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WORKSHOP ON FOOD



A REPORT ON THE  
LEMBAGA ILMU PENGETAHUAN INDONESIA -  
NATIONAL ACADEMY OF SCIENCES, USA,  
WORKSHOP ON FOOD HELD AT  
DJAKARTA, INDONESIA  
MAY - 1968

VOLUME - I

OVERALL FINDINGS & RECOMMENDATIONS

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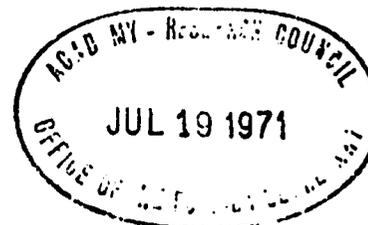
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VOLUME - I

OVERALL FINDINGS & RECOMMENDATIONS



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LIPI-NAS WORKSHOP ON FOOD

VOLUME I

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## FOREWORD

A week-long Workshop on Food was held in Djakarta May 27 . June 1, 1968 to formulate recommendations addressed to Indonesia's most crucial current problem: how to overcome calorie deficiencies and achieve a more nutritious diet for the country's 117 million people. A joint effort of the Indonesian Institute of Sciences (LIPI) and the National Academy of Sciences of the United States (NAS), the meeting sought to assist Indonesia's National Development Planning Board (BAPPENAS) with respect to the development of a national food policy and the identification of budget requirement priorities in connection with the Five-Year Development Plan (1969-1973). In the selection of subjects recommended for concentrated research, an effort was made to list topics for which the country's scientific and technological resources could be mobilized fully to support the top priority national goal of increased food production.

This report was drafted by the eight working groups, each of which considered food production from a different aspect. Volume I contains the over-all findings and recommendations of the Workshop. Volume II presents the reports of the individual working groups. Volume III, the final volume, includes keynote addresses, a list of participants, and other supporting material.

The report was submitted in preliminary form to BAPPENAS immediately following the Workshop. A summary of the conclusions and policy recommendations was presented to President Soeharto and to his cabinet ministers responsible for economic and agricultural development programs.

A basic guideline for the discussions was the 18-month White House report on world food problems conducted by the U.S. President's Science Advisory Committee and published in May, 1967. The Chairman, Executive Director, and several panel members of this comprehensive study participated in the Djakarta Workshop. In addition to the Academy's panel of 25 specialists, there were ten experts representing Australia, Japan, the Netherlands, as well as regional and international agencies. The 86 Indonesian panelists, resource specialists, and observers were drawn from several ministries, universities, and research institutes.

This report is published with the expectation that the observations, findings, and recommendations presented will be of interest and value to a wide audience in Indonesia and the

United States, and among planners, agriculturalists, and others in developing countries who are concerned with the increase of food resources, the organization of research, and the application of science and technology to economic and agricultural development. Additional copies of this report may be obtained free, upon request to either the Indonesian Institute of Sciences or the National Academy of Sciences, the addresses of which are given on the title page.

We were pleased to have Dr. Frederick Seitz, President of the National Academy of Sciences, and Dr. Sarwono Prawirohardjo, Chairman of the Indonesian Institute of Sciences, serve as Honorary Co-Chairmen. Since Indonesia's independence, close and cordial relations have existed between the Academy and the Indonesian scientific community. The Workshop in Djakarta is the latest in a series of workshops cosponsored by the National Academy of Sciences and the paramount national scientific institutions of Latin America and Asia, for the purpose of discussing the role of scientific and technological institutions and programs in national development.

We are grateful for generous support extended to the Workshop from diverse sources. Financial assistance in Indonesia was extended by the Office of the President, by BAPPENAS, by the Ministries of Agriculture, Estates, and Mines, and by LIPI and its constituent institutes. The Ford Foundation office in Djakarta awarded a grant for printing equipment to duplicate papers for the meeting and to publish the final report.

Participation of the Academy panel members and staff support was made possible principally through funds from the Agency for International Development (Contract AID/csd-1122), with additional support contributed by the Ford, Rockefeller, and Asia Foundations, the Agricultural Development Council, Asian Development Bank, AID Office of Regional Development for East Asia, the International Rice Research Institute, the U.S. Department of Agriculture, Tennessee Valley Authority, and several universities and corporations. We also wish to express our appreciation to several other countries and international agencies for arranging representation on the Workshop panels, including the Governments of Australia, Japan, and the Netherlands, the UNESCO Regional Science Cooperation Office, UNICEF, FAO, WHO, and the Asian Development Bank.

Recognition and thanks are due to the many individuals who contributed long hours and dedicated efforts to make the Workshop a success. Credit must go to the Indonesian and U.S. Steering Committees, to the hard-working members of the Local Organizing Committee of the Indonesian Institute of Sciences,

## LIPI-NAS WORKSHOP ON FOOD

### INTRODUCTION

Among the most important goals in Indonesia's struggle for a just and prosperous society are: to provide an adequate and nutritionally balanced diet for all the people, and, eventually to bring population size into harmony with the country's rich, but ultimately limited resource potential.

To reach these goals, she now wages a campaign for food. But to be effective, this campaign must be bound to another that will slow her rate of population increase. The only solution to the problem of feeding the Indonesian population is to increase the food supply and reduce the rate of population growth.

It is clear that some of the targets in the food struggle and some of the strategies to turn plans and aspirations into achievements demand well-coordinated action programs and vigorous leadership at all levels.

The LIPI-NAS Workshop on Food addressed itself to the formulation of strategies and tactics to conquer the spectre of hunger in Indonesia. It is concluded that there exists an alarming protein-calorie deficiency in the average Indonesian diet, a lack that threatens the health and development of young children particularly. In addition to pointing out this threat to the health and future competence of Indonesia's children, the Workshop report discusses measurements of food supply by type and adequacy, explores the possibility of massive increases in food production, and makes proposals for immediate action.

Focusing its attention on the major sources of food - especially rice, but also other crops and protein sources the Workshop has reviewed the situation with respect to current production (including the technological and other factors involved) and has suggested measures which, if applied immediately, could achieve the needed increases. The Workshop has examined the question of production incentives, and recommends policies to strengthen the motivation of farmers and to stimulate the work of agricultural agencies.

Recommendations are made to alleviate problems of food processing, storage, transportation, and distribution. Finally the Workshop has studied the institutional facilities for the research, education, and extension programs which would

stimulate large increases in production and thus reduce the size and scope of Indonesia's food problem.

## SUMMARY OF THE WORKSHOP'S CONCLUSIONS AND RECOMMENDATIONS FOR A NATIONAL FOOD PROGRAM

Assuming Indonesia's prior commitment to a national policy of population control, the LIPI-NAS Workshop on Food has urged a companion national food policy for immediate inauguration in many sectors of action. The food balance ratio is seriously in deficit, both in quantity and quality of the average diet. Unless there is a massive effort to produce more food, the estimated 400-calorie average shortage from the recommended 2100 calories per capita per day can only increase, to the detriment of child health and the permanent impairment of adult capacity when today's children reach adulthood. A national food policy can and must be Indonesia's agent to assure adequate food production. It is recommended that the Food Balance Sheet be revised annually and be presented by regions as well as for the nation, and that nutritional surveys and food consumption surveys be conducted and kept updated. The present record is clear, however, that massive increases in the production of Indonesia's main food crops, high-protein foods and sources of vitamin A are required.

