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THE AGRICULTURAL INPUTS INDUSTRY IN EL SALVADOR

KSU
KANSAS STATE UNIVERSITY

Food and Feed Grains Institute
Manhattan, Kansas 66506-2202
USA

THE AGRICULTURAL INPUTS INDUSTRY IN EL SALVADOR

by

Cornelius Hugo
Frederick Worman
and
Hugo H. Ramos

for the

AGENCY FOR INTERNATIONAL DEVELOPMENT

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SECTION I

INTRODUCTION

A. Background

While all agricultural inputs and practices have the potential for contributing to increases in productivity and, therefore output, seeds, fertilizers and agro-chemicals are perhaps the most important. During the last 10 to 12 years, the agricultural inputs industry in El Salvador has been severely affected by farmers' decisions to adjust their basic food grains production process. The same decisions have also affected productivity per unit of production and therefore production on a per capita basis. These decisions to reduce productivity and to increase land area use for the production of basic food grains have been taken in response to changes in macro and sectoral policies, input and product market conditions, and supporting services, all affecting their returns on production.

After more than a decade of decline, the Salvadorian economy, and especially the agricultural sector, seems to be responding favorably to numerous macro-policy, sectoral, structural, and trade related adjustments which were initiated in June 1989 and continue at present. [1]

As the agricultural sector returns to positive growth rates, and basic grains farmers perceive higher real incomes, the demand for agricultural inputs can be expected to increase. Accordingly, the impacts of the on-going changes in policies, regulations, and institutions related to this key sub-sector must be monitored and adjusted in order to achieve and sustain the most supportive and facilitating environment possible.

B. Terms of Reference

The de-technification of the basic food production system and parallel decline in per capita production since the early 1980's is of great concern to the Government of El Salvador (GOES) and the industry which provides the needed production inputs. The trends are not only negative but threaten to stymie the positive policy impacts achieved, so far in the agricultural sector, especially in the basic grains sub-sector.

The team was charged to undertake an appraisal of the agricultural inputs sub-sector, and to survey the respective industry in order to: (1) analyze the reasons for the apparent loss in technification or productivity in the production of basic food grains, (2) analyze the structure, conduct and performance of the agricultural inputs industry, (3) continue with the preparation of a data bank for subsequent work, and (4) suggest appropriate changes in the on-going policy, institutional, legal, regulatory, and industry reforms to help bring about a

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[1] See bibliography for relevant documents.

sustainable shift to higher productivity levels within the agricultural inputs industry and the production of basic grains in El Salvador. [2]

Being the second in a series of reports and manuals, this report is linked backwards to the first [3] and forward to the third [4]. For the sake of integrity certain sections have been repeated or modified as appropriate in each of the reports and/or manuals. This allows for independent reading as well as for continuity in the presentation of the results and applications throughout the report series.

C. Acknowledgements

The work was undertaken during two time periods, between November 11 and December 14, 1991, and between February 12 and March 6, 1992. During both visits the team worked with many individuals and institutions, both in the private and public sector. [5] The team wishes to thank them all for their support, collaboration, arguments, and criticism. It is the sincere hope of the authors that this small contribution will help the efforts being undertaken to shift the production of basic food grains to a higher level of productivity in El Salvador.

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[2] See Appendix 2 for complete terms of reference.

[3] See "Invigorating the Seed Industry in El Salvador, by Cornelius Hugo, Hunter Andrews, and David Stimpson, Food and Feed Grains Institute, Kansas State University, Manhattan, Kansas, 66506, September 1991.

[4] Basic Grains Supply Response Functions for El Salvador.

[5] See Appendix 3 for contacts.

SECTION II

TRENDS IN DEMAND AND USE OF AGRICULTURAL INPUTS

A. Trends in Basic Grains Crop Area, Yield, and Production

Grain production is a result of area under cultivation and the productivity per unit of cultivation. This relationship can be expressed as a simple function, as follows:

$Q_t = A_t * P_t$, where:

Q_t = Total production in time period "t", given in quintales (qq)
A_t = Area under cultivation in time period "t", given in manzanas (Mz)
P_t = Productivity per unit of production in time period "t", or yield per manzana, given as (qq/Mz)

While both area and yield contribute to total production, many factors will sway producers to use more acreage, to increase yields, or both. A production trend which over the years uses more acreage than increases in productivity is characterized as "extensive". Conversely, a production trend which over the years increases productivity more than the area being put under cultivation is characterized as "intensive". Naturally, there can be a production trend which falls in-between. At the extremes, each production trend will have both negative and positive consequences.

Gains in productivity result from research efforts or trials by individuals or institutions which, after a successful transfer to a comercial production level, result in higher yields per unit of production. In the case of basic grains production many factors affect this needed increase in productivity, including the development and availability of higher yielding varieties, availability of reasonably priced inputs, improved cultivation practices, appealing market conditions and prices for farm products, and effective outreach efforts and delivery mechanisms which encourage farmers to shift to higher levels of intensiveness in their production process.

The average production, area, and yield trends for basic grains in El Salvador are summarized in Table II-1 and Figures II-1, 2, 3, and 4. These averages were obtained from four time periods between 1961/62 and 1989/90. Such a long time period tends to diminish the importance of variables with medium to short-term impacts and allows those with significant long-term impacts to demonstrate their effects on basic grains production trends.

Generally, all four grains show remarkably similar trends in area and yields over the 30 year period. The individual tendencies are also very similar when analyzed within the four time periods. All this points out some common set of factors which influenced the components of the production equations over the 30 year time period. In other words, basic grains producers have responded to some externalities over the 30 year period which encouraged them to change their production process for basic grains over time.

TABLE II-1

TRENDS IN GRAIN PRODUCTION, AREA AND YIELD

Crop	Year	Average Production (qq)	Average Annual Change (%)	Average Area (Mz)	Average Annual Change (%)	Average Yield (qq/Mz)	Average Annual Change (%)
CORN	61/61-64-65	4,100,241		246,967		17	
			20.47%		4.92%		11.76%
	71/72-74/75	7,457,895		295,613		25	
			9.33%		5.21%		4.00%
	81/82-84/85	10,240,579		357,175		29	
			4.19%		2.37%		0.86%
	85/86-89/90	11,956,598		391,025		30	
RICE	61/61-64-65	528,375		15,403		34	
			16.09%		1.83%		13.24%
	71/72-74/75	868,525		16,530		52	
			5.05%		3.62%		1.44%
	81/82-84/85	1,043,948		18,925		55	
			2.34%		0.03%		2.27%
	85/86-89/90	1,141,513		18,950		60	
SORGHUM	61/61-64-65	2,072,305		139,642		15	
			13.66%		7.15%		5.00%
	71/72-74/75	3,205,000		179,600		18	
			-2.81%		-2.07%		-1.39%
	81/82-84/85	2,845,320		164,735		17	
			-2.26%		1.38%		-2.94%
	85/86-89/90	2,588,350		173,825		15	
BEANS	61/61-64-65	302564		36944		8	
			34.75%		17.59%		12.50%
	71/72-74/75	723150		62940		12	
			6.43%		6.12%		0.00%
	81/82-84/85	909030		78350		12	
			1.36%		4.04%		-4.17%
	85/86-89/90	958450		91025		10	

Source; Appendix 3

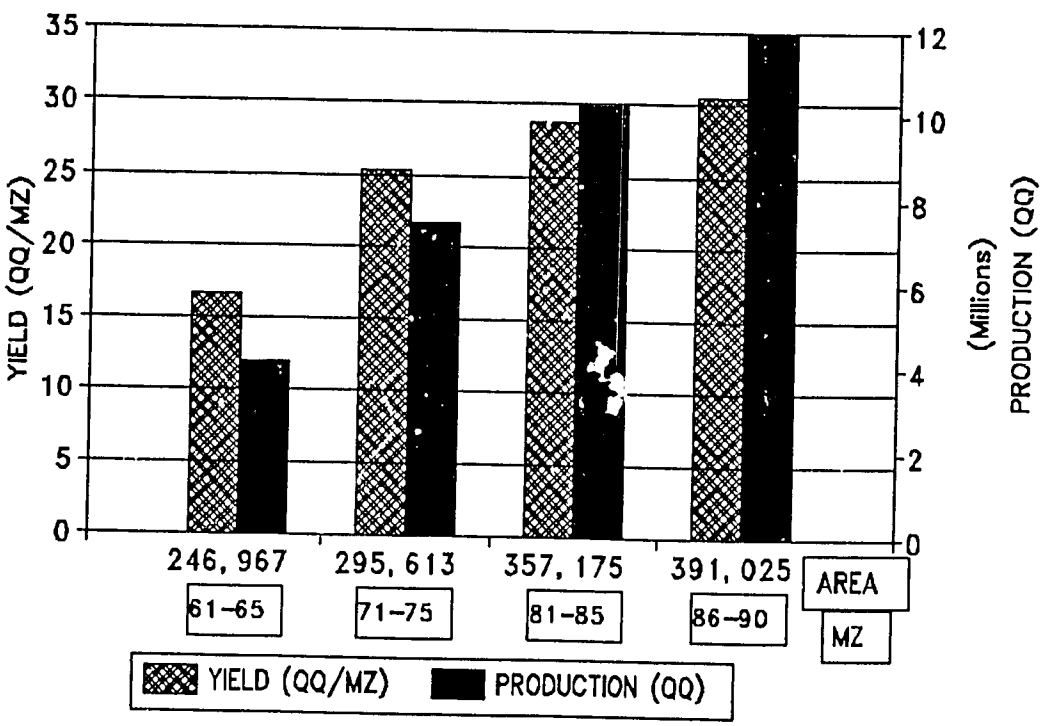
1. Corn

Since 1961, corn production increased threefold from 4 million quintals to 12 million. While a function of area and yield, the relative importance of these two basic variables have changed over the years. Production during the 60's and 70's can be characterized as becoming "intensive" or "technified" with yields increasing by 47%, from 17 to 25 qq/Mz between 1961-65 and 1971-75, and area expanding by only 20%, from 247,000 to 296,000 Mz during the same time period. For the time period 1981-85 and 1986-90 the reverse is true. Area expanded by 10% to 391,000 Mz while yield increased only 3.4%, to 30 qq/Mz. In other words, corn production became more extensive.

The estimated annual percentage changes listed in Table II-1 indicate the degree of loss in productivity per unit of production as corn production became more and more a function of area rather than yield. Yields which were growing at an average rate of nearly 12% during the 60's, were cut to 4% during the 70's, and are now barely increasing at 1% per year. As the cultivated area rate of expansion slowed from nearly 6% per year during the 60's to less than 3% per year during the 80's so did the rate of production, declining from over 20% per year to 4%.

FIGURE II-1

TRENDS IN CORN PRODUCTION, AREA AND YIELD



Source: Appendix 3

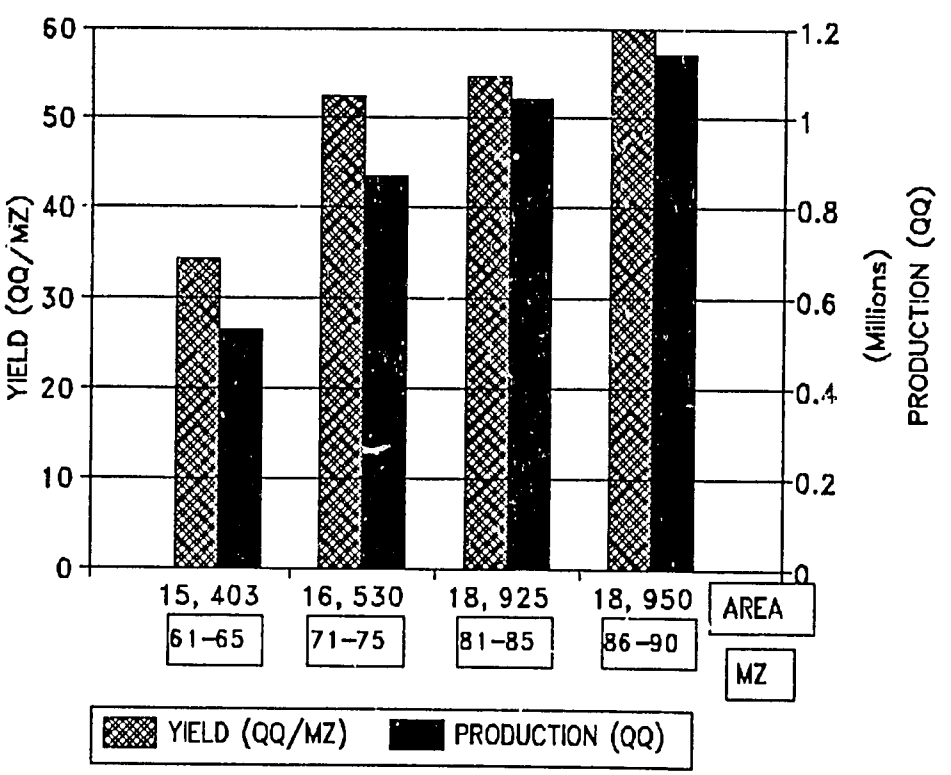
2. Rice

Rice shows the same tendencies as corn during the 60's and 70's. Application of improved technologies intensified production and yields increased by 53% from 34 to 52 qq/Mz, while area expanded only 7% from 15,400 to 16,500 Mz. During the 70's and first half of the 80's, farmers' production response shifted to area expansion and productivity declined. By the 1980's the trend reversed and further increases in production became strictly a function of productivity as a result of a slight 9% increase in yields. Area remained constant at 18,900 Mz. The decreasing productivity per unit of production over time is reflected by the heights of the bars representing the quantities of rice produced over time. As indicated, production continued to increase during the 1970's and 80's, but at an increasingly diminishing rate.

An analogue history can be drawn from the Average Annual Change columns in Table II-1. The tremendous productivity gained during the 1960's nearly disappeared during the 70's and early 80's. With land area under cultivation remaining nearly constant, annual production increases dropped from 16% to just over 2% by the late 1980's.

FIGURE II-2

TRENDS IN RICE PRODUCTION, AREA AND YIELD



Source: Appendix 3

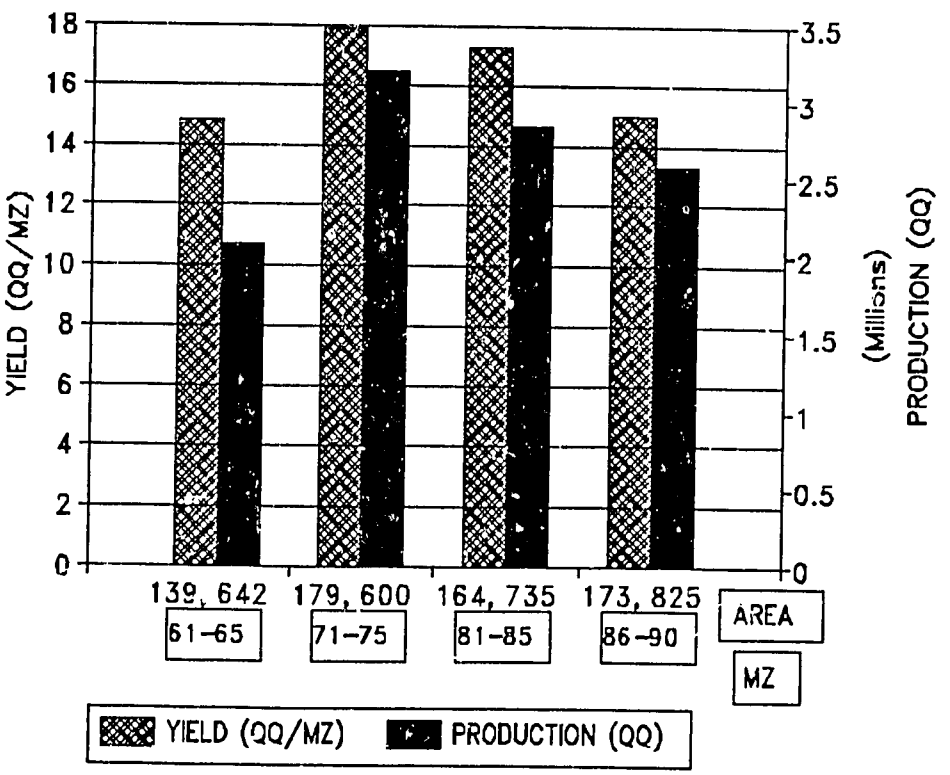
3. Sorghum

Unlike corn and rice, area and yield contributed in a more balanced fashion to sorghum production during the 60's and first half of the 70's. While area increased 29% from 139,000 to 179,000 Mz between 1961-65 and 1971-75, yield also increased 20% from 15 to 18 qq/Mz. By the 1980's, however sorghum production declined as a result of a severe reduction in yields which dropped by 12% to the levels experienced in the early 1960's. The slight increase in acreage of 6% to 174,000 Mz was insufficient to arrest the decline in productivity per unit of production.

An indication of the degree of loss in "technification" in sorghum production is given by the Average Annual Change columns in Table II-1. Whatever gains were made during the 1960's, these were lost during the last two decades, with total production decreasing since the peaks obtained in the early 70's.

FIGURE II-3

TRENDS IN SORGHUM PRODUCTION, AREA AND YIELD



Source: Appendix 3

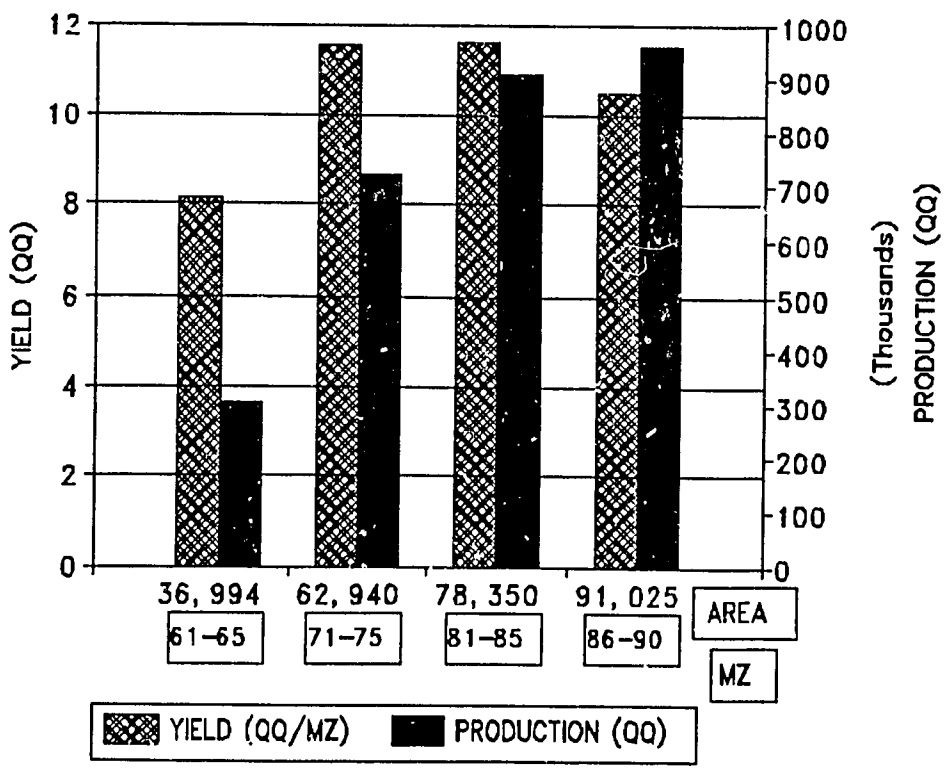
4. Beans

Between 1961-65 and 1971-75, bean production increased as a balanced contribution of area expansion and yield increases. Area expanded by 70% from 40,000 to 63,000 Mz, at roughly 18% per year, while yields increased by 50% from 8 to 12 qq/Mz, at approximately 13% per year. During the next decade yields seased to increase and increases in bean production became a function of expansion in the area cultivated. During the 1980 a severe constriction in yields more than offset a moderate increase in the area cultivated. Yield dropped by 17% to 10 qq/Mz, while acreage increased by 16% to 91,000 Mz.

Again, the increasingly declining rate at which production grew after the first period exemplifies the detrimental combination of a shift to extensive production (area expanding at a rate of 6.12% between 71/75 and 81/85, and 4.04% per year during the last decade) and a decline in productivity (at a rate of 0% between 71/75 and 81/85 and a negative 4.17% during the second half of the 80's).

FIGURE II-4

TRENDS IN BEAN PRODUCTION, AREA AND YIELD



Source: Appendix 3

All commodities demonstrated an intensive or balanced production phase during the 60's and first half of the 70's and shift to an extensive phase after that. With the exception of sorghum production volumes have continued to increase, but at increasingly declining rates. Naturally, a series of questions and concerns are raised as to the reasons which contributed to the "desirable" form of basic grains production (either intensive or balanced) during the first 15 to 20 years, and to the "undesirable" form of production (extensive) during the 1980's. Why was EL Salvador well on its way to "technification", that is increase the productivity of its is basic food production system, and after 30 years finds itself barely keeping up with population growth? [1]

A historical understanding of the reasons for the shift will enable policy makers to appreciate the critical linkages between policy decisions, farmers reactions, industry impacts, and consumers' welfare. This appreciation should encourage the development of ways and means to enable follow-up on policy desicions to monitor their impacts and develop adjustments as necessary. Private sector participants would gain a better understanding of the impact of policy desicions on their business, the industry, consumer demand, and the importance of productivity.

A host of other intriguing questions within and beyond the current scope of work come to mind. By no means inclusive, these are listed below.

On production:

- With the exception of corn, national production of basic grains has fallen below the rate of population growth. However, having become a function of area expansion and not yield increases, the rate of corn production is declining. How long will it take before this basic food also falls below the rate of population growth?
- Did all farmers react in the same way? If not, who are the ones which "de-technified" their production processes, and why?
- Increases in productivity per unit of production seems to be the key, how can this be brought about? What would it take to encourage those farmers who gave up productivity gains to reverse such trends?
- Under what conditions can the country have a position of comparative advantage in producing basic grains?
- How can regional and international trade be used most effectively to balance total food supply?

On demand:

- As per capita production has fallen, how have urban and rural consumers fared? Has their nutrition suffered, and if so at what income levels?
- Have substitutes been used, and if so what are they? Under what conditions are these being substituted? Where do they come from, and under what conditions?

On policy:

- Since 1988 the current Government has been implementing a series of macro, sectorial and institutional policy changes which are having and

[1] See Appendix 4 for Cereal Production Indices.

will continue to have definite impacts on farmers' desicions to produce basic food grains. Are farmers desicions, area and yields, and output on the "right track"? How can we monitor these developments?

- Would an analysis of production information since 1987 reveal some definitive changes, and reasons, in the area-yield composition of basic grains production?
- What macro policy desicions are not necessarily favoring or making the change back to technification difficult? Can their negative effects be minimized? Should they?
- Are the institional and program reforms taking place appropriate and sufficient to facilitate or encourage grain farmers to increase productivity?

<u>On the region</u>:

- Was this increase and subsequent decline in the productivity of basic grains production unique to El Salvador, or more generalized?
- If not unique, did other countries in Central America experience the same cycle?
- Was it due to similar policy conditions, or other more specific ones?
- Are these countries changing relevant policies and institutions, and if so what are such changes?
- What is being done in El Salvador to monitor and assess impact of policy changes in other Central American countries on basic grains production and use of technology?

To a high degree El Salvador's experience seems to be unique. No other country in the region shows the same consistency across all grains, and over the basic time periods, namely pre-1979/80 and post-1979/80. [2] On the other hand, no single country consistently fared better across all grains during the same time period. What this would indicate is that each country's production of basic grains responded to a set of macro, sectorial, and institutional variables which must have been somewhat unique to each. If there is one commonality among the countries it seems to be the tendency to loose productivity in the majority of the crops, especially during the 1980's.

In corn, for example Costa Rica and Honduras showed declines in yields during the 1980's, while Guatemala, Nicaragua, and Panama have seen yield increases, basically over the whole 30 year period. On the other hand all countries have seen their bean yields stagnate or decline over the same time period. Rice is mixed, with Costa Rica and Honduras showing steady yield increases, Panama stagnating in the last decade, and Guatemala and Nicaragua showing declines in productivity.

Sorghum cannot be readilly discussed since it is not clear whether we are dealing with the same kind (white or red) and there is insufficient data for Panama. Costa Rica is the only country with modest yield increases over the whole time period. However, its production levels have declined drastically due to area reduction. Guatemala, Honduras and Nicaragua have all reduced their productivity during the 1980's. Panama has shown increases in yield during the last decade.

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[2] Appendix 6 contains the same trend analysis for the other Central American Countries.

B. The Demand For Agricultural Inputs - A Synopsis [3]

The demand for an agricultural input in a free market economy depends upon how much of the input farmers wish to use. Adding the demand from all the input users gives us a total demand. This is true for one input or for several inputs. The key to determining the demand for an input, is determining the level at which farmers will use the input. How much of an input a farmer will use depends on physical and economic factors.

If we consider a single input by itself, such as certified hybrid corn seed used in corn production, there will be two results when the amount of seed is changed. One result will be physical - an increase or decrease in yield (production) - and the other will be economic - an increase or decrease in profit, i.e. how much the farmer receives for his/her corn, minus the costs of production. The question to be answered when we consider how much seed to use per manzana (i.e. the physical relationship) is: "What yield is obtained as we increase seed, while all other inputs are kept the same?" For example, if we plant 10 lbs of seed per manzana we might obtain 18 qq of corn, and if we plant 30 lbs of seed we might obtain 55 qq of corn per manzana. If we graph the various amounts of corn seed planted versus the corn yield, we get a physical response curve, called a *production function*, similar to the curved line in Figure II-5.

The economic question to be answered is: "What amount of seed will give us the greatest profit?" We wish to use only enough seed to obtain the maximum profit. The amount of seed used will depend on the price of the seed and the price the farmer receives for the corn harvested. According to economic theory, the best (optimum) amount of seed to use is found when the cost of one more unit of seed used on a manzana is exactly equal to the additional money received from the additional yield obtained by planting the additional corn seed. This optimum amount of seed to use, from the economic point of view, will generally be less than the amount of seed needed to get the greatest possible physical yield. The demand for seed will be the amount of seed used per manzana times the number of manzanas to be planted nationwide, for every different price of seed. A more detailed discussion of the derived demand curve for a single input is presented in a previous study in this series. [4]

No crop depends on a single input. Most require a number of inputs such as land, labor, seed, fertilizer, pesticides, etc. In the present study we are interested in determining the demand for two inputs - fertilizer and pesticides - used in basic grain production. As in the case of a single input, the demand for two inputs, which can be used in varying amounts, is a derived demand. The demand for each input depends on how much of each input farmers purchase. The challenge is to determine how the two inputs can be used together to produce the highest economic level of crop production. In this case physical relationships and economic considerations will encourage farmers to choose one particular combination of inputs, rather than some other combination, to produce each basic

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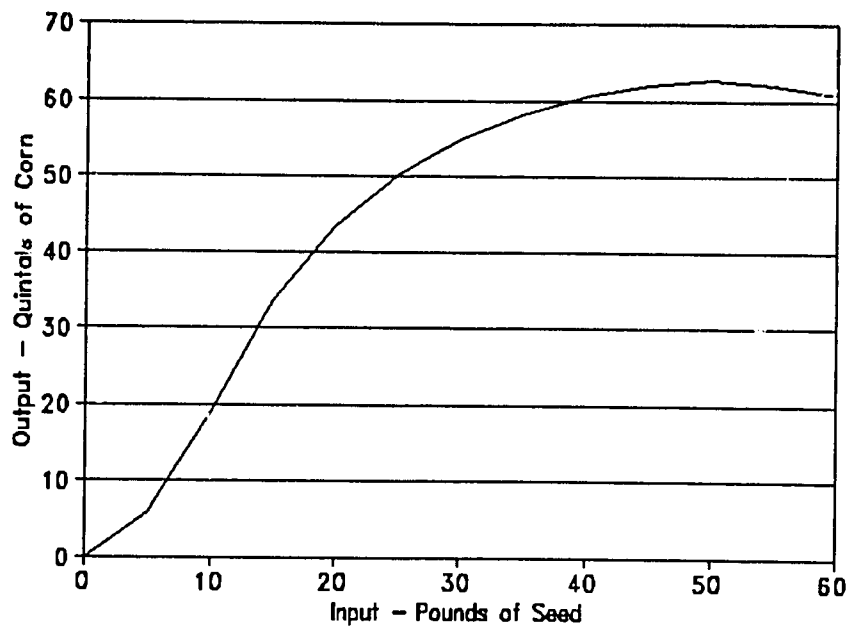
[3] A more technical discussion of the theory is presented in Appendix 7.

[4] C. Hugo, H. Andrews and D. Stimpson, Invigorating the Seed Industry in El Salvador, Food and Feed Grains Institute, KSU, September, 1991.

grain crop. As with the single input case discussed above, we are interested in the answer to two questions. First, how much of a particular basic grain, for example corn, can we produce by using various combinations of the two inputs. Second, how much of each input, when used together, will give the combination of inputs which costs the least, and provides the most profit.

FIGURE II-5

PRODUCTION FUNCTION



If there are only a few ways the inputs can be combined, then the easiest approach is to calculate the amount of profit (value of the yield minus the costs of production) for each combination of inputs, and choose the combination of inputs which gives the highest profit. This approach is very useful if we are considering a number of possible combinations of inputs, such as in agronomic research trials. Since many inputs, such as fertilizer and pesticides, can be divided into very small quantities, they can be used in a large number of combinations. Thus we must look for a more general approach to determining what the best combination of inputs will be.

1. Technical optimization of two inputs

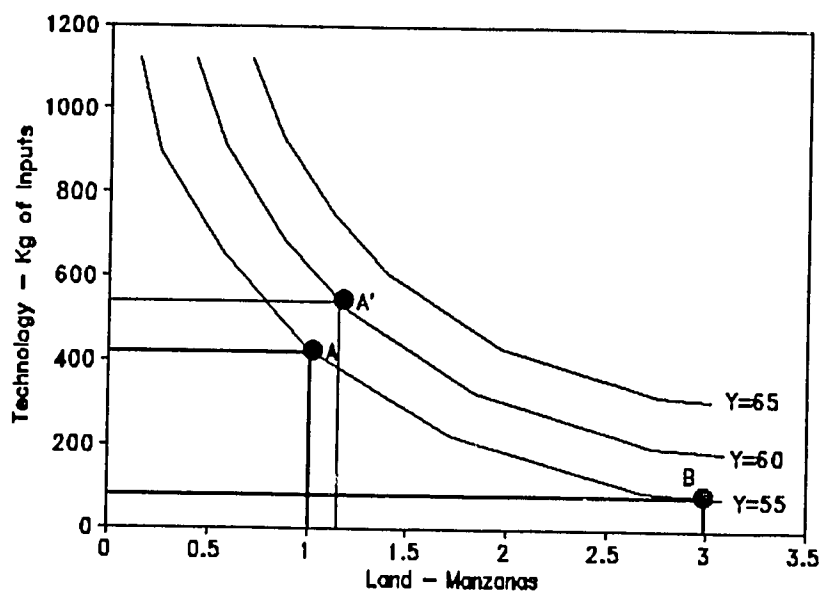
To produce a basic grain crop, for this example we will use corn, a farmer will use a number of resources. Let us also assume that the farmer has two variable inputs, (1) the amount of land which can be planted to basic grain crops, and (2) the technological package available to him (seeds, fertilizer, pesticides).

Finally, we will assume that other inputs, such as the amount of available labor are fixed. The first step in finding a best combination of land and technology is to look at the physical relationship between the inputs and the yield. Of great practical importance is the fact that different combinations of land and technology can give the same yield. Generally if we reduce the amount of land planted, the only way to keep the same yield is to increase the amount of technology used.

For example, if we start with a lot of land and little technology we will get some corn yield. Point B in Figure II-6 represents 3 manzanas of land and 78 kilograms of technology which together produce 55 quintals (qq) of corn. By reducing the amount of land used and increasing the amount of technology used, we can find other combinations of land and technology which will give this same 55 quintal corn yield. For example, at Point A, 55 qq of corn are produced using 1 manzana of land and 425 kilograms of technological inputs. A graph of points of equal yield, such as the curved line Y=55 in Figure II-6, gives an "equal production" curve, which is also called an *isoquant*. Thus an equal production curve (isoquant) shows all combinations of land and technology that can be used to produce a specific corn yield. In our case it is the Y=55 qq isoquant. By increasing both land and technology we can get a higher corn yield. For example at Point A' more land and more technology are used to produce 60 qq of corn. Land and technology can be varied to provide a new isoquant at a higher corn yield level. In Figure II-6 isoquants have been drawn for yields of 60 qq (Y=60) and 65 qq (Y=65).

FIGURE II-6

ISOQUANT MAP



2. Economic optimization of two inputs

Each point on an isoquant represents a combination of land and technology. The first economic question to be answered is which of the many combinations of land and technology, all of which give us the same corn yield, i.e. they are on the same isoquant, is the "best". The "best" combination will produce a specific corn yield at the lowest possible cost, i.e. we want to know which combination produces 55 qq of corn at the least cost. In order to find the optimum combination of land and technology we must consider the prices of both land and technology. If we know the price of land (rent) and the price of technology (cost of inputs) we can define the relationship in the costs of land and technology by using a "budget" line (also called an *isocost line*). This line shows how much land and how much technology can be purchased with a fixed amount of money.

For example, the straight line B=1,000 in Figure II-7 shows a 1,000 colon budget line when the price of technology is C1.17 per kg and the price of land (rent) is C500.00 per manzana. The end points of this budget line are determined by purchasing all land (2 manzanas at C500.00 per manzana = C1,000) or all technology (855 kg at C1.17 per kg = C1,000). The best combination of land and technology to use is determined by the point where the budget line touches the isoquant (Point A). At this point we have the best (i.e., the lowest total cost) combination, or ratio, of land and technology for producing 55 qq of corn, represented by the Y=55 isoquant.

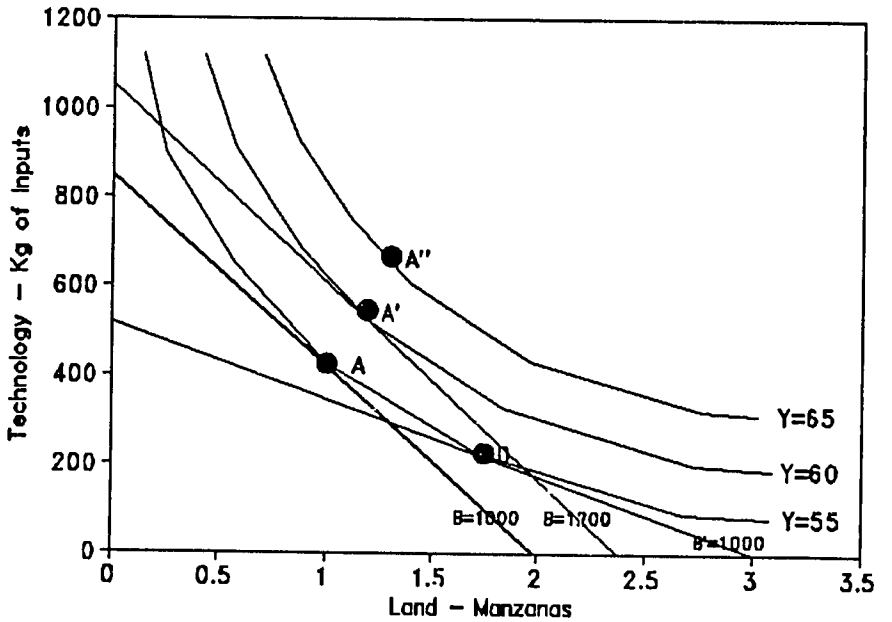
If we change the prices of land and technology we will change the slope of the budget line and thus move to a different best combination (ratio) of land and technology, represented by a different point on the isoquant. For example, if we have a C1,000 budget, land rents for C333.33 and technology costs C1.82 per kg, then we have budget line B'=1,000 which is tangent to isoquant Y=55 at Point D. In this example the rent for land is less and the price of technology is higher than with budget B=1,000, so we would use more land and less technology at the best production point for budget B'=1,000.

Once the best ratio of land and technologies has been found we can increase both land and technology together, using the same ratio, to increase the amount of corn produced, i.e., we move to a higher isoquant. In our case isoquants Y=60 and Y=65. For each of these higher levels of corn yield there is a least cost combination of land and technology, shown by a new budget line, which is at a higher total cost. For isoquant Y=60 the new least cost combination point is at A' on budget line B=1,200, representing an increase of C200 in production costs. Note that as long as the prices of land and technology remain the same, the budget lines for higher isoquants will be parallel to budget line B=1,000. The set of points (A, A', A", etc.) representing progressively higher levels of corn yield, at the lowest cost of land and technology, will form a production curve like the one in Figure II-7.

As long as the prices of land and technology remain constant, the best (optimum) amount of land and technology to use will remain in a fixed ratio, and our problem is the same as in the single input case discussed earlier. That is, we will produce at the point where the cost of an additional unit of land and technology, taken together in a fixed ratio, is equal to the value of the resulting additional corn yield.

FIGURE II-7

ISOQUANT\ISOCOST MAP



In order to find this optimum use of land and technology we must know the price of a unit of the corn yield as well as the prices of land and technology. When these prices change there will be a different combination of land, technology and corn yield which will be the highest possible yield at the lowest cost, i.e. the optimum production point.

3. The demand

How much land and technology will be used, i.e. the demand for each, is then determined by how much is used, in combination with the other input, in the production of corn. Thus, the individual demand curve for each input will be derived based on the demand for the combined inputs. Where the inputs are used in making several different products; i.e. land and technology are used in producing most crops, not just corn; the total demand is a summation of demand derived from the individual crop production functions, summed over all manzanas of production of the crops. Shifts for the combined demand curve, and for the individual input's demand curves, will be similar to shifts discussed by Hugo, Andrews and Stimpson in "Invigorating the Seed Industry in El Salvador" (pp. 6-8) except that shifts in input prices will create a whole new combined input demand curve with different ratios of the inputs.

C. Trends in Utilization of Fertilizers and Pesticides [5]

Section II-A summarized the trends and the composition of basic grains production during the last 30 years. It seems that a development very unique to all grains took place in which two decades of intensification (increased use of technology and higher yields) were followed by one of extensification and loss of technology (increased used of land and lower rate of yield increases and/or levels).

Section II-B presented a synopsis of the demand theory for agricultural inputs. It highlighted the different ways a specific level of output can be reached by using different amounts on two production inputs in an optimum manner. In this case the inputs considered were land and technology (agricultural inputs such as fertilizers and pesticides).

Section II-C reviews the trends in fertilizer and pesticide utilization in basic grains production to see whether there is a correlation between the findings in Section II-A and what the theory seems to suggest might have happened to the use of technology in basic grains production.

1. National fertilizer use, imports, and prices

In the case of El Salvador, two time series related to fertilizer are useful in identifying trends in the industry. These are: utilization and imports. Total fertilizer imports are a good indicator of fertilizer use because only one company produces fertilizers locally.

a. Utilization

Utilization statistics (Figure II-8, Table II-2) show a generally high level of fertilizer use in the late 1970's. A peak of 382,000 mt was reached in 1978, followed by a 56 percent decrease in the early 1980's down to nearly 200,000 mt. The 1980's can be characterized as a period of major fluctuations in fertilizer utilization, specially in complex fertilizers. A slight upward trend in the use of fertilizers increased utilization to 315,000 mt by 1988. The final two years of the period again showed a downward trend. Overall, from 1976 to 1990 there was a 29 percent decrease in the use of fertilizers.

Complex fertilizer has shown a much greater annual fluctuations than has simple fertilizer. However, during the 1976 to 1990 period, simple fertilizer utilization declined by 63 percent from 250,000 mt to 154,000 while complex fertilizer use increased by 22 percent from 90,000 to 109,000 mt.

b. Imports

The same general trends noted in fertilizer utilization are evident in fertilizer imports (Figure II-9, Table II-3), i.e. a generally steady growth in the 1970's, followed by very erratic but declining import levels during the 1980's. Total fertilizer imports declined 25 percent over the last decade, with simple

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[5] Due to the extensive use of data in this section, all tables and figures are presented immediatly after the text.

fertilizers being almost constant (5 percent decrease) and complex fertilizers showing a much greater decrease (81 percent).

Looking back over two decades the high point in fertilizer import was 1977 (450,000 mt) and the low point was 1982 (145,000 mt). There was an 11 percent overall decrease in fertilizer imports during the last 21 years, composed of a 5 percent increase in simple fertilizers and a 57 percent decrease in complex fertilizers.

c. Prices

Over the last 15 years the average nominal price paid for fertilizers (Figure II-10, Table II-4) has shown a relatively steady upward trend. The cumulative increase during the period (1975-90) was 147 percent. Nominal fertilizer and average farm-gate prices for the four basic grains have tended to follow the same generally increasing path, with fertilizer prices rising more rapidly in the early 1980's, leading to a widening in the gap between the prices. In the mid-1980's the gap again closed with some major fluctuations interrupting a generally parallel rise in nominal prices. Overall, fertilizer prices increased 209 percent from 1978 to 1990 average while farm-gate basic grain prices increased 205 percent.

2. Fertilizer use by crop

On a crop by crop basis, during the last six years,[6] total fertilizer use for producing basic grains has been relatively constant, with two crops (corn and sorghum) showing a minor increase in fertilizer use between 1985/86 and 1990/91, while two crops (beans and rice) showed a decrease.

There was a small, 3 percent, increase in total fertilizer used on basic grain crops (Figure II-11, Table II-5) during the last six years. Fertilizer used on corn accounted for most of the fertilizer used on basic grains, ranging from 68 to 83 percent of the total. This distribution was generally true for both simple and complex fertilizers.

a. Corn

In the case of corn (Figure II-12, Table II-6) there was a peak in use in 1987-88 with a general decline since. Overall fertilizer use on corn increased 8 percent. Simple and complex fertilizer use moved together over most of the six year period, with simple fertilizer use increasing and complex decreasing between 1989-90 and 1990-91. The general recommendation made by the Extension Service, to use equal parts of simple and complex fertilizer, is reflected in Figure II-12 with simple fertilizer accounting for 50 to 59 percent of the total.

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[6] This time series was assembled from raw data provided by Economía Agrícola. A longer time series was not available.

b. Beans

Fertilizer use on beans, over the last six years, has demonstrated an erratic but generally declining pattern (Figure II-13, Table II-7). During the period fertilizer use on beans decreased by 42 percent. Most (87 to 96 percent) of fertilizer used was complex fertilizer. Again, the high percentage of complex fertilizer used on beans reflects the Extension Service's fertilizer recommendation of only using complex fertilizer on beans planted after corn, e.g., the majority of the beans planted. Simple fertilizer maintained a low and relatively constant pattern during the period.

c. Rice

Rice production also showed a decrease in fertilizer use with a decline of 40 percent (Figure II-14, Table II-8). Fertilizer use for rice was marked by a very high peak in 1988-89, over three times as high as the next highest year. Simple and complex fertilizer use moved together, and at almost the same level (simple fertilizer was from 50 to 69 percent of total), over the period. Again this reflects the recommendation to use equal parts of simple and complex fertilizer for rice production.

d. Sorghum

In the case of sorghum, fertilizer use showed a slight (18 percent) increase over the six years (Figure II-15, Table II-9). The pattern was characterized by an increase, peaking in 1987-88, followed by a decline. Simple fertilizer represented 64 to 83 percent of the total fertilizer used for most of the period.

e. Fertilizer use and yield trends

Table II-10 shows fertilizer use and yields per manzana by crop. The yield data is national average data reported by the Dirección General de Economía Agropecuaria. The fertilizer data is based on fertilizer used and the total manzanas planted to each crop.

On a per manzana basis, corn yield generally moved with fertilizer use from 1985-86 until 1987-88 (Figure II-16). Since 1987-88 yield has essentially remained constant while there has been a decrease in fertilizer use.

Bean yields showed great fluctuations but in a general way moved with fertilizer applied (Figure II-17). For beans, there has been a decreasing trend in fertilizer use per manzana coupled with a wide fluctuation in yield, which has increased slightly, particularly if the drought year of 1987-88 is ignored.

For rice there was a three year downward trend in yields, followed by a three year upward trend (Figure II-18) while fertilizer use, with the exception of one year (which may be a data error), have been relatively stable.

On the other hand, fertilizer use on sorghum has been erratic at a relatively low level (Figure II-19) while yields, with the exception of one drought year, have remained remarkably stable.

FIGURE II-8

FERTILIZER UTILIZATION BY TYPE

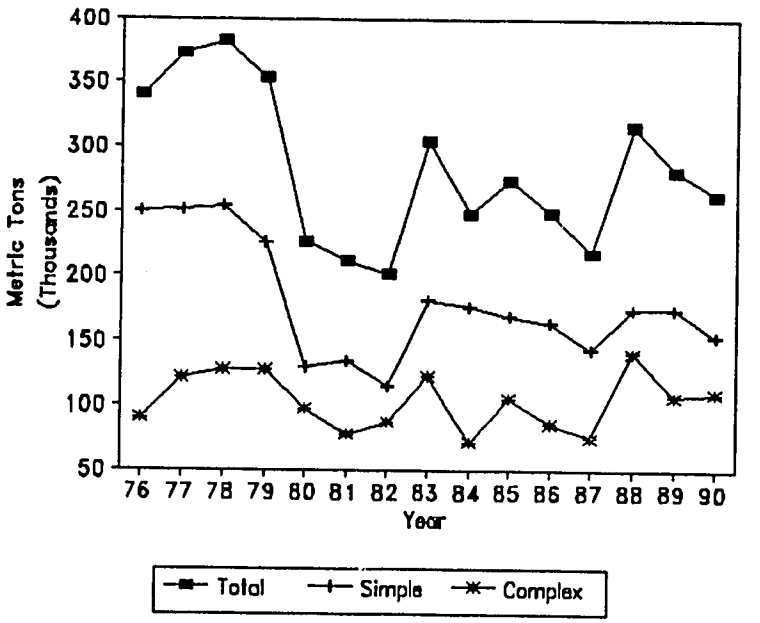


TABLE II-2

UTILIZATION OF FERTILIZERS BY TYPE
(Metric Tons)

YEAR	SIMPLE	COMPLEX	TOTAL
76	250,480	89,728	340,208
77	250,814	121,712	372,526
78	254,059	127,937	381,996
79	225,684	127,644	353,328
80	129,560	96,890	226,450
81	134,763	77,164	211,927
82	114,494	87,217	201,711
83	181,501	122,450	303,951
84	176,814	71,695	248,509
85	169,090	105,023	274,113
86	163,513	85,370	248,883
87	142,972	74,837	217,809
88	174,558	140,854	315,412
89	174,313	106,628	280,941
90	153,646	109,335	262,981

Source: Appendix 8. File: TABIIC-1.WQ1 and FIGIIC-1.PIC

FIGURE II-9

FERTILIZER IMPORTS BY TYPE (Metric Tons)

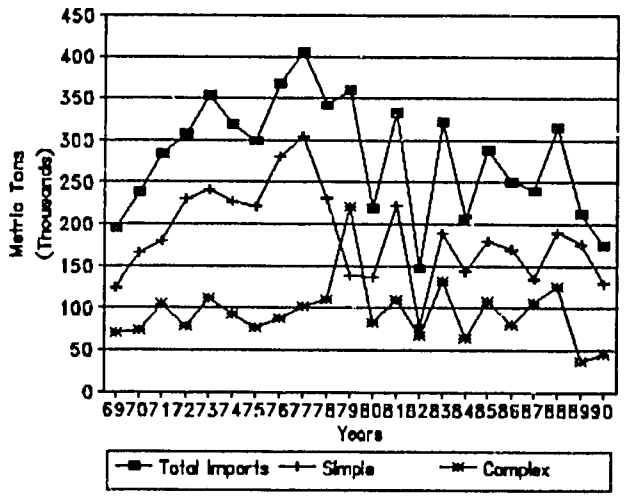


TABLE II-3

FERTILIZER IMPORTS BY TYPE (Metric Tons)

YEAR	SIMPLE	COMPLEX	TOTAL
1969	123,362	71,230	194,592
1970	164,964	72,875	237,839
1971	179,465	104,524	283,989
1972	229,556	78,080	307,636
1973	241,196	111,822	353,018
1974	226,264	92,672	318,936
1975	221,025	77,527	298,552
1976	279,959	87,600	367,559
1977	304,176	101,327	405,503
1978	230,884	110,485	341,369
1979	138,523	220,989	359,512
1980	136,156	82,144	218,300
1981	222,339	110,216	332,555
1982	79,126	67,543	146,669
1983	189,046	132,291	321,337
1984	143,048	63,455	206,503
1985	179,002	108,907	287,909
1986	169,847	80,789	250,636
1987	134,682	105,800	240,482
1988	189,596	125,494	315,090
1989	175,530	37,352	212,882
1990	129,169	45,401	174,570

Source: Appendix 8. File: TABIIC-2.WQ1 and FIGIIC-2.PIC

FIGURE II-10

AVERAGE NOMINAL FERTILIZER AND BASIC GRAINS FARM GATE PRICES

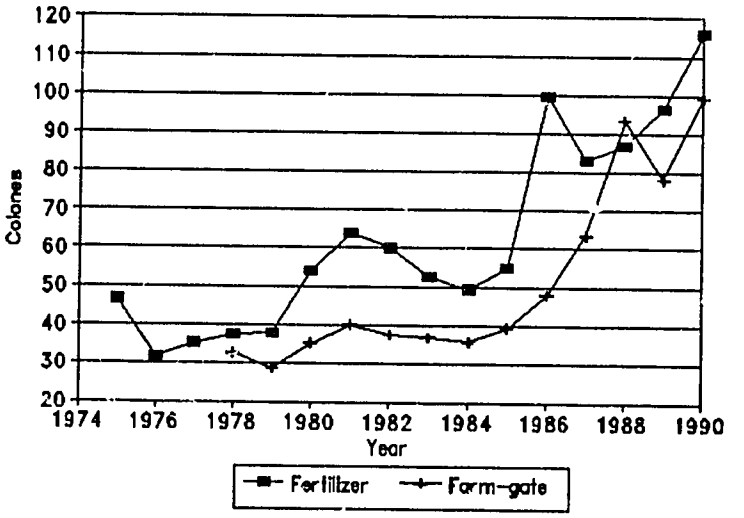


TABLE II-4

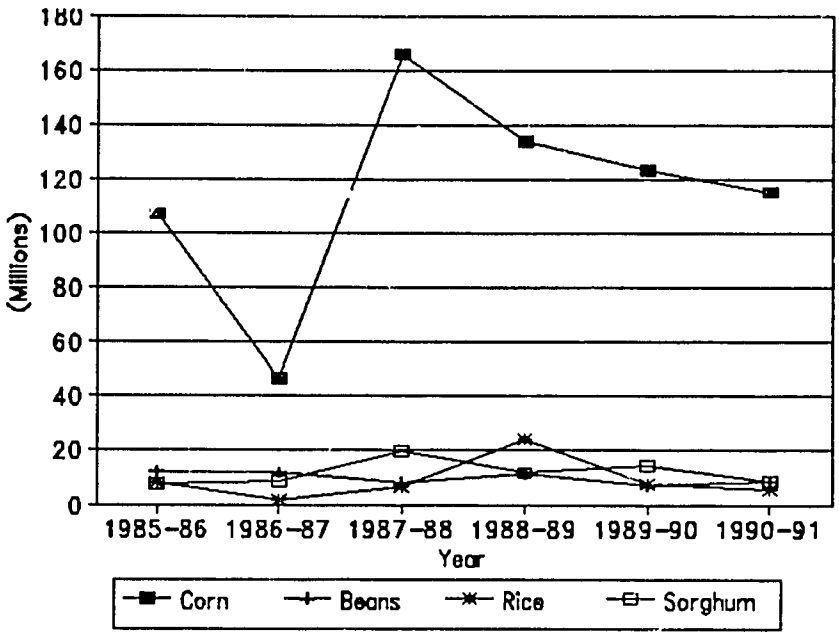
NOMINAL FERTILIZER AND FARM GATE PRICES FOR BASIC GRAINS

YEAR	SIMPLE	COMPLEX	AVERAGE	AVG GRAIN FARM-GATE
	COLONES PER 100 KG			C/QQ
1975	33.50	60.00	46.75	
1976	20.50	43.00	31.75	
1977	28.00	42.50	35.25	
1978	31.50	43.50	37.50	32.54
1979	31.50	44.50	38.00	28.55
1980	47.50	60.17	53.83	35.15
1981	55.33	72.50	63.92	40.12
1982	47.33	72.67	60.00	37.51
1983	40.33	64.50	52.42	36.91
1984	37.75	61.00	49.38	35.68
1985	44.00	66.00	55.00	39.46
1986	73.75	125.50	99.63	47.83
1987	60.08	105.92	83.00	63.46
1988	63.88	109.75	86.81	93.43
1989	77.65	115.36	96.51	78.11
1990	86.66	144.74	115.70	99.12

Source: Appendix 8. File: TABIIC-3.WQ1; FIGIIC-3.PIC

FIGURE II-11

TOTAL FERTILIZER USE BY CROP AND YEAR
(Kilograms)



Source: Table II-5; FIGIIC-A.PIC

TABLE II-5

SUMMARY OF FERTILIZER USE BY CROP AND YEAR (Kilograms)

SIMPLE FERTILIZERS

YEAR	CORN	% OF TOTAL	BEANS	% OF TOTAL	RICE	% OF TOTAL	SORGHUM	% OF TOTAL	TOTAL
1985-86	54,223,346	83.8%	925,994	1.4%	3,992,718	6.2%	5,541,865	8.6%	64,683,923
1986-87	27,015,362	75.0%	1,460,906	4.1%	908,465	2.5%	6,627,537	18.4%	36,012,270
1987-88	88,325,378	83.1%	314,091	0.3%	4,341,924	4.1%	13,262,927	12.5%	106,244,320
1988-89	71,840,438	76.6%	554,486	0.6%	12,062,819	12.9%	9,313,319	9.9%	93,771,062
1989-90	64,394,594	82.5%	666,338	0.9%	3,851,637	4.9%	9,125,371	11.7%	78,037,940
1990-91	67,683,608	85.6%	1,079,439	1.4%	3,071,919	3.9%	7,251,643	9.2%	79,086,609

COMPLEX FERTILIZERS

YEAR	CORN	% OF TOTAL	BEANS	% OF TOTAL	RICE	% OF TOTAL	SORGHUM	% OF TOTAL	TOTAL
1985-86	52,780,292	75.8%	11,175,567	16.0%	3,862,571	5.5%	1,838,843	2.6%	69,657,273
1986-87	19,559,058	60.9%	10,216,926	31.8%	570,588	1.8%	1,768,304	5.5%	32,114,876
1987-88	77,611,722	83.0%	7,572,376	8.1%	1,971,912	2.1%	6,323,357	6.8%	93,479,367
1988-89	62,450,452	71.2%	10,746,233	12.3%	12,075,738	13.8%	2,404,144	2.7%	87,676,567
1989-90	59,039,271	79.8%	6,171,283	8.3%	3,666,108	5.0%	5,152,146	7.0%	74,028,808
1990-91	47,693,450	80.7%	7,413,367	12.5%	2,541,600	4.3%	1,443,635	2.4%	59,092,052

TOTAL FERTILIZERS

YEAR	CORN	% OF TOTAL	BEANS	% OF TOTAL	RICE	% OF TOTAL	SORGHUM	% OF TOTAL	TOTAL
1985-86	107,003,638	79.7%	12,101,561	9.0%	7,855,289	5.8%	7,380,708	5.5%	134,341,196
1986-87	46,574,420	68.4%	11,677,832	17.1%	1,479,053	2.2%	8,395,841	12.3%	68,127,146
1987-88	165,937,100	83.1%	7,886,467	3.9%	6,313,836	3.2%	19,586,284	9.8%	199,723,687
1988-89	134,290,890	74.0%	11,300,719	6.2%	24,138,557	13.3%	11,717,463	6.5%	181,447,629
1989-90	123,433,865	81.2%	6,837,621	4.5%	7,517,745	4.9%	14,277,517	9.4%	152,066,748
1990-91	115,377,058	83.5%	8,492,806	6.1%	5,613,519	4.1%	8,695,278	6.3%	138,178,661

Source: Appendix 8

File: TABIIC-A.WQ1

FIGURE II-12

FERTILIZER USE ON CORN BY TYPE AND YEAR

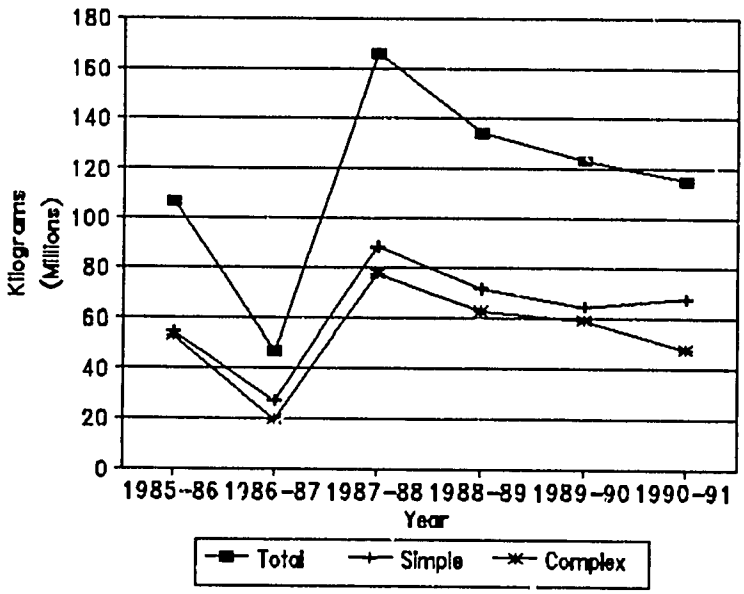


TABLE II-6

FERTILIZER USE ON CORN BY TYPE AND YEAR

	SIMPLE FERTILIZERS			COMPLEX FERTILIZERS		TOTAL FERTILIZERS		
YEAR	AREA (MZ)	KILOGRAMS	% OF TOTAL	AREA (MZ)	KILOGRAMS	AREA (MZ)	KILOGRAMS	NATIONAL CORN AREA (MZ)
85-86	375,668	54,223,346	50.7%	377,117	52,780,292	752,785	107,003,638	362,100
86-87	161,172	27,015,362	58.0%	149,346	19,559,058	310,518	46,574,420	368,100
87-88	515,117	88,325,378	53.2%	485,173	77,611,722	1,000,290	165,937,100	398,500
88-89	415,264	71,840,438	53.5%	382,936	62,450,452	798,200	134,290,890	402,800
89-90	363,527	64,394,594	52.2%	347,110	59,039,271	710,637	123,433,865	394,700
90-91	418,557	67,683,608	58.7%	323,441	47,693,450	741,998	115,377,058	402,600

Source: Appendix 8

File: TABIIC-4.WQ1 and FIGIIC-4.PIC

FIGURE II-13

FERTILIZER USE ON BEANS BY TYPE AND YEAR

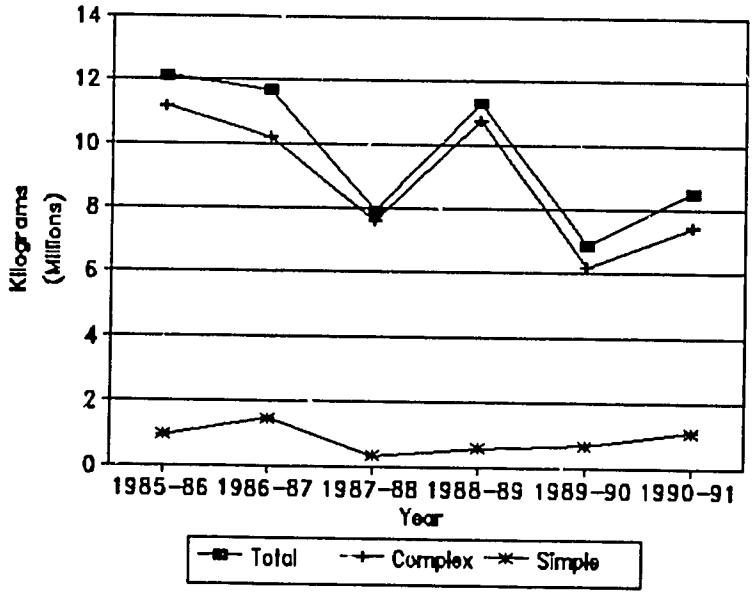


TABLE II-7

FERTILIZER USE ON BEANS BY TYPE AND YEAR

	SIMPLE FERTILIZERS		COMPLEX FERTILIZERS			TOTAL FERTILIZERS		
YEAR	AREA (MZ)	TOTAL (KG)	AREA (MZ)	TOTAL (KG)	% OF TOTAL	AREA (MZ)	TOTAL (KG)	NATIONAL BEAN AREA (MZ)
85-86	11,072	925,994	137,279	11,175,567	92.3%	148,351	12,101,561	83,300
86-87	14,223	1,460,906	101,816	10,216,926	87.5%	116,039	11,677,832	87,100
87-88	2,895	314,091	73,071	7,572,376	96.0%	75,966	7,886,467	89,300
88-89	22,291	554,486	94,449	10,746,233	95.1%	116,740	11,300,719	96,100
89-90	30,568	666,338	83,348	6,171,283	90.3%	113,916	6,837,621	91,600
90-91	6,315	1,079,439	81,162	7,413,367	87.3%	87,477	8,492,806	89,500

Source: Appendix 8

File: TABIIC-5.WQ1 and FIGIIC-5.PIC

FIGURE II-14

FERTILIZER USE ON RICE BY TYPE AND YEAR

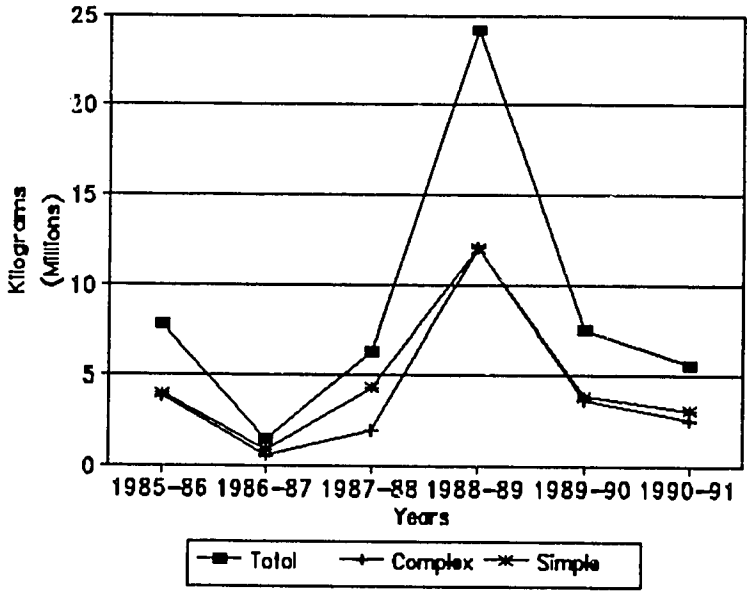


TABLE II-8

FERTILIZER USE ON RICE BY TYPE AND YEAR

	SIMPLE FERTILIZERS			COMPLEX FERTILIZERS		TOTAL FERTILIZERS		
YEAR	AREA (MZ)	TOTAL (KG)	% OF TOTAL	AREA (MZ)	TOTAL (KG)	AREA (MZ)	TOTAL (KG)	NATIONAL RICE AREA (MZ)
85-86	23,466	3,992,718	50.8%	24,210	3,862,571	47,676	7,855,289	24,700
86-87	4,464	908,465	61.4%	3,277	570,588	7,741	1,479,053	17,200
87-88	18,746	4,341,924	68.8%	12,611	1,971,912	31,357	6,313,836	16,700
88-89	35,507	12,062,819	50.0%	36,681	12,075,738	72,188	24,138,557	19,700
89-90	17,230	3,851,637	51.2%	31,919	3,666,108	49,149	7,517,745	22,200
90-91	14,427	3,071,919	54.7%	24,943	2,541,600	39,370	5,613,519	20,400

Source: Appendix 8

File: TABIIC-6.WQ1 and FIGIIC-6.PIC

FIGURE II-15

FERTILIZER USE ON SORGHUM BY TYPE AND YEAR

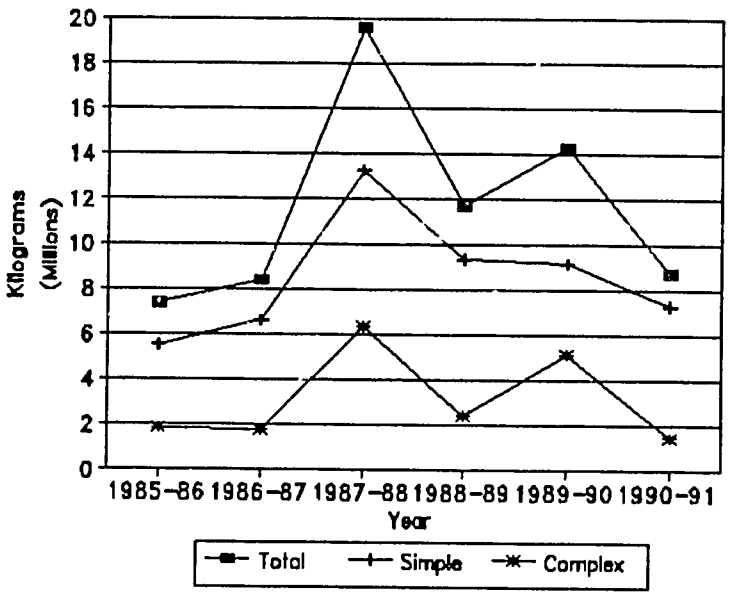


TABLE II-9

FERTILIZER USE ON SORGHUM BY TYPE AND YEAR

	SIMPLE FERTILIZERS			COMPLEX FERTILIZERS		TOTAL FERTILIZERS		
YEAR	AREA (MZ)	TOTAL (KG)	% OF TOTAL	AREA (MZ)	TOTAL (KG)	AREA (MZ)	TOTAL (KG)	NATIONAL SORG AREA (MZ)
85-86	52,666	5,541,865	75.1%	17,906	1,838,843	70,572	7,380,708	163,400
86-87	59,885	6,627,537	78.9%	16,394	1,768,304	76,279	8,395,841	171,500
87-88	114,502	13,262,927	67.7%	59,926	6,323,357	174,428	19,586,284	178,700
88-89	86,032	9,313,319	79.5%	40,386	2,404,144	126,418	11,717,463	174,200
89-90	98,711	9,125,371	63.9%	41,920	5,152,146	140,631	14,277,517	170,900
90-91	66,662	7,251,643	83.4%	14,396	1,443,635	81,058	8,695,278	184,700

Source: Appendix 8

File: TABIIC-7.WQ1 and FIGIIC-7.PIC

TABLE II-10

FERTILIZER USE AND YIELD PER MANZANA BY CROP

	CORN		BEANS		RICE		SORGHUM	
YEAR	FERT KG/MZ	YIELD Q/MZ	FERT KG/MZ	YIELD Q/MZ	FERT KG/MZ	YIELD Q/MZ	FERT KG/MZ	YIELD Q/MZ
85-86	296	29.7	145	9.0	318	60.6	45	17.6
86-87	127	25.8	134	12.6	86	59.3	49	18.7
87-88	416	31.2	88	6.0	378	54.8	110	3.2
88-89	333	32.3	118	12.9	1225	63.2	67	19.1
89-90	313	32.4	75	10.6	339	62.4	84	19.0
90-91	287	32.5	95	12.8	275	65.7	47	18.9

Average fertilizer use based on total national area planted.
Average yield based on national average yield.
SOURCE: Fertilizer Data: Appendix 8.
Yield Data: Política Agrícola, Vol 1, Aug 1991, UAD-MAG

File: TABIIC-8.WQ1

FIGURE II-16

FERTILIZER USE AND YIELD LEVELS FOR CORN

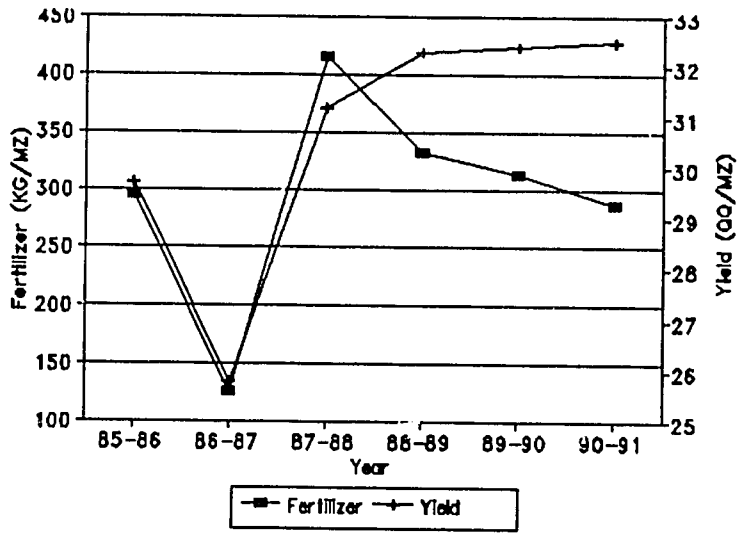
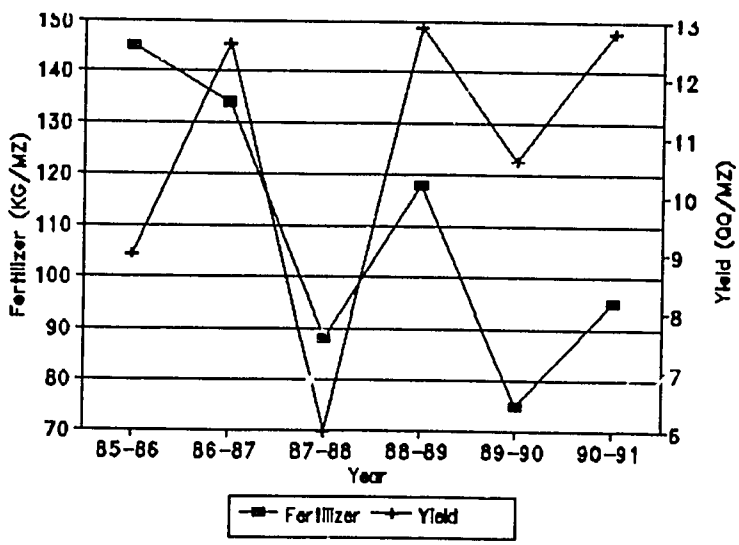


FIGURE II-17

FERTILIZER USE AND YIELD LEVELS FOR BEANS



Source: Table II-10; File: FIGIIC-8.PIC and FIGIIC-9.PIC

FIGURE II-18

FERTILIZER USE AND YIELD LEVELS FOR RICE

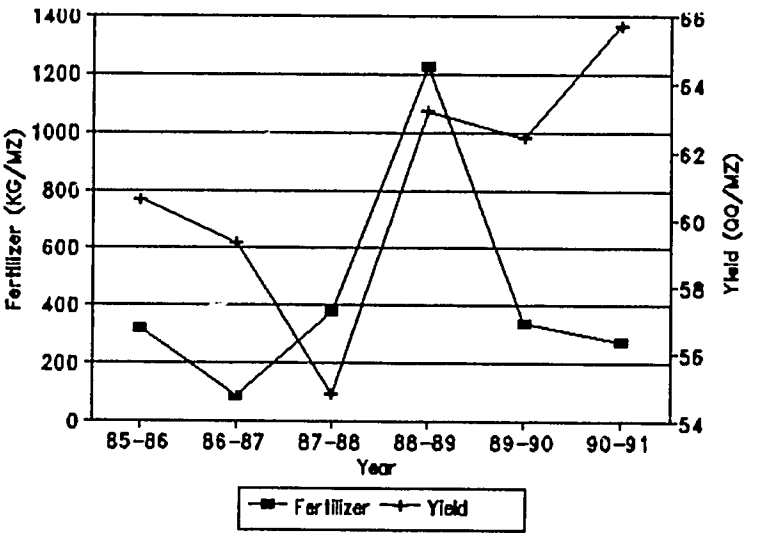
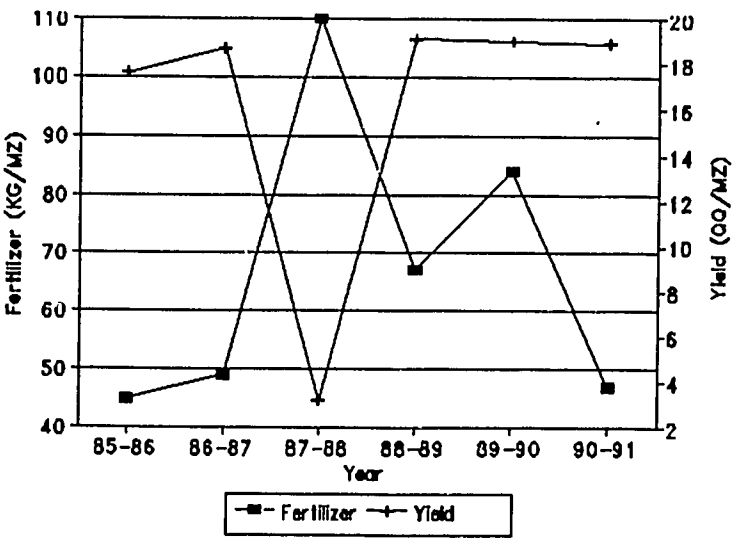


FIGURE II-19

FERTILIZER USE AND YIELD LEVELS FOR SORGHUM



Source: Table II-10; File: FICIIC10.PIC and FIGIIC11.PIC

3. National pesticide use, imports and prices

a. Utilization

Over the last decade national utilization of pesticides showed a steady increase which peaked in 1985 when 11.7 million units of pesticides were used. A rapid decline followed, with the last two years being constant at a much lower level (2.5 million units) than at the beginning of the decade (Figure II-20 Table II-11). Pesticide use in 1990 was only 36 percent of the use in 1981, an overall declined of 179 percent. The different types of pesticides followed the same general trend as overall use. Fungicides showed the most stability. Over the decade insecticide use decreased 294 percent and fungicide use decreased by 135 percent, while herbicide use actually increased by 8 percent. In 1990 insecticides accounted for 60 percent of all pesticides, followed by herbicides with 36 percent, while fungicides accounted for only 4 percent of all pesticides used.

b. Imports

Since pesticides are imported, the net imports of pesticides demonstrated an expected general downward, however, erratic trend over the last decade (Figure II-21, Table II-12). From 1980 to 1990, there was an overall decrease of 74 percent in net pesticide imports. During this period the net importation of insecticides decreased the most, 98 percent, followed closely by net fungicide imports which decreased by 90 percent, while net herbicide imports decreased only 18 percent.

c. Prices

The decrease in pesticide use has been accompanied by a general increase in nominal pesticide prices, particularly over the last decade (Figure II-22, Table II-13). In nominal prices, the average price of five pesticides increased 252 percent over the last 15 years. A comparison of nominal pesticide prices and average farm-gate prices for four basic grains for the 1978-1990 period indicates that the basic grain prices generally increased more than pesticide prices in the early 1980's, with the gap closing in the mid-1980's. During the last four years grain prices have again climbed more rapidly than pesticide prices. However, over the 12 year period, the nominal average basic grains price rose 205 percent, while the nominal average pesticide price rose 246 percent.

