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AGRICULTURAL CREDIT AND PRODUCTION SUBSIDIES
AS
POLICY INSTRUMENTS FOR PROTERRA

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SUMMARY

During the past ten years, Brazil has pursued an activist policy to increase food output through modernization of Agriculture. This policy has emphasized favorable credit and price programs to stimulate the use of modern inputs. Less emphasis has been devoted to development of the production technology base necessary to support a modern agriculture. This oversight is now readily apparent in the early demise of the credit and price policies as growth stimulators. The problem is country wide, though more serious in Northeast Brazil.

In some areas of Southern Brazil credit policies and price subsidies have been instrumental in stimulating new input use and output growth. The results, however, have been less than spectacular, and it now appears that existing production technology, when applied at the farm level, is not sufficiently productive to warrant massive programs to stimulate further input use. Directed programs toward specific farmer groups (i.e., credit for small farmers) can be justified and will encourage some additional growth in output and reduction in income disparity.

In Northeast Brazil, the situation is less favorable. Substantial infusion of credit generally has not resulted in increased input use or growth in productivity. Significant diversion of production credit to consumption and non-productive uses has occurred. Further, research results in most cases do not indicate significant economic returns from the uses of new inputs. In the special case of the Zona da Mata, a semi-feudalistic system of sugar production operating under quotas and high prices supports has effectively blocked modernization and diversification of agriculture.

This evidence indicates a general lack of profitable investment opportunities in Northeast Brazil. Simply stated, government intervention in pricing, credit, transport and markets has been largely sterile in an environment of stagnant production technology. The crucial development need, therefore, is for the creation of widely applicable, more productive forms of agricultural technology. In some cases this may merely require "putting it all together", that is, the assembly, integration and dissemination of existing fragmentary information on proper farm level management of soils, water, and cropping practices. Most technicians are persuaded, however, that present information is inadequate; more fundamental research is required in the areas of soil chemistry and fertility, plant genetics and diseases, and soil and water management. There is almost unanimous agreement that this research must be integrated toward a common goal with recognition of the practical farm level problems encountered in the economic application of results.

To develop the basic conditions for modernizing Northeast agriculture, the PROTERRA program as a first priority should immediately support the creation of the necessary research infrastructure, the identification of an appropriate research strategy involving the coordination of existing institutions and personnel, and the infusion of operating capital commensurate with the scope and complexity of the task to be confronted.

**AGRICULTURAL CREDIT AND PRODUCTION SUBSIDIES AS
POLICY INSTRUMENTS FOR PROTERRA**

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The government of Brazil, through its PROTERRA program, is preparing to make massive investments in the agricultural development of North and Northeast Brazil. Favorable credit and price policies have been suggested as possible components of the development package. The purpose of this paper is to provide a framework for evaluating the need for and desirability of further governmental intervention in price and credit mechanisms, and to suggest priorities for government action. The presentation is divided into four parts. First, a general rationale for the use or nonuse of these policy instruments is developed. This is followed by an examination of the results obtained from past and present government credit and price programs in Southern Brazil, where considerable research has been conducted on these issues. The major section of the paper interprets these findings in light of conditions in the North and Northeast of Brazil. Fragmentary research results, personal interviews and on-sight observations serve as the basis for this interpretation. The final section presents suggested priority areas of government action as part of the PROTERRA program.

Economic Justification for Credit and Price Programs

Within the context of agricultural growth government intervention in agricultural credit and prices is undertaken for two basic reasons:

- a) To induce farmers to employ new technology, and
- b) To reduce economic and social inequities that arise from the existing market mechanism.

In the first case, favorable credit and/or price policies are instituted to induce farmers to initiate or accelerate the adoption of improved technology. The objective is to temporarily increase the profitability or reduce the economic risk associated with adoption, as well as provide the financial means for acquisition of the required inputs. Policy instruments commonly used include subsidized factor and product prices, guaranteed minimum product prices, expansion of total credit available to agriculture, and improvement in loan terms including subsidized interest rates.

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The economic rationale is that the normal evolutionary process of adoption will operate too slowly to take maximum advantage of technological innovation, or that some groups of farmers will be systematically excluded, as is the case when low income farmers are faced with techniques requiring high initial investment costs. A fundamental assumption is that unused output increasing technology actually exists, or will soon become available and is economically preferable to traditional production methods. Once the technology has been adopted, no economic rationale exists for continued favorable policies. Indeed it would be expected that some factor and product prices would fall below previous equilibrium levels. A continuation of market disequilibrium through intervention will eventually lead to overcapitalization and mis-allocation of resources.

Substantial progress can be achieved by the judicious and selective application of credit and price stimulus. There are real social and economic costs, however, to following policies that induce farmers to invest in temporarily profitable alternatives which in the long run, at equilibrium prices, are not economically viable. First, the cost of inducement will be high. Secondly, pressure for continued intervention will be great, and economic and social adjustment painful when support is withdrawn.

Therefore, policies which interfere with the normal market mechanism should be undertaken only for short periods of time with specific well defined objectives, when it is reasonably certain that an inefficient agriculture will not be fostered or perpetuated.

In the second case, government intervention is intended to reduce economic and social inequities in the existing market mechanism. Problems to be redressed include, among others, unequal distribution of scarce resources among different groups of farmers (i.e. credit for small farmers), large seasonal fluctuations in product prices, and undue market concentration by a few input and product firms. Each is unique to a particular situation and requires a specific problem oriented solution. Solutions may be short or long run in nature.

Other reasons put forth as justification for government intervention include fostering domestic production of strategic products and maintaining agriculture incomes. These are largely political issues, and intervention encourages the same misallocation of resources and/or perpetuation of inefficient agricultural organization mentioned above. Agricultural policies used for these objectives must be justified on other than economic grounds.

