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CHANGING SEED PROGRAM NEEDS OF THE LDC's[1/]

James C. Delouche[2/]

We appreciate the opportunity to participate in these discussions and deliberations on "Changing Seed Program Needs of the LDC's. Since its beginning in 1950, the Seed Technology Laboratory of Mississippi State University, which we represent, has been deeply and irrevocably committed to the advancement of the seed program/industry of our state and country, and of other countries - developed and less developed - throughout the world. The Seed Technology Laboratory was established with the support of - indeed! - at the insistence of commercial seedsmen in the South to overcome an acute deficiency in seed research, training, and extension - or what might be more aptly termed technical assistance. As the program got underway in the early 1950's, it soon became clear that seed had been notoriously neglected. That, while plant breeding and varietal improvement and other agricultural research were well supported, and had greatly benefited the farmer and seedsmen, the work had not been taken to its logical conclusion. The equally important phases of seed production, harvesting, drying, processing, testing, storage, and marketing, all necessary for the full utilization of new varieties, had received scant attention from either public or private sector institutions. It was also soon determined that these deficiencies were not restricted to the South. They existed and were equally acute in all areas of the U.S., and in the so-called developed countries of Western Europe.

As a consequence, our laboratory since its beginning has essentially been engaged - often very much alone - in developing a new specialty or discipline in agriculture - SEED TECHNOLOGY. The tasks of defining the limits of the specialty so as to encompass all pertinent elements and components, of developing a conceptual, doctrinal and scientific framework, of researching seed to flesh out the framework, and of convincing the recognized specialties, disciplines and administrators that seed technology had something to contribute to agriculture and should be taken seriously - these are not easy. I use the present tense because the work is not complete. It continues as it must.

1/ Paper presented at AID Seminar on "CHANGING SEED PROGRAM NEEDS OF LDC's," May 27, 1970, in Washington, D. C. Some material that was not given at Seminar because of time limitation is included.

2/ Director, Seed Technology Laboratory, Mississippi State University, State College, Mississippi 39762, and Project Leader for the MSU-AID Contract, AID-W-607.

My remarks here are necessarily from the perspective of this long, and probably unique, involvement with the seed programs and industries of many countries, including the U. S.

I would like to address myself to these four topics:

(1) Improved Seed and Agricultural Development.

(2) Development of a Seed Program/Industry.

(3) Problems in Seed Program/Industry Development.

(4) Present and Future Needs in Seed Program Development in the LDC's.

Activities under contract AID-W-607 between MSU and AID are summarized in the Appendix.

Improved Seed and Agricultural Development

Man's discovery of the generative function of seed was the beginning of agriculture and the essential step on the road to civilization. Gathering and storing seed and later planting them at a site of choice, freed man from the limitations of a nomadic life and perpetual hunger. For the first time he was able to exert some control over his food supply. Man multiplied, groups or clans merged into tribes, and all members of the group did not have to be hunters or food gatherers. Thus, the creativity and inventiveness of some were turned to other tasks: more permanent dwellings were designed and constructed, irrigation systems were developed to water crops, the wheel was perfected and combined with frames to facilitate transportation of food stuff, and pots were made to store them.

One might speculate - with some basis - that the first war on hunger was won with the discovery of the function of seed. And, that this victory by stabilizing food supply and decreasing the rigors and attrition of the constant hunt for food, fostered population growth and started the almost continuous race between population and food supply.

Seed are the essential ingredient in agriculture. Their miniaturization and relative hardiness permit the distribution of cultivated plant populations over both time and space. Seed are also within the basic traditions of agriculture, that is, their role in crop production is so well understood that seed selection and preservation are the most ubiquitous agricultural practices.

Perhaps, it is just because seed are so bound within the basic traditions of agriculture, that improvements in their qualities and use have progressed so slowly. In traditional agriculture seed commonly are a portion of the overall production of the crop on the farm. Sowings specifically for seed production are unusual. In many countries there is no distinction between "grain" and "seed".

Seed are also the key element for increasing agricultural productivity. For they are the mechanism through which the genetically engineered improvements effected in plants by the modern plant breeder are transmitted to succeeding generations and distributed throughout adapted areas. Plant improvement, however, has an impact on agricultural production only when the improved seed are made available to cultivators in the necessary quantities and at the right time and place.

Experiences in many developing countries clearly demonstrate that improvement in plant breeding skills and development of superior varieties have no effect on agricultural production unless and until seed production and distribution methods are also improved. The lack of use of improved varieties, and not necessarily their availability, is believed to be one of the reasons why agricultural productivity is so low in some countries.

It has been estimated that a 100% increase in yield for a given area is a reasonable expectation if 50% of the crop land in the area is planted with improved seed and other inputs are applied.