4. Pesticide use by crop

Pesticide use by crop is based on pesticide use data collected by the Dirección General de Economía Agropecuaria. As with fertilizer this time series is based on surveys and is limited to the last six years from which these summaries were derived.

As with fertilizers, corn was the major user of pesticides, accounting for 58 to 82 percent of all pesticides used on basic grains (Figure II-23, Table II-14). This pattern carried through with most of the pesticides. While corn was the predominate user, herbicides tended to be more important in bean and rice production while fungicides had a greater importance with rice. The use of

chemicals to control slugs in beans dominated the "other pesticides" category in most years.

a. Corn

For the 1985-86 to 1990-91 period, the use of pesticides in corn grew 29 percent from 2.8 to 3.7 million units (Table II-15). Over this six year period the use of insecticide in corn first showed a slight increase, with one exceptionally low year, and then a large decrease, so that insecticide use at the end of the period was only half as much as at the beginning (Figure II-24). The portion of total pesticides accounted for by insecticide varied greatly, from 35 percent to 90 percent. Herbicide use, on the other hand, increased 762 percent, with the amount of herbicide used exceeding the amount of insecticide used by 83 percent in 1990-91. Herbicides accounted for 10 to 64 percent of pesticides used during the period. Fungicide and other pesticides (including chemicals to control slugs and snails, and foliar adherents) were not used to any great extend on corn, making up no more than 8 percent of total pesticides used in any year.

b. Beans

Overall, pesticide use in beans has tended to decline since 1985 when 585,900 units were used, with a light recovery in 1990-91. Insecticides used on beans (Figure II-25, Table II-16) demonstrated a slight decline in use, followed by a major drop in 1990-91, (possibly a data error). This was coupled with a somewhat erratic but relatively constant use of herbicides. Herbicide use more than doubled in 1990-91, (again this may be a data problem). With the exception of one year, insecticides accounted for close to half of the total pesticides (40% to 53%) while herbicides ranged from 25 to 50 percent of the total (again excluding one year of 79%).

The use of other chemicals, mostly for control of slugs, showed a decreasing then increasing pattern, for a decrease of 60 percent over the six years. The other chemicals group ranged from 6 to 28 percent of the total, usually accounting for more than one-fifth of the pesticides used. Fungicide use of beans was at a very low level (less than 1 percent of the total) for the entire period. Total use of pesticides on beans declined 13 during the period.

c. Rice

Overall, pesticide use in rice peaked in 1987-88 and have since decreased to less than 50% of the levels achieved in 1985-86 (Table II-17; Figure II-26). The use of herbicide on rice showed a rapid growth from 1985-86 to 1987-88, followed by a equally rapid decline, for an overall increase of 4 percent for the six years Insecticides started the period at a high level and then dropped to practically no use, finally stabilizing at a relatively low level. Fungicides and other chemicals were relatively constant at a low level of use.

At the end of the six years, pesticide use on rice had declined to only 45 percent of the use at the beginning of the period. There was a great deal of fluctuation in the use of the various pesticides, with insecticide use ranging from 3 to 80 percent of the total, and herbicide use ranging from 17 to 95

percent of the total pesticides. Fungicide and other chemicals never exceeded 10 percent of total pesticides used.

d. Sorghum

Pesticide use on sorghum grew 93 percent from 1985-86 to 1990-91 (Figure II-27, Table II-18). Insecticide use showed a growth and then decline while herbicide use declined and then grew. Herbicides were generally more important than insecticides (14 to 56%), accounting for 42 to 85 percent of the total pesticides used (except one year when "other chemicals" accounted for 70 percent of the total; possibly data error). Fungicide use and other chemicals were generally used at a low level (less than 3%) with the exception of a major peak in 1987-88.

e. Pesticide use and yield trends

Crop by crop comparisons of pesticide use and yields are almost photo copies of the same comparisons for fertilizer use and yields. These comparisons are presented in Table II-19 and Figures II-28 to II-31.

On a per manzana basis, corn yield generally moved with pesticide use from 1985-86 until 1987-88 (Figure II-28). Since 1987-88 yield has essentially remained constant while there has been a decrease in pesticide use.

Bean yields showed great fluctuations but in a general way moved with pesticide applied (Figure II-29). A decreasing trend in pesticide use per manzana during the first three years, was followed by an increasing trend during the last three. Yields have improved slightly, particularly if the drought year of 1987-88 is ignored.

For rice there was a three year downward trend in yields, followed by a three year upward trend (Figure II-30). Pesticide use, however showed an inverse pattern to yield levels during the same time period.

Pesticide use on sorghum has been erratic at a relatively low level (Figure II-31) while yields, with the exception of one drought year, have remained remarkably stable, showing apparently little response to pesticide use. Again, the average numbers may be masking the results of those farmers who do use pesticides.

FIGURE II-20

PESTICIDE USE BY TYPE AND YEAR

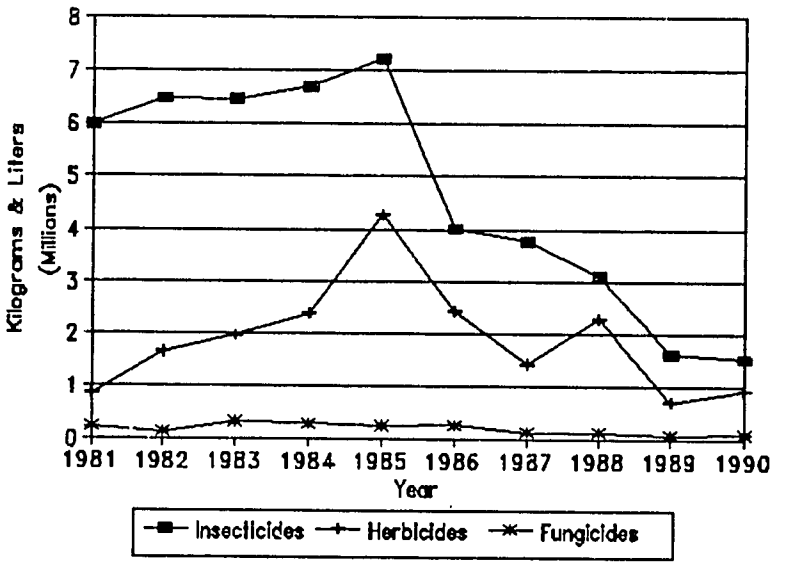


TABLE II-11

UTILIZATION OF PESTICIDES BY TYPE AND YEAR
(in Kilograms & Liters)

YEAR	INSECTICIDES	HERBICIDES	FUNGICIDES	TOTAL
1981	5,979,559	850,424	216,390	7,046,373
1982	6,466,054	1,650,199	123,390	8,239,643
1983	6,448,738	1,960,163	328,839	8,737,740
1984	6,680,359	2,387,487	290,129	9,357,975
1985	7,204,260	4,278,884	235,261	11,718,405
1986	4,005,150	2,423,297	252,386	6,680,833
1987	3,774,155	1,422,528	119,842	5,316,525
1988	3,112,707	2,292,890	120,231	5,525,828
1989	1,610,157	706,268	76,872	2,393,297
1990	1,517,083	916,524	92,159	2,525,766

Source: Appendix 8

File: TABIIC-9.WQ1 and FIGIIC12.PIC

FIGURE II-21

NET IMPORTS OF PESTICIDES BY TYPE AND YEAR

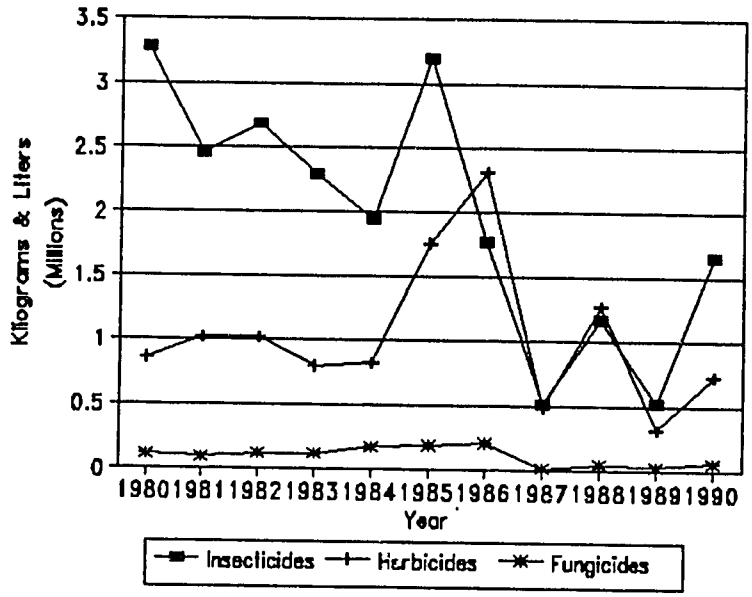


TABLE II-12

NET IMPORTS OF PESTICIDES BY TYPE AND YEAR
(in Kilograms & Liters)

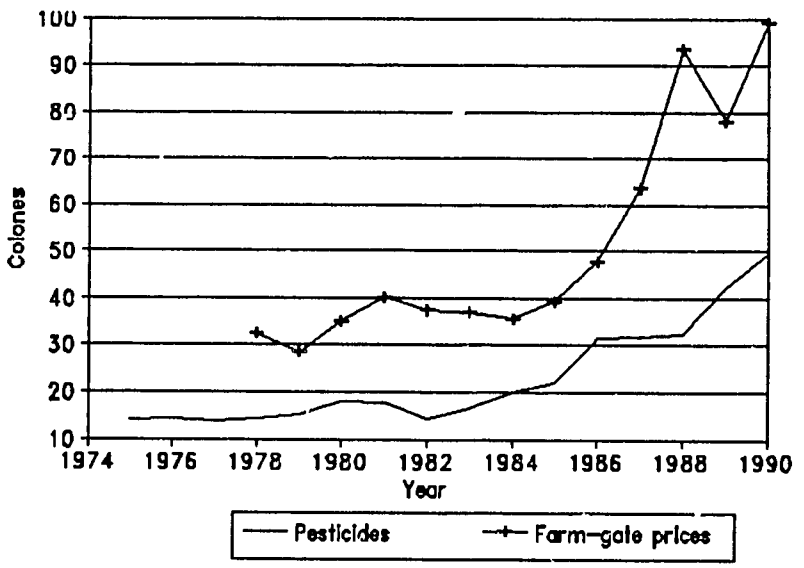
YEAR	INSECTICIDES	HERBICIDES	FUNGICIDES	TOTAL
1980	3,274,740	850,376	108,565	4,233,681
1981	2,459,485	1,013,595	92,254	3,565,334
1982	2,686,988	1,012,718	121,647	3,821,353
1983	2,295,711	787,212	117,838	3,200,761
1984	1,940,798	820,531	172,697	2,934,026
1985	3,199,281	1,755,234	188,846	5,143,361
1986	1,768,342	2,306,931	209,198	4,284,471
1987	512,410	488,307	18,293	1,019,010
1988	1,161,784	1,261,764	47,452	2,471,000
1989	517,838	314,936	28,451	861,225
1990	1,656,089	719,606	57,277	2,432,972

Source: Appendix 8

File: TABIIC10.WQ1 and FIGIIC13.PIC

FIGURE II-22

NOMINAL PESTICIDE AND FARM-GATE GRAIN PRICES



TABL[illegible]-13

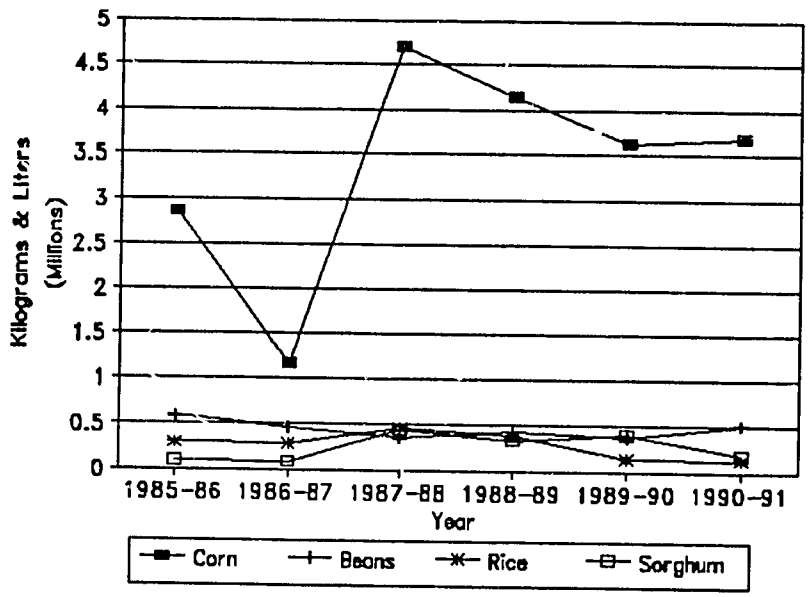
NOMINAL PESTICIDE [illegible]-GATE GRAIN PRICES

YEAR	AVERAGE FOR FIVE PESTIC[illegible]	AVERAGE FARM GATE PRICES FOR BASIC GRAINS
1975	14.05	
1976	14.23	
1977	13.86	
1978	14.29	32.54
1979	15.39	28.55
1980	18.09	35.15
1981	17.80	40.12
1982	14.13	37.51
1983	16.54	36.91
1984	19.97	35.68
1985	21.80	39.46
1986	31.56	47.83
1987	31.85	63.46
1988	32.51	93.43
1989	42.17	78.11
1990	49.43	99.12

Source: Appendix 8 File: TABIIC11.WQ1 and FIGIIC14.PIC

FIGURE II-23

TOTAL PESTICIDE USE BY CROP AND YEAR



Source: Table II-14

TABLE II-14

SUMMARY OF PESTICIDE USE BY CROP BY TYPE AND YEAR

INSECTICIDES

YEAR	CORN KG & LT	% OF TOTAL	BEANS KG & LT	% OF TOTAL	RICE KG & LT	% OF TOTAL	SORGHUM KG & LT	% OF TOTAL	TOTAL KG & LT
1985-86	2,570,015	84.2%	232,774	7.6%	234,500	7.7%	13,751	0.5%	3,051,040
1986-87	509,868	65.3%	227,023	29.1%	7,738	1.0%	36,743	4.7%	781,372
1987-88	2,928,774	88.5%	184,688	5.6%	91,317	2.8%	105,563	3.2%	3,310,342
1988-89	2,885,586	86.5%	187,851	5.6%	77,165	2.3%	184,638	5.5%	3,335,240
1989-90	2,322,035	84.7%	189,013	6.9%	42,881	1.6%	187,407	6.8%	2,741,335
1990-91	1,296,903	91.6%	5,483	0.4%	67,878	4.8%	44,805	3.2%	1,415,069

HERBICIDES

YEAR	CORN KG & LT	% OF TOTAL	BEANS KG & LT	% OF TOTAL	RICE KG & LT	% OF TOTAL	SORGHUM KG & LT	% OF TOTAL	TOTAL KG & LT
1985-86	275,794	46.5%	187,025	31.5%	49,310	8.3%	81,005	13.7%	593,134
1986-87	653,444	59.8%	116,672	10.7%	275,644	25.2%	47,823	4.4%	1,093,583
1987-88	1,593,957	77.4%	94,250	4.6%	352,357	17.1%	19,751	1.0%	2,060,315
1988-89	941,429	60.1%	217,211	13.9%	268,056	17.1%	140,970	9.0%	1,567,666
1989-90	1,287,511	75.4%	108,902	6.4%	92,160	5.4%	219,069	12.8%	1,707,642
1990-91	2,378,557	80.1%	399,945	13.5%	51,367	1.7%	139,470	4.7%	2,969,339

TABLE II-14 (Continued)

FUNGICIDES

YEAR	CORN KG & LT	% OF TOTAL	BEANS KG & LT	% OF TOTAL	RICE KG & LT	% OF TOTAL	SORGHUM KG & LT	% OF TOTAL	TOTAL KG & LT
1985-86	14,900	73.4%	797	3.9%	4,612	22.7%	0	0.0%	20,309
1986-87	0	0.0%	3,187	63.5%	1,835	36.5%	0	0.0%	5,022
1987-88	168,915	91.1%	436	0.2%	5,536	3.0%	10,617	5.7%	185,504
1988-89	55	0.7%	1,077	13.5%	6,6[illegible]	83.6%	174	2.2%	7,980
1989-90	13,680	54.9%	1,580	6.3%	9,643	38.7%	0	0.0%	24,903
1990-91	6,690	34.3%	668	3.4%	11,934	61.2%	193	1.0%	19,485

OTHER PESTICIDES

YEAR	CORN KG & LT	% OF TOTAL	BEANS KG & LT	% OF TOTAL	RICE KG & LT	% OF TOTAL	SORGHUM KG & LT	% OF TOTAL	TOTAL KG & LT
1985-86	7,393	2.7%	165,344	60.6%	4,480	1.6%	769	0.3%	272,742
1986-87	742	0.4%	115,042	56.2%	4,427	2.2%	0	0.0%	204,777
1987-88	739	0.1%	71,763	13.9%	6,837	1.3%	300,824	58.3%	516,094
1988-89	319,350	45.1%	27,202	3.8%	30,298	4.3%	5,841	0.8%	708,473
1989-90	4,578	0.9%	76,421	15.7%	0	0.0%	0	0.0%	487,475
1990-91	5,526	1.9%	103,483	35.2%	257	0.1%	0	0.0%	293,734

TOTAL PESTICIDES

YEAR	CORN KG & LT	% OF TOTAL	BEANS KG & LT	% OF TOTAL	RICE KG & LT	% OF TOTAL	SORGHUM KG & LT	% OF TOTAL	TOTAL KG & LT
1985-86	2,868,102	74.6%	585,940	15.2%	292,902	7.6%	95,525	2.5%	3,842,469
1986-87	1,164,054	58.2%	461,924	23.1%	289,644	14.5%	84,566	4.2%	2,000,188
1987-88	4,692,385	79.0%	351,137	5.9%	456,047	7.7%	436,755	7.4%	5,936,324
1988-89	4,146,420	78.3%	433,341	8.2%	382,193	7.2%	331,623	6.3%	5,293,577
1989-90	3,627,804	79.6%	375,916	8.3%	144,684	3.2%	406,476	8.9%	4,554,880
1990-91	3,687,676	81.7%	509,579	11.3%	131,436	2.9%	184,468	4.1%	4,513,159

Source: Appendix 8

File: TABIIC-B.WQ1 and FIGIIC-B.PIC

FIGURE II-24

PESTICIDE USE ON CORN BY TYPE AND YEAR

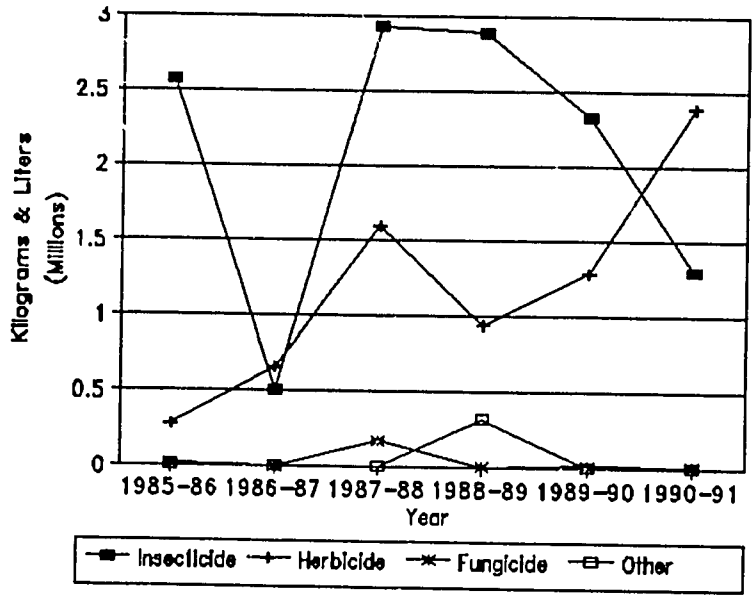


TABLE II-15

PESTICICE USE ON CORN BY TYPE AND YEAR

YEAR	TOTAL INSECT KG & LT	% OF TOTAL	TOTAL HERBIC KG & LT	% OF TOTAL	TOTAL FUNGIC KG & LT	% OF TOTAL	TOTAL OTHER KG & LT	% OF TOTAL	TOTAL PESTICIDE KG & LT
1985-86	2,570,015	89.6%	275,794	9.6%	14,900	0.5%	7,393	0.3%	2,868,102
1986-87	509,868	43.8%	653,444	56.1%	0	0.0%	742	0.1%	1,164,054
1987-88	2,928,774	62.4%	1,593,957	34.0%	168,915	3.6%	739	0.0%	4,692,385
1988-89	2,885,586	69.6%	941,429	22.7%	55	0.0%	319,350	7.7%	4,146,420
1989-90	2,322,035	64.0%	1,287,511	35.5%	13,680	0.4%	4,578	0.1%	3,627,804
1990-91	1,296,903	35.2%	2,378,557	64.5%	6,690	0.2%	5,526	0.1%	3,687,676

Source: Appendix 8

File: TABIIC-12.WK1 and FIGIIC15.PIC

FIGURE II-25

PESTICIDE USE ON BEANS BY TYPE AND YEAR

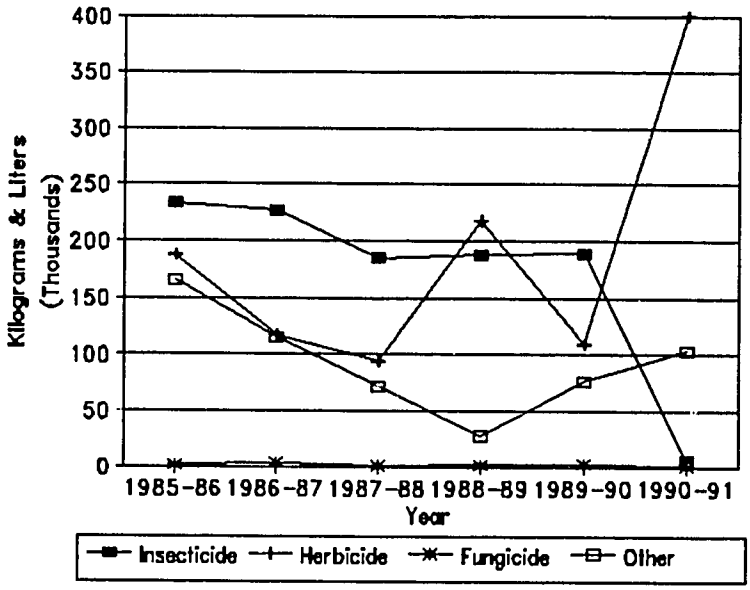


TABLE II-16

PESTICIDE USE ON BEANS BY TYPE AND YEAR

YEAR	TOTAL INSECT KG & LT	% OF TOTAL	TOTAL HERBIC KG & LT	% OF TOTAL	TOTAL FUNGIC KG & LT	% OF TOTAL	TOTAL OTHER KG & LT	% OF TOTAL	TOTAL PESTICIDE KG & LT
1985-86	232,774	39.7%	187,025	31.9%	797	0.1%	165,344	28.2%	585,940
1986-87	227,023	49.1%	116,672	25.3%	3,187	0.7%	115,042	24.9%	461,924
1987-88	184,688	52.6%	94,250	26.8%	436	0.1%	71,763	20.4%	351,137
1988-89	187,851	43.3%	217,211	50.1%	1,077	0.2%	27,202	6.3%	433,341
1989-90	189,013	50.3%	108,902	29.0%	1,580	0.4%	76,421	20.3%	375,916
1990-91	5,483	1.1%	399,945	78.5%	668	0.1%	103,483	20.3%	509,579

Source: Appendix 8

File: TABIIC-13.WK1 and FIGIIC16.PIC

FIGURE II-26

PESTICIDE USE ON RICE BY TYPE AND YEAR

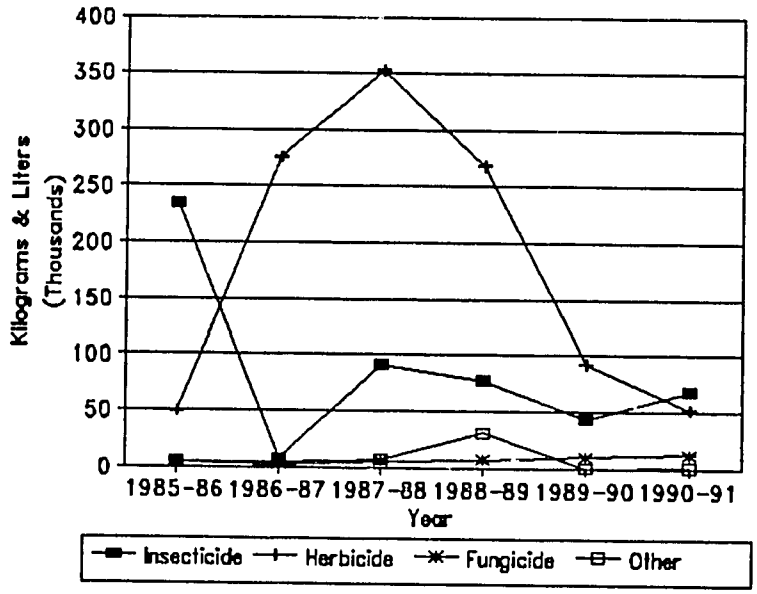


TABLE II-17

PESTICIDE USE ON RICE BY TYPE AND YEAR

YEAR	TOTAL INSECT KG & LT	% OF TOTAL	TOTAL HERBIC KG & LT	% OF TOTAL	TOTAL FUNGIC KG & LT	% OF TOTAL	TOTAL OTHER KG & LT	% OF TOTAL	TOTAL PESTICIDE KG & LT
1985-86	234,500	80.1%	49,310	16.8%	4,612	1.6%	4,480	1.5%	292,902
1986-87	7,738	2.7%	275,644	95.2%	1,835	0.6%	4,427	1.5%	289,644
1987-88	91,317	20.0%	352,357	77.3%	5,536	1.2%	6,837	1.5%	456,047
1988-89	77,165	20.2%	268,056	70.1%	6,674	1.7%	30,298	7.9%	382,193
1989-90	42,881	29.6%	92,160	63.7%	9,643	6.7%	0	0.0%	144,684
1990-91	67,878	51.6%	51,367	39.1%	11,934	9.1%	257	0.2%	131,436

Source: Appendix 8

File: TABIIC-14.WK1 and FIGIIC17.PIC

FIGURE II-27

PESTICIDE USE ON SORGHUM BY TYPE AND YEAR

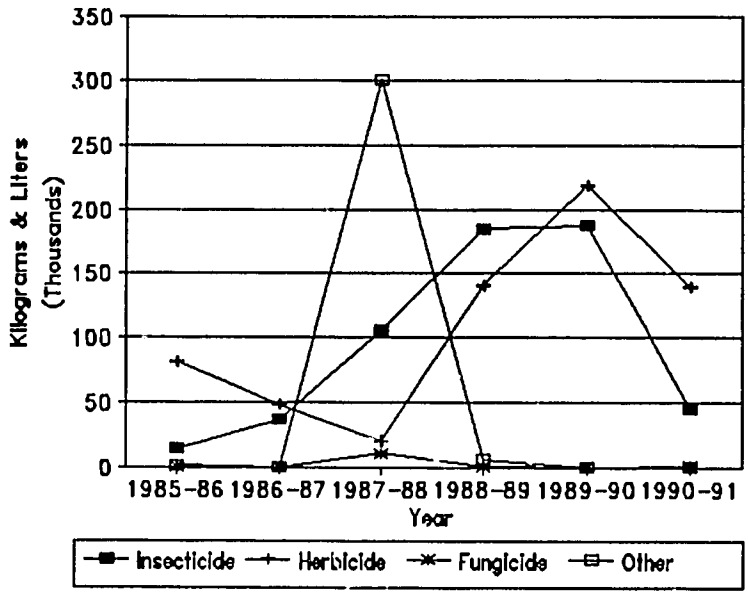


TABLE II-18

PESTICIDE USE ON SOURGHUM BY TYPE AND YEAR

YEAR	TOTAL INSECT KG & LT	% OF TOTAL	TOTAL HERBIC KG & LT	% OF TOTAL	TOTAL FUNGIC KG & LT	% OF TOTAL	TOTAL OTHER KG & LT	% OF TOTAL	TOTAL PESTICIDE KG & LT
1985-86	13,751	14.4%	81,005	84.8%	0	0.0%	769	0.8%	95,525
1986-87	36,743	43.4%	47,823	56.6%	0	0.0%	0	0.0%	84,566
1987-88	105,563	24.2%	19,751	4.5%	10,617	2.4%	300,824	68.9%	436,755
1988-89	184,638	55.7%	140,970	42.5%	174	0.1%	5,841	1.8%	331,623
1989-90	187,407	46.1%	219,069	53.9%	0	0.0%	0	0.0%	406,476
1990-91	44,805	24.3%	139,470	75.6%	193	0.1%	0	0.0%	184,468

Source: Appendix 8

File: TABIIC-15.WK1 and FIGIIC18.PIC

TABLE II-19

PESTICIDE USE AND YIELD PER MANZANA BY CROP

	CORN		BEANS		RICE		SORGHUM	
YEAR	PEST KG&LT/MZ	YIELD Q/MZ	PEST KG&LT/MZ	YIELD Q/MZ	KG&LT/MZ	YIELD Q/MZ	PEST KG&LT/MZ	YIELD Q/MZ
85-86	7.9	29.7	7.0	9.0	11.9	60.6	0.6	17.6
86-87	3.2	25.8	5.3	12.6	16.8	59.3	0.5	18.7
87-88	11.8	31.6	3.9	6.0	27.3	54.8	2.4	3.2
88-89	10.3	32.3	4.5	12.9	19.4	63.2	1.9	19.1
89-90	9.2	32.4	4.1	10.6	6.5	62.4	2.4	19.0
90-91	9.2	32.5	5.7	12.8	6.4	65.7	1.0	18.9

Notes:

1. Average pesticide use based on total national area planted.
2. Average yield based on national average yield.

Source: Pesticide Data: Appendix 8
Yield Data: Politica Agricola, Vol 1, Aug 1991, UAD-MAG

File: TABIIC-16.WQ1

FIGURE II-28

PESTICIDE USE AND YIELD LEVELS FOR CORN

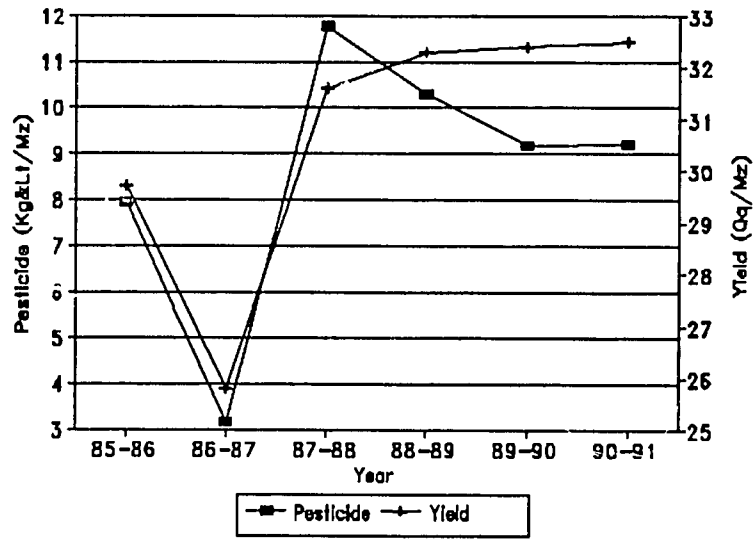
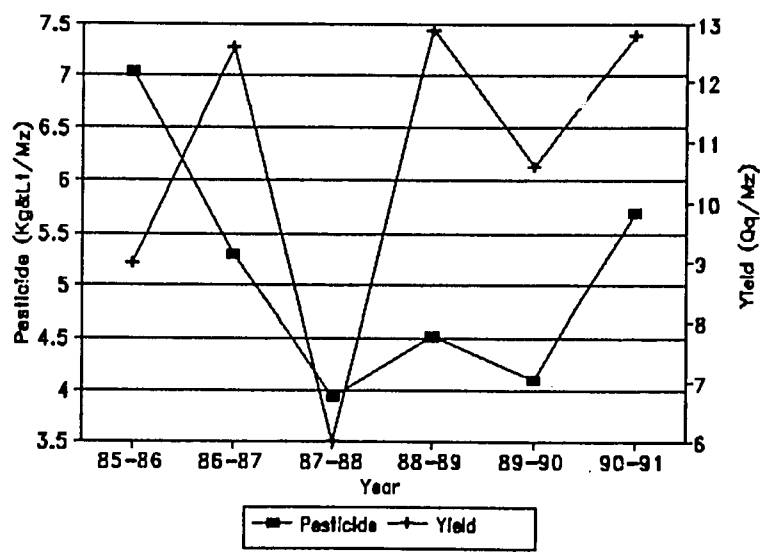


FIGURE II-29

PESTICIDE USE AND YIELD LEVELS FOR BEANS



Source: Table II-19; File: TABIIC16.WQ1, FIGIIC19.PIC and FIGIIC20.PIC

FIGURE II-30

PESTICIDE USE AND YIELD LEVELS FOR RICE

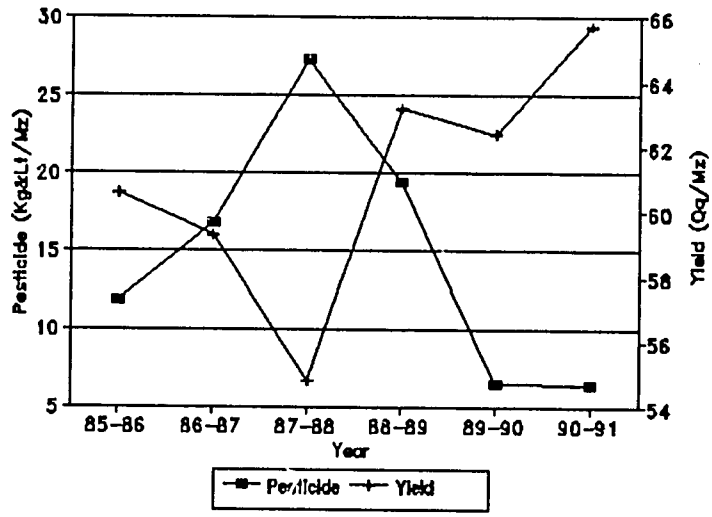
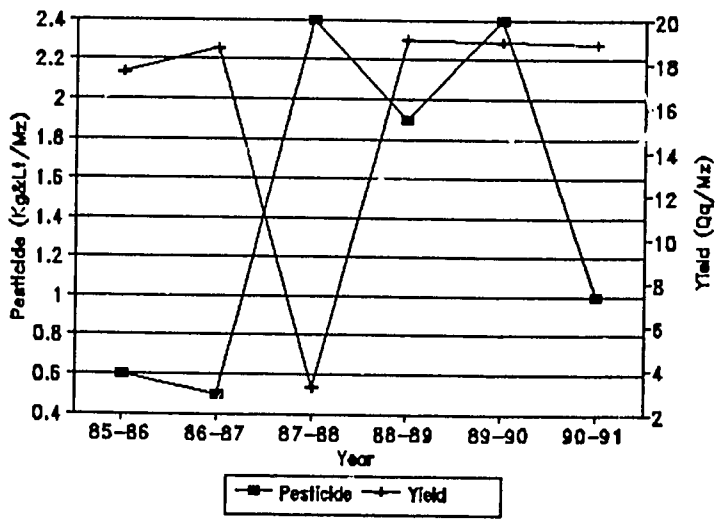


FIGURE II-31

PESTICIDE USE AND YIELD LEVELS FOR SORGHUM



Source: Table II-19; File TABIIC16.WQ1, FIGIIC21.PIC and FIGIIC22.PIC

D. Conditions Contributing to Trends

The growth, decline and apparent nascent recovery of the agricultural inputs industry in EL Salvador is closely linked to a set of macroeconomic, sectorial, and institutional variables. Over the last 30 years these variables have sent direct and indirect signals to grain producers, who in turn have responded by altering their production functions, and thus the aggregate demand for inputs. The effects of those variables which are thought to be more important in contributing to the trends, and therefore demand for agricultural inputs are summarized below.

1. General economic growth and decline [7]

One of the major reasons for the growth of the fertilizer and agro-chemical industries in El Salvador is found in the overall economic performance of the country, and the region in general, between 1950 and 1978. During this 30 year period the economy of El Salvador grew at an average annual rate of 5%. This average rate was even higher during the 1960's when the newly created Central American Common Market had its debut and brief history, ending in 1969, when war broke out between EL Salvador and Honduras. Growth resumed in the early 1970's with the conclusion of bilateral trade agreements with other Central American Countries.

Economic growth during this period was spearheaded by investment, as gross fixed capital formation rose steadily, in relation to GDP, from 10.5% in the fifties to 13% in the sixties and to nearly 20% in the 1970-78 period. The impressive growth performance, exceeding the rate of population growth by some 2% on average, was associated with remarkable price stability during most of this period.

During the two decades prior to the oil price increase of 1973, the rate of domestic inflation (consumer prices) averaged only about 1% per year, but accelerated to an average of 10% during 1974-78. This combination of high economic growth and low inflation lead to substantial increases in real income during the 30 year period.

It is under these favorable macro-economic and market conditions that the fertilizer and agro-chemical industries expanded in El Salvador, including the opening of the country's only fertilizer manufacturing firm . Agriculture, being the backbone of the economy was in a position to benefit from this development. The sector accounted for over 25% of real GDP, some 40% of the labor force, and about 2/3 of the total value of exports.

The favorable environment which was instrumental in the growth of the agro-chemical and fertilizer industries in El Salvador came to an abrupt halt at the end of the 1970's. In 1979 GDP declined 1.5%, and between 1979 and 1983 it declined 22%, with an anemic recovery registered in 1984. Between 1983 and 1988 GDP grew only 1.5% in real terms. Thus, during the 1980's GDP had mostly

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[7] Taken directly from "Evaluation of AID Agrarian Reform Credit Project in El Salvador", Chechi and Company, page 8 and 9, September 1985.

negative annual growth rates which by 1988 had reduced GDP to 13% below the level of 1979. On a per capita basis this GDP reduction reflected a 24% decrease. Inflation accelerated to unprecedented levels pushing consumer prices to increase by 90% over the same time period; salaries, however increased at a much slower rate, leading to an erosion in consumer purchase power; the agrarian reform, started in 1980 had an immediate and negative effect on agricultural production; capital markets were weakened when private capital sought safer heavens in other countries; and an increasingly overvalued exchanged rate penalized agricultural production in the country.

2. Income levels of grain producers

a. Inflation and real farm gate prices [8]

Inflation is perhaps the most important contributing factor to the decline in demand for fertilizers and agro-chemicals as well as other agricultural production inputs. Its adverse impact can be inferred through the generated "real" impact on farmers' returns, their decisions to adjust production, and therefore to modify the rate of utilization of agricultural inputs. Table II-20 contains the percentage change in the inflation rate by year since 1978. The inflation rate was over 15% in the late 1970's, it ranged between 12 and 15% during the early 1980's and accelerated to 32% per year by the end of 1986. Since then it has gradually declined yearly to 19.4% in 1990. The 1991 rate of inflation is expected to be under 15 percent.

The effects of these inflation trends on income levels of basic grain producers, their production decisions, and therefore on demand for agricultural inputs, are summarized below.

Between 1978 and 1990, nominal farm gate prices for basic grains and beans increased multi-fold (see upper portion of Table II-21). For example, nominal corn prices more than tripled from 19.39 C/qq to 70.76 C/qq between 1978 and 1991. Bean farm gate prices increased nearly five times from 59.15 C/qq to 279.49 C/qq during the same time period. Rice and sorghum price also tripled, from 34.11 to 110.28 C/qq and from 17.49 to 46.36 C/qq, respectively.

However, when the annual inflation rates during the same period of time are taken into account a completely different picture emerges. When these nominal prices are deflated, real farm gate prices for basic grains consistently decline until they are only a fraction of their levels a decade before. As a result, inflation not only eroded such nominal gains but reduced real farm gate prices, and therefore, the purchase power of these producers by substantial amounts.

For example, by 1990 the real farm gate price for corn had declined to 7.89 C/qq, or 41% of its level in 1978; the real bean producer price declined to 29.19 C/qq, or 49% of its 1978 level; the real rice producer price declined to 7.36 C/qq or 22% of its 1978 level; and the real sorghum producer price declined to 6.47 C/qq or 37% of the 1978 level (see lower portion of Table II-21).

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[8] Robert A Nathan, page 71-73, updated.

TABLE II-20

CHANGES IN CONSUMER PRICE INDEX 1978 - 1990

Year	CPI - December	Annual Change (Percentage)
1978	100.00	
1979	114.84	15.9
1980	136.15	17.3
1981	152.01	14.8
1982	172.44	11.7
1983	197.87	13.1
1984	217.30	11.7
1985	286.68	22.3
1986	373.70	31.9
1987	446.96	24.9
1988	528.53	19.8
1989	652.55	23.5
1990	778.80	19.4
1991 1/	855.66	9.9

Source: Evaluación de la Situación al Final del Proyecto de Crédito al Sector de Reforma Agraria, Robert R. Nathan Associates, Inc. June 1988, updated.
Dirección General de Estadística y Censos.
1/ Through Sept 1991; annualized CPI and inflation rate.

b. Inflation and Real input prices [9]

The first disincentive brought about by the impact of inflation on the revenue side was somewhat, but not sufficiently mitigated by its simultaneous impact on the costs of production farmers face. That is, while the annual inflation rate also increased nominal production costs, (seed, fertilizer, and pesticides) the real cost per Mz of these agricultural inputs did not decrease rapidly enough to compensate the erosion in the real farm gate prices received by producers for their commodities (see columns 4 and 5 in Table II-22, 23, 24, and 25).

For example, in real terms the average input costs for one Mz of corn in 1990 (seed, fertilizer and pesticide)[10] was reduced by 60% to 40 % of their levels a decade earlier. In contrast, the real farm gate price for corn was reduced by 38% to 62: of its level in 1980. Thus, while real input costs declined such rate of decline was not sufficient to fully compensate farmers, whose gross and net returns were deteriorating substantially during the last decade (see last 2 columns of Tables II-22, 23, 24, and 25).

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[9] Robert A. Nathan, page 73, updated.

[10] Does not include other production costs such as labor, rent, interest, etc., which would paint an even bleaker picture.

TABLE II-21

NOMINAL PRODUCER PRICES FOR BASIC GRAINS 1978-1990
(Colones per Quintal)

Year	Corn	Beans	Rice	Sorghum
1978	12.59	59.15	34.11	17.49
1979	15.13	46.68	35.58	16.80
1980	17.41	73.36	30.16	19.66
1981	18.49	88.97	31.64	21.39
1982	21.35	74.10	33.00	21.58
1983	26.33	60.35	36.45	24.50
1984	25.00	63.70	33.00	21.00
1985	23.46	78.16	33.50	22.71
1986	36.50	100.00	24.80	30.00
1987	40.33	103.92	71.31	38.29
1988	36.20	235.77	61.82	39.94
1989	49.19	177.05	45.66	40.55
1990	61.44	227.33	57.34	50.37
1991 [12]	70.76	279.43	110.28	46.36

REAL PRODUCER PRICES FOR BASIC GRAINS 1978-1990
(Index 1978 = 100)

Year	Corn	Beans	Rice	Sorghum
1978	19.39	59.15	34.11	17.49
1979	13.17	40.65	30.98	14.63
1980	12.79	53.88	22.15	14.44
1981	12.16	58.53	20.81	14.07
1982	12.38	42.97	19.14	12.51
1983	13.31	30.50	18.42	12.38
1984	11.50	29.31	15.19	9.66
1985	8.18	27.26	11.69	7.92
1986	9.77	26.76	6.64	8.03
1987	9.02	23.25	15.95	8.57
1988	6.85	44.61	11.70	7.56
1989	7.54	27.13	7.00	6.21
1990	7.89	29.19	7.36	6.47
1991 [11]	8.27	32.66	12.89	5.42

Source:
- Evaluación de la Situación al Final del Proyecto de Crédito al Sector de Reforma Agraria, Robert R. Nathan Associates, Inc. June 1988.
- Dirección General de Estadística y Censos
- Updated

[11] Through November 1991.

c. Productivity levels (yields)

Another factor that contributed to this bleak picture is the erosion or stagnation in farm productivity (yields per Mz) over the same time period. All grains have seen their yields increase marginally at best between 1978/79 and 1988/89.

Corn yields increased an average of only 1% per year during this time period, from 29 to 32 qq per Mz. Bean production yields remained unchanged at 12 qq per Mz. Rice yields managed to increase by less than 1% per year between 1979 and 1989. Sorghum yields declined from 19 qq per Mz in 1979 to about 16 qq per Mz in 1983 and managed to recover by the end of the decade.

d. Grain producers income levels

As real farm gate prices declined and productivity levels stagnated so did producers' gross and net incomes, and therefore their purchasing power (see last two columns in Tables II-22, 23, 24, and 25; these trends are also shown in the accompanying figures). Under these conditions the incentive to produce large marketable surpluses of basic grains and beans, above and beyond direct farm needs, were greatly reduced. [12]

For example, on average corn producers received the same net real income of 165 Colones per Manzana in 1991 as they did a decade ago. The brief increase in real incomes during those 10 years was due to a slight increase in yields during the late 1970's and early 80's. The low point occurred in 1987 when average net returns reached a low of 83 Colones per Manzana.

Bean producers lost approximately 36% in purchasing power between 1980 and 1991 with a low point reached in 1988 with a net return of 167 C/Mz. Rice producers lost over 60% in purchasing power between 1980 and 1990, with a low point reached in 1989 with a net return of 286 C/Mz. While the information on sorghum is very limited, it still does indicate that these producers also incurred significant reductions in gross and net returns, and therefore, in purchasing power.

The combined squeeze put on farmers' net returns, and therefore on their purchasing power translated into an incentive to reduce production costs, especially for inputs that must be purchased, such as fertilizers, pesticides, and seeds. As the use of production inputs declined so did demand, and production began to shift from intensive and technified to extensive and detechnified. Increasingly more labor was substituted for capital, and more and more marginal land was put under cultivation. This scenario is indicated by the complete stagnation and even decline in productivity, or yield per manzana.

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[12] It should be noted that these calculations take into account only the cost of variable inputs (seed, fertilizer, and pesticides) which must be purchased every season. These results would look even bleaker if other production costs such as labor, interests, rent and fixed inputs were included.

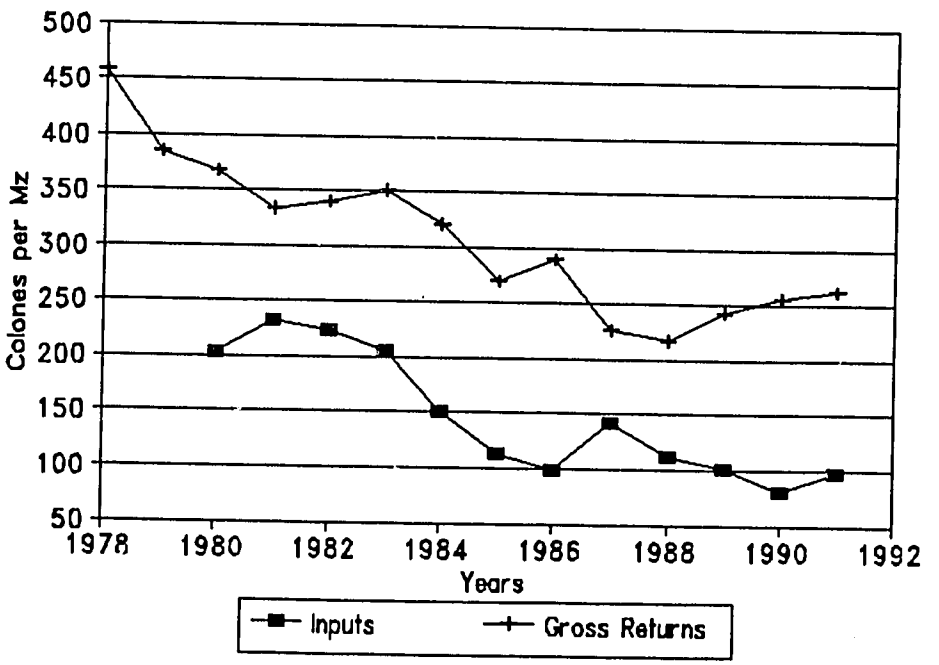
TABLE II-22

REAL INPUT COSTS AND RETURNS FOR WHITE CORN
(Colones per Manzana; Index 1978 = 100)

Year	Inputs			Total Input Costs	Farm gate Price C/qq	Average Yield QQ/Mz	Gross Return per Mz	Net Return per Mz
	Seed	Frtlzr	Pstcds					
1978	NA	NA	NA	NA	19.39	23.60	457.60	NA
1979	NA	NA	NA	NA	13.17	29.20	384.71	NA
1980	17.63	120.54	64.63	202.81	12.79	28.80	368.28	165.47
1981	18.15	148.00	65.79	231.94	12.16	27.50	334.50	102.56
1982	16.53	149.63	57.99	224.15	12.38	27.50	340.48	116.33
1983	14.40	130.40	60.65	205.45	13.31	26.40	351.30	145.85
1984	13.63	92.03	46.02	151.68	11.50	27.90	320.98	169.31
1985	9.94	69.83	34.18	113.96	8.18	33.00	270.05	156.09
1986	7.63	61.61	30.16	99.40	9.77	29.70	290.09	190.69
1987	9.40	89.05	43.28	141.72	9.02	25.00	225.58	83.86
1988	9.37	62.02	41.06	112.44	6.85	31.60	216.43	103.99
1989	9.19	58.19	33.71	101.10	7.54	32.20	242.73	141.63
1990	6.90	46.83	27.20	80.93	7.89	32.40	255.61	174.67
1991	8.23	58.58	30.08	96.89	8.27	31.70	262.15	165.26

FIGURE II-32

REAL INPUT COSTS AND RETURNS FOR WHITE CORN



Source: Appendices 8 and 9

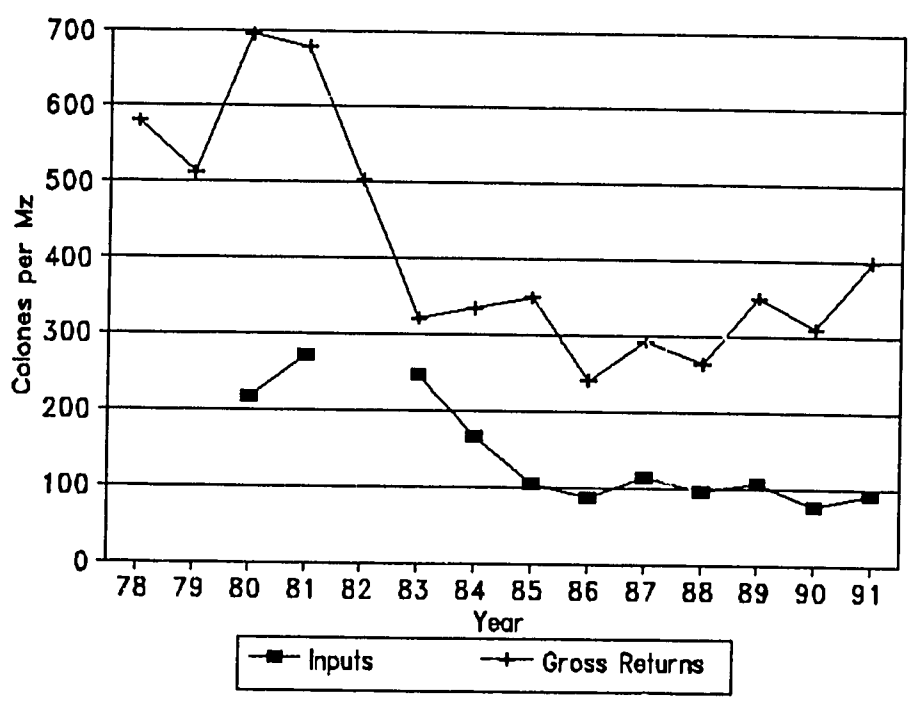
TABLE II-23

REAL INPUT COSTS AND RETURNS FOR BEANS
(Colones per Manzana; Index 1978 = 100)

Year	Inputs: Seed	Inputs: Frtilzr	Inputs: Pstcds	Total Input Costs	Farm gate Price C/qq	Average Yield QQ/Mz	Gross Return per Mz	Net Return per Mz
1978	0.00	0.00	0.00	0.00	59.15	9.80	579.67	NA
1979	0.00	0.00	0.00	0.00	40.65	12.60	512.16	NA
1980	61.70	72.07	84.47	218.23	53.88	12.90	695.07	476.84
1981	98.68	87.36	86.18	272.21	58.53	11.60	678.94	406.72
1982	0.00	0.00	0.00	0.00	42.97	11.70	502.77	NA
1983	90.97	75.81	79.45	246.22	30.50	10.50	320.25	74.03
1984	69.03	60.75	36.17	165.95	29.31	11.40	334.18	168.24
1985	47.96	21.49	35.23	104.68	27.26	12.80	348.98	244.30
1986	36.79	18.96	31.08	86.83	26.76	9.00	240.83	154.00
1987	38.03	30.05	45.09	113.17	23.25	12.60	292.96	179.79
1988	32.16	25.41	38.13	95.70	44.61	5.90	263.19	167.49
1989	53.64	21.91	30.65	106.19	27.13	12.90	350.00	243.81
1990	23.10	30.73	23.34	77.16	29.19	10.60	309.41	232.25
1991	34.43	24.00	33.08	91.51	32.66	12.23	399.48	307.97

FIGURE II-33

REAL INPUT COSTS AND RETURNS FOR BEANS



Source: Appendices 8 and 9

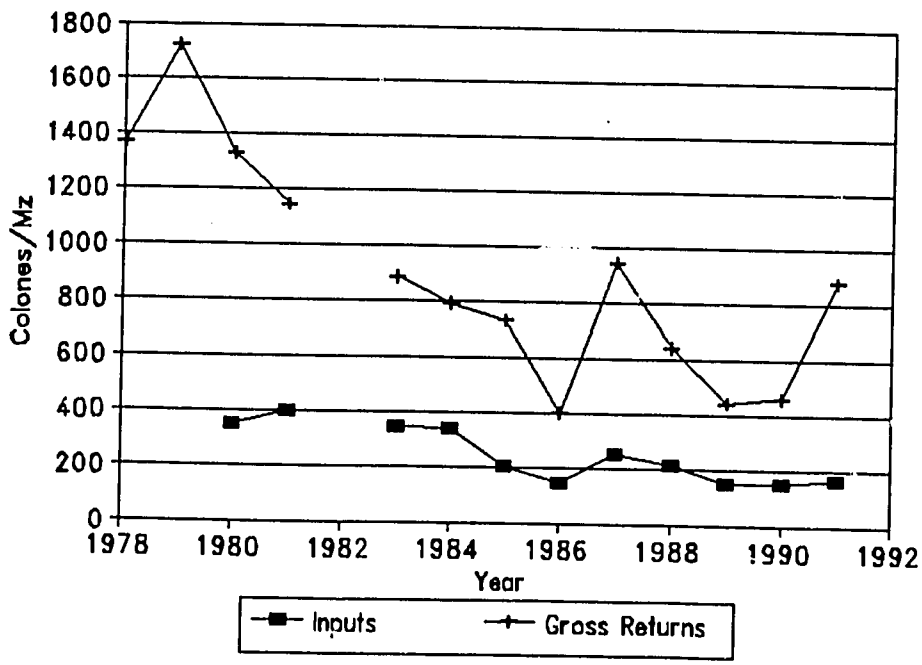
TABLE II-24

REAL INPUT COSTS AND RETURNS FOR RICE
(Colones per Manzana; Index 1978 = 100)

Year	Inputs: Seed	Inputs: Frtlzr	Inputs: Pstcds	Total Input Costs	Farm gate Price C/qq	Average Yield QQ/Mz	Gross Return per Mz	Net Return per Mz
1978	0.00	0.00	0.00	0.00	34.11	40.00	1,364.40	NA
1979	0.00	0.00	0.00	0.00	30.98	55.60	1,722.61	NA
1980	95.48	120.54	132.21	348.23	22.15	60.00	1,329.12	980.89
1981	105.26	141.83	154.60	401.68	20.81	55.00	1,144.79	743.11
1982	0.00	0.00	0.00	0.00	19.14	55.00	1,052.54	NA
1983	70.75	130.40	142.52	343.67	18.42	48.10	886.06	542.39
1984	92.04	98.49	150.35	340.88	15.19	52.20	792.73	451.85
1985	55.81	69.83	81.97	207.62	11.69	62.80	733.85	526.23
1986	32.11	61.61	53.85	147.58	6.64	60.60	402.16	254.58
1987	46.98	89.05	119.36	255.39	15.95	59.30	946.10	690.71
1988	39.73	75.30	100.94	215.97	11.70	54.80	640.97	425.00
1989	32.56	58.19	65.44	156.19	7.00	63.20	442.22	286.03
1990	29.16	55.98	68.78	153.93	7.36	62.40	459.43	305.50
1991	38.08	59.39	68.53	166.01	12.89	68.13	878.08	712.07

FIGURE II-34

REAL INPUT COSTS AND RETURNS FOR RICE



Source: Appendices 8 and 9

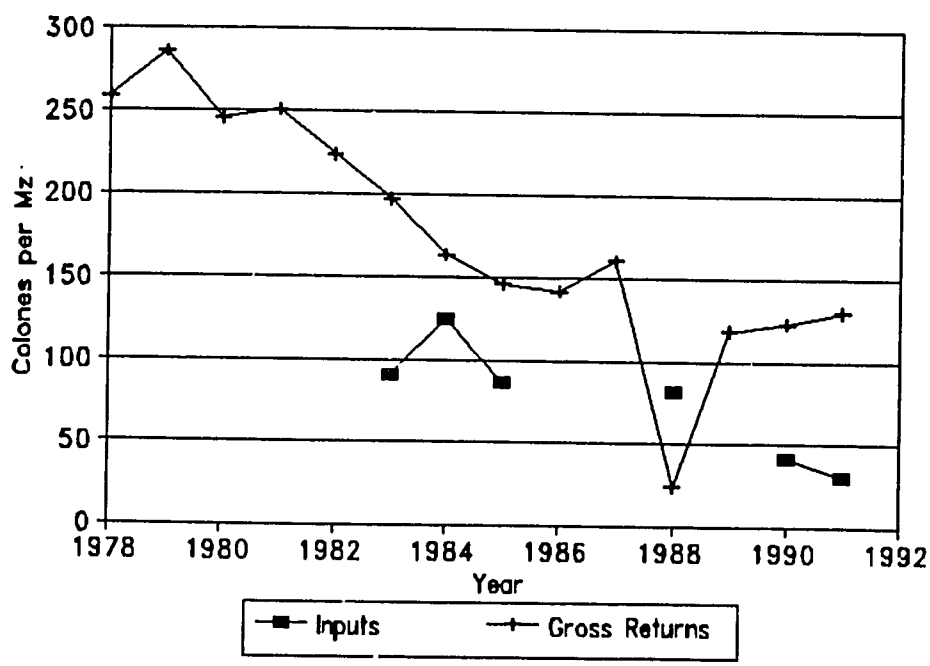
TABLE II-25

REAL INPUT COSTS AND NET RETURNS FOR SORGHUM
(Colones per Manzana; Index 1978 = 100)

Year	Inputs: Seed	Inputs: Frtlzr	Inputs: Pstcds	Total Input Costs	Farm gate Price C/qq	Average Yield QQ/Mz	Gross Return per Mz	Net Return per Mz
1978	0.00	0.00	0.00	0.00	17.49	14.80	258.85	NA
1979	0.00	0.00	0.00	0.00	14.63	19.50	285.27	NA
1980	0.00	0.00	0.00	0.00	14.44	17.00	245.48	NA
1981	0.00	0.00	0.00	0.00	14.07	17.80	250.47	NA
1982	0.00	0.00	0.00	0.00	12.51	17.90	224.01	NA
1983	11.37	37.22	42.45	91.04	12.38	15.90	196.87	105.83
1984	9.66	67.15	48.14	124.95	9.66	16.90	163.32	38.37
1985	6.10	47.61	33.14	86.86	7.92	18.40	145.76	58.90
1986	0.00	0.00	0.00	0.00	8.03	17.60	141.29	NA
1987	0.00	0.00	0.00	0.00	8.57	18.70	160.20	NA
1988	4.35	37.65	40.04	82.04	7.56	3.20	24.18	-57.86
1989	0.00	0.00	0.00	0.00	6.21	19.10	118.69	NA
1990	1.12	22.33	18.24	41.69	6.47	19.00	122.89	81.20
1991	1.52	12.48	16.45	30.45	5.42	23.90	129.49	99.04

FIGURE II-35

REAL INPUT COSTS AND RETURNS FOR SORGHUM



Source: Appendices 8 and 9

e. Apparent turn around

Attention is called to the gross and net return calculations for the years 1987 through 1991. It appears that beginning in 1987/88 a turn around might have begun since both gross and net returns have shown positive annual increases for all grains (see the widening gap since 1987/88 between the inputs and returns curves in Figures II-32 and 33 for corn and beans, and 1988/89 for rice and sorghum in Figures II-34, and 35). While also showing encouraging increases, a more cautious note must be sounded for rice. The steep increase in gross and net returns for 1991 was in part a result of weather impact (drought) on production. Nevertheless, if sustained these trends do portray a positive effect of policy and structural changes which began in the late 1980's.

3. Agricultural production credit

Agricultural credit (which is itself a derived demand) played a crucial role in the growth and decline of the fertilizer and agro-chemical industries. The economic, structural, and market conditions during the 60's and through the mid 70's created a favorable institutional environment under which farmers could borrow and repay their loans. Demand for agricultural inputs grew as farmers, benefitting from a growing national economy and the effectiveness of supportive services, such as extension increased production levels of many crops.

From the late 70's onwards the economic, structural and market conditions started to deteriorate and the mechanism under which grain producers could obtain credit also changed. Government intervention in the fertilizer and pesticide industry became more onerous over time. By the late 1980's government intervention included (1) foreign exchange controls, (2) import quotas, and (3) over-simplified technical production packages (credit in kind) for grain producers.

a. Credit levels and type

Figure II-36 summarizes the total area of basic grains financed by BFA for the period 1963/64 through 1990/91. Area financed by BFA grew very slowly during the 1960's and exploded during the 1970's, reaching a peak during the 1979/80 crop year, when 150,436 Mz of corn, 64,266 Mz of sorghum, 32,153 Mz of beans, and 17,144 Mz of rice were financed. As shown in Figure II-37, these areas represent significant amounts when viewed as a percentage of total area cultivated.[13] At the onset of the agrarian reform BFA production credit financed nearly 80% of the area cultivated with rice, 50% in beans, and nearly 40% in corn and sorghum.

To a degree, the method of providing credit also contributed to the demand for fertilizer and pesticides. Under a system of "credit in kind", BFA issued "Ordenes de Retiro para Insumos" which allowed farmers to obtain agricultural inputs (seed, fertilizer, chemicals, tools) from independent agro-services, and

[13]Since BFA accounts for over 75% of formal loans issued for basic grains production, the figures are representative of total industry behavior.

FIGURE II-36

BASIC GRAINS AREA FINANCED BY BFA 1963/64 - 1990/91
(1,000 of Manzanas)

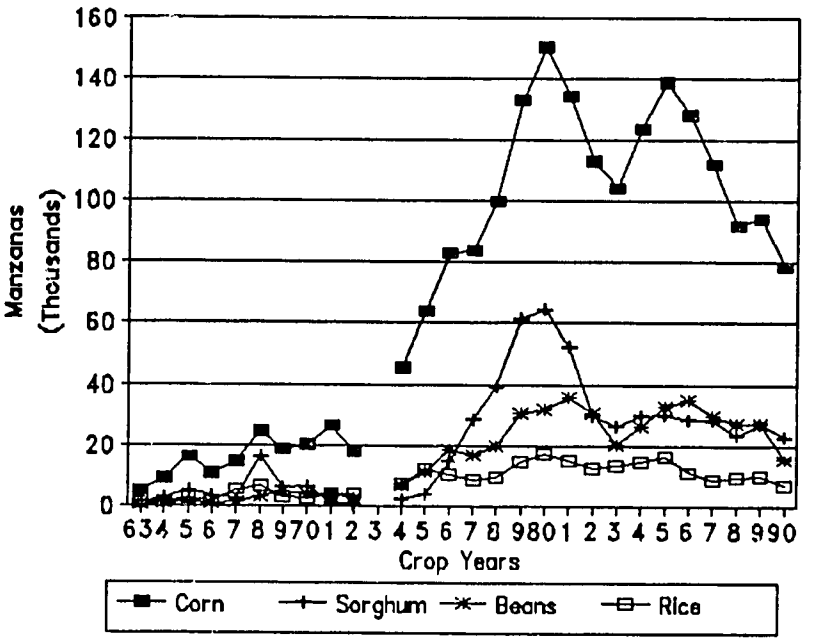
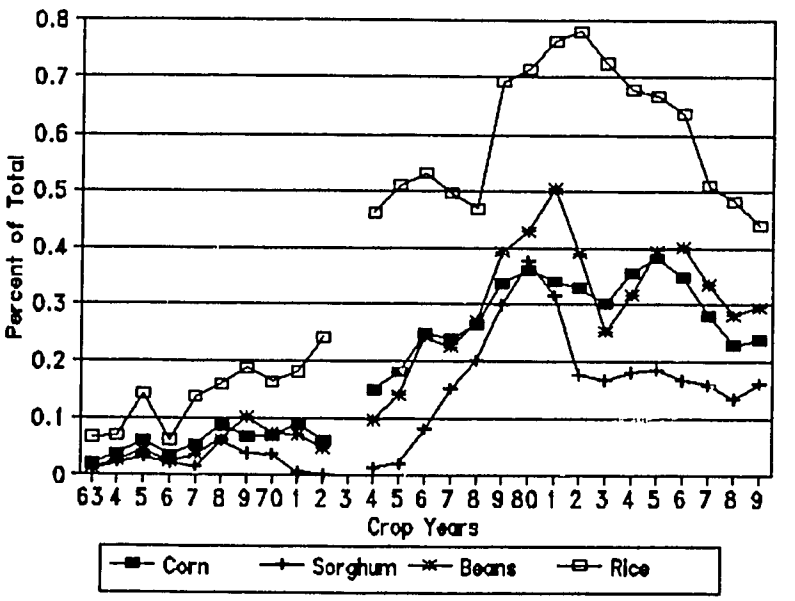


FIGURE II-37

PERCENTAGE OF BASIC GRAINS AREA FINANCE BY BFA 1963/64 - 1990/91



Source: Appendix 10

later (mid 1980's onward) from its own retail outlets.[14] Under this system farmers were "obligated" to take a certain amount of fertilizer and pesticides.

This over-simplified production package, introduced in part to make the system manageable reduced fertilizer availability to just three types, namely ammonium sulphate and two formulas (16-20-00 and 15-15-15). This contributed to the nationwide use of a set number of sacks of fertilizer and a standard package of pesticides, the levels of use of both probably exceeding the economically efficient and ecologically desirable levels.

b. Negative real rates of interest [15]

Until 1989, the Banco de Fomento Agropecuario (BFA) charged farmers a rate of interest which was below the inflation rate. For example in 1988 BFA was charging 13% versus and inflation rate of 20%. Thus, instead of paying a real rate of interest of say 8% (20+8), farmers were paying -7% (20-13), which represented an implicit subsidy of 15% by the bank.

Negative interest rates not only mis-allocate the use of financial resources in general but tend to create an incentive for borrowers to postpone repayment of their credit obligations as long as possible, since eventually they will pay it back with cheaper Colones. This behavior reduces the level of funds available for credit during the following crop cycles. As a result, banks become more and more reluctant to issue new credit since their uncollected balances reach disproportionate levels, and additional funds must be channeled to refinancing outstanding credit obligations from previous years.

While this implicit subsidy (negative interest rate) might have dampened the effects of inflation on farmers' incomes it was not enough to offset them, thus discouraging grain producers from taking on further credit obligations. Furthermore, the incentive by borrowers to postpone credit repayment and the reduced level of funds available for credit in subsequent years could well have contributed to an associated reduction in demand for other agricultural inputs, particularly fertilizers and pesticides.

4. Exchange rate [16]

The negative effects of an overvalued currency on agricultural production have been well documented by Norton and others in the late 1980's. The negative impact on demand for production credit was well documented by Robert R. Nathan in 1989. These findings, to the degree used here are reproduced with little or no modifications.

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[14]As of crop year 1991/92 BFA no longer provides credit in kind, and will close all its retail outlets. Credit to farmers will be provided in the form of cash advances or checks for inputs made to specific agro-services.

[15] Robert A. Nathan, page 71-72.

[16] Robert A. Nathan, page 78-79.

Table II-26 shows the overvaluation of the Colon relative to the US$, El Salvador's largest trading partner. An overvalued currency tends to make imports of grains and other agricultural commodities cheaper than the same commodities produced in El Salvador. This is so because when the imported commodity is paid for with an overvalued currency, only a fraction of the true value of the imported commodity is paid. However, when the same commodity is purchased in the country, the full price is paid in Colones. Thus, the incentive to buy abroad and import rather than to buy locally is greater the higher the overvaluation of the national currency. As Table II-26 shows, this scenario worsened during the 1980's in El Salvador.

TABLE II-26

EXCHANGE RATE PARITY RELATIONSHIPS
(Colones per Dollar)

Year	Exchange Rate	Parity Relationship	Overvaluation (Percentage)	REER Index Trade Weight
1974				1.289
1975				1.185
1976				1.188
1977				1.148
1978				1.094
1979				1.063
1980	2.50	3.21	28.2	1.000
1981	2.50	3.39	35.4	0.946
1982	na	na	na	0.937
1983	2.82	4.05	43.7	0.822
1984	2.87	4.31	50.1	0.820
1985	3.60	5.44	51.1	0.798
1986	4.96	7.09	42.9	0.805
1987	5.00	8.33	66.5	0.684
1988				0.580
1989				0.752
1990				0.705
June 1991				0.621

Source: Robert R. Nathan, page 78.
Loehr (1988) and Norton et.al. (1988)
Loehr (1991); REER = Real Effective Exchange Rate

An example will serve to explain the negative effects of this situation. In 1987 the exchange rate was 5.00 Colones per US$, however the parity exchange rate was estimated to be 8.33 Colones per US$. This amounted to an overvaluation of the Colon of 66.5%. Thus, by 1989 "a situation was reached when nationally produced

commodities such as corn had such a low price that farmers (say grain producers) do not earn an income, and at the same time (due to overvaluation of the currency) the local price is too high in relation to the international price of the corn" (Nathan, page 79). Farmers do benefit some from the overvalued exchange rate, in that imported agricultural inputs are bought without paying their full price. Nevertheless, the subsidies in the cost of imported inputs (due to overvaluation) explains only a fraction of the gross income.

The overvalued exchange rate has been the principal cause of reduced producer prices in the country, although low international prices and reduced domestic demand have also contributed. Norton points out (1988) "...that it is not the volume of imported agricultural commodities which depress domestic production, but rather the prices (domestic versus international) and the exchange rate which have been the main factors resulting in lower international prices relative to domestic prices." In other words increased import levels do not cause the decline (are not the direct cause) in domestic production, but rather both changes (increase import levels and depressed domestic production) are the result of a third factor, namely an overvalued exchange rate.

The Real Effective Exchange Rate provides the same argument (last column, Table II-26). The lower the index, the "cheaper" the exchange rate, and therefore the hard currency that can be bought. The higher the index, the more "expensive" the exchange rate, and therefore the hard currencies that can be bought, ergo imports. The series clearly indicates the "cheapening" of the exchange rate between 1974 and 1988. Under these circumstances, imported grains became increasingly more attractive to buy over the domestic alternatives. The macro-economic adjustments in 1989 and 1990 managed to increase the cost of the exchange rate, and therefore imports. If continued, grain users will be encouraged to expand their purchases of domestic grains.

5. International versus domestic agricultural prices

A series of price indices for agricultural imports to El Salvador were documented by Norton et al. (1988). His findings, as summarized by Nathan, page 78, (1989), are reproduced here in the context of the fertilizer and agro-chemical industries. According to the study, between 1980 and 1986 the price index for agricultural imports, in current Colones, increased by 30%, while the production cost index for nationally produced foods rose 74% (to a degree reflecting differential inflation rates).

Under these circumstances the incentives to import agricultural commodities (including grains) rather than buying locally produced commodities was great. Moreover, many of the imported food commodities were imported (and some still are) under concessionairy terms. For example, in 1987, grain imports were 83,000 tons of corn, 23,000 tons of rice, and 123,000 tons of wheat.

Increasing import levels contributed to a reduction in demand for locally produced grains. Reduced demand for locally produced grains (probably reflected in depressed real farm gate prices) reduced farmers' incentives to produce for the local market. This in turn led to a reduction in demand for agricultural inputs, such as fertilizers and pesticides.

6. The agrarian reform - a pivotal development

The agrarian reform was the most important public statement to legitimatize the government which assumed power in October, 1979. Under different schemes, a process was implemented to confiscate private agricultural property, compensate owners, and distribute such property to landless farmers.[17] This action had at lest three negative consequences on the fertilizer and pesticide industry.