Brazil's Agricultural Development Strategy

In the past ten years, the Brazilian government has employed several policy instruments to accelerate agricultural growth. The most important has been a substantial increase in institutional credit made available to the agricultural sector. As a result, the ratio of credit to gross agricultural product increased from .18 to .34 during the period 1960-68. (Adms). Since interest rates on most institutional credit ranged from 9 to 13 per cent per year while inflation varied from 25 to 85 per cent, real interest rates for agriculture were substantially negative.

Other policies like minimum product prices have contributed to growth in output of specific commodities. In the case of wheat, high stable prices and secure markets have brought Brazil to 50 percent of self-sufficiency with prospects for even greater future production.

The overall strategy has prompted rapid increases in adoption of new inputs, especially improved seeds, fertilizer, and mechanization. Agricultural productivity has risen; increased farm income and a feeling of confidence about future economic prospects have encouraged substantial farm-level investments. But the major impact of these policies has been largely restricted to Southern Brazilian agriculture.

Impact in Southern Brazil

Considerable research has been and is being conducted in Southern Brazil on the farm level impact of credit and price policies, with special attention directed to the use of modern inputs. The lessons to be learned from the research have important implications for future policy making both in the South, and in the North and Northeast.

While the important growth stimulus of these policies cannot be denied, several important limitations are now evident from the Southern experience. Generally, these policies have been selective in favoring large farmers, have distorted the allocation of both variable and fixed capital investments, and have in large measure already exhausted the possibilities for additional productivity gains under present production technology on affected farms.

More specifically:

1. Agricultural credit is closely related to the increased use of modern purchased inputs. On farms where substantial amounts of such inputs are used, new credit (\$) is equal to 50 to 75 percent or more of annual operating expenses (Rask, Rao).

(§) Total new loan, obligations incurred during the year.

Increases in fertilizer use at the national level are closely correlated with increases in agriculture credit (Nelson).

2. Increased use of modern inputs, stimulated by subsidized interest rates (in some cases negative real rates of interest), have pushed the use of these inputs, especially fertilizer, up to and even beyond the point of optimum utilization (Resik, Nelson).
3. It is especially significant that the optimum economic level of fertilizer use in some crops is reached at input and output levels substantially below those observed in other major producing countries with similar factor-product price relations. Water availability is not considered a major inhibiting factor. Rather it appears that major breakthroughs in production technology are prerequisite to additional productivity gains. Research is needed in soil fertility and management, and development of new varieties capable of effectively utilizing heavy applications of chemical fertilizers (Knight).
4. Abnormally high product prices (wheat) have been associated with intensive capitalization of agriculture (principally mechanization). Simulated farm situations indicate that a more modest amount of capitalization, with enterprise diversification and more intensive use of less machinery, would have accompanied a lower level of price subsidy (Engler).
5. It is apparent that the impact of these general policy instruments has been selective in favor of medium and large farmers. Probably the original conception of the policies did not explicitly consider the size issue, but in implementation conditions are more favorable to larger farms. Actually, in some cases (credit) an attempt is made to favor small farms (a notable exception would be credit for mechanization which in practice is most applicable only to large farms).

Small farmers generally use considerably less modern inputs, have a smaller ratio of credit to operating expenses, yet demonstrate higher marginal returns to the use of additional inputs than do larger farms. However, the experience of larger farms would indicate that productivity gains would soon be limiting for small farmers as well. Some readjustment in policy and its implementation should, however, result in modest productivity and income improvements for the smaller farms (Resik, Adams).
6. Credit policies and procedures may be largely responsible for the lack of credit use (and consequently input use) by small farmers. High marginal returns would indicate sufficient demand to use credit if it was functionally available. Therefore it is probable that a supply allocation problem exists. Given the great demand by large farms

for subsidized credit, increasing supplies of credit may never reach small farms because they represent higher risks and administration costs for profit oriented credit institutions (Engler).

7. Special development programs (pilot areas) which have included a package of inputs plus credit and limited technical assistance have prompted significant increases in credit and input use in small farm regions (Ezzen).

This research indicates that credit policies and price subsidies have been instrumental in some areas of Southern Brazil in stimulating the use of new productive inputs and accelerating growth of output. The results, however, have been less than spectacular, and it appears that these developments have essentially exhausted known opportunities. Massive programs to stimulate further input use are not warranted until production technology is improved. Thus the relatively easy increases in output have been exploited, and the much more difficult task of basic research must be confronted.

Contrasting Results in the Northeast

The Northeast has been an area of special concern for Brazilian decision makers for a long time. Periodic droughts have prompted state, regional and federal hydraulic investments in the so-called drought polygon for over 50 years. More recently, the emphasis has shifted to industrial development and agricultural modernization through both public and private investment. Credit has been subsidized and broadly distributed; some product prices have been subsidized and stabilized; marketing and transport systems have been studied and some recommended improvements adopted; research and extension have been stimulated through increased funding and a proliferation of organizations. Yet the results realized have fallen far short of those desired, and the same or similar policies have produced proportionately less development and growth in the Northeast than experienced in the South. This section of the report explains why.

Here data on the probable physical response of widespread adoption of modern inputs for the varied soil, water, and climatic conditions of the Northeast do not exist. Those experiments which have been conducted and are documented often show conflicting results. Therefore it is impossible to accurately calculate optimum allocation of productive resources. Likewise data on credit utilization and distribution is extremely sketchy. To compensate for such data limitations, visits were made in Recife with technicians of various state, regional, and federal agencies. The impressions obtained were subsequently tested by interviewing local bankers, agronomists and farmers during a twelve hundred mile trip through the states of Pernambuco and Alagoas.

During each interview a series of questions were raised relative to local production and the impact of existing policies. They were:

- 1) Does a modern profitable technology exist?

- 2) Is there sufficient credit available to meet current farmer demand?
- 3) Are there recognizable inequities in the distribution of credit?
- 4) Does lack of technical assistance hinder the application of technology and credit use?
- 5) Are minimum price supports an effective countermeasure to seasonal fluctuations in farmer prices?