Statistics illustrating yield increases resulting from use of improved seed with and without fertilization and other inputs could be recited at length. And, only a few years ago this might have been necessary to document the potential contribution of improved seed in increasing production. However, the spectacular advances in production effected through the introduction and use of recently developed high yielding rice and wheat varieties, and hybrids or synthetics of maize, sorghum and millets have demonstrated the role and importance of improved seed more dramatically and clearly than the most exhaustive compilation of yield data. The impact of these developments is vividly evident in such phrases as "wonder seed," "miracle rice," "revolutionary seed," and "green revolution" that are currently in fashion in the press throughout much of the world.

The agricultural revolution in progress in many countries is based primarily on the introduction, adaptation, wide dissemination and use of high yielding varieties or hybrids, along with provisions for other essential inputs. The high performance level of this superior germ plasm is not only rapidly increasing total production, but also effecting changes in the attitudes and programs of both cultivators and national planners. During the past few years it has been demonstrated that:

1. Farmers will readily use improved seed of crop varieties that out perform locally established and unimproved varieties by at least 30 to 35%.

2. An organized and effective system for maintenance, multiplication, processing, distribution and marketing of seed of improved varieties is essential for continued success, and for the effective introduction of "second generation" improvements in varieties.

3. Farmers will readily pay a premium for quality seed of truly superior varieties.

4. The tremendous performance potential of the improved varieties and their responsiveness to high levels of other inputs provide an excellent vehicle for the introduction and increased use of these other inputs.

5. The package program, that is, the recommendation and use of an optimal combination of selected inputs is the best approach for accelerating agricultural productivity, and improved seed is a key component of the package.

6. Successful implementation of agricultural improvement programs requires that the combination of selected inputs be available to farmers in adequate supply at accessible places and at the proper time.

An organized, effective seed program/industry is as important to continued agricultural development as is an organized,effective program/industry for supply and distribution of fertilizers. Seasonal resupply of hybrid seed is as necessary as seasonal resupply of insecticides. While resupply of non-hybrid seed is not as demanding and can be programmed for much longer cycles, it is no less critical for long range development. Considerable short term progress can be made by introducing and widely distributing large quantities of seed of high yielding varieties obtained from off-shore sources. But what of the long run? How long will the variety remain "pure"? How can a second generation variety of the same general plant type and statue but with improved nutritive value, disease resistance, or quality be introduced without a rapid loss of identity through genetic and/or mechanical admixtures.

It is not too difficult to introduce and disseminate new varieties that are as physically different from traditional types as are the IRRI rice varieties or the Mexican dwarf wheats. The problem arises later when even more advanced and better adapted varieties of the same type are introduced or released.

Many countries have good to excellent varietal testing, plant introduction and breeding programs. And, these programs are becoming quite productive under the stimulus of widespread publicity of high yielding varieties and demonstrations of what can be accomplished by determined, well supported, mission-oriented breeding and crop improvement work.

The best efforts of plant breeders are to no avail, however, when the ultimate products of their labor are experimental plot statistics recorded in a report filed in the Director's office, a few demonstration plantings, and a tin or two of seed in a storage room. Unfortunately, this has been the situation all too often in the past.

New and improved crop varieties become a significant agricultural input only when varietally pure, viable seed are available to and planted by cultivators. The justification and purpose of a seed program or industry is the extension of superior varietal performance in breeding nurseries and test plots to all crop lands where the variety is adapted. This is best accomplished through an organized, systematic and cooperative effort involving both public and private sector personnel and institutions.

Development of a Seed Program/Industry

Historically, the seed program/industry in a country has gradually evolved in response to needs and opportunities arising from changes in cropping patterns, improvement in crop plants and production practices, and progress in the supply and distribution of production inputs. The term "evolution" aptly describes this development because it has been gradual, and adaptable to a rather slowly changing agricultural "environment". In contrast, recent developments in crop production in some of the less developed countries have been revolutionary in scope and effect. Rapid advances in the supply and use of agricultural inputs and the introduction of <u>high yielding varieties</u> into the cropping patterns of many LDC's have effected changes and improvement in a few years that required decades in the past.

The urgency of the need to increase agricultural productivity dictates the revolutionary rather than the evolutionary approach, and results suggest that the tactics being used are successful. Nevertheless, change - particularly rapid change - creates as many new problems as the old ones it resolves. The road to progress is always littered with many casualties: the old ways, the traditional ways, are necessarily discarded, but so, too, are some of the not-so-old inovations and programs. Modest, "evolutionary" type programs started only a few years ago and which were progressing nicely, are simply overwhelmed by change because they lack the organizational flexibility to respond to the new situation. Yet,

the need for an effective seed program/industry increases and becomes more urgent with each advance in agricultural development.