- First, many of the farm units formed under the agrarian reform schemes did not have, or did not retain, the needed farm management skills to sustain them as profitable farming enterprises, and accordingly farm output declined.

- Second, a number of the major grain producers lost their land and stopped purchasing inputs. Many did not recover, or took years to resume production.

- Third, neighboring countries which were customers of the Salvadorian agro-chemical and seed industries found their supplies disrupted or no longer available. [18]

Combined, these three outcomes lead to a reduction in demand for fertilizers, pesticides, and seeds in the domestic market, and faced with reduced supplies, to a shift to other suppliers in previous client countries.

7. Extension service [19]

During the 19 year time period between 1960 and 1979 the extension service played an instrumental role in the increased use of agricultural inputs, i.e. hybrid corn, fertilizers, and pesticides, throughout the country. The system as organized and executed was critical to the growth of the fertilizer and agro-chemical industries in the country. A brief summary of this successful program and its activities follow.

Technology transfer, that is extension to the small and medium size farmers was the sole responsibility of the Agricultural Extension Division of CENTA.

The objectives of the Division were:

- to train small and medium size producers in new technologies generated by the research program;

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[17] The agrarian reform has been documented in many studies and will not be reviewed here except as it pertains to agricultural inputs industries.

[18] This third impact was also due to Government policies which made export activities very cumbersome, bureaucratic, anti-competitive.

[19] This material taken directly from "Diagnóstico de la Situación de Semillas de los Granos Básicos para la República de El Salvador", by Dr. Ronald Echandi Z., CIGRAS/ACR, and Ing. Hernán González IICA, 1978.

- to integrate the activities of extension with those of research and seed technology to achieve the highest possible efficiency in the transfer of technology;

- train rural housewives in the basic concepts of efficient management of a rural household; and

- to guide and train rural youth in agricultural techniques and home economics.

In order to achieve these objectives, the Division organized its activities under six major programs, namely (1) basic grains, (2) fruits and vegetables, (3) sugar cane, (4) cotton, (5) home economics, and (6) rural youth. These programs were managed through 70 extension agencies distributed throughout the nation. In 1978 a total of 124 extension agents were assigned to the first two programs alone.

The basic grains program had two major objectives, namely:

- provide technical assistance in order to increase national grain production and decrease import requirements, and
- train producers in improved farming techniques and promote the use of improved seeds in order to achieve higher production yields.

One program activity which was instrumental in convincing farmers of the benefits associated with switching to improved technologies, i.e. use of hybrid corn varieties, fertilizers and pesticides, was the use of demonstration plots. This activity was started in 1965, and was instrumental in the introduction and acceptance of the first hybrid corn (H3) between 1965 and 1968. In 1978, a total of 1,340 demonstration plots were being used throughout the country. Under this system the Extension Division provided assistance to 36,500 farmers who cultivated 58,000 Mz of basic grains during the crop year 1976-77.

CENTA also collaborated with other Government institutions such as the Banco de Fomento Agropecuario (BFA), the Instituto Salvadoreño de Transformación Agraria (ISTA), the Programa de la Presidencia de la República encargado del Fomento de la Acción Comunal (FOCCO), and the Instituto Salvadoreño de Fomento Agropecuario (INSA-FOCOOP). During the 1977-78 crop year a total of 8,000 farmers, organized in 1,200 groups benefitted from CENTA's inputs technology transfer program.

To a large degree, the agrarian reform legislation of 1979 was responsible for the reorganization of the structure of the extension service, as well as changes in its priorities, programs, and activities. This reorganization and changes led to a complete collapse of the effectiveness of the extension service in relation to the objectives of the basic grains program originally designed and implemented by CENTA.

First, the Ministry of Agriculture was decentralized into four independent regional units, which though theoretically linked to the main office in San Salvador carried out their programs and activities in a very independent manner. These units essentially became autonomous mini-ministries.

Second, new program and extension activities took priority over CENTA's original basic grains extension program objectives. Extension priorities were shifted to social issues such as housing, health, education, communication, infrastructure, and the management of newly formed cooperatives. Rather than hire additional extension workers, CENTA's extension personnel were transferred to the autonomous regional ministries, and their efforts redirected to these new priorities.

As a result of these developments, the critical link between research and extension was severed and information on agricultural inputs, cultivation techniques, and other research developments ceased to flow to grain producers. CENTA became isolated from the clientele it was supposed to serve. Extension no longer advised farmers on the benefits of input use and related cultivation techniques, and the initially successful drive to increase and improve their utilization faltered.

8. Research

In the 1960's and 1970's, CENTA produced a number of new lines of hybrid and improved varieties which, with the associated improved management systems, were effectively extended by the Extension Service. During the 1980's CENTA has been separated from the Extension Service and thus from one of the most important feed-back mechanisms necessary to an effective research program. There have been few successful varieties released in the last 10 years. Varieties which have been released have had undesirable characteristics either from the market, the farmer's, or from the commercial seed producer's point of view.

During the last ten years, major disease and insect problems appear to have developed faster than research has been able to develop resistant varieties or other measures to overcome the problems (reactionary rather than leading research). This has been part of the reason why there has been a decline (or at least no improvement) in the level of crop productivity.

9. Standardization of technology

At a time when agricultural diversity has been increasing, due to opening of marginal lands, the development of different pest complexes in different zones, and the need for farmers to diversify their agriculture because basic grain margins were decreasing, the agricultural research establishment failed to increase the number of parameters in their research and increasingly relied on standardized recommendations.

The increased use of standardized recommendations probably has several causes. One of these is the increased isolation of researchers brought about by the separation of research and extension. Another important aspect is the relatively low level of funding available to research, and the lack of highly trained staff. It is impossible to conduct relevant adaptive and adoptive research when 85 to 90 percent of the CENTA budget is tied up in personnel costs, leaving very little for operating expenses. Thus there is a tendency to conduct research on-station rather than taking it to farmer's fields, where many of the problems which need to be researched are found. Finally, government credit programs sought to "simplify" the logistics aspects of the programs, and one way of doing was by reducing the number of inputs required for in-kind production credit.

The increased dependency on standard crop production packages, including standard fertilizer recommendations throughout the country not only led to a decrease in the number of different types of fertilizers available to farmers, but became more and more sub-optimum for most grain producers. The industry fell in line rather than oppose the trend, and over a decade farmers' choices were reduced to just two types of fertilizers.

10. Other factors

a. Civil conflict

The civil conflict which started in 1979 affected demand for fertilizer and pesticides, especially in certain areas of the country. Nevertheless, the significance of this factor is outweighed by the economic, institutional and market factors.

b. Weather

Weather has not been a factor. The periodic droughts and extremely wet periods have not been consistent and prolonged enough over the 30 year period to have affected fertilizer and pesticide demand in any significant way.

E. Summary Outlook

1. Recent policy changes and structural reforms [20]

Since June 1989 the GOES has implemented a series of policy changes and structural reforms affecting macroeconomic variables, sectors, institutions, and trade which have begun to set the stage for a general economic recovery. These changes have created a unique opportunity to reverse the negative trends of the past decade and start a reactivation which will contribute to the recovery of the agricultural sector, and specially the basic grains sub-sector. A recovery in this sub-sector will have positive spill-over effects on the inputs industry. The most relevant changes are summarized below.

a. Macroeconomic changes

- The Colon has been devalued and a market determined exchange system has been implemented. [21]

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[20]For a detailed review of these changes see "Estrategia y políticas para el desarrollo del sector agropecuario, 1991-1994, agosto 1991, Unidad de Análisis de Políticas Agropecuarias, MAG. Pertinent sections have been lifted and used in this part of the report.

[21] The devaluation of the Colon can be a mixed blessing. While export crops can be promoted as they become more competitive when the Colon "cheapens", imported agricultural inputs become more expensive for the same reason. Under these conditions the relative shifts of inputs costs and products prices, as well as productivity become critical variables affecting farmers decisions.

- The federal deficit has been reduced from 1,340 million Colones in 1989 (4.2% of GDP) to 347.1 million Colones in 1990 (0.8% of GDP).

- Import tariffs for imported goods which ranged from 1% to 290% have been adjusted and realigned to between 5% and 20%.

- Exemptions from import tariffs which favored certain privileged private and public institutions to the detriment of those not benefiting from the same have been eliminated or curtailed.

- Reforms in the tax system have been initiated to simplify the system, reduce the tax brackets, and eliminate exemptions.

- Price controls for over 200 products, including grains, have been eliminated.

b. Sectorial changes

- State monopolies which intervened in the production, marketing and trade of agricultural commodities have been curtailed or eliminated (INCAFE, INAZUCAR, COPAL, ISIC, IRA).

- Export taxes on agricultural commodities have been reduced or eliminated.

- The 5% sales tax on agricultural inputs has been eliminated.

- An import price band with a uniform import tax of 20% for yellow corn and rice has been implemented. Studies for sorghum and soybean are underway.

- The amount of credit available for the agricultural sector has increased in real terms for the crop years 1990/91 and 1991/92.

- Starting with the 1989/90 crop season, positive real rate of interest for production loans are being charged.

- Bad debts amounting to 550 million Colones accumulated by the reformed sector (Phase I) have been refinanced, making these cooperatives eligible for new production credit.

- MAG is undergoing restructuring in an effort to make this institution more efficient and effective.

- CENTA is being restructured into a center for research and extension (extension returns to CENTA) with priority in basic grains.

- The extension service is being restructured and the "Extension by Objective" mode is being introduced.

- A resolution has been approved by all Ministers of Agriculture in Central America to harmonize the agricultural policies of the nations in anticipation of the regional market integration for agricultural commodities.

c. Results so far

- The devaluation of the Colon and market determined exchange rate has eliminated the "desprotección" of the agricultural sector, vis a vis, tradeable commodities and evened out the terms of trade between the rural and urban sectors.

- The annual inflation rate was reduced to under 20% during the 1990/91 crop year, and is expected to decline even further to under 16% for the 1991/92 crop year.

- Market and price distortions for agricultural commodities and services have been reduced or eliminated.

- The price band has provided effective protection for both producers and consumers of basic grains (corn and rice), while letting international prices orient the market for these grains.

- The agricultural sector turned around, increasing 0.5% during the 1989/90 crop year and 7.4% during the 1990/91 crop year.

- Prices for basic grains have been higher in real terms during the last two crop years.

- Gross and net returns to basic grain producers appear to be recovering from depressed levels reached in the mid to late 1980's.

- Record grain crops were registered for the 1990/91 crop year, increasing 4.3% over the previous crop year. Similar results were expected this crop year, however the drought has reduced expected production to the 1989/90 levels.

These recent changes and results so far are not only encouraging, but additional macro, sectoral, institutional, and trade related adjustment to be undertaken during the next two years give further reason to expect an increasing shift back to intensification in basic grains production, and therefore, a recovery in demand for agricultural inputs.[22]

2. Outlook

The abandonment of technology in basic grains production, the current status, and potential outlook for a return to technology and a recovery in demand for agricultural inputs in El Salvador has been summarized in a schematic way in Figure II-38. Beginning in the late 1970's, the trends for farm gate prices for grains and production costs began to decline in real terms. However, the rate of decline in real farm gate prices was steeper than the rate of decline in real production costs. As the gap between these two numbers shrank, farmers were forced to adjust production patterns, and therefore the use of production inputs, leading to declining or stagnating productivity at farm level.

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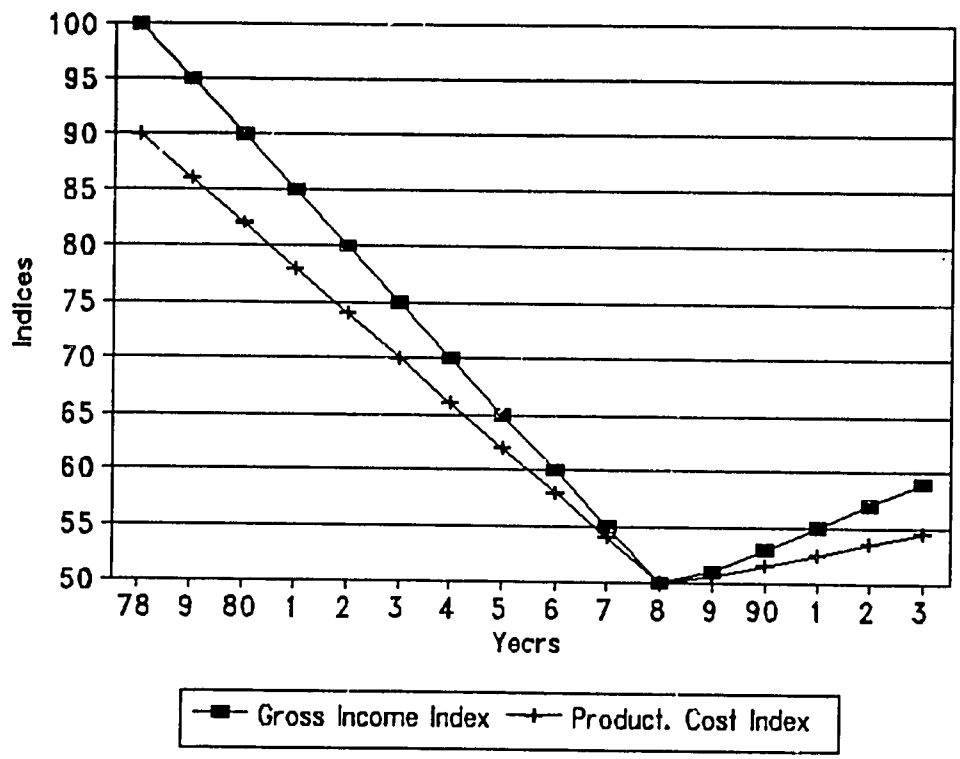
[22]For a detailed listing of these changes see the strategy document of MAG.

This economic juggernaut was compounded by other external factors, such as the decline in extension services, the lack of credit, few or no releases of successful new hybrids and improved varieties, and a market system which failed to innovate in order to make it more competitive and responsive.

FIGURE II-38

SCHEMATIC PRESENTATION OF DECLINE AND POTENTIAL RECOVERY GRAIN FARMERS' INCOMES



As a result, variable agricultural production inputs such as seed, fertilizers, and pesticides suffered declines in their respective marginal value products, that is in their worth to contribute value to the production of basic grains. Thus, as their marginal value products declined, the demand for them also declined, as farmers chose more and more to substitute labor, land, and inputs produced on the farm (such as seeds) for purchased inputs.

The lagged effects of the adjustments to macro, sectorial, institutional, and trade related policies that began in June 1989, as well as those expected from future adjustments are shown (expected) to result in an inverse mirror image for the trends in the curves representing real returns and costs. In other words, the real net returns will show a positive slope as real farm gate prices remain positive and even increase in real terms. While the slope for production costs is expected to increase as well, its slope ideally should be less steep than that of the farm gate price index, or at worst parallel.

This positive gap can be increased even further as productivity (yield per manzana) recovers and surpasses passed historical peaks. [23] This will depend greatly on improvements in the efficiency levels within the inputs industry, release and utilization of new, higher yielding varieties, the degree of effectiveness of the revamped extension system, improvements in the market system for basic grains, and farmer's willingness to change or adapt production after more than a decade of decline.

If sustained, [24] the widening future gap between farm income and the production cost will increase the marginal value product of agricultural inputs and lead to higher levels of demand by farmers. This, in short is the window of opportunity that the agricultural inputs industry in El Salvador has, to work towards reclaiming its valuable position within the agricultural sector in El Salvador.

The positive outlook presented above begs the question of the demand outlook for the inputs industry. In other words, what is the medium to long-run potential for increasing the production and sales of agricultural inputs? What rate of increase can be expected?

This question has been partially addressed in the first report of this series which dealt with the seed industry. The potential demand for agricultural inputs will be addressed in the third report of this series which will deal with supply response functions for basic grains in El Salvador.

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[23] A cursory analysis indicates that if corn yields are increased an average of 3 year, at the end of 5 years, El Salvador could be producing enough white corn for human consumption, satisfy large if not all the needs of the feed industry (depending on the growth of this industry), or export surpluses and import cheaper yellow corn.

[24] This is contingent on continued success of future macro policy changes, structural reforms, and trade related adjustments.

SECTION III

INDUSTRY STRUCTURE, CONDUCT AND PERFORMANCE [1]

A. Introduction [2]

Understanding how and why an industry is organized the way it is, how and why it behaves the way it does, and what the consequences are of its organization and behavior is critical if we are going to optimize over the long run its contribution to the general economic welfare of the nation.

The existence of a given organization, behavior and resulting performance is not the outcome of chance or happenstance, but the effect of forces which are within or outside the control of the industry. Understanding the underlying linkages between cause and effect can help us design changes which will improve these three components, and therefore lead to an increase social welfare.

The most popular framework used for this purpose turns on three simple concepts - market structure, market conduct, and market performance:

- *Market structure*: consists of the relatively stable features of the market environment that influence the rivalry among the buyers and sellers operating within it.

- *Market conduct*: consists of the policies that participants adopt toward the market (and their rivals within it) with regard to their price, the characteristics of their product, and other terms that influence market transactions.

- *Market performance*: is our normative appraisal of the social quality of the allocation of resources that results from a market's conduct.

Market structure (the environment) determines market conduct (the behavior of economic agents within that environment) and thereby sets the level of market performance (impact on general welfare).

If we are concerned with one or more aspects of market performance, these three concepts offer us an inventory of the aspects of market behavior and the elements of market structure that might allow us to determine how well a market performs in a given dimension. Then, if we can uncover reliable links between the elements of structure and the elements of performance, we have a powerful tool for economic analysis and policy.

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[1] This Section follows closely "American Industry: Structure, Conduct, and Performance, by Richard Caves, Sixth Edition, Prentice-Hall. Many sentences, paragraphs and graphs have been taken in their original form and inserted into the text where appropriate. It is hoped that this academic but applied research approach will encourage future research in this important industry in El Salvador.

[2] Caves, pages 13-15.

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If empirical analysis can expose some features of market structure or conduct that regularly cause poor market performance, then public policy can sometimes be used to change one or some of the elements of market structure or modify patterns of conduct to change the environment and raise the level of performance, that is increase general economic welfare.

B. Structure

The market structure, or the environment which surrounds the industry contains the elements which condition its conduct and ultimately influence its performance. For a given element to make a major difference in the market performance of an industry it must satisfy two basic assumptions. First, the element must have a sound theoretical foundation on which to base its influence. Second, its degree of influence must be subject to some kind of measurement through empirical research.

Elements of market environment which generally satisfy these two criteria are (1) industry concentration, (2) product differentiation, (3) barriers to entry, (4) market information, (5) industry capacity versus rate of market demand, (6) public sector participation, and (7) stability of market environment. While all these elements of the Salvadorian agrochemical industry fully satisfy the first assumption, the second criteria cannot be satisfy in a number of them due to a lack of empirical information. In such cases, only cautious qualitative or no assessments can be provided at this time.

1. Distribution channels (general description)

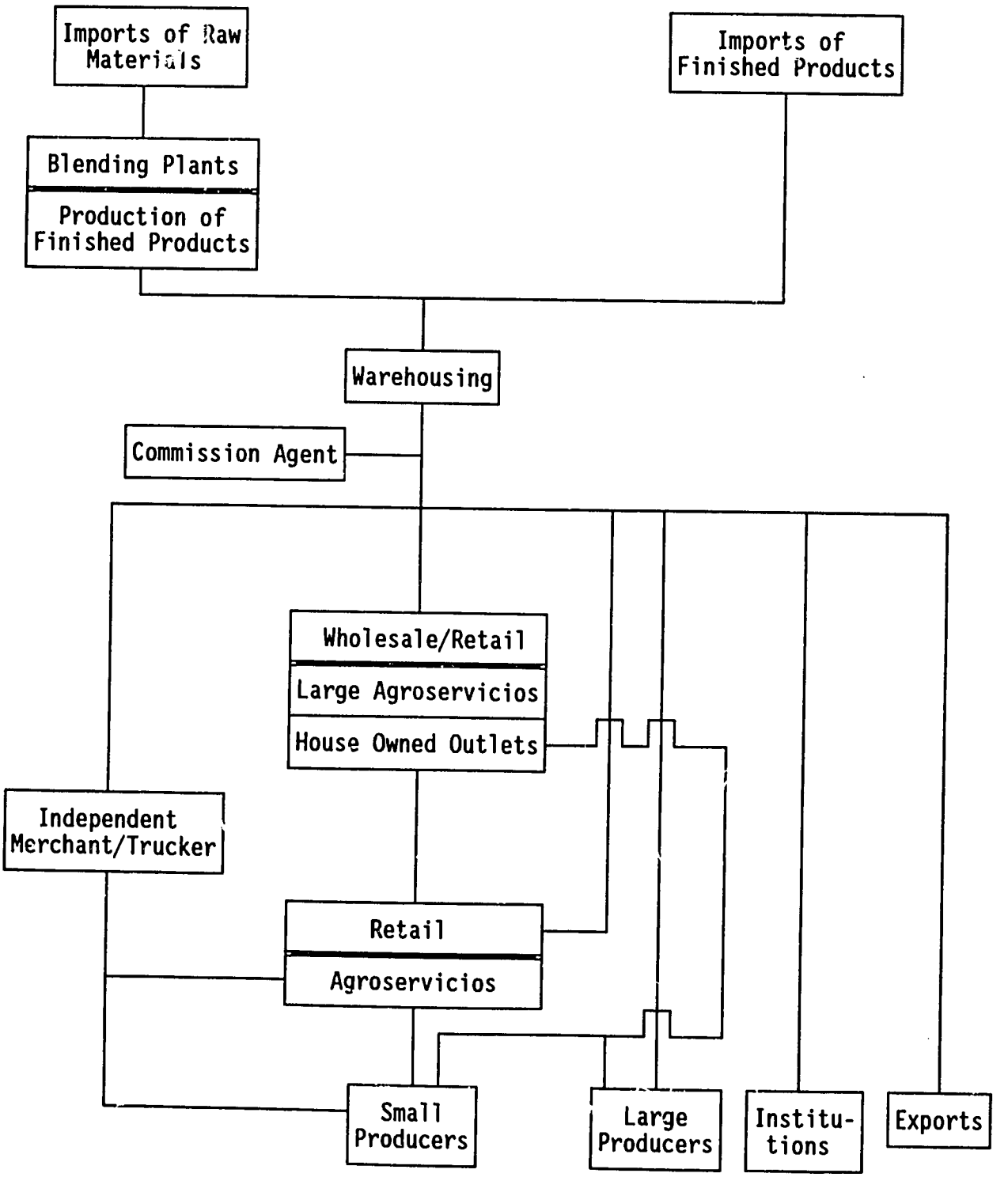
The distribution channels for fertilizers and pesticides used in agriculture are essentially the same, following a pattern of imports of either raw materials or finished products, blending (processing raw materials into finished products), warehousing, and distribution through independent distributors (agroservicios), own outlets, straight to some customers, and exports. The similarities stem from the number of firms handling both types of agrochemicals (fertilizers, pesticides), as well as other agricultural inputs, permitting utilization of the same distribution channels for these complementary products and services.

All (100%) raw materials and finished products are obtained from overseas either from brand name suppliers (for which there may be more than one licensed representative in the country; case of pesticides) or from independent sources (case of fertilizers). Blended or finished imported products are distributed through intermediaries and to a limited extent through own wholesale/retail outlets to small producers. Large producers, such as cooperatives take advantage of economies of scale and either take delivery of their inputs (fertilizers) FOB blending plant or import warehouse (Acajutla) or CIF destination, depending on the terms of trade offered by agrochemical firms.

Some of the agrochemical firms which only import finished products (do not have the capacity to produce or blend products from imported raw materials) obtain, under different arrangements, some finished products under their own name brand from firms with blending or processing capacity. Even those firms capable of blending or producing locally from imported raw materials import some finished products as well if they cannot produce the finished commodity in-country, or is more cost-effective or convenient to import the final product.

FIGURE III-1

GENERAL DISTRIBUTION CHANNELS FOR AGROCHEMICALS



Source: Field research

Until BFA abandoned its "in-kind" production credit system in 1990/91 and reverted to a strict production loan system, the institutional market used to be one the most important for all agrochemical firms. A small institutional market remains which buys fertilizers and agrochemicals from suppliers under sealed bid contracts or imports directly for their members. [3]

Some agrochemical products are also exported, either as re-exports of imported finished products or as locally blended products made from imported raw materials. Exports markets include the Central American region (fertilizers and pesticides) and the Caribbean and Latin America (pesticides). [4]

As part of their sales strategies, several agrochemical firms use commission agents who play varied roles such as sales representatives, technical assistants, and market surveyors. These agents not only promote their products, but also transmit knew information about products, their use, safety issues and other relevant facts to clients and users; they also observe market behavior and competitive reactions to their own market moves, and thus serve as feedback conduits to the firm's market development efforts.

The relative importance and use given to a specific distribution channel varies from one agrochemical firm to another. For example, sales to large producers (direct sales without intermediaries) ranged from 25 to over 70%, while sales to small producers (indirect sales through independent agroservicios) ranged from 32 to 60%. Institutional sales ranged from 0 to 20%. No reliable estimates could be obtained on the share of products marketed through independent merchant/truckers who buy the merchandise FOB suppliers and distribute to their clients. [5] Also, a client profile of this intermediary, and the terms of trade of this channel are unknown. Finally, a few agrochemical firms have a limited (less than 20?) number of house owned outlets (wholesale/retail) at different locations throughout the country. No reliable breakdown of volumes marketed through this type of outlet could be obtained.

A general (albeit how strong?) correlation was identified between the volume of sales and the percentage sold through independent agroservicios. It seems that the larger the total volume the larger the percentage of goods sold through these independent outlets. A reasonable assumption for this apparent correlation is that all firms have a number of preferred clients which are serviced no matter the "cost". This clientele, consisting of cooperatives and other larger independent producers (coffee, sugar cane) is served directly, with the rest of the inputs being sold through the other channels. Thus, the smaller the volume, apparently the more reliance is put on direct sales, and visa versa.

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[3] These are large producer organizations of single commodities such as coffee, or associations such as COADAES.

[4] Fertilizer exports are less than 10% of volumes imported and produced locally; no reliable estimates could be gathered for pesticides.

[5] This channel is apparently used more for fertilizer than for pesticides, however no breakdown could be obtained.

While at the moment the market channel of house owned wholesale/retail outlets is limited, increased recognition of advantages gained from vertical integration is making the industry look at further forward integration in the near future. Quite likely this channel will become more dominant in the near future as more firms choose to open their own wholesale/retail outlets at different locations throughout the country. [6]

2. Industry concentration

Concentration is defined as a ratio which measures the extent to which the larger sellers control the bulk of the industry's sale. [7] The higher the concentration ratio of sellers the closer the industry resembles a monopoly, and the stronger the objection from a general economic welfare point of view, since monopolies are more likely to charge higher prices and earn higher profits than industries with low concentration, i.e., competitive industries. [8]

Overall, the seller concentration ratios would indicate an industry tending to be more competitive than monopolistic in nature, since the number of sellers increases rapidly from the very beginning of the marketing chain, that is from at least 20 agrochemical suppliers, to over 600 agroservicios, and finally hundreds of thousand of farmers. While this tentative assessment is supported by other evidence (see below) there may be conditions under which monopolistic characteristics may prevail.

Monopolistic characteristics might exist among the first group of sellers, specially if the seller ratios were desegregated by type of agrochemical (fertilizers and pesticides), type of product (fertilizers: simple versus formula; and pesticides: herbicides, insecticides, and fungicides) and sub-products (fertilizers: different formulas; and pesticides: different types of herbicides, insecticides and fungicides with a common use). Another potential for a monopolistic situation to occur in a given area might exist if such area were to be serviced by a limited number, or only one agroservicio.

Table III-1 contains summary information on pesticide products being handled by different firms. During 1990 the firms handling these products could be divided into three groups, those handling 70 to 80 percent, those handling 30 to 50 percent, and those handling less than 20 percent of pesticide products used in agricultural production. By 1991, four firms of the last group and one of the second group no longer handled these products. The three firms of the first group maintained their dominance in terms of number of products offered, while one firm of the second group enlarged its product line to include nearly 70 percent of the products used.

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[6] The elimination of BFA as a supplier of agrochemicals and the advantages of forward integration are two basic stimuli for this process to happen.

[7] Caves, page 17.

[8] Caves, page 13.

Number of products is one thing however, and market share is another. While there tends to be a correlation between these two variables, an individual firm offering the most products does not necessarily possess the largest market share. Nevertheless, it is apparent that the four firms offering over 68 percent of pesticides used in agriculture also have the largest market share. This group's share could be as high as 60 to 70 percent of the market. The next group, offering 30 to 50 percent of the products has less of a market share ranging between 10 and 20 percent. The last group, consisting of firms offering less than 20 percent of the products used could have a market share ranging between 30 and 10 percent.

TABLE III-1

PERCENTAGE OF PESTICIDE PRODUCTS BEING OFFERED BY AGROCHEMICAL FIRMS

Firm	Percentage 1990	Percentage 1991
A	44.4	68.4
B	11.1	15.8
C	44.4	0.0
D	72.2	73.7
E	16.7	0.0
F	44.4	52.6
G	5.6	0.0
H	11.1	5.3
I	77.8	78.9
J	5.6	5.3
K	11.1	10.5
L	11.1	0.0
M	33.3	36.8
N	5.6	0.0
O	77.8	78.9

Source: BFA; others.

Note: The list is incomplete in that there are more firms handling pesticides than those listed; however, all the "principal" firms handling pesticides are included.

Is this high concentration ration (four firms with 60 to 70% of the pesticide market), and the fact that several firms have left the market necessarily an indication of a trend towards a monopolistic structure and profits? Is this rather a reflection of a market shakeout, given the macroeconomic and structural reforms taking place? Is the market tending to represent the potential licensing agreements that can be made with multinational firms? Definite answers to these questions can only be obtained through industry surveys over time and through comparisons with situations in other countries.

What about sub-products? Could a single firm be the only one offering a sub-product, or group of sub-products, such as a special fertilizer, a specific herbicide, or a new insecticide? This case of market share or concentration is more difficult to assess, needing more extensive market and demand surveys.

The concentration ratio for fertilizer is a bit easier to estimate due to the limited number of products and fewer firms, nearly all of them offering the same line of products. The concentration ratio is very high, with three firms sharing 75 percent of the market. While this ratio is high it does not necessarily imply excess profits (see below).

TABLE III-2

APPARENT MARKET SHARES IN FERTILIZERS

Firm	Market Share (%)
A/B	20
C/D	10
E	8
F	7
G	25
H	30
I	0

Note: Firm I had been in the fertilizer market, abandoned it in the mid 1980's and is now gearing up to reenter the market.

Source: Field research

3. Product differentiation [9]

Product differentiation is another important component of an industry's market structure. The degree of product differentiation (very few products are completely undifferentiated) affects the way a firm (and an industry) decides on its price and merchandizing policies (conduct). Product differentiation can be achieved two ways, namely through "brand identification" and/or through "terms or conditions of sale".

The implications of differentiation or lack off in terms of freedom of action by a single firm within such a market is highlighted in Figure III-2. The less differentiated (the more generic) a product is the less freedom a firm has to change its price without loosing customers to the competition (the more inelastic its demand curve) and visa versa. For example, let us assume that P_1 and Q_1 are going market prices and quantities for two products, one differentiated and the

[9] Theoretical base taken from Caves, page 18-22.

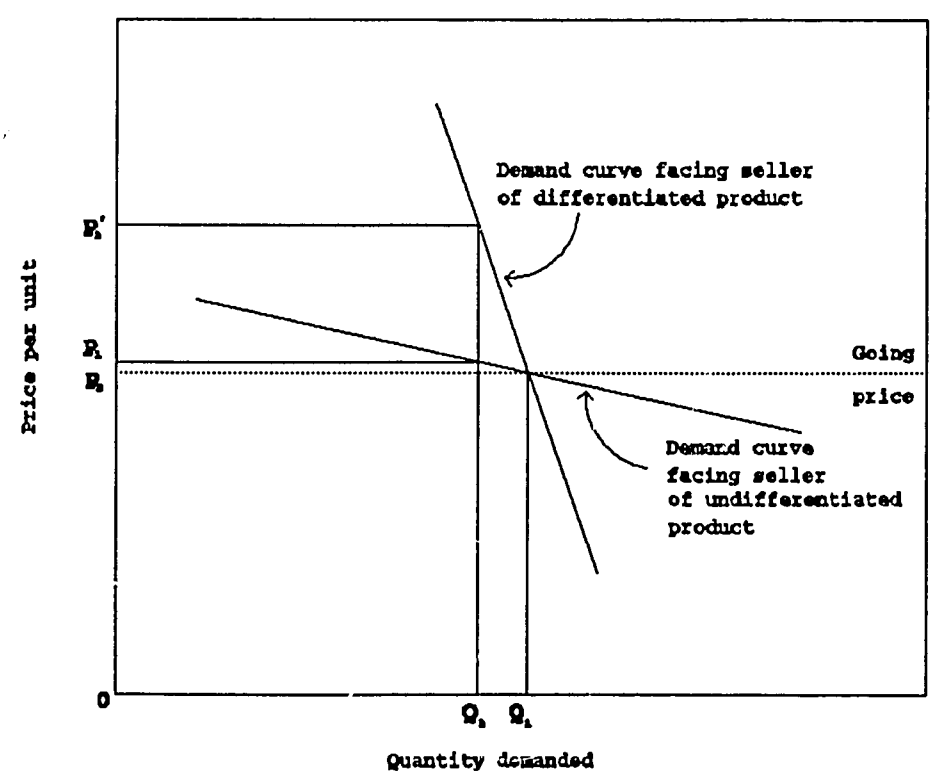
other not. In an undifferentiated product market a firm which raises its price just slightly form P_1 to P_2 will loose a large quantity of sales (Q_1-Q_2) to the competition, since in the mind of the customer there is no difference or not enough difference between the two brands in order to stay loyal to the firm which raised its price.

The more differentiated the product or its sale conditions the more the potential for raising the price of the product without loosing customers (the more elastic the demand curve for the product). This is the case for the second demand curve representing a differentiated product. In this case the seller can raise the price proportionally much higher than in the first case up to P_2' before loosing the same amount of sales volume (Q_1-Q_2) to the competition. In this case there is sufficient product differentiation (brand recognition or loyalty) or sale conditions to make it worth while for the customer to stick with the higher priced product.

FIGURE III-2

DEMAND CURVES FACING INDIVIDUAL SELLERS OF

DIFFERENTIATED AND UNDIFFERENTIATED PRODUCTS



Source: Caves, page 20, modified

To a large extent the agrochemical industry deals in products which are more undifferentiated than differentiated, whether perceived or for real. For example, ammonium sulphate, a simple fertilizer, or 16-20-00, a complex fertilizer are the same regardless of the brand names they are sold under. A herbicide, such as paraquat is still the same regardless under what brand name it is sold. Furthermore, this product has to compete with other herbicides which achieve the same result yet may have a different active ingredient. To what degree are these statements true, however?

From a technical point of view, ammonium sulphate may be the same, however it is the industry's experience that white ammonium sulphate sells for one or two Colons more than the yellow colored one. Somehow, in the mind of the consumer, white ammonium sulphate is of a better quality than the yellow one, and is willing to pay a higher price. However, beyond that basic differentiation the seller no longer has a price advantage. If seller A were to increase his price by one Colon (say from P_1 to P_2) he certainly would loose sales to competitor B (say Q_2-Q_1) who is offering the same product and has no incentive to increase his price.

The reverse also holds true under these conditions. If seller A reduces his price all other providers of the same product are forced to follow with a price match or offer some other concession, otherwise they would loose sales to the firm which lowered its price in the first place. The same argument can be made for a given pesticide product. Thus, each agrochemical firm selling fertilizers or pesticides faces, to one degree or another a relatively undifferentiated product demand curve similar to the one in Figure III-2.

Unable to compete aggressively in individual product prices the firms seek to differentiate (make demand curve for its products less elastic, i.e., steeper) through ways and means indirectly associated with the product or not built into the product itself - that is through conditions associated with the terms of sales and services.

For example, some firms try to "sell" the problems associated with the caking of certain fertilizers (in this case it is the competitor's fertilizer which has the problems associated with caking), or the "immediate" visual results of a certain herbicide (though the competitor's product is equally effective, has the same or even lower cost per application, is less toxic, but it takes longer for its effect to become visual).

A final means to make the demand curve less elastic (more differentiated) is through a successful product change which would add some uniqueness to the basic product and allow the firm to charge a higher price. An example of this would be the recent re-introduction of fertilizer which contains potassium (aside from nitrogen and phosphorus). In this case the firm(s) will want to charge a differential for the added component, however may not, depending on the firm's expectation and consumers' perception of the product.

If this new product achieves enough differentiation from the basic product (16-20-00), then a higher price may be charged, a promotional budget justified, and a larger market share won. If the farmer does not perceive a difference in the same manner, or if the consumer does not realize the differentiation in his

operation, (improvement in his bottom line), then the "new" product will not gain sufficient differentiation to establish a brand loyalty which would support a higher merchandizing margin.

In summary, while the perception of product differentiation by clients is more likely in pesticides than fertilizers, competition based on service and non-product differentiation, rather than price, is more the norm in the industry. Therefore, the more an agrochemical firm can shift the demand of a product to the more inclined demand curve, the more differentiation it obtains and the more liberty it gains in terms of product, pricing and service policies. As the economy, and farm producers respond to macro-economic and structural changes, agrochemical firms will be in a better position to introduce more product differentiation into this market.

4. Barriers to entry [10]

Barriers to entry into the industry constitute another important element of the firm's economic environment. While not as easy to measure as a concentration ratio, the conditions of entry into the industry can explain something about potential rivals entering, and therefore why and how existing firms conduct themselves.

Some of the better known barriers to entry include (1) economies of scale, (2) patented products and licensing agreements, (3) access to international key resources and products, (4) absolute-cost barriers and (5) product-differentiation. To different degrees all these barriers to entry are present at the level of agrochemical supplier/blender in El Salvador. Their relative importance and impact is, however, impossible to quantify with the present information. As a result some qualitative information is presented as follows.

a. Economies of scale

In order to gain the lowest possible average unit cost over the long-run, a firm must seek a compatible scale of production which in turn defines a given investment in infrastructure, equipment, working capital, and other fixed and variable inputs. Ideally, such investment in capacity should be balanced with the growth rate of market demand.

At the moment the fertilizer industry in EL Salvador (production of final products from imported raw materials) is saddled with excess production capacity relative to actual market volume. This unutilized capacity serves as a deterrent to new entrants, unless new technology were introduced which would allow for smaller scale production at equivalent or lesser average unit costs.

A similar situation arises in pesticides in that the existing blending plants have more than sufficient capacity for the local market and to a degree depend on existing export markets for sufficient volume to keep their unit costs down.

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[10] Caves, page 22-29.

Both situations, one of excess capacity and the other dependent on foreign markets for a vital balance of its output, create effective barriers to entry at that level in the national industry. It is unlikely that these barriers can be effectively reduced (see below).

b. Patented products and licensing agreements

Most if not all agrochemical firms have linkages to multinationals to import and merchandize their products under the original house brand or their own local label. These agreements can represent a certain barrier to entry if no other alternative sources exist (patented products) or if the licensing agreements are given on a sole source basis.

It was observed that some brand names of products supplied by multinational firms were being sold by more than one local agrochemical firm. The extent of representation and merchandizing process could not be ascertained, however its existence implies that the more common it is, the lower the barrier to entry, and the higher the probability of a competitive environment. The degree to which this might be the case could not be determined, and should be subject to a review of existing licensing agreements.

c. Access to international key resources and products

EL Salvador is totally dependent on imported raw materials or finished products for all agrochemicals used in agriculture. Whether such access to international resources and products is an effective barrier to entry could not be ascertained. More likely than not such access or potential to such access does not represent an effective barrier to entry in the market for finished products, however the same situation can be an effective barrier for a firm trying to enter the market as a blender or processor.

Fertilizers, the most undifferentiated group of products come from many sources all over the world, and these sources are separated by continents, countries and firms. Also, in order to take advantage of economies of scale, some of the firms in EL Salvador pull resources to import the amounts of fertilizers needed. These two conditions can reduce the potential for a barrier to access to international resources and products, since the international suppliers seek customers regardless of their affiliation, and local firms need to pull resources to gain economies.

Due to licensing agreements, international sources of key inputs and/or products is more likely to represent a barrier in pesticides. Some multinational chemical firms will only allow one firm to represent it and distribute its products in a given country, others may allow one representative but several distribution firms for the country, or even export in the region and outside the region. Lack of information in the licensing and distribution agreements, however prevents a detailed analysis of the potential barrier this structural element may represent.

d. Absolute-cost barriers

There are many reasons for absolute-cost barriers, including average cost of production, patents, access to a key production inputs or resources, availability

of specialized skills, and cost of capital. Several of these may represent a barrier to entry, with capital being perhaps the most significant absolute-cost barrier to entry into the agrochemical industry in El Salvador. Again, while detailed information is subject to more rigorous analysis, certain qualitative aspects can be mentioned.

Even at the scale of production operated in EL Salvador, capital investment needed is very high and risky relative to other investment opportunities. Specialized machinery and equipment alone will demand higher levels of investments, and being specialized with little or no other use should the initial investment fail, increases the risk of the investment. Key production factors, including specialized personnel may not be readily available. Access to key production inputs and other resources, while available internationally may not be readily accessible or already committed to another firm under a licensing agreement.

e. Product differentiation

As explained above, undifferentiated products is the rule rather than the exception in the industry, specially in fertilizers. Nevertheless, there is still room for barriers to entry based on product differentiation. The most common case is when an established brand, say of a given fertilizer, herbicide or insecticide has achieved a certain level of recognition, acceptance and goodwill in the market.

A firm trying to introduce a new competitive or less toxic product would have, under this condition a hard time convincing customers of the established brand to "forget the satisfaction they are receiving from the current product" which over the years gained and now enjoys a high level of goodwill by the customers. The cost to a single firm of attempting to brake into this established market for a product could be prohibitive. Alone the cost of advertizing and promotion could be beyond reach.

This can be a key barrier to the industry in general in introducing less toxic pesticides and more appropriate fertilizers. Farmers may even be willing to pay higher prices for the products they esteem, even though they may be more harmful and not as effective as the new product. Under this conditions, options for a successful change to more appropriate fertilizers and less toxic pesticides are limited to legislation, higher farm incomes, and extension programs.

5. Market information

Lack of, or access to relevant market information can represent an effective barrier to entry into any industry. Established firms not only have their own historical records, institutional history and linkages to outside information sources, but also the advantage to be in a position to correlate past volume (supply and demand conditions) and prices to policy and market conditions. Also, the experience gained from projecting annual demand versus actual results makes them better users of this type of information.

Against this background it is very difficult for a new entrant to have a "feel" for the market, to know what forces guide prices and volumes and what levels

approximate equilibria between supply and demand. In El Salvador, information on fertilizers and pesticides is very limited and not readily available. Such lack of information makes a risky situation even more so for firms already in the market, and may discourage new entrants or make a new entrant more conservative and perhaps less competitive.

6. Public sector participation

Historically, but more so from the late 70's to the late 80's the public sector played a major role in the agrochemical industry in El Salvador. Such participation ranged from macro [11] and trade policies [12] with direct impact on the industry, to intervention in the distribution and utilization [13] of these products through government directed programs. The undesirable impact of such public participation on its structure and, therefore, conduct and performance of the industry was realized, and since 1988/89 this type of public sector intervention has been reduced considerably or eliminated (see Section II).

Still other forms of public intervention exists which are known as "structure elements with predictive values". [14] The significance of this type of elements comes from the fact that as a part of the structure they bear predictive impacts on the conduct (flexibility of prices) and performance (profit rates) of the industry. The most common type of this structure elements with predictive value are taxes.

In El Salvador there is one such structure element in need of reassessment. All agrochemicals, whether raw materials or finished products are taxed when imported into the country. However, according to industry sources such taxation is not consistent among the two groups of agrochemical products. i.e., the degree to which raw materials and finished goods are taxed within the fertilizer group and the pesticide group, when imported.

While all products within the fertilizer group, whether raw materials of finished products pay an ad valorem import tax of 5 percent, products within the pesticide group pay different rates, namely 5 percent for raw materials and 15 percent for finished products.

Under these conditions the blenders and processors of pesticides enjoy a 10 percent protection (gross margin over imported finished products), whereas the local fertilizer processors or blenders enjoy none. While arguments both for and against this apparent anomaly can be made, there is no doubt that this structure element affects the conduct and performance of the industry, and therefor merits closer scrutiny. Should the import tax be the same for equivalent products (raw

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[11] The most important being the exchange rate.

[12] Including tariffs, quotas, exemptions, industry protection, allocation of foreign exchange, and others.

[13] The most important being the credit program used by BFA.

[14] Caves, page 30.

materials versus finished products) within both groups? If so, should the protection enjoyed by the pesticide group be reduced, or the tax on finished fertilizer products increased? In this regard, an analysis of the predictive value of the current situation and options would be very helpful in sorting out this apparent anomaly. In this case predictive value goes beyond pricing flexibility to include such items as local value added, employment, wage income multiplier effect and alternative tax sources and revenues.

7. Stability of market environment (structure) and public policy [15]

Certain degree of stability of the market environment or structure is critical to understand the cause and effect relationships and in order for public policy to be useful. Too many and frequent changes in the various elements of the structure would undermine our understanding of the various cause and effect relationships and diminish hope of influencing them through public policy. On the other hand, complete stability (no change) is also undesirable, reducing public policy opportunity to improve the conduct and performance of the industry.

The many macro and structural changes started in 1988/89 and on-going will no doubt affect the structure and thus the conduct and performance of the industry in years to come. As a result, the different barriers to entry may decline (increase), increasing (decreasing) the potential supply of rivals to firms in the industry; industry concentration may increase or decrease as firms leave and enter the market; product differentiation may increase as farm producers realize higher real farm incomes and firms are able to make their products more differentiated.

All these elements are interrelated and relatively stable over time. A change in one tends to bring about changes in the other elements. By monitoring and analyzing these relationships and changes, public policy is in a position to guide the industry to higher levels of effectiveness and efficiency.

C. Conduct [16]

Firms generally portray a certain market conduct in an attempt to maintain and expand current operations, thus guarantying their long-term survival. This type of market conduct can be broken down into several major areas of business policy, including (1) price policies, (2) product policies, (3) non-price policies, and (4) other policies that seek strategic advantage and deter entry. [17]

Given the industry's market structure, the behavioral pattern expected from the agrochemical firms in El Salvador in regard to these areas of business policy fall within the conduct choices expected under an oligopolistic structure. The essence of this market conduct consists of two interlinked points, namely [18]

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[15] Caves, page 32-35.

[16] Caves, page 48-65.

[17] Caves, page 49.

[18] Caves, page 49-50.

- that firms are few enough to recognize the impact of their actions on their rivals and thus on the market as a whole, and

- that firms recognize this mutual interdependence and take them into account as they take decisions on business policy

1. Price policies

Product prices for fertilizers and pesticides at the importer/blender/distributor level are set in a typical oligopolistic fashion. Individual product prices are set initially, based either on a "normal rate of return on their investment" or as a result of a "standard markup onto their costs". While no conclusive answer was obtained as to which method is actually used by type of product, it appears that most firms prefer to use the standard markup method to set their initial prices for their products. Given the uncertainties surrounding the realism and applicability of the desired rate of return method [19] and the relative ease of a standard markup, this choice seems reasonable.

These initial price lists are just that. They are set for the beginning of the crop year and are modified as market conditions change or as changes are made by rival firms competing with substitutes products. A firm's price change is known immediately and rivals react accordingly to protect their turf. This "process of price adjustment and response goes on very quickly and sensitively", specially in regard to changes in fertilizer prices, where price response can be a matter of hours rather than days.

Most agrochemical firms share such price list and subsequent changes with their clients. A few firms do not publish their lists, either because they merchandize relatively few products (say a limited selection of fertilizers) or consider it to be a competitive advantage in not doing so.

In general the suggested list prices loose importance at the secondary wholesale and final retail market levels (agroservicios, independent trucker/merchant) since these market participants are free to set their own prices. Thus, market forces, specially where several agroservicios are competing for the same clients become more dominant in the process of making business decisions.

The question about pricing is, however, broader than just setting individual firm prices and changing them to adjust to market conditions and rivals competitive movements. The broader question about industry pricing deals with the issues of (1) whether or not the oligopolists coordinate in one fashion or another to agree on prices or price ranges, (2) whether a price leader implicitly or explicitly "announces" a price or price range which is followed and respected by the others, and (3) whether predatory pricing is being practiced (the practice of punishing "chiselers" (punish non-conformist market participants) and the notion that "big fish eat little fish", that is bigger firms can coerce or eliminate small firms). [20]

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[19] What is an acceptable "normal" rate of return given the economic conditions, alternative investments and uncertainties regarding the economy in El Salvador?

[20] Caves, page 53-56.

Final answers to these important pricing questions, and therefore performance are left open. The reason is threefold. First, more detailed and in-depth survey information is needed to address them. Second, some impressions gathered during the course of this study seemed conflictive and in need of reconciliation (for example a high concentration ratio in the fertilizer component contrasting with apparent low profit margins ranging between 5 and 7 percent). Many potential answers can be offered for this situation, however none substantiated by information obtained from unbiased surveys. Third, the industry's structure is adjusting to new macro, sectoral, trade and market changes (specially in fertilizers where new entities are entering the market, national fertilizer production is increasing, and vertical integration into distribution and retail is being initiated). Such structural changes can and will have an impact on the conduct and performance of the industry.

2. Product promotion policies

In an industry dealing with relatively undifferentiated products the individual firm asks not only, "Can I raise my profits by cutting my prices?" but also, "Can I raise my profits by changing the quality of my product?" or, "Can I raise my profits by increasing my advertising budget (increase brand recognition)?" [21] Thus, product policies are related to actual changes in the quality of the product and/or services, or the creation of a strong correlation between quality and the existing product, that is brand recognition or loyalty by the consumer.

Naturally, the higher the level of differentiation the higher the degree for independent action and the higher the pay-off potential from advertising. Unlike a price reduction which can always be met, "product strategies are much more likely than price strategies to fill the requirement for independent action, that is the initial move (the change in the product) will not be met by rivals" any time soon, allowing the firm to get ahead of the competition.

This product policy is clearly evident in the agrochemical industry in El Salvador, where advertising budgets range from zero to several hundreds of thousand Colons, depending on the situation. Advertising costs are zero, or used more as a source of general and technical information the more undifferentiated the product, such as fertilizers or a pesticide with many substitutes. Such advertising is most often provided by the multinational firm (casa madre) being represented in the country and is general in nature, describing the attributes or comparative qualities of the product and/or service. Such advertising comes at no cost to the local representative to support his market promotion efforts.

The next type of advertising seeks to maintain and/or strengthen the goodwill or brand recognition gained by a specific product, such as a fast acting herbicide, or a multipurpose insecticide. In this case the local firms tend to use printed materials such as road signs, newspaper adds and inserts, flyers, as well as radio announcements to promote the product and reinforce its benefits in the mind of consumers. This type of promotion is done at regular intervals to create and maintain product recognition, or at appropriate times during the agricultural year to remind users.

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[21] Caves, page 57-58.

The third type and most expensive advertising concerns the promotion of improved products which have the potential for differentiation, and therefore higher profit margins. For example, the standard 16-20-00 fertilizer to which a certain proportion of the third element (Potassium) has been added (16-20-12) is now being promoted as superior or better then the old standard. Another example of this type of product promotion is the advertising being given to physical mixes of fertilizers. In this case the "right mix" (including customized to specific needs) is promoted as superior to the old standby. A similar case can be made for new pesticides and insecticides which are promoted as more cost effective and less toxic than the current products being used.

The advertising process for this third type of product promotion is more costly and complicated, including some or all of the following activities:

- sleek brochures showing the effect of the product (contrast with old product or no application), cost benefit analysis, easiness of use, safety tips, and other information
- special visual and written information material aimed at a certain clientele (by level of education, type of crop, social level)
- free samples for potential customers
- free technical assistance and advise for interested customers
- promotional stands in agricultural fairs and other public displays
- special presentations and promotion incentives to distributors and retailers
- demonstration plots

These product changes and sales promotion policies are typical conduct patterns of individual firms as they try to increase profits where product differentiation permits. While annual industry wide promotional expenses could not be obtained, this type of product promotion compared to total product value appears to be relatively small. The promotional expenses mentioned by some firms ranged from zero (all promotional material provided by the multinational firm) to several hundreds of thousand of Colons per year.

3. Trading policies

Another useful conduct often used by individual firms to create or increase differentiation and thus profits is known under the catch all phrase of trading policies or non-product differentiation. These policies attempt to create a special situation or environment which will attract and keep customers, despite the fact that the products being sold are highly undifferentiated.

The degree to which these non-product policies are used varies across group of products and firms. Generally the larger and more integrated the firm the more these policy instruments are likely to be used. Also, the more undifferentiated the products the more likely the use of these policy instruments in an attempt to create some advantageous differentiation.

These trading policies designed to create non-product differentiation can be a very effective marketing technique and can take many forms. The following are used to one degree or another by agrochemical firms in El Salvador.

- frequent sales staff visits to distributors and retailers
- the use of commission agents on an incentive basis
- prizes for meeting or exceeding sales quotas or thresholds
- variable credit arrangements with clients (retailers and final customers)
- price discounts for volume purchases
- free delivery of products over certain quantities
- no charge for soil sample analysis if client buys fertilizer products from the firm
- adjustable business hours to accommodate clients' needs
- reservation and temporary storage of materials until picked up by client
- technical support and advise to clients (distributors, retailers, and farm producers)
- free information and promotional materials on new products
- training sessions on existing and new products
- promotional materials related with the company and the brand name, such as t-shirts, caps, pens and knifes.
- raffles of complementary products such as sprayers and other tools
- special consideration for good clients who, for reasons beyond their control fall in arrears with payments

4. Role of association

Many industries form associations whose membership consists of most if not all the individual firms with interest in a specific industry. Generally, an association represents a single commodity (say corn a growers association within the cereals) or a group of commodities (say agrochemicals).

The reason for an association is basic. Since "united we stand and divided we fall", an association provides the critical mass needed to protect interests and promote the goodwill of the industry and the members it represents. In other words, an association is a position to undertake programs and activities in support of the industry (all firms) which are beyond the financial capacity of an individual firm, thus benefitting everyone. In this manner associations become part of the structure of the industry. Its programs and actions affect the industry's conduct and also its performance.

Generally the assets, personnel, programs and activities of the association are financed from annual dues paid by member firms and individuals, or check-off charges from the sale of the commodities it represents. Donations or matching funds are considered secondary sources of financing.

In El Salvador, the Asociación de Proveedores Agrícolas (APA) represents nearly all the agrochemical firms in the country. [22] Initially, the association's activities were aimed at presenting a united front to Government policies and to adjust to them in an equitable manner for all involved. For example, APA was instrumental in representing the industry during the time period when fertilizer imports were restricted through annual quotas and foreign exchange controls by the public sector, as well as handling the distribution of the import quota among members.

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[22] See Appendix 16 for members of APA.

Since the mid 80's APA has taken more leadership in promoting activities which enhance the general goodwill of the industry, as well as the safe and efficient use of pesticides and fertilizers. For example, a successful educational program has been financed with APA funds, as well as with funds from international donor agencies. [23] Under this program thousands of persons engaged in handling, transporting, distributing, storing and using these products, as well as paramedics from the Red Cross have received instructions and materials on safe and efficient handling of pesticides and fertilizers.

Another association engaged in promoting the interests of the industry at a different market level is the Asociación de Distribuidores de Insumos Agrícolas de El Salvador (ADAES). This association represents most of the agroservicios or retail stores for agrochemicals in the country. Less than five years old, this association is trying to improve the effectiveness and efficiency of this marketing level by (1) strengthening its bargaining power vis a vis the suppliers of agrochemical products, (2) taking advantage of the liberalized trading environment (achieve direct imports of inputs through COADAES, the cooperative of ADAES), and (3) by lobbying for an amendment to the 1973 law which would legalize the current practice of rebottling of pesticides and resacking of fertilizers at the retail level.

D. Performance [24]

The concepts of structure and conduct allowed us to put together economic facts and other non-quantitative information to "find out why things happen as they do". With that it is possible to compare the findings and "ask how public policy could improve this performance". Before we do this, however lets first understand the "meaning of market performance".

In order to provide the highest economic welfare for its citizens, an economy should achieve four goals: (1) it should be efficient, (2) it should be progressive, (3) it should be fully employed, and (4) it should be equitable. [25] Market performance can then be defined as "the appraisal of how far the economic results of an industry's behavior fall short of the best possible contribution it could make to achieve these goals". In order to do that "the actual performance of an industry is placed beside the potential". If gaps can be found "between the actual and the potential performance, then what ways and means (policy, structure or technical) can be suggested to reduce or eliminate the gaps? In this context it is important to understand that the performance appraisal is industry wide and not aimed at any single firm or participant, and second that blame per se is not being sought or singled out. Rather, the appraisal of conduct and performance is on global basis, and the potential remedies apply to all firms within the industry.

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[23] For 1992 APA obtained C700,000 from FEPADE (USAID financed) to expand the ongoing program on safe and efficient handling of pesticides and fertilizers.

[24] Caves, page 66-82.

[25] For a detailed description of these goals see Caves, page 66.

The problem with this logical approach is twofold. First, it is at best very difficult to measure actual performance, [26] and second, what is the optimum potential performance of a particular industry that would make the highest contribution possible to the four welfare goals? Having gained some insights into the first, and without approximations to the second one in terms of what is optimum for EL Salvador, the performance appraisal will be mostly qualitative in nature in this report. [27]

1. Efficiency [28]

Economic efficiency is an attempt to measure allocation of "productive resources among the various types of good and services produced in the economy". In terms of our analysis it represents an attempt to measure how efficient firms and industries are at using resources in the production of goods and services. This type of measurement is also known as "technical efficiency" as contrasted with "allocative efficiency" that results from a monopoly. [29]

a. Profit rates

The profit rate (rate of return) of an industry is perhaps the most significant measure of efficiency "since optimal resource allocation - one side of optimal market performance - requires a 'normal' rate of return on equity capital to prevail in each industry". Since the return is on equity capital, the question is what is a "normal" (or optimal) rate of return on capital that is invested for long periods of time? Establishing such normal long-term rate of return is not easy under stable economic conditions, and agreeing on one under the current conditions of macro and structural reforms, and reconstruction is just about impossible. [30]

Nevertheless, what would be a normal or acceptable long-term rate of return for the agrochemical industry in El Salvador, and how would actual rates of return compare? [31] Information shared by individual firms indicate the following actual ranges of rates of return:

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[26] Private firms are concerned, and correctly so with sharing information considered vital for their competitive situation.

[27] This statement should not be taken negatively, to the contrary, the more insights are gained through future research the higher the confidence in both parameters and the opportunity for sounder public policies to reduce the gaps.

[28] Caves, page 67-74.

[29] Caves, page 68.

[30] Opinions from colleagues working in El Salvador ranged from 12 to over 30 percent annually in real terms.

[31] Ideally this should be broken down by commodity group and firm size, however such data was not possible to obtain.

- fertilizers: 3 to 12 percent with 5 to 7 percent being the most mentioned

- pesticides: 15 to 30 percent with 20 to 25 percent being the most mentioned

At the next level of the marketing system for agrochemicals, namely the agroservicios profit margins quoted for both fertilizers and chemicals where inferior to those quoted by the previous market level:

- fertilizers: up to 5 percent

- pesticides: between 15 to 20 percent

Naturally, many arguments could be made for and against these stated returns. On the one hand, it is surprising to see such low returns in the fertilizer group when this segment of the industry has such a high concentration ratio at the supplier level (see Table III-2). On the other hand, the fertilizer business is highly seasonal, with the majority of the volume being sold during a few months of the year; under such marketing conditions what would be the equivalent annual rate of return? Perhaps the structure and recent macroeconomic changes, as well as other policies related to international trade is forcing the industry to operate closer to the normal long-term profit level (remember a normal long-term rate of return has not be specified).

The pesticide group reported much higher profit levels. Are these consistent with the normal rate of return that should be expected? The seasonality factor needs to be taken into account, though perhaps to a lesser extent. The products are more hazardous to handle, demanding higher profit margins. A combination of a large number of products, highly varying volumes per product, and a high number of different size containers carries higher costs per unit, demanding higher margins. Product differentiation is higher than in fertilizers, permitting more promotion and price competition, thus higher profit margins. The current import tariffs provide this segment of the industry with more protection than the fertilizer segment, giving locally produced pesticides a 10 percent margin to start with. Unlike fertilizer imports, pesticides are linked to a limited number of multinational firms and licensing agreements, reducing competition from overseas suppliers. On the other hand more firms share in the national pesticide market, alluding to less concentration and therefore lower profit margins.

Given the current socio/political, macroeconomic, trade, market and regulatory conditions affecting the industry current profit margins provided by industry sources for both levels of marketing do not seem unduly high. Nevertheless, without information of the cost side of the business (aside from product cost) it is impossible to give a final answer to this important measure of efficiency within this industry, again showing the need for future research in this area.

b. Comparative prices for agricultural inputs

Another important relative measure of performance can be obtained by comparing prices paid by Salvadorian farmers for agricultural inputs versus prices paid by farmers in other countries. This type of efficiency measure has to be done very careful for two reasons. First, the assumption that the same type of product is

being compared is very important. For example, ammonium sulphate from two different sources can be technically the same, however its appearance, texture, consistency, hydroscopic properties, packaging and other factors can differentiate the two basic products sufficiently to warrant different prices.

The second reason relates to the structure of the market for agrochemicals in each country. Many structure elements could account for the price differences. For example, a differential in the import tariffs could explain the difference in prices, if the rest of the structure is similar in the countries being compared, or only part of the difference if there are other structure elements which are different. If all of these can be pinpointed and measured, then a judgement on relative efficiency can be made.

In spite of these two important assumptions, the prices paid by Salvadorian farmers for three basic fertilizers (see Table III-3) appear to support a higher level of efficiency in this component of the Salvadorian agrochemical industry than in other Central American countries. The numbers are incomplete and only two time periods were found, however on both occasions farmers in El Salvador paid lower prices than in most of the other countries.

In one way or another, this favorable situation is due to structural differences which elicit a market conduct in El Salvador which in turn tends to result in a better performance. It would be interesting to analyze these structure differences to see whether further efficiencies can be gained. Unfortunately, a similar price sheet could not be elaborated for the pesticide component.

TABLE III-3

PRICES PAID BY PRODUCERS FOR AGRICULTURAL INPUTS IN CENTRAL AMERICA

	INSUMO (C/Tm) - 6/28/91			INSUMO (C/Tm) - 1/8/92		
COUNTRY	Urea Perlada	Sulfato de Amonio	15-15-15	Urea Perlada	Sulfato de Amonio	15-15-15
El Salvador	338.40	119.55	249.07	259.62	117.79	231.90
Costa Rica				255.65	181.40	239.40
Guatemala				240.65	124.57	270.65
Honduras	272.92	301.98		262.96	199.45	264.84
Nicaragua	317.40	97.39	184.13			
Panamá	249.99	250.44	266.09	271.74	251.74	277.17

Source: Files, USAID/San Salvador

c. Efficient scale of local production

What constitutes a level of local production which takes advantage of economies of scale and produces agrochemicals in the most efficient manner? From the structure of the industry we learned that the fertilizer group has excess capacity which is not being used, and the pesticide group depends on export markets for some of its volume of production. For opposing reasons both are effective barriers to entry, yet with the current information and understanding few specifics can be said about their efficiencies of production.

No doubt, the unused capacity in fertilizer production implies a higher per unit production cost which must be carried and recovered if local production is going to continue. How could public policies be applied to make this product group more efficient by achieving production levels nearer those based on the scale of the plants? Would this lead to higher levels of employment, tax revenue, and better fertilizer prices for farm producers? Could greater local production exceed national demand of certain fertilizers and lead to possible regional exports of finished products?

On the other hand, would increased local fertilizer production (from imported raw materials) lead to a monopolistic structure (two plants or less) and conduct (less competition and profit levels considered above normal)? If so, can such a development be counterbalanced with proper trade policies?

The dependency of the pesticide group on foreign markets for a significant portion of its volume of production suggests that the combined economic scale of production of the plants is larger than what the local demand is able to absorb. This, however does not address the concern whether the plants are producing at the most efficient level, nor whether a loss in export markets or a change in the current import tariffs, or other regional trade policies for finished pesticide products would be detrimental to local production efficiency.

d. Sales promotion

Unlike profit rates, efficiency in terms of sales promotion and product changes are not easily assessed. As we saw at the beginning of this Section the more differentiation a product enjoys the more the degree of price competition it can withstand, and the more effective advertising can be. However, at what level do sales promotion become ineffective and their costs exceed revenue generation? Promotion that "provides information to the public is not a waste of resources", since consumers become aware of the choices and make more intelligent buying decisions. However, at what point does advertising quit being informative and becomes misleading?

These performance questions cannot be directly answered, however some qualitative observations can be provided. The basic sales promotion undertaken buy the industry seems sound and informative. While no direct total promotion costs could be obtained, it seems that these expenses are minuscule compared with total sales revenue. The efforts undertaken by APA to inform market participants and users of agrochemicals on safety procedures and efficient use of these products is another worthwhile promotional activity with an impact that transcends to narrow objectives of advertising.

2. Progress, research and innovation [33]

This topic is only partially relevant to the agrochemical industry in El Salvador since all inputs (raw materials and finished products) are imported. Basic research and product innovation "to raise the quality and variety of products being made available" is a function of the multinational firms which have licensing agreements or direct representation in the country.

A limited program of applied or adaptive research of new products is being undertaken by only two or three local firms, and CENTA. The results of these efforts are not readily available, either for competitive reasons or lack of publication by the public sector.

A more relevant issue of economic performance is whether or not local firms have been "improving the techniques with which the industry organizes its factors of production"? Some positive developments have taken place in this regard in both product groups. A state of the art pesticide blending plant was opened less than three years ago; a new plant for production of physical mixes of fertilizers has also opened; and a fertilizer plant which had shut down in the early 80's, was recapitalized, its equipment upgraded, and production re-started in the mid 80's. These additions and improvements in factors of production have contributed to some of the economic welfare goals through increased employment and efficiency, and provisions to equity as well.

On the other hand the controversy over the rebottling of pesticides and the rebagging of fertilizers into smaller containers at the retail level continues unabated. The issue is not the rebottling and rebagging of products into smaller containers, since the market demands such services. The issue is where within the system it should take place, that is closer to the manufacturing point or closer to the consumer level. The industry has made progress in this regard, with several firms offering different container sizes for the most commonly used pesticides. Fertilizers, however are still being sold in the standard 50 Kg sack.

As discussed in Section IV, the legalization of this practice at the retail level is not the answer. If this important marketing service is to continue without the negative side effects it now has, it must be resolved at the import or blending level of the marketing structure. There is no other way the original supplier of a product can guarantee its quality and integrity unless he integrates to the retail level. Even so, this approach could not overcome the health and environmental hazards associated with re-packaging pesticides at that market level.

3. Full employment and price stability [34]

One of the economic goals necessary for achieving maximum social welfare is that of full employment and price stability. What has been the performance or the

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[33] Caves, page 74-78.

[34] Caves, page 78-79.

contribution of this industry towards this goal? Answers to the issues of employment and price stability are linked to an environment which is much broader (that is fiscal, monetary, exchange and trade policies) than the structure of the industry itself. In view of this some qualitative observations are presented.

The agrochemical industry contributes to the level of employment in two important ways. First, thousands of persons are productively employed within the industry itself in such areas as management, production, distribution, retailing, finance, and other productive activities. Second, the industry is a heavy user of goods and services provided by other industries such as ocean shipping and port services, inland transportation services, financial services, and other factors such as packaging materials made form plastic and natural fibers, advertising and others.

How does this industry compare to others? Would a more competitive environment (competition is always desired, the question is whether more competition is possible) create more employment opportunities within the industry and in other industries whose services it uses? Would stable and attractive investment rates and returns lead proportionally to more employment? These questions, and surely others need to be looked at in the future.

Price stability is not only desired by every consumer and investor, it is fundamental for positive long-term economic performance. The importance of this was demonstrated by the impact general price stability can have on farmers' incomes and, therefore, on demand for agricultural inputs (see Section II). In this regard, the performance of the industry has been affected by the change in exchange rate policy since 1988/89.

El Salvador imports every fertilizer and pesticide product used in agriculture, and these in turn represent a sizable portion of the cost of production. An exchange rate re-alignment (devaluation) which has been implemented to allocate total resources more optimally can have an undesirable effect on the prices of these products. The local price of these products will increase since a devaluation increases the cost of all imported commodities. This effect, however should be a short-term one, until a stable price level for the exchange rate is achieved and maintained.

There are at least three ways that the undesirable effects of the devaluation of the currency can be offset or counterbalanced (assuming a stable exchange rate price level is achieved). First, a locally produced substitute is introduced. This option is not viable since El Salvador lacks the natural resources and the industrial base for this. Second, more local finished product manufacturing is undertaken by importing more raw materials and semi-finished products and by increasing or adding to local production or blending capacity. This option would transfer portions of the total product cost to the local currency component and thus protect it from the effects of devaluation. The third option is both the simplest, and at the same time the most challenging for the industry. It is called productivity. Productivity is achieved when the industry succeeds in delivering the same amount of a given product a lower real cost per unit than before. This can be achieved in a number of ways, including planning production capacity at the right economy of scale, running installed capacity at optimum levels, introducing more advance production methods and equipment, containing variable and overhead costs, and so on.

4. Social dimensions of market performance [35]

The social dimensions of market performance addresses the issue of distribution "of the real output" among the members of the industry, that is "the fairness in the treatment of individuals" within the industry. This performance indicator appraises such qualitative variables as income distribution, discrimination and worker alienation.

These important performance indicators were not addressed under this study, and should be the subject of future research. As the nation recovers from the civil conflict it suffered for so long, workers expectations are likely to rise, and these qualitative performance issues will become more important. Fairness in income distribution is fundamental for a democratic governed nation to flourish; discrimination by either sex, race or religion must be reduced if they exist; and workers' needs beyond that of a minimum wage must also be addressed.

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[35] Caves, page 79-81.

SECTION IV

LEGAL AND REGULATORY ENVIRONMENT OF THE AGRO-CHEMICAL INDUSTRY

Similar to the seed industry study the team had plans to review the legal and regulatory framework which governs all aspects of the agro-chemical industry in El Salvador. The objective was twofold. First, to seek out those features of the current laws and regulations which do not support or are not compatible with the on-going policy changes and structural reforms, and to point out appropriate modifications and changes. Second, to analyze the degree to which laws and regulations are being implemented, and if necessary to investigate more effective ways to regulate the industry, and use of agro-chemicals.

During the process of gathering relevant materials and documentation it became apparent that some specific efforts are being undertaken, or are planned by donor and host government institutions which address these very same objectives. In view of this it was decided to limit this section to a brief description of the current laws and regulations and the regulatory process, provide a summary of the issues, and make a listing of the programs and activities being planned or already being implemented to address them.

A. Laws and regulations

The production, distribution, sale, use, imports, and exports of fertilizer and agricultural pesticide is governed by a specific set of laws and regulations. Beginning in 1936, this legal and regulatory framework has been modified several times to improve and adjust the legal code and regulatory apparatus to new forms, sources, and uses of agro-chemicals. A summary of these laws and regulations is provided in Table IV-1. [1]

The current law and regulations are contained in the "Law for the Control of Pesticides, Fertilizers and Products for Agricultural Use" (Legislative Decree No. 315), and the "Regulations for Implementing the Law for the Control of Pesticides, Fertilizers, and Products for Agricultural Use" (Executive Decree No. 28). These two instruments contain the current framework used for the control and regulation of the agro-chemical industry and the use of these products in El Salvador. Both are scheduled to be reviewed and modified as part of donor/host government programs being planned or under way.

B. Regulatory Institutions and Process

The public institutions in charge of making the laws and regulations include the Ministry of Agriculture, the Ministry of Public Health and Social Assistance, and the Ministry of Works and Social Security. Those in charge of carrying out the law and the regulations include the dependencies of the Ministry of Agriculture, such as Defensa Agropecuaria and CENTA.

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[1] See Appendix 11 for current Law and Regulations.

TABLE IV-1

LAWS AND REGULATIONS GOVERNING PESTICIDE USE IN EL SALVADOR

LAWS, REGULATIONS, DECREES	DATE AND STATUS	OBJECTIVE	RESPONSIBLE INSTITUTION
1. Legal Pest Control. Legislative Decree No.56)	May 30, 1936. Still in effect.	Declare the need and public benefit of controlling plant and animal pests.	Ministry of Agriculture Coffee Association Beef Producers Association Sugar Industry
2. Importation, Distribution and application of chemical and biochemical products used in Agricultural Production. (Legislative Decree No, 1326).	December 17, 1953. Annulled under Decree No. 315 in 1973.	Control and monitor the importation, distribution and use of chemical and biochemical products used in agriculture.	Executive powers of MAG
3. Regulations for the importation, distribution, and use of chemical and biochemical products applied in the production of agricultural products. (Executive Decree No. 27).	March 23, 1954. Annulled under Decree No. 28 in 1978.	Regulations for executing the law previously described.	Executive powers of MAG
4. Agricultural Sanitation Law. (Legal Decree No. 229).	July 27, 1961.	Establish the legal framework for control of agricultural pests.	Executive powers of MAG and DDA
5. Regulations for the Agricultural Sanitation Law. (Executive Decree No. 146).	September 8, 1964.	Establish ways and means to implement the Agricultural Sanitation Law.	Executive powers of MAG and DDA
6. Regulations for the application of insecticides using the method known as "ultra low volume". (Executive Decree No. 80).	September 10, 1968.	Establish appropriate ways and means to regulate the application of insecticides using the method known as "ultra low volume".	Executive powers of MAG and DDA
7. Law for control of pesticides, fertilizers, and products used in agriculture. (Legislative Decree No. 315).	April 25, 1973.	Regulate the production, marketing, distribution, imports and exports of pesticides & fertilizers used in the production of agricultural products	Executive powers of MAG, DDA, and MSPAS
8. Regulations for the execution of the law for control of pesticides, fertilizers and products used in agriculture. (Executive Decree No. 28).	May 21, 1980.	To monitor and regulate all activities as related to these products in order to assure sufficient supplies, quality, and appropriate handling, and application of these products.	Executive powers of MAG and DDA.

