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DEVELOPING AGRICULTURAL RESEARCH PERSONNEL

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1.1 INTRODUCTION

We all share concern in the rapidly increasing world population; many demographers now estimate that this increase may be forty percent within the next ten years. Such projections suggest that national average yields must increase forty percent, on the average, just to maintain present levels of availability of cereals (given the scarcity of new lands for crop production).

Among the many factors involved in boosting these yields, is the critical requisite for trained agricultural personnel. Looking ahead, through the 70's and beyond, perhaps the development of well-trained men and women is the single most essential factor in maize improvement and is certainly a slow and continuous process that cannot be overlooked. Thus, my discussion here seeks to provide both a rationale and specific recommendations for fulfilling some of the current needs in agricultural education and training.

2.1 SOME BASIC CONCEPTS

We can say that our human development is conditioned by two main factors: our genetic capability and the opportunity we have to reach our full potential. The first we are born with and can be changed very little with current knowledge. The second --opportunity-- is usually related to the economic status within which the individual is born. Unfortunately, the economic status of rural people, particularly in the developing countries, is generally below the level allowing full opportunity for education. Thus, we are faced with the fact that most of the people who receive advanced education and training are drawn from urban centers-- and this includes agricultural graduates. One of the basic questions then (and a major limitation in staffing) is: How do we go about developing people for service in agriculture who have had no association with agriculture during the first fifteen to twenty years of their lives, other than through the food they eat. Far too often, such a student's first association with agriculture occurs in a classroom; via a professor who may have had only an academic exposure to the problems of agriculture, with virtually no direct involvement in solving agricultural production problems.

It seems to me that we now have two areas for discussion: First, how do we train the present generation? Secondly, how do we train the generation that follows? Obviously the more urgent need today is the present generation; therefore, this paper focuses primarily on that issue.

3.1 PREPARING YOUNG SCIENTISTS

The development of young scientists is a costly and time consuming process. For this discussion, I plan to start with the student's first year at an agricultural college. (However, the terms of motivation, prestige, career course, the process must begin much earlier). We can begin by asking: What does the student need, and how does he get it?

I think we all agree he needs a sound education in the basic sciences, the agricultural sciences, and considerable exposure to the social sciences. In addition, as a solid foundation from which to be able to develop, he will need to assimilate a good deal of practical

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field and laboratory experience. This sort of direct experience is often called an internship or apprenticeship. After such a basis has been acquired, he will be in a position to learn through personal experience; acquiring and gaining additional depth in a continuing process throughout his career.

On the surface, such a system of education seems quite simple. Most universities and colleges probably feel that they are providing the background a student needs. In general, however, I disagree. My experience suggests that most universities are simply not adequately preparing students to give the world what it needs in agricultural research and production. In far too many cases, students are being taught by professors who are poorly qualified. True, these professors may have the required academic degrees and years of teaching experience, but these per se are not an adequate measure of qualifications. And let me add, quickly, that this dilemma is not unique to any part of the world. Perhaps it is best to fault the educational process, rather than any segment.

Since an agricultural scientist is basically the product of his education and experience, we need to give much more attention to the undergraduate and graduate study programs. We must find ways to improve the educational system so that it will turn out better qualified young people.

3.1.1 SOME BASIC PROBLEMS

Here are some of the problems we must struggle with. In the first place, teachers and professors traditionally receive very low salaries. Thus, the education system often cannot afford the best talent. Further, academic roles within a civil service system are usually fixed, with rigid salary scales and increments that prevent the possibility of promotions for merit. When the excellent, good, fair and poor members of the academic staff are treated identically, mediocrity is usually the product.

In many institutions, agricultural teaching is done by professors who are not engaged in research; who have no access to modern libraries. As a result, they often teach from notes taken when they were students. For some of the basic courses this aspect is perhaps not too serious, if the professor took his course from a good teacher. In other words, the anatomy of a plant does not change; basic genetics at the undergraduate level has not changed much, etc. But advanced courses of the applied sciences do change, and they must be revised continually to be really effective. Courses such as production agronomy, plant breeding, production economics, must use examples that fit the current local situation. Unfortunately, this usually is not the case. The material and examples are outdated and, even worse, are often related to an agriculture totally different from that found in the student's native country. The problems here involve: What information inputs are available? From whom? How translate for student?