In interpreting the answers to these questions one must be cognizant of the substantial regional differences that exist in present and potential agricultural organization and output in the Northeast. Moisture availability and distribution for example are the principal limiting factors in the Sertão and Agreste. Sufficient rainfall is available for many forms of agricultural production in the Zona de Mata, but a semi-feudalistic system of sugar cane production on large farms under an umbrella of quotas and price supports has effectively dampened the appearance of, or experimentation with other systems of agricultural production in that region. The potential role of credit and price policies also reflects these differences.

The five issues mentioned above do not adequately encompass the principal barriers to increased agricultural productivity in the Zona de Mata. In recognition of this difference, the following discussion treats these questions for the Sertão and Agreste together, and a subsequent section covers the Zona de Mata in a different format.

Sertão and Agreste

It would be an obvious oversimplification to treat the Sertão and Agreste as one homogeneous area in analyzing agricultural development potential. Conditions vary widely between and within the two regions. However the responses by interviewees to the above policy issues were surprisingly uniform, so the discussion that follows does not contain any distinction between these two regions. But if solutions to the problems raised are to be effective, they will have to be area specific in design and implementation.

1) Does a modern profitable technology exist?

In general, existing research results do not show positive economic returns from using purchased inputs. Certain exceptions, tomatoes for example, are apparent. Farmers generally support the experimental findings by not using modern inputs.

The reason for the unprofitability of "high return inputs" are numerous. Extreme variability in soils, water availability and climate pose the very important question of risk at the farm level. Farmers are

reluctant to contract expenses when many production factors are largely beyond their control. But more basic is the fact that current varieties do not respond well to fertilization unless limited water availability in certain soils. In most cases the inherent soil fertility is sufficient to meet plant nutrient demands under normal rainfall conditions. Further, wide year to year variability in yields, resulting from variation in rainfall, masks the possible modest response that may be attributable to fertilization.

One would conclude that gains from new technology must be substantial and highly visible to foster acceptance by the farmer. To date this has occurred only in a few isolated instances. In these cases, adoption has been fairly rapid.

Irrigation would be a logical answer to inadequate and unpredictable rainfall. However, experience has indicated that within the region, salt content of veteren soil is often sufficiently high to cause serious salinity problems after just a few years of irrigation. Further, development costs of practically all irrigation projects to date are reported to be so high that there would be severe economic problem even if no physical problems remained. (Frederick).

2) Is there sufficient credit available to meet current farmer demand?

The answer to this question is a definite yes. In fact evidence suggests that much of the current credit is actually going to relatively non-productive uses. Modern inputs such as improved seed and fertilizer are generally not used nor considered profitable except in special cases. Agricultural credit for operating expenses, thus, is applied to hired labor, minor investments, livestock purchase, and, perhaps most importantly, family consumption expenditures. Actually, most bankers feel that a major use of operating credit is for consumption purposes. On small farms this involves direct support of family living expenses during low income periods, and on larger farms perhaps financing the necessities of laborers and sharecroppers. Both cases represent a relatively unproductive use of subsidized credit originally intended to stimulate improved technology.

This conclusion was supported by the unanimous response from bankers that they felt no credit constraint in meeting farmer demand. In fact, sharp competition has developed between the federal bank's currently authorized to loan at rates of 7 to 10% per year, and the state and local banks which must follow a 13-17% interest schedule. While the former have no trouble meeting the demand for agricultural credit, the latter cannot find sufficient demand to exhaust available supplies at interest rates that are still substantially negative in real terms.

A further indication of an adequate or super adequate supply of credit is the relative position of the Northeast in terms of credit used per unit of gross output. Northeast Brazil uses approximately the same percentage of credit to output as the rest of the country, (Tendler), yet considerably less modern inputs. Labor and land continue to be the

principal factors of production. This implies a correspondingly lower cost to output ratio, indicating a lower need for operating credit. The fact that credit use remains high supports the bankers' view of substantial diversion of credit resources to non-productive uses.

3) Are there recognizable inequities in the distribution of credit use among farmer groups?

As a general rule, larger farmers are obtaining institutional credit to a greater extent than small farmers and sharecroppers. To the extent that credit use is oriented more to the larger farmer, inequities exist. However, a concomitant "inequity" in the use of production inputs is not readily apparent, that is, with or without credit, little modern technology is employed by either large or small farmers. Thus, an economic rationale for readjustment of credit services to serve a broader clientele is not clearly indicated. Social considerations, however, may dictate a change in credit distribution.

Once again considerable variability exists within these broad generalizations. Credit restrictions for small farmers are more an administrative than a policy problem, and as such conditions vary considerably from one credit agency to another and between branches of the same agency. For example, Bank of Brazil regulations reduce the cost and other requirements for small farmer loans. However, some branches establish self imposed minimum loan limits that effectively exclude most small borrowers. Others apply rather crude subjective criteria for determining credit worthiness. In some cases land ownership almost becomes a prerequisite for eligibility to receive credit. Other lenders recognize the small borrowers inability to effectively articulate a need for credit and demonstrate credit worthiness. Further, they believe that small farmers desire to repay. These individuals actually "bend" existing regulations to accommodate the situation of a small farmer.

The end result in the execution of credit policy is that some regions have a considerably wider distribution of credit use among farmer groups than do neighboring areas. The extent to which this situation is economically detrimental to the growth of output in the Northeast is not clear. In situations where credit would go largely for consumption purposes, the output effect is minimal. In cases where new technology may be unattainable by this credit allocation, growth in agricultural output and income is retarded.

It would seem that a more energetic application of existing regulations, and perhaps some additional liberalizations of banking procedures affecting small farmers is called for.

4) Does lack of technical assistance hinder the application of technology and credit use?