The farmer has to do many things concurrently. Seed from new, high-yielding varieties will double or triple yields only if the padi is watered well, properly fertilized, adequately cared for, and protected from pests and diseases. Indonesia has its own name for the package approach that farmers must use with padi. It is an established concept, pantja usaha (the five practices); but all elements in the package must be continually modernized and updated, using developments from modern science and agricultural technology.

Specific recommendations of the Workshop concern other crops as well as rice. Corn, soybeans, cassava, sweet potatoes, vegetables are treated, and their required contribution to Indonesia's food supply is emphasized. Needed programs for breeding new varieties should be commenced at once in order that long-range and continuous production increases can be realized.

The addition of high-protein food, such as fish, to the average diet is as urgent as any other feature of the total food problem. The most practical means of increasing the supply of fish is from inland and brackish water sources. Fish from such areas can be obtained at less cost and handled with the present infrastructure. By contrast, to get at fish resources from the sea rapidly enough would take more ships and facilities than can be pressed into service. The cost of

providing substantial increases in the supply of fish from this source would therefore be higher.

Soybeans are of great importance also and must not be overlooked. The same is true of eggs and poultry, but they will make their largest contribution somewhat later. Inland fisheries offer quicker availability of fish in sufficient quantity to help toward meeting immediate needs.

It is tempting to suggest seeking more resources for increasing food production by opening new lands and extending irrigation to new areas. However, the Workshop concluded that short-term emphasis must be on intensification, not extensification, which remains a somewhat more distant goal. First, it is essential that the 60 percent of Java's irrigation system which is in disrepair be placed in operation again; and land already well-watered, and favorably situated, should get first priority. The greatest increase in food production can be realized by the most efficient usage of presently-developed land and water resources. The full complement of practices, the pantja usaha, must be used where it will get the fullest response from every seed, every hectare, every drop of water, every granule of fertilizer, and every particle of pesticide. Certain methods of intensification, such as multiple cropping, shortening of the growing season, as well as time intervals between crops, will increase the yield of a given piece of land. Selective use of appropriate power implements could be of great help in this.

Food supplies will increase if farmers are motivated to produce them, and if the institutions and agencies involved are similarly inclined. All the elements in the complex system of agricultural production influence the farmers' incentives. The price of rice needs to be protected from inflation and difficulties in the market. Extension features of the BIMAS (mass guidance-extension) program are helpful to the farmer in encouraging him to use modern technologies in production practices.

Increased production will create a need for more facilities for storage, processing (drying will be especially important), transportation, and marketing; and provision for these essentials must be made before harvest. In fact, some of these facilities are needed to handle fertilizers and pesticides, which must be available to the farmer at the proper time if full benefits are to be obtained.

The institutions and agencies serving agriculture have a heavy responsibility for achieving the goals of food sufficient for the Indonesian people. In this field especially, there is

the requirement of integration and cooperation among agencies, and at provincial and regional levels, extending to include the village. Improved management is essential in government and business. Symposia, training programs, and up-grading of agency personnel are urgent. Budget allocations must be known in advance and fixed as a security to insure that programs will be developed. Channels of communication must be open and active within and between organizations, and between government and farmers.

All the elements in the campaign to overcome Indonesia's food crisis are urgent and insistent. The time horizon is now - this year, and next. But crops take time to grow, and gains can only be season-by-season. The action to take now makes use of today's knowledge, but with each unit of time the situation changes, and new problems emerge. New knowledge and new skills are needed. This is why, even at the moment of immediate action for quick results, Indonesia must begin planning a long-range program of research and education to provide the necessary training and research for future growth and development of the nation.

TOPICAL REVIEW OF THE WORKSHOP'S  
CONCLUSIONS AND RECOMMENDATIONS

I. Population, Food Needs, and Nutrition

Nutrition surveys show that protein-calorie malnutrition and vitamin A deficiency are common and are especially critical for preschool children (0 - 6 years of age), pregnant women, and nursing mothers. Although poor nutrition is a national problem, afflicting all age groups, the likely permanent effect on the physical and mental development of children is particularly costly in terms of human misery and Indonesia's future human resource development. Protein-calorie malnutrition in the preschool age child is of special concern, since permanent damage in the form of impaired physical and intellectual development can result, with seriously adverse consequences for the nation's future manpower.

The nutritional need of Indonesian children is further confounded by widespread incidence of parasitic, gastrointestinal infections and other related diseases. These maladies impair nutrient absorption from the intestinal tract, further depriving the child already existing on a nutritionally marginal diet.

The solution of nutritional problems requires concurrent improvement in public health programs designed to reduce sources of intestinal and other infectious agents in the environment. Public health programs needing attention include environmental sanitation, improved water supplies, and preventive medicine.

The problem of food supplies and food requirements on the one hand and of population growth on the other, are inseparably intertwined; hence there is an inevitable effect of alternate rates of national population growth upon food. At the present time, the figure of 2.6 percent is probably the best single estimate of the national annual population growth rate of Indonesia. Regional differences are recognized, however, and the rate of 2.35 percent per annum is probably the best figure for the densely populated islands of Java, Bali, and Madura, while the outer islands are considered to be growing at the rate of 2.8 percent per year.

The Workshop has calculated and discussed a Food Balance Sheet and Food Allowance per capita and recommendations are made accordingly. The estimated average food supply per capita per day is about 1700 calories which, when compared to a

recommended allowance of a national average per capita per day of 2100 calories, indicates a need for further detailed studies.

The current estimated population of 117 million when projected to 1991, using annual growth rates of 2.2, 2.4, and 2.6 percent and assuming a continuing decline in mortality through improvements of health, would give an expected population of 204, 223, and 235 million, respectively.

The continued imbalance between birth rates and death rates, if not corrected, will make it impossible to supply even a minimum level quantity and quality of food.

The nation faces a critical food problem. To meet it, the Government should develop a national food policy and a functional national program to stimulate research, program building, and program implementation in all public and private agencies concerned. It should promote productive working relations among agencies in regional areas, and between regional areas and the centre.

A national system for applying science and technology to food and nutrition problems can be developed by strong and positive leadership with the knowledge that success depends on technically-adequate personnel, valid and reliable recommendations based on applicable research, continuity and versatility in programs, and productive working relations among all concerned. These conditions in turn require that programs become more scientifically and problem oriented, both in materials and practices used and in the social technology employed in getting the job done. There is, therefore, a continuing task for an organization such as LIPI to perform in facilitating the adequacy of programs and in stimulating their implementation.