TABLE IV-1 (Continued)

LAWS AND REGULATIONS GOVERNING PESTICIDE USE IN EL SALVADOR

LAWS, REGULATIONS, DECREES	DATE AND STATUS	OBJECTIVE	RESPONSIBLE INSTITUTION
9. Regulations for cotton production. (Executive Decree No. 95)	December 21, 1976.	Regulate certain activities related to cotton production, such as issuing permits to the destruction of stubble, prohibition to graze animals in cotton fields, and obligatory pest control.	Executive powers of MAG and DDA.
10. Labor law and its reforms. Legislative Decree No. 15, Chapter II, Consequences of Professional Risks).	June 23, 1972	Harmonize relationship between employers and employees, establish their rights, and obligations, based on principles which should lead to the improvement of the quality of life of workers.	Ministry of Labor and Social Security.

1. Registration

Before any pesticide, fertilizer, or raw material to make them can be imported, formulated, produced, distributed and used, it must be approved by the Dirección de Defensa Agropecuaria of the Ministry of Agriculture. Defensa Agropecuaria is responsible for approving or denying the initial registration, subsequent registration renewals (every three years), canceling the permit of a registered product or raw material, and maintaining the records.

The applicant must submit the initial application for registration in accordance with the stipulations contained in the Regulations, as follows:

- Chemical and commercial name of the product, chemical formula, qualitative characteristics, and all necessary identification.

- Name and residence of persons or enterprises engaged in making, importing (including country of origin), distributing or selling such product or raw material.

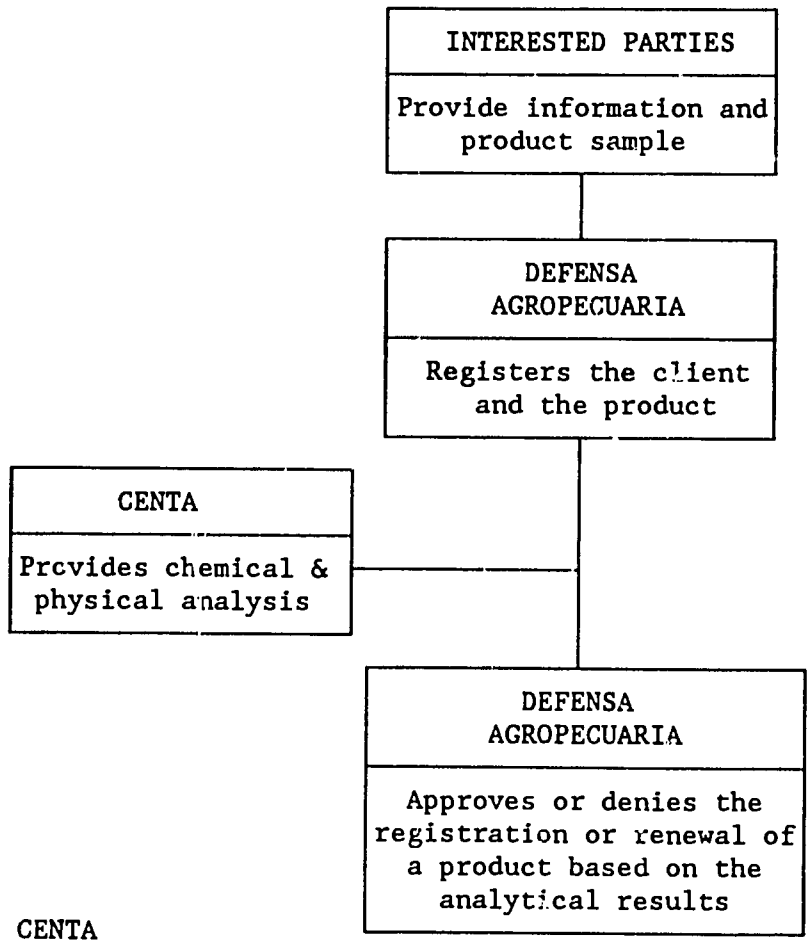
- A product sample, sufficient to make a complete analysis.

- An analytical standard, applicable analytical techniques and efficacy data of the product.

- Any technical literature on the physical and chemical characteristics of the product, method of use, and dossification.

FIGURE IV-1

REGISTRATION PROCESS FOR AGRO-CHEMICALS AND FERTILIZERS



Source: CENTA

A US$10.00 fee is charged for the registration and analysis of each product or raw material. Depending on the results of the analysis of the material (this is done at CENTA), Defensa Agropecuaria approves or denies the registration of a product or raw material. A material or product which does not meet the criteria for registration can be approved if the client is willing to change the formulation to meet standards. The client can appeal and provide proof to request a change in the case of a negative ruling.

If approved for use, the firm must also develop a label for the product. Such label must also be approved by DDA. The registration of a product or raw material is valid for a three year period, starting from the date it was registered for the first time. The permit for materials or products must be renewed on or before the three year period expires if further commercial use is desired in its original formulation. The renovation is valid only for the original product formulation. If this is changed, then a new product registration is needed and the current permit is canceled. A US$10.00 fee is charged for the renewal of the registration.

At the moment a total of 241 agro-chemical products are registered for use in El Salvador. See Table IV-2. [2]

TABLE IV-2

PRODUCTS REGISTERED FOR USE BY TYPE

Insecticides	106
Herbicides	66
Fungicides and Bacterial Agents	43
Products to control slugs	3
Fumigants	2
Rodenticides	3
Other: Solvents, Surfactants, Adhesives	18
Total	241

Source: CENTA

2. Market regulation

Once a product is approved for use in the country or for export, a regulatory system monitors and controls the quality of the product throughout the production and distribution chain to its final use. Defensa Agropecuaria and CENTA are responsible for carrying out this regulatory action. The regulatory system consists of the following steps.

- Sampling: Defensa Agropecuaria is in charge of taking representative samples from different points in the system, including production (enterprises which mix final products from concentrates or raw materials), distribution (wholesale distributors and retail outlets), import/exports (customs), and end-use (farm or household application).

  The size of the samples and the manner in which they are taken and handled are determined by CENTA. For this purpose a Manual for Sampling of

[2] See Appendix 12 for detailed listing of registered products. Fertilizers are also registered but are not shown in this table.

Pesticides and Formulated Products is used. The samples sent to CENTA for analysis are anonymous, that is any reference to brand, producer, or distributor is removed and the sample is identified only by its generic name and a sample number.

- Analysis: Samples are brought to the quality control laboratory at CENTA for analysis. The chemical and physical analysis is undertaken according to international methods approved by such agencies as EPA and CIPAC.

- Comparing: The analytical results are compared with the Norms ST 001 (Quality norms for pesticides and their raw materials). These Norms contain the range of acceptable variations (tolerances) against which the quality of the formulation and the content of the active ingredient are compared. Results are tabulated and stored.

- Reporting: Results of the analysis are sent to DDA for regulatory action.

- Sanctioning: Defensa Agropecuaria is responsible for any regulatory action if a sample failed the comparative stage of the regulation process. Sanctions are supposed to be applied according to the Law and Regulations.

C. Current Issues

The competence of the current system to effectively mandate and regulate the agro-chemical industry, the distribution system, and the use of these products in El Salvador is being questioned critically by the GOES, the private sector, and international donor and financial agencies. Basic issues which are serious and in need of immediate attention and redress, include (1) the legal and regulatory framework, (2) the effectiveness of the regulatory apparatus, and (3) human health and the environment.

1. Legal framework

At the moment, the pesticides and fertilizer industry, distributors, and users of these products are regulated by the Law (Legislative Decree No. 315) and the Regulations (Executive Decree No. 28). This Law and its Regulations date back to 1953 (see Table IV-1), and are, in the opinion of many knowledgeable persons no longer suitable for current needs, and worse, not even relevant for the future. Some critical deficiencies include:

- The current law and its regulations, however well intentioned often fail to achieve their intended goals. This is mainly due to the incompatibility between "intent" of the law and the characteristics of the regulations that were designed as ways and means to achieve such intent. In other words, while the intent of the law is "good", the regulations are based on the premise that only the State can guarantee such goodness and that the private sector must be watched, otherwise it will act automatically against the law and interest of society.

  For example, the requirement to either be or have an agricultural engineer (agrónomo) co-sign the permit allowing a person to establish a legally registered enterprise to distribute and sell agro-chemicals is well

intended. It is intended to promote the participation of "knowledgeable" and responsible persons in the trade of potentially hazardous products. Supposedly, an agrónomo would act in a responsible manner.

In reality, a great number of distributors are staffed by employees who are not such "knowledgeable" persons. The supposedly "knowledgeable" and responsible person who co-signed the original permit is acting as a absentee owner, or was used as a mere pretext to obtain the permit in the first place. Under these conditions the legal requirements can be satisfied without complying with the "intent" of the law.

What makes an agrónomo inherently more knowledgeable or responsible than any other person with equivalent training or education? Would a high school degree, with rigorous technical training, a license requirement, and periodic re-training be more effective and less expensive?

- The emphasis on punishment without reasonable cost-&-effect relationship, and the means, capability, or even desire to carry out due punishment provides no real protection for those already operating within the law, and encourages those, who for one reason or another cannot or will not comply with the legal requirements to operate unmolested outside the law. In other words, self-regulation by the industry is not promoted, and by the State is ineffective.

  For example, the many requirements that need to be satisfied to produce, handle, distribute and sell these products are so stringent, detailed, and costly that many market participants cannot afford them and simply ignore them. These illegal operators are seldom punished since the regulatory agency in charge is not capable, or unwilling to apply the regulations in a consistent fashion.

  On the other hand, the financial repercussions for violating the law or the regulations may be ineffective. The fines levied for infractions range between 100 and 1,000 Colones, hardly a deterrent for a business with such high margins and operating capital. Furthermore, DDA can cancel the inscription of a product after three violations. The emphasis being on "can" rather than "obligatory" cancellation of the product, makes such regulation less effective.

- Many new products have been developed since the existing law and the regulations were last changed in 1973. Many of these products are less toxic, equally effective, and some even less harmful to the environment. Neither the current law and its regulations, nor the proposed changes have little in terms of incentives to encourage the industry and users to change to these new products. In other words the current law and regulations, as well as efforts underway to change them, are behind the times and the new and pressing issues related to sustainability of the very ecology which sustains plant, animal, and human habitats.

  For example, some pesticides being used liberally in EL Salvador have been put under restricted use in many countries due to their high toxicity and residual effects. Parhaps even worse, some products which are banned in many countries, including in El Salvador, may still being used.

- Some of the new changes being proposed to the existing Law follow the old pattern of protecting those already engaged in the business rather than promoting changes which would produce a sum-total positive benefit to society.

  For example, efforts are under way to "legalize" the practice of re-bottling or re-sacking pesticide and fertilizer (liquid, powder, and granular forms) at the retail level. This "legalization" is being promoted as a the best way to assure preservation of such vital service to farmers. In reality such change would only legalize what is already a standard marketing practice among retailers.

  Granted, this practice is vital, not only for the farmer but also for the retailer who would loose sales, unless he or she is willing to sell sub-divided lots of merchandize in units affordable to the client. Moreover, repackaging the merchandize allows for higher profit margins per unit sold, just as a bar earns more when it sells liquor by the shot or drink instead of by the bottle.

  However, to legalize a practice which many within the trade, as well as disinterested specialists, acknowledge to be harmful is not beneficial to farmers, the environment or society in general, it merely protects those who have to undertake such practice for "practical" business reasons.

2. Regulatory effectiveness

The effectiveness of the regulatory system is also being questioned by the GOES, the private sector, and donor agencies. It seems that the regulatory system which emphasizes punitive actions rather than self-regulation is not successful in achieving a high compliance rate with the law. This is indicated by a host of not fully answered questions and observations made during the assignments.

- Product registration: [3]

  * Are all products being marketed and used legally registered? The records are unclear; there was doubt in the minds of staff in charge of testing and regulation; and survey data indicates that some products may be being sold without proper registration.
  * Are all products whose three year period expired being re-registered on time? Again, a review of the records does not provide a conclusive positive answer.
  * Are registration records current? A comparison between existing registration records and market survey data indicates that the records are not current.
  * Is the registration fee sufficient to cover cost? Apparently not. Should it be increased sufficiently to cover the full cost? Such high margin products may very well sustain a much higher registration fee. Should the registration fee vary according to toxicity, discouraging the registration and use of the most toxic chemicals?

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[3] See Appendices 13, and 14.

* Is the registration process compatible with market and safety needs? Again, no conclusive answers were obtained.

- Market regulation

* With over 90% of the budget going to salaries, what is DA's real capacity to monitor and regulate the market? Between 1985 and 1990 approximately 25% of the fertilizer samples apparently failed their quality test, however there is no indication that DDA took any regulatory action. In 1990 a total of 223 pesticides were analyzed, of which 64 or 29% were rejected. Again, there is no information on whether legal sanctions were enforced. Under these conditions a high percentage of agro-chemical products used by farmers must be rather ineffective.
* With retail sale of small units of products being a market necessity, what use is it to legalize the practice of sub-dividing large units into smaller ones for sale? What other avenues are available to provide clients with their needs and at the same time avoid health and environmental hazards, as well as the potential for product contamination? Can original suppliers be incentivated to provide products in sealed containers of different sizes, a practice which is done to a degree?
* Are products without proper registration or no registration at all being marketed and used? Regulatory records do not provide a ready answer, and a comparison between registration records and survey data does not provide a conclusive answer.
* Are banned products still being marketed? When the few survey records are compared with the list of banned products, [4] no conclusive positive answer can be obtained in the case in some products. Again, regulatory agencies could not provide a firm answer.

3. Human health and the environment

A third issue of grave concern is the impact that these products are having on human health and the environment. El Salvador uses more pesticides and fertilizer per unit of production than any other Central American country. The use of these products, however, is not done in a manner which would tend to minimize or prevent the potential negative side effects on human health and the environment. In this regard a host of concerns have been raised, among them:

- With a such a high rate of illiteracy what use is the current method of labeling the products? While the "law" has been satisfied, the potential users who do not read derive no effective benefit from it. [5]

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[4] See Appendix 15.

[5] The illiteracy rates range from below 50 to 70%, depending on the source. The older the source the higher the rate. The real important question to be asked is what age group is farming and applying these products, and what can be done to assure understanding and application of label instructions.

- Apparently too many farmers apply pesticides without proper protection; bare hands are used for granular products; shoulder mounted applicators are used for liquid products without wearing protective gear such as masks, gloves, and rubber boots. Too often, the only precaution taken is avoiding spraying the pesticide against the wind, and a bath, if possible at the end of the day.

- What options would be more effective to transmit to users appropriate application and protection practices? Are any cost-effective means available? [6]

- In what should be construed as criminal negligence someone, years ago, instructed farmers in the Western part of the country to take their "antidote" (Atropin) half an hour before starting the application of pesticides. This practice, of course has the very opposite effect since farmers are mistaken in thinking that their health is protected by this practice.

- In order to save on labor cost farmers frequently mix different pesticides for one application. This practice can have several detrimental effects, including reducing or inactivating the effect of one of the pesticides in the mixture, or reacting in a toxic manner when one non-toxic or low-toxic chemical is mixed with another chemical compound.

- Too little is known about residual effects of pesticides on food products. No regular testing for pesticide residues is being done on products such as vegetables and other perishables as they enter the marketing system.

- On the other hand, it is openly recognized that the application of materials with highly toxic residual effects is being undertaken in violation of the time limits set for such products before harvest time.

- Some products (herbicides, i.e, Paraquat) are apparently preferred due to their immediate "burning" effect on weeds, though they are far more toxic than less "immediate" alternatives. Paraquat is a restricted use herbicide in many countries.

- The reasons for excessive use of pesticides (and exaggerated use such as up to 34 applications in cotton) are little understood. The notion that the more pesticide applied the better it is, is often given as a justified answer. However if this is true then other reasons may be more plausible. Perhaps pests are becoming more resistant; natural enemies of pests could have been wiped out; the products are not being properly applied; or the products are being adulterated.

- A thorough analysis of all registered cases of chemical poisoning has not been done, however it is estimated that there are over 1,000 such cases per year. These cases reflect only those persons who sought assistance

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[6] The efforts by APA to educate the public on "Safe Handling of Pesticides and Fertilizers" is a very commendable activity. See Appendix 17.

at some hospital or health center and were duly registered. The real number of annual poisonings is quite likely a lot higher. Between 1982 and 1987, approximately 65 percent of the pesticides poisoning were accidental, and 35 percent were attempted suicides. Of these 12 percent resulted in death.

- The impact of pesticide use on the environment, such as non-target populations, natural enemies, rivers, estuaries, and soil organisms in EL Salvador is poorly understood. Only a few studies have been undertaken. No concerted effort is present to analyze this fundamental long-term issue. Perhaps more important, the critical level of consciousness regarding the need to preserve the environment is not present.

In summary, it can be concluded that the existing laws and regulations are not satisfactory for the needs of today, and more important the future. They need to be reviewed and updated. Second, the effectiveness of the regulatory apparatus is not satisfactory, and must be upgraded to be useful. Third, human environmental concerns must be given a higher priority in future policy planning and development efforts regarding pesticides use in agricultural production.

D. Current and Planned Efforts to Address Issues

The concerns of the GOES in regard to the legal framework, effectiveness of regulatory apparatus, and the human health and environmental consequences are beginning to be addressed through specific projects and institutions. A summary of those the team became aware off during the assignments is presented below.

1. Integrated Pest Management Project, CENTA - GTZ

The main objective of this German financed project is to reduce and rationalize the use of pesticides in agricultural production, specifically in regard to cotton, corn, and beans. This project has been signed and is scheduled to start in January, 1992. It will last three years. A base line study will serve as a basis to compare the impact of the project on pesticides use after three years. The project is located at CENTA and will be phased into the newly linked "extension by objective" service and DA. Emphasis will be on training, technology transfer, and follow-up as related to integrated pest management. Little research is contemplated since much of the technology related to pesticide use in an integrated fashion is available. [7] Research will be undertaken only to fill in the gaps as they occur.

Under a letter of understanding between GTZ, DDA, and FUSADES, a pesticide quality control laboratory will be integrated into the soils and residue laboratory being established at FUSADES. The GTZ will finance the laboratory equipment and the training of personnel needed to operate the pesticide quality control component.

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[7] This current project is a continuation of the Integrated Pest Management Project started in 1988. The first phase from 1988 to 1991 was the research phase.

The project will also address the legal framework and regulatory system related to pesticides. First, the current law which is considered too ambiguous and antiquated will be reviewed. Modifications, designed to overcome current deficiencies will be elaborated and incorporated into a new law. Second, the current regulations will be revised to make them inherently more effective. A new set of regulations governing registration, production, distribution, sale, and application of pesticides is envisioned.

2. Research and Extension Component, CENTA - PRISA/WB

Under the Programa de Reforma e Inversión Sectorial Agropecuaria (PRISA), the GOES and the World Bank have agreed to finance a Research and Extension Component. The main objective of this PRISA component is to assist the GOES in transforming CENTA back into what it once was, namely a center for research and extension of excellence. The project is scheduled to last five years, beginning in 1992. The loan funds will be made available to provide the necessary institutional strengthening in management, finance, planning and logistics, training of personnel, and equipment purchase.

The project will support the generation of technology via research and the dissemination of successful results to medium and small farmers through the newly linked "extension by objectives" service. Research will be regionalized according to needs at five centers for technology development located in San Andrés (CENTA's main research site, outside San Salvador), Santa Cruz Portillo, Morazan, Tejutla, and Izalco. Fifty extension agencies located throughout the nation will be linked to the five research centers. In this fashion extension agents will be associated with researchers making transfer of new technology more efficient and effective.

Research funds and efforts will be directed mainly to basic grains, namely corn, rice, sorghum and beans. Other industrial commodities such as sesame, soybean, peanuts, and yucca will also be included. This first group will absorb 75% of the funds. Fruits and vegetables will be allocated the other 25% of the funds. In early December CENTA's PRISA Project Coordinator was busy consolidating the 5 year plans elaborated by the different program leaders.

A cursory inspection of the plans elaborated for basic grains indicated some emphasis on developing or identifying varieties resistant to field pests. This was especially the case in beans which have been plagued by viral deceases since the mid 1980's. Successful research results should lead to reduced and more rationalized use of pesticides in the production of basic grains.

3. Vegetable and Animal Sanitation Component, DDA - PRISA/BID

Also under PRISA, the GOES and the Interamerican Bank for Development have agreed to finance a Vegetable and Animal Sanitation Component. The main objective of this PRISA component is to assist the GOES in transforming DDA into an effective regulatory agency in charge of vegetable and animal sanitation.

The project sub-component dealing with vegetable sanitation is being prepared with the assistance of IICA, and is scheduled to last five years, beginning in 1993. Loan funds will be made available to provide the necessary institutional

strengthening in management, finance, planning and logistics, training of personnel, and equipment purchase.

An assessment of all laws and regulations related to vegetable sanitation is part of the institutional framework review to be carried out under this PRISA sub-component. A successful project should not only lead to improvements in the laws and regulations but also in the effectiveness of regulation efforts.

4. Improving Vegetable and Animal Sanitation to Facilitate the Regional Trade of these Products, IICA, San Salvador

This IICA project is designed to improve existing laws, regulations and sanitation practices for vegetable and animal sanitation in order to facilitate regional trade of these commodities. The 1992 project activities call for a series of seminars and workshops dealing with laws and regulations and their harmonization, specific pests, integrated pest management, information, and regional coordination.

This regional project could serve as a means to obtain valuable additional inputs for the up-coming efforts designed to improve the legal framework and regulatory apparatus to monitor and control the use of agro-chemicals and vegetable sanitation in EL Salvador.

5. FUSADES Residue Laboratory

FUSADES is in the process of building a new multi-function laboratory, including soil testing, chemical residues, quality analysis, tissue analysis, and others. The chemical residue module of the laboratory was designed to test non-traditional agricultural products for chemical residues before they are exported to the U.S.A. The objective is to assure USDA and FDA compliance before the products are shipped.

6. Coordination Efforts

More likely than not other projects exist and others will surely surface in the near future which will directly or indirectly affect users of pesticides an fertilizers. The need to coordinate these efforts and activities to reduce duplication, turf battles, and waste of funds and other resources should be recognized at this stage rather than later. At least three projects are committed to change the laws and regulations and improve respective institutions in charge. The potential exists to increase efficiency and improve results if these unrelated programs receive some kind of central coordination and joint leadership.

SECTION V

PRODUCTION SYSTEM PARAMETERS, RESEARCH AND EXTENSION

A. Production System Parameters [1]

During the last 30 years the trend in production of basic grains has been positive. However, the rate of production as well as the technical production parameters applied to such production have been influenced by development policies, macro policies, institutional settings (research and extension), and general economic conditions. The structural reforms taking place since 1988 are already having some effect on production levels and technical parameters as well.

During the last decade the deterioration in production system parameters, that is the abandoning of technology, or even worse the increasing inappropriate use of technology, is cause for concern. Fully exploring such concern is beyond the scope of this report, however, some leading questions, thoughts and comments are provided here which hopefully will assist current efforts to improve research and extension programs which focus on basic food grains production systems.

- Were these production system parameters always in balance, that is was the ratio of unit of production to input use optimal at any time? If so for what time period? If not, what prevented grain farmers in general from optimizing their grain production systems? How were the different farming systems (as defined by size, activities, or other definition) affected? [2]
- Were research results and extension recommendations compatible with economic reality faced by grain farmers in general and by farm type?
- While farmers' decisions were rational and efficient from their point of view, were they also optimal from a societal, environmental, and long-term point of view? If not, what made a personal rational choice also detrimental to society and the environment?
- Given the policy and institutional changes taking place what would be optimal ratios of unit of production to technology use? How can these be researched? How can such balanced ratios be achieved under actual farming conditions? How can results be monitored, and feedback mechanisms used to direct research and policy decision making?

While finding the answers to the first three sets of questions may be regarded a luxury, understanding historical cause and effect relationships when the results are known provides the basis for analyzing potential future results when the relationships between causes and effects are changed. This is critical if research and extension are going to have long-lasting positive impacts.

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[1] As used in this report, technology parameters involve only the issue of intensification (improvement in the use, including quantities of production inputs, per unit of production) versus extensification (inadequate use of production inputs coupled with extensive use of land).

[2] This question has been partially answered in this report.

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1. Fertilizer use

Figures V-1, 2, 3, and 4 show fertilizer response curves based on the national average fertilizer use and production yields for basic grains from 1985-86 through 1989-90. [3] Due to the lack of studies in this area and the composition of the data, a cautions approach is taken in interpreting these results. For example, these are survey data representing averages, while the results of a specific cropping pattern (say corn followed by beans) may show quite a different result. Nevertheless, while the following interpretations should be taken as suggestive rather than as final and absolute, they do provide some challenging thoughts for additional research in this area.

- Despite the existence, and promotion of standardized recommendations, the national fertilizer utilization figures indicate that the average amounts of fertilizer applied do not coincide at all with the recommended levels. If this is true then farmers are, by responding rationally to their perceived economic risks, trying to optimize results at different levels (Marginal Value Product) than what research recommendations or survey data suggest is possible.

- For example, the threshold in yield response to fertilizer application for corn and beans seems to be below what is being recommended for both crops. For example, in corn an average use of 313 Kg/Mz (or 6.9 QQ/Mz) seems to yield more than 416 Kg/Mz (9 QQ/Mz). A slightly higher yield response appears to be possible with a fertilization level closer to 6 QQ/Mz. In beans the yield response is higher when about one third less fertilizer (118 Kg/Mz) is used than what is being recommended (150 Kg/Mz). Again, interpretation is tentative. Could it be that intervals in fertilizer response studies are too large to capture the correct threshold in yield response, i.e., the true MPP of this input? Are farmers adopting technology in different ways than anticipated? Are farming practices too varied so as to render these average national figures useless? Were there other factors which influenced these yield response curves?

- Rice yields (excepting 1987-88, being a drought year, and 1988-89 where we assume a survey data error due to the unrealistic application rate) show a small response of only 10.8% over a rather large increase (220%) of fertilizer application from 86 Kg/Mz to 275 Kg/Mz. Beyond that point rice production does not seem to be responsive to fertilizer. Again, are rice farmers approximating optimum yield response at levels which are lower than those recommended? Would a change in farming practices allow a drastic decrease in fertilizer application without harming yield levels? Is something else masking the true cause of these numbers?

- So little fertilizer is use on sorghum that the average figures presented here do not mean a whole lot. What the flat response curve shows is that at such low levels of fertilizer application no response is forthcoming. In reality whatever fertilizer was used on sorghum was applied to a much smaller total area, and therefore the response would have been higher where applied.

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[3] These are sorted numbers from Table II-10.

FIGURE V-1

CORN YIELD RESPONSE TO FERTILIZER

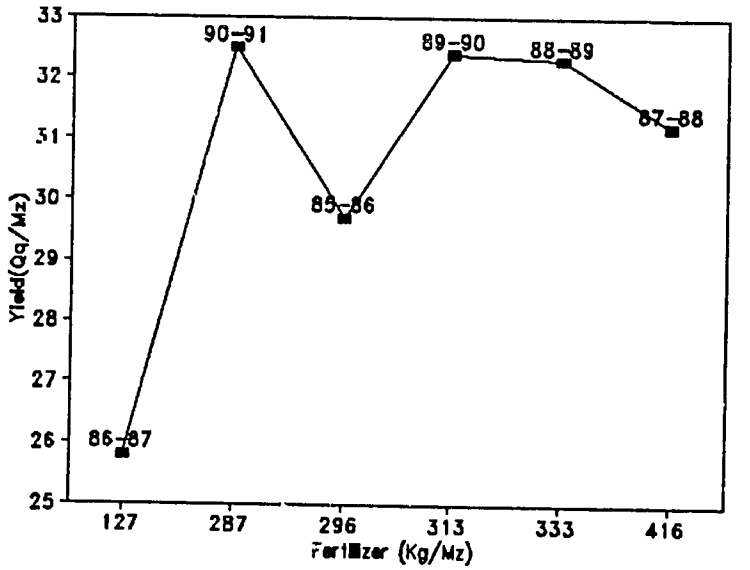
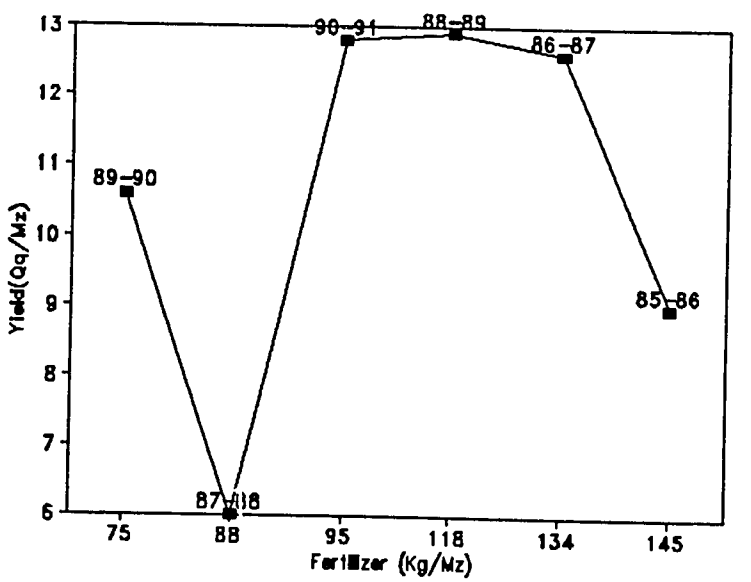


FIGURE V-2

BEAN YIELD RESPONSE TO FERTILIZER



Source: Table II-10

FIGURE V-3

RICE YIELD RESPONSE TO FERTILIZER

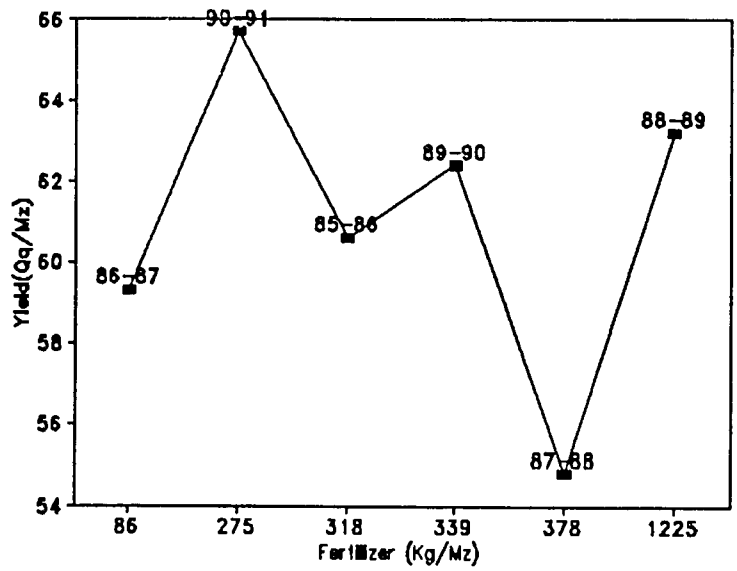
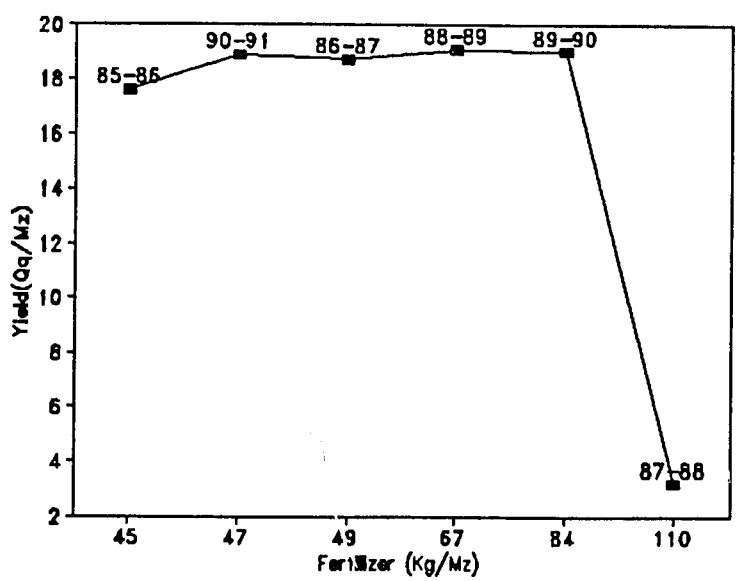


FIGURE V-4

SORGHUM YIELD RESPONSE TO FERTILIZER



Source: Table II-10

Nevertheless, the concern as to why the average marginal physical product is so low in sorghum still remains? What factors matter, and how can they be modified, if at all?

Thus, at some time in the past recommendations for fertilizer use were developed and applied uniformly by the Extension Service to the entire country. Over the years these recommendations became the "standard". For example the use of two (100 Kg) sacks of 16-20-0 fertilizer and two sacks of Ammonium Sulfate per manzana for corn. Similar standardized recommendations are used for other grain crops. The use of a standard recommendation continues today, and may be an easy answer for research and extension but has several potentially adverse impacts.

- First, in a country with as much diversity in soil types, agro-climatic zones, and topography as El Salvador, the use of standard recommendations for fertilizer application is unlikely to be technically or economically optimum for most farmers.

- Second, by making standard recommendations, the variety of fertilizer formulations has been concentrated to two basic fertilizers: the simple fertilizer, ammonium sulfate, and the complex fertilizer, 16-20-0. These two fertilizers may not be appropriate for many farmer's conditions and may lead to long term harmful soil effects, i.e. acidification of the soil from the use of ammonium sulfate, which in turn can lead to a drop in yield. [4]

- Third, researchers and extension agents agree that the best way to make recommendations on fertilizer use is to base them on soil tests. This is also suggested in the brochures that accompany the release of a new variety or hybrid. However, farmers do not do so in most cases because soil tests are expensive for limited resource farmers, [5] and results of soil test may take up to 45 days to be returned, necessitating advanced planning.

- Fourth, discussions with researchers indicate that the standardized recommendations are based on attempting to attain the maximum physical response from the crop. Unfortunately, aiming for the maximum physical response will inevitably cause a higher rate of fertilizer use than is economically justified.

2. Pesticide use

While El Salvador has the highest grain yields per hectare, it also has the highest per hectare use of pesticides in Central America. Whether such high yields justify, or are partially in response to the level in pesticide use is questionable. Figures V-5, 6, 7, and 8 summarize the average yield response to pesticide application in basic grains.

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[4] For an in-depth discussion of the problems associated with soil acidification see Bibliography Review #13, pp. 123-132.

[5] A recently instituted fee of 10 Colones per soil sample has cut what little demand existed considerably.

FIGURE V-5

CORN YIELD RESPONSE TO PESTICIDE USE

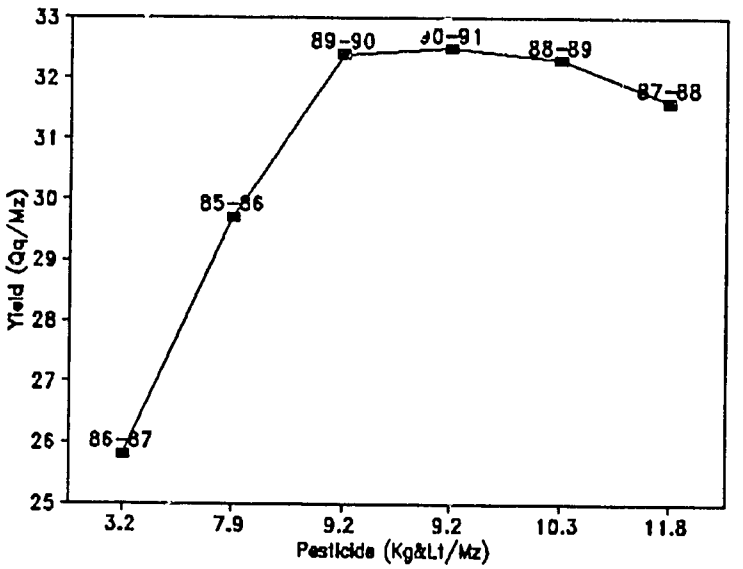
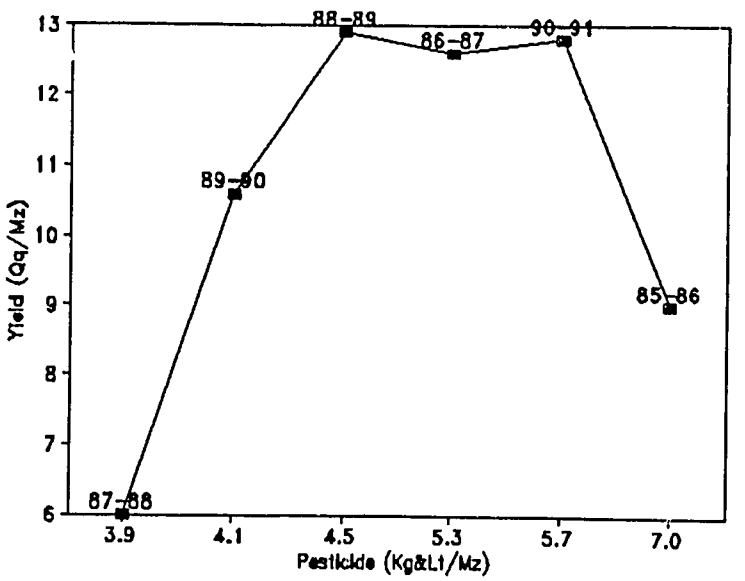


FIGURE V-6

BEAN YIELD RESPONSE TO PESTICIDE USE



Source: Table II-19

FIGURE V-7

RICE YIELD RESPONSE TO PESTICIDE USE

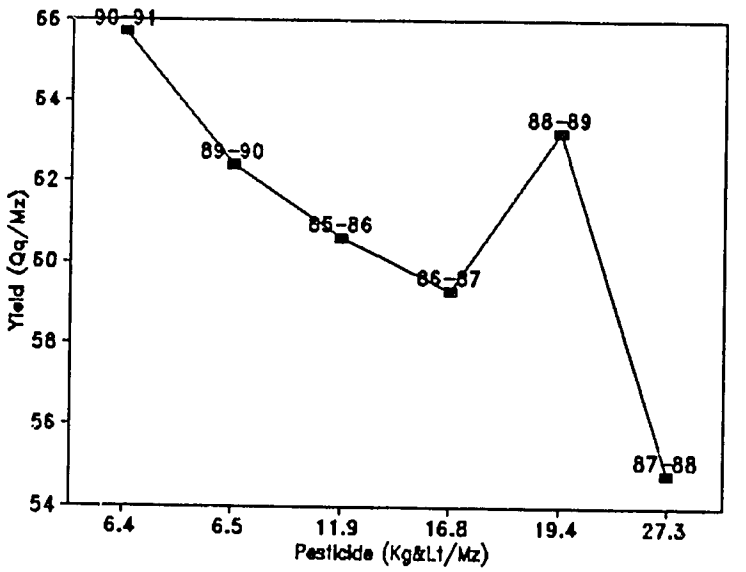
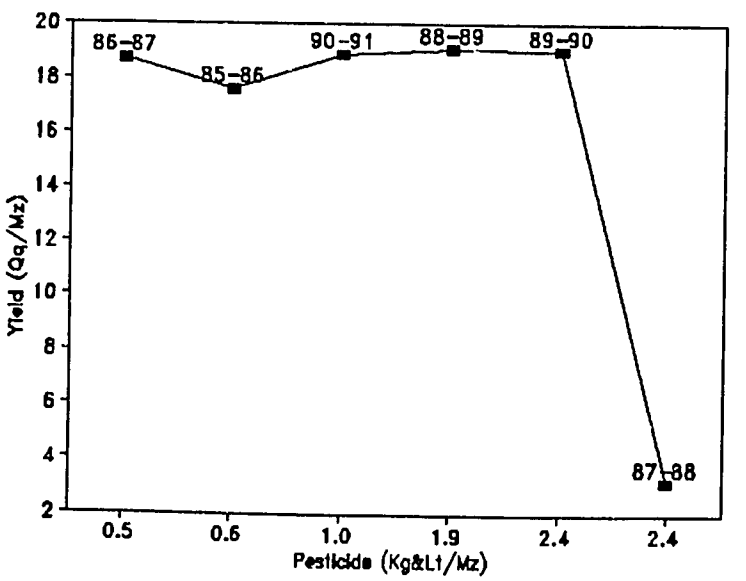


FIGURE V-8

SORGHUM YIELD RESPONSE TO PESTICIDE USE



Source: Table II-19

These average national figures should be interpreted with some caution at this stage until more segregated numbers can be gathered and analyzed. It should be kept in mind, that unlike fertilizer there are no standard "recommended"levels of application for pesticides. Nevertheless, they do provide some basis for the potential negative impacts that high pesticide application can have on production, human health, and the environment. A few observations include:

- Similar to fertilizer, corn and bean yields response to pesticide use have apparently gone beyond their optimum levels of application in recent years. Again, while many factors affect the impact of pesticide use (take weather alone) it seems that corn yields on average do not respond after pesticide use exceeds 9 Kg&Lt/Mz, and bean yields after an average application of 4.5 Kg/Lt per Mz.

- If the information is correct, than on average rice farmers are using quantities of pesticides which are way beyond optimum physical and economic levels. In other words these average numbers indicate that the MPP and MVP of fertilizer are both negative, i.e., rice farmers are not recovering, at the margin the cost associated with the use of pesticides.

- In sorghum we have a similar situation to the fertilizer response. The area receiving pesticide is too small. Therefore, whatever effect pesticide use has on sorghum yield is masked by the large number of Mz which do not receive any application. Is this assumption correct, however? Could it be that sorghum is not very responsive to pesticide application? Does it need it as much as other grain crops? Are varieties resistant to most pests, making pesticide use marginal at best?

These average figures, however questionable they might be, tend to substantiate current concerns and efforts to address the issues surrounding the acknowledged indiscriminate, and unsafe use of these chemicals in EL Salvador. This practice has several very negative impacts on production, farmers, and the environment.

- First, these figures support the strong indications that pesticides may be used in quantities that far exceed the economically justifiable levels of use. Farmer's apparently apply many pesticides on a regular basis, i.e. "by the calendar", rather than in response to a specific pest problem. This practice leads to high use of pesticides, production costs, and possibly negative marginal returns.

- Second, there also appears to be a tendency to apply a pesticide treatment at the first sign of a particular pest, rather than waiting until the pest reaches a pre-determined economic threshold. This tendency leads also to high uses of pesticides, but does not necessarily produce efficient results.

- Third, the other side of the coin is that some farmers do not have the resources to purchase necessary pesticides, and thus face reduced yields.

- Fourth, another undesirable result of high pesticide use is the development of resistance in pests, particularly insects. Thus greater quantities or more toxic pesticides must be used for adequate control. This increases production costs and has environmentally undesirable consequences (case of

cotton production). Alternatives, such as the use resistant varieties, has not been an option for most farmers, because resistant varieties are not readily available; IPM is not common; and biological controls are not used.

- Fifth, there are strong indications that the over-use of pesticides is coupled with a low level of understanding of the safe use of pesticides. In some instances this has lead to increased social costs, through pesticide poisonings of both people and the environment.

- The potential for reducing pesticide use in basic grains production is not only apparent but highly desirable from multiple points of view such as production levels, human health, sustainability of the production ecology, the environment in general, and savings in foreign exchange.

B. Research and Extension

The release of a new technology (the package containing a new variety or hybrid with its complimentary cultivation recommendations) follows a multi-year process which ends with a successful validation of the promising material on farmers' fields. Such efforts consume not only enormous amounts of time but also human, financial, fixed, and technical resources. This process is also inherently "wasteful" in that a promising new line has to be selected from dozens or even hundreds of competing candidates. This is being accomplished after many trials lasting three to five years. At each stage there is also the potential that one candidate with good or superior characteristics is eliminated by mistake or due to reasons beyond the control of the researcher.

Each new technology is then disseminated through extension and market channels to farmers, who either reject or assimilate the new technology. The assimilation, however can be partial, modified or completely different from what was envisioned by researchers and extensionists. This is recognition of the fact that basic grains farmers are making rational economic production decisions which, however may not coincide with recommended standards (the case of fertilizers), or may not conform with health and environmental thresholds (the case of pesticides).

Some researchers suggests that farmers' decisions, in many instances, are not even rational. They may be right, but perhaps for the wrong reasons. For example, the custom of applying the first fertilizer after the plant has germinated and shows nutritional deficiencies (the standard recommendation is to fertilize during planting), may not be "economical" but very rational. By fertilizing after the optimum moment has passed a farmer is minimizing his risk of loosing inputs (which he may not have the capital to replace), if the seed does not germinate, at the expense of fewer (how many??) quintals per manzana. The application of insecticides when the pest attack is so slight as to make the application more costly than what would have been lost without an application, is another example of rational (i.,e. risk minimizing) behavior, which apparently is not optimal in economic terms. The pest is eliminated, and the risk of loosing production has been taken care off.

In view of this, and keeping in mind the current restructuring of MAG and the realignment of CENTA's research programs under the Research and Extension

Component of the PRISA Project, two basic complementary observations and some more detailed suggestions are offered.

- First, what is the net social return to the development and promotion of technological packages which when applied by grain producers under their different socio-economic conditions result in physical and economic returns which are different (lower?) than those suggested by research results?

- Second, how can the differential between the optimum social return and the real applied return from research and extension efforts be decreased so as to gain more productivity from research, extension, and on-farm production, and achieve increases in social welfare?

These two basic questions are directly related to the on-going realignment of CENTA's research and extension programs and the resources being allocated under the Research and Extension Component of the PRISA Project.

1. Realignment of research programs

Within CENTA there is some apprehension as well as expectations as to the impact of the re-organization of the Ministry of Agriculture. The re-organization has changed the alignment of certain responsibilities by moving the organization toward a commodity based structure and away from a functions structure.

Under the new commodity based structure the impact on basic grains will be to have four programs, i.e. corn, beans, rice, and sorghum, which are responsible for all research within their commodity area. In the past several units have had to cooperate in each area, thus soil fertility activities were carried out by the Soils Department, agronomic research by the commodity group, and validation (on-farm trials and demonstration) and follow-up (adaptation results) by the Sociology and Economics Department.

Under the new structure the commodity group will have responsibility for all aspects of the research in its program. The Soils Laboratory will provide soils analysis as a service to the commodity program but will not be directly involved in research. In the case of the Sociology and Economics Department, the validation activities will be moved to the commodity programs, with the Economics Department becoming a support unit.

2. Issues related to realignment of research programs and CENTA/PRISA Project

a. CENTA/PRISA five year research programs for basic grains

The five year research programs to be funded under the Research and Extension Component of the PRISA Project are being finalized. The team could only make a cursory review of the proposals being prepared for the four grain programs. Furthermore, during the second visit CENTA was in the throes of reorganization and personnel change making further analysis impossible. In light of this, the following observations are made with certain reservations.

- The overall approach to research and extension in regard to basic grains seems to follow the 30 year old doctrine of the "green revolution" which is

based on the development and introduction of new technological packages. In the case of El Salvador this has led mainly to the development or selection, and release of new hybrids or improved varieties of basic grains. While necessary, this "technical" research and extension approach is no longer sufficient to help achieve higher productivity rates in grain production and, therefore, increases in the welfare of grain producers.

Serious consideration should be given to (1) changing the technical foundation of the current research and extension program to one based on social-anthropology and socio-economic parameters, and (2) to see whether or not a research approach which starts on-farm research early in the research cycle and examines how proposed technologies will fit into the existing farming systems would yield more positive results.

At least five different grain production systems have been identified in EL Salvador. [6] A technical approach to research and extension, while necessary is simply not sufficient to address the very unique production decisions and requirements of each one. A more focused approach will yield much higher social returns to the research and extension program than the existing technical approach.

- Enormous efforts have been made and will continue to be made in order to achieve the objectives set for research and extension thrusts of the institution. With few exceptions, these two thrust have focussed on the <u>production</u> phase of the food system. The few attempts made over the years to create a <u>post-production</u> phase failed, though the importance of the post-production phase in grain producers' decisions regarding acceptance of new production technologies is widely understood.

  The new reorganization and reorientation of CENTA provides a unique opportunity to integrate a postharvet research and extension thrusts to compliment those of the production phase. By extending research and extension beyond the production phase the total yield (and derived benefits) of the basic food system can be increased considerably above and beyond of what is achievable in the production phase alone. [7]

- The research agendas for each program were drawn up by the researches themselves. While there is nothing inherently wrong with this approach, a review by a disinterested third party would help in judging whether the proposed research agendas support the basic rationale and general objectives of the new set of macro-economic and sectoral policies.

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[6] See Caracterización de los Productores de Granos Básicos en El Salvador, CADESCA, Octubre de 1991.

[7] During February 1992, the regional representative of the Cooperación Suiza de Desarrollo for Central America made the first contacts with the GOES in regard to a grain postharvest project for EL Salvador. It is hoped that this first contact will lead to a permanent and equally weighted national post-production research and extension thrusts in basic food grains.

- Apparently, the scientists also prioritized the research activities within each agenda according to their own criteria. Again, while nothing is inherently wrong with this approach, an outside review would be very helpful in judging whether these priorities are in line with what is expected from the grain sub-sector under the new set of macro-economic and sectoral policies.

- While researchers insist that farmers' practices are taken into consideration, the apparent discrepancies between recommended fertilizer standards and pesticides usage, and what seems to be the case at farm level begs to be investigated. Such research efforts should be included, if not already part of the proposals.

b. Including Soils and Economics in CENTA/PRISA project

From discussions with CENTA staff, it appears that the Soils Laboratory and the Sociology and Economics Departments have not been included in the institutional strengthening effort of the Research and Extension Component of the PRISA project. Strengthening the research and extension thrusts of CENTA without commensurate support to such vital sub-components makes the whole project questionable. If this observation is correct, then it should be redress within the PRISA Project while the five year plans are being finalized.

Justifications to re-think the apparent exclusion of the soils laboratory, as well as address other weaknesses related to the laboratory, include:

- While everybody agrees that soil samples are fundamental to achieve the right application of fertilizers, very little has been done in nearly 30 years to correct the situation. The Government does not have a systematic process to establish soil fertility maps for the nation.

- The existing soil maps [8] are useless for the perceived extension needs. The laboratory could be given the responsibility and the means to correct this deficiency, i.e., produce adequate soil maps, at least for the most important production areas.

- Approximately one half of the soil samples being brought in for analysis are from donor supported projects. Once these projects are phased out, keeping such an extensive soils laboratory becomes questionable.

- In November 1990, a 10 Colones fee was introduced for each soil sample analysis. Since then the demand for such service has declined considerably. This policy should be questioned. While payment of a fee for a public service rendered is becoming popular, the impact on users should be carefully analyzed. Is such a token fee worth? Does it cover the cost of the analysis? What clients have given up on the service? Are these the clients CENTA is mandated to serve?

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[8] One map is on a scale of 1:300,000 from the 1960's and the second is an incomplete set on a scale of 1:50,000 from 1974.

- The soil samples brought in by farmers are not being verified for field representation, making the recommendations questionable.

- The fertilizer recommendations made nowadays are technical, based on the soil sample brought in by the farmer and his planting intentions. No complimentary economic analysis and recommendations are provided.

- A soil sample from a piece of land on which a farmer is going to plant different vegetables receives the same general fertilizer recommendation since no planting grid is made to know where each type of vegetable is going to be planted.

- No statistical analysis have ever been made of the thousands of soil samples brought in over the years from different areas. The information exists on paper and a data bank could be formed, and analysis made to see whether changes in soil quality have taken place, and to structure rudimentary soil profiles for certain areas.

- Soil acidification is mentioned as one of the most pressing problems related to current fertilizers being used, jet hardly any research is undertaken in this area. [9] Research to analyze the benefits of alternative fertilizers such as ammonium nitrate, urea, urea sulfate, organic fertilizers, and crop rotation should be considered.

Justifications to re-think the apparent exclusion of the Sociology and Economics Department, include:

- The Department should extend its current activities much beyond the current validation work being done. The need for grain production simulation models, establishment of production functions, supply response functions, and demand functions for agricultural inputs for the different grain farming systems should become one of the first priorities for the unit. Excellent long-term results can be obtained if this is done in conjunction with UAPA and some interested university professors and students looking for worthwhile thesis projects. Feedback from such research can be invaluable for orienting the commodity research programs, agricultural policy analyst (UAPA), policy decision makers, grain producers, and private sector firms engaged in agricultural inputs and products.

- The Department does not have a single agricultural economist on the staff. Only one agronomist has received some "economic" specialization. There is a dire need to upgrade staff to a Masters level in agricultural economics with specialization in production economics. This can be accomplished under the PRISA Project.

- The Department lacks computer equipment and software to improve current validation work.

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[9] According to one source 30% of the soils are highly acid.

c. Reason for realignment - coordination

The decision to realign the research programs along commodity lines came from the perception that under the previous structure a lack of coordination and follow-up led to sub-standard results in the programs, delays in releases, research started but never finished, and other deficiencies. This is to a degree understandable since coordination among departments or units at the same level is one of the most difficult horizontal management functions. The following two observations are made in regard to the realignment of the research programs.

- To improve coordination, and therefore, research results, both the Soils and Economics Departments should be made into "staff" departments, reporting to the heads of each research program or the chief of all four programs. Other solutions, such as putting the Soils and Economics Departments in line, that is beneath the research programs, or absorbing them into the commodity programs, carry more disadvantages than advantages, such as conflict in reporting to four different program directors, and the need for additional staff and equipment, if absorbed into each program.

- While the actual on-farm validation trials for new varieties will be carried out by the commodity programs, in conjunction with the regional extension organizations, it is unclear if the commodity programs will also be responsible for acceptability and adoption studies on new varieties, or if these will remain as part of the Sociology and Economics Department's function.

SECTION VI

CONCLUSIONS AND RECOMMENDATIONS

Over the last 30 years the production function for basic grains has shifted from one lead by productivity increases (increased use of technology and higher yields) to one lead by area expansion and loss in productivity (increased use of land and lower rate of yield increases). As a result, national production has been increasingly unable to keep up with the rate of population growth and demand for basic grains, while the utilization, and therefore demand for factors of production related to productivity has fallen.

The basic reason for these undesirable trends can be found in "bad" policies during the second half of the period (1975-1988) which gradually but surely forced grain farmers to abandon factors of production related to productivity in favor of factors of production related to subsistence. These policies not only unleashed ominous trends which affected the food security balance of the country, but also a vital industry which provides some of the key factors of production related to farm productivity.[1]

Since 1988/89 many policy changes related to macroeconomic variables, sectors, international trade, institutions, and other factors have taken and continue to take place. It is expected that these changes will bring about a return to the positive productivity rates enjoyed in basic grains production during the first half of the time period reviewed, a revitalization of the agrochemical industry, and a sounder national food security situation.

This industry appraisal may be atypical and complicated in that it tried to look into a complex set of factors concerning the supply, processing, distribution, utilization and regulation of agrochemicals, all of which affect, one way or another, the national basic food situation. Questions went unanswered and new ones emerged as the work progressed - and more time was needed. However, due to the pace of the structural reforms taking place, it was felt that a draft publication at this time would be of more use than a delay to seek additional answers.

Thus, the conclusions and recommendations summarized in this Section are intended to interpret the most salient findings in each Section of the report which permit extrapolation for policy or programmatic recommendations which will hopefully assist ongoing and future policy analysis, changes and follow-up. It expected that future research activities will yield additional policy changes which will enhance the performance of this vital industry.

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[1] It is also true that the supply of other important factors of production not dependent on market forces (e.g. research and extension) did not keep up.

A. Trends in Utilization of Fertilizers and Pesticides

1. Conclusions

- Total fertilizer utilization decreased by 31 percent between 1978 and 1990.

- Total pesticide utilization decreased by 64 percent between 1978 and 1990.

- The stagnation and/or decline in grain production yields correlate with a declining, erratic and apparent non-optimal (technical and economic) use of factors of production related to productivity such as commercial seed, fertilizers and pesticides.

- The problem of soil acidity has apparently been compounded by the use of improper fertilizers and fertilization practices. This in turn has contributed to stagnation in the yields.

- This negative yield trend was counterbalanced with more area being put under cultivation, increasingly marginal land.

- The choices and use of fertilizers have been reduced to just a few basic products such as simple fertilizer (ammonium sulphate), formula (16-20-00; 15-15-15), and urea for all crops and soils.

- The choices in pesticides, while more numerous, are not necessarily the most desirable from health and environmental points of view.

- The drastic declines in the use of agrochemicals may have reached a plateau, and may have started to recuperate.

- A move to more rational use of agrochemicals (at least in physical terms, and specially in fertilizer) seems to have taken place in the last three years.

2. Recommendations

- It is important that some of the analysis undertaken in regard to the trends be refined and repeated annually to monitor whether or not the trends which are developing are in the right direction and within acceptable ranges. UAPA should be charged with this task.

- The analysis in regard to "physical" (MMP) and "economic" (MVP) use of fertilizers and pesticides should be refined, and if possible broken down by the identified grain production systems. This is excellent thesis material and UAPA in conjunction with a university could carry this out. The policy, research and extension implication should be obvious.

- UAPA should collaborate with DGEA in determining what type of information is needed and in what form to continue with utilization analysis and monitoring.

- An annual publication with relevant statistical data, analysis and situation outlook should be initiated. Again, UAPA, DGEA and the private sector could collaborate on this task.

A. Conditions Contributing to Trends

The broadest possible structure element that affects an industry is the global macro/institutional environment that surrounds it. This environment determines components of its structure which have unilateral effects on its conduct and performance. In this regard, the conclusions and recommendations are few and general in nature.

1. Conclusions

- The most drastic decline in the utilization of agrochemical products is linked with the near elimination of cotton production, which decreased by over 90 percent by 1991.

- The second most significant factor affecting demand for agricultural inputs has been inflation. High inflation rates throughout the 80's eroded grain producers real prices and incomes, leading to a constriction in the demand for factors of production associated with productivity and to a substitution with land area.

- An overvalued currency and cheaper international grain prices also took their toll, favoring grain imports for industrial uses as well as human consumption over domestic sources. This trend cut into the demand for locally produced grains. Demand for agrochemical inputs, being a derived demand also suffered.

- Public programs designed to intervene in grain markets in an effort to strengthen farm gate prices were totally ineffective against the erosion in real prices brought about by high inflation.

- Government intervention in the import and distribution of agrochemicals and the simplistic approaches used to standardize technology created a unstable environment with a specter of corruption, and a less productive total input package. Over the years the industry lost the trust and the favorable conditions for financing provided by international suppliers.

- The separation of CENTA's research and extension programs, and the reorientation of the latter to agrarian reform activities and programs crippled the ability of the system to conduct pro-active research, generate new technologies and achieve a high rate of adaptation by grain producers. As the impact from research and extension efforts from the 60 through the mid 70's wore off, grain producers also reduced the rate of technology adaptation, and demand for agrochemicals slowed.

- The agrarian reform upset many productive grain farms in the country. As their productivity declined so did demand for agricultural inputs.

- The BFA production credit program, while effective in providing in-kind credit for small farmers without access to formal credit sources helped create the simplistic fertilizer application norms (standard technology regardless) and did nothing to address the economic and environmental issues linked to pesticides.

- Macro, sectoral, trade, and institutional policy changes which began in 1988/89 and continue, have set the stage for a reversal of the undesirable trends in basic grain production and, therefore in the demand for agrochemicals. Sustainability of these changes is critical for the reversal to take hold and for grain production to reverse back and be led by productivity. This in turn will result in a more appropriate use of and higher demand for agrochemicals in grain production.

2. Recommendations

- It is imperative that the macroeconomic and structural reforms stay on track. Unless grain producers continue to receive higher real incomes the reversal of the undesirable trends will not be sustained and further de-technification with all its undesirable consequences is then likely to continue.

- The industry, which benefits indirectly as farmers are better off, as well as directly through the impacts of the reforms, will also be in a position to accelerate the introduction of better agrochemical products and improve its performance, if the pace of reform is sustained.

C. Structure, Conduct and Performance of Agrochemical Industry

The structural environment of the industry is undergoing changes brought about by the forces emanating from the structural reform programs and macro-economic changes being undertaken by the GOES. These adjustments to the structural changes will be gradual and will take years to implement. To what degree these changes and adjustments will enhance the performance of the industry is unknown at this stage, and will require periodic update of specific indicators.

1. Conclusions

- In the first stage of the market (import, blending/production and wholesale), the industry has a oligopolistic but apparently competitive structure. In the second tier the industry has many more participants (over 600 retail stores), which depending on the location and distribution may be very competitive (two or more stores in a town or village), or monopolistic (one store dominating a significant market radius or area).

- Industry concentration in the first marketing stage is high in both groups of commodities with three firms sharing 75 percent of the fertilizer market, and four firms, each offering 60 to 70 percent of all the pesticide products.

- Product differentiation is much less in fertilizer than in the pesticide group, implying more non-price competition in the first, and more price competition in the second.

- The industry has certain barriers to entry, some inherent and others outside the control of the local industry. Among the barriers are lack of national resources, economies of scale, excess capacity, patented products and licensing agreements, access to international resources and products, absolute-cost barriers, certain product differentiation, and market information.

- Pricing and profits of the two product groups in the industry are being affected by a public structure element with predictive value, namely the difference in the import tax applied to raw materials and finished products. The issue is the explicit protection being given to blenders and processors of pesticides with a 10 percent import tax on imported finished pesticide products versus a 5 percent import tax on both raw materials and finished fertilizer products.

- The conduct of the industry in terms of product pricing and promotion, and trading policies are characteristic of a competitive oligopolistic industry. Product pricing is more important in the more differentiated pesticide group, and less in the undifferentiated fertilizer group.

- New fertilizer products are making product pricing a more significant element of conduct, increasing product promotion efforts (advertising) and the potential for higher profit levels.

- Product promotion follows a similar pattern. The less differentiated the product the more generalized the promotion, tending to be educational or informative in nature. The more differentiated the product, the more pointed the promotion, aimed at creating and maintaining brand loyalty among customers.

- A number of sound trading policies are being used by all agrochemical firms to create non-product differentiation, and therefore a competitive edge to help keep current customers and gain new ones.

- No obvious collusive arrangements on pricing were found, or could be seen, or interpreted from discussions with industry representatives or from field surveys.

- The industry contains two associations representing the first two market tiers, namely APA and ADAES. Both are involved with issues and interests relevant to the market levels represented, as well as global issues relevant to the whole industry.

- Perhaps the largest discrepancy in views between these two associations is their stand on the issue of resacking and rebottling of fertilizers and pesticides at the retail level. While both agree that such service is demanded by customers, they disagree as to the market level where it should be provided. APA leans towards a one-time, tamper-proof sealed

packaging of different containers at the import/blending/processing stage, while ADAES prefers a legalization of the practice at the retail level.

- APA manages and co-finances an educational program aimed at increasing the efficiency of fertilizer and pesticide use, as well as the safety precautions that should be used when using chemicals and disposing of containers.

- Evaluation and judgement as to the performance record of the industry is limited due to lack of information about actual and potential performance levels.

- Profit levels for the product groups seemed reasonable when taken at face value. However, when other factors such as duration of sales season, credit terms received, industry concentration at the first market tier, and a specific structural element with predictive value (import tax) are taken into account the "reasonableness" of profit levels are open to question. This is not to say that they would turn out to be too high once these issues are factored in, rather that insufficient information on these issue prevents at the moment a more definite comparison between actual and potential performance in terms of profit levels.

- Based of farm gate prices for fertilizers, El Salvador's agrochemical industry compares very favorably to similar industries in other Central American countries. Limited information suggests that a sounder structural environment in El Salvador permits delivery of fertilizers at lower prices than in the other countries. Since no information is available on what these structural differences might be, no evaluation or comments can be provided as to how this favorable condition could be improved even further, if at all.

- Whether local production of fertilizers and pesticides is efficient in terms of scale of production (as contrasted to excess capacity) is another performance measure which could not be researched, given the information available. Whether or not the most efficient scale for local production is available or planned is critical due to its long-term impact on efficiency (unit cost).

- Product promotion efforts by the industry are informative as well as instructive in nature. Promotion costs did not appear to be excessive compared to total value of sales. The issue of literacy, that is functional literacy as juxtaposed to just being able to read, left doubts as to whether these efforts have the desired impact on users or potential users. Reading is one thing, understanding the meaning and applying the message consistently, if at all is another.

- During the last five years the industry has invested considerable amounts of capital in infrastructure designed to improve local factors of production. These steps are likely to pay off in more efficient production processes and lower unit costs. Also, whether by design or coincidence the peace and reconstruction initiatives put the industry and

its customers in a better position to benefit from these investments.

- Whether the industry's performance can be improved through continued imports of finished products or through increased local capacity to generate finished products from imported raw materials or intermediate goods is an important and difficult question yet to be answered. How much more local employment, value added, foreign exchange savings could be generated? Can this be done within a reasonable scale of production? How would loss in import tax revenue be offset? Can it be done in an environmentally safe and responsible manner?

- Whether or not the industry should be voluntarily taking leadership in phasing out the most toxic products or whether it should abide by the laws and wait for them to change before acting is a moral issue and value judgement worth investigating. Would the total social benefit of such a move outweigh the industry's cost? If so, should compensation be offered?

2. Recommendations

Because the Salvadorian agrochemical industry is a state of flux, some important questions generated during this study in regard to its structure, conduct and performance went unanswered. Until the "dust settles" it will be very difficult to address them. Whether these structural changes will lead to higher or lower levels of performance in the future depends greatly on the sustainability of macro, sectoral and trade reforms which create the environment within which the industry performs.

Nevertheless, the following action recommendations should be taken up by the industry and respective public institutions such as UAPA and DGEA. Joint rather than separate efforts are likely to yield better results.

- Analyze why the Salvadorian agrochemical industry is capable of delivering production inputs at much lower prices (at least fertilizers) than similar industries in other Central American countries. Public policy might very well be in a position to modify the reasons or conditions why this is so, giving the local industry and grain producers further price and competitive advantages.

- In recent years, the industry has improved production factors at the blending/processing stage. This trend should be encouraged since increased in-country capacity to blend/process raw materials or intermediate goods into finished products adds to the industrial base of the country, increases employment, reduces foreign component cost in finished products, increases the national value added component of the product and helps counterbalance the negative effects of devaluation and adds to the tax base of the nation.

  The trend can have a potential down-side in that a very limited number of firms are likely to be involved (probably no more than two in each product group), creating the potential for collusive arrangements and monopolistic profits. This potential threat can be effectively

counterbalanced with appropriate trade and tariff policies to insure that these firms are exposed to sufficient international competition and thus guaranteeing normal, or near-normal profit levels.

- The structure element with predictive value, that is the differential in import taxes for finished pesticides (10%) and fertilizers (5%) must be addressed. The issue is not equal treatment, but whether or not differential taxation of different product groups within the same industry is detracting from total industry performance. This issue is directly linked with the preceding action recommendation, and both could be analyzed and resolved at the same time.

- Total industry performance is somewhat hampered by the lack of basic information on agrochemical products utilization, volumes, prices, as well as analysis, dissemination and utilization of results. A large portion of the statistical information used in this study was obtained from raw survey data assembled by DGEA. Such information is assembled, but apparently never processed, analyzed and published.

  Industry and DGEA should form a joint committee to decide what information is most useful, when it is needed, and decide on a user fee which would help defray some of the cost of gathering and assembling such information. Using standard computer software (perhaps donated by the industry) to input, sort, and analyze and print this type of information DGEA would be in a position to either sell raw data for the clients for them to analyze is a s they see fit, or to provide standard analysis for a fee.

D. Legal and Regulatory Environment of the Agrochemical Industry

Perhaps no other element has more bearing on the conduct and performance of an industry than the soundness of the structure element representing its specific laws and regulations, and the degree to which such parameters are upheld. It was the intent of this appraisal to address this legal and regulatory environment that surrounds and affects the industry. This effort was curtailed in view of other projects addressing this very point.

Nevertheless, the limited review undertaken leaves no doubt that great priority should be given to this structure element, and in view of the fact that several projects are and will be looking into this matter, the following conclusions and recommendations are given.

1. Conclusions

- It is widely acknowledged that current laws and regulations dating to the early 1970's and still governing the agrochemical industry are outdated, impractical, and no longer supportive of a progressive and socially responsible performance of the industry.

- Sufficient evidence exists to demonstrate that while the implied intent of the laws and regulations are "good", the actual results can be quite different. This situation is specially alarming with respect to the

potential harmful side-effects to humans and the environment.

- It is also acknowledged that current regulatory agencies are not capable of following through with the mandates of the law and regulations. The reasons include, bloated bureaucracies, inadequate budgets, lack of skilled employees, low salaries, lack of equipment, lack of communication among agencies, low deterrence or penalties for violations, and corruptive practices.

- The basic conclusion is inescapable. Current laws, regulations and public institutions responsible for compliance and improvement are in need of revision and restructuring.

- At least four different projects are scheduled to start this year and in 1993, all having a component addressing the legal and regulatory structure component of the agrochemical industry. Coordination among these will be critical in order to generate a progressive and effective legal and regulatory structure component for the industry.

2. Recommendations

- Projects, specially projects financed by different sources, can have the tendency to work cross-purposes even though they are addressing the same issues or problems. There is no need for each project to bring legal experts, to draw a new law and regulations, or to make an independent effort which will have to be reconciled with the efforts of the other projects. Since the national institutions involved with the laws and regulations are the same, regardless of the project, it is recommended that a "Law Review Committee" be set up to head up and coordinate the efforts of each project in this regard.

  Resource use will be much more effective and the result far more satisfactory. Combined, all these projects have the resources to bring the best national and international minds to bear on this challenge and formulate a new set of laws and regulations which will set the example for the region and the future.

- In view of the regional as well as world wide trends and concerns the revised law and regulations should aim at being (1) regional in scope, (2) visionary in terms of health and ecology, (3) be efficiency oriented, and (4) introduce market forces as a regulatory agent.

- It is critical that the private sector be included in the review process from the very beginning. Drafting a law from the "intent" point of view is one thing, making it work in the "real" world is another. Private sector involvement will bring into the process their concerns and needs, and provide the committee with a valid test of feasibility prior to finalizing the proposals.

- No doubt, the issue of resacking fertilizers and rebottling pesticides will come to the forefront of the discussions. The issue is not easy to settle. Health, environmental, economic, and market interest are all at

stake. Nevertheless, given the understanding of the system by the authors, it is their opinion that the earlier in the market system the subdivision into smaller containers takes place the safer the system will be. While this option may not be the most economical in terms of direct costs (remains to be analyzed), the total social cost of the health hazards and environmental impacts of the current practices are quite likely to outweigh the incremental cost of the proposed solution.

E. Production System Parameters, Research and Extension

While research and extension do not form an explicit structure component of the agrochemical industry, they are very important elements of the environment which surrounds it. Researchers generate better and more efficient methods of production. Extension transmits such new knowledge to farmers who in turn make decision which influence the ways they will continue to use agrochemical products. Finally, these decisions impact on the demand for products and services provided by the industry. It is in this round-about fashion that these programs affect the performance of the industry.

The information gathered on production system parameters, research and extension not only underline and strengthen what was learned in the seed study, but bring to light more serious concerns regarding the relevance of the current research framework being used at CENTA to generate new technological packages for basic grains. It is in this regard that the following conclusions and recommendations are given.

1. Conclusions

- Information obtained from different sources cast doubts as to the appropriateness of current recommendations being given to grain producers, specially in regard to fertilizers. The information appears to indicate that fertilizer recommendations being given are not optimum from a physical point of view (Marginal Physical Product), nor from an economic point of view (Marginal Value Product).

- While everybody agrees that a soil test is critical for a sound fertilization regime such a practice is virtually non-existent for grain producers. The available soil maps go back to 1962, are outdated and too generalized to be of any use. A recently instituted fee of 10 Colons per sample cut what little demand existed to nearly zero.

- Statistical and field survey information provide strong evidence which indicates that grain producers are not optimizing the application of either fertilizers or pesticides. It appears that too much fertilizer is being used per unit of production, and that pesticides follow a calendar, or an immediate application regime, rather than an economic application regime. This conclusion is more startling than the previous one since farmers are "known to be poor but not inefficient".

- The basic conclusion is that less fertilizer and an economic regime of pesticide application appear to be reasonable propositions to achieve higher yields in grain production at lower cost. If true, this raises

serious and challenging questions for the research and extension programs.

- With external financing, the GOES is undertaking a "structural" change of CENTA, designed to make it again a "center of excellence for research and extension". Major thrusts of the adjustment include, a restructuring of the whole institution, the reintegration of extension, a realignment of research programs, a training component to upgrade the skills of the staff, and equipment acquisition. This project provides a unique opportunity to present CENTA with a new and visionary research and extension framework.

  El Salvador's research and extension program in regard to basic grains has followed the 30 year old doctrine of the "green revolution" which is based on the development and introduction of new technological packages. This has led mainly to the development or selection, and release of new hybrids or improved varieties of basic grains.

  Recently, at least five different grain production systems have been identified in EL Salvador. The traditional technical approach to research and extension, while necessary is simply no longer sufficient to address the very unique production decisions and requirements of each system. A visionary and more focused approach will yield much higher social returns to the research and extension program than the existing technical approach.

- From discussions with CENTA staff, it appears that the Soils Laboratory and the Sociology and Economics Departments have not been included in the institutional restructuring of the Research and Extension Component of the PRISA project. Strengthening the research and extension thrusts of CENTA without commensurate support to such vital sub-components makes the whole project questionable.

- Over the years several initiatives were taken to institutionalize a grain postharvest research and extension component. All have failed. While such a program is not relevant to production agrochemicals, it is in regard to chemicals being used to preserve grains during storage, of which there is great use in El Salvador. Also, this postharvest component has the potential to contribute to a total yield increase and quality improvement of the grains, which after production and storage enter the food system of the nation.

- With GTZ financing CENTA is entering the second phase (extension) of a long-term integrated pest management project affecting cotton, corn and beans. The project has the potential to increase grain yields while at the same time reducing agrochemical utilization, as well as health hazards and environmental contamination.

- Great concern was expressed by industry representatives, researchers and scientist on the issue of soil acidification, which can reduce yields considerably and limit the types of crops produced on such soils. The use of inappropriate fertilizers has, over the years compounded the

problem of soil acidity. Some estimate that up to 30 percent of the soils suffer from this condition. While the total scope of the problem is not well documented, it is obvious enough to warrant attention.