Two problems are closely related to the efficient functioning of technical assistance in the Sertão and Agreste. The first and most important is the lack of technology to extend to farmers. The research results that exist on fertilizer response on new varieties show only modest productivity gains over indigenous varieties and current farming practices. Further, the results are not very specific; thus applicability to a given farming situation is often questionable. In many cases farmers prefer the rustic characteristics of the indigenous varieties, thereby demonstrating perhaps, a lack of sensitivity by researchers to adequately design research and development programs. In this way the extension agent begins work from a disadvantageous position.

A second problem concerns the duplication of effort in some areas by the co-existence of several separate extension agencies. The state extension services, the secretary of agriculture and special development agencies such as SUDENE or GERAN may all be undertaking separate staffing and support of extension functions in the same municipio with approximately the same objectives. A tremendous duplication of time and effort and a resultant waste of scarce resources and personnel occurs.

These factors limit the potential impact of technical assistance. With the lack of concrete new technology to extend, however, it is unlikely that provision of additional extension services would lead to increased use of improved technology and credit. The weakest link in the chain of adoption is that first link of solid basic research.

5) Are minimum price supports an effective counter measure to seasonal fluctuations in farmer prices?

There exists only fragmentary and conflicting evidence on this point. Monthly farmer price quotations of the Bank of the Northeast for major agricultural products do not demonstrate dramatic seasonal price fluctuations. Professionals in the producing areas feel that seasonal price variations are not the real problem. The major price swings result from abundant or scarce production, that is, the year to year price change that reflect uncertain production levels are greater than seasonal fluctuations.

Bankers who administer the minimum price program report that farmers make little use of it. Several reasons are suggested. First, in many cases the prevailing market price is substantially above the minimum price. Secondly, they feel that farmers are escaping payment of the ICM tax by not using the minimum price program. In this case the minimum price would have to be 15-20% above "market price" to cover the tax and other charges involved in complying with the minimum price program. Thirdly, some feel that farmers lack the initiative to make use of the program.

Lastly, others indicate that facilities for preparing and storing the products are not readily available.

In summary, the use of credit and price policy instruments in the Sertão and Agreste regions have had little impact on input use and growth in output. Significant diversion of production credit to consumption and non-productive uses has probably occurred. Further, research results in most cases do not indicate significant economic returns from the use of new inputs. Continued expansion of credit supply is not warranted, though some adjustments in the procedures for helping small and tenants farmers to gain access to credit would be desirable.

ZONA DA MATA

A major share of the credit and purchased inputs used in the Northeast goes to sugar cane growers in the Zona da Mata. This occurs under a system of sugar quotas and subsidized prices. Since there are several dysfunctional effects of sugar policy (aspects of which are in the process of correction), significant changes in the economic and organizational structure of the Zona da Mata are both imminent and economically justified. As the price subsidy is reduced and thereby encourages required adjustment in the organization of agriculture, the content and form of specific policies will necessarily need to change as well. Therefore the following discussion explains the current situation and possible development paths.

Present Situation

The Zona da Mata offers the best long-run development prospects for the NE because of its superior natural resources endowment. Water, the key limiting factor for the Agreste and Sertão, is in fairly dependable supply, both in quantity and seasonal distribution in the Zona da Mata. In certain periods of the year, rainfall may actually be excessive for optimum yields of temperate zone crops like corn and beans. Soils in the traditional cane growing areas are somewhat infertile but respond to chemical fertilizers. The level land known as the tabuleiros is sandier and requires fertilization. However, there is limited experience with this soils so its production potential is somewhat unknown. A major restriction on land use is topography, but some areas are no more hilly than the Agreste or Sertão. Soil conservation is practiced by planting cane on the contour; switching to annual crops could pose the threat of severe erosion.

Sugar cane is by far the most important crop in the region. Manioc is the only other crop with significant acreage. Part of the cane is produced by sugar refineries and the balance is purchased from neighboring farmers. Tradition wisdom recommended that hilltops be retained in natural vegetation to assure adequate rainfall. Therefore much of the cane is grown on hillsides; at present more than one third of the cane acreage is on slopes greater than 2% where mechanization is impossible. Further, sugar producers are only planting one-third of their acreage to cane. Some of the remaining land is better than that now cultivated. Most of the labor is provided by the resident labor force, but workers from the Agreste migrate in for the harvest.

The GERAN (4) program is designed to facilitate modernization of refineries and mechanization of production. It provides for land clearing

(4) A federal agency to assist in the regional development of the sugar cane industry in the Northeast.

in level areas, shifting to mechanized cane production on the better topography, and settling displaced workers on land taken out of cane. Landowners are encouraged to diversify into other crops and livestock on their remaining poorer land. It is assumed that the colonists will produce some cane, food crops and livestock on their individual plots. After six years of operation, only one GERAN project is in process of implementation and several others are being planned.

Livestock is the second most important agricultural activity, and a few farmers are experimenting with non-traditional crops but none has yet reached major proportions. In the Northern Interior part of Pernambuco, a few farmers are producing oranges and pineapples. Corn, beans, manioc and rice are grown by sugar workers for subsistence, but there is limited commercial production. Farmers desiring to diversify find a certain data and recommendations on alternatives and preferred cultural practices. Their own trial-and-error experiments have not yet established production potential, and no one interviewed was ready to suggest that any non-traditional crop would become a feasible widespread alternative to cane in the near future.

It is estimated that almost 90 percent of the fertilizer consumed in the NE goes into cane. The few experiments conducted have not clearly demonstrated returns from fertilization on other crops. Cane growers keep fertilizer costs down by direct importation as individuals or through their cooperative.

Almost all credit currently goes to cane producers for paying fertilizer and labor costs, and buying livestock. Increases in demand for credit for other purposes will occur only when profitable alternatives to cane and livestock have been discovered.