So, in preparing young people, we must first improve the teachers and their information. Incentives must be found to motivate teachers. They must be involved in dynamic research programs. They must be thoroughly familiar with the problems of agricultural production, and should know farmers and the farmer problems, if their testing is to be relevant to a country's needs. Let me give an example or two to illustrate the present situation. For the most part, in the developing countries, agricultural research is conducted by the Ministry of Agriculture. Their colleges and universities are doing very little, if any, agriclture research and almost no research of an applied nature. Often, however, young scientists and administrators from the Ministry of Agriculture have opportunities to travel, or to study as participants in in-service training programs. Such activities seek to improve the knowledge and experience of the individual. But, the classroom professor usually has far fewer chances to travel; and if he does, he generally visits another university having the same orientation as his own. Many universities have research responsibilities, of course, but frequently the

research lacks relevance to the needs of the country. My suggestion is that professors and teachers be provided opportunities and motivations to travel and participate in dynamic research and production programs, keeping them up to date on the latest in applied research. This concept also implies that research and field people should have some access to classroom and lab work, for a two-way flow of information.

In addition, I believe we should develop teaching programs which require the student to think through and apply the new knowledge he has gained. His work should focus on the needs of his own country. Unfortunately, the system most commonly used today simply throws a series of "facts" at the student. If he can memorize the material and regurgitate this to the teacher, he will probably be "Number One" in his class. Within such a system, he receives no guidance or reward for recognizing the principles involved; or for his ability to marshall facts and data and translate them into a solution of problems. In my opinion, such academic experiences limit the potential of both the student and his native country.

A student must acquire a practical education, plus on the job training and experience, before he can be productive in solving problems in his chosen field. During his undergraduate preparation, such problem-oriented training should involve application of his newly acquired knowledge, plus a strong motivation to acquire additional information through reading discussion and thinking. Such experiences demand precision in the student's thinking, in the implementation of the exercise, and in the interpretation and reporting of results.

Students also should become thoroughly familiar with experimental techniques. Since applied agricultural research must be field-oriented to be effective, students should learn food field techniques. Students could be given an opportunity to work as research assistants during the "breaks" in the academic program. In my opinion such work experiences should be a requirement for the degree. It is imperative that the student work with a scientist who fully understands the importance of high quality field research; that is, good seed bed preparation, good stands of plants, good water control, careful recording of data. With such training, the student soon learns that the best statistical analysis known will not improve poor data or foggy thinking. Such concepts can only be learned by direct participation on the part of the student. As an extra dividend, the student can learn much about experiment station management and operation via the same process. In my view, this lack of direct experience is the weakest link in applied agricultural research and generally is given far too little attention by both the researcher and the administrators.

Obviously, a Bachelor's degree does not, in itself, prepare an individual to serve as a research scientist. But if he has had the experience, basic courses, and training described above, he is qualified to be a first rate assistant in a dynamic research and production program. He will have enough of the concepts and skills to understand the why's and wherefore's of what he is doing, even though he will not be able to analyze all of the biological, economic and social implications.

3.1.2 ADVANCED STUDY

After the receipt of the basic academic degree, what then? When the young scientist starts out as an assistant he should be assigned a role with a well defined responsibility in the overall research and production program. But, he must also be given sufficient guidance to allow him to effectively perform the functions that are required. His education in conduct of research is just beginning.

After completion of his Bachelor's degree or equivalent a young scientist should have at least a year of on the job experience in the national program after which he should be capable of getting the most out of one of the international in-service training programs. On completion of this he should then spend another year in his national program. At this time he, if he merited selection for such a program in the first place, will be able to carry a substan-

tial load of responsibility and exercise it efficiently and effectively.

Assuming his continued performance has been satisfactory he then should be considered as a candidate to work towards a Master's degree in an institution that will provide the best possible advanced training and education to fit his and his country's individual needs. This in my opinion is not necessarily available at the most prestigious universities in the world.

Obviously, not all of the young scientists will have the capability of interest to go on for advanced degrees. Only those who are well qualified, interested, highly motivated and responsible should be sponsored. Qualifications in this context means far more than just academic qualifications. He should, of course, be intelligent but he also must be dedicated and willing to pursue a course that is relevant to the needs of this country. (This really suggests a planned program of staff development to meet the national needs rather than the free choice approach that exists in the more advanced countries). The world food problem forces us to consider priority ratings in all aspects of agricultural training for research and production. Staff development must be organized on a much more structured basis than has been the case in the past.