It is recommended that:

1. The Government support family planning projects to cover the whole nation, with priority for Java, Bali, and Madura.
2. The Government publish a National Food Balance Sheet annually; and that these sheets be prepared for geographic and economic units of the country.
3. The Government collect nutritional and food production data systematically at regular intervals through regional and group surveys in order to be kept aware of the result of

production efforts. Since nutritional surveys are not feasible in a short period of time, food consumption surveys should be carried out in the near future, preferably incorporated into the National Socio-economic Surveys (SUSENAS);

4. The solution to the problem of vitamin A deficiency, which is widespread in Indonesia, causing much blindness and increased susceptibility to infection, be achieved through several alternatives, any of which would be acceptable from the nutritional point of view:

Increased utilization of fat and of plant carotene sources, particularly green leafy vegetables, yellow fruits and red sweet potatoes,

Development of sources and utilization of red palm oil and/or shark liver oil, and

Purchase of concentrated vitamin A preparations for oral use for annual or semi-annual dosages;

5. Tables of dietary allowances and protein and calorie requirements be used by the planners in food production and supply; and that such data be reevaluated and adjusted periodically;

6. Further studies be made to complete information on wastage of food and on the energy expenditures of various groups within the population;

7. The appropriate scientists be given more participation in planning and follow-up of the food and nutrition policy;

8. The results of this Workshop on Food be given consideration in the formulation of a national food and nutrition policy;

9. LIPI, as the national institute for sciences, promote the strengthening of a system for applying science and technology in food and nutrition programs;

10. Stronger relations be established among the government departments, agencies, and institutions involved in food and nutrition programs, and that liaison officers of sufficient rank and capability be appointed to BAPPENAS and LIPI to assure effective representation in the respective programs.

## II. Intensification of Production: Soil, Water, Fertilizer, and Improved Agricultural Tools

The potentials for increasing food production are unquestionably high in view of the abundance of solar energy, water, and potentially arable soils. This does not mean that increasing production will be easy, however, because there are serious problems in making full use of the resources which Indonesia has in abundance.

Accelerated soil erosion has become a serious problem. Between one and one and one-half million hectares on Java are badly eroded. Control of erosion also will be a problem on sloping soils in the outer islands when they are brought under cultivation.

Combinations of practices that will work on new hectares need to be determined before people move to new lands, not thereafter. Because the soil-climatic conditions in potentially arable but not yet cultivated lands in the outer island differ from those on Java, research and testing should be done in new areas before migration to such areas is encouraged.

Indonesia has tremendous areas of potentially arable soils which are not yet cultivated. Success in the settlement and development of new lands will not, however, be assured without careful planning based upon sound facts about the soils, climate, water, and other relevant environmental elements.

The soil in most of the underdeveloped areas is different from the major soils on which most of the crop production is now taking place. For example, most of the soils in the other islands are lower in fertility than the soils of Java, many of which have been enriched by deposits of volcanic ash. In the lowlands along some coasts, especially in Kalimantan and Sumatra, there are tremendous areas of swampy and marshy soil. Offhand, these would appear to be easily reclaimable by merely providing drainage. However, soils in such locations often contain an excess of sulfides. Under presently known technology, such soils are only moderately productive at best. Perhaps more important, the risks of disastrous damage from over-draining imposes an exacting management requirement.

It is of utmost importance to recognize that high production requires the proper combination of input factors. To be sure, irrigation alone can increase crop production. So can improved varieties, fertilizers, or pesticides. The real payoff, however, comes from putting all these practices in the right combination for each kind of soil. This is the solution

to the problem of dramatically increasing production where the people are living now and already have soils under cultivation.

In view of the immediate need for increasing food production, it seems reasonable to concentrate on the hectares already under cultivation and begin to apply complete "packages" of improved inputs.

Ample evidence indicates that applying combinations of practices is the best way to increase production; but much is yet to be learned about what combinations of inputs are best for Indonesian conditions.

It is indeed unfortunate that maintenance has been inadequate on as much as 60 percent of the irrigation works. Many, many hectares designed to receive irrigation water, are now denied such water. As a result, instead of sawahs, they become rain-fed padi subject to the vagaries of rainfall, with resultant lower yields and without full use of multiple cropping. Repair of the irrigation systems, at least the parts that are easiest to repair, deserves a high priority, and should be done even at the expense of delaying the building or extending of new systems.

About 145,000 and 750,000 tons of additional plant nutrients for 1968-69 and 1972-73, respectively, are estimated to be needed in order to supply food for the additional population at an adequate dietary level. It is recognized that fertilizers are one of a number of important inputs; however, the importance and the volume of fertilizers that will be required are of such magnitude that immediate attention should be given to assuring that these materials will be available to the farmers where and when needed. Since this probably will be the most costly input, but also one that will produce a large return in a short time, special emphasis to infrastructure and credit systems to encourage their use is indicated. It would seem that this is one area in which Indonesia should rely heavily on outside expertise to make a thorough and timely analysis of required fertilizer needs and of the marketing, distribution, and sales activities that will be required to make optimum use of this important input.

Selective use of power equipment offers hope of increasing yields. For example, if the time between harvesting one crop and planting the next can be substantially reduced by use of power tillage, the time that a field is actually used for growing food crops can be increased and more crops can be grown in one year.

It is recommended that:

1. Scientific surveys be undertaken to establish land classification and zoning maps as a basis for wise land use;
2. Control or prevention of flooding receive immediate attention as a national responsibility;
3. Immediate, maximum effort be given to improving production on land that is already under cultivation; that priority be given to areas that have the best irrigation and water control systems; that available seed of the new varieties of crops be concentrated in these areas; and that first priority on fertilizers, pesticides, technical assistance personnel, equipment, and facilities be applied to the new varieties.
4. In allocating resources to irrigation engineering projects, first priority be given to improvement of existing systems, putting into full operation the systems that will be easiest to repair, even at the expense of delaying the building or extending of new facilities. Furthermore, as renovation proceeds, it is recommended that all-out efforts be made to stabilize the watershed areas that are contributing to the siltation problem, and to permanently improve the hydrology of the watershed.
5. The possibility of irrigating many hectares of land from shallow wells using small pumps at a minimum of investment be evaluated immediately, since information on groundwater reserves in Indonesia looks favorable for this practice.
6. Research on soil and water management for all major food crops and vegetables on principal kinds of arable soils be intensified.
7. Consideration be given to maximizing the use of solar energy and available water on the better soils, and research carried out to determine the best cropping sequence, both biologically and economically.
8. A study be made to determine the feasibility and practicability of using power equipment to reduce the time interval between crops and thus increase food production in Indonesia.
9. Because of the role fertilizers must play if food needs are to be met, and in view of the complexity of problems involved in their production, import, distribution, marketing,

and use, an in-depth survey of the broad scope of the fertilizer industry be undertaken. <sup>1/</sup>

10. Increased efforts be made to determine and develop indigenous resources for fertilizer, if economically feasible.

11. Studies be started to determine not only the engineering feasibility of draining large areas in the outer islands, but also to determine the kinds of soils and their suitability for cultivation if they were drained. (Note necessity for caution as cited by this Working Group in Volume II; also recommendation 13 below.)