Requisites for a Seed Program/Industry

A seed program is nothing more or less than a vehicle for the production and supply of one of the essential inputs for agricultural development. Considering the countries that are making rather rapid advances in agricultural productivity as well as those that are only approaching the "take off" point for substantial and sustained progress, certain requisites for the effective organization, implementation and subsequent development of a seed program/industry are clearly indicated. Many of the problems associated with the establishment of seed programs and most of the failures or near-failures can be attributed to failures in recognizing these requisites, or in providing for their proper development.

HIGH-LEVEL SUPPORT: Desire and determination within the decision-making level of government to improve agriculture and the supply of essential inputs is the first requisite. Determination and desire along, however, are not sufficient. They must be tempered with an understanding and appreciation of the needs of agriculture and their priority, alternative avenues to progress and their relative accessibility, and the human and material resources that can be committed to the task. The proper balance of programs is most important.

Strong emphasis and ample allocation of resources to a fertilizer acquisition and use program will not produce maximum results when seed improvement and pesticide programs are neglected or ignored. A seed testing laboratory, regardless of how well equipped and staffed, is not a seed program nor is a seed law, processing plant, certification agency, or the importation of vast quantities of an improved variety for one-time distribution. These are only elements of a seed program - links in the chain. Emphasis or rather over-emphasis on specific elements of a seed program at the expense of others of equal importance is one of the major impediments to the establishment of truly effective seed programs in the LDC's. High investments, elaborate facilities and disappointing results are most often the results.

Administrative support, understanding and appreciation of the nature and potential contributions of the seed program are needed not only at the high policy-decision making level, but also at lower echelons in the chain responsible for planning and implementing the program. A seed program can be enthusiastically sanctioned and actively promoted at the top level only to have its objectives thwarted or turned into some unprofitable or undesirable direction by improper or incompetent implementation.

The development of administrative support for and committment to a new program - particularly a seed program - is not a simple task. But it is a task to which advisors and planners must address themselves before attempting to move on.

PRODUCTIVE PLANT BREEDING PROGRAM: An active and productive plant breeding, introduction and varietal testing program is the cornerstone and second requisite of the seed program/industry. Structuring a seed program on native or unimproved varieties can seldom be justified. Sporadic yield increases might result from improved seed production and processing practices, but the overall and long term effect is usually disappointing. Cultivators have worked out successful methods for saving seed of traditional varieties over hundreds of years. Elaborate schemes and facilities - no matter how well intentioned - are unlikely to improve things very much. For the cultivator has only a small quantity of seed - a few kilograms - to select and store - enough for his own planting - and he has a personal interest in them.

In the newly organized seed program, however, large quantities of seed are frequently produced, processed, stored and distributed by technicians with little training in seed operations and no real interest in the result of their labors. The validity of these statements is strongly supported by the fact that so-called "Seed Programs" were organized, and implemented in many countries in the middle and late 1950's. In some, the program was literally abandoned and facilities and equipment acquired at considerable expense were never put into operation or allowed to deteriorate. In other countries, the seed program struggled along until stimulated by the introduction and development of strikingly superior varieties.

Historically, the same trends can be discerned in the evolution of seed programs and industries in the agriculturally advanced countries. We have only to consider the influence of the development of hybrid maize, superior varieties of cotton, hybrid sorghum, and adapted varieties of soybeans on the growth of the field crop seed industry in the United States, and how the release of hybrid wheat and interspecific crosses of the cereals will affect its future development to see the parallels. We are mindful that the vegetable, forage crop and ornamental seed industries had a somewhat different history. But the later are special cases - crops that are grown for products <u>other than the seed or grain themselves</u>. Thus, seed production in these crops is outside the experience of the average cultivator.

The almost total dependence of a seed program/industry on the development and/or introduction of improved varieties is so clear that it is difficult to see how it was overlooked in the earlier efforts to establish seed programs in the LDC's. Perhaps the advisors, mostly specialists,

simply took it for granted that truly superior varieties had been or were being developed. In any event, we are not familiar with a single case in which an effective seed program/industry developed on a base of unimproved varieties of the major food and feed crops, e.g. maize, wheat, rice, sorghum, beans, etc.

COORDINATED EFFORT: There are three other requisites for successful seed program/industry development that we have been able to identify. These are: cultivator demand, a sound plan and adequate organization, and a cadre of trained workers. These are considered together here because basically they are products of coordination and cooperation.

The production of a large quantity of quality seed of a superior variety for which there is no demand, or which cannot be effectively distributed, is as futile as creating a strong demand for improved seed without provision for adequate production. Either situation can wreck the developing seed program and stifle development. In the first case, the waste of resources and effort is so obvious that it will have to be curtailed, while in the second case, the cultivators simply consider that the situation is just another in a long series of governmental misadventures, and they will become even more distrustful of non-traditional schemes for agricultural improvement.