2. Recommendations

- CENTA's research program in basic grains must be given a new vision and framework. The current technical foundation of its research program is necessary but no longer sufficient. It should be changed to one based on socio-anthropological and socio-economic parameters, where farming systems research takes priority over the current development of "generalized technical packages" at a research station.

  In order to give CENTA an appropriate research mission into the next century, advantage should be taken of CENTA's restructuring and funding being made available under the PRISA project to design and introduce this more relevant research concept and framework. This will necessitate the input of experts at the cutting edge of this scientific field, and implies a restructuring of research goals, methods, skills and personnel engaged in basic grains.

- Applied research approach which starts on-farm research early in the research cycle and examines how proposed technologies will fit into the existing farming systems would yield more positive results. Until the new research format is designed and fully introduced, applied on-farm research should be introduced as early as possible into the existing research cycle.

- The apparent discrepancies between recommended fertilizer and pesticide applications and what grain producers are presumably doing bring to question the validation results and follow-up work being undertaken by CENTA. Of course, errors in the data and in the analysis could help answer this apparent "irrational behavior" by grain farmers.

  Nevertheless, sufficient justification exists to recommend that these two steps (validation and follow-up) be strengthened through immediate introduction of more advanced and refined techniques for validation analysis and equipment, and through intensive short-term personnel training in farming systems research and production economics.

- If the observation in regard to the apparent exclusion of the Soils Laboratory and the Sociology and Economics Departments from the institutional restructuring of the Research and Extension Component of the PRISA project is correct, then it should be redressed within the PRISA Project while the five year plans are being finalized.

  The Soils Laboratory should be charged with the development of soil maps useful for general agricultural production decisions, conservation, and extension.

  The issue of soils acidification needs to be addressed in depth. The Soils Laboratory could also be charged with this task.

Another chance is being offered to institutionalize a grain postharvest research and extension program, with the assistance of the Swiss Development Program. Advantage should be taken of the offer made last March to integrate this important component into CENTA's grain research and extension program. Institutional integration with the on-going integrated pest management project in grain production will enhance the potential for increasing total yield and quality of basic food grains in the nation.

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APPENDIX 1

TERMS OF REFERENCE

APPRAISAL OF THE DELIVERY SYSTEM FOR AGRICULTURAL INPUTS

OBJECTIVES:

In light of the on-going structural reform programs, appraise the changing structure, conduct and performance of the present agricultural input delivery system in the country. Special emphasis should be given to the system's effectiveness in reaching small farmers.

RATIONALE:

Under the on-going structural reform programs, the State is reducing its activities in the provision and distribution of agricultural inputs (seeds, fertilizers, chemicals, tools, credit). Farmers at the fringes of the monetary economy have been the major beneficiaries of the State supported distribution system. As the current State system is dismantled many of these farmers are likely to be left with a limited or with no access to these essential inputs. The private, market driven delivery system oriented by profit incentives may not be effective in reaching these farmers.

The potential negative consequences of such a development on basic food production can be serious if this group represents a great number of farmers. If this is the case, an appropriate incentive structure for effective private sector distribution and delivery of inputs to these farmers needs to be studied, planed, executed and monitored.

UTILIZATION OF RESULTS:

This information would be used by the GOES, USAID/El Salvador, other donors and financial agencies in planning and coordinating improvements of the agricultural input distribution and delivery system, as the structural reform programs are carried out and their effects take hold.

STEPS TO BE FOLLOWED IN IMPLEMENTING THE ACTIVITY:

1. Conduct literature review prior to field work.

2. Conduct an in-country appraisal mission to (1) review current agreements under the structural reform program, directly and indirectly related to the distribution and delivery system of agricultural inputs (2) determine present level of participation of State operated firms in agricultural inputs, (3) determine present clientele served under the existing State operated system, (4) assess farming and socio/economic characteristics of such clientele, (5) develop a programmatic approach to assess the impact of eliminating the State operated system on clientele and redress negative impacts and (6) develop a programmatic approach to assess private sector effectiveness in servicing this clientele.

3. Develop (1) conclusions and (2) policy and action recommendations to assure timely execution of programmatic approaches in order to achieve continued access to agricultural inputs by this group of farmers or at least minimize the negative impact of the changes.

4. Provide GOES and USAID officials with final team report in English one week before departure.

5. Conduct seminar/workshop with private sector representatives, public sector officials and USAID personnel prior to departure. Results of presentation and discussion feedback will be included in final English report.

6. Translate and type report in Spanish (in the USA).

7. Submit final Spanish report to USAID/El Salvador.

PERSONNEL ASSIGNED:

1. Agricultural economist:	Dr. Cornelius, Hugo, Kansas State University
2. Ag. production/farming system specialist:	Dr. Fred Worman, Kansas State University.

APPENDIX 2

CONTACTS

CONTACTS

1. MAG
   Dr. Antonio Cabrales, Ministro

2. OSPA
   Lic. Mercedes Llort, Directora

3. AUPA
   Lic. Luis Enrique Córdoba, Director

4. DGEA
   Lic. Julio Cesar Gonzales, Sub-director
   Lic. Francisco Vanegas

5. Defensa Agropecuaria
   Dr. Rolando Martinez Melara, Director

6. CENTA
   Dr. Ever Amaya, Director
   Ing. Salvador Berrios, Jefe de la División de Certifcación de Semillas
   Carlos Atillo Perez Cabrera, Investigación de Leguminosas
   Adan Aguiluz, Invesigación de Maíz
   Eduardo Sendeyon - arroz
   Elías Mejía Figueroa - Coordinador del Projecto PRISA
   Mauricio Manzano, Jefe de la División de Tecnología y Plantas
   Dra. Gloria Ruth Calderón, Jefa Laboratorio de Calidad
   Mario Minervini, Jefe Laboratorio de Suelos
   Ing. Jorge Mercado, Dept. de Sociología y Economía
   Ing. Tito Montenegro, Dept. de Sociología y Economía
   Ramón Montoya, Jefe Programa de la GTZ

7. DESAP
   Ing. Roberto Rodriguez, Director

8. Asociación de Distribuidores Agropecuarios de El Salvador
   Dr. Ricardo Escobar, Secretario
   Many other members
   Tel. 26-3541

9. APA
   Some members

10. FAO
    Dr. José Tubino, Representante en El Salvador

11. CLUSA
    Sr. Satley Khuen, Director
    Lic. Mauricio Salinas

12. PMA
    Dr. Oscar Sarroca, Representanta en El Salvador

13. BFA
Lic. Carlos Abel Membreño, Gerencia General
Ing. Rafael Blanco Alarcón, Gerente de Planificación
Ing. Fito Escobar, Gerente General
Sr. Max Montano, Gerencia Comercial
Lic. Monje Ayala

14. IICA
1ra. Calle Poniente y 61 Av. Nte.
Edificio Bukele 2da. Planta
Alberto Perdomo
Tel 23-3774
23-2561

15. Agroservicios

Agropecuaria Las Pavas, S.A. de C.V
José René Portillo
Agrónomo Representante Legal
Av. Santa Ana No. 10
Cojutepeque
Tel. 32-0397

Centro Agrícola La Campiña
Thelmo Estanislao Guadrón
Calle José Mariano Méndez y Décima Avenida Sur
Santa Ana
Tel. 40-3758 40-0821

Agroservicio Veterinario Rudacon
Rubén Dario Contreras - Extensionista
1ra C.O. #15
Sensuntepeque
Dept. Cabañas
El Salvado
Tel. 32-3002

Centro Agrícola y Ganadero de San Martin
Julio Faustino Sosa
2a. Calle Oriente No.2
San Martin
Tel. 38-0048

Agroservicio La Terminal
Belisario Hernández - Ing. Agrónomo
10 Avenida Sur y 17 Calle Poniente
Santa Ana
Tel. 40-2819

Disagro
Ing. David Isaias Alvarez
Calle José Mariano Méndez # 2
Santa Ana
Tel. 41-1506

La Casa del Agricultor S.A. de C.V.
José Ernesto Portillo Salazar
2da Norte # 22
Quezaltepeque
Tel. 31-2525

Agroservicio El Rancho
Oswaldo Paniagua
Av. central Nte. No.6
Aguilares
Tel. 31-4069

16. USAID/San Salvador
Dr. Ken Ellis, RDO, Chief
Dr. Mike Wise, RDO, Project Officer
In. Adolfo Cristales, Project Officer

APPENDIX 3

CROP AREA, YIELD AND PRODUCTION

AREA, PRODUCTION, AND YIELD OF WHITE CORN

Crop Year	AREA (Mz) National	Hybrid	Total	PRODUCTION (qq) National	Hybrid	Total	YIELD (qq/Mz) National	Hybrid	Total
61-62	210,700	11,095	221,795	2,750,855	393,810	3,144,665	13.1	35.5	14.2
62-63	260,302	22,292	282,594	3,750,589	878,592	4,629,181	14.4	39.4	16.4
63-64	219,448	27,238	246,686	3,411,530	1,090,135	4,501,665	15.5	40.0	18.2
64-65	217,017	19,775	236,792	3,451,601	713,850	4,165,451	15.9	36.1	17.6
65-66	241,640	34,180	275,820	3,278,275	1,134,900	4,413,175	13.6	33.2	16.0
66-67	247,060	49,540	296,600	3,930,329	1,850,401	5,780,730	15.9	37.4	19.5
67-68	244,215	29,880	274,095	3,469,900	1,070,100	4,540,000	14.2	35.8	16.6
68-69	233,840	51,510	285,350	3,605,150	1,993,750	5,598,900	15.4	38.7	19.6
69-70	179,340	97,960	277,300	2,613,900	3,450,600	6,064,500	14.6	35.2	21.9
70-71	196,620	97,580	294,200	3,760,310	4,132,690	7,893,000	19.1	42.4	26.8
71-72	200,300	100,000	300,300	3,895,000	4,305,000	8,200,000	19.4	43.1	27.3
72-73	167,320	125,480	292,800	2,111,725	3,035,715	5,147,440	12.6	24.2	17.6
73-74	146,125	141,125	287,250	3,054,040	5,761,600	8,815,640	20.9	40.8	30.7
74-75	135,775	166,325	302,100	1,917,900	5,750,600	7,668,500	14.1	34.6	25.4
75-76	143,535	208,165	351,700	2,388,210	7,160,590	9,548,800	16.6	34.4	27.2
76-77	136,517	197,983	334,500	1,944,977	5,499,123	7,444,100	14.2	27.8	22.3
77-78	154,266	195,513	349,779	2,181,164	6,074,005	8,255,169	14.1	31.1	23.6
78-79	166,800	210,800	377,600	2,946,400	8,074,200	11,020,600	17.7	38.3	29.2
79-80	133,468	260,832	394,300	1,947,337	9,417,163	11,364,500	14.6	36.1	28.8
80-81	141,546	275,454	417,000	1,946,709	9,501,039	11,447,748	13.8	34.5	27.5
81-82	121,058	273,942	395,000	1,778,320	9,089,495	10,867,815	14.7	33.2	27.5
82-83	104,951	236,049	341,000	1,462,710	7,537,290	9,000,000	13.9	31.9	26.4
83-84	101,645	243,355	345,000	1,447,315	8,185,685	9,633,000	14.2	33.6	27.9
84-85	103,110	244,590	347,700	2,094,500	9,367,000	11,461,500	20.3	38.3	33.0
85-86	104,510	257,590	362,100	1,942,200	8,827,000	10,769,200	18.6	34.3	29.7
86-87	112,370	255,730	368,100	2,025,440	7,474,560	9,500,000	18.0	29.2	25.8
87-88	139,800	258,700	398,500	2,821,590	9,754,300	12,575,890	20.2	37.7	31.6
88-89	148,100	254,700	402,800	3,686,800	9,269,400	12,956,200	24.9	36.4	32.2
89-90	152,700	242,000	394,700	3,968,400	8,825,900	12,794,300	26.0	36.5	32.4
90-91	171,600	231,000	402,600			0	0.0	0.0	0.0

YEAR	AREA	PRODUCTION	YIELD
61-65	246,967	4,110,241	17
71-75	295,613	7,457,895	25
81-85	357,175	10,240,579	29
86-90	391,025	11,956,598	30

Source: DGEA

File: CORN.WQ1

RICE AREA, PRODUCTION AND YIELD

Crop Year	Area (Mz)	Production (qq/Mz)	Yield (qq/Mz)
61-62	12,710	388,700	30.6
62-63	15,519	557,233	35.9
63-64	12,234	448,597	36.7
64-65	21,150	718,971	34.0
65-66	18,900	758,123	40.1
66-67	28,178	1,096,179	38.9
67-68	40,000	1,692,240	42.3
68-69	39,000	1,730,700	44.4
69-70	15,300	775,700	50.7
70-71	17,000	961,550	56.6
71-72	20,920	1,192,300	57.0
72-73	15,700	774,600	49.3
73-74	13,600	809,500	59.5
74-75	15,900	697,700	43.9
75-76	24,200	1,320,000	54.5
76-77	19,710	776,100	39.4
77-78	17,800	712,600	40.0
78-79	19,850	1,104,500	55.6
79-80	21,100	1,266,200	60.0
80-81	24,000	1,320,000	55.0
81-82	19,800	1,089,790	55.0
82-83	16,000	770,000	48.1
83-84	18,000	940,000	52.2
84-85	21,900	1,376,000	62.8
85-86	24,700	1,497,600	60.6
86-87	17,200	1,020,400	59.3
87-88	16,700	914,550	54.8
88-89	19,700	1,245,900	63.2
89-90	22,200	1,385,200	62.4

YEAR	AREA	PRODUCTION	YIELD
61-65	15,403	528,375	34
71-75	16,530	868,525	52
81-85	18,925	1,043,948	55
86-90	18,950	1,141,513	60

Source: DGEA

File: RICE.WQ1

SORGHUM AREA, PRODUCTION AND YIELD

Crop Year	AREA (Mz) National	AREA (Mz) Improved	AREA (Mz) Total	PRODUCTION (QQ) National	PRODUCTION (QQ) Improved	PRODUCTION (QQ) Total	YIELDS (QQ/Mz) National	YIELDS (QQ/Mz) Improved	YIELDS (QQ/Mz) Total
61-62			140,470			1,835,510			13.1
62-63			150,189			2,429,235			16.2
63-64			143,453			2,117,024			14.8
64-65			124,455			1,907,450			15.3
65-66			158,700			2,295,900			14.5
66-67			153,719			2,493,049			16.2
67-68			148,400			2,350,000			15.8
68-69			162,500			2,700,200			16.6
69-70			162,575			2,784,100			17.1
70-71			177,400			3,199,700			18.0
71-72			180,000			3,400,000			18.9
72-73			186,400			3,170,000			17.0
73-74			170,000			3,400,000			20.0
74-75			182,000			2,850,000			15.7
75-76			189,100			3,800,000			20.1
76-77			178,500			3,399,200			19.0
77-78	176,455	12,344	188,799	2,440,635	344,364	2,784,999	13.8	27.9	14.8
78-79	183,742	11,658	195,400	3,486,979	330,721	3,817,700	19.0	28.4	19.5
79-80	192,430	12,570	205,000	3,140,945	344,055	3,485,000	16.3	27.4	17.0
80-81	160,233	10,467	170,700	2,740,689	300,211	3,040,900	17.1	28.7	17.8
81-82	154,915	10,025	164,940	2,658,594	291,686	2,950,280	17.2	29.1	17.9
82-83	161,807	8,193	170,000	2,503,333	196,667	2,700,000	15.5	24.0	15.9
83-84	145,170	12,830	158,000	2,375,140	301,960	2,677,100	16.4	23.5	16.9
84-85	147,500	18,500	166,000	2,433,000	620,900	3,053,900	16.5	33.6	18.4
85-86	145,000	18,400	163,400	2,419,100	463,700	2,882,800	16.7	25.2	17.6
86-87	150,200	21,300	171,500	2,630,200	576,600	3,206,800	17.5	27.1	18.7
87-88	150,500	28,200	178,700	458,740	105,460	564,200	3.0	3.7	3.2
88-89	147,400	26,800	174,200	2,748,800	583,900	3,332,700	18.6	21.8	19.1
89-90	141,700	29,200	170,900	2,606,600	643,100	3,249,700	18.4	22.0	19.0

YEAR	AREA	PRODUCTION	YIELD
61-65	139,642	2072304.8	14.8
71-75	179,600	3205000.0	17.9
81-85	164,735	2845320.0	17.3
86-90	173,825	2588350.0	15.0

Source: DGEA

File: SORGHUM.WQ1

BEAN AREA, PRODUCTION AND YIELD

Crop Year	Area (Mz)	Production (qq/Mz)	Yield (qq/Mz)
61-62	30,700	227,815	7.4
62-63	47,044	398,959	8.5
63-64	39,690	314,400	7.9
64-65	30,541	269,082	8.8
65-66	33,600	359,700	10.7
66-67	37,761	336,120	8.9
67-68	40,595	380,120	9.4
68-69	45,270	462,400	10.2
69-70	46,965	571,460	12.2
70-71	51,600	649,500	12.6
71-72	57,000	750,000	13.2
72-73	56,850	595,700	10.5
73-74	64,440	814,700	12.6
74-75	73,470	732,200	10.0
75-76	79,800	861,800	10.8
76-77	75,540	870,100	11.5
77-78	75,125	733,540	9.8
78-79	74,000	933,000	12.6
79-80	78,700	1,011,330	12.9
80-81	75,000	866,500	11.6
81-82	71,000	831,820	11.7
82-83	79,400	830,000	10.5
83-84	80,500	918,300	11.4
84-85	82,500	1,056,000	12.8
85-86	83,300	751,200	9.0
86-87	87,100	1,093,900	12.6
87-88	89,300	531,000	5.9
88-89	96,100	1,240,000	12.9
89-90	91,600	968,900	10.6

YEAR	AREA	PRODUCTION	YIELD
61-65	36,994	302,564	8
71-75	62,940	72[illegible],150	12
81-85	78,350	909,030	12
86-90	91,025	958,450	10

Source: DGEA

File: BEAN.WQ1

APPENDIX 4

CEREAL PRODUCTION INDICES

TOTAL CEREAL PRODUCTION INDEX
(1979-81 = 100)

Year	COSTA RICA	EL SALVADOR	GUATEMALA	HONDURAS	NICARAGUA	PANAMA
1978	95.15	99.50	94.50	105.62	86.81	95.64
1979	97.21	102.88	99.09	86.21	88.82	98.92
1980	103.95	101.81	96.58	97.16	91.93	94.39
1981	98.85	95.31	104.33	116.63	119.25	106.69
1982	73.53	79.08	114.28	95.11	111.98	102.28
1983	109.35	84.44	113.18	113.43	109.65	115.18
1984	106.09	102.08	99.61	125.51	99.19	102.81
1985	110.74	97.77	114.14	105.37	130.65	118.39
1986	98.66	86.58	124.73	111.21	111.15	113.78
1987	85.75	90.97	122.84	110.61	129.83	116.95
1988	82.89	108.82	140.65	122.84	108.54	114.35
1989	95.50	111.44	152.48	131.84	103.77	116.77

PER CAPITA CEREALS PRODUCTION INDEX
(1979-81=100)

Year	COSTA RICA	EL SALVADOR	GUATEMALA	HONDURAS	NICARAGUA	PANAMA
1978	101.03	102.94	99.92	113.76	92.29	99.95
1979	100.13	104.41	101.92	89.64	91.84	101.13
1980	103.92	101.64	96.61	97.50	92.25	94.43
1981	95.95	93.95	101.47	112.85	115.91	104.44
1982	69.29	77.24	108.08	88.72	105.32	97.96
1983	100.06	81.80	104.07	102.02	99.71	107.95
1984	94.33	97.97	89.04	108.93	87.19	94.29
1985	95.72	92.64	99.17	88.36	111.03	106.27
1986	82.97	80.72	105.30	90.19	91.32	99.99
1987	70.18	83.30	100.76	86.85	103.11	100.64
1988	66.07	97.70	112.09	93.47	83.34	96.56
1989	74.18	97.98	118.06	97.25	77.05	96.44

Source: FAO PRODUCTION YEAR BOOKS

APPENDIX 5

POPULATION

EL SALVADOR

TOTAL POPULATION (in Millions)

Year	Population	Year	Population Growth at 2.13%	Population Growth at 3.00%	Population Growth at 4.00%
1960		1990	5,247	5,247	5,247
1961		1991	5,359	5,404	5,457
1962		1992	5,473	5,567	5,675
1963	2,721	1993	5,590	5,734	5,902
1964	2,857	1994	5,709	5,906	6,138
1965	2,954	1995	5,831	6,083	6,384
1966	3,057	1996	5,955	6,265	6,639
1967	3,168	1997	6,081	6,453	6,905
1968	3,283	1998	6,211	6,647	7,181
1969	3,400	1999	6,343	6,846	7,468
1970	3,582	2000	6,478	7,052	7,767
1971	3,632				
1972	3,747				
1973	3,863				
1974	3,983				
1975	4,085				
1976	4,173				
1977	4,263				
1978	4,354				
1979	4,448				
1980	4,525				
1981	4,573				
1982	4,622				
1983	4,672				
1984	4,722				
1985	4,767				
1986	4,846				
1987	4,934				
1988	5,031				
1989	5,138				

Source: FAO PRODUCTION YEAR BOOKS

APPENDIX 6

GRAIN STATISTICS FROM CENTRAL AMERICAN COUNTRIES

CORN

	COSTA RICA			EL SALVADOR			GUATEMALA		
Year	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)
1961	50	1,070	53	190	928	176	625	829	518
1962	54	1,094	59	199	1,076	214	639	875	559
1963	59	1,073	63	172	1,202	207	688	856	589
1964	65	1,072	70	165	1,161	192	698	921	643
1965	80	1,052	84	193	1,052	203	676	955	646
1966	78	1,053	82	208	1,280	266	659	900	594
1967	81	1,052	85	192	1,088	209	697	872	607
1968	82	1,053	86	200	1,289	258	691	997	689
1969	70	1,052	73	194	1,437	279	735	965	709
1970	42	1,093	45	206	1,765	363	695	1,035	719
1971	29	1,191	34	230	1,640	377	709	1,024	726
1972	55	1,150	64	204	1,166	238	832	800	666
1973	52	1,011	52	202	2,004	406	844	843	712
1974	55	1,000	55	210	1,709	359	850	721	613
1975	65	1,416	92	246	1,786	439	514	1,328	683
1976	53	1,681	89	234	1,464	342	514	1,335	686
1977	43	1,419	61	245	1,540	377	590	1,281	756
1978	37	1,726	64	264	1,918	507	591	1,533	906
1979	39	1,462	57	276	1,894	523	622	1,512	941
1980	40	1,775	71	275	1,953	537	650	1,628	1058
1981	47	1,876	88	276	1,810	500	681	1,464	997
1982	54	1,579	85	239	1,734	414	669	1,645	1100
1983	62	1,814	113	280	1,587	444	925	1,131	1046
1984	61	1,680	103	243	2,166	527	599	1,735	1038
1985	69	1,802	125	253	1,954	495	660	1,627	1073
1986	62	1,691	104	257	1,519	391	687	1,610	1106
1987	75	1,701	127	279	2,076	578	749	1,565	1172
1988	61	1,601	98	282	2,086	587	644	2,055	1324
1989	61	1,675	103	276	2,107	582	691	2,174	1501
1990									
61/64-57	57	1077	61	182	1092	197	663	870	577
71/74-48	48	1088	51	212	1630	345	809	847	679
81/84-56	56	1737	97	260	1824	471	719	1494	1045
86/89-65	65	1667	108	274	1947	535	693	1851	1276

61/64-182
71/74-212
81/84-260
86/89-274

61/64-663
71/74-809
81/84-719
86/89-693

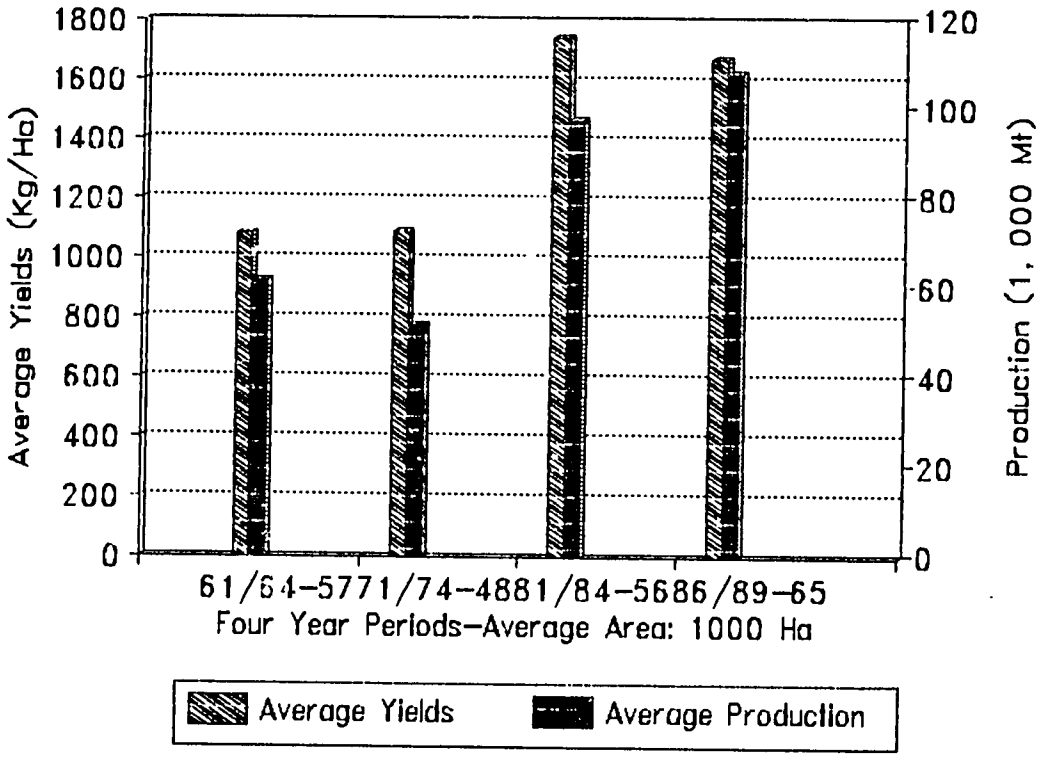
Source: FAO PRODUCTION YEAR BOOK

CORN

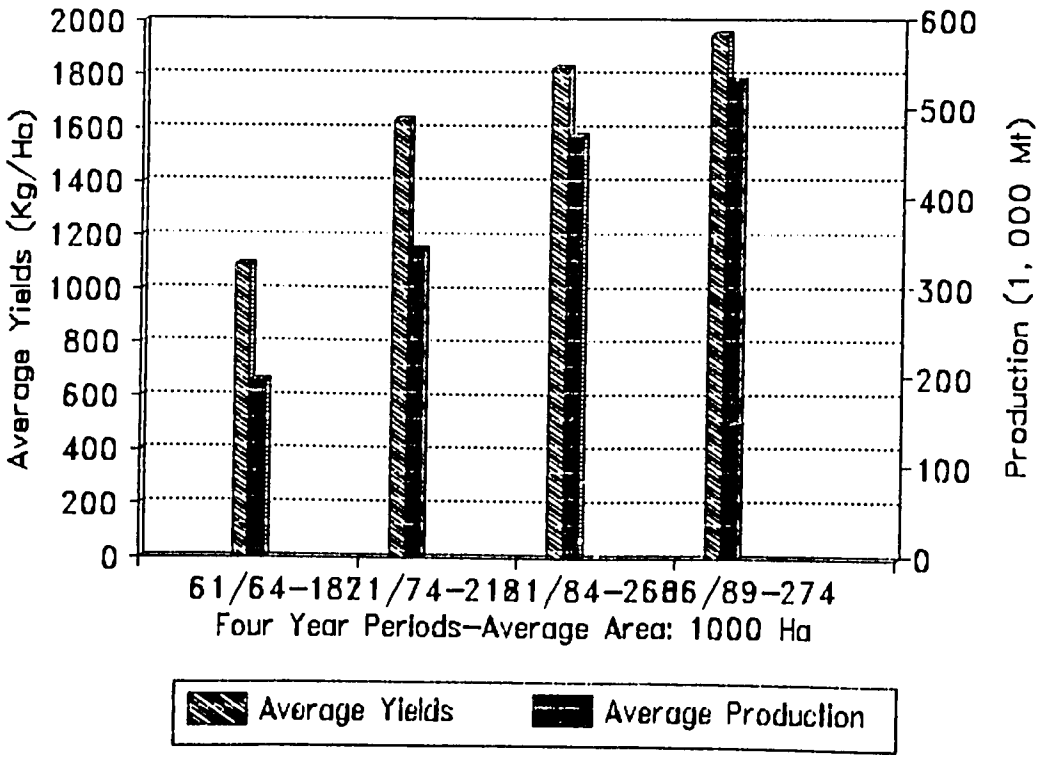
Year	HONDURAS Area (1000 Ha)	HONDURAS Yield (Kg/Ha)	HONDURAS Production (1000 Mt)	NICARAGUA Area (1000 Ha)	NICARAGUA Yield (Kg/Ha)	NICARAGUA Production (1000 Mt)	PANAMA Area (1000 Ha)	PANAMA Yield (Kg/Ha)	PANAMA Production (1000 Mt)
1961	252	1,052	258	165	848	140	92	806	74
1962	266	1,053	280	173	866	150	83	865	72
1963	263	1,081	284	161	887	142	94	806	76
1964	300	1,109	333	175	906	158	99	829	82
1965	294	1,137	334	195	877	171	105	801	84
1966	271	1,165	316	176	891	198	108	778	84
1967	281	1,192	335	202	889	228	113	788	89
1968	289	1,220	353	216	1,006	216	100	835	84
1969	272	1,248	339	257	899	231	103	854	88
1970	272	1,274	346	250	900	225	69	805	56
1971	272	1,301	354	259	913	236	68	795	54
1972	290	1,000	290	221	620	131	66	675	44
1973	330	1,000	330	221	924	204	68	811	55
1974	290	897	260	164	1,173	193	73	828	60
1975	330	1,099	363	210	916	192	74	877	65
1976	330	876	289	228	883	201	83	769	64
1977	412	915	377	240	926	222	80	963	77
1978	474	959	455	228	117	254	65	995	64
1979	348	983	342	140	1,196	168	66	959	63
1980	348	1,029	358	197	1,164	229	68	956	65
1981	338	1,424	481	200	989	198	56	1,012	57
1982	341	1,492	509	164	997	164	59	1,044	62
1983	330	1,424	470	220	1,032	227	70	971	68
1984	367	1,380	507	189	1,127	213	63	1,119	71
1985	285	1,487	424	161	1,452	234	79	1,210	96
1986	345	1,402	484	211	1,250	264	70	1,071	75
1987	284	1,560	443	191	1,448	277	78	1,255	98
1988	518	965	500	200	1,402	280	77	1,195	92
1989	532	1,014	540	223	1,341	299	95	1,053	100
1990									
61/64	270	1074	289	169	877	148	92	827	76
71/74	296	1050	309	216	908	191	69	777	53
81/84	344	1430	492	193	1036	201	62	1037	65
86/89	420	1235	492	206	1360	280	80	1144	91
	61/64-270			61/64-169			61/64-169		
	71/74-296			71/74-216			71/74-216		
	81/84-344			81/84-193			81/84-193		
	86/89-420			86/89-206			86/89-206		

Source: FAO PRODJCTION YEAR BOOK

CORN – COSTA RICA



CORN – EL SALVADOR



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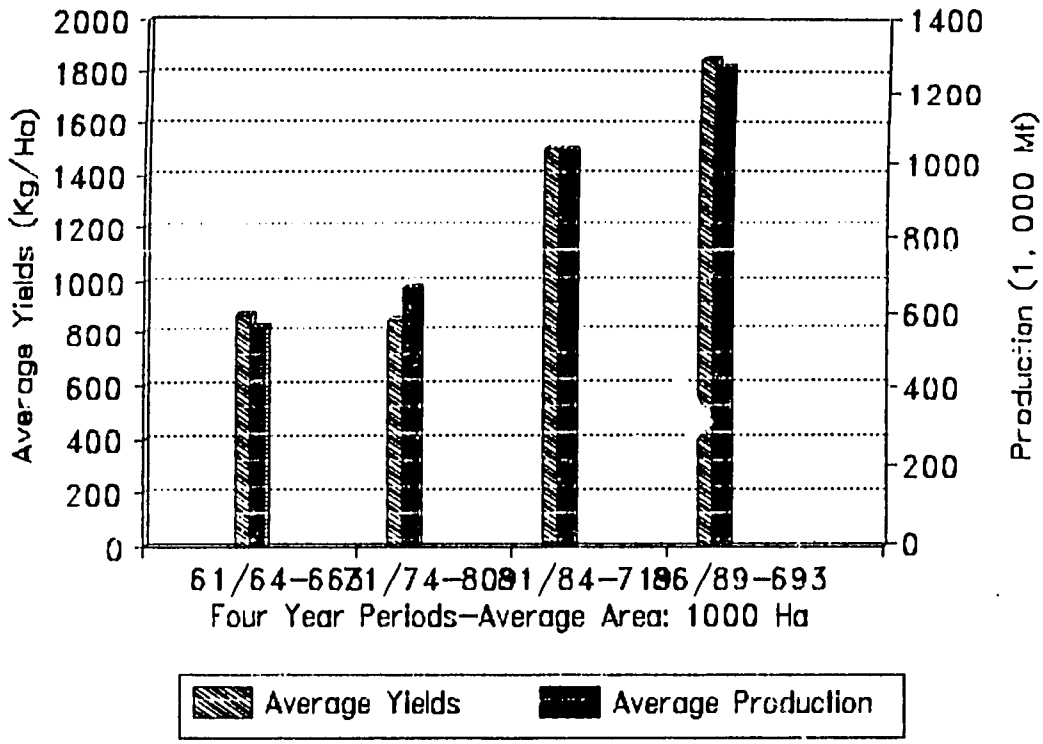

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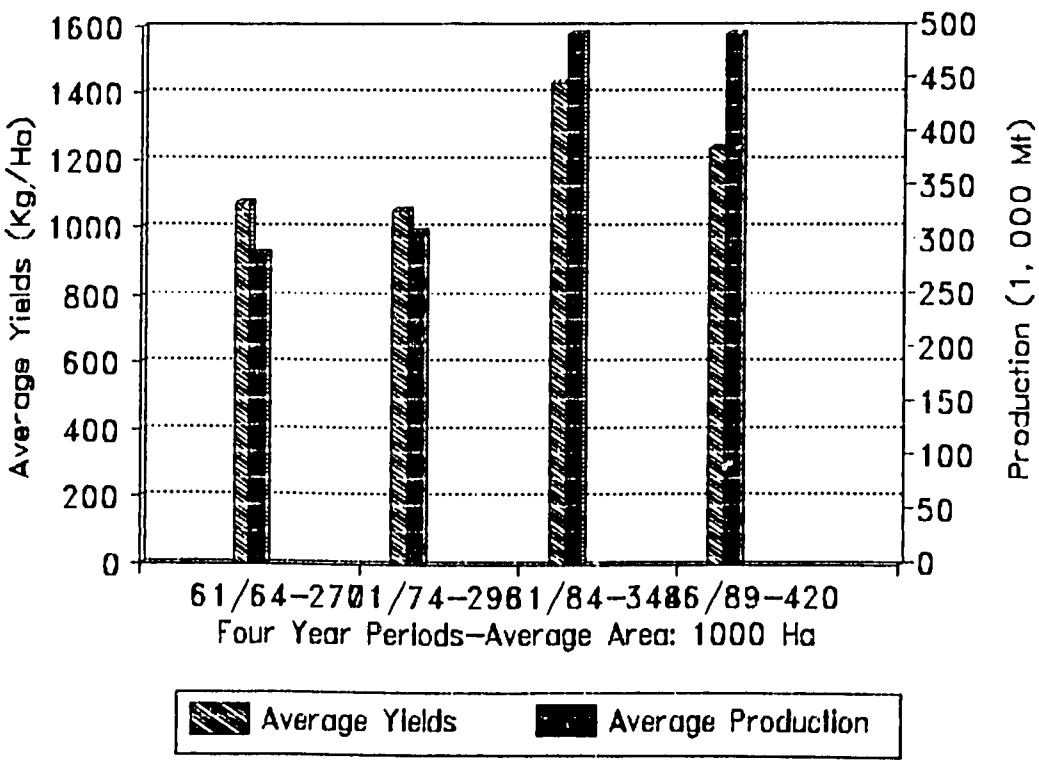

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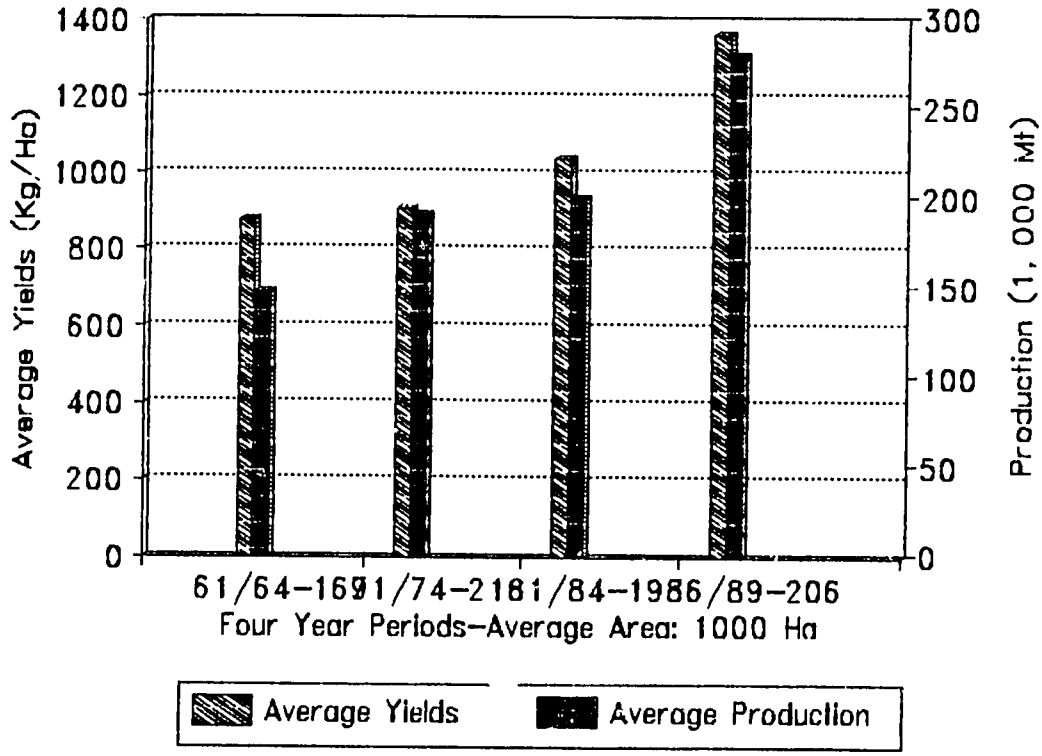
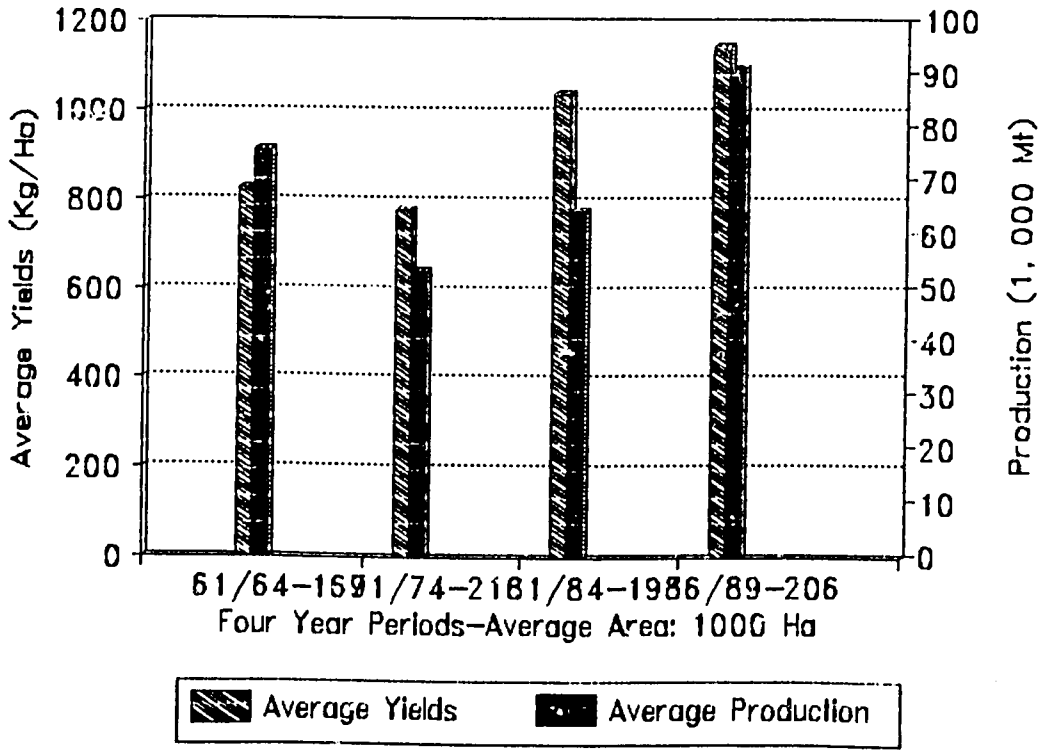


CORN – PANAMA



RICE

	COSTA RICA			EL SALVADOR			GUATEMALA		
Year	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)
1961	46	1,275	57	9	2,012	18	9	1,399	13
1962	48	1,253	60	11	2,360	26	10	1,590	16
1963	51	1,275	65	9	2,268	21	13	1,436	18
1964	52	1,309	68	15	2,234	33	11	1,743	20
1965	53	1,356	72	13	2,636	35	8	1,753	13
1966	54	1,408	77	20	2,557	50	8	1,750	15
1967	56	1,461	81	28	2,780	78	12	1,770	21
1968	57	1,477	84	21	3,040	83	14	1,848	25
1969	70	1,500	104	11	3,511	38	14	1,924	27
1970	43	1,835	79	12	3,720	44	9	1,549	15
1971	35	2,583	90	15	3,746	55	10	1,572	15
1972	32	2,775	89	11	3,245	36	16	2,751	44
1973	65	1,590	104	10	3,911	37	19	1,974	38
1974	66	1,621	107	10	2,977	30	18	1,783	32
1975	80	2,246	196	17	3,588	61	19	1,786	33
1976	80	1,868	150	14	2,590	36	14	1,670	24
1977	63	2,063	130	13	2,603	33	17	2,059	35
1978	76	2,586	196	14	3,656	51	11	2,297	26
1979	81	2,568	208	15	3,943	58	13	2,954	37
1980	74	2,338	173	17	3,353	57	15	2,573	39
1981	80	2,518	201	14	3,621	50	11	2,192	23
1982	77	1,840	142	11	3,166	35	8	2,896	24
1983	83	2,554	212	13	3,435	43	12	3,113	46
1984	72	2,251	223	15	4,136	63	16	2,778	44
1985	74	3,035	224	17	3,988	69	15	2,597	38
1986	60	3,064	185	14	3,848	53	14	2,550	36
1987	50	3,013	152	12	3,602	42	18	2,469	44
1988	64	3,051	196	14	4,101	57	27	2,582	69
1989	67	3,444	229	16	4,065	63	18	2,908	51
61/64-49	49	1278	63	11	2219	25	11	1542	17
71/74-50	50	2142	93	12	3470	40	16	2020	32
81/84-78	78	2291	195	13	3590	48	12	2745	34
86/89-60	60	3143	191	14	3904	54	19	2627	50
				61/64-11			61/64-11		
				71/74-12			71/74-16		
				81/84-13			81/84-12		
				86/89-14			86/89-19		

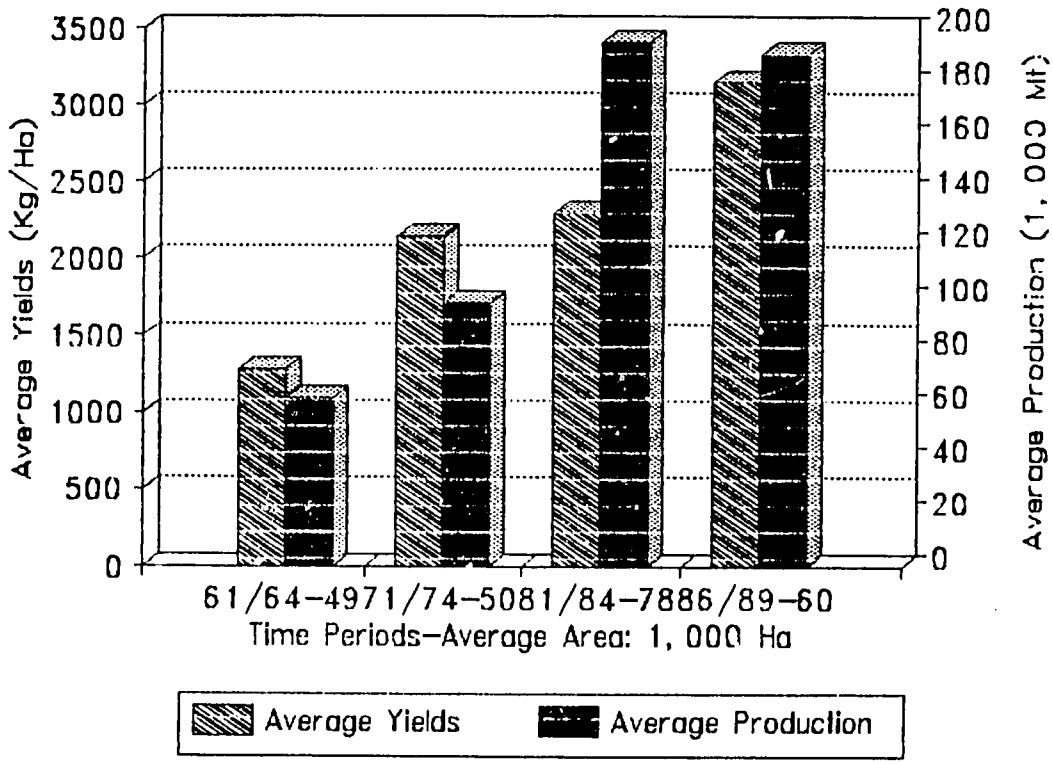
Source: FAO PRODUCTION YEAR BOOKS

RICE

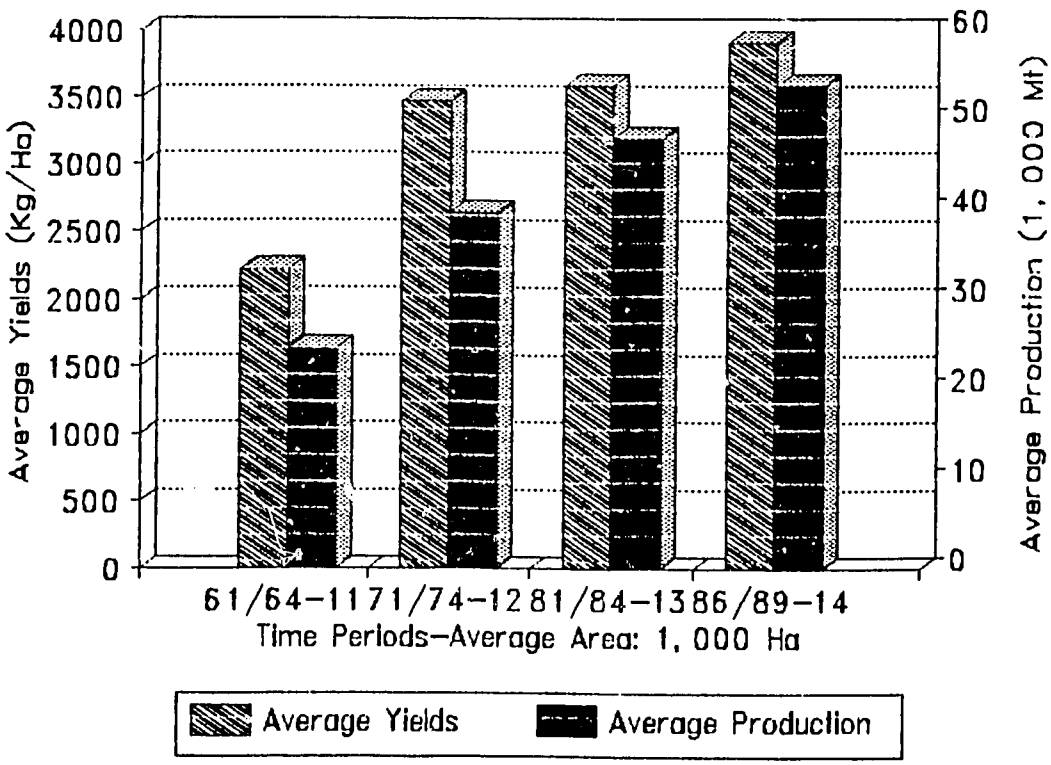
	HONDURAS			NICARAGUA			PANAMA		
Year	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)
1961	9	1,308	12	24	1,631	39	100	1,085	109
1962	10	1,281	12	23	1,630	37	100	1,101	110
1963	9	1,247	11	22	2,167	47	103	1,076	111
1964	8	1,222	10	23	2,151	48	121	1,057	128
1965	9	1,180	11	25	2,149	54	133	1,138	151
1966	5	1,178	5	26	2,403	63	132	1,065	140
1967	7	1,188	8	26	2,470	64	130	1,170	151
1968	6	1,180	7	32	2,690	86	129	1,270	163
1969	6	1,182	7	38	2,290	86	126	1,310	165
1970	6	1,167	7	40	2,730	109	91	1,360	124
1971	6	1,167	7	43	1,730	74	100	1,350	135
1972	15	1,067	16	26	2,839	74	105	1,190	125
1973	16	1,063	17	29	2,946	84	105	1,538	162
1974	15	1,323	19	27	3,011	82	109	1,569	171
1975	18	1,616	29	30	3,013	89	115	1,602	185
1976	16	1,625	26	21	2,901	61	122	1,181	144
1977	24	1,292	31	15	2,994	45	115	1,652	190
1978	16	1,675	27	28	3,037	85	99	1,638	162
1979	19	1,491	29	19	1,947	37	99	1,720	170
1980	24	1,725	41	25	2,556	64	120	1,658	199
1981	21	1,734	37	42	3,900	163	100	1,955	195
1982	23	1,641	38	45	3,606	162	95	1,855	176
1983	24	1,792	43	47	3,674	172	80	2,113	169
1984	18	2,725	49	41	3,937	162	93	1,877	175
1985	15	2,972	45	41	3,813	156	91	2,057	186
1986	14	2,508	34	37	3,386	124	100	1,720	172
1987	14	3,837	53	40	3,746	149	86	2,087	180
1988	14	3,586	48	38	2,901	111	83	2,203	183
1989	26	1,875	48	39	2,046	104	85	2,118	180
61/64	9	1265	11	23	1895	43	106	1030	115
71/74	13	1155	15	31	2632	79	105	1412	148
81/84	22	1973	42	44	3779	165	92	1950	179
86/89	17	2952	46	39	3020	122	89	2032	179
	61/64-9			61/64-23			61/64-106		
	71/74-13			71/74-31			71/74-105		
	81/84-22			81/84-44			81/84-92		
	86/89-17			86/89-39			86/89-89		

Source: FAO PRODUCTION YEAR BOOKS

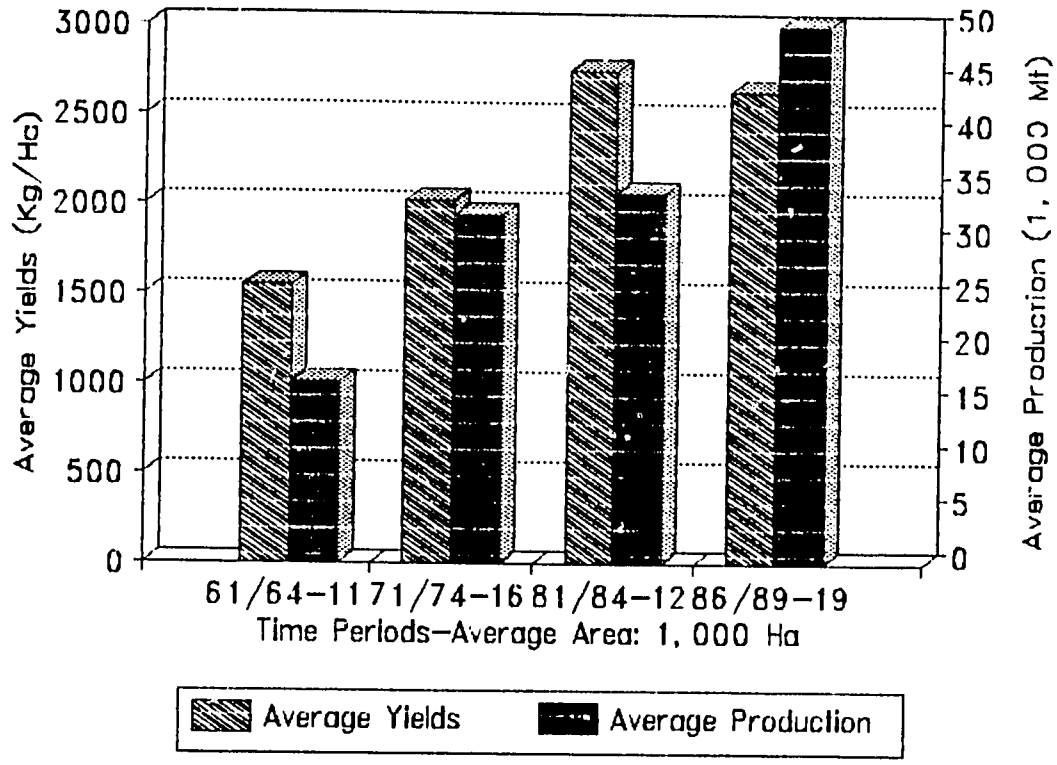
RICE – COSTA RICA



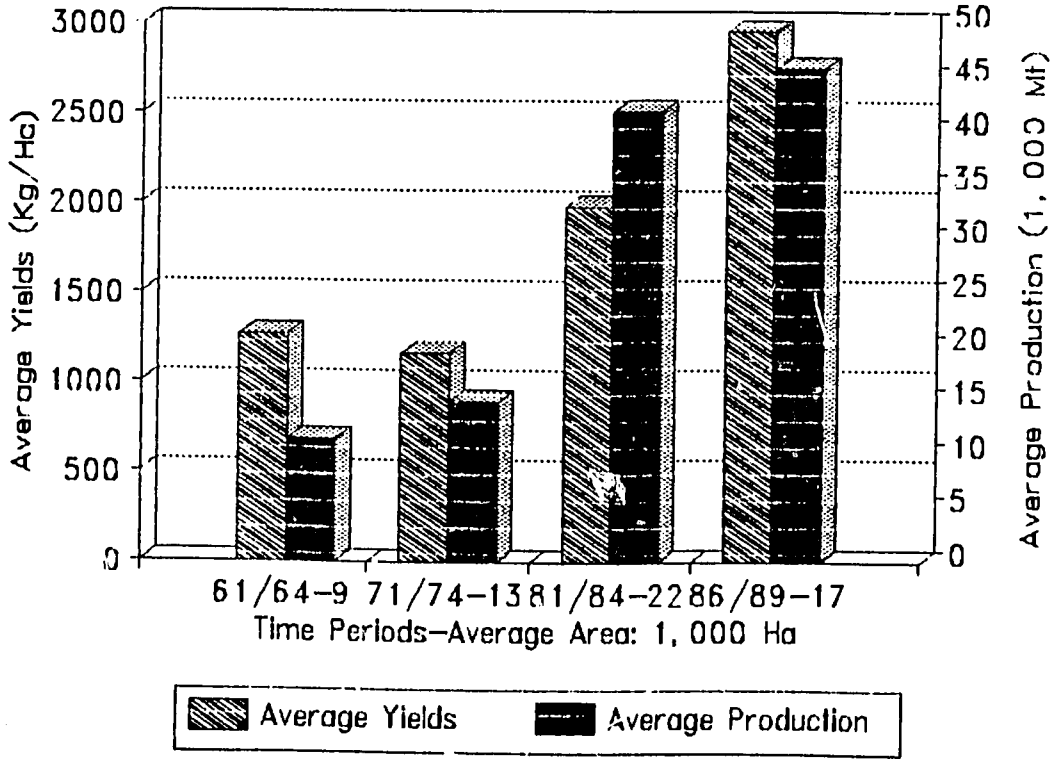
RICE– EL SALVADOR



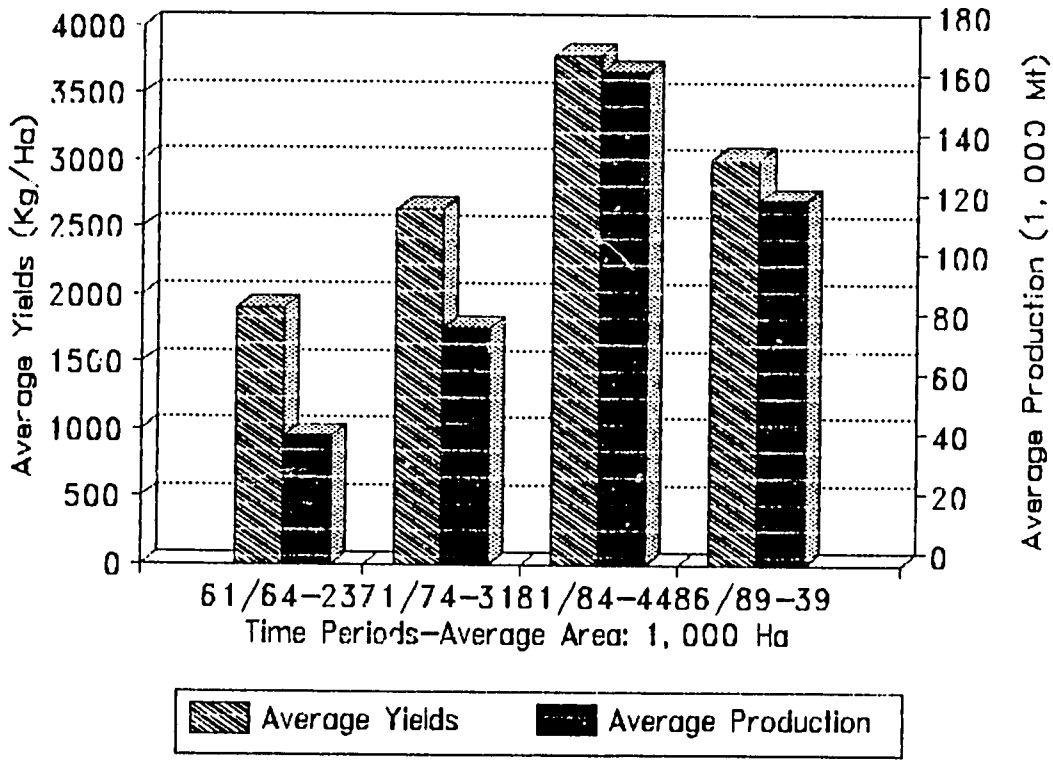
RICE – GUATEMALA



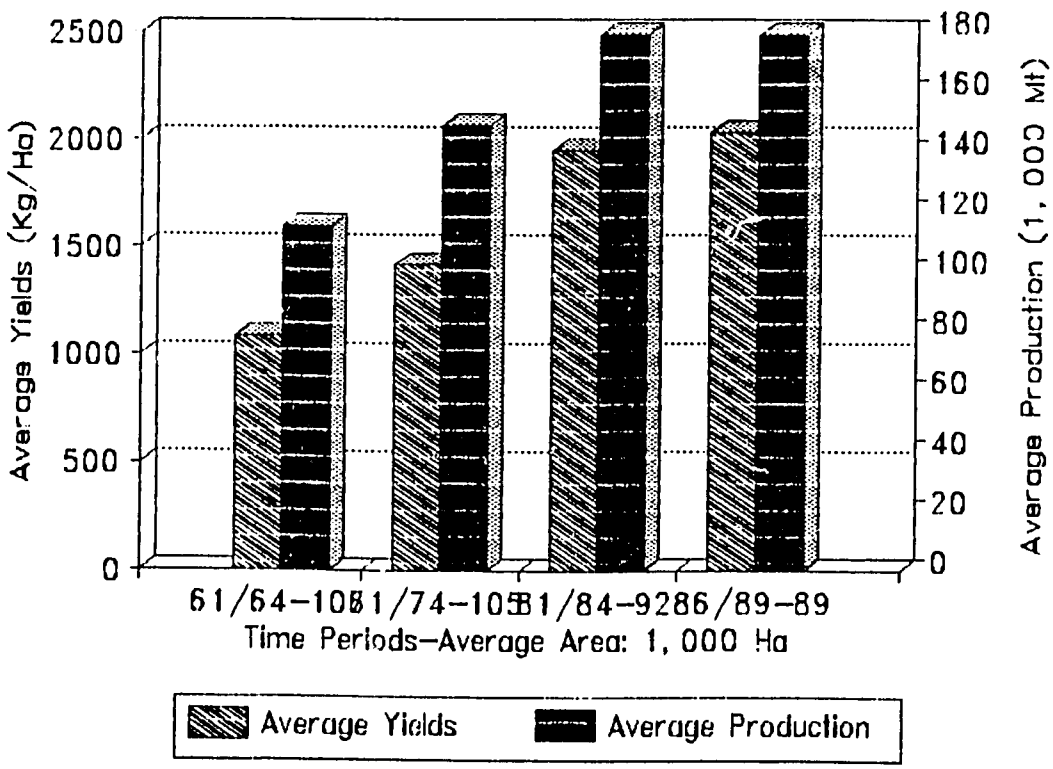
RICE – HONDURAS



RICE – NICARAGUA



RICE – PANAMA



SORGHUM

	COSTA RICA			EL SALVADOR			GUATEMALA		
Year	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)
1961	4	1,585	7	98	860	84	27	593	16
1962	6	1,613	10	93	950	88	27	593	16
1963	4	1,634	7	93	950	91	40	600	24
1964	7	1,632	11	87	1,007	88	48	570	27
1965	8	1,646	13	111	953	106	48	892	44
1966	6	1,633	10	107	1,068	115	51	673	39
1967	6	1,655	9	104	1,041	108	44	718	32
1968	7	1,643	12	114	1,091	124	47	895	42
1969	7	1,643	12	114	1,126	128	49	1,106	54
1970	7	1,644	12	124	1,186	147	51	888	46
1971	8	1,642	13	136	1,150	156	53	893	47
1972	8	1,686	8	130	1,119	146	73	616	45
1973	4	2,000	8	119	1,316	156	74	614	45
1974	9	1,798	16	110	1,192	131	75	560	42
1975	11	1,840	11	132	1,322	175	57	1,678	95
1976	19	1,743	19	125	1,253	156	55	1,752	96
1977	20	1,841	37	144	1,226	176	54	1,722	93
1978	24	2,206	53	137	1,183	162	43	1,509	65
1979	30	2,248	67	144	1,117	160	44	1,250	55
1980	20	2,000	40	144	1,229	177	47	1,351	64
1981	21	2,007	42	115	1,176	136	41	2,120	86
1982	16	1,738	28	119	1,044	124	31	2,515	77
1983	26	2,000	51	120	850	102	33	2,455	81
1984	23	1,647	37	116	1,209	140	46	1,988	90
1985	30	2,368	71	114	1,159	133	67	1,496	100
1986	15	2,100	31	119	1,128	135	66	1,288	85
1987	7	2,567	19	125	207	26	70	1,446	101
1988	1	2,296	2	122	1,130	138	53	2,566	136
1989	2	2,518	5	123	1,269	156	75	1,607	121
61/64-5	5	1616	9	94	942	88	36	589	21
71/74-7	7	1782	11	124	1194	147	69	671	45
81/84-22	22	1848	40	118	1070	126	38	2270	84
86/90-6	6	2370	14	122	934	114	66	1727	111

61/64-94
71/74-124
81/84-118
86/90-122

61/64-36
71/74-69
81/84-38
86/90-66

Source: FAO PRODUCTION YEAR BOOKS

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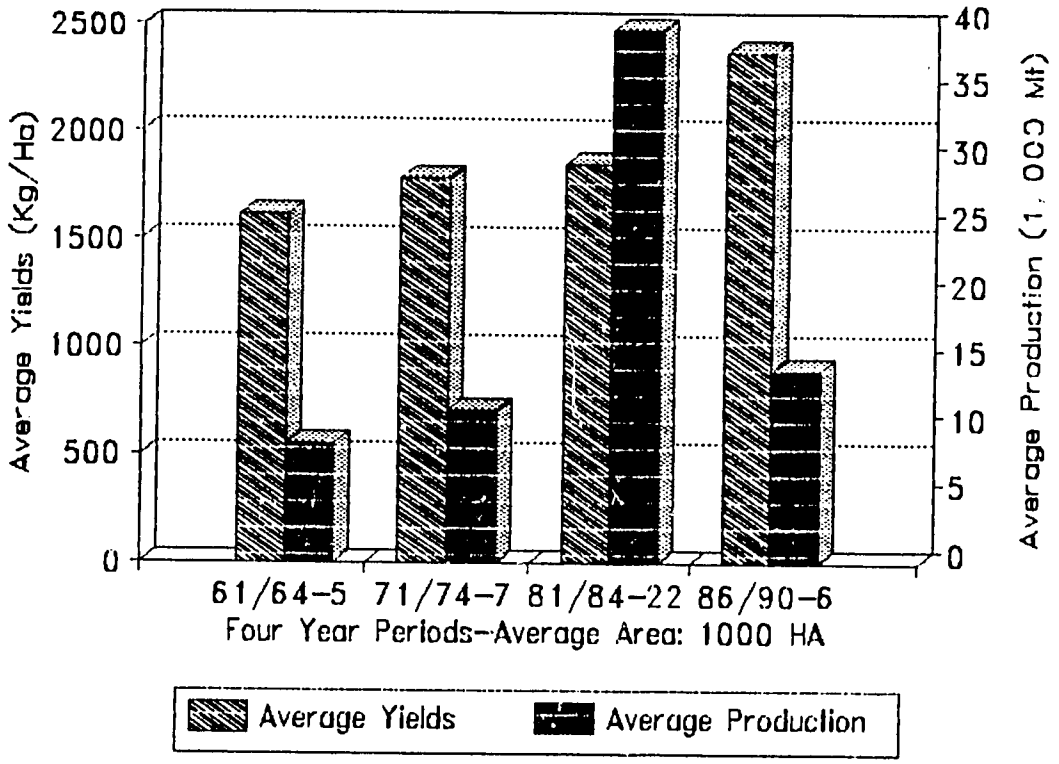
SORGHUM

	HONDURAS			NICARAGUA			PANAMA		
Year	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)
1961	40	1,161	47	55	917	50			
1962	42	1,195	50	56	880	49			
1963	42	1,231	52	41	1,002	41			
1964	42	1,264	53	48	984	47			
1965	41	1,299	53	50	930	46			
1966	36	1,334	48	51	968	49			
1967	32	1,371	44	52	990	52			
1968	33	1,406	46	55	1,013	56			
1969	33	1,440	48	56	1,366	77			
1970	33	1,435	47	60	1,000	60			
1971	33	1,426	47	55	934	51			
1972	29	1,379	40	38	1,061	40			
1973	30	1,400	42	55	1,058	59			
1974	30	1,313	39	56	1,072	60			
1975	56	954	53	60	1,046	63			
1976	57	821	47	56	981	55			
1977	71	867	62	52	1,018	53			
1978	62	710	44	51	1,240	64			
1979	54	667	36	55	1,058	58			
1980	52	656	34	60	1,260	76			
1981	58	997	58	56	1,597	89			
1982	60	965	58	39	2,149	84			
1983	50	1,020	51	30	2,272	89			
1984	59	883	52	52	2,146	111	10	1,705	17
1985	13	988	12	74	2,609	194	12	1,639	19
1986	43	441	19	79	2,320	184	12	1,583	19
1987	25	1,448	37	72	1,758	127	10	2,567	26
1988	60	898	54	70	1,469	102	10	2,223	23
1989	96	629	61	50	1,444	72	10	2,600	26
61/64	42	1213	51	50	946	47	ERR	ERR	ERR
71/74	31	1380	42	51	1031	53	ERR	ERR	ERR
81/84	57	966	55	44	2041	93	10	1705	17
86/90	56	854	43	68	1748	121	11	2243	24

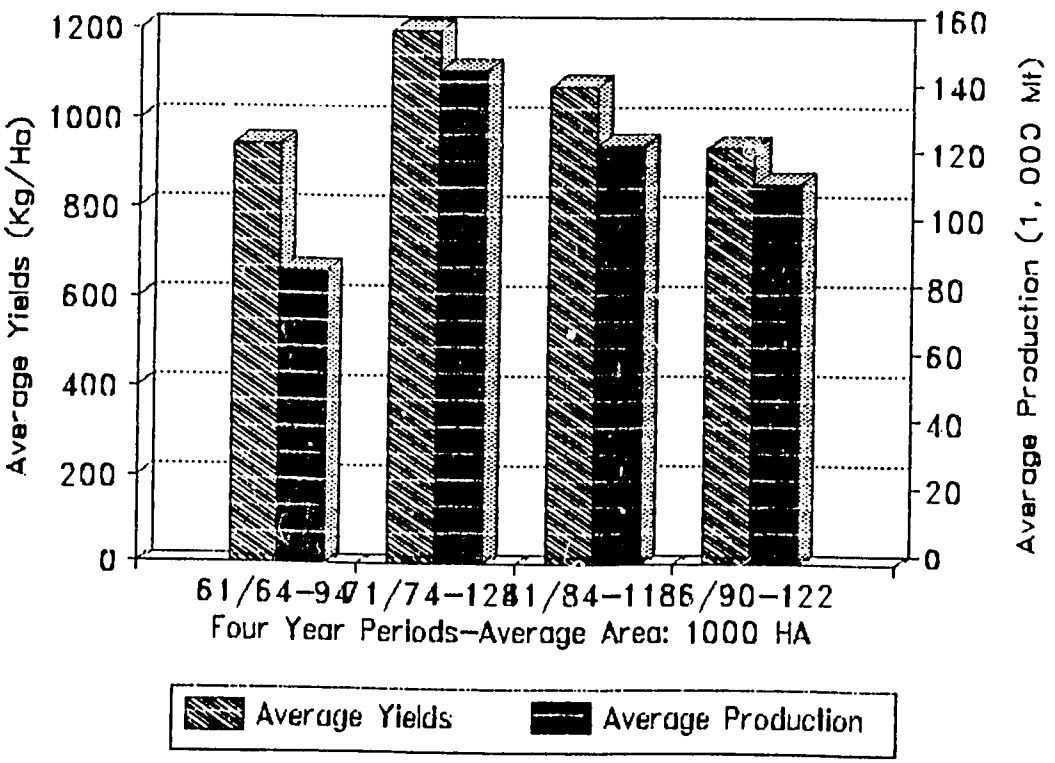
61/64-42	61/64-50	61/64-ERR
71/74-31	71/74-51	71/74-ERR
81/84-57	81/84-44	81/84-10
86/90-56	86/90-68	86/90-11

Source: FAO PRODUCTION YEAR BOOKS

SORGHUM – COSTA RICA



SORGHUM – EL SALVADOR



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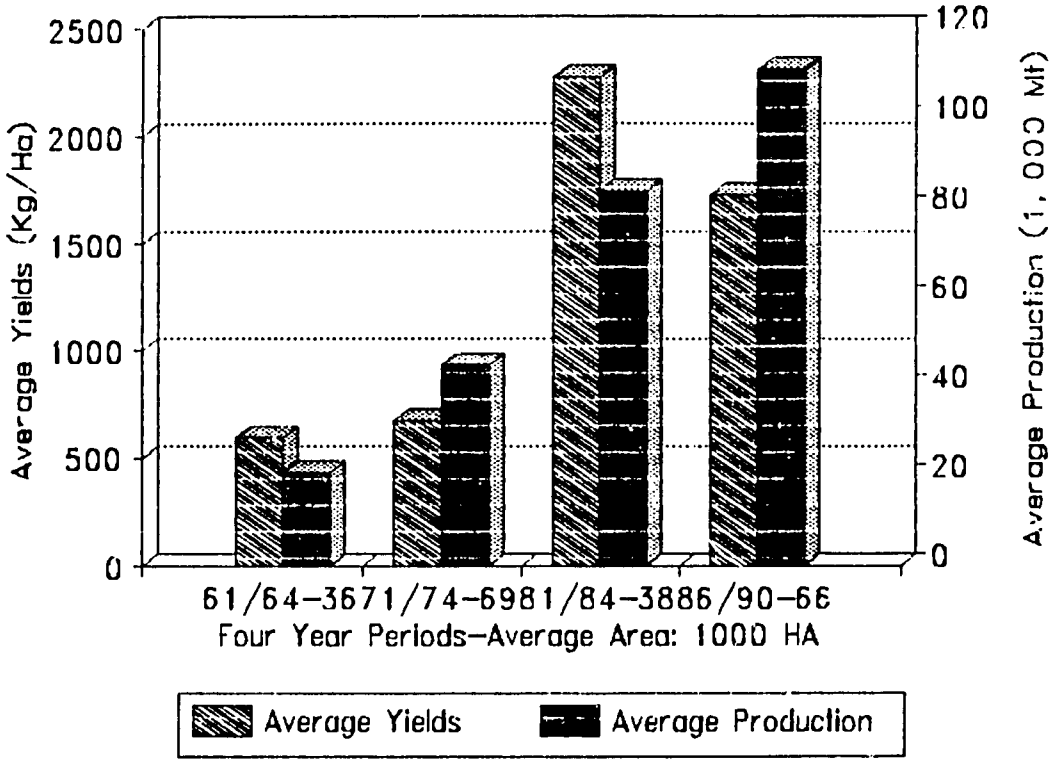