After the Master's degree has been completed the individual should be placed in a position of responsibility and some leadership in the National program. He should have reached a level of qualification through education, training, experience and maturity which will provide the kind of thinking, planning and leadership that is required of a person in such a role. It is absolutely essential that he be allowed to productively use his talents.

Training programs at the Ph.D. levels should be restricted to those scientists with a Master's degree who have demonstrated over at least a two year period that they can perform effectively in the research program and have shown leadership ability.

The schedule of scientific and academic development I have just outlined require about fourteen years during which the individual has actually worked in this country only four years. During these fourteen years he has prepared himself to develop his capabilities on a continuous basis for the rest of his scientific working life. Of course, people without formal education continue to develop but those who have followed a structured program designed to meet the national needs should be better able to continue to develop the changing technology and systems required by the developing nations.

It is very apparent to most of us that education and training cost considerable amounts of money. At present it is estimated that graduate study costs on the average $7,500 U.S. equivalent per year. An M.S. program requires a minimum of two years and a Ph.D. program normally requires three and a half years. Thus, the total average cost for an M.S. and a Ph.D. degree will be about $41,250. Such an expense must be considered carefully. If the wrong scientist is chosen,or if he was a wise choice but is not subsequently placed in a position where his education can be exploited, the investment cannot yield the expected dividend.

However, we must remember that even with the best education and training, people very quickly become isolated unless there is a system whereby they can keep abreast of new developments. This is best done by maintaining ongoing contact with other scientists, both within their country and the world-wide network of scientists in their area of interest. Thus, opportunities to move out occasionally as visiting scientists to see and participate in foreign research and production programs is essential. It is also essential for foreign scientists to periodically visit the National program.

Finally, I want to emphasize that although considerable time is devoted to the preparation of young scientists, the best system will be ineffective unless it is staffed by qualified people. Qualified people, to be effective, must be in a system which allows them to

function. Far too often, stifling bureaucracy fossilizes and destroys productive scientists.

4.1 QUALIFIED STAFF

4.1.1 RECRUITING

There are many different systems used for recruiting young scientists. Unfortunately, the system usually is designed to fit a governmental policy that often renders the system ineffective.

In addition, no matter how carefully the system screens the candidate, mistakes will be made. Far too often such mistakes are not rectified and the organization, over time, accumulates dead wood. One system that I believe would avoid this problem would require that young staff working in research, production and administration would work one year for the employing agency with no commitment on their part or on the part of the institution for future employment. At the end of the year the outstanding candidates would be selected for the vacancies in the system.

In many countries eager to rapidly staff programs, it is found that there are insufficient qualified graduates to meet the needs. This leads to employing a number of people of less than desirable capability. After these people are on the payroll, in most systems, it is impossible to dismiss them. The real tragedy here lies in the fact that they are not only inadequately filling positions, but that, with time they may be promoted into higher positions. There they not only are less and less productive themselves, but preclude the development of effective leadership in the scientific cadre below their level.

I therefore ask the question, is it not time to remove the agricultural research, production and administration personnel from the traditional civil service system? It seems to me very unfortunate that scientists are employed, promoted, etc. through the same system used for the more routine clerical positions of government.

If there are no means for removing recruiting from the traditional civil service system, it is probable that there will be no efficient way of guaranteeing that positions will be filled by the best candidates. Can we, with the present and future world food problems, afford to continue dealing with agriculture in the same inefficient bureaucratic way?

4.1.2 ESTABLISHING INCENTIVES AND BUILDING ATTITUDES

The attitude of the individual is often the difference between success and failure. Although attitudes are individual qualities, changes of poor to good attitudes and the stimulation of good attitudes is done through good leadership. Poor or indecisive leadership will most certainly dampen the spirit and attitude of the subordinate staff.

Energetic people must be fully occupied mentally and physically or they will become dissatisfied. They should have a little more responsibility than that which they can comfortably handle. If they have leadership capability, they will respond favorably to an overload. If, however, the young scientists are treated as second class citizens they most certainly will lose or fail to develop a positive attitude. This must be avoided at all cost and one mechanism that can overcome this problem is a built-in system of incentives. These incentives may take many forms; contrary to popular opinion, money is only one such incentive and not necessary the most important.

