- Night halt Bharatpur & Rampur	
Saturday	27 October	0900 - 1100	- Visit IAAS	
		1400 - 1430	- Bharatpur - Kathmandu RA 354 Afternoon free	
Sunday	28 October	1300 - 1400	- Kathmandu - Bhairawa	
		1400 - 1800	- Visit Wheat Research Station	- P. S. Rana M. A. Khan NWDP staff
			- Night halt Lumbini Hotel	
Monday	29 October	1030 - 1900	- To Pokhara by road	
		2000 - 2230	- Dinner and discussions with Regional and District Officers	
			- Night halt Hotel Crystal	

Tuesday	30 October	Pokhara	
		0730 - 1100 - Visit Pumdi Bhumdi CS site	D. C. Pathic S. Mathema A. H. Manzano M. Van Der Veen
		1130 - 1300 - Meeting of Review Team	
		1400 - 1800 - Workgroup sessions - Sub-committees	
		2000 - 2200 - Drafting Sub-committee reports	
Wednesday	31 October	0730 - 1530 - Drafting Sub-committee reports	
		1600 - 1640 - Pokhara - Kathmandu RA 310	
		1900 - Typists prepare report	
Thursday	1 November	1000 - 1800 - Review of draft report	
Friday	2 November	1700 - Presentation of report to Secretary of Agriculture, HMG	

CURRENT, INTERMEDIATE, AND LONG RANGE STAFFING STRUCTURE FOR THE PRESENT CROPPING SYSTEMS PROGRAM AND THE FUTURE NATIONAL FARMING SYSTEMS PROGRAM

Staffing for Each Site

Current[1/]	Intermediate[2/]	Long Range
1 Site Coordinator	1 Site Coordinator	1 Site Coordinator
1 Junior Techn.	2 Junior Techn.	3 Junior Techn.
	1 Junior Techn. Asst.	2 Junior Techn. Assts.
3-5 Field Assts.	3-5 Field Assts.	3-5 Field Assts.
1 Peon	1 Soc. ec. Recorder	1 Soc. ec. Recorder

National Program Leadership Staff

1	Program Coord.	I[3/]	1	Program Coord.	I	1	Program Coord	I
1	Agronomist	II	2	Agronomists	II	2	Agronomists	II
2	Agronomists	III	2	Agronomists	III	2	Agronomists	III
1	Economist	II	1	Economist	II	1	Economist	II
			1	Statistician	II	1	Statistician	II
			1	Asst. Econ.	III	1	Asst. Econ.	III
			1	Asst. Stat.	III			
						1	Animal Scientist	II
						1	Animal Scientist	III
						1	Plant Prot. Sp ec.	III
						1	Horticulturist	III
			1	Soc. Ec. Sup.	III	2	Soc. Ec. Sup	III
			4	Interviewers	(JT,JTA)	8	Interviewers	(JT, JTA)
						4	Data Processers	(JTA)
			1	Accountant	(JT)	1	Accountant	(JT)

1/ Not all sites are currently fully staffed.

2/ Staffing to be achieved in 1980-81.

3/ All present staff are on deputation, the Program Coordinator has additional responsibilities as head of the Agronomy division.