12. Feasibility of livestock production be investigated in the substantial areas of land in the outer islands which are physically suitable for livestock production, where land preparation would be minimal.

13. Planning for the expansion of food production onto new lands should be continued, but implementation should take second priority to intensification in areas already in cultivation. Soil surveys and the collection of information on climate and hydrologic conditions should be continued. The Tidal Swamp System (especially its water-control techniques) needs more study to determine the technical feasibility of sustained rice production. The probability of tidal soils having unfavorable characteristics (such as high content of sulfides) is greater than in non-swamp soils, and the risk of failure is therefore greater. Priority in the development of new agricultural areas should be given to potentially arable soils, with conventional irrigation, rather than to the reclamation of tidal and swamp lands.

14. Since soil surveys are essential to sound planning of use, management, and conservation of land, they should be continued. It is particularly important that such surveys be made in advance of the settlement of areas under consideration for expansion of cropping, so that soils unsuitable for sustained cropping can be avoided, and management of the suitable soils may be designed so as to make the best use of them. Surveys of the hydrologic conditions, including groundwater supplies, should also be continued, as well as exploration of minerals important to agriculture.

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<sup>1/</sup> During the preparation of this report, attention was called to the comprehensive study carried out by the International Bank for Reconstruction and Development - International Finance Corporation. The results of this study should be carefully reviewed during consideration of recommendation 9.

15. Since the expansion of agriculture requires research on many scientific and technical problems related to plants, soils, water, diseases, insects, marketing, storage, and other phases, it is important that research and educational institutions be improved and that liaison be maintained with research institutions in other countries so as to make use of research findings that are applicable to Indonesia.

### III. Intensification of Production: Food Crops

Rice occupies the largest area under cultivation and has received the major attention. Even though the production of rice has increased steadily from 1960 to 1967, it is still not adequate to the needs, due to the increase in population.

Rice receives major emphasis, but attention must also be given to other crops, to develop and maintain a more balanced food supply, and to increase the availability of protein-quality food.

The recent introduction of PB5 (IR5) and PB8 (IR8) will help immensely in increasing rice production, if these varieties are intensely cultivated, utilizing all of the essential inputs, including fertilizer and plant protection. They should be utilized in the areas and seasons of their greatest adaptation. Adequate technology is at hand to capitalize fully on these two varieties. Additional scientific research should be initiated immediately to develop new varieties and production practices to meet future needs.

Among the various types of insecticides, those of granular form are best suited for use in Indonesia.

For each of the new rice varieties (PB5 and PB8), yields can be doubled or possibly increased even further by the use of higher amounts of fertilizer (120 kg. N and 60 kg. P<sub>2</sub>O<sub>5</sub> per hectare) and proper management.

New varieties of corn that have the potential of doubling yields, if properly managed, have just become available. These varieties should be pushed into a production program employing all of the production technology that has been confirmed by trial and research in Indonesia.

The low yields of soybeans (6.9 quintals per hectare), peanuts (7 quintals per hectare), and green gram (5 quintals per hectare), do not provide sufficient incentive for production of needed quantities of these crops. Intensified,

problem-oriented research could develop varieties and production technology that would make these crops much more profitable and competitive economically.

Production of cassava and sweet potatoes (as carbohydrate supplements) may be adequate for present needs, but potential yields could be increased up to five-fold. However, substantial increases in production must be predicated on market demand and a system of processing and transportation developed to get products of these crops to the consuming centers.

Satisfactory varieties are available for most of the crops; however, intensified research programs are necessary to meet inevitable increasing demands and improved quality characteristics.

It is recommended that:

1. The package or systems approach, with all improved practices (pantja usaha) on the major food crops, be used in order to obtain maximum benefits from presently known technology.
2. The Government enlist farmers' groups and private agencies in the production and distribution of improved seeds, fertilizers, and other agricultural chemicals.
3. Research programs be intensified, with well-defined objectives emphasizing varietal improvement and development of production technology for the major food crops. Less emphasis is needed on small, localized environmental differences, whereas more attention should be given to varieties and cultural practices that are adapted to broader soil-climatic conditions.
4. Encouragement be given to the establishment of national research programs for groups of crops such as corn and sorghum, the pulses, etc. Consideration should also be given to the appropriate places at which such programs would best fit in the over-all institutional organization.
5. A team composed of Indonesian and foreign specialists should be assembled to assist in making a detailed study of organizational patterns and research procedures. Such a group should also assist in the development of graduate and in-service training programs for research and extension personnel.

#### IV. High Protein Foods, Animal Food

Securing an adequate protein complement in the diet of Indonesia is important, since this is tantamount to investing in the country's future; for protein deficiency in children leads not only to impaired physical growth and decreased resistance to infectious disease, but also can contribute to impaired mental development and learning.

Since the protein to be added to the diet must be acceptable, and within the purchasing power of low income groups, fish from inland and brackish waters, and soybeans show greatest promise.

Poultry and egg production deserve some priority also, especially at the village level, and should be actively promoted.

Though Indonesia's seas are rich in fish, the tapping of these stocks will require modernization of her simple fishing fleet and of the presently inadequate infrastructure of transportation, and this will take time. These changes should, however, be initiated at a moderate scale.

Fresh and brackish water fish supplies could be increased with lower expenditures, and would involve less attention to storage and marketing than would boosting the marine catch. It is therefore advisable that the step-up in fresh water fisheries become one of the food campaign goals to be reached urgently and quickly. Working Group IV proposed measures to this effect, stressing strengthening of inland fisheries, particularly the extension program.

Soybeans are accepted by the Indonesian people, and they are cheap and high in protein. Increased soybean production could have a significant impact on alleviating protein shortages for infants and children. High priority should therefore be given to agricultural research for new varieties and better cultural practices, and to local processing technology that will extract all possible benefit from this valuable crop (soybean foods for infants and possibly full-fat soy flour).

Meat for general consumption is scarce at present and therefore expensive. Outer island cattle industries could well become profitable, especially in the export of processed meat, with sufficient shipping and veterinary control. Increases in meat animal production for export and domestic consumption should be considered in long range plans for dietary enrichment and for the utilization of grazing lands which

are not suitable for cultivated crops. Improvement of the marketing system for the locally produced cattle in Java could lower the meat prices within reach of more of the low income population. This is also true for eggs and milk, especially for the urban population.

Given a protein-scarce food economy, it is tempting to think of unconventional protein sources such as those derived from yeast or solvent-extracted Fish Protein Concentrate. Present technologies for either process are such that the product would be expensive when compared to more conventional protein sources. Processing would require massive installations that would not be a sound economic investment, due to high price of the product. Moreover, it is not known if the products would be acceptable to Indonesian consumers. There are, however, simple, cheap techniques already known to fisheries specialists which can produce sanitary and highly nutritious edible fish meal locally with the flavor and odor of fish which the people like, and with no added salt, so as to be suitable for feeding even to young children.