4.1.3 ESTABLISHING A SENSE OF RESPONSIBILITY AMONG SUBORDINATE STAFF

Mankind seems to respond to challenge by instinct, and this instinct can be either

stimulated or dampened depending on how a staff is handled. As with all aspects of human nature, the opportunities that people have and the leadership that they work with are crucial.

The responsibility for developing young people who will have a sense of pride, initiative and be able to provide leadership lies with the senior staff and administrative system of each particular organization. As senior staff, we often criticize the failures of our subordinate staff without analyzing our role in such failures. If we are truthful, the problem often lies not with the young scientist or administrator, but with the senior people and the administrative system.

Many times the system provides a mechanism for punishment for mistakes, but few or no rewards for excellence. This is a reverse incentive. Imagine how frustrating it is to the young energetic scientist or administrator who works hard to fulfill his responsibility only to be punished for minor mistakes.

To establish a sense of responsibility in subordinate staff, the senior research and administrative staff must provide adequate and timely leadership. Unfortunately, all too often, people with inadequate qualifications and capabilities have been promoted into the top positions. Most systems do not include a mechanism to release them or to reassign them to other positions where they could be effective. Such staff often have an inferiority complex and, through a natural instinct for survival, never let the talents of the younger staff emerge. This leads to a kind of institutional suicide.

If a sense of total team effort is established among the subordinate research and administrative staff, they will automatically be more productive. They will perform their duties with a zeal and integrity. Not only will they be more productive in their routine duties, but they will quickly develop the skill of discussion with their superiors and colleagues.

When younger well-trained staff have become capable of making decisions, they must not only be allowed to make them but encouraged to do so. In reality, most young (and too many senior) administrators are afraid to make decision. Why? A no decision-no punishment;wrong decision - severe punishment attitude prevails in many institutions. The art of procrastination seems to have reached a level of perfection in such administrative systems. Individual procrastination, plus the further stifling delays resulting from resorting to committees, is often the rule rather than the exception. It is just such a system that results in fertilizer being available two months after the crop is planted; in floor prices not being announced before planting, or not defended at harvest (as far as the farmers are concerned) because of delay in governmental decision making processes.

Just such bottle necks have rendered most, if not all, public national seed corporation ineffective -- a liability to the nation and a hindrance to the supply of quality seed to the farmers. The same situation applied to many government fertilizer factories where delays in decision making and availability of money on time have resulted in government plants running at less than full capacity and at an efficiency far below standard -- frequently 60-55% of rated capacity. This situation generally results in fertilizer priced substantially above world market prices.

4.1.4 IN-SERVICE INPROVEMENT

In-service improvement, as is the case with the development of incentives, depends to a great extent on the system and the leadership provided for the young people. Few people can learn the necessary practical application of knowledge on their own. They need teachers on the job.

If a nation is to have a strong dynamic research and production program the right type of leadership is essential. The same applies to administration. Young people should have

great opportunities for improvement through their association with dynamic people and participation in a well-defined and implemented program.

If the administrative or research program does not meet the above criteria, the opportunities for in-service staff improvement are poor. Earlier in this paper it was stated that young people should work in the national system before entering in-service training. I think this is advisable, even if the program is not one that will provide the most desirable experience.

The value lies in the fact that it gives the young person a chance to understand the local system before becoming involved in other approaches. As a result he learns more from his training experience.

As young people are allowed to flex their new skills, they will bring about partial change (again if the system and senior people will allow it). Change breeds change and this process can be accelerated. It is important, on the one hand, to allow the young and highly motivated to have a voice, but at the same time keeping it within reasonable bounds. This involves a fine line of judgement which we as senior people must be able to exercise in a reasonable manner.

With the urgency for economic development, and more specifically the development of food production capability, careful consideration must be given to in-service training of professional and technical staff in all countries. Closely associated with this is the need to redefine priorities, to establish sound objectives, and to implement programs sharply focused on these objectives.

Although most countries are very short of people qualified for administration, research and production, they do have a nucleus staff. Several countries are pursuing a vigorous program of promotion of agricultural production and staff development. As pointed out earlier, staff development is a slow, costly, and never-ending process.

It is physically and economically impossible to provide training abroad for all of the people necessary to make a country self sufficient in its trained manpower requirements. In-service training programs should be established in a country as soon as possible; in addition to the training opportunities provided during the University degree program. In-service training programs must be built around a dynamic research and production program, or, in administration, around the action of administrators. Unless these conditions are met, training is inefficient, often superfluous, and will not hold the interest and imagination of the trainee. Trainees must be involved in action programs.