The general conclusion to be drawn from the Zona de Mata is that a strange phenomenon exists: underutilized land coexists with surplus labor. Traditional labor-intensive cane growing predominates on hillsides while large amounts of land are uncultivated, some with topography superior to that cultivated. Labor is underutilized during a portion of the year, and the general lack of employment forces people into the cities. Why? The answer lies with the interaction of sugar policies and the organizational structure of agriculture.

Effects of Sugar Policies

The present sugar policies-consisting of higher prices for NE sugar, subsidized credit, and import privileges have, ironically created a development bottleneck. An inefficient industry has been propped up, serious economic and social problems have been created, and strong vested interests have developed which inhibit rational decision-making and problem-solving.

How has this happened? To understand the phenomena, it is necessary to consider the entire economic, social and political context of the region. First, land has a low opportunity cost. It is held in large tracts, and sugar quotas effectively limit expansion of cane into underutilized land. As elsewhere in Brazil, land taxes are low. Current agronomic and economic information does not give any clear indication of how land could be used in other enterprises, or what the returns from doing so would be. Demand for land is limited because of this lack of alternative uses, and an inability of non-owners to finance land purchases. Thus there is a supply of under and unutilized land but little demand so the land owners' motivation to adopt land saving technology is reduced.

The labor market in the NE is characterized by excess supply, and the slow growth of demand in the industrial and service sectors diminishes their labor absorption capacity. Furthermore, the systematic frustration of the creation of effective rural labor unions prevents the raising of wage rates above equilibrium levels. Those minimum wage and social welfare regulations which do exist are regularly circumvented. Thus the sugar grower can keep total wage costs low in spite of inefficient usage. Therefore he finds it preferable to continue producing labor-intensive cane on the hillsides rather than incur the high costs of land clearing required in the shift to mechanized operations. If labor costs were increased, or the high investment in land clearing reduced, labor saving technology would become more attractive.

To summarize, high sugar prices in the face of low opportunity cost for underutilized land and low wage rates act as a disincentive to modernization. The farmer is rational in adopting land and labor intensive cane production while excess labor supply is denied access to land uneconomic for cane. As long as cane producers receive high product prices and control the allocation of factors of production, this is a logical outcome.

Future Policy Alternatives

As we have seen, the present sugar policy leads to underutilized land and labor. Surely the resources spent on the subsidy could be effectively employed elsewhere, and some production obtained from underutilized land and labor. Therefore modifications in policies and perhaps agriculture structure are required for reasons of both economic efficiency and social justice.

The main issue never really confronted in Brazil is that of determining the long-run comparative advantage of the Zona da Mata. Sugar is being produced more economically in the South. Does that necessarily mean that sugar still does not have a comparative advantage within the NE? Do the limited experiments with food crops in the Zona da Mata imply that cane is really more profitable? If so, would it be without present subsidies?

Is it likely that food crops can be grown more cheaply in the Agreste? Where are future technological advances in agriculture likely to have the biggest effect? In the Zona da Mata? In the Agreste and in the South?

Few insights into these questions can be gained from present research in the NE. That may be due to the difficulty of finding easy solutions to basically tough problems, or inadequate research efforts to date, or both. Yet, development of a rational set of policies depends on production possibilities. Since present data do not provide the foresight to anticipate what lies ahead all that can be accomplished now is a prediction of possible outcome under various assumptions. For purposes of discussion, let us assume two fundamental situations relative to sugar cane production in the Zona da Mata:

- 1) The long run comparative advantage rests with sugar cane, or
- 2) Other crops or combination of agricultural activities hold the long run comparative advantage.

In either case, a basic policy tenet is that no useful economic or social criteria is served by an indefinite continuation of high price supports on sugar cane production.

Comparative Advantage with Sugar

First, let us assume that sugar has the best long run prospects. Then our objective should be to make production more efficient. This could be accomplished by lowering the present high price and using part of the fund's previously spent on the subsidy to stimulate the use of specific inputs. For example, we could assume that mechanized cane growing is the long run objective. Then machinery purchases and clearing of flatter land should be stimulated through input and credit subsidies. This strategy forces the farmer to use certain inputs if he is to receive the subsidy given to the sector. Inefficient producers on marginal land who cannot mechanize because of topography would be forced to discontinue cane entirely or set up operations on flatter land. Production quotas might be eliminated, or at least adjusted so farmers with good land could expand beyond present limits.

Infertile and hilly land would go out of cane and become available for alternative uses including distribution to laborers displaced by mechanization. This becomes the biggest development challenge because of incomplete knowledge about likely alternatives and their labor absorbing capacity. It is possible that the complexities and costs of developing economic alternatives will be so great as to warrant conversion of the entire sector to a peasant cane system. Furthermore, profitability of other activities may never reach levels comparable to cane or to crops and livestock in the Agreste and Sertão thereby creating permanent economic and social inequities. Only a substantial amount of more research will provide insights into these results.

Comparative Advantage not with Sugar

Now let us assume that crops and livestock rather than cane offer the best long-run potential. The recommended policies are the same as the previous case: massive short- and long-term investments in research, followed by incentive policies to stimulate adoption of recommended inputs and practices. First, it must be determined which enterprises have the best prospects given reasonable expectations of future agronomic research results, projected domestic and foreign demand, and labor absorption possibilities in those enterprises and the non-agricultural sectors. This implies an initial stage of adaptive research drawing heavily on experience already obtained in the Northeast and the South. Simultaneously, longer term research must be started to develop those varieties, practices, and techniques specifically suited to the NE which will assure the future competitiveness of the region, recognizing that Southern Brazil and other countries will be continuing their drive for productivity increases in some of the same commodities.

The transition from cane to new enterprises is likely to be more difficult than to modernize cane. Much of the agricultural capital invested in sugar production will have little use. Widespread abandonment of agriculture by cane growers would leave the sector in the hands of workers with little previous entrepreneurial experience precisely when profound transformation in inputs and products are required. Lack of information about sound alternatives would make it difficult for even well intending extension personnel to make recommendations.