Improved varieties first have to be truly "superior" and their superiority dramatically demonstrated to the cultivators for they - the cultivators - do not lightly turn from the familiar and traditional. It has been said that "cultivators may be illiterate but they can all figger." They do understand input-output relationships and are often shrewder judges of the economic merits of varieties than the breeders themselves. Well planned, convincing demonstrations will create a strong demand for seed of a new variety.

Developing an awareness among the cultivators of the potential of improved seed - or any input to the point where they will demand it - is obstensibly a function of the agricultural extension service, farm advisor corps, or whatever it is called. Since the extension service obtains information on new developments from research agencies, the closest cooperation and coordination between research, extension and supply programs (such as the seed program) are essential.

The failure of the extension service to keep pace with developments and to "sell" the cultivators on new practices, or varieties, is one of the problems most frequently related to us by seed specialists in the LDC's. Since most of our contact is with specialists in research and production, the extension service may often be used as a convenient "scape goat". It is certain, however, that the success of a seed program/industry must be judged in terms of how much of the seed produced

are actually planted. "Selling" improved seed to the cultivator is a big enough job for all: research, extension, and the seed program/ industry including private sector participants.

Most frequently, seed program development has progressed "piece meal", a seed testing laboratory here and now, a certification agency there and later, and so on, with little attention to the basic mission of the program, namely, production and distribution of high quality seed of improved varieties or hybrids in adequate quantities at the proper time and at the right place. The various elements of the program are never integrated into a functional vehicle for carrying out the mission. Piece meal development of this type results from faulty planning, no planning, or an inadequate understanding of what a seed program is and what it is not. Either there is no comprehensive plan, or there are too many unrelated and uncoordinated plans (for example, one for each element of the program), or the plan is incomplete.

Sporadic supply of seed to selected cultivators, promiscuous distribution of seed of new varieties until the limited supply is exhausted, and the scatter-gun distribution of vast quantities of imported seed have all been used to introduce superior varieties into the cropping pattern of an area or country. Short-term effects are variously successful or unseccessful (in all degrees) depending on the circumstances, the country, the superiority of the variety, and the timing. None of these methods, however, remotely resembles a seed program/industry and they will all fail in the long run. They will fail because there is no committment to continuity, or permanency to effort and resource allocation.

Accomplishment of the mission of a seed program requires planning and organization. Planning outlines the program, establishes its goals and scope, allocates necessary resources, and provides for continuity.After planning, organization is then necessary for successful implementation and attainment of goals. Effective cooperation has to be established among the various governmental agencies involved in crop improvement, research, extension, education, agricultural credit, supply, and with cultivators and other parties in the private sector. In the long run, the latter will or shouid evolve into a "seed industry".

The organization of a seed program does not have to follow some rigid pattern. There are no pat formulae for success. The biological characteristics of plants and seed do impose some limitations on what can and what cannot be done. Aside from these, however, the only criteria are that the plan and organization should foster a maximum of effectiveness and efficiency, a minimum of unnecessary procedures and irrelevant regulations, and should provide for and encourage - from the beginning - the participation of private persons and institutions.

The results of even the best seed program plan can be essentially negative, however, if the plan is not properly and competently implemented. Implementation of a seed program requires the services of persons competent and knowledgeable in the techniques of seed production, harvesting, drying, processing, storage, etc., and in the technical and fiscal management of a multiple-faceted operation.

Unfortunately, experienced seed specialists are few in number. This is true both in the developed countries as well as in the LDC's. Further, the specialists that are available are often so specialized that they are experienced in only one or two of the elements or phases of the seed program; for example, the seed analyst, or the certification specialist. The seed "generalist", that is, one technically competent in all aspects of the seed program, is very rare indeed. This "over-specialization" on the part of advisors and indigenous personnel has contributed to the "piece meal" development of seed programs - a specialist always does his "thing" first.

General familiarity with seed production, processing, storage, or marketing might suffice for broad planning of seed programs, establishment of goals and the outlining of an organization. But, implementation of the plan and the conduct of operations are quite different things. Acquaintance with the general principles of drying is simply not sufficient to equip a person to deal with the immediate problem of drying maize seed during the wet season in Honduras when humidities and temperatures are both near 100°. The seasonal division between a rainy and dry period, the high temperatures and humidities, poor transportation and communications characteristic of many of the LDC's are outside the experience of most seed specialists from Western Europe or the U.S.