It is recommended that:

1. Adaptive research and extension work in fertilization, feeding, stocking, and manipulation of fishpond stocks be undertaken by the Fisheries Department, whose extension program needs to be strengthened.

2. Home pond construction be fostered as well as fish culture in rice fields. For the latter endeavor to be successful, joint research on insecticides by rice and fish experts is necessary, since pesticides at certain levels of application are incompatible with fish.

3. Inland fisheries from swamps, lakes and rivers be increased very quickly by the improvement of inter-island transportation, a measure that would benefit other sectors of food production as well.

4. Brackish water fisheries be upgraded, and adaptive research applied to them for the formulation of special production incentives.

5. Adaptive research on the production and acceptance of sanitary fish meal for human consumption be carried out.

6. Soybeans, because of their high protein content, receive high research priority, second only to rice. Therefore, the Central Agricultural Research Institute should intensify

scientific effort on selection, breeding, cultural practices, and adaptation programs with indigenous and foreign strains and varieties. As rapidly as improved varieties and cultural practices become available the Extension Service should increase its education program on this crop.

7. High priority be given to studying the feasibility of producing soybean foods for children and possibly full-fat soy flour.

8. Poultry and egg production be encouraged on a subsistence level; and adaptive research and extension work be undertaken on breeding, feeding, management, disease control, and marketing of these products.

9. Commercial entrepreneurs be encouraged to establish hatcheries, feed mills, equipment manufacture, and vaccine production.

10. Meat animal production be emphasized and encouraged in locations where opportunities are most promising and feed can be produced without serious competition with human food needs; current research projects be continued and new ones initiated on both a short- and long-term basis on breeding, feeding, management, disease control, and marketing in order to keep the production of animal products in pace with the gradual increase in the demand for them.

11. Efforts be made to improve the quality of the present dairy animals and the milk supply.

12. Research and extension efforts be oriented to encourage poultry raising and cattle raising as part of the program to diversify the agriculture of the estates and increase their contribution to the food supply.

13. As rapidly as possible, one of the genes - opaque-2 or floury-2 - be introduced into high-yielding corn varieties adapted to Indonesia. This would significantly improve the quality of protein in any corn variety.

14. The Government issue regulations requiring enrichment of imported wheat flour with standard B vitamin and mineral ingredients and with 0.2 percent lysine hydrochloride.

#### V. Processing, Marketing and Utilization of Food

The use of effective and efficient methods of storage and preservation offer the quickest method of increasing the food

supply. It is estimated that losses of food commodities from the time of harvest to the time they reach the consumer may in many cases exceed 25 percent. Anything that can be done to reduce these losses will produce an immediate increase in the food supply.

The proposals that are being made to increase production of food will necessitate shifts in the location of storage facilities, as well as the creation of an additional storage space, together with more efficient transportation systems. As the country becomes more self-sufficient in food production, the need for storage for imported foods will decrease, and this requirement will shift to production areas.

The increased production of rice will create an increased demand for storage space more than proportionate to the amount of the increase of rice production itself, due to shifting of rice processing practices from home pounding to de-huller processing. The efficiency of production of edible rice from padi in Indonesia is approximately 10 percent lower than elsewhere. The better nutritional value of home-produced rice may be more than offset by losses in yield, in comparison to rice processed by hullers or rice mills.

Efforts to increase rice production will require a tremendous increase in the amount of fertilizers that will need to be used, most of which at least initially will have to be imported. The possibility of purchasing out-of-season fertilizers will determine whether warehouses should be located at the port or whether they should be closer to the use centers. This determination should be part of the aforementioned overall fertilizer study.

The major effort to improve processing, conservation, and utilization of food must be made at the farm or village level where most of the country's food is produced and consumed.

The shortcomings of the present distribution system will reduce the effectiveness of the proposals for the improvement of agricultural products, and will also offset many of the benefits of the application of technology. Specific marketing difficulties include the prospective inadequacies of transportation and storage facilities, governmental regulations, pricing policies, and a shortage of farm credit.

There are many people and groups now engaged in trade, or in furnishing services in accordance with existing patterns of distribution, who benefit from continuation of their present activities. Under some conditions a mark-up of 100 percent in

price is required to induce the movement of rice from one area to another through private channels. Transportation costs represent less than 10 percent of this mark-up. The balance consists of commissions, licensing fees, illegal "taxes", and large margins of profit added to the costs of handling these goods or providing services.

There is evidence of decline of the transportation system capacity, due to lack of spare parts for trucks and for railroad equipment, and a growing shortage of railroad rolling stock. It is estimated that during the next five years an additional 750,000 tons of plant nutrients will enter the seaports of Java and will require transportation to various destinations throughout the islands. During the same period, 7 million additional tons of grain must move from one point to another in Java. This tonnage is over and above the present volume of traffic.

It is estimated that more than one-half of the agricultural credit now extended to Indonesian farmers comes from private sectors. The terms of this credit are frequently such that they inhibit borrowing and thus reduce the incentives for the use of new technology.

Problems encountered in fish processing by salting and drying include the relative scarcity and high cost of salt, the quality of the salt, and the length of time required to accumulate enough fish to provide a cargo for a ship. Salted fish are very hygroscopic, and as much as 40 percent of the fish may be lost during the wet seasons. Most of these losses could be prevented by proper drying and storage.

Fresh fish represent a much smaller percentage of the total quantity of fish consumed, and the fresh product suffers severe losses in quality due to decomposition. At present, ice that is badly needed on the fishing vessels, at the docks, and in the markets is not available in adequate quantity, because the ice that is being produced is used for direct consumption.

It is recommended that:

1. A plan be developed for the location of storage facilities, including the type of those which will be coordinated with the increased production of foodstuffs.
2. A study be made of the complete system of storage for the increased volume of fertilizers.
3. Appropriately-sized artificial dryers, such as rotary

spouted-bed or tray dryers be used. The fuels for these may be charcoal, rice hulls, coal, kerosene or wood. For efficiency of drying, it is recommended that gabah be dried and not stalk padi.

4. There be additional capacity for the manufacture of ice; suggested locations are Djakarta, Surabaya, Tegal, and Banjuang.

5. Dependable sources of salt be made available at fish processing centers, and that forced air dryers be installed at the ports where the salted dried fish are processed.

6. Milling facilities be encouraged for the processing of rice at the village level. This will substantially increase the processed rice yield and reduce the labor for home processing.

7. Repair and rehabilitation of commercial mills be an important part of the program as production of rice increases.

8. Steps to induce the most clearly required changes in the existing pattern of distribution, including transportation development, be undertaken in conjunction with the efforts to carry out recommendations in other fields.

9. There be further liberalization of internal trade, through removal of some of the regulations, as well as simplification of procedures under which the present system operates.

