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EDUCATION FOR INCREASING AGRICULTURE PRODUCTION IN DEVELOPING COUNTRIES

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The persistent inertia in traditional agriculture has been cited among the reasons why many developing countries have not been able to meet rising demands for food and fiber. There is an implication that farmers resist change merely for the sake of sustaining tradition. A more perceptive study of the alternatives available to farmers may show that their choices result from economic phenomena in the same way that industrial development is influenced by economic incentives and rewards.

Perhaps technical assistance in agriculture to developing countries would show greater returns if programs were able to demonstrate some of the management principles which have been essential to increased agricultural production in the United States. These inputs have been largely managerial responses to economic stimuli.

A developing country planning economic growth cannot expect industrial development without concomitant agricultural development and, conversely, sustained agricultural progress must depend upon industrial development. Agriculture contributes by providing a market for manufactured goods. Industrial development can employ some of the manpower released from agriculture and it can provide a technical base for the equipment and the services essential in agricultural production. Industrial development is necessary to provide such inputs as fertilizer, mechanization and petroleum derivatives.

An agriculture sector contributing to the increased productivity necessary for economic growth in a developing country should include the following:

1. Yield-increasing inputs.
2. An incentive and reward system allowing profit to individual farmers.
3. An educational foundation of knowl-

edge and skill; an agriculturally literate farm population.

4. A method of evaluating the results and identifying the returns in terms of inputs.

5. A national plan for integrating agricultural research and education.

The basic inputs of agriculture are described as land, labor and capital. Each is a complex concept and should be described as a complex set of interrelationships. Some of the largest increases in agricultural production have come, for example, from a flow of inputs which began off the farm. Research in agricultural colleges and in industry have made available such important inputs as hybrid seed, fertilizer and efficient machinery. Those are inputs in a form that requires a constant redefinition of the nature of capital. The need for continued and expanded research cannot be overlooked. At the same time, research that considers production increases without considering its economic feasibility may not be an asset. Developing countries are in need of new inputs that will give massive increases in production at a cost that will leave a reasonable margin for the farmer.

Frequently the need for more land is given as the most limiting factor in increasing production. Farm size does not necessarily describe the problem. In this instance it is useful to compare India and Japan. Although farms in India are two and a half times as large as they are in Japan—5.4 acres and 2.1 acres respectively — Japanese agriculture is essentially modern, including machinery, while farming in India is still largely the traditional type.¹

Capital is certainly a limiting input in many farm operations, but as indicated above, the form of the capital is crucial. Research must identify it and education must equip the operator to apply it.

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Labor in many developing countries has been referred to as the most abundant resource for agricultural production. In terms of ordinary accounting procedure, it is obvious that many rural people in developing countries are under-employed. They produce only enough food for their own substandard diets. In considering labor as a resource, quality is often overlooked. The availability of farm operators with adequate training and experience to combine the complexities of administering farm resources with the variety of skills needed is scarce in every agricultural area of the world. It is crucially scarce in countries where education for practical agriculture has been omitted from the general educational system.

It is axiomatic that farm businesses must rely on profit margins and a profit motive. Farm costs must be less than farm income if there is to be a profit margin. This is a basic principle yet many education programs for the improvement of agriculture have no focus on this principle. Cost of production figures are not easily derived from farm operations because inputs for one enterprise are often produced by another enterprise on the same farm. If a farmer does not have meaningful records he cannot identify the return from each enterprise. Farm profit must also take into account such factors as family living from the farm and long range improvement programs. Profit is not easily understood in production agriculture in a country such as Brazil where marketing practices cause wide variation in prices.

The agricultural extension programs in the United States as well as in many developing countries have focused attention on practices. The hypothesis is that if a farmer applies enough "approved practices," production will increase and profit will be forthcoming. A major defect in this approach to education is the lack of analytical research to know which practices to teach and how to combine re-

sources. Moreover, practices and resources combinations which appear desirable in the United States may not apply in other countries. In El Salvador one can see corn being grown on mountain sides so steep that it is difficult to handle a hoe. The first reaction by the North American expert is to criticize the lack of erosion control. The truth in this case is that without some erosion, the yield would decline. Most of El Salvador has a very deep covering of mountainous volcanic ash. The soil elements leach downward under the heavy rainfall and, if it weren't for erosion, they would soon be too deep for root penetration. Since the soil is similar through the entire profile, erosion control practices are of little significance when carried out for the usual reasons.

A common approach to agricultural improvement is to encourage farmers to imitate the best farmers in the area. This is risky if one does not consider the quantity or quality of available resources. There is little doubt that in much of South America, and particularly in Brazil, fertilizer would increase crop yields. But the notion that teaching farmers to use fertilizer will increase production may not be practical in many areas. If fertilizer does not bring a return considerably higher than its cost or if the farmer can acquire more land that will return more for each monetary unit of input, perhaps the practice of fertilizer application should not be encouraged. Moseman² has indicated that these inputs must be applied in the proper combination for specific environments if risks are to be minimized and full benefits realized. Attention must be given to substantive inputs; the "what" and "why" as well as "how" must be taught.

As agriculture moves from traditional to modern, the need for better resource allocation increases. In a growing agricultural industry the equilibrium of assigned resources for maximum profit becomes a continually changing process whereas in the so-called traditional agriculture this remains rather stable. Farmers must understand profit to bring about change and to manage resources as more highly developed agriculture systems emerge.