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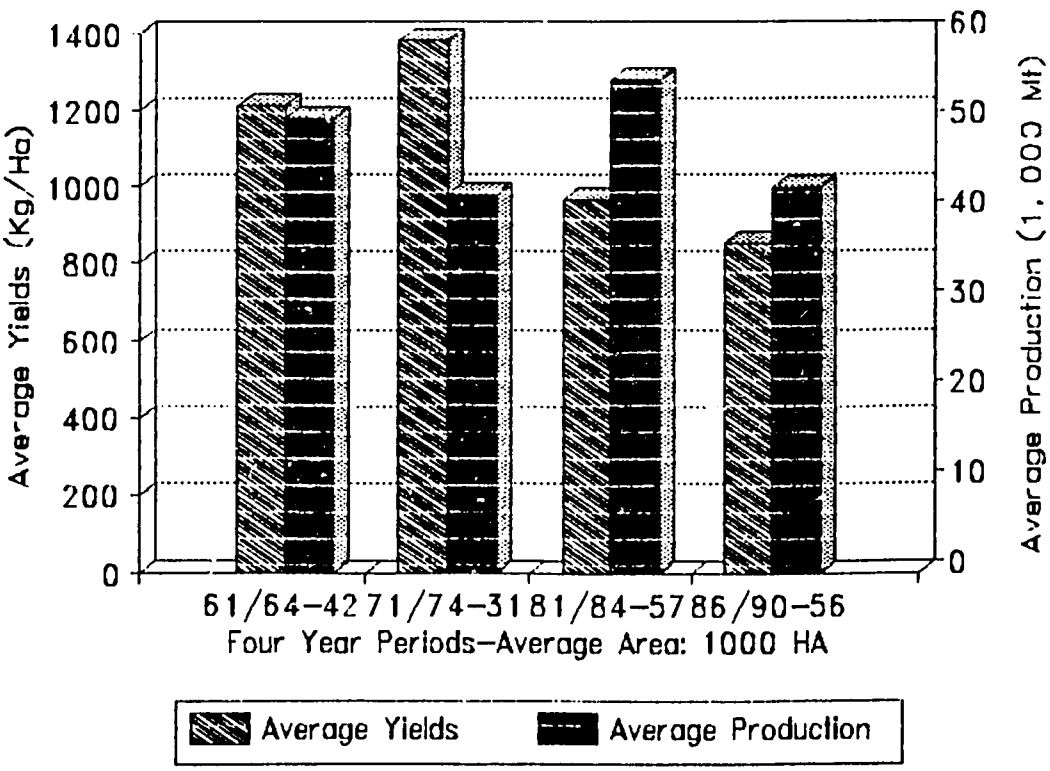

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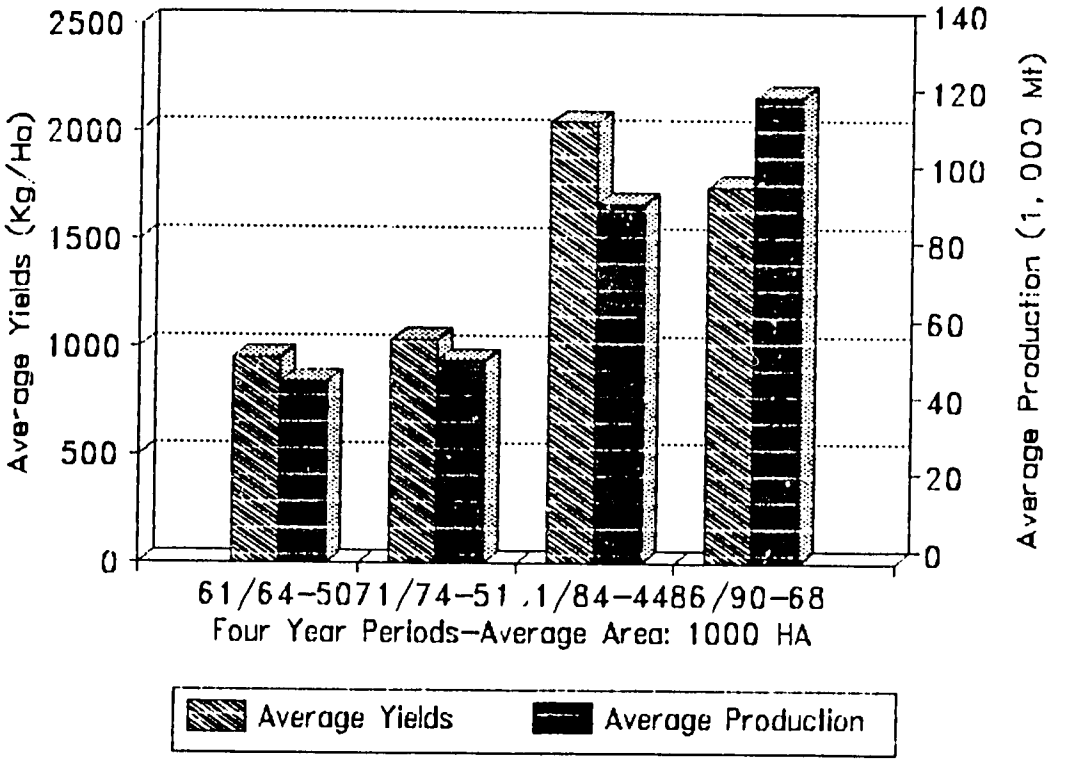

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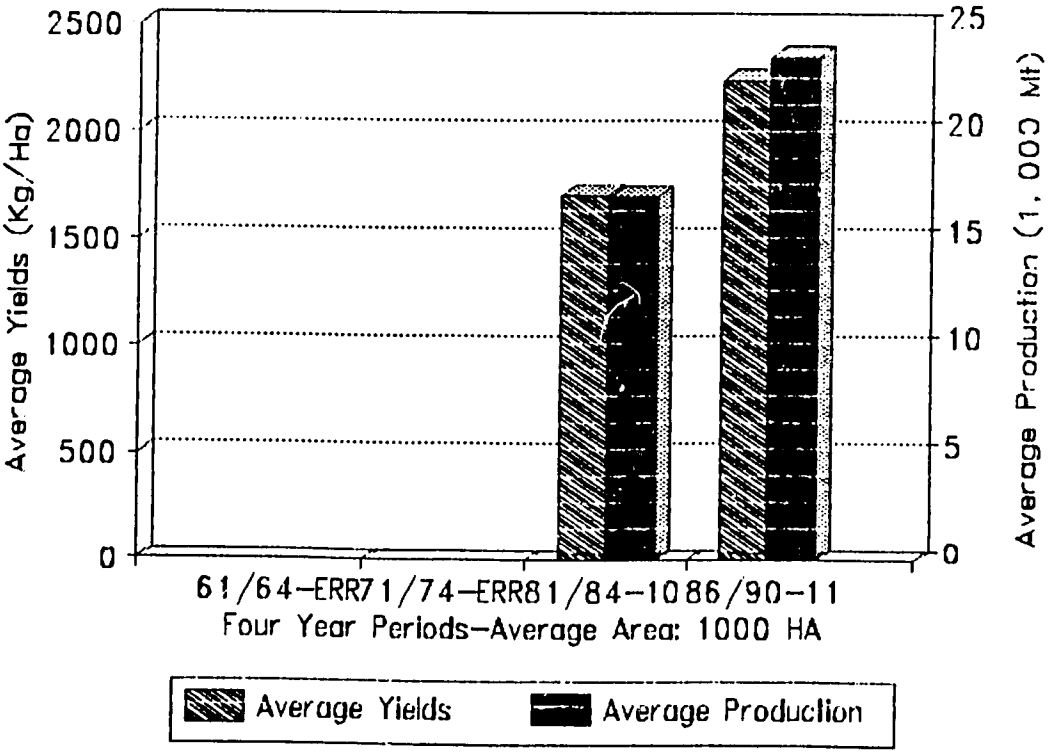

BEANS

	COSTA RICA			EL SALVADOR			GUATEMALA		
Year	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)
1961	52	370	19	21	940	20	51	640	33
1962	52	390	20	33	610	20	53	620	33
1963	44	360	16	28	820	23	55	660	36
1964	51	420	22	21	750	16	56	660	37
1965	57	390	22	23	700	17	61	660	40
1966	37	510	19	26	590	15	74	690	51
1967	19	410	8	28	620	18	107	650	69
1968	17	490	8	32	670	21	107	610	66
1969	16	430	7	35	740	26	100	620	62
1970	23	407	7	36	827	30	96	650	63
1971	17	402	9	40	865	35	100	651	65
1972	12	837	10	40	688	27	100	653	65
1973	27	413	11	45	834	37	101	708	72
1974	22	464	10	45	702	32	110	705	78
1975	36	456	16	56	710	40	93	692	65
1976	36	516	19	53	758	40	138	565	78
1977	35	429	15	55	727	40	126	532	67
1978	17	522	9	52	829	43	135	596	81
1979	25	480	12	55	895	47	95	895	85
1980	21	619	13	55	855	47	116	688	80
1981	24	519	12	40	960	38	119	682	81
1982	38	366	14	56	687	38	97	866	84
1983	39	511	20	55	771	42	97	918	89
1984	43	529	23	58	841	49	167	668	111
1985	44	606	26	58	593	35	167	677	113
1986	58	540	31	61	820	50	167	677	113
1987	48	474	23	62	386	24	173	639	111
1988	51	543	28	67	839	56	140	667	94
1989	54	527	28	67	703	47	186	748	139
61/64-50	50	385	19	26	780	20	54	645	35
71/74-20	20	529	10	43	772	33	103	679	70
81/84-36	36	481	17	52	815	42	120	784	91
86/89-53	53	521	28	64	687	44	167	683	114
				61/64-26			61/64-54		
				71/74-43			71/74-103		
				81/84-52			81/84-120		
				86/89-64			86/89-167		

Source: FAO PRODUCTION YEAR BOOKS

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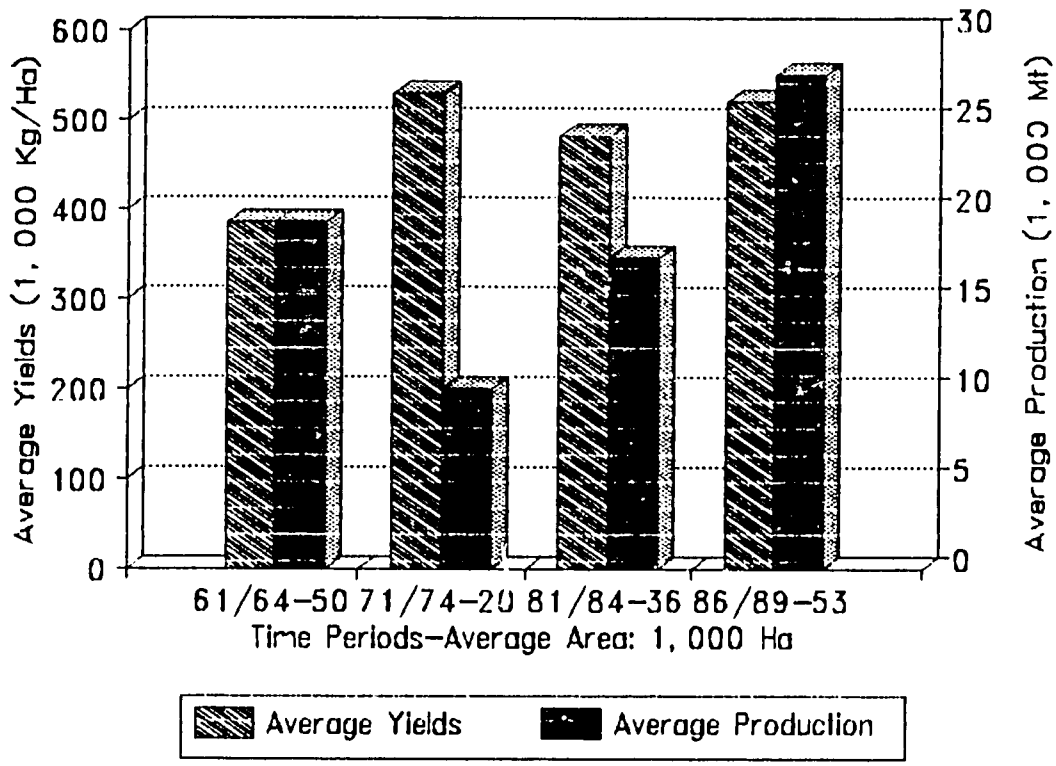
BEANS

	HONDURAS			NICARAGUA			PANAMA		
Year	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)	Area (1000 Ha)	Yield (Kg/Ha)	Production (1000 Mt)
1961	89	430	38	46	700	32	19	270	5
1962	93	430	40	43	680	29	26	720	6
1963	102	430	44	43	760	32	25	280	7
1964	111	460	50	49	730	36	20	259	5
1965	112	460	52	50	720	36	15	280	4
1966	70	490	49	51	660	34	22	310	7
1967	113	450	45	52	730	39	21	330	7
1968	123	550	55	61	720	44	18	330	6
1969	120	500	60	65	690	45	17	300	5
1970	80	750	60	64	836	53	17	291	5
1971	80	750	60	68	838	57	18	184	3
1972	60	583	35	61	710	43	12	276	3
1973	60	600	36	64	736	47	10	303	3
1974	67	476	32	64	806	52	12	289	3
1975	80	536	43	56	785	44	16	252	4
1976	90	534	48	68	785	53	17	253	4
1977	91	549	50	82	785	64	16	212	3
1978	78	569	44	67	834	55	15	272	4
1979	84	454	38	67	776	52	12	277	3
1980	69	549	38	65	769	50	15	310	5
1981	76	552	42	89	665	59	9	390	3
1982	77	615	47	68	684	47	6	322	2
1983	70	629	44	68	684	47	6	323	2
1984	59	560	33	84	698	59	8	349	3
1985	66	730	48	86	662	57	11	394	4
1986	75	537	40	104	680	71	10	300	3
1987	83	542	45	72	520	38	9	341	3
1988	76	678	51	88	564	50	9	454	4
1989	177	508	90	110	550	60	12	342	4
61/64	99	438	43	45	718	32	23	382	6
71/74	67	602	41	64	773	50	13	263	3
81/84	71	589	42	77	683	53	7	346	3
86/89	103	565	57	94	579	55	10	359	4

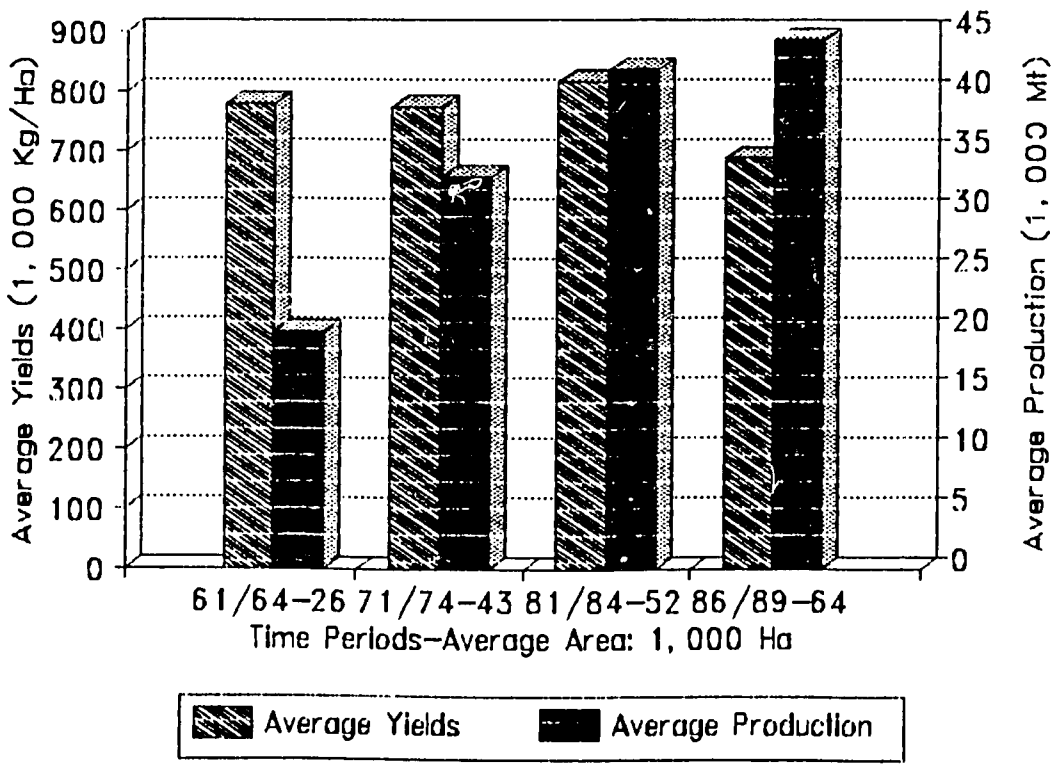
61/64-99	61/64-45	61/64-23
71/74-67	71/74-64	71/74-13
81/84-71	81/84-77	81/84-7
86/89-103	86/89-94	86/89-10

Source: FAO PRODUCTION YEAR BOOKS

BEAN – COSTA RICA



BEAN – EL SALVADOR



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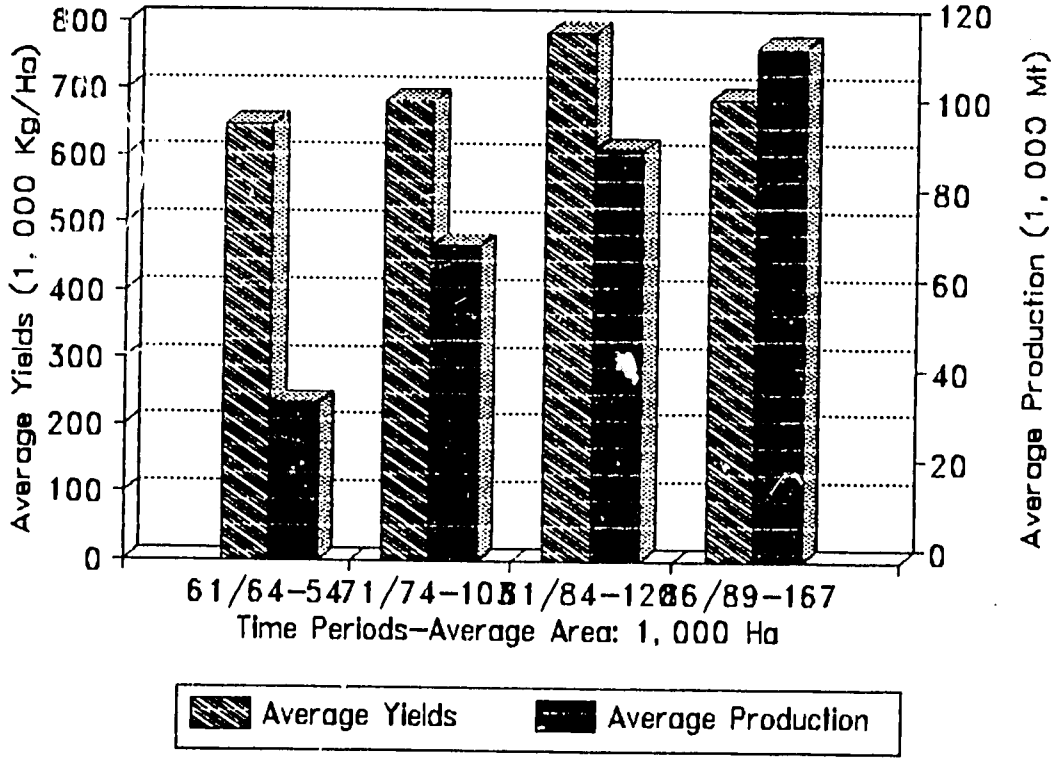

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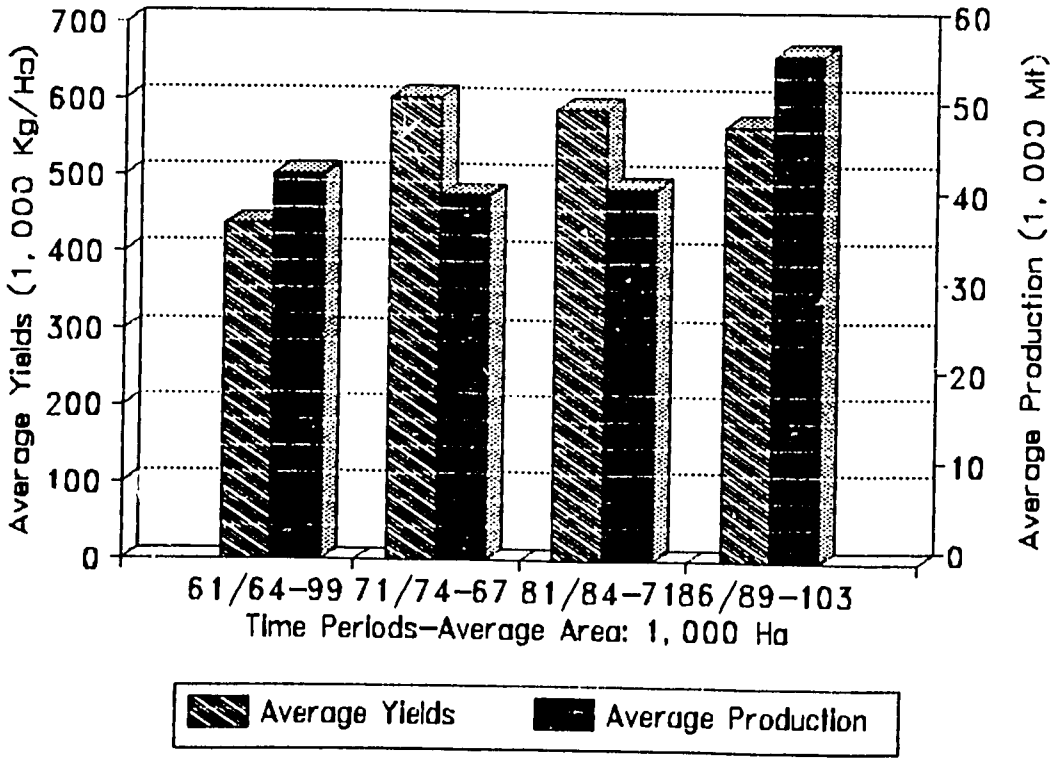

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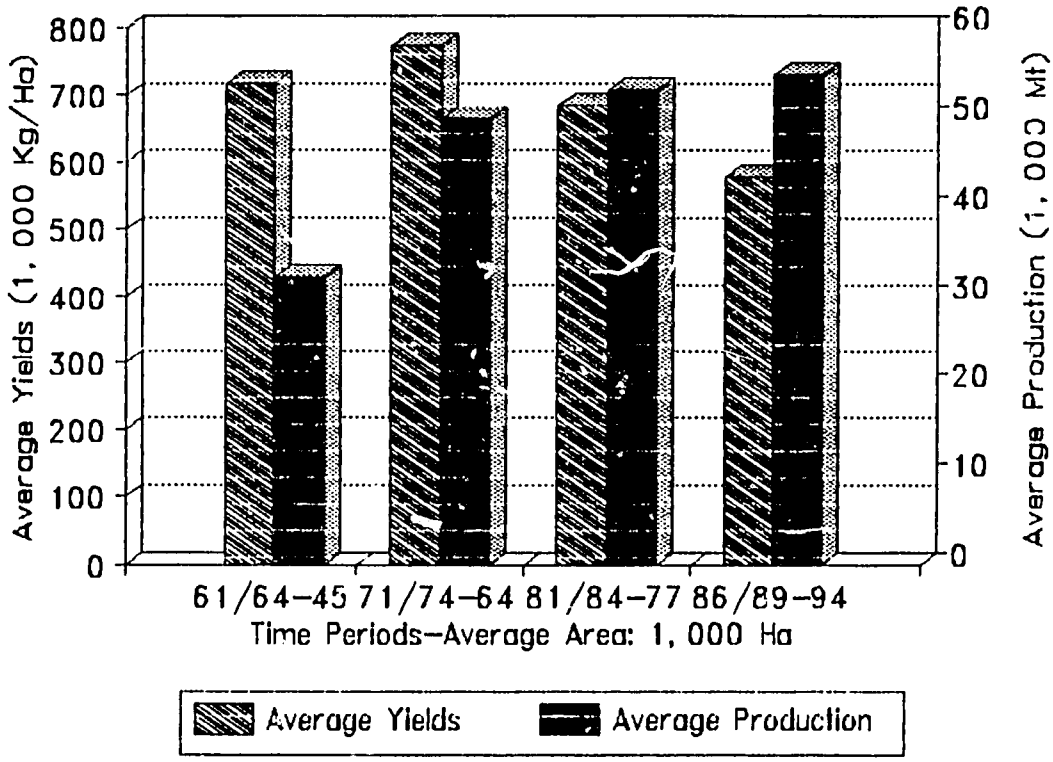

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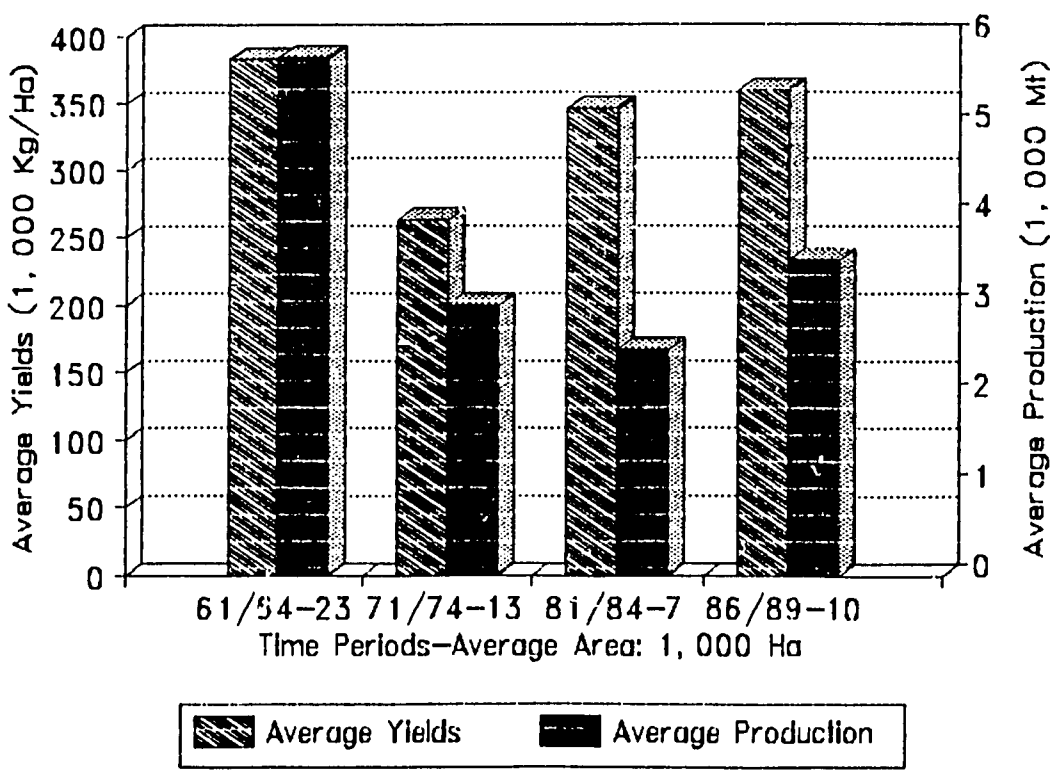

APPENDIX 7

DEMAND THEORY FOR AGRICULTURAL INPUTS

DEMAND THEORY FOR AGRICULTURAL INPUTS

THE DEMAND FOR AGRICULTURAL INPUTS [1]

There will be two results from changing the amount of a single input, such as certified corn seed, used in corn production. One result will be physical - an increase or decrease in production - and the other will be economic - an increase or decrease in economic return i.e. value of production minus the cost of production. The technical question to be answered is: "What yield (Y) is obtained by varying the input (X_1), all other factors (X_2,X_3, etc.) being held constant?" The answer to this question is a production function ($Y=X_1|X_1$) showing total physical product (TPP) at each level of the input. This relationship can be drawn as a production curve with input (X_1) on one axis and production (Y) on the other. The second question is: "What level of inputs provides the greatest economic return from the production?" The level of input which provides the greatest return for production depends on the prices of the input (P_{X1}) and the product (P_Y). The optimum input amount is the input level where the monetary value of one more unit of input (Marginal Value Produce, MVP) is equal to the monetary value of the additional output received from that one more unit of input (Marginal Factor Cost, MFC). The demand for the input is derived from the economic optimum input level for each price of the input, and can be represented as a derived demand curve. A more detailed discussion of the derived demand curve for a single input is presented in a previous study in this series. [2]

Few agricultural products depend on a single input. Most require a number of inputs such as land, labor, seed, fertilizer, pesticides, etc. In the present study we are interested in determining the demand for two inputs - fertilizer (X_1) and pesticides (X_2). As in the case of a single input, the demand for two variable inputs is a derived demand. The demand for each input is determined by how the two inputs can be combined to produce the economically optimum level of production (Y), for each price level for the inputs. As with the single input case discussed above, we are interested in the answer to two questions. First, what physical yield (Y) can be obtained using various combinations of the two inputs (X_1 and X_2), and second, what level of the two inputs used together will provide the least cost combination of inputs used in production.

Physical Relationships - In producing a product requiring two inputs which vary, and additional inputs which are fixed, we have a production function of the general form $Y = f(X_1X_2|X_3X_4)$. An example might be a case where the amount of land used for a crop and the amount of technology (fertilizer and pesticides) can vary but the amount of labor available is fixed by the number of family members who can work on the crop. In this case physical relationships and economic

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[1] This section is taken directly from G.L. Cramer and C.W. Jenkins, Agricultural Economics & Agribusiness, Chapter 5, 3rd Edition, New York: John Wiley & Sons, 1985, pp.96-125.

[2] C. Hugo, H. Andrews and D. Stimpson, Invigorating the Seed Industry in El Salvador, Food and Feed Grains Institute, KSU, September, 1991.

considerations will cause producers to choose one particular set of inputs rather than some other combination of inputs to produce their products. The first step in identifying an optimum set of inputs is to examine the physical relationship between the inputs and the output. Of great practical importance is the fact that different input combinations are capable of producing a given quantity of output. With a two variable input production function, reducing one input will reduce output and also change the Marginal Physical Products (MPP) [3] of the two inputs, *ceteris paribus*. But the producer does not necessarily have to suffer a decrease in production because the loss in production may be offset by increasing the amount of the other input. As is illustrated in Figure 1, different proportions of the inputs X_1 and X_2 can be used to produce a given amount of output, such as Y_n. At point "A" on the diagram the quantity Y_n is produced with a small amount of X_1 and a large amount of X_2. Moving along the curve of points of equal production, called an *isoquant*, toward point "E" we find points where Y_n is being produced using increasing amounts of X_1 and decreasing amounts of X_2. An isoquant thus shows all the combinations of the two inputs that can be used to produce a given quantity of output.

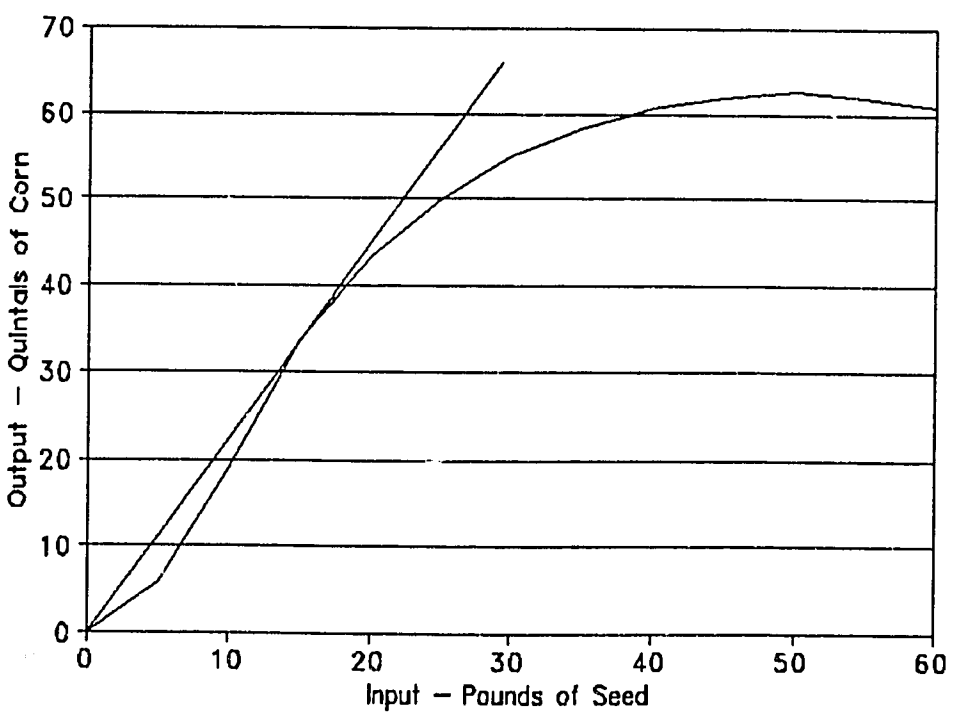

FIGURE 1. Hypothetical Production Function

[3] Where MPP is defined as the change in total product (Y) when there is a one unit change in the input (X).

Most agricultural inputs are imperfect substitutes, that is, as the quantity of one input is decreased in equal increments, it takes an increasing amount of the other input to maintain production at the same level. The limit to this type of substitution is when the MPP of an input becomes zero. At that point no matter how much additional input is added, there will be no increase in output and there may be a reduction in output. The *Marginal Rate of Substitution* is the rate at which inputs substitute for one another. The Marginal Rate of Substitution of X_1 for X_2 is the change in the number of units of X_2 divided by the change in the number of units of X_1. [4] An increase or decrease in an input will cause a change in production equal to the Marginal Physical Product of the input times the among of change, i.e. $MPP_1 \cdot \Delta X_1$. The same is true of X_2. When moving along an isoquant the output remains constant and so the change in one input times its marginal physical product must equal the change in the other input times its marginal physical product, i.e. $MPP_1 \cdot \Delta X_1 = MPP_2 \cdot \Delta X_2$. By rearranging terms we have $\Delta X_1/\Delta X_2 = MPP_1/MPP_2$.

If both inputs are increased (decreased) there will be an increase (decrease) in total production. Increasing or decreasing the amount of the inputs, while maintaining a fixed ratio between the two, will produce a new isoquant with a higher or lower level of production. By making successive increases, or decreases, in both inputs, a family of isoquants can be defined which, taken together will form an isoquant map. At some high level of input for both inputs, a point will be reached where additional inputs no longer increase production. This will be the maximum amount of physical output obtainable using the two variable inputs. [5] An isoquant map describes the physical relationships which is one component needed for making economic decisions.

Economic Relationships - For each amount of output produced, many combinations of inputs can be used (these combinations form an isoquant). It is possible to select numerous input ratios along the isoquant between the horizontal and vertical (i.e. zero and infinity). Each of these ratios will represent a different set of costs and returns. However, only one ratio will represent the optimal, or best, ratio in terms of costs and returns. Any other ratio than the optimal will involve input costs which are higher than necessary to produce the output - thus reducing total profits. Relating the prices of the inputs to their Marginal Rate of Substitution, provides a way of determining the optimum ratio of inputs.

To define the relationship in the costs of the two variable inputs we use the *isocost line*, which shows the amount of both inputs which can be purchased with

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[4] The formula is: $MRS_{X1X2} = \Delta X_2/\Delta X_1$

[5] It may help to visualize the physical relationships in three dimensional space. Starting with X_1 and X_2 as axis in a plane it is possible to have an output (Y) perpendicular to the X_1X_2 plane (like a flagpole). The tops of the Ys for all combinations of X_1 and X_2 form a *production surface*. This would be like stretching plastic over a whole set of flagpoles and it would resemble a mountain. Planes (cuts) passing through the production surface (mountain) parallel to the X_1X_2 plane trace out isoquants which may be projected downward onto the X_1X_2 plane, forming the isoquant map. The peak of the isoquant (mountain) is the maximum physical output obtainable using the two inputs.

a set amount of money. Figure 1 shows a C100 isocost line when the price of X_1 is C5.00 per unit and the price of X_2 is C2.50 per unit. The end points of this isocost line are determined by purchasing all of one input or all of the other. Thus point "A" is determined by purchasing only X_2, i.e. $C100/P_{X2}$ (C2.50) = 40 units of X_2. Likewise point "B" is determined where only X_1 is used, i.e. $C100/P_{X1}$ (C5.00) = 20 units of X_1. All other points on the isocost line represent different combinations of X_1 and X_2 which, given their fixed prices, represent a total of C100 spent on the two inputs. The isocost line is a straight line in the case of pure competition, i.e. where the producer will not affect the price of the inputs no matter how much of one or the other is purchased. The slope of the isocost line is determined by the ratio of the input prices (P_{X1}/P_{X2}). A whole family of isocost lines with the same slope (P_{X1}/P_{X2}) can be generated by varying the amount of money available for purchasing inputs. Likewise different families of isocost lines can be generated by varying the relative prices of the inputs and the amount of funds available for purchasing inputs.

In order to determine the minimum cost of producing a given amount of output [6] it is necessary to combine the information provided by the isoquants and isocost lines, as is shown graphically in Figure 2. With the level of output and the prices of inputs given, we can optimize the ratio of the inputs X_1 and X_2 by finding the only point along the isoquant where the slopes of the isoquant and isocost line are equal. Another way of saying this is to find the ratio of inputs where their Marginal Rate of substitution in production is equal to the rate at which they substitute in the market. The prices of the inputs tell us what they are worth in other uses in a competitive markets.

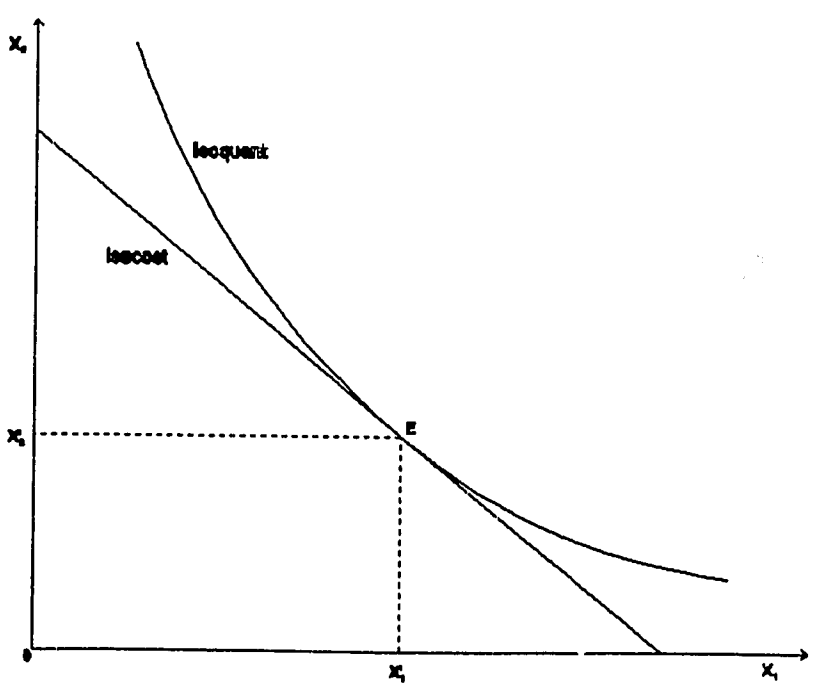

FIGURE 2. Hypothetical Isoquant/Isocost Function

[6] The same thing stated in a different way is: what is the maximum output which can be obtained from a given outlay for inputs (cost).

The slope of the isocost line is determined by the ratio of input prices (P_{X1}/P_{X2}) while the slope of the isoquant is the ratio of the inputs Marginal Physical Products (MPP_{X1}/MPP_{X2}). At the point of tangency the two slopes are equal and we have $P_{X1}/P_{X2} = MPP_{X1}/MPP_{X2}$. The point of tangency minimizes the cost of producing that output and is called the *least cost combination*. The least cost combination is the ratio of inputs where an additional Colon spent on either variable input will yield the same output or value of product. The least cost combination ratios can be written as $MPP_{X1}/P_{X1} = MPP_{X2}/P_{X2}$, which demonstrates that whatever the relationship between X_1 and X_2, the Marginal Physical Products per Colon's worth of these two inputs must be in the same ratio in order that the cost of producing any quantity of output is minimized.[7]

A family of isoquants constructed using a constant ratio of inputs forms a production surface (Figure 3). For each price ratio of the inputs there is likewise a family of isocost lines formed. The combination of isoquants and isocosts, given a fixed ratio of the inputs and fixed input prices, produces a series of least cost combination points, one per isoquant. A line starting at the origin and connecting these least cost combination points on the production surface is called the *expansion path*. Ridge lines are also formed on the production surface by connecting the points where one or the other of the inputs has a zero Marginal Physical Product. These ridge lines set the boundaries on the production surface within which economic production should take place. There will be many expansion paths (formed by varying the prices of the inputs) extending out from the origin, each determined by the points at which the slope of families of isocost and isoquant curves are equal ($P_{X1}/P_{X2} = \Delta X_2/\Delta X_1$). Along a given expansion path the ratio of inputs is constant because the prices of the inputs are fixed for the expansion path. Two resources used in a constant ratio behave as a single input because one of the inputs is "fixed" in relation to the other. Thus in the case of two inputs the problem of identifying the level of optimal production is reduced to the case of one variable input, with other inputs fixed. The optimal level of production can now be determined given prices of inputs, their Marginal Physical Produce as a combined input and the value of the output, by equating the Marginal Factor Cost [8] with the Marginal Value Product. [9]

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[7]This relationship holds for any number of variable inputs, i.e. as long as the MPP price ratios are equal for all inputs, the output will be produced at the least cost combination of inputs.

[8] MFC is the amount that is added to total cost when one more unit of the combined variable input is used, i.e. $P_{X1} \cdot \Delta X_1 + P_{X2} \cdot \Delta X_2$ with ratio of X_1 and X_2 fixed.

[9] Marginal value product is derived by dividing the change in total value product (TVP), which is the yield times the price of the output, by a unit change in the combined input used. Thus $MVP = \Delta Y/\Delta X_{1\&2}$.

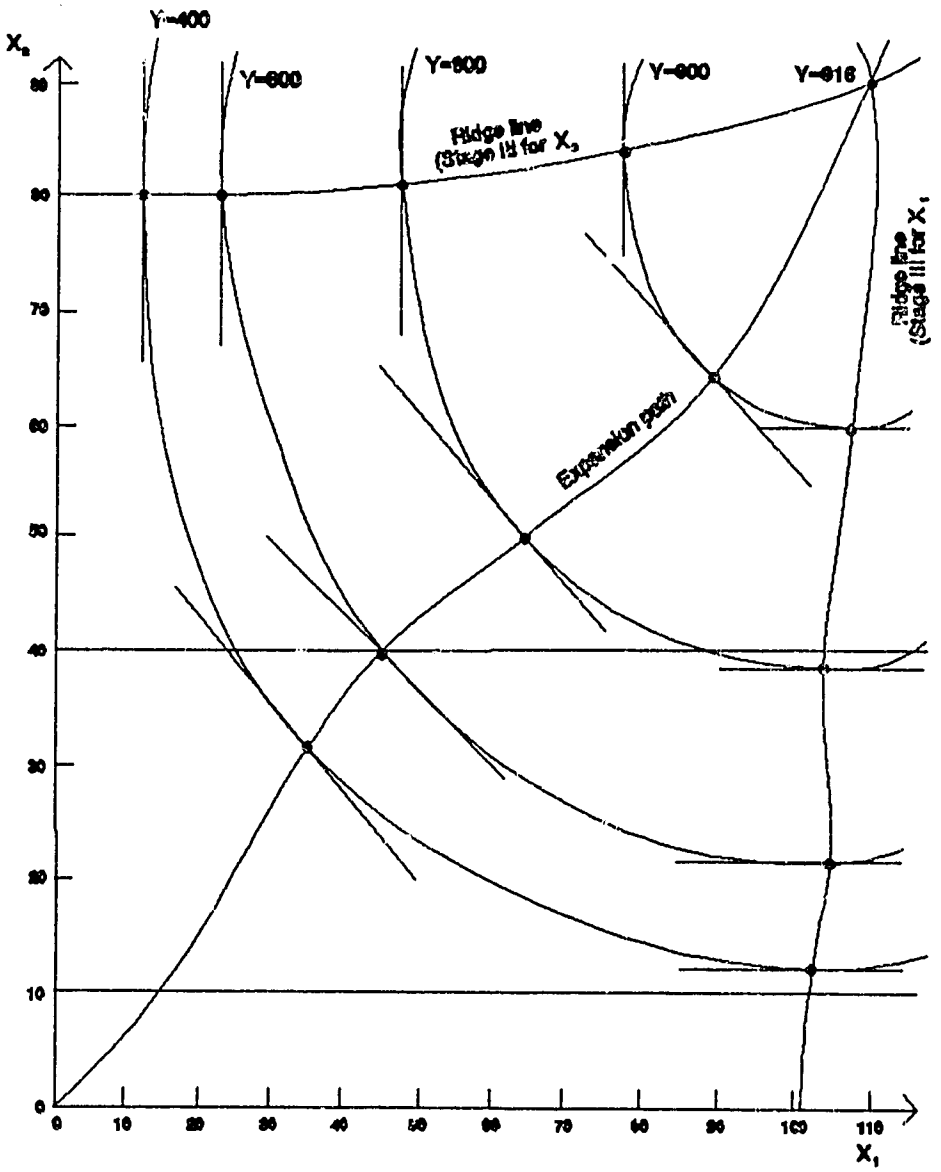

FIGURE 3. Hypothetical Production Surface

The demand for each of these inputs is then derived from its use, in combination with the other input, in the production of the output. The individual demand curve for each input will be determined based on the demand for the combined inputs at varying prices, but will be disaggregated from that demand to make individual input demands, based on individual input price. Where the inputs are used in making several different products; i.e. fertilizer and pesticides are used in producing most crops, not just corn; the total demand is a summation of demand derived from the individual production functions. Shifts for the combined demand curve, and for the individual inputs demand curves will be analogous to shifts discussed by Hugo, Andrews and Stimpson in "Invigorating the Seed Industry in El Salvador" (pp. 6-8) except that shifts in input prices will create a whole new combined input demand curve with new relationships.

APPENDIX 8

FERTILIZER AND PESTICIDE UTILIZATION, IMPORT, PRICES

UTILIZATION OF FERTILIZERS BY TYPE, SOURCE AND YEAR

	METRIC TONS								
	PUBLIC		PRIVATE		TOTAL		PUBLIC	PRIVATE	
YEAR	SIMPLE	COMPLEX	SIMPLE	COMPLEX	SIMPLE	COMPLEX	TOTAL	TOTAL	TOTAL
1976					250480	89728			340208
1977					250814	121712			372526
1978					254059	127937			381996
1979					225684	127644			353328
1980					129560	96890			226450
1981					134763	77164			211927
1982	9815	13993	104679	73224	114494	87217	23808	177903	201711
1983	80358	105929	101143	16521	181501	122450	186287	117664	303951
1984	88694	55029	88120	16666	176814	71695	143723	104786	248509
1985	89560	71200	79530	33823	169090	105023	160760	113353	274113
1986	83021	53599	80492	31771	163513	85370	136620	112263	248883
1987	65743	43926	77229	30911	142972	74837	109669	108140	217809
1988	67017	77828	107541	63026	174558	140854	144845	170567	315412
1989	66639	41878	107674	64750	174313	106628	108517	172424	280941
1990	47762	22762	105884	86573	153646	109335	70524	192457	262981

SOURCE: Revistas Semestrales & Boletin Trimestral de Informacion Agropecuaria, DGEA-MAG Situacion del Mercado de Fertilizantes, no date, DGEA-MAG.

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FERTILIZER IMPORTS BY TYPE AND YEAR IN METRIC TONS

	SIMPLE FERTILIZERS				COMPLEX FERTILIZERS				FOLIATES		TOTAL
YEAR	AMON SUL	UREA	OTHERS	TOTAL	16-20-0	20-20-0	15-15-15	OTHER	MINOR EL	TOTAL	IMPORTS
1969	70769	8630	43963	123362	16777		4428	37842	12183	71230	194592
1970	127050	9078	28836	164964	3505		4921	35631	28818	72875	237839
1971	141972	4437	33056	179465	17329		5164	46806	35225	104524	283989
1972	174855	17932	36769	229556	7676	7425	4104	56580	2295	78080	307636
1973	164227	18276	58693	241196	7084	11360	3938	58052	31388	111822	353018
1974	172305	14234	39725	226264	5192	6608	1497	75485	3890	92672	318936
1975	129678	5094	86253	221025	7013	24649	1846	43913	106	77527	298552
1976	220963	33255	25741	279959		2800	7999	76323	478	87600	367559
1977	223804	30540	49832	304176		15588	11343	73069	1327	101327	405503
1978	146180	33324	51380	230884	1100	4946	8820	95522	97	110485	341369
1979	103159	21273	14091	138523	3583	10413	6516	36977	163500	220989	359512
1980	118610	17546		136156	34179	42913		5061		82144	218300
1981	216861	5426	52	222339	84456	17592		8092	76	110216	332555
1982	76506	2398	222	79126	32590	4293	4696	3124	22840	67543	146669
1983	179297	9749		189046	97016	200	9363	1944	23768	132291	321337
1984	143030		18	143048	34949	299	17446	10162	599	63455	206503
1985	153511	25491		179002	91004	37	16891	720	255	108907	287909
1986	164312	3594	1941	169847	56447	2470	11809	8691	1372	80789	250636
1987	132262	2152	268	134682	56216	4041	8260	7835	29448	105800	240482
1988	168586	13354	7656	189596	61704		3525	35177	25088	125494	315090
1989	166016	7485	2029	175530	18629		10731	7992		37352	212882

SOURCE: ANUARIO DE ESTADISTICAS AGROPECUARIAS AND REVISTA SEMESTRALES, VARIOUS ISSUES, MAG-DGEA

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FERTILIZER PRICES BY TYPE AND YEAR IN COLONES/100 KG
(COLONES/100 KG)

YEAR	AMMONIUM SULFATE BFA	AGSERV	AVG	16-20-0 BFA	AGSERV	AVG	OVERALL AVERAGE
1975	30.00	37.00	33.50			60.00	46.75
1976	18.00	23.00	20.50	42.00	44.00	43.00	31.75
1977	26.00	30.00	28.00	41.00	44.00	42.50	35.25
1978	31.00	32.00	31.50	41.00	46.00	43.50	37.50
1979	31.00	32.00	31.50	41.00	48.00	44.50	38.00
1980	44.00	51.00	47.50	55.67	64.67	60.17	53.83
1981	52.33	58.33	55.33	68.33	76.67	72.50	63.92
1982	43.00	51.67	47.33	69.67	75.67	72.67	60.00
1983	40.33		40.33	64.50		64.50	52.42
1984	36.50	39.00	37.75	59.50	62.50	61.00	49.38
1985	43.00	45.00	44.00	65.00	67.00	66.00	55.00
1986	73.00	74.50	73.75	126.50	124.50	125.50	99.63
1987	59.00	61.17	60.08	102.00	109.83	105.92	83.00
1988	60.25	67.50	63.88	105.50	114.00	109.75	86.81
1989	72.30	83.00	77.65	112.23	118.50	115.36	96.51
1990	80.18	93.15	86.66	133.33	156.15	144.74	115.70

SOURCE: Revista Semestral and Informe Trimestral, Various Issues, DGEA-MAG

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FERTILIZER USE ON CORN BY TYPE AND YEAR

FERTILIZER	CORN 1985/86 AREA (MZ)	KG/MZ	TOTAL KG	CORN 1986/87 AREA (MZ)	KG/MZ	TOTAL KG	CORN 1987/88 AREA (MZ)	KG/MZ	TOTAL KG	CORN 1988/89 AREA (MZ)	KG/MZ	TOTAL KG
SIMPLE												
AMONIUM SULFATE	375308	144.3	54172246	158511	168.9	26769918	512897	171.7	88084305	408499	174.5	71265302
AMONIUM SULFATE (SHORT TON)												
AMONIUM SULFATE (QUINTAL)										289	96.7	27951
AMONIUM SULFATE (LITER)												
AMONIUM SULFATE 43%							1171	150.0	175613			
AMONIUM SULFATE 43% (QQ)							14	91.0	1307			
NITRATE AMONIUM SULFATE												
UREA	360	142.0	51100	2661	92.0	245444	878	64.9	56998	5693	87.0	495456
UREA FOLIATE (KG)							157	45.5	7155	783	66.1	51729
TOTAL SIMPLE	375668	144.3	54223346	161172	167.6	27015362	515117	171.5	88325378	415264	173.0	71840438
COMPLEX												
15-15-15	193	96.0	18592							701	5.9	4114
15-15-15-6+				272	200.0	54400						
16-20-0	352023	144.8	50960524	146607	132.8	19466544	480168	160.9	77257861	381701	163.6	62440606
16-20-0 (QUINTAL/OTHER)										12	100.0	1160
16-20-0 (SHORT TON)												
16-20-0-0-1.5	38	100.0	3800				1840	182.0	334835			
18-46-0							42	150.0	6272			
20-20-0	24779	72.5	1797292				24	182.0	4374	36	100.0	3600
20-0-20				211	159.0	33603						
BAYFOLON (LITER)				2256	2	4511	3099	2.7	8380	486	2.0	972
BAYFOLON (KG)	84	1.0	84									
COMPLEX TOTAL	377117	140.0	52780292	149346	131.0	19559058	485173	160.0	77611722	382936	163.1	62450452
TOTAL FERTILIZER	752785	142.1	107003638	310518	150.0	46574420	1000290	165.9	165937100	798200	168.2	134290890
TOTAL FERTILIZER-NAT AREA	362100	296	107003638	368100	127	46574420	398500	416	165937100	402800	333	134290890

a. Area to which fertilizer was applied and total fertilizer applied as recorded in summary sheets. Fertilizer per manzana calculated from area and fertilizer applied.

b. National area is total area planted to the crop.

FERTILIZER USE ON CORN BY TYPE AND YEAR (CONTINUED)

FERTILIZER	CORN 1989/90 AREA(MZ)	KG/MZ	TOTAL KG	CORN 1990/91 AREA(MZ)	KG/MZ	TOTAL KG	CORN 1991/92 (FIRST HARVEST ONLY) AREA(MZ)	KG/MZ	TOTAL KG
SIMPLE									
AMONIUM SULFATE	361117	177.7	64176950	418298	161.8	67663525	39	4.4	147
AMONIUM SULFATE (SHORT TON)	162	200.0	32480						
AMONIUM SULFATE (QUINTAL)							321624	4.1	1316637
AMONIUM SULFATE (LITER)	410	100.0	41040						
AMONIUM SULFATE 43%									
AMONIUM SULFATE 43% (QQ)									
NITRATE AMONIUM SULFATE				97	100.5	9744			
UREA	1838	78.4	144124	152	63.8	10339	2542	2.1	5228
UREA FOLIATE (KG)									
TOTAL SIMPLE	363527	177.1	64394594	418557	161.7	67683608	324205	4.1	1322012
COMPLEX									
15-15-15				1656	110.1	182334			
15-15-15-6+	162	200.0	32480				51	4.4	180
16-20-0	338279	169.8	57438593	321257	147.7	47457588			
16-20-0 (QUINTAL/OTHER)	5854	189.2	1107556	28	135.4	3791	298844	3.4	1006254
16-20-0 (SHORT TON)	348	200.0	69500	208	98.5	20487			
16-20-0-0-1.5				72	100.1	7210			
18-46-0									
20-20-0	2067	188.5	389708	220	100.2	22040			
20-0-20									
BAYFOLON (LITER)	372	3	1117				70	1.0	70
BAYFOLON (KG)	28	11	317						
COMPLEX TOTAL	347110	170.1	59039271	323441	147.5	47693450	298965	3.4	1006504
TOTAL FERTILIZER	710637	173.7	123433865	741998	155.5	115377058	623170	3.7	2328516
TOTAL FERTILIZER-NAT AREA	394700	313	123433865	402600	286.6	115377058			

a. Area to which fertilizer was applied and total fertilizer applied as recorded in summary sheets. Fertilizer per manzana calculated from area and fertilizer applied.
b. National area is total area planted to the crop.

SOURCE: Summary Sheets Provided by Dirección General de Economía Agropecuaria - División de Estadísticas Agropecuaria

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TOTAL FERTILIZER USE ON BEANS BY TYPE AND YEAR

FERTILIZER	BEANS 1985/86 AREA(MZ)[a]	KG/MZ	TOTAL KG	BEANS 1986/87 AREA(MZ)	KG/MZ	TOTAL KG	BEANS 1987/88 AREA(MZ)	KG/MZ	TOTAL KG	BEANS 1988/89 AREA(MZ)	KG/MZ	TOTAL KG
SIMPLE												
AMONIUM SULFATE	10883	85.0	925304	14223	102.7	1460906	2495	109.9	274128	4633	113.9	527672
AMONIUM SULFATE (QUINTAL)												
UREA	189	3.6	690									
UREA FOLIATE (KG)							400	100.0	39963	1648	0.8	1283
UREA FOLIATE (LITER)										16010	1.6	25531
TOTAL SIMPLE	11072	83.6	925994	14223	102.7	1460906	2895	108.5	314081	22291	24.9	554486
COMPLEX												
10-30-6-3-3 (LITER)												
15-15-15				863	205.3	177156						
16-20-0	121619	88.7	10791030	78490	124.1	9740626	63606	118.8	7557495	85731	125.0	10713807
16-20-0 (QUINTAL/OTHER)										139	100.0	13900
16-20-0 (SHORT TON)												
16-20-0-0-7 5				60	100.0	6044						
17-8-8												
18-46-0												
20-20-0	2451	148.1	363140	2108	93.4	196964	48	100.0	4840	36	200.0	7210
20-0-20				24	91.0	2202						
BAYFOLAN (LITER)	11277	1.7	18933	20271	4.6	93934	8500	1.1	9595	8369	1.3	11090
BAYFOLAN (KILOGRAM)										174	1.3	226
OTHER FOLIATES (LITER)	417	2.0	834				387	1.0	387			
OTHER FOLIATE (KG)	1515	1.1	1630				530	0.1	59			
COMPLEX TOTAL	137279	81.4	11175567	101816	100.3	10216926	73071	103.6	7572376	94449	113.8	10746233
TOTAL FERTILIZER	148351	81.6	12101561	116039	100.6	11677832	75966	103.8	7886467	116740	96.8	11300719
TOTAL FERTILIZER-NAT AREA[b]	83300	145.3	12101561	87100	134	11677832	89300	88.3	7886467	96100	117.6	11300719

a. Area to which fertilizer was applied and total fertilizer applied as recorded in summary sheets. Fertilizer per manzana calculated from area and fertilizer applied.
b. National area is total area planted to the crop.

TOTAL FERTILIZER USE ON BEANS BY TYPE AND YEAR (CONTINUED)

FERTILIZER	BEANS 1989/90 AREA(MZ)	KG/MZ	TOTAL KG	BEANS 1990/91 AREA(MZ)	KG/MZ	TOTAL KG	BEANS 1991/92 (1ST HARVEST) AREA(MZ)	KG/MZ	TOTAL KG
SIMPLE									
AMONIUM SULFATE	23781	27.8	661546	4932	211.1	1041113			
AMONIUM SULFATE (QUINTAL)	187	2.0	375				2233	2.6	5790
UREA				285	129.2	36887			
UREA FOLIATE (KG)	413	0.7	304	635	1.5	977			
UREA FOLIATE (LITER)	6187	0.7	4113	462	1.0	462			
TOTAL SIMPLE	30568	21.8	666338	6315	170.9	1079439	2233	2.6	5790
COMPLEX									
10-30-6-3-3 (LITER)	58	4.0	231						
15-15-15				10	135.9	1365			
16-20-0	71864	85.1	6117108	68628	107.6	7383401			
16-20-0 (QUINTAL/OTHER)	209	91.0	19049				9003	2.3	20896
16-20-0 (SHORT TON)				70	100.0	6950			
16-20-0-0-1.5									
17-8-8	1081	4.4	4759						
18-46-0	42	91.0	3810						
20-20-0									
20-0-20									
BAYFOLAN (LITER)	9633	1.9	18723	11474	1.8	20425	216	1.4	296
BAYFOLAN (KILOGRAM)				68	1.0	68			
OTHER FOLIATES (LITER)	53	1.3	71						
OTHER FOLIATE (KG)	408	18.5	7532	912	1.3	1158			
COMPLEX TOTAL	83348	74.0	6171283	81162	91.3	7413367	9219	2.3	21192
TOTAL FERTILIZER	113916	60.0	6837621	87477	97.1	8492806	11452	2.4	26982
TOTAL FERTILIZER-NAT AREA[b]	91600	74.6	6837621	89500	94.9	8492806			

a. Area to which fertilizer was applied and total fertilizer applied as recorded in summary sheets. Fertilizer per manzana calculated from area and fertilizer applied.
b. National area is total area planted to the crop.

SOURCE: Summary Sheet Provided by Dirección General de Economía Agropecuaria - División de Estadísticas Agropecuarias

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TOTAL FERTILIZER USE ON RICE BY TYPE AND YEAR

FERTILIZER	RICE 1985/86			RICE 1986/87			RICE 1987/88			RICE 1988/89		
	AREA (MZ)	KG/MZ	TOTAL KG	AREA (MZ)	KG/MZ	TOTAL KG	AREA (MZ)	KG/MZ	TOTAL KG	AREA (MZ)	KG/MZ	TOTAL KG
SIMPLE												
AMONIUM SULFATE	23466	170.1	3992718	4464	203.5	908465	18746	231.6	4341924	35047	344.0	12056446
AMONIUM SULFATE (QUINTAL)												
UREA (QUINTALS)												
UREA										41	136.4	5536
UREA FOLIATE (LITER)										419	2.0	837
UREA FOLIATE							55	100.0	5461			
TOTAL SIMPLE	23466	170.1	3992718	4464	203.5	908465	18746	231.6	4341924	35507	339.7	12062819
COMPLEX												
6-1-5 (LITER)										1469	2	2938
15-15-15										707	200.0	141440
16-20-0	22743	157.1	3573731	3277	174.1	570588	12611	156.4	1971912	34453	346.3	11931047
16-20-0 (QUINTAL)												
20-20-0	1467	196.9	288840									
BAYFOLON (LITER)										52	6.0	313
COMPRESAL												
COMPLEX TOTAL	24210	159.5	3862571	3277	174.1	570588	12611	156.4	1971912	36681	329.2	12075738
TOTAL FERTILIZER	47676	164.8	7855289	7741	191.1	1479053	31357	201.4	6313836	72188	334.4	24138557
TOTAL FERTILIZER-NAT AREA	24700	318.0	7855289	17200	86.0	1479053	16700	378.1	6313836	19700	1225.3	24138557

a. Area to which fertilizer was applied and total fertilizer applied as recorded in summary sheets. Fertilizer per manzana calculated from area and fertilizer applied.
b. National area is total area planted to the crop.

TOTAL FERTILIZER USE ON RICE BY TYPE AND YEAR (CONTINUED)

FERTILIZER	RICE 1989/90 AREA (MZ)	RICE 1989/90 KG/MZ	RICE 1989/90 TOTAL KG	RICE 1990/91 AREA (MZ)	RICE 1990/91 KG/MZ	RICE 1990/91 TOTAL KG	RICE 1991/92 (FIRST HARVEST ONLY) AREA (MZ)	RICE 1991/92 (FIRST HARVEST ONLY) KG/MZ	RICE 1991/92 (FIRST HARVEST ONLY) TOTAL KG
SIMPLE									
AMONIUM SULFATE	14292	238.7	3410997	14427	212.9	3071919			
AMONIUM SULFATE (QUINTAL)							14188	4.5	63343
UREA (QUINTALS)							3453	1.1	3725
UREA	2938	150.0	440640						
UREA FOLIATE (LITER)									
UREA FOLIATE									
TOTAL SIMPLE	17230	223.5	3851637	14427	212.9	3071919	17641	3.8	67068
COMPLEX									
6-1-5 (LITER)									
15-15-15				1251	150.0	187680			
16-20-0	28163	129.9	3657549	23692	99.4	2353920			
16-20-0 (QUINTAL)							14652	4.3	62324
20-20-0									
BAYFOLON (LITER)	3574	2.3	8228				4189	2.0	8377
COMPRESAL	182	2	331						
COMPLEX TOTAL	31919	114.9	3666108	24943	101.9	2541600	18841	3.8	70701
TOTAL FERTILIZER	49149	153.0	7517745	39370	142.6	5613519	36482	3.8	137769
TOTAL FERTILIZER-NAT AREA	22200	338.6	7517745	20400	275.2	5613519			

a. Area to which fertilizer was applied and total fertilizer applied as recorded in summary sheets. Fertilizer per manzana calculated from area and fertilizer applied

b. National area is total area planted to the crop.

SOURCE: Summary Sheets Provided by Dirección General de Economía Agropecuaria - División de Estadísticas Agropecuarias

File:APPIIC-F.WQ1

TOTAL FERTILIZER USE ON SORGHUM BY TYPE AND YEAR

FERTILIZER	SORGHUM 1985/86			SORGHUM 1986/87			SORGHUM 1987/88			SORGHUM 1988/89		
	AREA (MZ)	KG/MZ	TOTAL KG	AREA (MZ)	KG/MZ	TOTAL KG	AREA (MZ)	KG/MZ	TOTAL KG	AREA (MZ)	KG/MZ	TOTAL KG
SIMPLE												
AMONIUM SULFATE	51877	106.1	5506373	59885	110.7	6627537	114502	115.8	13262927	85794	108.3	9289494
AMONIUM SULFATE (OTHER)	789	45.0	35492							167	100.0	16725
AMONIUM SULFATE (QUINTAL)										71	100.0	7100
AMONIUM SULFATE (POUND)												
TOTAL SIMPLE	52666	105.2	5541865	59885	110.7	6627537	114502	115.8	13262927	86032	108.3	9313319
COMPLEX												
10-30-6												
15-15-15												
16-20-0	17779	102.7	1826139	15194	106.9	1624158	59083	104.9	6196889	40168	59.3	2382384
16-20-0 (QUINTAL/OTHER)												
16-20-0-0-1.5	127	100.0	12704				843	150.0	126468			
17-8-8												
20-20-0				1200	120.1	144146				218	100.0	21760
NUTREX												
COMPLEX TOTAL	17906	102.7	1838843	16394	107.9	1768304	59926	105.5	6323357	40386	59.5	2404144
TOTAL FERTILIZER	70572	104.6	7380708	76279	110.1	8395841	174428	112.3	19586284	126418	92.7	11717463
TOTAL FERTILIZER-NAT AREA	163400	45	7380708	171500	49	8395841	178700	110	19586284	174200	67	11717463

a. Area to which fertilizer was applied and total fertilizer applied as recorded on summary sheets. Fertilizer per manzana calculated from area and fertilizer applied.

b. National area is total area planted to the crop.

TOTAL FERTILIZER USE ON SORGHUM BY TYPE AND YEAR (CONTINUED)

FERTILIZER	SORGHUM 1989/90 AREA (MZ)	KG/MZ	TOTAL KG	SORGHUM 1990/91 AREA (MZ)	KG/MZ	TOTAL KG	SORGHUM 1991/92 (FIRST HARVEST ONLY) AREA (MZ)	KG/MZ	TOTAL KG
SIMPLE									
AMONIUM SULFATE	98433	92.5	9104521	66662	108.8	7251643			
AMONIUM SULFATE (OTHER)	278	75.0	20850						
AMONIUM SULFATE (QUINTAL)							3425	3.1	10633
AMONIUM SULFATE (POUND)							142	2.0	283
TOTAL SIMPLE	98711	92.4	9125371	66662	108.8	7251643	3567	3.1	10916
COMPLEX									
10-30-6	382	100	38225						
15-15-15				1958	150.0	293760			
16-20-0	18575	127.5	2367646	12438	92.4	1149875			
16-20-0 (QUINTAL/OTHER)							2355	1.9	4368
16-20-0-0-1.5									
17-8-8	1368	1.0	1368						
20-20-0	17693	100	1769282						
NUTREX	3902	250	975625						
COMPLEX TOTAL	41920	122.9	5152146	14396	100.3	1443635	2355	1.9	4368
TOTAL FERTILIZER	140631	101.5	14277517	81058	107.3	8695278	5922	2.6	15284
TOTAL FERTILIZER-NAT AREA	170900	83.5	14277517	184700	47.1	8695278			

a. Area to which fertilizer was applied and total fertilizer applied as recorded on summary sheets. Fertilizer per manzana calculated from area and fertilizer applied.
b. National area is total area planted to the crop.