#### VI. Production Incentives and the Use of Technical Inputs

Efforts to achieve rapid increases in food production must be accompanied by effective economic incentives for farmers and for the institutions which serve agriculture. Either directly or indirectly, each recommendation of the Workshop encourages greater effort and increased output by the persons and institutions that produce Indonesia's food. Successful effort, when adequately rewarded, encourages repetition. Achievement of food production goals, when accompanied by favorable cost-price ratios, itself represents a major inducement for further increases in production.

Incentives will be strengthened by the successful implementation of programs to make improved seed, fertilizer and pesticides readily available, and in good form. Restoration of deteriorated irrigation facilities, reduction of

discouraging food supply losses due to pests, diseases, spoilage, floods and droughts, adaptation of multiple cropping, use of suitable power tools to reduce time between production seasons, loosening barriers to freer transportation and communication, improved diet and health, provision of information, free channels of mobility through schools all are important incentive strengtheners for farmers. For persons at work in the institutions serving agriculture, incentives will be strengthened by improvement in working conditions and salaries, by effective flows of communication within their organizations, and by visible opportunities for advancement and promotion.

The Workshop has grouped under three headings the factors which influence incentives to produce food: (1) the general political, social, economic, and cultural setting; (2) the technical alternatives available to farmers and to the institutions which serve agriculture; and (3) the policies and programs aimed specifically at influencing production and marketing decisions.

The first group of factors is particularly important in traditional agriculture, but they respond only slowly to the policy instruments available to Government. The Workshop accordingly placed major attention on policies relating to the factors falling in the second and third groups.

It has frequently been held that peasant producers in traditional societies either are not responsive or respond perversely to economic incentives, and that nationalistic and ideological appeals can effectively replace economic incentives in public administration and the management of economic activities in low-income countries. There is increasing evidence from studies in many countries, including Indonesia, that peasant producers do respond to economic incentives. It also seems clear that efficient administration and management of public- and private-sector activities related to agriculture development is facilitated by economic incentives.

The Workshop emphasizes, therefore, the importance of evolving a system of agricultural planning, including food policy, that places major reliance on the public sector for providing an effective system of incentives, and on the private sector for individual production decisions and logistical support.

The Workshop also notes that the country's present organization of scientific manpower in agriculture does not provide the economic incentives necessary to permit agricultural scientists to devote their full energies to the task of developing

the technical basis for modern agriculture. This waste of manpower is a major limiting factor in agricultural development.

It is recommended that:

1. Major support be given to research programs directed specifically to raising the yield potential of the food crops in each major agro-climatic zone of Indonesia. The single, most significant, economic incentive that can be made available to farmers lies in the improvement of the technical capacity of crops and animals to respond to the variables that can be controlled by man; particularly the new biological and chemical inputs made available by science.
2. The effectiveness of the urea/rice ratio of 1:1 adopted in the BIMAS program, which represents a relatively favorable production incentive, be safeguarded by protection against inflation and against imperfections in the marketing system, and that similar considerations be given to incentives to stimulate the production of other important food and export crops.
3. Extension efforts be directed toward the acceleration of the adoption of the technology necessary to increase food production. However, extension activities cannot be used as a substitute for the availability at the local level of adequate supplies of production inputs, adequate markets for farm products, and favorable price relationships.
4. The technical efficiency and pricing efficiency of both input markets and product markets be improved.
5. The use of scientific and technical manpower be organized toward the application of its full potential to increase food production, and that emphasis be placed on in-service and formal academic training for professional workers.
6. A national statistical system be developed for agriculture; sources of output growth evaluated; land and resource development opportunities studied; and cultural diversity and response to incentives be reviewed by competent scholars.

## VII. Biology Basic to Agriculture

Research is responsible for the recent spectacular advances in agriculture in developing countries. Though requiring some time to pay off, research still offers the most promising and expeditious means of solving Indonesia's complex problems, such as food and population. It is imperative, therefore, that agricultural research, including biological studies related to

food production, be developed to the fullest capacity.

This Working Group gave consideration to the importance of scientific manpower, institutional arrangements, and program building as these relate to the food needs of Indonesia. While the task of this Group was primarily devoted to biology basic to agriculture, it concerned itself with some aspects of the topics discussed by the other Working Groups.

Each Group recognized the need for a sharply increased emphasis upon research to increase food production. Priorities must be established for studies and trained personnel allocated for each task. Some groups urged a focus upon applied and adaptive research, particularly with respect to all aspects of crop production. Yet the need for selective, agriculturally-related basic research in biology, admittedly requiring considerable lead-time before producing results, was agreed upon as essential to solve the long-run problems of food production.

Shortcomings in current research, besides limited financial support, are: insufficient coordination between research institutes and universities and between researchers and field agents; poor communication in both scientific and administrative matters; lack of national planning on the basis of agreed-upon priorities (e.g., soybean breeding and adaptation); failure to employ interdisciplinary teams on problems which demand this approach, such as tidal swamp utilization and upland agriculture; and involvement of limited research manpower in non-research activity of a managerial and administrative nature, resulting in a fragmentation of trained human resources.

The following points made by other Working Groups are considered of such importance in relationship to Biology Basic to Agriculture that they are reiterated here. For complete details the report of the respective Working Groups should be consulted.

1. Research productivity can be markedly raised by improved coordination of research with training between universities and research institutes, an increase in financial and other incentives to encourage research work, and the concentration of research funds on fewer projects and deserving scientists. Publication of research findings could be improved by consolidation of research journals and improved collaboration between universities and research institutions.

2. Simplification of organization patterns in research is essential; a reorganization of research institutions and units may be required in this connection. Steps should be taken to establish a nation-wide integrated system of

institutionalized agricultural science and technology with a capability of conducting problem-oriented research on all aspects of agricultural development. A joint team of Indonesian and foreign agricultural scientists should be set up to study the organization and capability of research, and related education, extension, library, and documentation services, as recommended by Working Group VIII.

3. Among the number of high priority studies in applied research recommended by the Working Groups, those with special reference to intensification of production included:

Fertilization of crops, giving full consideration to regional variations in soil and climate, and to the economics of fertilizers throughout the full cycle of multiple cropping;

Expansion of research in all aspects of crop development;

Increasing production of high-protein foods, which calls for studies on the productivity and economic returns of native cattle, sheep, goats and swine; on range pasture management in the various regions; on livestock marketing systems; on the adaptation of improved animal breeds to local conditions; and to minimizing losses in local livestock shipments. An adaptive testing program should be initiated to determine productivity of the new soybean variety for highland use.

4. A series of specific urgent investigations was recommended by the group concerned with processing, marketing, and utilization of food:

Study the prevalence of mold-produced toxins in food-stuffs subjected to extended exposure to high humidity;

Develop improved preservation techniques to stabilize fresh coconut meats processed in the village, as well as industrial methods to recover edible protein concentrates and oil from coconuts;

Design a small, hot air dryer suitable for village food preservation;

Compare the efficiency of various methods of rice milling to determine the best techniques for recovering maximum yields;

Seek to develop innovative processing techniques for development of other foods equivalent to rice;

Develop or adapt fumigant grain protectant procedures to reduce insect spoilage of stored cereals;

Work out improved procedures for microbial modification of soybeans to gain maximum stability against spoilage and rancidity and assure optimum retention of food values;

Seek new food products from peanuts by microbial modification, with special attention to mycotoxins.