It is probable that the evolution of agricultural organization and structure in the Zona da Mata will follow some middle path between these two assumed alternatives. But by choosing these extreme cases, the policy considerations are placed in sharp relief. The basic policy instruments are the same in both cases: variation is largely a matter of direction and magnitude. Central to both is a reduction in price subsidy and adjustments in the quota system. A research program must accompany these changes to identify and develop alternative cropping systems for released land and labor. The larger the amounts released, the greater must be the research effort. Credit and price policies and sound extension services can undoubtedly play an important role in accelerating and facilitating changes suggested by the research.

RECOMMENDATIONS

Based on the preceding discussion, the following three recommendations, are offered for immediate consideration as part of the PROTERRA program. Recommendation number 1, is considered to be of highest priority and absolutely essential for modernization of Northeast agriculture. A more detailed explanation of these recommendations and suggested proposals for implementation are given in the appendix.

1. Development of new production technology

Establish in the NE an integrated production technology research program that includes, as a minimum, fundamental research in the areas of soil chemistry and fertility, plant genetics and diseases, and soil and water management. The research should be goal specific recognizing practical farm level problems encountered in economic application of results. In later stages of development, this program should include an associated action component designed to disseminate results and speed adoption of recommended practices. Credit and price policies should be an integral part of the action component.

This program may be operated through expansion and coordination of existing research facilities or may include the establishment of new facilities. The concept of an integrated approach, however, is critical to the successful elimination of present production barriers. (See appendix I).

2. A more rational credit policy

A proliferation of special credit programs has resulted in a morass of confusion and conflicting interests on the part of banks and farmers. There is a real need to streamline and simplify the credit delivery system so it can operate more efficiently and judiciously for the general purpose of stimulating and facilitating growth in the agricultural sector. Widely varying interest rate levels, differential returns to banks on special fund sources and cumbersome regulations all serve to impede the effective flow of credit resources into agriculture. The following specific recommendations will help to streamline and simplify this process.

- a. To increase bank willingness to loan to small farmers;
 1. Institute a program of loan guarantees to minimize risk of financial loss.
 2. As a concomittant measure, facilitate small farmer access to credit by reducing collateral requirements and eliminating formal procedures.
 3. Maintain a common interest rate for all farm sizes (equalize returns).

2. Subsidize banks for making loans to small farmers. Reduce bank administrative costs on all loans by adopting a single annual loan contract per farmer.
3. To ameliorate non-productive use of credit, set interest rates for agricultural lending more closely to competitive rates. As a minimum establish rates that are positive in real terms.
4. Equalize the returns to local banks on all fund sources.
5. Establish a monitoring research function to determine if these policy modifications achieve the desired goal of reducing inequities.
3. Reduce Sugar subsidies and liberalize quotas

Gradually reduce the subsidy prices and quotas on sugar to allow a more rational allocation of production resources. It is expected that significant changes in enterprise organization will emerge as a result of this price reduction. Therefore, it is recommended that a sector study be undertaken to determine the most likely path(s) of change and the problems expected to be encountered, including estimating demand and supply for both inputs and outputs. This sector study would also serve to orient the research efforts for developing appropriate forms of new technology for the Zona de Mata and test inter-regional competition and complementarity of production possibilities. (See appendix III).

The above recommendations emerge from information and observations made concerning credit and prices subsidies. In addition to the factors already mentioned, informants in all regions raised questions about efficiency and welfare aspects of existing tenure systems. For example, it was suggested that land use, access to credit and markets, and motivation to seek and adopt new technology are in part determined by tenure status. These issues merit special attention, particularly in light of expected future technological innovations to be derived from expanded research.

REFERENCES

- Alams, Dale W. - Foreign Assistance for Agricultural Development in Brazil 1950-1970 - Economics and Sociology Occasional Paper Nº 27. Department of Agricultural Economics and Rural Sociology The Ohio State University, Columbus, Ohio, 1971.
- Agricultural Development in the Brazilian Northeast: Technological Alternatives and Probable Development Patterns
 - Report prepared for the United States Agency for International Development, Washington, D.C., December, 1970.
- Brazil, - Ministério da Agricultura, SUPLAN, A Agricultura na Região Nordeste, Unpublished Research, Brasília, 1971.
- Banco do Brasil, S.A., Boletim Trimestral, Nºs. I, II, III, IV, 1970.
- Banco do Brasil, S.A., Crédito Especializado - Quadros Estatísticos, 1968/1969.
- Banco Central do Brasil, Crédito Rural - Dados Estatísticos, GECCI, Brasília, 1969.
- Engler, Joaquim J. de C., I. J. Singh - Production Response to Technological and Price Changes: A Study of Wheat and Cattle Farming in Southern Brazil, Occasional Paper, Nº 33, Ohio State University, Columbus Ohio, 1971.
- Erven, Bernard and Norman Rask - Credit Infusion as a Development Strategy The Ibiruba Pilot Project in Southern Brazil, The Agricultural Development Council and The Ohio State University, Columbus Ohio September 13-15, 1971.
- Frederic, Kenneth D. - Revolution Red or Green: An Examination of the Rural Northeast - Report prepared for the United States Agency for International Development, 1971.
- Hawaiian Agronomics International - Diversification and Modernization of Agriculture in the Sugar Zone of Northeast Brazil. Prepared for the United States Agency for International Development under Basic Agreement Nº AID/csd - 942, Task Order Nº 1, n.p., n.d.
- International Bank for Reconstruction and Development, IDA, Washington D.C. August 1970. Agricultural Sector Survey Brazil - Volume IV Agricultural Development in Northeast Brazil.
- Land Reform in Brazil, Northeast - Spring Review Paper - Country Paper, USAID/NEAO/Brazil; June, 1970.