As previously mentioned, the shortage of trained manpower is not restricted to the LDC's. The shortage also exists in the U.S. The basic reason for this shortage is that seed technology is almost totally ignored in the undergraduate or graduate curricula of most of the Land Grant Universities. Thus, a U. S., or international student interested in Seed Technology either has to enroll in one of the two or three institutions that do offer some formal and practical training in seed technology, or join a commercial seed company for in-service training after completion of traditional agronomic, horticultural, or business training. In the U. S. the shortage of seed specialists is partially off-set by in-service training programs with seed companies, seed testing laboratories foundation seed programs, or certification agencies, etc., that are operational. But, where can one receive similar training in a country such as Ghana or Ecuador, or Pakistan, East or West? Until such time as a small corps of trained manpower is available in a country to operate the seed program and <u>to train others</u>, basic training must be provided for in the U. S. or one of the other developed countries, or by a team of advisor-experts called into the country.

It may appear that we are over-emphasizing these "requisites" for seed program development, or that they are so obvious that they can be taken for granted. We have found, however, that ignorance of the bases for a seed program has been responsible for many seed program failures in the LDC's.

The decision to initiate and implement a seed program is an important step in agricultural development. It should not, however, be taken precipitantly. Before major organization and capitalization of a seed program are undertaken, the bases essential for success and subsequent development should be available or provided for.

Problems in Seed Program/Industry Development

The conditions, actions, situations, and circumstances that have inhibited or stifled establishment of seed program/industries in the LDC's are as numerous and varied as the countries themselves. Nevertheless, some conditions or actions common to several countries have been identified. These are considered here - not necessarily in any order of importance. Time does not permit much more than a listing and brief comment on each problem.

Inadequate Basis for Program

We have already considered the requisites or bases for a seed program: high level support, crop improvement program, plan and organization, coordination, cooperation, etc. Unless these requisites and bases are available or provided for, the seed program will develop slowly, unevenly, and be largely ineffective. One of the first actions in planning and organizing a seed program should be to determine whether a program is needed, and if one is needed, what should be its initial scope. An objective inquiry into the present status of agricultural improvement and future prospects before planning would eliminate much wasted effort and funds.

Inadequate Planning and Organization

The poor planning of seed programs is not usually the result of insincerity or lack of seriousness of purpose. The person or persons assigned responsibility for developing a plan and organizational structure may simply not be very knowledgeable about seed. They do the best they can, which is usually not good enough. The situation is further aggravated by the fact that the "literature" on seed industries, technical aspects of seed technology, and seed program development is deficient and widely scattered. There is no place the planner can turn to for assistance or advice except a consultant from one of the developed countries.

The planners of seed programs are often further handicapped by lack of time for careful, considered planning. Seed projects or programs are somehow nearly always of the "crash-program" type.

If a seed program is important, then ample time ought to be spent on its planning and organization. Further, the best possible assistance should be provided to the planners and the plan ought to be reviewed by competent persons.

Since the successful program/industry is composed of public institutions and private persons and/or companies working in harmony toward a common objective, the advice and assistance of private sector persons and institutions should be sought very early in the planning stage. Programs planned and organized entirely in and by the public sector tend to develop into monopolistic operations, which effectively exclude participation of the private sector.

Incomplete Programs

As previously mentioned, a major impediment to establishment of a seed program/industry in the LDC's is an incomplete understanding of just what a seed program/industry really is and what it is not. This can be attributed in part to the absence of a suitable model in the developed countries. Where are the precedents?

Taking the U. S. as an example, how did our "seed program" develop? Do we really have a seed program? Do the various states have seed programs? There is really no formally-organized, nationally coordinated or state-coordinated seed program in the U. S. There are agencies in the public sector that are concerned with seed production and marketing and persons or companies in the private sector that are involved in complete seed programs, or specific phases of seed programs. Basically, the activities of our seed program/industry - if it can be so designated - are coordinated by supply and demand, and a mutual inter-dependence among the various components and agencies involved. Our seed program/industry developed not as a result of planning or organization, but in response to opportunities and needs. It really developed as agriculture developed, and development was rather slow.

The urgency of the agricultural problems in the LDC's preclude a leisurely development attuned to population growth, frontier, expansion, changes in land use, and the slow process of building toward break-throughs in the technology of agriculture. Thus, change has to be very sudden and drastic. It has to be planned for, advocated, and actively promoted and not just allowed to happen in due course.

With this background it is not surprising that advisors on seed program development and nationals trained (or oriented) in seed work in developed countries - the U. S. - are often uncertain as to just what is a seed program. The problems inherent in specialization further complicate the problem. The specialist is accustomed to doing his thing - and leaving other things - however, closely related - to other specialists. Thus, we find in the LDC's seed testing laboratories that have no seed to test, certification agencies with no seed to certify, and seed businesses which have no markets for their seed. There is no balance in the program - and more often than not - no supply of seed.