What staff are needed for an in-service training program?

It is unrealistic to expect the research scientist or administrator to bear the extra load of training and at the same time effectively fulfill his responsibilities. Position or positions should be created for trainers whose responsibility is to train the young cadre of the nation. The training program must provide opportunities for the trainees to participate as assistant team members working directly with research and administrative staff. The trainer's responsibility is to organize, coordinate and fill in the gaps.

In the initial stages of developing such a training program, it is just as legitimate for a country to request outside assistance and expatriate help as it is for research, or for advisors to assist policy makers.

There are some nations that now have the necessary programs around which this training can be built. Many have not reached this level of development, however, and it is crucial that a nation have a good solid base before such training is begun.

4.1.5 PREVENTING PERSONNEL DRAIN

The greatest deterrent to the "Brain Drain" existent in many developing countries is an opportunity to work freely and productively in a dynamic system which has adequate facilities. Assuming this requirement has been met, a reasonable salary within the income stratification of the society is normally acceptable.

Different countries try different strategies. Few are totally effective if the above requirements are not met. In far too many situations young people are required to sign bonds, contracts, etc. to proved service to the country for a number of years equal to that they are sponsored for training. In my opinion such an approach does not set the stage for respect and loyalty to a particular country, or dedication to solving the chronic problems of that nation.

Clearly some people accept positions in other countries or in other institutions within a country simply for economic gain. I believe, however, that this group constitutes a very low percentage. The majority leave their home institution because opportunities elsewhere provide a freer hand and more responsibility with better facilities.

It must be recognized, however, that there are far too many countries where salaries (again tied up with civil service) are not adequate to maintain a scientist and his family. In such situation , one of two things inevitably occurs. Those who can find employment outside will leave the country, and those who cannot (or for personal reasons choose not to leave their country) will work at more than one job. Either situation is undesirable. The first represents a complete loss to another nation, which often is not in desperate need of the talent. In the second situation, the individual is not dedicating his major efforts to handling the responsibility for which the investment was made in training and education. Governments must come to grips with this problem, and it is another strong argument for removing agricultural research, production and administrative staff from the standard civil service system.

If staff recruitment in such areas were to be removed from the general civil service system, real thought and effort would need to be given to designing a reliable and workable system. Some countries have separated their Government agricultural work from the remainder of Government employees, only to find in a few years that an equally undesirable bureaucratic system has evolved. This accomplishes little.

Basically, developing people is not so complicated if all of the pieces of the puzzle are put together. In my opinion, this can be accomplished if a government firmly makes a decision to do so. Further, I believe, that in the long run, progress would be made at a more rapid rate than can possibly be expected with the pattern of events that occur today. If a government decides to make the necessary changes and launch a deliberate effort to systematically develop its agricultural research and administrative staff, it must first make a thorough appraisal of present and long-range staff requirements. I do not know of a single so-called developed or underdeveloped country in which adequate planning has been done in this regard.

Some of the more advanced countries are, however, prime examples of overstaffing, duplication of effort, and lack of coordination. Under such conditions, their accomplishments are the product of mass force and effort; not of efficient management of human and monetary resources.

Less developed countries, unfortunately, tend to look to one or more of the advanced countries for a pattern to emulate. The world (not to mention some of the individual nations) cannot afford that luxury today.

Other countries show other products of inadequate or non-realistic planning. In these countries, inadequately qualified people fill positions for which they are totally unsuited.

Since they are not qualified, the task laid out by the planners is not accomplished. This leads to the appointment of still more unqualified people and the job is still not done. These nations are caught up in a numbers game with people and limited funds. The funds are limited because they are paying too many people to do a very poor job.

Political pressures have forced most governments to try to attack a wide range of problems within their country. No doubt this may be necessary politically, but it results in a dissipation of resources and human talents to the extent that very little is achieved in any one field. How much longer can the world afford the luxury of such political decision?

This brief discussion on the need to train and use our scientists and resources in the most efficient manner highlights the urgency for governments to develop staff development programs in an organized and systematic way, even if this means changing systems, releasing senior people who are retarding factors and overcoming other such barriers. The need is so great and the hour so late that these steps must be taken if each nation is to bear up under its responsibility for food production.