Magalhães, Camillo Calazans, Presença do Banco do Brasil no Nordeste, Palestra perante a Comissão Coordenadora de Estudos do Nordeste, 1971 (Paper for Coordinating Commission of NE Studies, 1971).

Rash, N. - The impact of Selective Credit and Price Policies on the use of New Inputs, Development Digest, Vol. IX, Nº 2, April 1971.

Rao, Bodepudi Prasada - The Economics of Agricultural Credit Use in Southern Brazil, Ph.D. thesis, Department of Agricultural Economics and Rural Sociology, The Ohio State University, 1970.

Research Notes on Agricultural Capital Formation and Technological Change. Capital Formation Project, Department of Agricultural Economics and Rural Sociology, Ohio State University, Columbus Ohio.

Nº 1 - Nelson, William C. - Fertilizer, Brazil, 1970

Nº 2 - Nelson, William C. - Credit and Fertilizer - Brazil December, 1970.

Nº 3 - Nelson, William C. - Fertilizer Marketing - Brazil, January, 1971.

Nº 4 - Stitzlein, John - Agricultural Mechanization - Southern Brazil, March, 1971.

Nº 5 - Adams, Dale W. & Joseph L. Tommy - Credit - Brazil, April, 1971.

Nº 6 - Rash, Norman and E.Wayne Denny - Rural Savings - Brazil, April, 1971.

Nº 7 - Meyer, Richard L. and Donald Larson Brazil's program for Increasing Wheat Production, May, 1971.

Nº 8 - Adams, Dale W., William Simp and Joseph, Tommy, Credit Brazil, June, 1971.

Tandler, Judith - Agriculture Credit in Brazil - U.S. Agency for International Development, Washington, D.C. October 1969.

The Fertilizer Requirements of Countries in Latin America - Annual Report 1957 - International Soil Testing Center, AID/csd - 237 - North Carolina State University, Raleigh, North Carolina.

APPENDIX I

The purpose of Appendix I is to provide some tentative guidelines for the organization and implementation of a basic and applied research program to discover new production technologies for Northeast Brazil.

A key factor in determining the success of this expanded research effort will be coordination between existing and possible new institutions, as well as between researchers from various disciplines. An integrated program is absolutely essential if researchers are to pool their talents and efforts toward the accomplishment of mutually determined objectives. With the large number of institutions presently engaged in independent research or quasi-research programs, it would be desirable to have one of them responsible for coordination. This institution, in addition to its own program, could channel PROTERRA funds to the others to finance projects designed and undertaken to contribute to the established objectives. Certain individuals and institutions by virtue of location, specialization and tradition will have developed special areas of expertise. The objective of coordination will be to bring this competence to bear on specific aspects of the research, and rationally distribute the research load among qualified persons. The discretionary control of funding would permit support of only those on-going and planned activities most directly related to priority objectives.

A second function of the institution charged with coordination would be to facilitate the training and effective employment of research staffs, and development and maintenance of required facilities. Training would include short-term practical courses in Brazil, and graduate work in Brazilian and foreign institutions. Trained personnel in low salaried positions might be paid supplemental salaries as encouragement to stay in and assist the development of respective institutions. Material support would be provided primarily through supporting research budgets, but some large infrastructure investments may be required.

Orientation for the direction and design of this type of research program could be immediately obtained by studying such programs successfully operating in other countries. The examples of corn and wheat breeding in Mexico, and rice research in the Phillipines are two obvious cases. Key Brazilians might visit one or more of these installations, or short-term consultants familiar with the programs might make useful on-sight observations in Brazil.

Modern technology can liberate farmers from low productivity stagnation, but at the same time can make them financially vulnerable to potential defects of that technology. For example, wheat production in Southern Brazil has rapidly expanded in part because of exceptionally good weather during the past six years. A given crop may be suddenly attacked, however, by a

disease or insect not previously important with earlier varieties planted in widely separated fields. The recently reported losses caused by a new type of aphid may be a case in point. Therefore a research program specifically designed to produce rapidly adaptable production technology must be built upon a solid base of knowledge about farm level conditions with sufficient linkage to actual innovators to quickly identify and correct heretofore disguised defects. Research does not make a once and for all contribution rather a system must be developed to provide a constant flow of information in response to new and different problems.

Steps to consider in implementation of the research program

1) Assemble, integrate, and critically evaluate existing research results.

A fair amount of piecemeal research has been undertaken by a variety of technicians and institutions in the Northeast. Unfortunately much of this work is unpublished. Little is known about the complementarity of these several activities. A systematic review of work performed to date will help identify those areas where important results are already available, and meaningful work underway thereby assisting the identification of priority areas for immediate support.

2) Inventory of existing research facilities and personnel

Some of the research objectives can probably be met simply by coordinating and strengthening existing institutions and programs. However, rapid and significant breakthroughs will require expansion of present facilities; perhaps the creation of some new ones, and the commitment of scientists for in excess of present numbers. To rationally identify and plan for these needs, it will be necessary to undertake a complete inventory of existing facilities and personnel by geographic location and discipline. Specific areas of competence must be identified to prevent unnecessary duplication and competition.

3) Creation of Multi-disciplinary research teams

The successful development of new forms of technology and its economic application at the farm level requires an understanding of soil chemistry and fertility, plant genetics and disease, and soil and water management. In specific cases, additional specialists will need to be trained. Perhaps more important is the coordination of individual efforts and various phases of research. Such coordination can be facilitated by the creation of multi-disciplinary teams to work on specific problems and objectives.

4) Research Advisory Committee

An advisory committee composed of individuals from the various institutions actively engaged in research should be established to set general guidelines for research, to make periodic evaluations of progress, and to set priority goals for specific research efforts.

This recommendation has implicitly assumed that existing institutions can be sufficiently strengthened to fulfill the research function. However a thorough study of these institutions might reveal that a rapid fulfillment of research objectives could be most efficiently accomplished through the creation of a NE research center.

