NATIONAL PRODUCTION CAMPAIGNS

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The goal of organizations like IRRI or CIMMYT that undertake cooperative crop improvement programs in partnership with developing countries is to help those nations help themselves quickly to reach production goals, while making outside assistance unnecessary as soon as possible.

In any national crop improvement program, emphasis should be placed initially on crops important to both the economy and nutrition of the country. I could illustrate my points equally well by discussing any of several such crops—rice, maize, potatoes, or any other with which The Rockefeller Foundation has undertaken cooperative work. However, because of my own experience, I will confine my remarks to wheat.

In the long years that I have worked in different countries, I have never considered myself a "consultant," but rather a participant who tries to bring together three elements essential to successful crop production programs.

The first is adaptive research, which I need not discuss further since it was covered in Dr. Chandler's presentation.

The second element is the training of young scientists. This, I think, is especially important in view of the sophistication of the agricultural research being carried on today in many universities. Young scientists from the emerging and developing countries must be given practical experience—opportunities to learn how to grow a crop, to learn something about all of the factors that are involved in crop production, including the dignity of human sweat.

The third element consists in assembling the package of improved varieties and recommended practices in order to launch a national production program whose objective is not a slow, steady increase of yields, but a revolution in production.

But first let me describe some of the attitudes and conditions a host country must be willing to assume before such a revolution can be launched.

Political stability is important, but just as important is the commitment at the top levels of government to back these agricultural production programs aggressively, a commitment that must be substantiated by deeds and actions.

There must be assurances by the host country that there will be continuity of program and support for a minimum of five years, so that one can demonstrate what can be accomplished, leaving no room for the confusion of progress with what might have been accidents of nature.

There must be sound fiscal policy and incentive prices, to allow farmers to produce at a profit. There must be the will on the part of the government to make available the inputs that will be needed to revolutionize production. Adequate operating budgets must be available for research and training, and there must be some flexibility in how the money can be used. The host country must try to cut red tape to clear the road to progress.

Young trainees must be assigned to the programs for training in depth, then be provided adequate opportunity to spread their new knowledge across the breadth of the land.

Given all or most of these basic conditions, the scientific leadership responsible for the commodity production program must then be able to manipulate three groups of factors, placing them in their proper perspective, assigning priorities on the basis of the factors that limit crop production:

Technical Factors

First, there are the biological and soil factors. In my opinion, if one seeks to stimulate really drastic change, one must first consider the soil; soil fertility is a major factor contributing to stagnant agriculture in many parts of the world. Where land has been cultivated for hundreds and thousands of years, nitrogen is limited. In many areas this is also true of phosphorus, and in some cases potash and minor elements are needed in various combinations. Research is needed to find out—for each crop—what formulae fit what kind of soil under what kind of moisture conditions. This is not as simple as it sounds.

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Then there is the question of crop varieties. In a static agriculture the plant produces a very low yield, only a few hundred kilos per hectare, or a few bushels per acre.

Nonetheless these varieties, given starvation conditions, are in one sense quite efficient plants. They have been selected over a long period of time for adaptability to low levels of fertility—by nature, by the farmer, his father, his father's father, and so on. They are as well adapted to starvation culture as any plant could be.

When one changes soil conditions and fertility conditions with fertilizer, one must be prepared to change the variety also, substituting one designed and created to be highly productive—one with an ability to yield much more than the original type.

At this point other cultural practices that were more or less acceptable in a stagnant agriculture are no longer adequate. With traditional agriculture it made little difference what the farmer did or did not do regarding husbandry of his crop. Nothing he could do could materially raise his yields; he was hopelessly trapped. Even though the traditional farmer was an artist with the simple implements that he had, his yield potential or yield production was very low indeed. It has been clearly learned that development and adoption of cultural practices specifically prescribed for new varieties and better soils becomes imperative.

The same is true of the irrigation process. With more water and no other changes, one might get a 10 percent higher yield. But poor use of water is inevitable using old practices.

Take the question of weed control. Under starvation conditions, weeds are just as miserable as the crop plants: they cannot live, grow, or prosper any better than the crop. But once the farmer starts fertilizing, he will be growing weeds instead of cereal grain unless he is careful.

Insect control is complicated, too: the poor insects in the unproductive wheat fields are about as unfortunate as the man who is trying to grow the wheat. With heavy fertilization, the microclimate changes in the grain field. It becomes thick, humid, and shaded, and insects thrive. New insect problems of tremendous magnitude may suddenly occur, requiring equally sudden change to modern practices of insecticide control.

Diseases are similar in behavior. The rusts are not aggressive, and epidemics are seldom of any magnitude in fields of wheat where plants are widely scattered and undernourished. But start fertilizing and plant a dense stand with proper irrigation, or utilize the moisture from rain to its optimum, and a whole new set of conditions is created. Unless new varieties have built-in genetic resistance to rust, this disease will destroy the crop despite all of the other inputs and despite all the farmer's efforts.

Psychological Factors

The second group of variables that the leadership of any crop improvement program must be able to understand and use to full advantage includes what I call the psychological factors.