SOURCE: Summary Sheets Provided by Dirección General de Economía Agropecuaria - División de Estadísticas Agropecuarias

File: APPIIC-G.WQ1

UTILIZATION OF PESTICIDES BY TYPE AND YEAR

YEAR	INSECTICIDES LITERS	INSECTICIDES KILOGRAMS	HERBICIDES LITERS	HERBICIDES KILOGRAMS	FUNGICIDES LITERS	FUNGICIDES KILOGRAMS	TOTAL LITERS	TOTAL KILOGRAMS
1981	2600830	3378729	788279	62145	118405	97985	3507514	3538859
1982	3082448	3383606	1565141	85058	14274	109116	4661863	3577780
1983	2873560	3575178	1849453	110710	25417	303422	4748430	3989310
1984	2830274	3850085	2246634	140853	32097	258032	5109005	4248970
1985	1344769	5859491	3906564	372320	44175	191086	5295508	6422897
1986	1083009	2922141	2101840	321457	37372	215014	3222221	3458612
1987	332441	3441714	1193894	228634	25543	94299	1551878	3764647
1988	521049	2591658	2024059	268831	20261	99970	2565369	2960459
1989	290445	1319712	546479	159789	3661	73211	840585	1552712
1990	239188	1277895	778774	137750	23431	68728	1041393	1484373

YEAR	INSECTICIDES TOTAL	INSECTICIDES % CHANGE	HERBICIDES TOTAL	HERBICIDES % CHANGE	FUNGICIDES TOTAL	FUNGICIDES % CHANGE	TOTAL TOTAL	TOTAL % CHANGE
1981	5979559		850424		216390		7046373	
1982	6466054	7.52	1650199	48.47	123390	-75.37	8239643	14.48
1983	6448738	-0.27	1960163	15.81	328839	62.48	8737740	5.70
1984	6680359	3.47	2387487	17.90	290129	-13.34	9357975	6.63
1985	7204260	7.27	4278884	44.20	235261	-23.32	11718405	20.14
1986	4005150	-79.87	2423297	-76.57	252386	6.79	6680833	-75.40
1987	3774155	-6.12	1422528	-70.35	119842	-110.60	5316525	-25.66
1988	3112707	-21.25	2292890	37.96	120231	0.32	5525828	3.79
1989	1610157	-93.32	706268	-224.65	76872	-56.40	2393297	-130.89
1990	1517083	-6.14	916524	22.94	92159	16.59	2525766	5.24

SOURCE: Revistas Semestrales & Boletin Trimestral de Información Agropecuaria, DGEA-MAG

File:APPIIC-H.WQ1

NET IMPORTS OF PESTICIDES BY TYPE AND YEAR

	NET IMPORTS FORMULATED						IMPORTS OF TECHNICAL MATERIAL					
	INSECTICIDE		HERBICIDES		FUNGICIDES		INSECTICIDE		HERBICIDES		FUNGICIDES	
YEAR	KILOGRAM	LITER	KILOGRAM	LITER	KILOGRAM	LITER	KILOGRAM	LITER	KILOGRAM	LITER	KILOGRAM	LITER
1980	1371146	1903594	51080	799296	94147	14418						
1981	764094	639165	100626	912969	84666	7588	1056225					
1982	553536	1013704	60350	952368	109477	12170	1089748	30000				
1983	663749	478374	53560	707998	105659	-5602	1153588		25654		17781	
1984	384452	430911	98093	722438	136474	10375	1125435				25848	
1985	1327699	258282	342598	1073450	173010	-19102	1603300		338086		34938	
1986	959978	2048	268477	1486822	220040	-27296	806316		551632		16454	
1987	220131	-89316	110293	163622	13683	-17296	381595		214392		21906	
1988	469367	96382	144795	925688	35329	-4032	596035		191281		16155	
1989	528836	-10998	61555	253381	26011	2440						
1990	586378	115485	112940	358531	31734	-10199	914226	40000	212564	35571	35742	

	COMBINED FORMULATED PRODUCT			COMBINED TECHNICAL MATERIAL				TOTAL PESTICIDES			
	INSECT	HERBI	FUNGI	INSECT	HERBI	FUNGI	TOTAL	INSECT	HERB	FUNGI	TOTAL
1980	3274740	850376	108565	0	0	0	4233681	3274740	850376	108565	4233681
1981	1403259	1013595	92254	1056226	0	0	3565334	2459485	1013595	92254	3565334
1982	1567240	1012718	121647	1119768	0	0	3821353	2686986	1012718	121647	3821353
1983	1142123	761558	100057	1153588	25654	17781	3200761	2295711	787212	117838	3200761
1984	815363	820531	146849	1125435	0	25848	2934026	1940798	820531	172697	2934026
1985	1595981	1417148	153908	1603300	338086	34938	5143361	3199281	1755234	188846	5143361
1986	962026	1755299	192744	806316	551632	16454	4284471	1768342	2306931	209198	4284471
1987	130815	273915	-3613	381595	214392	21906	1019010	512410	488307	18293	1019010
1988	565749	1070483	31297	596035	191281	16155	2471000	1161784	1261764	47452	2471000
1989	517838	314936	28451	0	0	0	861225	517838	314936	28451	861225
1990	701863	471471	21535	954226	248135	35742	2432972	1656089	719606	57277	2432972

SOURCE: Revistas Semestrales & Boletín Trimestral de Información Agropecuaria, DGEA-MAG

File: APPIIC-I.WQ1

ANNUAL AVERAGE PRICES FOR FIVE PESTICIDES
COLONES/UNIT

YEAR	MALATHION LITER	TAMARON LITER	2-4-D LITER	PARAQUAT LITER	ANTRACOL KILOGRAM	AVERAGE PRICE
1975	9.26	23.00	8.33	19.31	10.35	14.05
1976	9.26	23.80	7.41	21.16	9.50	14.23
1977	10.00	24.80	8.00	17.00	9.50	13.86
1978	8.73	24.80	6.75	21.16	10.00	14.29
1979	10.00	31.00	6.22	19.00	10.75	15.39
1980	11.00	37.00	6.35	23.33	12.75	18.09
1981	12.00	37.00	11.00	15.00	14.00	17.80
1982	12.00		11.00	17.00	16.50	14.13
1983	12.00	24.00	9.99	17.25	19.45	16.54
1984		31.00	10.90	18.00		19.97
1985		35.00	11.90	18.50		21.80
1986	24.45	48.00	18.81	35.00		31.56
1987	27.50	53.66	18.25	28.00		31.85
1988	28.00	57.00	19.05	26.00		32.51
1989	30.00	59.00			37.50	42.17
1990	36.50	69.90	39.40		51.90	49.43

SOURCE: Bolatin Trimestral de Información Agropecuaria, DGEA-MAG

FILE: APPIIC-J.WQ1

PESTICIDE USE ON CORN BY TYPE AND YEAR

	INSECTICIDE				HERBICIDE				FUNGICIDE			
	KILOGRAMS		LITERS		KILOGRAMS		LITERS		KILOGRAMS		LITERS	
YEAR	AREA	VOLUME	AREA	VOLUME	AREA	VOLUME	AREA	VOLUME	AREA	VOLUME	AREA	VOLUME
1985-86	226838	2453110	112906	116905	4984	9166	123737	266628	68	10260	928	4640
1986-87	59858	463926	37567	45942	17726	585636	28803	67808				
1987-88	374677	2798619	140965	130155	67045	1017353	306861	576604	16609	168915		
1988-89	364581	2666690	197136	218896	73084	250942	324244	600487	56	13	84	42
1989-90	250917	2041819	191547	280216	73915	739785	259788	547726	137	13680		
1990-91	219388	1101658	211579	195245	59733	1809721	256237	568836	21853	4835	1101	1855

PESTICIDE USE ON CORN BY TYPE AND YEAR (CONTINUED)

	OTHER				NATIONAL	TOTAL	AVERAGE
	KILOGRAMS		LITERS		AREA	PEST	PEST
YEAR	AREA	VOLUME	AREA	VOLUME	MANZANAS	KG&LT	KG&LT/MZ
1985-86	144	519	5547	6874	362100	2868102	7.9
1986-87			317	742	368100	1164054	3.2
1987-88			1249	739	398500	4692385	11.8
1988-89	10127	126139	9927	193211	402800	4146420	10.3
1989-90	3176	4261	386	317	394700	3627804	9.2
1990-91	12532	5398	128	128	402600	3687676	9.2

SOURCE: Summary Sheets Provided by Dirección General de Economía Agropecuaria - División de Estadísticas Agropecuarias

FILE:APPIIC-K.WK1

PESTICIDE USE ON BEANS BY TYPE AND YEAR

	INSECTICIDE				HERBICIDE				FUNGICIDE			
	KILOGRAMS		LITERS		KILOGRAMS		LITERS		KILOGRAMS		LITERS	
YEAR	AREA	VOLUME	AREA	VOLUME	AREA	VOLUME	AREA	VOLUME	AREA	VOLUME	AREA	VOLUME
1985-86	22217	165208	72042	67566			83317	187025	1195	797		
1986-87	19136	180679	46912	46344	3512	4062	52529	112610	3186	2945	121	242
1987-88	20897	160955	30810	23733			41686	94250	722	436		
1988-89	16832	120497	77733	67354	608	280	105954	216931	1710	1077		
1989-90	21437	129525	60227	59488	795	442	50697	108460	1638	1580		
1990-91	4008	5483			3105	284570	57550	115375	1787	668		

PESTICIDE USE ON BEANS BY TYPE AND YEAR (CONTINUED)

	OTHER				NATIONAL	TOTAL	AVERAGE
	KILOGRAMS		LITERS		AREA	PEST	PEST
YEAR	AREA	VOLUME	AREA	VOLUME	MANZANAS	KG&LT	KG&LT/MZ
1985-86	42650	163672	511	1672	83300	585940	7.0
1986-87	27587	114361	341	681	87100	461924	5.3
1987-88	27595	71763			89300	351137	3.9
1988-89	12107	26399	957	803	96100	433341	4.5
1989-90	13267	74207	226	2215	91600	375916	4.1
1990-91	33688	102026	1778	1457	89500	509579	5.7

SOURCE: Summary Sheets Provided by Dirección General de Economía Agropecuaria - División de Estadísticas Agropecuarias

FILE:APPIIC-L.WK1

PESTICIDE USE ON RICE BY TYPE AND YEAR

	INSECTICIDE				HERBICIDE				FUNGICIDE			
	KILOGRAMS		LITERS		KILOGRAMS		LITERS		KILOGRAMS		LITERS	
YEAR	AREA	VOLUME	AREA	VOLUME	AREA	VOLUME	AREA	VOLUME	AREA	VOLUME	AREA	VOLUME
1985-86	16386	222836	9160	11664	97	93	20500	49217	1798	1980	2562	2632
1986-87	975	6090	1210	1643	986	262829	4783	12815			1697	1835
1987-88	9623	77354	11105	13963	2257	323440	14986	28917	558	558	4285	4978
1988-89	5041	57316	11154	19849	1833	257374	5967	10682	610	540	3293	6134
1989-90	7755	28867	11598	14014	287	41219	15332	50941	2573	3237	5361	6406
1990-91	1724	59999	7275	7879	412	824	18116	50543	4059	2299	8560	9635

PESTICIDE USE ON RICE BY TYPE AND YEAR (CONTINUED)

	OTHER				NATIONAL	TOTAL	AVERAGE
	KILOGRAMS		LITERS		AREA	PEST	PEST
YEAR	AREA	VOLUME	AREA	VOLUME	MANZANAS	KG&LT	KG&LT/MZ
1985-86			2350	4480	24700	292902	11.9
1986-87	162	221	4164	4206	17200	289644	16.8
1987-88	632	284	4369	6553	16700	456047	27.3
1988-89			7760	30298	19700	382193	19.4
1989-90					22200	144684	6.5
1990-91			128	257	20400	131436	6.4

SOURCE: Summary Sheets Provided by Dirección General de Economía Agropecuaria - División de Estadísticas Agropecuarias

FILE:APPIIC-M.WK1

PESTICIDE USE ON SORGHUM BY TYPE AND YEAR

	INSECTICIDE				HERBICIDE				FUNGICIDE			
	KILOGRAMS		LITERS		KILOGRAMS		LITERS		KILOGRAMS		LITERS	
YEAR	AREA	VOLUME	AREA	VOLUME	AREA	VOLUME	AREA	VOLUME	AREA	VOLUME	AREA	VOLUME
1985-86	2840	8792	5170	4959	5550	27744	37843	53261				
1986-87	5953	35483	1321	1260			36293	47823				
1987-88	16905	91460	18309	14103	139	208	12228	19543	42	64	139	10553
1988-89	20521	149125	36449	35513	7135	10449	67528	130521	390	90	28	84
1989-90	16014	113323	41676	74084	10284	97545	60521	121524				
1990-91	5361	35156	10700	9649	2395	2532	60418	136938	837	193		

PESTICIDE USE ON SORGHUM BY TYPE AND YEAR (CONTINUED)

	OTHER				NATIONAL	TOTAL	AVERAGE
	KILOGRAMS		LITERS		AREA	PEST	PEST
YEAR	AREA	VOLUME	AREA	VOLUME	MANZANAS	KG&LT	KG&LT/MZ
1985-86	63	769			163400	95525	0.6
1986-87					171500	84566	0.5
1987-88			46930	300824	178700	436755	2.4
1988-89	2548	5841			174200	331623	1.9
1989-90					170900	406476	2.4
1990-91					184700	184468	1.0

SOURCE: Summary Sheets Provided by Dirección General de Economía Agropecuaria - División de Estadísticas Agropecuarias

FILE:APPIIC-N.WK1

APPENDIX 9

HISTORICAL COSTS AND RETURNS OF BASIC GRAINS PRODUCTION

HISTORICAL COSTS AND NET RETURNS OF CORN PRODUCTION

PRODUCTION/MANZANA - DGEA DATA

		FERTILIZER								PESTICIDES		
		16-20-0			AMONIUM SULFATE			TOTAL NOMINAL FERTL. COST	TOTAL REAL FERTL. COST	INSECTICIDE	HERBICIDE	FUNGICIDE
YEAR	CPI	QUANTITY	NOMINAL COST/QQ	TOTAL COST	QUANTITY	NOMINAL COST/QQ	TOTAL COST			NOMINAL COST	NOMINAL COST	NOMINAL COST
1978	100.00											
1979	114.84											
1980	136.15	4.40	22.30	98.12	4.40	15.00	66.00	164.12	120.54			
1981	152.01	4.40	30.49	134.16	4.40	20.64	90.82	224.98	148.00			
1982	172.44	4.40	34.09	150.00	4.40	24.55	108.02	258.02	149.63			
1983	197.87	4.40	34.09	150.00	4.40	24.55	108.02	258.02	130.40			
1984	217.30	4.40	28.18	123.99	4.40	17.27	75.99	199.98	92.03			
1985	286.68	4.40	28.00	123.20	4.40	17.50	77.00	200.20	69.83			
1986	373.70	4.40	32.20	141.68	4.40	20.13	88.57	230.25	61.61			
1987	446.96	4.40	56.82	250.00	4.40	33.64	148.00	398.00	89.05			
1988	528.53	4.40	47.00	206.80	4.40	27.50	121.00	327.80	62.02			
1989	652.55	4.40	56.80	249.92	4.40	29.50	129.80	379.72	56.19			
1990	778.80	4.34	44.19	191.79	4.72	36.63	172.90	364.69	46.83	85.45	111.49	14.31
1991	855.66	3.98	71.74	285.52	4.89	44.11	215.69	501.21	58.58	114.43	132.82	10.15
1992		3.98	87.52	348.33	4.89	47.20	230.79	579.12		146.47	170.01	12.99

			SEED							
YEAR	TOTAL NOMINAL PESTICIDE COST	TOTAL REAL PESTICIDE COST	NOMINAL SEED COST	REAL SEED COST	REAL TOTAL COST	AVERAGE YIELD QQ/MZ	NOMINAL FARM GATE PRICE C/QQ	REAL FARM GATE PRICE C/QQ	GROSS REAL RETURN PER MZ	NET RETURN PER MZ
1978						23.60	19.39	19.39	457.60	
1979						29.20	15.13	13.17	384.71	
1980	88.00	64.63	24.00	17.63	202.31	28.80	17.41	12.79	368.28	165.47
1981	100.00	65.79	27.59	18.15	231.94	27.50	18.49	12.16	334.50	102.56
1982	100.00	57.99	28.50	16.53	224.15	27.50	21.35	12.38	340.48	116.33
1983	120.00	60.65	28.50	14.40	205.45	26.40	26.33	13.31	351.30	145.85
1984	100.00	46.02	29.61	13.63	151.68	27.90	25.00	11.50	320.98	169.31
1985	98.00	34.18	28.50	9.94	113.96	33.00	23.46	8.18	270.05	156.09
1986	112.70	30.16	28.50	7.63	99.40	29.70	36.50	9.77	290.09	190.69
1987	193.45	43.28	42.00	9.40	141.72	25.00	40.33	9.02	225.58	83.86
1988	217.00	41.06	49.50	9.37	112.44	31.60	36.20	6.85	216.43	103.99
1989	220.00	33.71	60.00	9.19	101.10	32.20	49.19	7.54	242.73	141.63
1990	211.85	27.20	53.77	6.90	80.33	32.40	61.44	7.89	255.61	174.67
1991	257.40	30.08	70.42	8.23	96.89	31.70	70.76	8.27	262.15	165.26
1992	329.47		88.03							

SOURCE: Costs of Production for Basic Grains, D.G.E.A.-M.A.G.

FILE: CRNINPMZ.WQ1

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HISTORICAL COSTS AND NET RETURNS OF BEAN PRODUCTION

PRODUCTION/MANZANA - DGEA DATA

		FERTILIZER								NOMINAL PESTICIDES		
		16-20-0			AMONIUM SULFATE			TOTAL NOMINAL	TOTAL REAL			
YEAR	CPI	QUANTITY	NOMINAL COST/QQ	TOTAL COST	QUANTITY	NOMINAL COST/QQ	TOTAL COST	FERTIL. COST	FERTIL. COST	INSECT COST	HERBIC COST	FUNGIC COST
1978	100.00											
1979	114.84											
1980	136.15	4.40		98.12				98.12	72.07			
1981	152.01	4.40	30.18	132.79				132.79	87.36			
1982	172.44											
1983	197.87	4.40	34.09	150.00				150.00	75.81			
1984	217.30	4.40	30.00	132.00				132.00	60.75			
1985	286.68	2.20	28.00	61.60				61.60	21.49			
1986	373.70	2.20	32.20	70.84				70.84	18.96			
1987	446.96	2.20	56.82	125.00		FOLLIATE	9.29	134.29	30.05	147.52	54.00	
1988	528.53	2.20	56.82	125.00		FOLLIATE	9.29	134.29	25.41	147.52	54.00	
1989	652.55	2.20	56.80	124.96		FOLLIATE	18.00	142.96	21.91	140.00	60.00	
1990	778.80	2.74	58.11	159.21	1.31		80.10	239.31	30.73	102.57	66.57	12.61
1991	855.66	2.27	82.90	188.18		FOLLIATE	17.18	205.36	24.00	110.71	148.73	23.57
1992		2.27	101.14	229.58		FOLLIATE	21.99	251.57		141.71	190.37	30.17

YEAR	NOMINAL TOT PEST COST	REAL TOT PEST COST	NOMINAL SEED COST	REAL SEED COST	REAL INPUTS COST	NATIONAL AVG YIELD QQ	NOMINAL FARM GATE	REAL FARM GATE	REAL RETURN MZ	RETURN MINUS INP COST
1978						9.80	59.15	59.15	579.67	NA
1979						12.60	46.68	40.65	512.16	NA
1980	115.00	84.47	84.00	61.70	218.23	12.90	73.36	53.88	695.07	476.84
1981	131.00	86.18	150.00	98.68	272.21	11.60	88.97	58.53	678.94	406.72
1982						11.70	74.10	42.97	502.77	NA
1983	157.20	79.45	180.00	90.97	246.22	10.50	60.35	30.50	320.25	74.03
1984	78.60	36.17	150.00	69.03	165.95	11.40	63.70	29.31	334.18	168.24
1985	101.00	35.23	137.50	47.96	104.68	12.80	78.16	27.26	348.98	244.30
1986	116.15	31.08	137.50	36.79	86.83	9.00	100.00	26.76	240.83	154.00
1987	201.52	45.09	170.00	38.03	113.17	12.60	103.92	23.25	292.36	179.79
1988	201.52	38.13	170.00	32.16	95.70	5.90	235.77	44.61	263.19	167.49
1989	200.00	30.65	350.00	53.64	106.19	12.90	177.05	27.13	350.00	243.81
1990	181.75	23.34	179.87	23.10	77.16	10.60	227.33	29.19	309.41	232.25
1991	283.01	33.08	294.63	34.43	91.51	12.23	279.49	32.66	399.48	307.97
1992	362.25		294.63			12.23				

SOURCE: Costs of Production for Basic Grains, D.G.E.A.-M.A.G.

FILE: BENINPMZ.WQ1

COSTS OF RICE PRODUCTION

PRODUCTION/MANZANA - DGEA DATA

		NOMINAL FERTILIZER						NOMINAL	REAL	NOMINAL PESTICIDES		
		16-20-0			AMONIUM SULFATE			TOT FERT COST**	TOT FERT COST			
YEAR	CPI	QUANTITY	COST/QQ	TOT COST	QUANTITY	COST/QQ	TOT COST			INSECT COST	HERBIC COST	FUNGIC COST
1978	100.00											
1979	114.84											
1980	136.15	4.40	22.30	98.12	4.40	15.00	66.00	164.12	120.54	110.00	70.00	
1981	152.01	4.40	29.36	129.18	4.40	19.64	86.42	215.60	141.83	150.00	85.00	
1982	172.44											
1983	197.87	4.40	34.09	150.00	4.40	24.55	108.02	258.02	130.40	180.00	102.00	
1984	217.30	4.40	30.00	132.00	4.40	18.64	82.02	214.02	98.49	199.20	127.51	
1985	286.68	4.40	28.00	123.20	4.40	17.50	77.00	200.20	69.83	150.00	85.00	
1986	373.70	4.40	32.20	141.68	4.40	20.13	88.57	230.25	61.61	51.75	92.00	57.50
1987	446.96	4.40	56.82	250.00	4.40	33.64	148.00	398.00	89.05	362.25	171.23	
1988	528.53	4.40	56.82	250.00	4.40	33.64	148.00	398.00	75.30	362.25	171.23	
1989	652.55	4.40	56.80	249.92	4.40	29.50	129.80	379.72	58.19	302.00	125.00	
1990	778.80	4.48	56.32	252.31	4.85	37.88	183.70	436.01	55.98	148.35	282.44	104.87
1991	855.66	3.60	77.29	278.24	4.40	46.97	206.66	508.18	59.39	202.51	293.40	90.51
1992		3.60	94.29	339.45	4.40	50.26	221.13	590.38		259.25	375.55	115.85

YEAR	NOMINAL TOT PEST COST	REAL TOT PEST COST	NOMINAL SEED COST	REAL SEED COST	YIELD QQ	REAL TOTAL COST	NOMINAL FARM GATE	REAL FARM GATE	REAL RETURN MZ	RETURN MINUS INP COSTS
1978					40.00		34.11	34.11	1364.40	NA
1979					55.60		35.58	30.98	1722.61	NA
1980	180.00	132.21	130.00	95.48	60.00	348.23	30.16	22.15	1329.12	980.89
1981	235.00	154.60	160.00	105.26	55.00	401.68	31.64	20.81	1144.79	743.11
1982					55.00		33.00	19.14		NA
1983	282.00	142.52	140.00	70.75	48.10	343.67	36.45	18.42	886.06	542.39
1984	326.71	150.35	200.00	92.04	52.20	340.88	33.00	15.19	792.73	451.85
1985	235.00	81.97	160.00	55.81	62.80	207.62	33.50	11.69	733.85	526.23
1986	201.25	53.85	120.00	32.11	60.60	147.58	24.80	6.64	402.16	254.58
1987	533.48	119.36	210.00	46.93	59.30	255.39	71.31	15.95	946.10	690.71
1988	533.48	100.94	210.00	39.73	54.80	215.97	61.82	11.70	640.97	425.00
1989	427.00	65.44	212.50	32.56	63.20	156.19	45.66	7.00	442.22	286.03
1990	535.66	68.78	227.11	29.16	62.40	153.93	57.34	7.36	459.43	305.50
1991	586.42	68.53	325.85	38.08	68.13	166.01	110.28	12.89	878.08	712.07
1992	750.65		433.38		68.13					

** 1991 INCLUDES C 23.28 AND 1992 INCLUDES C 29.80 FOLLIAR FERTILIZER

SOURCE: Costs of Production of Basic Grains, D.G.E.A.-M.A.G.

FILE: RICINPMZ.WK1

COSTS OF SORGHUM PRODUCTION

PRODUCTION/MANZANA - DGEA DATA

YEAR	CPI	NOMINAL FERTILIZER 16-20-0 QUANTITY	16-20-0 COST/QQ	16-20-0 TOT COST	AMONIUM SULFATE QUANTITY	AMONIUM SULFATE COST/QQ	AMONIUM SULFATE TOT COST	NOMINAL TOT FERT COST	REAL TOT FERT COST	NOMINAL PESTICIDES INSECT COST	HERBIC COST	FUNGIC COST
1978	100.00											
1979	114.84											
1980	136.15											
1981	152.01											
1982	172.44											
1983	197.87				3.00	24.55	73.65	73.65	37.22			
1984	217.23	3.00	30.00	90.00	3.00	18.64	55.92	145.92	67.15			
1985	286.68	3.00	28.00	84.00	3.00	17.50	52.50	136.50	47.61			
1986	373.70											
1987	446.96											
1988	528.53	2.20	56.82	125.00	2.20	33.64	74.00	199.00	37.65	170.00	41.60	
1989	652.55											
1990	778.80	1.75	54.13	94.73	2.02	39.21	79.20	173.93	22.33	51.14	90.89	
1991	855.66				2.29	46.65	106.82	106.82	12.48	49.50	91.27	
1992					2.29	49.91	114.30	114.30		63.36	116.83	

YEAR	NOMINAL TOT PEST COST	REAL TOT PEST COST	NOMINAL SEED COST	REAL SEED COST	YIELD QQ/MZ	REAL TOTAL INPUTS	NOMINAL FARM GATE C/QQ	REAL FARM GATE C/QQ	REAL RETURN MZ	RETURNS MINUS INP COST
1978					14.80		17.49	17.49	258.85	
1979					19.50		16.80	14.63	285.27	
1980					17.00		19.66	14.44	245.48	
1981					17.80		21.39	14.07	250.47	
1982					17.90		21.58	12.51	224.01	
1983	84.00	42.45	22.50	11.37	15.90	91.04	24.50	12.38	196.87	105.83
1984	104.60	48.14	21.00	9.66	16.90	124.95	21.00	9.66	163.32	38.37
1985	95.00	33.14	17.50	6.10	18.40	86.86	22.71	7.92	145.76	58.90
1986					17.60		30.00	8.03	141.29	
1987					18.70		38.29	8.57	160.20	
1988	211.60	40.04	23.00	4.35	3.20	82.04	39.94	7.56	24.18	-57.86
1989					19.10		40.55	6.21	118.69	
1990	142.03	18.24	8.72	1.12	19.00	41.69	50.37	6.47	122.89	81.20
1991	140.77	16.45	12.99	1.52	23.90	30.45	46.36	5.42	129.49	99.04
1992	180.19		12.99		23.90					

SOURCE: Costs of Production of Basic Grains, D.G.E.A.-M.A.G.

FILE: SGRINMZ.WQ1

APPENDIX 10

BASIC GRAINS AREA FINANCED BY BFA

GRAIN PRODUCTION CREDIT

AREA FINANCED AS PERCENTAGE OF TOTAL AREA PLANTED

Year	Crop	Total Area Harvested (Mz)	Area Financed by BFA (Mz)	BFA Share	Amount & Share of Credit (C 1,000) Other Banks 1/	BFA Share	Total Amount	BFA Share
1990/91	Corn		78,729	ERR				
	Sorghum		22,930	ERR				
	Beans		15,266	ERR				
	Rice		7,071	ERR				
	Total	0	123,996	ERR				
1989/90	Corn	394,700	94,157	23.9%				
	Sorghum	170,200	27,308	16.0%				
	Beans	91,600	27,058	29.5%				
	Rice	22,200	9,749	43.9%				
	Total	678,700	158,272	23.3%				
1988/89	Corn	402,800	91,926	22.8%	20,256	81,584	101,840	80.11%
	Sorghum	174,200	23,392	13.4%	NA	NA		
	Beans	96,100	27,021	28.1%	1,564	18,380	19,944	92.16%
	Rice	19,700	9,503	48.2%	7,709	19,703	27,412	71.88%
	Total	692,800	151,842	21.9%	29,529	119,667	149,196	80.21%
1987/88	Corn	398,500	111,919	28.1%				
	Sorghum	178,700	28,454	15.9%				
	Beans	89,300	29,970	33.6%				
	Rice	16,700	8,497	50.9%				
	Total	683,200	178,840	26.2%				
1986/87	Corn	368,100	127,952	34.8%				
	Sorghum	171,500	28,600	16.7%				
	Beans	87,100	34,926	40.1%				
	Rice	17,200	10,938	63.6%				
	Total	643,900	202,416	31.4%				
1985/86	Corn	362,100	138,647	38.3%				
	Sorghum	163,400	30,346	18.6%				
	Beans	83,300	32,956	39.6%				
	Rice	24,700	16,475	66.7%				
	Total	633,500	218,424	34.5%				
1984/85	Corn	347,700	123,550	35.5%				
	Sorghum	166,000	30,038	18.1%				
	Beans	82,500	26,186	31.7%				
	Rice	21,900	14,850	67.8%				
	Total	618,100	194,624	31.5%	21,478	89,638	111,116	80.67%
1983/84	Corn	345,000	104,105	30.2%				
	Sorghum	158,000	26,419	16.7%				
	Beans	80,500	20,316	25.2%				
	Rice	18,000	13,036	72.4%				
	Total	601,500	163,876	27.2%				
1982/83	Corn	341,000	112,586	33.0%				
	Sorghum	170,000	29,814	17.5%				
	Beans	79,400	30,953	39.0%				
	Rice	16,000	12,486	78.0%				
	Total	606,400	185,839	30.6%				
1981/82	Corn	395,000	134,388	34.0%				
	Sorghum	164,940	52,095	31.6%				
	Beans	71,000	35,783	50.4%				
	Rice	19,800	15,106	76.3%				
	Total	650,740	237,372	36.5%				
1980/81	Corn	417,000	150,436	36.1%				
	Sorghum	170,700	64,256	37.6%				
	Beans	75,000	32,153	42.9%				
	Rice	24,000	17,144	71.4%				
	Total	686,700	263,989	38.4%				

AREA FINANCED AS PERCENTAGE OF TOTAL AREA PLANTED (cont.)

Year	Crop	Total Area Harvested (Mz)	Area Financed by BFA (Mz)	BFA Share	Amount & Share of Credit (C 1,000) Other Banks 1/	BFA Share	Total Amount	BFA Share
1979/80	Corn	394,300	132,790	33.7%				
	Sorghum	205,000	61,163	29.8%				
	Beans	78,700	30,962	39.3%				
	Rice	21,100	14,598	69.2%				
	Total	699,100	239,513	34.3%				
1978/79	Corn	377,600	99,672	26.4%				
	Sorghum	195,400	39,268	20.1%				
	Beans	74,000	20,018	27.1%				
	Rice	19,850	9,324	47.0%				
	Total	666,850	168,282	25.2%				
1977/78	Corn	349,779	83,502	23.9%				
	Sorghum	188,790	28,547	15.1%				
	Beans	75,125	16,854	22.4%				
	Rice	17,300	8,820	49.6%				
	Total	631,503	137,723	21.8%				
1976/77	Corn	334,500	83,045	24.0%				
	Sorghum	178,500	14,576	8.2%				
	Beans	75,540	18,317	24.2%				
	Rice	19,710	10,467	53.1%				
	Total	608,250	126,405	20.8%				
1975/76	Corn	351,700	63,632	18.1%				
	Sorghum	189,100	3,845	2.0%				
	Beans	79,800	11,190	14.0%				
	Rice	24,200	12,329	50.9%				
	Total	644,800	90,996	14.1%				
1974/75	Corn	302,100	45,389	15.0%				
	Sorghum	182,000	2,352	1.3%				
	Beans	73,470	7,065	9.6%				
	Rice	15,900	7,329	46.1%				
	Total	573,470	62,135	10.8%				
1973/74	Corn	287,250		0.0%				
	Sorghum	170,000		0.0%				
	Beans	64,440		0.0%				
	Rice	13,600		0.0%				
	Total	535,290	29,900	5.6%				
1972/73	Corn	292,800	17,734	6.1%				
	Sorghum	186,000	387	0.2%				
	Beans	56,850	2,391	4.7%				
	Rice	15,700	3,785	24.1%				
	Total	551,350	24,597	4.5%				
1971/72	Corn	300,300	26,543	8.8%				
	Sorghum	180,000	1,066	0.6%				
	Beans	57,000	3,997	7.0%				
	Rice	20,920	3,768	18.0%				
	Total	558,220	35,374	6.3%				
1970/71	Corn	294,200	20,453	7.0%				
	Sorghum	177,400	6,428	3.6%				
	Beans	51,600	3,769	7.3%				
	Rice	17,000	2,784	16.4%				
	Total	540,200	33,444	6.2%				
1969/70	Corn	277,300	18,911	6.8%				
	Sorghum	162,575	6,183	3.8%				
	Beans	46,965	4,793	10.2%				
	Rice	15,300	2,869	18.8%				
	Total	502,140	32,756	6.5%				
1968/69	Corn	285,350	24,544	8.6%				
	Sorghum	162,500	7,846	4.8%				
	Beans	45,270	2,828	6.2%				
	Rice	39,000	6,225	16.0%				
	Total	532,120	41,443	7.8%				

AREA FINANCED AS PERCENTAGE OF TOTAL AREA PLANTED (cont.)

Year	Crop	Total Area Harvested (Mz)	Area Financed by BFA (Mz)	BFA Share	Amount & Share of Credit (C 1,000) Other Banks 1/	BFA Share	Total Amount	BFA Share
1967/68	Corn	274,095	14,574	5.3%				
	Sorghum	148,400	2,259	1.5%				
	Beans	40,595	1,450	3.6%				
	Rice	40,000	5,465	13.7%				
	Total	503,090	23,748	4.7%				
1966/67	Corn	296,600	10,563	3.6%				
	Sorghum	153,719	3,237	2.1%				
	Beans	37,761	923	2.4%				
	Rice	28,176	1,721	6.1%				
	Total	516,258	16,444	3.2%				
1965/66	Corn	275,820	16,341	5.9%				
	Sorghum	158,700	5,014	3.2%				
	Beans	33,600	1,425	4.2%				
	Rice	18,900	2,673	14.1%				
	Total	487,020	25,453	5.2%				
1964/65	Corn	236,792	9,021	3.8%				
	Sorghum	124,455	2,768	2.2%				
	Beans	30,541	787	2.6%				
	Rice	21,150	1,475	7.0%				
	Total	412,938	14,051	3.4%				
1963/64	Corn	246,686	4,955	2.0%				
	Sorghum	143,453	1,520	1.1%				
	Beans	39,690	432	1.1%				
	Rice	12,234	810	6.6%				
	Total	442,063	7,717	1.7%				

Source: BFA Memorias

File: CREDIT.WQ1

APPENDIX 11

PESTICIDES LAWS AND REGULATIONS

LEY SOBRE CONTROL DE PESTICIDAS, FERTILIZANTES Y PRODUCTOS PARA USO AGROPECUARIOS.

(DECRETO Nº 315)

D.O. Nº 85 Tomo 239, 10 de mayo 1973

Publicación del Departamento Jurídico, Dirección de Defensa Agropecuaria, abril 1988.

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DECRETO Nº 315

LA ASAMBLEA LEGISLATIVA DE LA REPUBLICA DE EL SALVADOR,

CONSIDERANDO:

I - Que como consecuencia de la tecnificación de los cultivos agrícolas y de las explotaciones pecuarias, se ha aumentado considerablemente el empleo de productos químicos y químico-biológicos, especialmente pesticidas, fertilizantes y otros productos afines;

II - Que es necesario garantizar a los usuarios de dichos productos la calidad, composición y cualidades etribuidas a los mismos por sus fabricantes, importadores, distribuidores y vendedores a fin de proteger a aquellos de una baja en la producción agrícola y pecuaria en perjuicio de la economía del país;

III - Que por el uso y control inadecuado de algunos productos se han producido daños personales y materiales y se ha acentuado el riesgo de una elevada contaminación ambiental que afecta a algunas industrias de productos alimenticios y como consecuencia, la salud de las personas;

IV - Que la aplicación práctica del Decreto Legislativo Nº 1316 de fecha 17 de diciembre de 1953, publicado en el Diario Oficial Nº 232, Tomo 161 del 21 del mes y año citados, ha demostrado que carece de los fundamentos legales suficientes para una efectiva regulación y control de la fabricación, importación, distribución y uso de dichos productos, y para la deducción de las responsabilidades que de estos actos se originen y deriven;

V - Que es deber del Estado estimular y mejorar la producción agropecuaria en beneficio general, propiciando en uso adecuado de productos de buena calidad destinadas a la producción de los cultivos agrícolas y de las explotaciones pecuarias; prevenir daños personales o materiales así como la destrucción de los recursos naturales y además dictar las disposiciones pertinentes para fijar los precios de venta de estos productos, cuando las utilidaddes sean exageradas;

POR TANTO,

en uso de sus facultades constitucionales, y a iniciativa del Presidente de la República por medio del Ministro de Agricltura y Ganadería, y oída la opinión de la Corte Suprema de Justicia,

DECRETA la siguiente:

LEY SOBRE CONTROL DE PESTICIDAS, FERTILIZANTES Y PRODUCTOS PARA USO AGROPECUARIO

CAPITULO I

OBJETO Y CAMPO DE APLICACION

Art. 1. - La presente ley tiene por objeto regular la producción, comercialización, distribución, importación, exportación, y el empleo de: pesticidas, fertilizantes, herbicidas, enmiendas o mejoradores, defoliantes y demás productos químicos y químico-biológicos para uso agrícola, pecuario o veterinario y sus materias primas.

Art. 2. - Las disposiciones de la presente ley se aplicarán a cualquiera de las actividades referidas en el artículo anterior, gubernamentales o privadas, ya sea con fines comerciales, industriales, educacionales, experimentales o de investigación.

Art. 3. - Las disposiciones contenidas en la presente ley se aplicarán con preferencia a cualesquiera otras que la contraríen.

Art. 4. - La fabricación, para uso no comercial, de abonos orgánicos, queda excluida de las regulaciones establecidas en esta ley.

CAPITULO II

DEFINICIONES Y CONCEPTOS TECNICOS

Art. 5. - Para los efectos de esta ley y sus reglamentos, regirán las definiciones técnicas y el significado de los conceptos que a continuación se expresan, salvo que en su contexto se les den expresamente una definición o significado distinto;

a) PESTICIDAS: toda sustancia química o químico-biológica o mezclas de sustancias destinadas a prevenir o combatir plagas o enfermedades en animales y vegetales, tales como: insecticidas, fungicidas, germicidas, nematocidas acaricidas, moluscocidas, rodenticidas, ornitocidas, bactericidas, viricidas, repelentes, atrayentes y otros productos para uso tanto en los animales como en los vegetales, con la misma finalidad expresada en esta letra;

b) FERTILIZANTES: comúnmente conocidos como abonos químicos u orgánicos: son toda sustancia o mezcla de sustancias que se incorporan al suelo o a las plantas en cualquier forma, con el fin de promover o estimular el crecimiento o desarrollo de éstas o aumentar la productividad del suelo;

c) ENMIENDAS O MEJORADORES: las sustancias que modifican principalmente las condiciones físicas del suelo y secundarimanete las químicas, tales como: el yeso, el azufre, sales, turba, y toda otra sustancia que responda a esta definición;

d) DEFOLIANTE: todo producto o mexcla de productos que sirva para acelar artificialmente la desecación de los tejidos vegetales, causando o no la caída de las hojas;

e) HERBICIDA: sustancia que se utiliza para la destrucción o eliminación de hierbas indeseables o dañinas a los cultivos agrícolas;

f) DEMAS PRODUCTOS QUIMICOS Y QUIMICO-BIOLOGICOS PARA USO AGRICOLA, PECUARIO O VETERINARIO: se entenderá toda sustancia o mezola de sustancias destinadas a prevenir, atenuar o curar enfermedades o plagas en animales o plantas, tales como medicinas genéricas, medicinas de patente, sueros, vacunas y otros productos biológicos; y, concentrados alimenticios y demás productos destinados a la alimentación animal; y

g) MATERIAS PRIMAS: materiales técnicos, inertes, solventes y emulsificantes para prepara o fabricar pesticidas, fertilizantesm herbicidas, enmiendas o mejoradores, defoliantes y demás productos químicos o químico-biológicos para uso agrícola, pecuario o veterinario.

CAPITULO III

DE LA AUTORIDAD Y SUS ATRIBUCIONES

Art. 6. - Corresponde al Ministerio de Agricultura y Ganadería, por medio de sus dependencias, el cumplimiento de la presente Ley y sus Reglamentos, para cuyo efecto tendrá la siguientes atribuciones:

a) Realizar inspecciones y extraer muestras en cantidad suficiente, en cualquier momento y lugar, de los productos y materias primas de que trata el artículo 1 de esta Ley, ya sean importados, fabricados o formulados en el país, con el fin de determinar si tales productos cumplen con los requisitos y condiciones legales y reglamentarios;

b) Dictar las medidas que sean necesarias y prestar la asistencia técnica que las circunstancias demanden, para lograr el empleo eficiente, oportuno y adecuado de los productos a que se refiere esta Ley, de modo que su utilización y manipulación no causen daños a personas, animales, cultivos, corrientes o depósitos de agua, fauna y flora y lugares que corran peligro de contaminación;

c) Emitir instructivos para regular la limpieza y manejo u otras actividades a que habrán de someterse los equipos, terrestres y aéreos, utilizados en la aplicación de los productos de que trata esta Ley;

d) Solicitar, si lo estima conveniente, asesoramiento, dictamenes o información a entidades científicas o técnicas, dedicadas a la investigación y experimentación, sobre los productos y materias primas referidos por esta Ley;

e) Llevar el registro de los productos y materias primas a que se refiere la presente ley, acordar su inscripción, denegatoria de inscripción o cancelación, de conformidad con esta Ley y sus Reglamentos;

f) Autorizar, prohibir o denegar la importación, fabricación y venta de los productos y materias primas de que se trata en esta Ley y revocar las autorizaciones de importación, fabricación y venta de los mismos, cuando así lo aconsejen la experiencia, los ensayos, las investigaciones de comprobación o por las infracciones comprobadas de conformidad a esta Ley y sus Reglamentos;

g) Establecer mediante Acuerdo Ejecutivo, las normas de calidad a que estarán sujetos los productos fabricados, formulados o importados en base a las investigaciones y comprobaciones efectuadas por sus laboratorios;

h) Solicitar a los fabricantes, importadores, formuladores o distribuidores de los productos y materias primas de que trata esta Ley cualiquier información sobre los mismos, que se considere necesaria o conveniente;

i) Aprobar las leyendas de las etiquetas en los envases de los productos y controlar rótulos y folletos instructivos o propagandísticos, con el fin de garantizar su veracidad y que se suministre al consumidor la información indispensable para el uso del producto sin riesgo para la salud y de acuerdo a los fines a que se destine;

j) Imponer las sanciones que establezca esta Ley y sus Reglamentos; y

k) Adoptar y ejecutar las medidas complementarias que considere necesarias para el cumplimiento de la presente Ley y sus Reglamentos.

CAPITULO IV

DEL REGISTRO E INSCRIPCION DE PRODUCTOS Y MATERIAS PRIMAS.

Art. 7. - Para el objeto indicado en el artículo 1 de esta ley, se establece el registro de los productos y materias primas a que la misma se refiere, el cual estará a cargo del Departamento de Defensa Agropecuaria.

Cuando se trate de alimentos concentrados y sus materias primas y en general, todo producto destinado a la nutrición y alimentación animal, será la Dirección General de Ganadería, la que tendrá a su cargo el registro e inscripción de tales productos, en los términos establecidos en esta Ley.

En el registro correspondiente, la inscripción se hará separadamente por cada producto bajo numeración correlativa y para cada país de origen.

Cada inscripción deberá contener los datos siguientes:

a) Nombre químico y comercial de los productos de que trata esta ley; fórmula cualitativa y cuantitativa, química estructural; y las explicaciones necesarias para su completa identificación; y

b) El nombre y domicilio de las personas o empresas que fabriquen, formulen, importen, distribuyan o vendan los productos y materias primas en referencia y el de su país de origen.

Art. 8. - El interesado en la inscripción de determinado producto, deberá solicitarlo por escrito al Departamento de Defensa Agropecuaria, acompañando a la respectiva solicitur lo siguiente:

a) Cantidad suficiente, del producto terminado, materias primas y del material técnico químicamente puro para los efectos de análisis a juicio del Departamento.

Cuando se trate de productos veterinarios medicinas de patente o genéricas, deberá presentarse el producto en envases originales, cerrados y sellados, y en caso necesario el correspondiente material técnico, químico y biológico de calidad reactivo analítico;

b) Fórmula completa, modo de usarlo, dosificación, certificado de análisis, literatura suficiente relacionada con las propiedades físico químicas del producto de que se trata, metodología de análisis y el nombre de los antídotos conocidos; y

c) Si el producto fuere extranjero, certificado de origen y comprobación de que su distribución ha sido autorizada en el país de origen y las condiciones en que se permite su uso.

Cuando se tratare de la inscripción de materias primas, se aplicará en lo pertinente lo dispuesto en este artículo.

Art. 9. - La solicitud de inscripción a que se refiere esta ley, deberá hacerse por el productor, importador o distribuidor del producto o materia prima de que se trata.

La documentación deberá presentarse con la visa consular respectiva, si el producto es extranjero.

Art. 10. - Solicitada la inscripción de un producto, se procederáa a su experimentación bajo la supervisión de Ministerio de Agricultura y Ganadería y por cuenta del solicitante, con el fin de comprobar los posibles alcances de la contaminación ambiental y los residuos tóxicos que pudiesen resultar de su aplicación.

Las muestras de los productos químicos, biológicos y químico-biológicos, serán sometidas a los análisis que el Departamento de Defensa Agrope cuaria estime necesarios, por medios de los laboratorios del las dependencias técnicas de dicho Ministerio, previo pago de los derechos correspondientes.

En vista del resultado de las pruebas de campo, análisis, pruebas experimentales o biológicas, de la legitimidad de la documentación presentada y de la eficacia o conveniencia de su uso, el Departamento de Defensa Agropecuaria accederá a la inscripción solicitada y otorgada el permiso de venta, previo pago de los derechos de inscripción dentro de los ocho días siguientes al resultado.

Art. 11. - El jefe del Departamento de Defensa Agropecuaria denegará la inscripción de los productos y materias primas a que se refiere esta ley, en los casos siguientes:

a) Cuando el resultado del análisis químico cuantitativo no concuerde con lo declarado en la solicitud de inscripción y la diferencia sea mayor a las cantidades aceptadas como margen de error de las técnicas análticas a criterio de laboratorio del Ministerio de Agricultura y Ganadería;

b) Cuando en los ensayos de aplicación que se realicen, se compreuebe que el producto es ineficaz para los fines que se le atribuyen en la solicitud respectiva;

c) Cuando de las informaciones técnicas apareciere que el empleo del producto cuya inscripción se solicita, presente elevada peligrosidad para la salud humana; y

d) Cuando no se cumpla con los requisitos qu señala la presente ley.

Art. 12. - Cualquier modificación en la fórmula de los productis ya inscritos, no afectará la inscripción existente, pero se inscribirá por separado y con nuevo nombre, el producto que resultare modificado, llenando los requisitos que se establecen en este capítulo.

Cuando la solicitod se contraiga únicamente a obtener el cambio de nombre de un producto ya registrado o el de su país de origen, sin variar su formulación original, deberá manifestarse la razón de dicho cambio y proporcionar las muestras del producto para su análisis, a fin de constatar lo afirmado por el solicitante. Al comprobarse que se trata del mismo producto, el Departamento de Defensa Agropecuaria hará la anotación marginal en la inscripción correspondiente al producto de que se trate.

Art. 13. - El Departamento de Defensa Agropecuaria, podrá cancelar la correspondiente inscripción, cuando a resultas de las pruebas de campo, análisis pruebas experimentales o biológicas, u otras a que se someta el producto de que se trate, se comprebe que ya no reune los requisitos exigidos por esta ley y sus reglamentos, o no tiene las propiedades que se le han asignado o las que de él se han declarado para efectos de su inscripción, siguiendo los trámites establecidos en el capítulo IX de esta ley y de acuerdo a lo dispuesto en la letra c) del artículo 52.

Art. 14. - La inscripción de los productos y materias primas a que se refiere esta ley, será válida únicamente por el término de tres años contrados a partir de su inscripción, pudiendo renovarse por períodos iguales llenado los requisitos señalados en el artículo 7, previo el pago de los derechos correspondientes.

El Departamento de Defensa Agropecuaria podrá previo dictamen de la correspondiente dependencia técnica del Ministerio de Agricultura y Ganadería, denegar la renovación, si consideráse necesario el cambio en la formaulación o fabricación del producto, quedando como consecuencia cancelada su inscripción.

En los caso considerados en este artículo, antes de denegar la renovación, se dará audiencia al interesado por el término de tres días, haciéndole saber las razones que se tengan para fundamentar la resolución.

El interesado podrá solicitar dentro de los tres días hábiles siguientes, se abra a prueba las diligencias por ocho días, término dentro del cual deberá presentar las que considere conducentes a demostrar que las razones invocadas para denegar la renovación no son valederas.

Transcurrido dicho término o cuando el interesado no contestare la audiencia, se pronunciará la resolución correspondiente.

Tanto de la denegatoria de inscripción como de la renovación procederá el recurso de revisión, en los términos indicados en el artículo 55 de esta ley.

CAPITULO V

DE LA IMPORTACION Y EXPORTACION

Art. 15. - La importación de los productos y materias primas de que trata esta ley, sólo se podrá hacer previa inscripción de los mismos y con la autorización correspondiente del Departamento de Defensa Agropecuaria.

Art. 16. - Todo producto o materia prima de los referidos en esta ley, que se importe, deberá acompañarse de la documentación que consigne su fórmula, grado, o cualquier otro dato o datos exigidos por esta ley y sus reglamentos.

Art. 17. - La tuberculina para el diagnóstico de la enfermedad en animales bovinos, podrá ser importada tanto por el Ministerio de Agricultura y Ganadería como por las casas distribuidoras de productos veterinarios siempre que éstas esten autprizadas para ello por la Dirección General de Ganadería; otros antígenos para diagnóstico de enfermedades de animales únicamente serán importados por el Ministerio de Agricultura y Ganadería.

Art. 18. - Para proceder al registro aduanal de productos y materias primas sujetos a la presente ley, las facturas y demás documebtos de embarque deberán ser visados por el Departamento de Defensa Agropecuaria, para cuyo efecto deberá constar en las facturas respectivas el número de inscripción del producto de que se trata.

El Departamento de Defensa Agropecuaria, antes de visar las facturas y demás documentos que se mencionan en el inciso precedente y previa opinión favorable de la Dependencia Técnica del Ministerio de Agricultura y Ganadería, podrá disponér que se tomen muestras en los recintos de las aduanas de la República, de los productos y materias primas de que se trate, para efectos de análisis.

Si los resultados no concuerdan con los obtenidos cuando se efectuó la inscripción del producto o materia prima, se denegará la visación a que se refiere el inciso primero de este artículo, pudiendo el interesado hacer uso del recurso establecido en el artículo 55 de esta ley.

Art. 19. - Podrá permitirse la importación de los productos y materias primas no inscritos, cuando lo sean en calidad de muestras, que vengan marcados como tales, listos para ser usados inmediatamente en análisis y demostraciones o experimentos, siempre que en las facuras correspondientes se mencione expresamente aquella finalidad y que tales productos y materias primas vengan consignados al Ministerio de Agricultura y Ganadería.

Art. 20. - Con el objeto de fomentar la agricultura y ganadería, y cuando los interese económicos nacionales lo demanden, los productos y materias primas de que trata esta ley podrán ser importados libres de impuestos, derechos de aduana y visación consular, previa autorización del Ministerio de Hacienda y oída la opinión del Ministerio de Agricultura y Ganadería.

Art. 21. - La exportación de fertilizantes, abonos u otros productos y materias primas referidos en esta ley, deberá ser autorizada por el Poder Ejecutivo en los Ramos de Agricultura y Ganadería y de Economía. Dicha autorización se concederá siempre que se asegure el abastecimiento interno.

CAPITULO VI

DE LA PRODUCCION

Art. 22. - Las autoridades encargadas de autorizar la construcción y funcionamiento de fábricas destinadas a la elaboración de los productos y materias primas a que se refiere esta ley, deberán oir previamente al Ministerio de Agricultura y Ganadería a efecto de que dictamine si el uso de dichos productos y materias primas, es conveniente de acuerdo con las normas de defensa agropecuaria. En caso negativo, se rechazará la solicitud.

Art. 23. - El Ministerio de Agricultura y Ganadería con el objeto de garantizar la conveniencia de su uso, podrá ordenar que se introuzcan modificaciones en el proceso de elaboración de los productos y materias primas a que se refiere esta ley, las cuales serán de obligatorio cumplimiento para los productores o formuladores.

Art. 24. - Los Ministerios de Salud Pública y Asistencia Social y de Agricultura y Ganadería, dictarán las medidas para evitar la contaminación de las aguas por desechos provenientes de la fabricación o formulación de pesticidas u otros productos tóxicos; y, establecerán el tratamiento que deberá darseles en caso de que se produzca su contaminación.

CAPITULO VII

DE LA COMERCIALIZACION Y DISTRIBUCION

Art. 25. - No se podrá ofrecer en venta o expender los productos y materias primas de que se trata en esta ley, si no es dentro del término de validez de su inscripción en el registro correspondiente y conservando el nombre y contenido con que hayan sido inscritos.

Art. 26. - Los productos y materias primas a que se refiere esta ley, sólo podrán ser vendidos en establecimientos especialmente autorizados por el Departamento de Defensa Agropecuaria, cuyos propietarios serán los responsables de su calidad y uso dañoso por falta de la información necesaria.

Este establecimiento deberá contar con los servicios de un idóneo en la materia, si el propietario no lo fuere, quien será responsable solidariamente con éste.

Podrán realizarse ventas al por menor bajo la responsabilidad de los propietarios de los establecimientos autorizados, mediante facultad expresa que éstos otorguen a otras personas, las cuales estarán exentas de cumplir el requisito señalado en el inciso anterior y únicamente deberán observar las idsposiciones del reglamento respectivo, para la venta de los productos y materias primas de que trata esta ley.

Art. 27. - Los fabricantes, importadores, formuladores, distribuidores y vendedores, responderán solidariamente al usuario de los productos que le vendieren, por los daños y perjuicios que le causaren su aplicación o falta de efectividad, cuando la composición y cualidades o propiedades del producto aplicado no coincidieren con las que se le han atribuido en la correspondiente inscripción o en las leyendas de las etiquetas adheridas a los envases.

Art. 28. - Para los efectos del artículo anterior, el interesado podrá solicitar al Ministerio de Agricultura y Ganadería que por medio de sus organismos se lleven a cabo pruebas de campo, análisis físicos y químicos, pruebas experimentales o biológicas y cualquiera otra que se considere necesaria.

Art. 29. - En el reglamento de esta ley, se regulará lo concerniente al transporte, envasado, empaque, presentación y propaganda de los productos y materias primas a que se refiere la presente ley.

Cuando a juicio del Ministerio de Agricultura y Ganadería los precios o utilidades sean exagerados, deberá solicitar la intervención del Ministerio de Economía para que éste fije los precios máximos de venta de los productos a que se refiere la presente ley.

CAPITULO VIII

DE LA APLICACION.

Art. 30. - La aplicación aérea de pesticidas, herbicidas y demás productos de uso agrícola de efectos similares, estará sujeta al cumplimiento de los requisitos siguientes:

a) Verificar los cambios de velocidad y dirección del viento sobre el campo de operación;

b) Las boquillas de los equipos de aspersión deberán estar provistas de válvulas de cierre hermético;

c) El lavado de los tanques de las aeronaves deberá verificarse conforme a los instructivos que dicte el Ministerio de Agricultura y Ganadería;

d) Los lugares de almacenamiento en los aeropuertos o aeródromos deberánestar delimitados con el fin de que no mezclen herbicidas con insecticidas u otros similares, abonos, fertilizantes, etc.;

e) La aplicación de pesticidas se efectuará solamente cuando las condiciones de viento ofrezcan la seguridad necesaria de acuerdo al producto de que se trate y bajo las normas fijadas por el Ministerio de Agricultura y Ganadería; y

f) Que la aplicación de los productos se haga dentro de las zonas y distancias mínimas que señale el reglamento respectivo o las instrucciones expresas del Ministerio de Agricultura y Ganadería, particularmente respecto a la no contaminación de ríos, nacimientos de agua, estaques, esteros, lagos y lagunas así como también otros depósitos y corrientes de agua susceptibles de contaminación.

El propietario del cultivo en que se deba hacer aplicaciones de las indicadas en el inciso anterior, deberá informar al Departamento de Defensa Agropecuaria la época de iniciación y finalización en que se verificarán las aplicaciones; y además, en el término de su duración enviar al referido Departamento denttro de los ocho días siguientes al último de cada mes calendario una relación mensual indicando número de aplicaciones, producto, dosificación, lugar, clase de cultivo, extensión cubierta en cada una y nombre de la persona o compañía que las verificó.

La omisión de cualquiera de estas obligaciones será calificada como falta grave de las señaladas en la letra a) del artículo 52.

Art. 31. - El Ministerio de Agricultura y Ganaderia ordenará a los productores, distribuidores, usuarios de productos tóxicos, la inutilización de los envases usados, de tal modo que se impida su aprovechamiento para almacenar alimentos para consumo humano o animal o para ser usados nuevamente en el envasado de los productos.

Art. 32. - Prohíbese la aplicación aérea y terrestre de productos altamente tóxicos o de elevada peligrosidad para los usuarios de los mismos. Se tendrán

por tales, los así clasificados por los Ministerios de Salud Fública y Asistencia Social y de Agricultura y Ganadería.

Art. 33. - El dueño del cultivo en que se haga aplicación aérea o terrestre de alguno de los productos a que se refiere esta ley, deberá indemnizar a terceros los daños y perjuicios ocasionados por dicha aplicación efectuada en contravención a las normas que la regulan. Las personas naturales o jurídicas que ejecuten la aplicación, responderán solidariamente con aquél.

Art. 34. - Cuando las aplicaciones de los productos de que se trata en esta ley, se efectúen siguiendo las indicaciones dictadas por el Ministerio de Agricultura y Ganadería y sus dependencias, o ciñéndose a las prescripciones legales y reglamentarias y se causare daño, el referido Ministerio deberá seguir una investigación a fin de establecer quién es el responsable del mismo.

Art. 35. - El uso y aplicación de los producto de que trata esta ley con fines distintos a los agropecuarios, será regulado en un reglamento especial que dictará el Poder Ejecutivo en los Ramos de Salud Pública y Asistencia Social, y de Agricultura y Ganadería.

Art. 36. - El juez competente del lugar donde ocurran los hechos a que se refieren los artículos 33 y 34 o el del domicilio del demandado, conocerá de las acciones provenientes de los daños y perjuicios causados, Si hubiere varios jueces competentes, conocerá cualquiera de ellos a prevención.

Art. 37. - La Guardia Nacional, y en su defecto cualquier otro cuerpo de seguridad, al tener conocimiento de hechos que produzcan la responsabilidad a que se refieren los artículos 33 y 34, se constituirá inmediatamente en el lugar con el objeto de iniciar la investigación correspondmente, debiendo tomar las providencias siguientes:

1) - Si encontraren personas con síntomas de envenenamiento, disponer sobre su conducción inmediata al centro asistencial más próximo;

2) - Si el envenenamiento se produjere en animales, tomar las medidas apropiadas para que sean tratados oportunamente y que no se utilicen como alimento;

3) - Si hay sospechas de que el envenenamiento se origina en la contaminación de aguas, alimentos u otros objetos, tomar muestras de óstos y enviar las dentro del menor tiempo posible, a la Agencia de Extensión Agropecuaria del Ministerio de Agricultura y Ganadería más cercana, y si hubiere necesidad de tomar muestras en animales o plantas, hacerlo del conocimiento de la dependencia indicada, para que disponga lo conveniente; y

4) - Recoger información sobre los hechos, particularmente respecto a nombres, apellidos y direcciones de las personas jurídicas, de los presun tos responsables de los daños causados y de las personas que puedan aportar datos que sean útiles en la investigación.

En cualquiera de los casos a que se refiere este artículo, si hubiere fundados sospechas de que se ha cometido un delito, la autoridad o funcionario que practique las diligencias lo comunicará en el acto al juez competente, aportándole los datos necesarios para la averiguación del hecho.

Las diligencias instruidas en cumplimiento de lo que en este artículo se dispone, serán remitidas al Departamento de Defensa Agropecuaria, tan pronto como sean concluidas.

Art. 38. - La Agencia de Extensión Agropecuaria que haya recibido las muestras o el aviso a que se refiere el artículo anterior, lo comunicará inmediatamente al Departamenteo de Defensa Agropecuaria, a efecto de que tome las medidas pertinentes para la realización del análisis correspondiente, quien dejará constancia del resultado en las diligencias que le envíe la Guardia Nacional o cualquier otro cuerpo de seguridad.

Para los efectos de este artículo, cuando hubiere resultado la muerte de una persona, el expresado Departamento solicitará al juez competente, la certificación de los dictamenes periciales efectuados para establecer la causa de la defunción.

Art. 39. - El interesado en la reparación de los daños y perjuicios y el o los responsables de los mismos, podrán convenir sobre la indemnización a cubrir y la forma y condiciones de su pago. El convenio deberá hacerse ante cualquier juez de paz o un notario, quienes asentarán en acta lo acordado por las partes. La certificación del acta extendida por el juez, o el acta notarial, en su caso, tendrá fuerza ejecutiva.

Art. 40. - Si no tuviere lugar el convenio a que se refiere el artículo anterior, la persona perjudicada podrá plantear su demanda por escrito ante el juez competente.

La demanda podrá interponerse conjunta o separadamente contra los presuntos responsables; deberá llenar los requisitos señalados en el Código de Procedimientos Civiles y será acompañada de tatas copias de la misma cuantas sean las personas demandadas.

Cuando de los hechos expuestos apareciere que se ha comecido algún delita a falta, el juez que conozca del asunto certificará lo conducente para instruir el informativo de ley y remitirá la certificación al juez competente en el ramo penal; o para conocer en pieza separada, si el Tribunal es mixto.

El Proceso penal a que hubiere lugar, no impedirá el juicio civil por reclamo de daño y perjuicios de que trata esta ley, aún cuando aquél haya precedido a éste.

Art. 41. - Admitida la demanda, el juez señalará de inmediato día y hora para la comparecencia de las partes a audiencia conciliatoria y ordenará su citación, Las partes podrán concurrir personalmente o por medio de apoderado especial o general.

La citación a conciliación tendrá la calidad de emplazamiento para contestar la demanda.

Art. 42. - La citación se hará entregando personalmente al demandado la copia indicada en el artículo 40, al pie de la cual el notificador transcribirá la resolución que ordena la citación. Si el demandado no fuere hallado, la entrega se hará a cualquiera de las personas indicadas en el artículo 210 del Código de Procedimiento Civiles; y si esto no fuere posible, se fijará los documentos en la puerta principal de la casa del demandado. El notificador relacionará en el expediente la diligencia que haya efectuado.

Art. 43. - Si los presuntos responsables no comparecieren, el juez le hará constar en un acta y se presumiran ciertos los hechos expuestos en la demanda, salva prueba en contrario. Si el que no compareciere fuere el perjudicado, se expresará así en el acta y se tendrá por renunciado de parte suya el beneficio de la conciliación.

Art. 44. - Cuando las partes concurrieren en el acto de la conciliación el juez les hará ver la conveniencia de resolver el diferendo en una forma amigable y si no se pusieren de acuerdo les propondrá la solución que estime equitativa, la que los interesados deberán aceptar expresamente en todo o en parte o rechazarla en su totalidad. En el acto no habrá necesidad de los hombres buenos que señala el Derecho Procesar Común. El juez pondrá fin a los debates de las partes cuando lo considere necesario.

De lo ocurrido en la audiencia conciliatoria se dejará constancia en acta que firmará el juez, el secretario y las partes, teniendose por intentada la conciliación cuando no se produjere acuerdo. Si estás no quisieren o no pudieren firmar, se expresará así.

En caso de arreglo conciliatorio, la certificación del acta tendrá fuerza ejecutiva.

Art. 45. - Si en la audiencia conciliatoria no se lograre avenimiento, el o los demandados deberán contestar la demand, por escrito, en el mismo día o dentro de los tres días siguientes al señalado para la audiencia conciliatoria.

Contestada la demanda o declarada la rebeldía, se recibirá la causa a prueba por ocho días si fuere necesario.

El juez queda facultado para practicar de oficio todas las diligencias que a su juicio contribuyan al mejor esclarecimiento del asunto, debiendo en todo caso, pedir al Departmento de Defensa Agropecuaria certificación de las diligencias a que se refiere el artículo 37, la cual será apreciada prudencialmente como prueba o como simple información sujeta a verificación judicial.

Art. 46. - El juez pronunciará resolución definitiva dentro de los tres días siguientes a la fecha de encontrarse el juicio en estado de sentencia, la que será motivada en forma breve, limitándose la relación de la prueba a lo necesario y suficiente para fundamentar la resolución, en la cual se condenará a los demandados y se fijará el monto de la indemnización, o se les absolverá, según sea el caso.

La sentencia condenatoria, se hará efectiva ejecutivamente en trámite que se seguirá en el mismo juicio.

Art. 47. - Quienes hubieren sufrido los daños y perjuicios a que se refieren los artículos 27, 33, y 34, podrán ocurrir a la Procuraduría General de Pobres en demanda de asistencia jurídica, quien para concederla no estará obligada a comprobar previamente la situación económica de los solicitantes.

Art. 48. - Para acreditar la calidad de cultivador, de aplicador de los productos a que se refiere el artículo 1 de esta ley, de representante legal de una sociedad u otros hechos relacionados con el reclamo por daños y perjuicios, tendrá valor de plena prueba la certificación o el informe que expida la autoridad competente que en cumplimiento de una ley o reglamento, le competa

llevar algún registro, el control, o efecturar la práctica de análisis de laboratorio de los productos a que se refiere esta ley.

Art. 49. - En esta clase de juicios el actor no está obligado a rendir fianza; y en cualquier estado del mismo, antes de la sentencia, las partes pueden darlo por concluido mediante arreglo conciliatorio extrajudicial que será comunicado al juiz, quien lo incorporará al proceso y dará por terminado éste.

Art. 50. - Cuando el monto de la indemnización reclamada no excediere de doscientos colones, de la sentencia definitiva sólo habrá recurso de revisión; y excediendo de dicha cantidad, de apelación.

Art. 51. - En lo que no esté regulado expresamente en esta ley, se observará en lo que fuere aplicable, el Código de Procedimientos Civiles.

CAPITULO IX

SANCIONES Y PROCEDIMIENTOS

Art. 52. - Las infracciones a esta ley serán sancionadas:

a) Con multa de cien a mil colones, de acuerdo a la gravedad de la infracción y la situación económica del infractor.

b) Con suspención temporal o cierre definitivo del establecimiento cuando se incurra por segunda vez en la misma clase de infracciones calificadas como graves o muy graves respectivamente;

c) Con la cancelación de la inscripción del producto en caso de que se incurra por tercera vez en la situación señalada en el artículo 13 de esta ley; y

d) Con el decomiso de los productos o materias primas adulteradas, falsificados o que se hallen en condiciones que no sean las establecidas por esta ley y sus reglamentos.

Las anteriores sanciones se entenderán sin perjuicio de la responsabilidad penal o civil en que incurriere el infracotr o infractores.

Art. 53. - El Procedimiento para imponer las sanciones establecidas en el artículo anterior será el siguiente: con la denuncia, aviso, conocimiento o noticia que tuviere el jefe del Departamento de Defensa Agropecuaia, de haberse cometido una infracciOn a esta ley, instruirá el informativo correspondiente, para lo cual se dará audiencia por tres días hábiles al infractor; con su contestación o sin ella, se abrirá a prueba el expediente por ocho días y transcurridos éstos se pronunciará resolución.

El jefe del Departamento de Defensa ASgropecuaria, para mejor proveer, podrá ordenar la práctica de inspecciones peritajes y recabar de oficio las demás pruebas o practicar los análisis e investigaciones de orden físico, químico y biológico que creyere necesarias.

Art. 54. - Para formarse convencimiento de las infracciones, será suficiente cualquier medio de prueba, especialmente las actas e informes que

rindan los funcionarios o empleados del Ministerio de Agricultura y Ganadería en el cumplimiento de esta ley y sus reglamentos, los cuales se tendrán por relaciones exactas y verdaderas de los hechos en ellos relatados, en tanto no se demuestre su falsedad o inexactitud.

Art. 55. - Del fallo pronunciado por el jefe del Departamento de Defensa Agropecuaria, se admitirá recurso de revisión para ante el Ministerio de Agricultura y Ganadería, el cual deberá interponerse dentro de los tres días inmediatos poteriores a la fecha de la notificación del fallo recurrido.

Admitido el recurso, el jefe de dicho Departmento remitirá diligencias sin dilación alguna al Ministro y éste resolverá dentro de los ocho días siguientes lo que fuese procedente. De lo que el Ministro resuelva no habrá recurso.

Art. 56. - La sanción deberá cimplirse por el infractor dentro del término de tres días después de notificada la resolución firme que la imponga; caso contrario, se procederá a su inmediata ejecución.

Art. 57. - La certificación de la resolución firme en que se imponga una multa tendrá fuerza ejecutiva, y su cuantía ingresará al fondo general del Estado. Para los efectos de la ejecución se remitirá a la Fiscalía General de la República dicha certificación.

Art. 58. - En el caso contemplado en la letra d) del artículo 52 al tener conocimiento de la inforacción, el Departamento de Defensa Agropecuaria, procederá inmediatemente a sellar los envases que contienen los productos o materias primas con una leyenda que indique la prohibición de su uso o comercialización y los depositará en persona responsable. Si ésto no fuere posible, serán trasladados a la oficina más cercana del Ministerio de Agricultura y Ganadería.

Concluido el trámite indicado en los artículos 53 a 55 de esta ley y en caso de ser favorable al presunto infractor la resolución que se pronuncie, le serán devueltos dichos productos y materias primas, Si la resolución fuere desfavorable, se procederá a la destrucción de ellos o a su empleo en alálisis o investigaciones que realicen las dependencias técnicas del Ministerio de Agricultura y Ganadería, a juicio del funcionario que conozca del caso.

Art. 59. - Para el cumplimiento de los fallos de que trata esta ley, el Ministerio de Agricultura y Ganadería y sus dependencias, podrán acudir en demanda de auxilio de la fuerza pública, la cual estará obligada a prestarlo con sólo el pedimiento.

CAPITULO X

DISPOSICIONES GENERALES

Y TRANSITORIAS

Art. 60. - Los Ministerios de Salud Pública y Asistencia Social y de Agricultura y Ganadería, fijarán conjuntamente las tolerancias máximas de residualidad de los productos tóxicos sobre los alimentos de origen agrícola o pecuarin, tomando en consideración sus propias experiencias y recomendaciones que sobre la materia hicieren los organismos internacionales especializados.

Art. 61. - Todas las personas o empresas relacionadas con cualquiera de las actividades de elaboración, importación, formaulación, distribución, almacenamiento, transportación aplicación y empleo de las productos de que se trata, estan obigados a proporcionar los datos, muestras, informes, análisis propaganda, publicidad y colaboración que en cumplimiento de esta ley y sus reglamentos, les sean requeridos por las autoridades de Ministerio de Agricultura y Ganadería y sus dependencias y a permitir el acceso de sus delegados a los lugares de inspección o investigación.

Art. 62. - Todas las menciones que se hagan con relación a peso y volumen, en las solicitudes, procedimientos, análisis, aplicaciones; y en lo relativo al cumplimiento, de las disposiciones de la presente ley y sus reglamentos, se expresará de acuerdo con elsistema métrico decimal.

Art. 63. - Los derechos de registros y renovación de inscripción de las productos y materias primas de que trata esta ley, serán de veinticinco colones en cada caso.

Art. 64. - El Poder Ejecutivo en el Ramo de Agricultura y Ganadería y en su caso, en el de Salud Pública y Asistencia Social, distará el o los reglamentos que fuesen necesarios para la aplicación de esta ley.

Art. 65. - Derógase el Decreto Legislativo Nº 1316 de fecha 17 de diciembre de 1953, publicado en el Diario Oficial Nº 232, Tomo 161 del día 21 del mes y año citados.

Art. 66. - Las disposiciones del artículo 11, letra g), h) e i) de la Ley de Consejo Superior de Salud Pública y de las Juntas de Vigilancia de las Profesiones Médica, Odontológica y Farmacéutica, no serán aplicables a los productos y materias primas de que trata esta ley.

Art. 67. - El Reglamento Sobre Importación, Distribución y Uso de Productos Químicos y Químico-Biológico para la Industria Agropecuaria emitido por el Poder Ejecutivo mediante Decreto Nº 27 del 23 de marzo de 1954, publicado en el Diario Oficial Nº 68, Tomo 163 del día 28 de abril del año citado, continuará vigente en todo lo que no se oponga a la presente ley, hasta que se emita el reglamento correspondiente.

Art. 68. - Las inscripciones de los productos y materias primas a que se refiere esta ley y hechos hasta el 31 de diciembre de 1970, deberán renovarse dentro del término de seis meses contados a partir de la vigencia de la misma. El término de validez de las inscripciones posteriores a la fecha indicada, se contará de conformidad a lo dispuesto en el artículo 14 de esta ley.

Art. 69. - Las diligencias para la autorización y funcionamiento de fábricas destinadas a la elaboración de los productos y materias a que se refiere esta ley, iniciadas antes de la vigencia de la misma, se continuarán tramitando sin oír la opinión del Ministerio de Agricultura y Ganadería.

Art. 70. - Lo dispuesto en el artículo 26 de esta ley, será exigible transcurrido un año a partir de la vigencia de la misma.

Art. 71. - El presente Decreto entrará en vigencia ocho días después de su publicación en el Diario Oficial.

DADO EN EL SALON DE SESIONES DE LA ASAMBLEA LEGISLATIVA: PALACIO NACIONAL: San Salvado, a los veinticinco días del mes de abril de mil novecientos setenta y tres.

+ D. de la J.R. de Gob. Nº 419 del 6 de octubre/80,
D. O. Nº 187, Tomo 269 de Oct. 6/80

+ D. L. 458 del 15 de febrero/78.
D. O. 45 Tomo del 6 de marzo/78.

Rubén Alfonso Rodríguez,
Presidente

Alfredo Morales Rodríguez,
Vice-Presidente

Jorge Escobar Santamaría.
Primer Secretario

Rafael Rodíguez Gonzalez,
Primer Secretario.

Carlos Enrique Palomo
Segundo Secretario

Luis Neftalí Cardonza López
Segundo Secretario.

Pablo Mateu Llort,
Segundo Secretario.

SG/fal.

DECRETO Nº 28

EL PODER EJECUTIVO DE LA REPUBLIC DE EL SALVADOR

CONSIDERANDO:

I. Que la agricultura es la base en que descansa la economía nacional y y que por consiguiente conviene protegerla contra los facores naturales que disminuyen la producción, y sea dañando las plantas, o simplemente afectando la calidad de los productos;

II. Que siendo de vital importancia para la agricultura del país el combate de los elementos nocivos, como son las plagas y enfermedades, es necesario regular el uso y control adecuado de los productos químicos y químico-biológicos, especialmente pesticidas, fertilizantes y otros afines, pues su alta toxicidad implica graves riesgos al no adoptarse las precauciones necesarias en el manipuleo de dichos productos, tanto para la integridad de la salud y vida humana, como para la fauna y flora útil, lo cual implica para el Estado la obigación de salvaguardar esos intereses, dictando las medidas adecuadas para regular el uso en las aplicaciones de dichos productos;

III. Que por Decreto Legislativo Nº 315 de fecha 25 de abril de 1973, publicado en el Diario Oficial Nº 85. Tomo 239 del 10 de mayo del mismo año, fue promulgada la Ley sobre control de Pesticidas, Fertilizantes y Productos para uso Agropecuario, en cuyo Art. 64 faculta al Poder Ejecutivo en el Ramo de Agricultura y Ganadería para dictar el o los Reglamentos que fueren necesarios para su aplicación.

POR TANTO,

En uso de las facultades legislativas que le confiere el Decreto Nº 1, del 15 de octubre de 1979, publicado en el Diario Oficial Nº 191, Tomo 265, de la misma fecha,

DECRETA EL SIGUIENTE:

REGLAMENTO PARA LA APLICACION DE LA LEY SOBRE CONTROL DE PESTICIDAS, FERTILIZANTES Y PRODUCTOS PARA USO AGROPECUARIO:

CAPITULO I.

OBJETO Y CAMPO DE APLICACION

Artículo 1. El presente Reglamento desarrolla la "Ley sobre control de Pesticidas, Fertilizantes y Productos para uso Agropecuario", emitida por Decreto Legislativo Nº 315, de fecha 25 de abril de 1973, el cual fue publicado en el Diario Oficial Nº 85, Tomo 239, del 10 de mayo del mismo año, la que en el texto de este Reglamento se denominará "La Ley", en lo concerniente a las disposiciones relativas a pesticidas, defolientes, herbicidas, productos de uso doméstico, que son usado también para combatir plagas en explotaciones agropecuarias y a los demás compuestos químicos-biológicos para uso agropecuario, incluyendo sus materias primas, a fin de facilitar su interpretación y aplicación para el mejor funcionamiento y el logro de los objetivos de la Ley.

Artículo 2. Este Reglamento se aplicará a toda actividad encaminada a la producción, formulación, elaboracion, distribución, importación, exportación, comercialización y aplicación de pesticidas, defoliantes, herbicidas, arboricidas, otros productos de uso doméstico y a los demás productos químicos, biológicos y químico-biológicos, incluyendo sus materias primas, a que se refiere el artículo anterior y que en el texto de este Reglamento se denominarán "Los Productos" y materias primas, sean estas actividades desarrolladas gubernativamente o privadas, con el fin de garantizar el abastecimiento interno, la calidad, el buen uso y manipulación de los productos y materias primas antes mencionadas.

CAPITULO II

DEFINICIONES Y CONCEPTOS TECNICOS

Artículo 3. Para los efectos de este Reglamento, regirán las definiciones y el significado técnico de los conceptos expresados a continuación:

a) PESTICIDAS. Toda sustancia química, biológica y químico-biológico o mezcla de sustancias destinadas a prevenir o combatir plagas o enfermedades en animales y vegetales, tales como: insecticidas, fungicidas, germinicidas, nematicidas, acaricidas, moluscocida, rodenticidas, bactericidas, viricidas, repelentes, atrayentes y otros productos para uso en los animales y en los vegetales, con la misma finalidad expresada en este literal.

b) DEFOLIANTES. Todo producto o mezcla de productos que sirva para acelerar artificialmente la desecación de los tejidos vegetales, causando o no la caída de las hojas.

c) HERBICIDAS. Sustancia que se utiliza para la destrucción o eliminación de hierbas indeseables o dañinas a los cultivos agrícolas.

d) DEMAS PRODUCTOS QUIMICOS, BIOLOGICOS Y QUIMICO-BIOLOGICOS PARA USO AGRICOLA, PECUARIO O VETERINARIO. Se entenderá toda sustancia o mezcla de sustancias destinada a prevenir atenuar o curar enfermedades o plagas en animales o plantas.

e) ARBORICIDAS. Producto químico o químico-biológico que se utiliza para la destrucción o eliminación de árboles.

f) MATERIAS PRIMAS. Materiales técnicos, inertes, solventes y emulsificantes que sirven para preparar o fabricar pesticidas, herbicidas, defoliantes y demás productos químicos, biológicos y químico-biológicos para uso agrícola, pecuario o veterinario.

g) PERIODO DE ESPERA. Es el tiempo que debe transcurrir entre la última aplicación de la sustancia tóxica y la cosecha, pastoreo o sacrificio de animales.