The fact that many farmers in Latin America, or the poorer farmers in the United States have very inaccurate ideas of their costs of production indicates the need for better methods of teaching and a clearer understanding of profit. The importance of instruction in farm management at the vocational level becomes apparent.

Evaluating Results

Research to determine quality, quantity, and balance among agricultural inputs implies the need for evaluative, programmatic research techniques. Farm management information should be compiled from farming operations to determine the effects of applying research to practical farming situations. Accurate measures of progress in production agriculture require systematic collection and analysis of information concerning markets, sales, prices and expenditures. If data concerning production factors are to be useful in planning and directing programs, the system must be organized uniformly on a state and perhaps on a national basis. The information should exist in a system which simplifies the compilation thus maximizing its use in budgeting and planning operations at various levels.

Vocational agriculture teachers and extension workers who have been trained in institutions where research is a part of the training program can add to the evaluative information the researcher will need. They will also be able to identify problems, thus providing benchmarks for further research. A close working relationship between the instructor in the field and the research worker will assist in directing the research toward the needs of farmers and to the elements relevant to development.

Education For Increased Agricultural Production and Economic Growth

A government of any country that recognizes the need for a healthy agriculture must also recognize the concomitant need for a national plan for education with an appropriate share of resources allocated to agricultural education. Many countries in Latin America have assumed that educational resources should be applied to professional and technical training and that agriculture can somehow take care of itself. Perhaps this was tolerable a century ago. It is untenable in the 20th century. When a new industry is established in Brazil the manufacturing plants will follow the most modern automation principles learned from experiences of North America, Europe or Japan. When the more highly industrialized countries were developing their own systems of automation, they started with assembly line techniques which could utilize labor having a minimum of skill or training. As the automated process developed by gradual steps, the skills of the labor force could be developed largely while working on the job. Since industrial development often absorbs

the labor released from agriculture and since the newly developing industries require skilled labor, there is need for an early consideration of a well planned rural education program. A prior consideration is the need for increased agriculture production and the educational requisites affecting the economic and social changes that accompany the total development process.

The Priority of Rural Education

Many Latin American countries have developed new education programs for the urban areas, but they have given little attention to the rural areas. If limited resources require priorities to be placed on education, a compelling case can be made for placing the priorities on the rural sector. Brazil, like many developing countries, has 70% of its population in rural areas and inadequate agricultural production is one of the greatest, if not the greatest, deterrent to economic development. The decision to develop rural education with emphasis on agriculture production would be a sound one.

Agricultural education is relevant and rewarding for people in rural areas and it is not inappropriate for people who may later find themselves in urban areas. But if agriculture education is to be effective as basic education and also effective in increasing agricultural production, it must stem from and be an integral part of the commitment of universities to education, research and public service. One of the principle weaknesses of extension programs in Brazil has been their independent autonomous organization. The vocational agriculture teaching programs have also suffered from the fact that their teachers have not been trained in practical, research-oriented institutions. They are not in contact with a research commitment at the university level. Vocational agriculture and extension programs are systems of rural education whose effectiveness in every country has been proportional to the way in which teachers are trained and their access to the flow of agricultural research.

If vocational agriculture programs are conducted by adequately trained teachers whose resources include a flow of appropriate research, the basic education needs of students can be strengthened by community-oriented learning experiences. One of the clearest principles of effective teaching involves an organization of knowledge which moves from the familiar to the unfamiliar. This always requires that a teacher begin by building on the fund of knowledge that students bring to the class.

Vocational agriculture programs have greater appeal to most rural people than abstract, academic types of instruction. Most rural people must first be made aware of the need for education. The instructional program that is based on their immediate needs is a first step in the educational process.

A sound vocational agriculture program must include instruction for adults dealing directly with management and production concepts which may increase income. Obviously an education program that involves parents and their children and one which deals with daily problems of common interest will have greater participation and holding power than academic formal instruction of remote usefulness on application. Limited educational background of students requires that much of the teaching in rural areas be simple and elementary. In developing countries, this has led to the false assumption that teachers need less ability and superficial preparation. Organizing and conducting an education program under such conditions requires more ability and better preparation in both social and physical sciences than to teach a more narrowly defined subject in the sophisticated urban school system. In-service and continuing education for teachers is vitally important in a rapidly changing society. The need for in-service and continuing education for the vocational agriculture instructor increases in proportion to the need for accelerated change.

The answer to the question of how teachers can "keep up" must come for the university that has teacher educators and researchers working full time seeking new agricultural inputs and training students for future teaching and research.

Conclusion

The effect of an appreciable investment in a comprehensive rural education program on economic development would appear to be a

worthwhile consideration for a developing country such as Brazil. The results may be too long range to appeal to many planners, but instances can be cited to prove the fallacy of short term emergency measures.

Brazil has been called the sleeping giant because of its unparalleled potential and its tardiness in becoming a major world power. The importance to the free world of accelerated development should receive priority consideration by those nations able to assist this potential giant. Assistance to a large country with tremendous resources should be based on methods to accelerate self help rather than "give away" programs. In some of the smaller countries of the world where resources are lacking, stronger nations no doubt will always be called upon for the least disruptive method of making donations. Such is not the case with Brazil. Brazil can be one of the world-influencing powers called upon to feed some of the less able nations.

The conditions in Brazil point to the need for technical assistance to agricultural and rural education. In a country with 2% of the land under cultivation, 70% of the people living in rural areas, a population growth rate of 3½%, and food importation including the principle food of beans, the priority for a massive effort in agricultural education appears obvious.

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