Conflicting Advice

Planners and workers in some countries are literally inundated with advice from various technical assistance missions and groups. And, probably in no other area is the advice given so much at variance as in seed program development. The worker or planner in an LDC exposed to conflicting advice becomes confuses and soon cannot differentiate between significant differences in procedure or philosophy and "nit-picking". The differences in philosophy and experience among advisors and consultants -particularly, those from different countries - can frustrate seed program development.

Restrictions on Private Sector Participation

Inevitably, the spectre of an uncontrolled, capricious, exploitative seed industry is resurrected at the moment private sector participation in the seed program is first considered, and thereafter haunts many public servants involved in seed program development. In reality the danger is not from lack of control of the private participants but from over control to the point that participation is effectively throttled.

One must appreciate that in many of the LDC's, the resources and recourses of government to restrict, inhibit, hamper, impede, etc., are far greater than those of private enterprise to evade, hurtle, sabotage or litigate. It is with this situation in mind that we place considerable emphasis on high level support and coordination of the seed program/industry. Only firm, high level policy can prevent the erection of barriers to private sector participation and the harassment of private companies by lower echelon officials.

Non-Concern About Seed

In countries where the importance of seed improvement and a seed program is not understood or not appreciated, there obviously can be no progress. If a seed program is not needed, then fine. But, if the absence of a seed program is impeding progress, the gravity of the problem is obvious.

The inability or refusal on the part of key officials and/or advisors in a country to recognize the role of a seed program/industry in agricultural development must be counted as the most frustrating of problems. Until this barrier is effectively penetrated, nothing much can be done.

Lack of Trained Manpower

Insufficiently trained or untrained manpower is a root cause of many problems arising during establishment of seed program/industries in the LDC's. It also contributes in the same way to many of the problems remaining in the U. S. seed industry.

Opportunities for comprehensive training - academic and practical - in seed technology are greatly restricted. Insofar as we can determine, only our University - Mississippi State University - provides training in seed technology that is fairly comprehensive, practical, and closely relevant to the environmental conditions and kinds of crops grown in the LDC's: hot, humid conditions, and corn, rice, peanuts, sorghum, wheat and soybeans.

The few successful seed programs in the LDC's emphasized training from the beginning and provide for continuous in-service training. The trained manpower that spins-off from a well managed, seed operation in the public sector can and does provide the technicians and managers needed by an emerging seed industry.

In our judgement nothing is more important to seed program development than training.

Technical and Operational Problems

Many of the problems discussed here are related. For example, technical and operational problems often derive from inadequate planning, poor organization, insufficiently trained personnel and lack of coordination. Nevertheless, the technical and operational problems encountered in seed program/industry development are abundant and complex. They cannot be lightly dismissed or ignored. A successful, effective seed industry or agri-business of any type is based on technology. We submit that until the technological problems are satisfactorily resolved, substantial development of a public or private seed industry is not possible.

The technical problems encountered are very complex and severe in those LDC's that are in tropical or subtropical zones - and most of them are.

Here we can do more than list some of the more important of these technical and operational problems:

1. Adverse environments for production, harvesting, drying and storage of seed.

2. Inadequate facilities and equipment, with little provision for maintenance and repairs.

3. Lack of competent supervision and management.

4. Small seed production units, which are inherently inefficient.

5. Inadequate operational funds, and high interest rates.

6. Poorly developed marketing and distribution system, including transportation network, and market information and statistics.

7. Poor communications.

Present and Future Seed Program Needs in the LDC's

Much of what I have discussed has related to Seed Program Development in the LDC's, now I should like to consider how the needs in this area are changing - the specific theme of this seminar.

I do not believe that basic seed programs needs have really changed - the things that have changed are the higher degree of urgency in fulfilling these needs, a shortening of the allowable time span in implementing programs, an advancement to a more substantial base for seed program development (the high yield varieties, the package program) and an increase in the spectrum of opportunities deriving from agricultural development and the "green revolution" in some countries, particularly, agri-business opportunities which add a new dimension to seed program development.

The extension of and consolidation within the "green revolution" require that seed supply be assured through an on-going seed program/industry, that steps be taken now to further advance and commercialize the seed program/industry in those countries that have the necessary base, and to initiate programs in countries that have not yet started, and that these goals be given high priority and pursued with determination, imagination, renewed dedication, vigor, and dispatch, but also a moderate degree of patience.

But these are generalizations - let me be more specific - -

1. Seed program/industry development should be given high priority in AID's assistance programs in agriculture. Long range committment to and continuity in seed program development is essential. The stop and go, hot and cold, feast and famine, crash type approaches to seed program development since the middle 1950's are simply too wasteful and ineffective for these times.

2. There must be more careful planning for seed program development. The plans should be drawn on the basis of a study of current needs, projections, available resources, potential for commercialization, etc., and not as an afterthought or spur-of-the-moment decision. The plan should include a definite but flexible schedule for implementation with provisions for initial and periodic review and revision depending on the changing situation and rate of progress. Insofar as possible, private persons and institutions including progressive cultivators should participate in the planning and review processes.