At one time, many more years ago than I like to think about, I was an athlete, and later I served as a coach working with boys from grade school on through the university. I found that the motivation and determination that one can instill into an athletic team is tremendously important: it is not always the team with the greatest physical power that wins the ball game. Motivation and determination are equally important to teams of scientists.

In many of the developing countries, the agricultural scientists have not won a ball game in a very long time, and one can quite realistically expect a certain amount of defeatism. This makes it vital to put together the right package—a thoroughly tested combination of new varieties and prescribed practices—and then aim for a breakthrough. One has to understand this: the very first attempt must be a success, or the game may be over.

The package must be structured in such a way that the farmer is shaken out of his old beliefs. This is not so difficult: farmers are receptive when they can see real results with their own eyes.

The most conservative man in traditional agriculture is the scientist, and sometimes I am not proud to be one of them. This is most discouraging. The scientist is a privileged person, the man who should lead us out of the wilderness of static, underproductive agriculture, and yet by his apathy and failure to exercise his unique vision, he keeps us in the swamp of despair.

The scientist fears change because he is in a relatively privileged position in his own society. If there is no breakthrough in yield, he will not be criticized. But if he makes a recommendation and something goes wrong, he may lose his job.

In many different countries there is no faith or understanding between the farmer and the scientist. Almost without exception the farmer says, "This man is a theorist. He is not a doer, and he can't help us." In the past, this complaint was all too often valid, but today the situation is rapidly changing.

Economic Factors

The third group of factors which must be dealt with imaginatively and consistently is comprised of the economic components of agricultural productivity as they affect a country's overall development. Since David Hopper has promised to examine these factors in some detail, I will not go into them. But let me say this: it has been my experience in all the countries where I have been given the opportunity to work in crop production programs that once the possibilities of achieving high yields rapidly are clearly explained to people at policy levels, their enthusiastic cooperation often follows.

When all of the necessary factors are combined in the right order in a wheat production program, and yields are changed from 500 kilos per hectare to 5,000, many things start happening. A cataclysmic reaction occurs across the whole spectrum of human activity, from the farmer to the scientist, to the government planner and policy maker.

If it can be demonstrated to the national leadership that benefits are likely to outweigh the dangers that are involved, they will take the risk almost without exception. If the leadership is good, the possibilities of success are very great.

The Question of Speed

With regard to the Mexican program, it is sufficient to say that it was a long, slow process. Our own staff initially did not have the experience and background to bring about sudden change. Rather, we learned and changed and modified the package gradually. It took a relatively long time to achieve self-sufficiency in wheat in Mexico. However, times are changing: Pakistan has done in three years what I believe it took 13 to accomplish in Mexico.

I would like to say a few words about the wheat programs of Pakistan and India. In 1963, these Governments invited me to have a look at their wheat problems. In looking over the genetic material in Pakistan, I found quite a number of lines from Mexico—brought back by young trainees who had completed our applied training program—growing at several stations.

We talked about the opportunity for a breakthrough with Malik Khuda Bakhsh, who was Pakistan's Secretary of Agriculture at that time. The following year, under Ford Foundation sponsorship, a program of accelerated wheat improvement was launched in Pakistan. The results achieved to date have gone beyond my fondest expectations.

I have just returned from a month-long trip to India and Pakistan, and I have seen what I think is near, if not full, self-sufficiency in Pakistan. God was kind this year. Pakistan has had the most bountiful winter rainfall in perhaps the last two decades. This factor is operating in their favor.

But on the ground there is a new technology built around the so-called Mexican wheats. It is estimated that only 20 percent of the area, something like three million acres out of a total of 15, is covered with new varieties and technology; this will produce 41 or 42 percent of the total wheat harvest. The area so benefiting can be doubled next year if the inputs are available, and if the Government decides to take this action. The technological package is there.

What has happened in Pakistan with one crop, wheat, has had some influence on other crops. Dr. Chandler described 10,000 acres of IRRI rice in Pakistan that will soon become a million. Synthetic maize ran to a few hundred thousand acres; it is going to be a half-million.

Rice, maize, and sorghum will push cotton off the scene unless something is done dramatically now to control the limiting factors in cotton production. You see, when you change one factor, you had better be ready to develop new technology on a series of resulting problems.

In India the same factors are at work. During the past 12 months probably between six and seven million acres of Mexican wheat have been grown under intensive culture with high levels of fertility. About 16 percent of the total acreage will probably produce 37 or 38 percent of the total harvest.

The recent accomplishments in Pakistan are two years ahead of schedule. In India, one must be a bit more indefinite because the country is so large and complex.

Attitudes are changing. I am hesitant to voice even cautious optimism, because complacency in any form is likely to prove disastrous. Unrestrained population increases are driving us into a corner from which it is difficult to emerge. I am referring not merely to the ever-precarious balance between food and people. Population density—overcrowding—is putting individuals under almost unbearable stresses, to the real detriment of society as a whole. All of us—agricultural specialists, economists, sociologists, and administrators—still have an enormous job to do in making a better life for an animal—*Homo sapiens*—who often is his own worst enemy.