Determine whether red palm oil may be processed in a stabilized form acceptable in Indonesias as a vitamin A source.

#### Recommendations of Working Group VII

The following areas of research are recommended to receive special emphasis:

1. Surveys and studies on erosion control through conservation and reforestation in Java, where soils are in dangerously critical stages of destruction.
2. Intensification of breeding programs for soybeans and peanut varieties, and for selected species of freshwater fish, with emphasis upon genetic and cytogenetic approaches.
3. Acceleration of plant nutrition research, particularly basic and adaptive work on N, P, and K, as well as fundamental research in soil chemistry, physics, microbiology, and soil management. This to include examination of fertilizer requirements for high-yielding varieties, and identification of new problems which may arise from intensive use of fertilizers.
4. Special attention to expansion of knowledge about the rat species causing extensive damage to Indonesian crops, including studies of relevant aspects of rat biology related to reproduction and control.
5. Survey major crop diseases and their distribution; conduct an inventory of known germ plasm resources for breeding resistance to identified diseases, set up national nurseries for screening purposes, and identify whenever possible new incidences of diseases affecting new, high-yielding varieties.
6. Intensive study on the biology of weeds and their control.

7. Studies on means of improving correlation between climatic conditions and crop management, including methods of enabling agriculturists to relate weather station data to crop and animal production, pest and disease control.

8. Although shrimp is assumed to be in good supply, ecological studies, including migration habits, time of maturity, size, etc., are needed to assure adequate future supplies as an important export commodity.

9. Research on poultry and bovine diseases is essential in the development of suitable methods of control.

10. Interdisciplinary research on human ecology is needed, particularly with respect to special groups of people residing in certain problem areas. This has immediate relevance to successful transmigration as a means of increasing agricultural production.

11. Additional scientific manpower is needed. Increased emphasis should be placed on training in Indonesia and abroad. Full advantage should be taken of foreign assistance for this purpose. Indonesia should provide greater incentives in the training of its scientific manpower.

#### VIII. Institution Building and Resource Development

National planning involves a careful appraisal of resources and needs, and the development of short- and long-range goals designed to accomplish specific objectives in overall economic advancement.

As indicated throughout the Workshop sessions, the most important and overriding current problem facing Indonesia is food production for her people. Based upon the present situation in Indonesia and man's experience throughout the world, there are clear and unmistakable needs for more effective institutional arrangements in channeling the necessary resources into imaginative and innovative food programs. It is apparent that the effectiveness of presently employed personnel and resources devoted to food production programs can be increased. It is also evident that additional funds must be appropriated for more and better trained personnel, equipment, supplies, and travel in the conduct of research and extension programs.

Integrated field programs involving the public and private sectors are essential. The Workshop reviewed at some length the problem how the system of government services and institutions, especially in food-production and related supporting

fields, could be geared to achieve accelerated development and the needed breakthrough, through the network of ministerial agencies and through the four levels of administrative set-up of the government: 25 provinces, 225 rural districts (kabupaten), 3,200 subdistricts (ketjamatan), and 50,000 villages (desa, negeri). These include problems of development strategy, administration, and management, especially in package problems.

The Workshop reviewed the present system of education for technical change, especially training for skills in agricultural development. Discussing its achievements, shortcomings and problems, one field needing urgent attention was found to be that of vocational education at secondary school level, as there is a serious gap of middle level technical manpower. Higher education, especially in agriculture, is a new offshoot since independence. The recent decision to strengthen university level education is commendable, to give appropriate emphasis to the sciences which can contribute quickly to increasing food production. The plan to concentrate on a restricted number of national centers of excellence (feeder universities) is wise. At the same time, however, additional support should be given to carefully selected universities, colleges, and vocational schools. To accomplish this objective will necessitate all agencies of the government having educational training responsibilities to cooperate in assessing the nature and scope of the manpower needs, and to jointly plan and carry out the necessary programs.

The effective application of new technology in improvement of food grain crops in the past decade by organizations concerned with international agriculture has produced varieties of rice, wheat, maize, sorghums, millet, and grain legumes with outstanding yielding capacity and with wide adaptation. Many countries of Asia now have a reasonable expectation of achieving self sufficiency in food grains within the next few years.

This new level of crop productivity has been achieved through the coordinated and simultaneous efforts of scientists concerned with genetics and breeding, plant disease and pest control, soil fertility and water management, plant physiology, agronomic practices, and agricultural economics. The teams of scientists focussing on the specific factors which limit crop yields have boosted productivity levels to double or four-fold the yields achieved from commonly grown varieties in many parts of the world.

The availability of this new high-yield potential of the major food grains permits the phasing of research in units of

time as follows: an immediate period of exploitation of the new resources through adaptive and crop protection research; and longer range efforts, which will require greater attention to fundamental or background research in building systems of agricultural science and technology, through research and educational institutions which will serve total national requirements.

The widely adapted IR-8 and other rice varieties from the International Rice Research Institute should make possible the doubling of yields in many rice growing areas of Indonesia. This will require, however, the strengthening and realignment of research to modify the varieties, soil, fertilizer and water management, and pest control practices to fit specific cropping environments. Of special importance is the strengthening of research in crop protection to insure continuing resistance to new diseases and pests which emerge in intensified agricultural production systems. This is essential to maintain the yield potentials of these new food grain resources.

The orderly exploitation of currently available new technology should lessen the food pressure in most regions of the world in the next decade. For the period beyond that time, if population growth proceeds at the anticipated rate in Indonesia and other developing nations, it will be increasingly difficult for outside organizations to supply the new technology inputs for sustained agricultural growth and productivity. Indigenous sources for a steady flow of improved materials and methods for intensified agriculture will be essential.

If we can assume that the recently available food grain production technology has furnished up to a decade of lessened pressure for world food supplies, this period must be utilized for implementation of the adaptive and protective research to meet current needs and for the restructuring and strengthening of research capability for the longer term. The essential manifold goals of agricultural science and technology include: (1) increased production of food crops and livestock products; (2) improvement of nutrition for all of society; (3) strengthening of background research for guidance of sustained agricultural growth; (4) research to guide the best economic use of lands in less populous areas of the nation; and (5) the building of a broad-based system of agricultural science and technology to provide maximum flexibility and versatility in the full utilization of agricultural resources.