3. The requisites and bases essential for seed program development must be attended to - they can no longer be over-looked or neglected.

4. Technological problems encountered should be satisfactorily resolved before moving on. They will not disappear simply because they are ignored.

5. Manpower training should be accelerated and made more effective. Participants should be carefully selected for high technical and/or managerial aptitude and programmed for comprehensive training in the U. S. Technicians with more limited capabilities should be programmed for short term, more specialized training in the U.S., or given in-country on-the-job training. Provision should be made for periodic, practical training courses or workshops for workers in each country with instruction provided by qualified seed technologists, preferably, from the U.S. Such training would be most efficient since it is less costly to send 2 to 3 instructors to a country to train 25 to 30 people than to send 10 to 15 people to the U. S., and most effective since training would be directly related to actual operations and conditions in the country. Finally, more attention needs to be focussed on "management" training, and on the development of an indigenous training capability in each country.

6. Major emphasis in seed program development, particularly in countries that are just starting, should be given to the establishment of a well organized and staffed, modern, and effective foundation seed program. In most countries, a foundation seed program would necessarily be in the public sector and tied very closely with agencies involved in plant breeding and crop improvement research. Initially, it would and should probably be involved in seed supply to general cultivators as well as providing basic seed stocks for multiplication by other seed producers. The foundation seed program could also serve as a model, training vehicle and experience-provider for prospective private seedsmen, and the inspectors, seed analysts, plant operators, and seed advisors needed to service an expanding seed program/industry. As seed production and marketing advanced, the foundation seed program could revert more and more to its primary roles as a supplier of pure, high quality seed stocks to seed producers, and a center of expertise and service to the entire seed program/industry.

7. Agri-business should be strongly promoted and supported in countries that have an adequate base for commercial development in agriculture. The emergence of a competently managed, vigorous, fiscally sound agricultural supply industry - including a seed industry - will resolve many of the production, marketing and distribution problems that stifle development.

8. Participation of U. S. seed companies - or seed companies from other developed countries - in seed production, supply and marketing should be encouraged and fostered in every way. Experienced private seed companies have much to offer the LDC's. It should be recognized, however, that opportunities for such participation are presently limited to the larger, more progressive countries which are not openly hostile to off-shore private investments, and then only in the case of seed of hybrids and specialty crops: hybrid maize, millet, sorghum, and vegetables and forages.

These are the tasks that should command our attention, imagination, and committment. The fields stretch before us; when and if we lay our hands to the stock, we must be prepared to plow the long furrow.

APPENDIX

The MSU/AID W-607 Contract

Mississippi State University's involvement in seed program work in the LDC's began in 1956 when the first "Special Course on Seed Improvement" for international participates was given on our campus. The course was sponsored by ICA and FAS, and continues on an annual basis to this date. Two years later, on March 18, 1958, an agreement was entered into between Mississippi State University and AID under terms of which MSU agreed to provide development, training, and technical services in the area of seed improvement to the less developed countries receiving technical assistance from the U. S. The Seed Technology Laboratory was charged by the University with carrying out its responsibilities under the contract.

The services provided for and the resulting activities engaged in can be generally classified into three broad categories: technical assistance and services, development of essential technology and information, and training.

Technical Assistance

During the 12 years the contract has been in effect, specific consultation visits and follow-up work has been provided to 26 countries, 12 to 15 other countries have received very substantial assistance through correspondence, as a follow-up to brief stop-over visits made in connection with other assignments, or as a result of visits by AID staffers and seed specialists from the LDC's to our laboratory.

Basically, the consultations have involved:

(1) Plans and designs for specific facilities.

(2) Assistance and advice on operations.

(3) On-the-job training.

(4) General in-country seed training.

(5) Program development.

Program development (planning, organization, and so on) was listed last because although it is prominent among the objectives of the contract, assistance in initial planning and program development has seldom been requested. Rather, we have been most often called in after a program of some type has been initiated and the problems have

become almost insurmountable, or to assist with specific elements of the program.

While problem solving and brush-fire fighting work of this type are and will continue to be urgently needed, we strongly feel that timely assistance in the planning stage might have minimized the number and complexity of problems that arose later, and that as another consequence, funds and resources expended might have been more effectively and efficiently used.

It is certainly not necessary for seed program workers and advisors in the LDC's to experience everything - much time, effort and funds could be saved by taking advantage of our experience or the experience of others.

As measured by level of seed program development, the results of this technical assistance have been successful, partially successful and unsuccessful in about the same proportions as any other technical assistance venture. But in terms of the development of human resources - men and women with an appreciation and understanding of seeds and their importance - we don't count any failures. We work now, here and in the LDC's, as we have since the beginning - with people. For we learned long ago that progress is and must be effected through people.