APPENDIX III

Analysis of the development prospects for the three ecological areas of the NE is hampered by the dearth of economic and agronomic data about production possibilities for each area. The problem is compounded by a lack of knowledge about present and potential complementarity and competitiveness between the areas. Production systems, resource use, and farm output are conditioned by this inter-relationship. For example, peak labor requirements during the Zona da Mata cane harvest are met, in part, by migrant workers from the Agreste; relatively high productivity in Agreste food crop production may be important in limiting diversification in the Zona da Mata.

Furthermore, there is considerable competition in resources use within each area. It is suggested that sugar cane producers resist colonization because they fear that once workers have an opportunity to work a small tract of land, they will not need to labor in the cane fields. Corn is planted on steep hill-sides in the Agreste and Sertao because the large landowners attempt to assure a forage supply for their livestock by retaining humid lowland in pasture. They allow their workers to cultivate the hills and absorb the risk of losing the crop in case of drought.

Adjustments in farm policies and discoveries of improved technology can accentuate regional complementarity and competitiveness, and force farm-level changes in resource use and output. Since the basic resource endowment varies within and between areas, these developments necessarily have a differential effect, increasing the demand for various types of resources in one area and reducing it in others. Owners and users of these resources obviously gain or lose in the process.

The scope of the problem can best be highlighted by an example. Widespread amelioration of economic and social problems in NE agriculture is going to require increased production of food crops. Let us assume that present knowledge suggests corn as a commodity with some potential in the Zona da Mata. The following questions immediately come to mind:

Do the returns from corn compare favorably with cane? With other commodities?

What is the present productivity of corn in the Agreste compared to the Zona da Mata?

Is there a specific farm size or organization most efficient in corn production?

What are the employment implications of a massive shift from cane to corn in the Zona da Mata?

How would such a shift affect seasonal employment opportunities for Agreste labor?

What technological innovations are likely to be forthcoming for corn in the Zona da Mata?

Will heavy fertilizer application become necessary and economic with such innovations? If so, by how much will fertilizer demand likely increase?

Will such innovations have an even greater effect on productivity in the Agreste?

Some of these questions can be answered by simple farm-level analysis; others are far too complex. Systematic testing of the potential impact within and between areas of policy changes or technological innovations is impossible with simple technique. Only a well-prepared regional economics model has the analytical power to simultaneously manipulate several variables and identify required adjustments and bottlenecks.

It is recommended that work be immediately initiated on such a model to meet two general objectives with regard to present and future agriculture development: examine possible farm-level adjustments, including changes in farm income, and demand for factors of production and services such as credit and transport; project demand for land, labor and modern inputs, and supplies of various commodities. Specifically, the model should be designed to:

- 1) describe comparative production possibilities within each area using present technology;
- 2) analyze potential changes in uses of production factors and resulting farm output, assuming various rates of adoption of present technology;
- 3) predict possible farm-level adjustments in response to hypothesized changes in farm policies, such as elimination of sugar subsidies and quotas, reduction in costs of selected farm inputs, and subsidization and stabilization of certain commodity prices, and
- 4) identify likely development paths, assuming:
 - a) anticipated technological change (breakthrough in tropical corn growing),
 - b) massive public investments (transportation, irrigation), and
 - c) structural changes (elimination of cane, agrarian reform).

This type of economic analysis could fulfill yet another important function. Rather than simply utilize existing and future research results, it could

help orient the basic research itself. It has been suggested that the desired characteristics of "miracle" rice varieties were largely established in advance of the actual research. An economic model could help identify desirable characteristics for particular types of agricultural activities considering known production possibilities, potential market demand, and general economic needs of the area. This would require specifying assumed production characteristics, including:

1. specific crop to be grown or type of livestock to be raised in a particular area;
2. size and scale of production units;
3. power source (manual, animal or tractor);
4. use of purchased inputs (improved vs. hybrid seed, recommended levels of liming, fertilization, etc.), and
5. managerial ability of farmer.

After completing such an exercise, it would be possible to suggest, for example, that profitable corn production in the Zona da Mata would require a variety capable of performing well under hot humid conditions, with well-drained soils of limited fertility, for farmers with limited corn growing experience, who would be expected to purchase new seed each year and utilize modest amounts of fertilizer and machinery.

Implementation

An ambitious economic research program of this magnitude would require the efforts of a group of researchers, some sufficiently competent in farm-level analysis to derive the required enterprise coefficients, and others capable of developing inter-regional and inter-sectoral aspects of the model. The innate complexities of the task and concomitant data requirements suggest a preferred research strategy; first conduct a series of farm level commodity studies in one area to obtain general background information and required coefficients, second develop and test the aggregate model for just one area, and third incorporate each of the other areas into the model as the required data is made available. In fact, it might be worthwhile to divide the three large ecological areas into smaller homogeneous subareas. At a later stage the model might even be extended to explore inter-relationships between the agriculture of the NE and other parts of Brazil.

In addition to these general considerations, there are several specific factors to be examined:

1. The long-term nature of the study requires that it be conducted under the auspices of a Brazilian entity sufficiently committed to the task.
2. It is probable that few Brazilian agricultural or general economists have had great experience with regional model building, or even have sufficient general knowledge of the technique to single-handedly develop an effective and efficient model. A long-term relationship with a foreign entity would be valuable in providing qualified periodic consultation and, perhaps, short and medium term staff.
3. Administrative continuity and dependable funding would be essential because initial research results may be relatively less important than those emerging later in the life of the project. Reduced commitment or termination mid-way in the project may destroy much of the value of the first research undertaken.
4. Models of this type are valuable teaching devices, and provide a useful stimulus for complementary research. Therefore there is merit in involving a Brazilian university with a graduate training program which could also provide some of the required staff.
5. Adequate computer and programming services are absolutely essential for maximizing the use of scarce technician time. Improving the adequacy of such services may be a necessary complement to the first stages of research.