The LIPI-NAS Workshop review of Indonesia's current agricultural research organization and capability has been limited largely to the study of records and reports, supplemented by

the knowledge of some panel members gained during longer visits or tours of duty previously in the country. From the information available it is apparent that: (1) research and development for agriculture is located primarily in the Ministry of Agriculture and the Ministry of Estates, but is also scattered among other ministries or organizations of government; (2) major emphasis has been placed on research for improved production of commercial crops, with less support for research on the food crops; (3) research capability is fragmented into more than 30 institutes and stations or centers; (4) there are great opportunities for improved coordination of activities of the several research institutes which would maximize the use of facilities and increase the productivity of personnel resources; and (5) there is urgent need for more effective collaboration and planning research programs of the institutes with the institutions of higher learning.

It is recommended that:

1. Steps be taken promptly to identify a joint team of Indonesian, U.S. and other foreign agricultural scientists competent in research and knowledgeable about the organization and capabilities of research and related education, extension, library and documentation services in Indonesia, the United States and selected other countries. The joint team would be requested to develop recommendations to strengthen Indonesia's research organization structure and its research staff development.
2. On the basis of recommendations made by the joint team referred to above, a plan should be made to systematically establish a more effective national institutionalized system to conduct problem-oriented research on all aspects of agricultural development. The system should embrace the present research institutes and centers, the 18 agricultural universities and colleges and selected field research testing stations in Indonesia.
3. Attention be given to the more effective linkage of research and extension, and to the upgrading of the extension staff. Modern agriculture requires a high degree of precision in the selection and application of inputs and practices. This calls for a high level of competence on the part of the extension specialists who plan and conduct verification trials and who are to provide reliable information on packages of improved practices suited to specific localities.
4. A study be made of present management of programs in food production, especially package programs and agencies

supporting them. The study should be followed by courses and symposia for key personnel and by a formulation of guidelines in development strategy - administrative and management - for use at central, provincial and district levels. In these training and retraining efforts, managers of enterprises (including cooperatives) would also be involved.

5. A manpower-cadre survey be made of the present availability and future needs of personnel, by qualification and numbers, in the various fields of agricultural and related or supporting skills, both at the central and implementation levels. The time horizon should be two, five and ten years. On the basis of such a survey immediate steps could be taken for a more efficient use of existing skills and for the planning of needed courses in top priority area for professional upgrading at each level.

6. Communications channels among policy-makers and professional workers be improved for dissemination of technical information and other data required for planning and evaluation. This would include economic maps as well as reliable and timely series of statistical data to be provided through libraries, documentation centers and governmental and scientific publications.

7. A firm budget be set aside for programs in agricultural development to assure continuity and support for research and extension operations. This would be in addition to funds required to improve working conditions and salaries of personnel and to procure equipment. The centers of greatest research capability can make the most effective use of funds budgeted for research. This budget provision for research and extension should receive attention at provincial and district levels as well in order that field operations may effectively reach the villagers. Where feasible funds from foreign agencies and private enterprises should be applied to strengthen existing government budgets.

8. Provision be made for a closer linkage between research and educational institutions, emphasizing advanced training in local institutions as a principal means of building research manpower resources.

9. The development of vocational and technical high schools in agriculture and supporting fields be actively promoted as a way of reducing the serious shortages of middle-level technical manpower and managers and supervisors for agri-supporting enterprises. Needed additional top-level management personnel will have to be trained on the job, either at home in cooperation with universities of excellence or abroad.

10. The role of universities, especially in the agricultural and rural development fields, be strengthened to enable them to become partners in planning and evaluation with executive agencies at the center and in the regions (provinces and districts). The universities could contribute to upgrading of personnel apart from formal training, perform research, especially adaptive research, in the field and in public services (extension), and including action research in pilot projects.

11. The use of mass media, particularly radio broadcasts and simple publications, at national as well as at regional and local levels, be put to better use in educational and extension work in the villages. In this way villagers may benefit from information on science and technology in improving production and family levels of living.

## CONCLUDING STATEMENT

Each of the eight groups of the Workshop addressed itself to a specific problem area in the overall complex of agricultural production and food supply, and while each of them came forth with certain important conclusions and recommendations of an administrative and/or technical nature there emerged a general consensus on several principles for action as summarized below:

1. Food and nutrition should be dealt with by establishing a firm national food and nutrition policy acknowledging the existence of calorie and protein requirements and the urgency of overcoming present deficiencies, and implemented by a legally established and continuous program for which regular evaluations and revisions are provided. Decisions made under this policy may require national priority treatment, as well as at regional and local levels. The greatest impact will be made by building on existing strength, i.e., on rice land already under cultivation, by application of packages of improvement and by promoting the use of present knowledge and skills to increase the supply and use of foods which are good sources of protein. Imports of various kinds, including the staples themselves, will remain necessary for a time.

2. Attention must also be given to the stage beyond the immediate future with moderate diversification of crops and urgent adaptive work on maize, soybeans, and fish, aside from rice, to increase yield potentials, and with necessary safeguards against the erosion of productive soils.

Progress in a field of interplaying forces as complex as agricultural production can be hampered by deficiencies in the organization of agents and agencies involved in it. Need is indicated for scrutiny of the organization with a view to modifications that make it responsive to change itself and to serve best the purposes of dealing with the country's food production.

3. Strategic objectives which must be sought are: substantially increased yields of the basic food crops (rice, maize and the pulses) and diversified farming in intensive cropping systems. Drying, storage, the efficiency of marketing and reduction of waste will require improvement and become increasingly vital as production increases; also, selection and preparation of food and public understanding and improvement of nutrition (particularly for vulnerable age groups) will then become feasible. The fundamental goal is a

modernizing rural community, efficient in producing to meet the needs of the society and participating fully in the socio-economic development of Indonesia.

4. Activities to reach these objectives will succeed to the extent that they are built into a national system for improving food production and nutrition. To do this, feasible points of departure can be located from which experience shows the way to enduring progress. The first of these must be retraining of field staff to test new technology and train farmers in its use.

Significantly better technology, and the inputs to make it perform, must be used effectively to start the process of increasing production. With increases in production and marketing efficiency, rational rural finance and special incentives for farmers become feasible and necessary objectives.

5. Areas of greatest readiness for immediate development can be located and separated from those where more adequate infrastructure is needed before development is feasible. Also, all the services to farmers and merchants in a rural area can be integrated into a functioning, concerted program. Intermediate and central services can be modified specifically to serve these "work areas." Feedback from them can make national agricultural plans more realistic and effective.

6. The Workshop revealed deficiencies in the Indonesian food production and nutrition programs but also pointed to areas of strength and to several hopeful new and effective action programs underway. It became clear that Indonesia has the potential for self-sufficiency in food production. Rice and corn yields can be doubled if certain operational and administrative constraints are removed.

7. The attainment of this target is less certain, however, than the expectation that Indonesia's population will also double by the last decade of this century. Whether or not Indonesia will reach her desired goal of self-sufficiency in food production and how soon she will reach it depends first and foremost on the willingness of her people, and their leaders, to increase their efforts in agriculture along the guidelines suggested by the Workshop, but as much, also, on how soon and how vigorously she implements an active program of family planning.