Some of the plans we helped develop were never implemented or fully implemented because advisors and their counterparts changed, and their replacements turned to other things. Changes in key personnel - both in the AID Missions and in the Ministries of Agriculture or other counterpart agencies with the resulting lack of continuity of interest, effort and support has been a recurring and frustrating problem in our 12 years experience. The rather sudden retirements last fall of many AID staffers severed in almost one moment lines of communication that has been building up over several years. The result was that we almost completely lost contact with on-going projects in several countries.

In other countries, portions of the plans developed were implemented and the rest was left hanging. Perhaps, facilities of the size and type requested were not really needed at the time assistance was given. In this connection, we have noticed several "second generation" requests for essentially the same type of assistance provided in earlier years. Only now the tone is more urgent - and sometimes rather desperate.

It has been interesting to us that the spread of the "green revolution" among the LDC's can almost be followed by the requests for technical assistance or information on seed operations. If the high yielding varieties continue to be the cutting edge of this revolution, there can be no doubt but that more and more technical assistance in the seed area will be needed and requested.

Development of Essential Technology and Information

At the beginning of this talk I stated that since its establishment in 1950, the Seed Technology Laboratory has been essentially engaged in creating a new discipline or specialty in agriculture. And, that during much of this period we have been pretty much alone. Since, with the exception of Seed Testing, there is no basic background information - no literature - in Seed Technology other than what we and a few others have gathered together from diverse sources, developed and recorded, our laboratory has become a sort of world-wide information and advisory center to seed specialists around the world - literally from Afghanistan to Zambia, and including both the developed and less developed countries. Our correspondence grows each year and the number of visitors increases. Much of the technology and information we develop never gets beyond the mimeograph stage, so great is the demand for it. I sometimes think of the field of seed technology as a sort of frontier where we are dealing in rough-hewn logs that can be used to construct houses that are functional, sturdy, and warm - albeit, without all the aesthetic qualities of a town or ranch house. There will be time enough for aesthetics later. The same feelings must have existed in genetics or soil chemistry about 50 to 60 years ago.

It has been our task not only to record and disseminate information, but to develop it as well. In our technical assistance work with the Missions we've encountered many problems - particularly in the areas of seed drying and storage - for which we had no tried and tested solution. Sometimes we've guessed at the unknown parameters - and usually we've been pretty close. More often, though, we had to build several models, do much testing and evaluation, and talk with a lot of folk from aerophysicists to retired farmers.

The information developed and disseminated has had an enormous influence on seed programs in the LDC's whatever their state of development. It would be hard to find a seed program in the LDC's that has not been influenced in some way by our work and thinking.

Training

Lack of trained, knowledgeable manpower in the LDC's continues to be one of the serious bottle necks in seed program development. Our laboratory has done yeomen service in the training field for 14 years, and still the need continues. This is to be expected - we have conducted an annual training short course for U. S. Seedsmen that has followed pretty much the same format and featured the same topics for 19 years - and we have not felt that it should be dropped or even changed to any extent. U. S. Seedsmen still need basic training.

Although some of the training we have given has not been directly under the Contract, we simply could not have justified the tremendous effort expended without some of the resources made available under W-607. Since 1956, 202 agriculturalists from 48 countries have participated in the annual 5 to 6 week seed improvement training course and 51 students from 18 countries have obtained B. S., or graduate degrees in Agronomy-Seed Technology. Presently, we have 16 international graduate students from 7 countries working on M. S. or Ph. D. degree programs. This fall we expect the number to increase to 21, plus, 6-8 new students on non-degree practical training programs.

We have also held discussion with and given general and specific training to seed specialists with the foundations, other University AID contractors, AID staffers, and many participants on training and observation tours sponsored by their governments, AID, the Foundations, FAO, and so on.

We have organized and conducted 6 regional seed training courses, 3 held in Latin America, one in the Far East, and 2 in Central America. Well over a 100 participants were involved. Last fall we conducted two in-country training courses - one in Colombia in cooperation with the AID Mission and the Caja Agraria, and one in Ecuador in cooperation with RF, MOA, USAID/Mission and the agricultural research organization (INIAP) in Ecuador. Twenty-five to 30 participants were enrolled in each course.

Not all - perhaps not even a majority of these trainees and students were or are working in seed programs. Many were plant breeders, extension workers, production specialists, administrators, and so on. But, they too need to understand and have some knowledge of the role, composition, technology and management of seed programs. Many are already leaders in their countries, others are rising to positions of influence. They will be heard from and listened to in the years ahead.

I know that my associates concur in this statement - that our most satisfying work has been in the training area - in working with people - and that in the long run, this will prove to be the most significant of all our efforts.