Artículo 4. En base a su dosis letal media (DL 50) por vía oral dermal o cualquier otra vía, los productos de que trata este Reglamento se clasifican toxicológicamente en las siguientes categorías:

Categoría I. Extremadamente tóxicos, DL50 menor de 5 mg/kg. de peso.

Categoría II. Altamente tóxico, DL50 de 5 a 50 mg/kg. de peso.

Categoría III. Medianamente tóxicos, DL50 de 50 a 500 mg/kg. de peso.

Categoría IV. Ligeramente tóxicos, DL50 de 500 a 5,000 mg/kg. de peso.

Categoría V. Prácticamente no tóxico, DL50 mayor de 5,000 mg/kg. de peso.

CAPITULO III

DE LA AUTORIDAD Y SUS ATRIBUCIONES

Artículo 5. El Ministerio de Agricultura y Ganadería, que en este Reglamento se denominara "El Ministerio", ejercerá por medio de sus dependencias, además de las señaladas en la "Ley sobre Control de Pesticidas, Fertilizantes y Productos para uso Agropecuario", las siguientes atribuciones:

a) Establecer existencias y realizar inspecciones, extraer muestras en cantidad suficiente de envases sellados, en cualquier momento y lugar, de los productos y materias de que trata el Artículo 1 de este Reglamento, ya sean imprtados, fabricados o formulados en el país, con el fin de determinar si tales productos y materias primas cumplen con los requisitos de calidad y demás condiciones legales y reglamentarias.

b) Elaborar periódicamente a través del Centro Nacional de Tecnología Agropecuaria y del Departamento de Defensa Agropecuadia, en colaboración con los Ministerios de Salud Pública y Asistencia Social, de Trabajo y Previsión Social y de las Empresas Importadoras, Productoras y Distribuidoras de los Productos y Materias de que trata el Art. 1 de este Reglamento, una guía técnica sobre losmismo, relacionando el nombre comercial de cada uno de ellos, su composición química, el uso para el cual están destinados, categoría de su toxicidad, dosis recomendada, precauciones a tomar, el antídoto correspondiente y la empresa que los distribuye.

c) Aprobar por medio del Departamento de Defensa Agropecuaria, las leyendas de las etiquetas adheridas en los envases de productos elaborados; así como los folletos instructivos y propagandísticos, con el fin de comprabar la veracidad de lo declarado con la calidad del producto previamente analizado de acuerdo a los fines que se destine.

Artículo 6. El Ministerio con la intervención técnica del Departamento de Defensa Agropecuaria, cuando lo estime conveniente, muestreos de pesticidas, defoliantes, herbicidas, arboricidas y demás productos de que trata el presente Reglamento y las materias primas que se emplean en la fabricación o formulación de los mismos; dichos muestreos podrá efectuarlos de envases sellados, en el material embodegado, en lugares de distribución o en el que se va a utilizar en el lugar de aplicación. La toma de muestras se realizará de acuerdo a instructivo que para tal fin emitirá el Ministerio a través del Departamento de Defensa Agropecuaria y el Centro Nacional de Tecnología Agropecuaria.

Artículo 7. Con el objeto de evitar daños a personas, animales, cultivos y la contaminación en corrientes o depósitos de agua, lagunas o entradas de mar, fauna, flora y lugares que corran peligros de contaminación, tales como centros de invetigaciones científicas, hospitales, escuelas, mataderos, industrias alimenticias, áreas industriales, lugares públicos o de recreo y demás similares; queda terminantemente prohibido la aplicación de pesticidas u otros productos tóxicos enumerados en este Reglamento, en forma aérea u otra manera que produzca daño o peligro de contaminación en las áreas circunscritas a los lugares mencionados, sin seguir las normas e instructivos que a cada caso se refiere.

Artículo 8. El Ministerio en coordinación con sus dependencias técnicas emitirá los instructivos para capacitar a las personas en la limpieza, manejo y en las demás actividades que habrá que someterse los equipos terrestres y aéreos utilizados en la aplicación de pesticidas, defoliantes, herbicidas, arboricidas, materias primas o cualquier otro tipo de sustancias.

Artículo 9. Todo desecho resultante de la producción, formulación, almacenamiento o de la aplicación de productos, deberán ser neutralizados o destruidos en lugares adecuados, a fin de evitar daños a las personas, flora, fauna y medio ambiente.

Artículo 10. Para los efectos del artículo anterior, el Ministerio instrucirá a sus organismos técnicos para que emitan los instructivos necesarios. Dichos organismos serán también los encargados de supervisar el cumplimiento de la anterior disposición y en caso de constatar infracciones a la misma, el empleado o funcionario que haya sido delegado para la supervisión, levantará el acta correspondiente, la cual será transcrita, según este Reglamento, al Ministerio para la imposición de las sanciones que el caso amerite.

Artículo 11. El Ministerio a través del Departamento de Defensa Agropecuaria regulará la importación, el uso y aplicación de herbicidas, arboricidas y defoliantes en los distintos cultivos. Por ser estos productos especificos para cierta clase de cultivosy que pueden producir otros daños, su uso y aplicación quedará reglamentado por medio de instructivos que al efecto se emitirán.

Artículo 12. El Ministerio por medio del Departamento de Defensa Agropecuaria, será el organismo encargado de ejecutar lo prescrito en el literal "F" del artículo 6 de la Ley.

Artículo 13. El Ministerio a través del Centro Nacional de Tecnología Agropecuaria será el organismo encargado de ejecutar lo prescrito en el literal "G" del artículo 6 de la Ley.

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Artículo 14. En el caso de las existencias de materias primas para produción y producto elaborado; programación de importaciones, exportaciones y precios a que se expenderán o comercializarán dichos productos, las empresas importadoras, productoras, formuladoras, distribuidoras, comercializadoras, y aplicadoras de los productos, deberán permitir trimestralmente dicha información a la Dirección General de Economía Agropecuaria. En complementación de lo anterior, se deberá informar además, sobre las cantidades de producto vendido y el cultivo a que se aplicó cuando sea solicitado por el Departamento de Defensa Agropecuaria.

Artículo 15. Cuando la información solicitada sea referida al aspecto técnico, los fabricantes, importadores, formuladores o distribuidores de los "productos" tendrán que hacer llegar toda la información que sea necesaria o conveniente a las dependencias técnicas que lo soliciten en un tiempo no mayor de 60 días.

CAPITULO IV

DEL REGISTRO E INSCRIPCION DE PRODUCTOS Y MATERIAS PRIMAS

Artículo 16. El Departamento de Defensa Agropecuaria, de conformidad a lo establecido en la Ley de Control de Pesticidas, Fertilizantes y Productos para uso Agropecuario, será el encargado de llevar el Registro de los productos y materias primas a que se refiere el presente Reglamento, siendo éste el organismo encargado de aprobar o denegar su inscripción de conformidad con la Ley y el presente Reglamento, previa consulta a las Dependencias técnicas del Ministerio, que considere necesarios.

Artículo 17. Todo producto deberá estar previamente inscrito, para su comercialización, en el registro que al efecto lleve el Departamento de Defensa Agropecuaria.

Artículo 18. El interesado en el registro de un producto o materia prima, deberá presentar solicitud por escrito, en papel sellado del valor de treinta centavos, dirigida al Jefe del Departamento de Defensa Agropecuaria.

El escrito a que se refiere el inciso anterio deberá ser firmado por el productor, importador o distribuidor del producto o materia prima de que se trate y para efectos de autenticidad, la firma que lo ampare deberá estar previamente registrada en un libro que al efecto llevará el Departamento de Defensa Agropecuaria.

A la solicitud deberá acompañarse:

a) Muestras suficientes para efectos de análisis y ensayos de campo, de acuerdo al Plan de Investigación a que se refiere el Artículo 22 del presente Reglamento.

b) Estandar analítico.

c) Viñeta que se adherirá a los envases.

d) Certificado de análisis en original.

e) Certificado de origen en original.

f) Certificado de libre venta en su país de origen, en original y el cual deberá coincidir con el año en que se solicita la inscripción del producto.

g) Literatura técnica y comercial requerida de acuerdo a instructivos.

h) Metodología de análisis en original.

i) Información sobre las diferentes capacidades del envase en que se comercializará y clase de material de que está hecho el envase.

El estandar analítico deberá ser renovado a requerimiento del Centro Nacional de Tecnología Agropecuaria, o al menos cada seis meses.

Artículo 19. Cuando se trate de productos y materias primas y inscritos y que solo hubiere cambio en su país de origen sin variar su formulación y composición original bastará que el interesado manifieste por escrito la razón de dicho cambio, haciendo referencia al número de registro y estará obligado a acompañar muestras del producto para su análisis de comprobación. De igual forma se procederá, cuando la solicitud se contraiga a cambio de nombre comercial de un producto ya registrado.

Artículo 20. Cuando se trate de productos y materias primas y incritas su reinscripción requerirá solamente la solicitud respectiva de acuerdo a lo establecido en el artículo 14 de la Ley, siempre y cuando estos productos y materias primas conserven las propiedades descritas en su registro inicial y que no hayan sido canceladas en su país de origen o rechazadas por organismos internacionales, debido a susefectos colater[illegible] indeseables para la salud humana y animal para el medio ambiente en general.

Artículo 21. Para aquellos productos que [illegible] comercialicen en su país de origen por ser específicos para cierta [illegible] cultivos y que carecieren de certificado de libre venta el interesado [illegible] ectos de registro en el país, deberá presentar un certificado extendido [illegible] empresa productora en el que conste que el producto está indicado para el uso en la agricultura y que su uso racional no es perjudicial a la salud humana, fauna y flora benéfica. Este certificado deberá estar autenticado por la autoridad Oficial respectiva del país de origen y vigente del año.

Artículo 22. Cuando se tratre de productos o materias primas que no han sido utilizadas en el país, será necesario para su registro llevar a cabo investigaciones de camp; la institución responsable elaborará un presupuesto del costo de la investigación el cual se hará del conocimiento del interesado en inscribir el producto, una vez efectuado el pago respectivo se procederá a ejecutar la investigación.

Estos ensayos de investigación también podrán ser realizados por el interesado a través de sus entes técnicos, quienes presentarán para su aprobación el Plan de Investigación a ofectuarse, a la Oficina responsable, la cual designará a un técnico para la supervisión del plan, si éste fuese aceptado.

En ambos caso, el presupuesto de la investigación deberá los costos en que incurriere la institución, ocasionados por la asignación del técnico para la investigación directa o supervisión. Los ingresos provenientes por este rubro ingresarán a través de la Colecturía Habilitada respectiva.

Artículo 23. Cuando se pretenda comercializar internamente una mezcla de productos ya registrados, con el fin de lograr una mayor eficacia en el control de plagas en forma simultánea, será necesario para su registro el análisis respectivo y de laboratorio, que indique las concentraciones de material técnico declarado, su compatibilidad físico-química, y ensayos de comprobación hechos por el interesado bajo la supervisión de la institución respectiva. Si el producto fuese producido la exportación bastará con el análisis de comprobación para su registro.

Artículo 24. El Ministerio a través del Departamento de Defensa Agropecuaria, exigirá que la documentación que ampara el producto de que se trate, previa la inscripción correspondiente, deberá ser pesentada en el idioma oficial de la República, así como las leyendas de las etiquetas, folletos, instructivos o propagandísticos.

Artículo 25. Los solicitantes de la inscripción de los productos que trata este Reglamento, están obligados a colaborar con las dependencias técnicas del Ministerio respectivo que realizan investigaciones de los alcances de la contaminación ambiental y los residuos tóxicos que pudiesen resultar de su aplicación.

Artículo 26. Los análisis o pruebas que deberán efectuarse en las muestras de los productos y materias primas que se solicitan inscribir, serán indicados por el Departamento de Defensa Agropecuaria, previa opinión de las dependencias técnicas del Ministerio encargadas de tales actividades y en base a los resultados obtenidos, el Departamento de Defensa Agropecuaria aprobará o negará la inscripción solicitada.

Artículo 27. Para darle cumplimiento al Artículo 11 de la Ley en lo referente a la denegatroia de inscripción de los productos a que se refiere este Reglamento, el Departamento de Defensa Agropecuaria emitirá el fallo respectivo.

Artículo 28. Para hacer efectivo lo dispuesto en el Artículo 13, de la Ley, el Departamento de Defensa Agropecuaria se asesorará de las dependencias técnicas respectivas del Ministerio. Las investigaciones y fallos de Organismos Internacionales que prohiban el uso de productos en su país de origen o donde se comercialicen, serán pruebas suficientes para que el Departamento de Defensa Agropecuaria proceda a su cancelación.

CAPITULO V

IMPORTACIONES Y EXPORTACIONES

Artículo 29. Para importar productos o materias primas a los que se refiere este Reglamento y que estuvieren registrados, el interesado deberá presentar al Departamento de Defensa Agropecuaria la factura correspondiente para la visa respectiva; la mencionada oficina anotará los datos si guientes: Nombre y cantidad del producto, procedencia, y su valor comercial, unitario y total. Los datos anteriores servirán para los fines que el Ministerio disponga.

Artículo 30. Para los efectos de lo prescrito en el inciso segundo del Artículo 18 de la Ley, el Departamento de Defensa Agropecuaria deberá efectuar los muestreos de los productos y materias primas para efectos de análisis, a costa del interesado.

Artículo 31. Cuando los productos y materias primas de que trata este Reglamento, señalados en el Artículo 19 de la Ley, vengan consignados al Ministerio, la dependencia técnica receptora de dichos productos será el Departamento de Defensa Agropecuaria, quien a su vez lo enviará a la Institución Técnica respectiva.

Artículo 32. Será obligación de los importadores y exportadores presentar a la Dirección General de Economíc Agropecuaria, durante el primer trimestre de cada año, la programación anual de exportaciones e importaciones, y trimestralmente presentar la actualización de los datos, antes mencionados.

Artículo 33. Unicamente mediante autorización del Ministerio de Economía, se podrá exportar los productos y materias primas, debiendo oirse previamente la opinión del Ministerio.

Artículo 34. Cuando de los estudios e investigaciones pertinentes los Ministerios de Agricultura y Ganadería y Economía determinen que es preciso garantizar el abastecimiento interno de los productos y materias primas no se permitirán la exportación de los mismos hasta que no cesaren las condiciones que motivaron su escasez y que además se compruebe que está asegurado dicho abastecimiento.

CAPITULO VI

DE LA PRODUCCION

Artículo 35. El Departamento de Defensa Agropecuaria emitirá opinión sobre la conveniencia o no de autorizar la construcción y funcionamiento de fábricas destinadas a la elaboración de los productos y materias primas, de acuerdo a lo establecido en el Artículo 22 de la Ley; basando su opinión en criterios tales como proximidad a lugares poblados o centros de investigación científica, hospitales, escuelas, rastros o centro de investigación científica, industrias alimenticias, áreas industriales, lugares públicos, de recreo y en la técnica a emplearse para el tratamiento de los residuos o desechos que afectan el medio ambiente, la flora y fauna.

Artículo 36. De conformidad a lo prescrito en el Artículo 23 de la Ley, la dependencia encargada de recomendar modificaciones en el proceso de elaboración de los productos, será el Centro Nacional de Tecnología Agropecuaria, de acuerdo a la investigación efectuada por los diferentes Departamentos que proporcionan asesoría técnica en el manejo de los productos.

Artículo 37. Queda prohibido evacuar subproductos, residuos o desechos que provngan de la elaboración o formulación de los productos, por medio del alcantarillado, de ríos, fuentes o corrientes de agua, lagos, oceános; en consecuencia, toda fábrica de funcionamiento o por funcionar, deberá contar con el procedimiento técnico adecuado para la destrucción o neutralización de estos subproductos, residuos y desechos.

Para los efectos de lo establecido en el Artículo 24 de la Ley, el Ministerio de Agricultura y Ganadería y el Ministerio de Salud Pública y Asistencia Social serán los encargados de vigilar su cumplimiento.

Artículo 38. Prohíbase la formulación, elaboración y distribución de mezcla de pesticidas con fertilizantes realizados en fases sólidas y líquidas.

Artículo 39. Con el objeto de garantizar la calidad de los productos elaborados o formulados, las empresas productoras o formuladoras están obligadas a designar como responsable de producción, un profesional académico en la rama de Química debidamente acreditado por las Universidades Nacionales.

Artículo 40. Con el objeto de garantizar la salud de los trabajadores involucrados en el proceso de producción o formulación de sustancias tóxicas, los Ministerios de Agricultura y Ganadería, Salud Pública y Asistencia Social y de Trabajo y Previsión Social emitirán los instructivos respectivos, previo a su autorización.

CAPITULO VII

DE LA COMERCIALIZACION Y DISTRIBUCION

Artículo 41. Se podrán realizar ventas en envases o envoltorios de cualquier capacidad, los cuales contendrán en las viñetas las indicaciones técnicas, peso y volumen del material contenido, siempre que esté autorizado por el Ministerio de Agricultura y Ganadería a través del Departamento de Defensa Agropecuaria.

Artículo 42. Todo envase que contenga productos químicos y materias primas en forma líquida, deberán llenar los siguientes requisitos: Material resistente al manipuleo normal, impermeable, que no reaccione el productoal entrar en contacto con el envase; si hubiere reacción entre ambos, el envase deberá tener un recubrimiento protector que tenga propiedad plástico-elástica.

Cuando los productos sean en forma de polvo, gránulos, polvos humectables, polvos solubles, el empaque o envase de éstos deberá reunir las siguientes condiciones:

a) Para los que no ofrezcan mayor peligro, por su toxicidad, deberá usarse bolsas o empaques de material resistente, indicando en parte visible que se proceda a su destrucción.

b) Para el caso de los productos clasificados como altamente tóxicos, deberán usarse envases o empaques de material resistente al manipuleo normal y evitar los riesgos para las personas que los manejan.

c) Ningún producto podrá venderse a granel y deberá distribuirse en envases o envoltorios originales debidamente autorizados por el Ministerio a través del Departamento de Defensa Agropecuaria, según lo estipulado en el literal "I" del Artículo 18 del Reglamento, prohibiéndose terminantemente al reenvase y venta en envases o empaques que no están regulados por este Reglamento, so pena de las sansiones que la Ley establece.

Artículo 43. Para los efectos que señalan los Artículos 6 literal "I" y 29 de la Ley, los fabricantes, importadores, formuladores, distribuidores y vendedores de los productos están obligados a nominar en una viñeta situada en parte visible de los envases o envoltorios y en idioma castellace, una leyenda que contenga las indicaciones siguientes: Nombre comercial del producto o marca registrada, indicando su clase, (fungicida, herbicida, pesticida o una mezcla de éstos). Debajo del nobre comercial deberá figurar el nombre común del producto o productos que contega, formulación, composición, cualidades o propiedades, indicando recomendaciones adecuadas para el envasado transporte, manipulación, uso y restriciones, dosificación época e intérvalo de aplicación en plantas y animales de acuerdo con cada plaga o enfermedad a controlar. Nombres comunes y científicos de las plantas y animales a proteger, período de espera, compatibilidad, métodos para preparar el material para las aplicaciones, efectos colaterales del uso del producto o mezcla, descripción de síntomas de intoxicación, dosis sobre antídotos y primeros auxilios, recomendaciones para el médico y otras precauciones, a fin de evitar posibles daños y los consiguientes perjuicios debido a la mala interpretación por quienes los utilice.

Deberá contener además la viñeta, el número de registro oficial del país y fecha de expiración de éste, nombre y dirección del fabricante, formulador, importador, distribuidor envasador o titular del registro que garantice el producto e indicación del lote de producción.

Artículo 44. De acuerdo a la categoría de toxicidad los productos de que se trata en este Reglamento se identificarán de la siguiente manera:

a) Categoría I y II, deberán llevar una calavera con los huesos cruzados, la cual tendrá como mínimo un tamaño del cuatro por ciento del área total de la viñeta. Las palabras "PELIGRO-VENENO".

   Se inscribirán las leyendas "ALTO". Lea la viñeta, "Manténgase alejado de alimentos, personas no responsables y animales domésticos". "En caso de intoxicación llámese a un médico de inmediato". "No almacenar en casas de habitación". El fondo de la viñeta será de color rojo.

b) Categoría III, deberá tener impresa la palabra "CUIDADO" la cual será de un tamaño del tres por ciento del área total de la viñeta. Llevará impresas las mismas leyendas descritas para la categoría I y II. Elfondo de la viñeta será de color amarillo.

c) Categoría IV, llevará la palabra "PRECAUCION" la cual tendrá un tamaño del tres por ciento del área total de la viñeta y las demás leyendas indicadas para la Categoría III.

   La etiqueta será de fondo azul.

d) Categoría V, deberá contener las leyenda "ALTO", Lea la viñeta. "Manténgase alejado de alimentos, personas, no responsables y animales domésticos". "No se aplique en lugares donde se encuentren niños enfermos o animales domésticos".

En caso de aeresoles deberá indicar que no contiene gases que destruyan la capa de oxono y se incluirán la leyendas: "No se aplique cerca de los ojos o llamas".

"No perfore el envase". "No se queme el envase, ni se exponga al calor". El fondo de la viñeta será de color verde.

El tamaño de todas las viñetas deberá ser proporcionado al del envase, en un 10%, a efecto de preservar la visibilidad y deberá colocarse en cada una de éstas, la leyenda "Destruya este envase después de usarlo".

El Departamento de Defensa Agropecuaria será el responsable de determinar los productos que integrarán categoría.

Artículo 45. Queda prohibido ofrecer a la venta productos que no hayan sido registrados en el Departamento de Defensa Agropecuria del Ministerio de Agricultura y Ganadería y productos que hayan expirado. La violación a lo prescrito en este artículo dará lugar a decomiso de los productos a quese hace referencia.

CAPITULO VIII

DE LA APLICACION

Artículo 46. Con el objeto de reducir los efectos de la contaminación ambiental por el uso inadecuado de los pesticidas, defoliantes, herbicidas y demás productos químicos, biológicos y químico-biológicos para uso agrícola y pecuario, el establecimiento deberá ser asistido por un idóneo si el propietario no lo fuera quien será responsable solidariamente con ése.

Artículo 47. Para los efectos del inciso segundo del artículo 26 de la Ley, entiéndase por idóneo la materia, aquellos profesionales graduados de Ingenieros Agrónomos y Agrónomos, quienes deberán registrarse en el Departamento de Defensa Agropecuaria de acuerdo a los requisitos establecidos en los instrucctivos que se emitirán al efecto, y solamente podrán regentear tres agroservicios como máximo.

Queda prohibido que funcionarios del Ministerio, que están directamente involucrados en la aplicación de este Reglamento, ejerzan su calidad de idónoes como regentes de empresas o establecimientos dedicados a la venta de los productos que trata la Ley y este Reglamento.

Artículo 48. Sin perjuicio de la prohibición establecida en el Artículo 32 de la Ley, los productos clasificados como altamente tóxicos serán de uso restringido, en consecuencia, el Departamento de Defensa Agropecuaria, será el encargado de regular su aplicación para cuyos efectos será emitido el instructivo correspondiente.

Artículo 49. La aplicación terrestre ya sea manual o mecánica y la área, de los productos, deberá efectuarse de acuerdo a las siguientes disposiciones.

a) Aplicación Terrestre manual.

Para este caso, todo propietario, empresa agrícola o empresa dedicada a la aplicación de productos tóxicos, deberá proporcionar al operario su equipo de protección básica, el cual estará formado por: un protector de la cabeza, anteojos especiales, mácara con sus respectivos filtros, botas y guantes de hule, así como ropa adecuada, la cual deberá cambiarse diariamente.

Los filtros de las mascarillas deberán desecharse después del tiempo estipulado de acuerdo a su vida útil.

En lo que respecta al equipo de aplicación, éste deberá tener sus empaques y mangueras en óptimas condiciones, con el objeto de evitar derrames que podrían provocar intoxicaciones en el operario.

Para la calibración del equipo a utilizarse y el aseo del mismo por el operario en la aplicación de los pesticidas el Ministerio, por medio de sus dependencias técnicas, emitirá los instructivos correspondientes.

b) Aplicación Terrestre Mecánica.

Para la aplicación por medio de este sistema, se deberá en primer lugar considerar la velocidad y dirección del viento, siendo prohibido aplicar el producto cuando la velocidad del viento exceda a los 12 kilómetros por hora, para lo cual cada agricultor, empresa agrícola o empresa aplicadora de pesticidas, deberá contar con el equipo mínimo necesario para establecer la velocidad y dirección del viento de conformidad a lo indicado por el Departamento de Defensa Agropecuaria.

La bomba que impulsa el líquido deberá de estar en óptimas condiciones para proporcionar la presión adecuada para la aplicación correcta del producto. Los empaques mangueras, válvuals y boquillas del sistema de aplicación deberán estar en tales condiciones que eviten derrames o contaminaciones.

A los operarios encargados de hacer las mezclas y aplicaciones deberá proporcionárseles el equipo de protección personal correspondiente el cual será similar al utilizado en la aplicación terrestre manual.

Las premezclas elaboradas en el lugar de aplicacción deberán agitarse antes de trasegarse a los tanques del equipo de aplicación y tendrán que utilizarse en forma inmediata.

c) Aplicación Aérea.

El aeródromo utilizado como base para aplicación de productos de que trata este Reglamento, deberá llenar los requisitos establecidos por el Departamento de Defensa Agropecuaria emitidos a través del instructivo respectivo. Contará además con equipo para medir la dirección y velocidad del viento.

Se prohibe la aplicación de los productos cuando la velocidad del viento exceda de 8 kilómetros por hora. El aeródromo debe reunir condiciones adecuadas para mezclar los insecticidas y carga de aviones, a fin de evitar que los pesticidas sufran alteraciones. Con este propósito el aeródramo debe contar con un local cubierto destinado al almacenamiento de los envases que contengan pesticidas para protegerlos de la radiación solar directa.

Los tanques de captación de agua situados en los aeródromos, deberán tener una capacidad adecuada a la superficie que se asperja y se contruirá o protegerá con materiales anticorrosivos y pintados de color plateado, para evitar que el calentamiento del agua influya en la estabilidad de la formulación.

El tanque mezclador, deberá construirse bajo techo, con materiales que no se oxiden, tales como: asbesto o fibra de vidrio y en el orificio de salida de éste, deberá colocarse un filtre para que el caldo llegue limpio al tanque del avión.

El almacenamiento de pesticidas deberá ser inmediato a la base de operación y además contará con condiciones que permitan preservar los productos, tales como: piso encementado, aireación adecuada y techo.

Los operarios que trabajen en los aeródromos en las actividades del manejo, mezcla y carga de pesticidas, deberán estar provistos de un equipo de protección dásica similar al prescrito para el operario en la aplicaciOn terrestre manual debiendo reunir los mismos requisitos de seguridad.

El equipo de aspersión de las aeronaves deberá revisarse y preparase con suficiente anticipación y sus características principales serán:

Tanque:

Deberá estar construído con material anaticorrosivo; mantenerse completamente limpio, libre de residuos, suciedades y sustancias contaminantes.

Tener abertura grande para facilitar la inspección, limpieza y reparaciones internas.

Sistema de Agitación:

Deberá revisarse periódicamente para verificar su buen funcionamiento, con elfin de conservar la mezcla homogénea y evitar sedimentaciones del producto a utilizarse.

Bombas:

Deberán estar en óptimas condiciones a fin de mantener presiones constantes y soportar largos períodos de trabajo y ser resistentes a la corrosión, fácilmente reparables y de mantenimiento sencillo.

El cierre deberá ser hermético a manera de no permitir ninguna fuga del líquido por el sistema de aspersión.

Tuberías y Filtros:

Para una eficiente operación del sistema, es esencial que las tuberías, los filtros y mecanismos de succión, se encuentre completamente limpios.

Boquillas:

Todas las boquillas que lleva la aeronave serán del mismo tipo y número para que la aspersión sea homogénea y sometidas a revisión diaria para mantenerlas en óptimas condiciones.

Las boquillas y sus accesorios como son: filtros diafragmas, estrellas y discos se cambiarán cada vez que sea necessario.

El aguilón porta boquillas no deberá cubrir totalmente el fuselaje, sino deberá finalizar dejando completamente una distancia, de un metro en la parte final de ambas alas, para evitar la turbulencia y el arrastre de los productos.

Las boquillas y sus accesorios deben limpiarse diariamente después de utilizadas, guardándolas en solventes para eliminar residuos adheridos.

Canasta Rotativa (Sistema Micronair):

Todas las canastas rotativas que lleve la aeronave, serán del mismo tipo y número para que la aspersión sea homogénea. Deberán revisarse después de cada aplicación, para comprobar su libre acción rotativa y el buen estado de todos sus accesorios.

La limpieza del equipo de aplicación se realizará en la base de operación respectiva. Antes de cada aplicación de pesticidas se calibrarán y revisarán las granduaciones para que todas las canastas rotativas tengan una misma regulación.

La altura del vuelo del avión que realiza la aplicación de pesticidas deberá de ser de dos metros sobre la parte terminal de las plantas; y las horas en que se deberán efectuar dichas aplicaciones serán: en la época lluviosa, entre las seis y media y las diez y media horas y en la época seca, además de las horas señaladas para la época lluviosa, se podrá aplicar entre las quince horas y las diecisiete y mediz horas.

En esta clase de aplicaciones, y para la mejor efectividad, deberá contarse con el auxilio de un grupo de abanderados o abanderilleros, quienes serán personas capacitadas y con experiencia en esta clase de labores. El uso de banderilleros se hará siempre que se apliquen productos no restringidos y de baja peligrosidad para los mismos.

Las banderas empleadas serán de tamaño y color que permitan la mayor visibilidad posible, preferentemente amarillo o rosado fosforescente que contraste con el color verde de la plantación.

El equipo protector del abanderado consistirá en: protector de la cabeza, mascarilla, anteojos especiales, guantes y botas de hule, ropa adecuada, la cual deberá cambiarse diariamente; filtros de las mascarillas desechabls deconformidad a las especificaciones de su vida útil, y además, contar entre el equipo, con dos bandas de color rosado fosforecente, adheridas a su ropa.

Artículo 50. Todo propietario, empresa agrícola o empresas dedicadas al uso y aplicación de los productos están obligados a contar con los medios necesarios para la destrucción o neutralización de los residuos o desechos que quedan después de la aplicación.

Se prohibe además evacuar estos residuos o desechos a través de alcantarillas, canales de drenaje, ríos, quebradas y fuentes de agua.

Artículo 51. En lo referente al literal "F" del artículo 30 de la Ley, se emitirá para tal efecto los instructivos o las indicaciones expresas del Ministerio a través del Departamento de Defensa Agropecuaria.

Artículo 52. En relación al Artículo 31 de la Ley, los Ministerios de Salud Pública y Asistencia Social y el de Agricultura y Ganadería, por medio del Departamento de Defensa Agropecuaria u otras depandecias técnicas de ambos Ministerios velarán por el cumplimiento de lo que establece dicho artículo.

Artículo 53. Con relación al Articulo 32 de la Ley en lo que se refiere a la no aplicación de productos extremadamente tóxicos o de elevada peligrosidad para los usuarios de los mismos, cuando se trata de productos utilizados en el campo agropecuario, el Ministerio de Agricultura y Ganadería por medio del Departamento de Defensa Agropecuaria, indicará que productos o mezclas no deben emplearse; y cuando éstos sean utilizados en actividades que no sean agropecuarias, será el Ministerio de Salud Pública y Asistencia Social, a través de la dependencia técnica que éste designe, la que clasificará como de elevada peligrosidad o extremadamente tóxicos los productos o mezclas.

Artículo 54. De conformaidad a lo prescrito en el Artículo 33 de la Ley, cuando las personas sean dañadas o perjudicadas, en sus personas, propiedades, animales

o cultivos, podrán solicitar al Juez competente de la localidad o a cualquier cuerpo de seguridad pública, que a la mayor brevedad, inicien las investigación e informen al Departamento de Defensa Agropecuaria para la aplicación de la sanción respectiva.

Artículo 55. Para los efectos señalados en el Artículo 34 de la Ley, será el Departamento de Defensa Agropecuaria, la dependencia del Ministerio encargada de investigar y establecer los daños y responsabilidades de que hace mención dicho artículo.

CAPTIULO IX

SANCIONES Y PROCEDIMIENTOS

Artículo 56. Las infracciones a lo prescrito en el presente Reglamento se transmitirán y sancionarán de acuerdo a lo establecido en el Capítulo IX de la Ley.

CAPITULO X

DISPOSICIONES GENERALES Y TRANSITORIAS

Artículo 57. Para el cumplimiento de lo dispuesto en el Artículo 60 de la Ley, se reglamentará de acuerdo a los resultados de análisis que se efectúen en el Centro Nacional de Tecnología Agropecuaria y la Dirección General de Salud del Ministerio de Salud Pública y Asistencia Social.

Artículo 58. Para el cumplimiento de Artículo 61 de la Ley todo elaborador, importado, formulador, distribuidor, alamcenador, transportista, y el que aplica o emplea los productos está obligado a proporcionar las muestras y datos que las dependencias técnicas del Ministerio soliciten en los siguientes aspectos: informes, análisis propaganda, publicidad y cualesquiera otra información requerida para el cumplimiento de la citada Ley y este Reglamento.

Artículo 59. Para efectos del Artículo 66 de la Ley, el Ministerio es la máxma autoridad en lo que se relaciona con la inscripción, exportación, fabricación, formulación, comercialización y uso de los productos y materias primas de que trata este Reglamento.

Artículo 60. Todo propietario, empresa agrícola o empresa dedicada a la importación, producción, venta y aplicación de sustancias tóxicas, está obligado a someter a las personas que trabajan regularmente con los productos mencionados en este Reglamento, a exámenes médicos y de laboratorio en forma periódica, a fin de determinar el grado de contaminación de dichos compuestos en su organismo.

Artículo 61. El Ministerio de Agricultura y Ganadería juntamente con el Ministerio de Salud Pública y Asistencia Social, o por separado deberán formar juntas agromédicas, cuyo objetivo será el de llevar a cabo las investigaciones pertinentes a los efectos colaterales, producidos por los productos mencionados

en el presente Reglamento y todos aquellos objetivos y funciones que por su misma naturaleza les sean atribuidos.

Artículo 62. El Ministerio a través del Departamento de Defensa Agropecuaria, Centro Nacional de Capacitación Agropecuaria, (CENCAP) y otros organismos que al efecto designe, dictarán cursos de capacitación para el personal encargado de manipular y aplicar los productos mencionados en este Reglamento y emitirá previa aprobación del curso, un Diploma de Supervisor o Aplicador Certificado.

Artículo 63. El presente Reglamento estará en vigencia ocho días después de su publicación en el Diario Oficial.

DADO EN CASA PRESIDENCIAL: San Salvador, los veintiún días del mes de mayo de mil novecientos ochenta.

Coronel DEM. Adolfo Arnoldo Majano Ramos

Coronel e Ing. Jaime Abdul Gutiérrez

Dr. José Ramón Avalos Navarrete

Ing. José Napoleón Duarte

Ing. Octavio Orellana Solis
Ministro de Agricultura y Ganadería

Publicado Diario Oficial Nº 101
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30 de mayo de 1980.

APPENDIX 12

LEGALLY REGISTERED AGROCHEMICAL PRODUCTS

PRODUCTOS LEGALMENTE INSCRITOS - EL SALVADOR

HERBICIDAS

NOMBRE COMERCIAL	NOMBRE COMUN	VL50 (mg/kg)
Alanap-L	Naptalae	1770
Alanex	Alachlor	1200
Ametrex	Ametryn	1045
Ametrina 80 P.M.	Ametrina	1045
Amina	2, 4-D	375
Amina	2, 4-D 720 gramos	375
Amina	2, 4-D 6 libras	375
Arsenal	Arsenal	5000
Atranex	Atrazina	3080
Atrazina 80	Atrazina	3080
Avirosam 500 EC	Pirerofos-atrazina	8000
Banvel D	Dicamba	1040
Basagran	Bentazon	1000
Basagran M-60	Bentazon	1100
Basfapon	Dalapon	6500
Butisan S	Metazaclor	2150
Cotoran 500 FW	Fluometuron	6416
Cotoran 80 WP	Fluometuron	6416
Daconate-6	MSMA-C	700
Dicloruro de paraquat 25%	Paraquat	150
Diuron 80 WP	Diuron	3400
DMA-6	2, 4-D	375
Dowpon-M	Dalapon, sales Na y Mg de Dalapon	6500
Dual 960 EC	Metolachlor	2790
Fernoxone	2, 4-D	375
Formunil 3	Propanil	1384
Fusilade	Fluazifop-butil	3328
Gesapax 500 FW	Ametrina	1405
Gesapax 80 WP	Ametrina	1405
Gesaprim 80 FW	Atrazina	3080
Gesaprim 80 WP	Atrazina	3080
Goal - EC	Oxifluorfen	5000
Gramoxone super	Paraquat	150
Gremaron-Y	Paraquat	150
Hedonal 700	2, 4-D	375
Hedonal M 600	2, 4-D	375
Herbaxon	Paraquat	150
Herbax-Lv 30	Propanil	1384
Karmex	Viuron	3400
Latigo	Glifosate	4320

HERBICIDAS (cont.)

NOMBRE COMERCIAL	NOMBRE COMUN	VL50 (mg/kg)
Lazo	Alachlor	1200
Machete	Butaclor	3000
Paraquat	Paraquat	150
Paraquat 300 Gre.	Paraquat	150
Paraquat - 25	Paraquat	150
Patoran	Metobromuron	2500
Pillarxone 42 M	Paraquat	150
Polaris	Glifosine	3925
Prefar 4-E	Bensulide	770
Propoanilo 360	Propanil	1384
Prewl 500 E	Pendimetalin	1250
Guimadiuron 80%	Diuron	3400
Quimatrazina 80% P.S.	Atrazina	3080
Quinquat 25%	Paraquat	150
Roundup	Glifosate	4320
Roustar 25 EC	Oxadiazon	3500
Sencor 70 WP	Metribuzin	2200
Stam LV-10	Prepanil	1384
Stam Tix	Propanil	1384
Surcopur 360 EC	Propanil	1384
Tordon 101	Picloran	8200
Tordon 472	Picloran	8200
U-46-D Fluid 600 grs.	2, 4-D	375
U-46-D Fluid 720 grs.	2, 4-D	375
Velpar	Hexazinona	1690
Velpar L	Hexazinona	1690

INSECTICIDAS

NOMBRE COMERCIAL	NOMBRE COMUN	VL50 (mg/kg)
Abate 1% gr.	Biotion	2030
Abate 500 CE	Biotion	2030
Actellio 50	Pirimisfosmatil	2080
Arrivo 300 CE	Cipermetrina	4030
Arrivo 60 EC	Cipermetrina	4030
Azodrin	Monocrotofos	5
Bactospeine	Bacillus thuringiensis	no tóxico
Basamid granulado	Dazomet	640
Basudin 60 CE	Diazinon	300
Baytex 2% Polvo	Pention	190
Baytroid 100 cc	Ciflutrin	590
Belathion 57 EC	Malathion	1375
Bellotion 4-E	Paration metilico	9
Bellotion 800 CE	Paration metilico	9
Bellotion 800 ULV	Paration metilico	9
Belmark 30%	Fenvalerato	451
Bulldock	Ciflutrin K + L	590
Cogollon 1.5%	Foxim	1680
Counter 10% Gr.	Terbufos	4.5
Counter 2.5% Gr.	Terfufos	4.5
Curacron 500 CE	Profenofos	400
Curater granulado 10%	Carbofuran	8
Curater Gr. 3%	Carbofuran	8
Curater Gr. 5%	Carbofuran	8
Cymbush 25 CE	Cipermetrina	4030
Cytrolane 2%	Mefosfolan	8.9
Decis EC 2.5%	Deltametrina	128
Decis EC 2.7% UBV	Deltametrina	128
Dedevap 50	DDVP	50
Diazigran 2.5 Gr.	Diazinon	300
Diazigran 5% gr.	Diazinon	300
Dipel	Bacillus thuringiensis	no tóxico
Dipterex 95 SP	Triclorfon	450
Disyston Gr. 10%	Disulfoton	2.6 - 12.5
Dominex 75 CE	Alfametrina	4030
Exprolan 250 E	Fosfolan	8.9
Fenon 200 ED	Cipermetrina	4030
Fenovalerato 90N (Blok)	Fenovalerato	450
Folidol 800 ULV	Paration metilico	9
Folidol 900 EC	Paration metilico	9
Folidol M-2 polvo	Paration metilico	9
Folimat 800 SL	Ometoato	50
Folithion 1% polvo	Fenitrotion	490

INSECTICIDAS (cont.)

NOMBRE COMERCIAL	NOMBRE COMUN	VL50 (mg/kg)
Forithion M-800 CE	Paration metilico	9
Gusathion M-250 ECI	Azinfos-metil	11
Halmark 10%	Alfa-esfenvalerato	2/
Karaie	Lombiosialletrina	2/
K-nox-out 2 FM	Diazinon	300
Lannate	Metomil	17
Lannate L	Metomil	17
Larvin 375	Tiodicarb	1600
Lebaycid 500 EC	Fention	190
Lebaycid gr. 5%	Fention	190
Lorsban 2.5% gr.	Clorpirifos	135
Lorsban 4 E	Clorpirifos	135
Lorsban 4 UBV	Clorpirifos	135
Malathion 4 polvo	Malation	1375
Malathion 57 EC	Malation	1375
Malathion 5%	Malation	1375
Malathion 800 EC	Malation	1375
Metacide 480 EC	Paration metilico	9
Metasistox R 500	Oxidemston metil	60
Metasistox R-25	Oxidemston metil	65
Metil parathion 2%	Paration metilico	9
Miral 10 gr.	Isazophos	60
Mocap 10% gr.	Etoprop	62
Morestan 2 DR 1/	Oxitioquinox 2500	2500
Morestan 25 WP	Oxitioquinox	2500
MTD 600	Metamidofos	29.9
Nemacur 10%	Fenamifos	15
Nemacur gr. 5%	Fenamifos	15
Nudrin 24 OE	Metomil	13
Nudrin 90 P.S.	Metomil	13
Nuvacron 60 SCH	Monocrotofos	5
Oftanol gr. 10%	Isofenfos	32
Parathion metilico BOO	Paration metilico	9
Ray-off 125 BC	Flucitrinate	67
Pencap-M	Paration metilico	9
Perfektion	Dimetoeth	225
Pillardrin 72%	Monocrotophos	5
Pillarnate	Metomil	17
Pillaron 73%	Metamidofos	29.9
Pirimor	Pirimicarb	147
Polytrin	Cipermetrina	4030
Quimadrin 5 CSM	Monocrotophos	5
Quimathion M-480 CE	Paration metilico	9

INSECTICIDAS (cont.)

NOMBRE COMERCIAL	NOMBRE COMUN	VL50 (mg/kg)
Quimathion M-800 CE	Paration metilico	9
Quimatox M-6-3 UBV	Paration metilico-canfeclor	9-49
Ripcord 20% CE	Cypermetrina	4030
Sumition	Fenitrotion	490
Supertion M-480	Paration metilico	9
Tamaron 600 EC	Metamidophos	29.9
Tamik 15 gr.	Aldicarb	0.79
Thimet 10%	Forate	2
Thiodan 35%	Endosulfan	40
Thuricide HP	Bacillus thuringiensis	no tóxico
Tokuthion 500 EC	Prothiopos	1000
Unden 20% EC	Propoxur	90
Unden 50% WP	Propoxur	90
Vidate-L	Oxamil	5.4
Volaton 2.5%	Foxim	1680
Volaton 500 EC	Foxim	1680
Volaton 800 ULV	Foxim	1680
Volaton gr. 1.5%	Foxim	1680
Volaton gr. 2.5%	Foxim	1680

1/ Acción insecticida, acaricida y fungicida.
2/ Información no disponible.

FUNGICIDAS Y BACTERICIDAS

NOMBRE COMERCIAL	NOMBRE COMUN	VL50 (mg/kg)
Afugan 30 CE	Pirazofos	151
Agrimycin 100	Estreptomicina	9000
Agrimycin 500	Estreptomicina	9000
Antracol	Propineb	8500
Anvil 5%	Hexaconozole	6071
Bavistin	Carbendazin	15000
Bayfidan 1%, 3%	Triadimenol	700-1200
Bayfidan WB 25	Triadimenol	700-1200
Baylaton 250 ED	Triadimefon	1500
Baylaton WP 25	Triadimefon	1500
Benomilo 50% PM	Benomil	9590
Cobox	Gricloruro de cobre	700
Cobox	Oxicloruro de cobre	700
Cobre nordox 50%	Oxido de cobre	470
Cobre-entranol	Propinab-Hidroxido y oxicloruro de cobre	5000
Cuprevit verde	Oxicloruro de cobre	700
Cuprosan 211 BR	Oxicloruro de cobre	700
Curzate M-C	Cicoxenil	1100
Cycosin 50	Metil tinfameno	7500
Cycosin 70	Metil tinfameno	7500
Dacomil 2787 W-75	Clorotelomil	10000
Delsene 75	Carbendazin	15000
Delsene M-200	Carbendezin-mancozeb	15000-7500
Dithane M-45	Mancozeb	7500
Hidroxido de cobre 50%	Hidroxido de cobre	1000
Hinosan 500 BO	Edifenfos	340
Hinosan TOP 35% MP	Edifenfos	340
Kasumin 2%	Kasumin	22000
Kocide 101	Hidroxido de cobre	1000
Kunulus -3	Azufre	no tóxico
Mancate 200	Mancozab	7500
Morestan 70 (Premezobe)	Oxittioquinox	7500
Oxicloruro de cobre 50%	Oxicloruro de cobre	700
Oxicloruro de cobre	Oxicloruro de cobre	700
Pillartan	Captafol	5000
Pimorstin	Cambendamin	15000
Pomersol WP BO	Thinam	780
Prevensol	Dichlomophen	1050
Rhodan 70 P.M.	Pesstil -	5800
Ridomil MC	Metelaxil -	669-7500
Rizolex	Telolodos - metil	5000
Teets 10K	Tiabendozol	3100
Til 250 50	Propiconezol	1517

APPENDIX 13

PESTICIDES REGISTRATION AND RENEWAL DATES

NÚMERO DE REGISTRO Y FECHA DE VENCIMIENTO

1 - Plaguicidas Agrícolas

NOMBRE DEL PRODUCTO	FABRICADO POR	REGISTRADO POR	REGISTRO	VENCIMIENTO
Azodrin técnico	Shellehemie, Holanda	Shell Química de El Salvador, S.A.	88-4-59	29-4-9
Azodrin S, C. Soluble	AGROPROESA, El Salvador	Shell Química de El Salvador, S.A.	88-4-60	29-4-9
Agrispon (estimulador de crecimiento).	APROPIATE LTD., U.S.A.	AGRITEC El Salvador	88-6-78	9-6-91
Anvil - 5% (Fungicida)	ICI Sopra, Francia	ICI El Salvador	88-6-78	24-6-91
Bayteoid 100 EC	BAYER, El Salvador	BAYER de El Slavador	88-2-7	5-2-91
Belmarck 30 CE	AGROPROESA, El Salvador	Shell Química, S.A.	88-2-28	29-2-91
Belmarck Técnico	Sumitomo Corp, Japón	Shell Química, S.A.	88-2-29	29-2-91
Bulldock Téc.	Bayer AG., Alemania	Bayer de El Salvador	88-3-32	1-3-91
Bayfidan 1% G.	Bayer AG., El Salvador	Bayer de El Salvador	88-5-75	31-5-91
Bayfidan 3% G.	Bayer AG., El Salvador	Bayer de El Salvador	88-5-76	31-5-91
Bayfidan WP 25%	Bayer AG., Alemania	Bayer de El Salvador	88-6-83	20-6-91
Ballotion 800 CE	Agroquímica, Guatemala	Quintegra	88-7-89	4-7-91
Bulldock 012.5 EC	Bayer, El Slavador	Bayer de El Salvador	88-8-102	23-8-91
Caracolicida Bayer	Bayer, El Salvador	Bayer de El Salvador	88-2-8	5-2-91
Cyflutin técnico	Bayer, El Salvador	Bayer de El Salvador	88-8-7	15-1-91
Diptarex 500 SL	Bayer, El Salvador	Bayer de El Salvador	88-1-1	19-1-91
Diazifran 2.5 gr.	Atisa, Guatemala	Profer, S.A.C.V.	88-2-18	25-2-91
Diazingran 5% gr.	Atisa, Guatemala	Profer, S.A.C.V.	88-2-19	25-2-91
Dicrotofos técnico	Ciba grig's, Suiza	Ciba El Salvador	88-5-71	26-2-91
Deltametrina técnica 98%	Rousell Uclaf, Francia	Rousell Uclaf El Salvador	88-5-71	11-5-91
Disyston Gr. 10%	Bayer, El Salvador	Bayer El Salvador	88-8-96	10-8-91
Furadan técnico	F.M.C. Corp., U.S.A.	Moore Comercial S.A.	88-5-77	31-5-91
Halmarck técnico	Sumitomo Hd., Japón	Shell Química S.A.C.V.	88-2-30	29-2-91
Halmarck 40% C.E.	Shell Underland, Holanda	Shell Química S.A.C.V.	88-2-31	29-2-91
Karate	ICI, Inglaterra	ICI El Salavdor	88-8-104	24-8-91
Lebaycid 500 EC	Bayer, El Salvador	Bayer de El Salvador	88-2-9	5-2-91
Melasyxtox R-250 SL	Bayer, El Salvador	Bayer de El Salvador	88-1-2	19-1-91

PLAGUICIDAS AGRICOLAS (cont.)

NOMBRE DEL PRODUCTO	FABRICADO POR	REGISTRADO POR	REGISTRO	VENCIMIENTO
Melasyxtox R-500 SL	Bayer, El Salvador	Bayer de El Salvador	88-2-4	5-2-91
Miral 10 gr.	Ciba greigy, Suiza	Ciba El Salvador	88-2-25	26-2-91
Malathion 57 EC	H.G.S., Dinamarca	Sagrisa	88-3-36	22-3-91
Metabromo 980	Bromine Ltd., Israel	Sagrisa	88-3-37	22-3-91
Marlophen 814	Chemisehe, Alemania	Bayer de El Salvador	88-4-54	22-4-91
M t d 600	Agroquímicas para, Guatemala	Quimica integrada	88-5-65	4-5-91
M t d técnico	Síntesis química, Guatemala	Química integrada	88-5-66	4-5-91
Metanol (alcohol)	Retaloff Co., U.S.A.	Química integrada	88-7-90	4-7-91
Metil cellosalve	Retaloff Co., U.S.A.	Química integrada	88-7-91	4-7-91
Nuvacron 60 Scw	Agroquímicas, Buatemala	Quintegra	88-3-40	22-3-91
Nemacur gr. 10%	Bayer, El Salvador	Bayer	88-8-98	10-8-91
Pillartan 95% Téc.	Pillar International Co., Taiwan	Pillar Co. El Salvador	88-3-42	23-3-91
Profenofos técn.	Ciba Geigy, Suiza	Ciba El Salvador	88-4-45	18-4-91
Pillarmate 95%	Pillar Co., Taiwan	Pillar Co. El Salvador	88-5-68	4-5-91
Pillarmate 95%	Pillar Co., Taiwan	Pillar Co. El Salvador	88-7-93	13-7-91
Peunetrin técnica	ICI Protection, Inglaterra	ICI El Salvador	88-7-94	15-7-91
Preventol D2 (Fungicida, Bactericida)	Bayer, Alemania	Bayer de El Salvador	88-6-84	20-6-91
Paration Metílico Técnico	V.E.B., Alemania	Bayer de El Salvador	88-8-101	23-8-91
Quimation M-800 CE	Químagro S.A.C.V., El Salvador	Quimagro	88-3-43	24-3-91
Quimation M-6-3 UBV	Químagro S.A.C.V., El Salvador	Quimagro	88-3-44	24-3-91
Quimation M-480 CE	Químagro S.A.C.V., El Salvador	Quimagro	88-5-73	20-5-91
Ridomil S gr. (Fungicida)	Ciba geigy, Suiza	Química integrada	88-3-38	22-3-91
Ripcord técnico	Shell Ltd., Inglaterra	Shell Química El Salvador	88-4-61	29-4-91
Ripcord 20% CE	Shell Ltd., Holand	Shell Química El Salvador	88-6-79	17-6-91
Solfac VM 20%	bayer Ag, Alemania	Bayer de El Salvador	88-4-53	22-4-91
Camaron técnico	Mobay Corp., U.S.A.	Bayer de El Salvador	88-2-6	5-2-91
Camaron 59.62%	Bayer, El Salvador	Bayer de El Salvador	88-6-82	20-6-91
Tokuthsón 500 EC	Bayer, El Salvador	Bayer de El Salvador	88-6-80	20-8-91

PLAGUICIDAS AGRICOLAS (cont.)

NOMBRE DEL PRODUCTO	FABRICADO POR	REGISTRADO POR	REGISTRO	VENCIMIENTO
Tokuthsón 1.5% Polvo	Bayer, El Salvador	Bayer de El Salvador	88-6-97	10-8-91
Volatón 1.5%	Bayer, El Salvador	Bayer de El Salvador	88-3-33	10-3-91
Volatón 65% Sol.	Bayer, El Salvador	Bayer de El Salvador	88-6-81	20-6-91
Badistin	Bosf, Alemania	Bosf El Salvador	88-5-70	11-5-91
Cubre corte Bayer	Bayer, El Salvador	Bayer de El Salvador	88-2-5	5-2-91
Cobre antracol	Bayer, El Salvador	Bayer de El Salvador	88-5-62	3-5-91
Gilmore coproxat cloable	Cnemie Linz A., U.S.A.	Profer, S.A.C.V.	88-8-100	23-8-91
Oxicloruro de cobre	Chema chemie, Alemania	Bayer de El Salvador	88-4-55	22-4-91
Q-2000	Química Centroamericana S.A.C.V., El Salvador	Química Centroamericana S.A.C.V.	88-4-58	22-4-91
Gesapx 80 WP	Ciba geigy, Colombia	Ciba El Salvador	88-2-20	26-2-91
Gesaprím 500 FW	Ciba geigy, Colombia	Ciba El Salvador	88-2-21	26-2-91
Gesaprím 50 WP	Ciba geigy, Colombia	Ciba El Salvador	88-2-22	26-2-91
Gesapax	Legtermoet BV, Holanda	Ciba El Salvador	99-2-24	26-2-91
Hedonal 600 SL MCPA	Bayer, Alemania	Bayer de El Salvador	88-2-3	5-2-91
Herbaxon	Agroquímica, Guatemala	Quíntegra	88-3-41	22-3-91
Herbaxon	Moore Comercial, El Salvador	Quíntegra	88-4-57	25-4-91
Herbax LV. 30	Síntesis Química, Guatemala	Quíntegra	88-7-92	4-7-91
Quim Quat 25%	Químagro S.A., El Salvador	Químagro S.A.	88-5-74	20-5-91
Látigo	Mousanto Inc., Guatemala	Monsanto C.A. El Salvador	88-2-10	8-2-91

PLAGUICIDAS DE USO CASERO

NOMBRE DEL PRODUCTO	FABRICADO POR	ORIGEN	REGISTRADO POR	REGISTRO	VENCIMIENTO
"A"					
Autan Espirales	Bayer	El Salvador	Bayer El Salvador	87-3-8	13-3-90
"E"					
Exterminator	Ainsa de C.V.	El Salvador	Ainsa, de C.V.	87-6-15	19-6-90
"F"					
Folition 5%	Bayer	El Salvador	Bayer El Salvador	87-4-13	9-4-90
"M"					
Muritan	Bayer	El Salvador	Bayer El Salvador	87-7-16	3-7-90
"P"					
Prentox Dovp Tec.					
Prentox Piperonyl	Prentiss Corp.	U.S.A.	Drum Lab. S.A. de C.V.	87-3-5	9-3-90
Butoxide Tec.	Prentiss Corp.	U.S.A.	Drum Lab. S.A. de C.V.	87-3-6	9-3-90
Prentox 20% Extracto	Prentiss Corp.	U.S.A.	Drum Lab. S.A. de C.V.	87-3-7	9-3-90
Pynamin Forte	Sumitomo Corp.	U.S.A.	Sumitomo Corp. E.S.	87-4-12	3-4-90
"R"					
Racumin VM 40%	Bayer	Alemania	Bayer El Salvador	97-3-11	27-3-90
"S"					
Solfac WP 10%	Bayer	El Salvador	Bayer El Salvador	87-4-14	9-4-90
"X"					
Xylamon	Bayer	El Salvador	Bayer El Salvador	87-2-4	2-2-90
Xylamon Aerosol	Bayer	El Salvador	Bayer El Salvador	87-3-9	13-3-90
Xylamon Liquido	Bayer	El Salvador	Bayer El Salvador	87-3-10	13-3-90
"A"					
Abate 3% Gr.	Cyanamio Corp.	Costa Rica	American Cyanamiro El Salvador	87-1-18	26-11-90
"B"					
Bayclin Liquido	Bayer	El Salvador	Bayer El Salvador	87-11-17	17-11-90

PLAGUICIDAS DE USO VETERINARIO

NOMBRE DEL PRODUCTO	FABRICADO POR	ORIGEN	REGISTRADOR POR	REGISTRO	VENCIMIENTO
Asuntol Polvo 50%	Bayer	Guatemala	Bayer Quimicas Unidas	86-1-25	21-1-89
Asuntol Polvo 50%	Bayer	El Salvador	Bayer Quimicas Unidas	86-2-4	5-2-89
Asumtol Liquido 20%	Formuquisa	Costa Rica	Bayer Quimicas Unidas	86-8-193	12-8-89
Asuntol Liquido 20%	Bayer	Guatemala	Bayer Quimicas Unidas	86-8-196	1208089
Asuntol Polvo 50%	Formuquisa	Costa Rica	Bayer Quimicas Unidas	86-8-199	12-8-89
Matagusanos	Lafar	El Salvador	Lafar	85-7-302	11-7-88
Matagusanos	Labis	El Salvador	Labis	85-12-473	12-12-88
Matagusanos Unguento	Lab. Flym	El Salvador	Lab. Flym El Salvador	86-1-7	14-1-89
Matagusano Rojo	Brovel	Mexico	Sagrisa	86-11-253	28-11-89
Neguvon Polvo	Bayer	Guatemala	Bayer Quimicas Unidas	86-1-24	21-1-89
Neguvon Polvo	Bayer	El Salvador	Bayer Quimicas Unidas	86-2-9	5-2-89
Neguvont Asuntol	Formuquisa	Costa Rica	Bayer Quimicas Unidas	86-8-192	12-8-89
Neguvon Polvo	Formuquisa	Costa Rica	Bayer Quimicas Unidas	86-8-197	12-8-89

APPENDIX 14

PESTICIDES - PRODUCTS REGISTERED OR RENEWED IN 1990

LISTA DE PLAGUICIDAS DE INSCRIPCION O REINSCRIPCION RECIBIDOS PARA EFECTOS DE CONTROL DE CALIDA. LABORATORIO CONTROL DE CALIDAD DE AGROQUIMICOS CENTA/MAG ENERO/DICIEMBRE 1990

Casa Commercial	Nombre Genérico	Nombre Común	Nombre Según DDA	Acción
ICI El Salvador	Buprofezin	Buprofezin	Applaud 25 wp	Insecticida
ICI El Salvador	Ordram + Propanil	Ordram + Propanil		
ICI El Salvador	Cipermetrina	Cipermetrina	Arrosolo	Herbicida
ICI El Salvador	Permetrina	Permetrina	Cymbush 25	Insecticida
	Tetrametrina	Tetrametrina		
	Pinamín	Pinamín		
ICI El Salvador	EPTC	EPTC	Dragon Sln	Insecticida
ICI El Salvador	Cihalotrina	Cihalotrina	Erradicane	Herbicida
ICI El Salvador	Bensuliole	Bensulide	Icon 5, 10	Insecticida
ICI El Salvador	Pebulate	Pebulate	Prefar 4 E	Herbicide
ICI El Salvador	Clorfuazuron	Clorfuazuron	Tillan	Herbicide
ICI El Salvador	Permetrina	Permetrina	Jupiter	Insecticida
Bayer El Salvador	Neopinamín	Neopinamín	Ambush 10	Insecticida
Bayer El Salvador	Propineb	Propineb	Amplitrin	Insecticida
Bayer El Salvador	Dietiltolvamida	Dietiltolvamida	Antracol	Fungicida
Bayer El Salvador	Dimanin	Dimanin	Autan Líquido	Insecticida
Bayer El Salvador	Faytan	Triadimenol	Bayclean	Bactericida
Bayer El Salvador	Propoxur	Propoxur	Bayfidan Lc 250	Fungicida
Bayer El Salvador	Baylaton	Triadimefon	Baygón	Insecticida
Bayer El Salvador	Bayothrin	Benflutrin	Bayleton 250 EC	Insecticida
Bayer El Salvador	Baytex	Fention	Bayothrin	Insecticida
Bayer El Salvador	Baytroid	Ciflutrin	Baytex	Insecticida
Bayer El Salvador	Metaldehidro	Metaldehidro	Baytroid	Insecticida
Bayer El Salvador	Furadan	Carbofuran	Woprograin	Insecticida
Bayer El Salvador	2-4 D	2, 4-D	Curater, Furadan	Insecticida
Bayer El Salvador	DDVP	Dichlorvos	2, 4 D Amina	Herbicida
Bayer El Salvador	Disulfoton	Disulfoton	DDVP	Insecticida
Bayer El Salvador	Diuron	Diuron	Disyston 10 G	Insecticida
Bayer El Salvador	Fenitrothion	Fenitrothion	Diuron	Herbicida
Bayer El Salvador	Folidol M-2	Metil Paration	Fenitrothion	Insecticida
Bayer El Salvador	Folimat	Ometoato	Folidol M-2	Insecticida
Bayer El Salvador	Fenitrothion	Fenitrothion	Folimat	Insecticida
Bayer El Salvador	Metil-Gusathion	Metilgusathión	Folithion	Insecticida
Bayer El Salvador	Fenthion	Fenthion	Gusation	Insecticida
Bayer El Salvador	Metil paration	Metil paration	Lebaycid	Insecticida
Bayer El Salvador	Metaldehido	Metaldehido	Metacid 480 EC	Insecticida
Bayer El Salvador	Oxicloruro de cobre	Oxicloruro de cobre	Metaldehido	Caracolicida
			Oxicron 50	
Bayer El Salvador	Paraquat	Paraquat		Fungicida
Bayer El Salvador	Paratión metilico	Paratión M.	Paraquat técnico	Herbicida
Bayer El Salvador	Propanil	Propanil	Paratión Metil.	Insecticida
Bayer El Salvador	Racumín	Coumatetralyl	Propanil técnico	Herbicida
Bayer El Salvador	Metribuzin	Metribuzin	Racumín	Rodenticida
Bayer El Salvador	Baytroid	Cyflutrin	Sencor	Herbicida
Bayer El Salvador	Propanil	Propanil	Solfac	Insecticida
Bayer El Salvador	Metamidofos	Metamidofos	Surcopur 360 EC	Herbicida
Bayer El Salvador	Baygon	Propoxur	Tamaron 600	Insectidida
Bayer El Salvador	Baychion	Phoxim	Unden 50 Wp	Insecticida
Bayer El Salvador	Phoxim-Baycarb	Phoxim-Baycarb	Volatón 2.5 y 5%	Insecticida
Bayer El Salvador	Baytroid	Cyflutrin	Xilamon	Anticarcoma
Bayer El Salvador	Metamidofos	Metamidofos	Baytroid	Insecticida
CIBA GEIBY	Fluometuron	Fluometuron	MTD	Insecticida
CIBA GEIBY	Clorofenvinfos	Clorofevinfos	Cotoran	Herbicida
CIBA GEIBY	Azametifos	Azametifos	Esteladon	Insecticida
CIBA GEIBY	Cipermetrina	Cipermetrina	SNIP	Insecticida
	Profenofos	Profenofos		
CIBA GEIBY	Cipermetrina	Cipermetrina	Tambo 400 EC	Insecticida
CIBA GEIBY	Clorofluazuron	Clorofluazuron	Extomin 100 EC	Insecticida
QUIMICA INTEGRADA	Clorpirifos	Clorpirifos	Jupiter 120 EC	Insecticida
QUIMICA INTEGRADA	Cipermetrina	Cipermetrina	Agromil	Insecticida
			Arrivo 60 EC	Insecticida

LISTA DE PLAGUICIDAS DE INSCRIPCION O REINSCRIPCION RECIBIDOS PARA EFECTOS DE CONTROL DE CALDIDA. LABORATORIO CONTROL DE CALIDAD DE AGROQUIMICOS CENTA/MAG ENERO/DICIEMBRE 1990 (cont.)

Casa Commercial	Nombre Genérico	Nombre Común	Nombre Según DDA	Acción
QUIMICA INTEGRADA	Malatión	Malatión	Belatión 57 EC	Insecticida
QUIMICA INTEGRADA	Paratión Metílico	Paratión Metilico	Bellotion 800	Insecticida
QUIMICA INTEGRADA	Clorotalonil	Clorotalonil	Clortesip 75% Pm	Insecticida
QUIMICA INTEGRADA	2, 4-D	2, 4-D	2, 4-D Amina	Herbicida
QUIMICA INTEGRADA	Cipermetrina	Cipermetrina	Dominex Tec.	Insecticida
QUIMICA INTEGRADA	Metamidofos	Metamidofos	MTD 600	Insecticida
QUIMICA INTEGRADA	Monocrotofos	Monocrotofos	Nuvacron 60 SW	Insecticida
QUIMICA INTEGRADA	Propanil	Propanil	Herbac técn.	Herbicida
QUIMICA INTEGRADA	Propanil	Propenil	Propasint LV 30	Herbicida
QUIMICA INTEGRADA	Permetrina	Permetrina	Pounce	Insecticida
QUIMICA INTEGRADA	Trifluralina	Trifluralina	Sinfluoran	Herbicida
QUIMICA HOECHST	Bacillus thuringiense	Bacillus thuringiense	Thuricede Hp	Insecticida de Microbial
QUIMICA HOECHST	Glufosinato de sodio	Glufosinato de sodio	Basta	Herbicida
DUPONT	Bromocil	Bromocil	Hyvarx	Herbicida
Rohnay Haas	Mancozeb	Mancozeb	Dithane M-45	Fungicida
Rohnay Haas	Mancozeb	Mancozeb	Dithane M-II	Fungicida
CARUSA	Decis	Decametrina	Decis	Insecticida
CARUSA	K-Othrine	Deltametrina	K-Otrine	Insecticida
CARUSA	Butox	Decametrina	Butox	Insecticida
CARUSA	Bromadiolona	Bromadiolona	Ramortal Bloques	Rodenticida
CARUSA	Bromadiolona	Bromadiolona	Ramortal Pellets	Rodenticida
MOORE COMERCIAL	Permetrina	Permetrina	Kudos	Insecticida
MOORE COMERCIAL	Banvel	Dicamba-2-4D	Banvel D	Herbicida
Monsanto Centro-Americana	Butaclor	Butaclor	Machete	Herbicida
Monsanto Centro-Americana	Roundup	Glyphosate Isopropylamine Salt	Roundup	Herbicida
BASF DE EL SALVADOR	Basagran	Bentazon	Basagran	Herbicida
BASF DE EL SALVADOR	Dazomet	Dazomet	Basamid granular	Fungicida
BASF DE EL SALVADOR	Carbendazin	Carbendazin	Bavistin F.L.	Fungicida
BASF DE EL SALVADOR	Ronilan	Vinclozolin	Ronilan	Fungicida
BASF DE EL SALVADOR	Dimethoato	Dimethoato	Perfektion	Insecticida
AVELAR HERMANOS	Ametrina	Ametrina	Ametrina	Herbicida
AVELAR HERMANOS	Carbendazin	Carbendazin	Bendazin	Fungicida
AVELAR HERMANOS	Diuron	Diuron	Diuron	Herbicida
AVELAR HERMANOS	Halozifop Metilester	Halozifop Metilester	Galant	Herbicida
AVELAR HERMANOS	Fosforo de Aluminio	Fosforo de Aluminio	Gastión	Insecticida
AVELAR HERMANOS	Mirex	Mirex	Mirenex	Insecticida
AVELAR HERMANOS	Acephate	Acephate	Orthene 95	Insecticida
AVELAR HERMANOS	Fenvalerato	Fenvalerato	Sumicidin	Insecticida
AVELAR HERMANOS	Fenitrothion	Fenitrothion	Sumithion 50 EC	Insecticida
AVELAR HERMANOS	Formaldehidro	Formaldehidro	Formaldegen	Fungicida
AVELAR HERMANOS	Picloran	Picloram-2-4D	Tordon 101	Herbicida
AVELAR HERMANOS	Rizolex	Tolclofos Metil	Rizoles	Fungicida
AVELAR HERMANOS	Oxamyl	Oxamyl	Formunox	Insecticida
AVELAR HERMANOS	Pinamin Porte	Aletrina	Pinamin Forte	Insecticida
AVELAR HERMANOS	Aliette	Phosethyl Al	Aliette	Fungicida
Lab. Avi. El Salvador	Carbaryl	Carbaryl	Opigal 50	Insecticida
Soc. Comercial Agropecuaria	Yodo Libre	Yodo Libre	Vanodine Fam.	Insecticida
Agroquímicas de Centro America	Counter	Terbufos	Forater	Insecticida
Shell Qca. El Salvador	Asana	Esfenvalerato	Halmark	Insecticida
Distribuidora ZABLAH	Propoxur	Propuxur Neopinamin	Raid Aerosol	Insecticida
Profers S.A. de C.V.	Diazinon	Diazinon	Diazinon	Insecticida

APPENDIX 15

BANNED AGROCHEMICAL PRODUCTS

PRODUCTOS QUE HAN SIDO CANCELADOS LOS REGISTROS Y PROHIBIDA LA IMPORTACION Y COMERCIALIZACION EN EL PAIS

PRODUCTO	CLASE	MOTIVO	ANO CANCELADO
DDT	Insecticida	Por los riesgos que implica su suo para la salud humana, así como también por la contaminación ambiental, y de la flora, fauna, aguas corrientes y alimentos, por ser un producto altamente persistente en el ambiente	1980
2, 4, 5 TP (SILVEX)	Herbicida	Por causar efectos Neurotoxicos, teratogénicos y carcinógenos en la salud humana y animal.	1980
2, 4, 5 T (Tribution 600, Esteron 245, Tordon 155, Traxone, Brushkiller, Herbexal DT 480 etc.)	Herbicida	Por causar efectos Neurotoxicos, teratogénicos y carcinógenos en la salud humana y animal	1980
Parathion	Insecticida	Por ser extremadamente toxico para los humanos	1980
Ethilico UBV/ Dimethoato en polvo	Insecticida	Produce efectos de mutación genética, cercinogénicas y Te-ratogénicas.	1980
PCNB (Pentacloronitrobenceno)	Fungicida	Por retiro voluntario de la casa	
Aldrín	Insecticida	Por ser un producto organoclorado persistente en el ambiente y por su alta residualidad, con posibles efectos teratogénicos en el humano	
DIELDRIN	Insecticida	Es un producto organoclorado, persistente en el ambiente y por alta residualidad en los productos de consumo y exportación	
ENDRIN	Insecticida	Es un producto organoclorado, persistente en el ambiente y por alta residualidad en los productos de consumo y exportación	1986

PRODUCTOS QUE HAN SIDO CANCELADOS LOS REGISTROS Y PROHIBIDA LA IMPORTACION Y COMERCIALIZACION EN EL PAIS (cont.)

PRODUCTO	CLASE	MOTIVO	ANO CANCELADO
CHLORDANE	Insecticida	Es un producto organoclorado, persistente en el ambiente y por alta residualidad en los productos de consumo y exportación	1986
HEPTACHLOR	Insecticida	Es un producto organoclorado, persistente en el ambiente y por alta residualidad en los productos de consumo y exportación	1986
CHLORDIMEFORM	Insecticida	Por retiro voluntario de la casa	1987
TOXAFENO	Insecticida	Producto persistente y por su alta residualidad en el ambiente.	1988
CLORANFENICOL	Antibiótico de uso veterinario	Por producir efectos carcinígenos en animales	1988
MANCOZEB		En lista de cancelación	1989

APPENDIX 16

MEMBERS OF APA

FIRMS

AGROCONSA, S.A. de C.V.

AGROPROESA de C.V.

AVELAR HERMANOS, S.A.
BAYER DE EL SALV. S.A.
CIBA GEIGY, S.A.
COMERCIAL AGROPECUARIA
COMISA de C.V.
CRISTIANI BURKARD, S.A.
CYANAMID INTER-AMERICAN C.

EXPRO, S.A.

FMC INTERNATIONAL, S.A.
ICI PANAMERICANA, S.A.
MONSANTO C.A., S.A.
MOORE COMERCIAL, S.A.
QUIMICA HOECHST DEL EL SALV.

QUINTEGRA, S.A.
SAGRISA, S.A.
SAGROS, S.A. de C.V.
SERTESA de C.V.

APPENDIX 17

PROGRAMA "MAJENO SEGURO DE PLAGUICIDAS Y FERTILIZANTES" MSPyF.

ANTECEDENTES

En Agosto de 1986 los Miembros de la Asociación de Proveedores Agricolas, APA, se reunieron en Asamblea General Extraordinaria con el objeto de preparar un plan de Acción para el Manejo y uso adecuado de plaguicidas en beneficio de una mayor protección de la Salud Humana y el Medio Ambiente. Los participantes dieron su apoyo unánime al desarrollo de una campaña para lograr los objetivos propuestos a traves del Programa "Manejo Seguro de Plaguicidas" dirigido por APA.

En Febrero de 1991 con el objeto de ampliar los beneficios del programa se le denomino, "Manejo Seguro de Plaguicidas y Fertilizantes", por la Asamblea General de miembros de APA.

ORGANIZACION

La maxima autoridad la constituye la Asamblea General de miembros de APA, quienes delegan en su Junta Directiva, además se cuenta con una Comisión Asesra del Programa. A nivel Operativo el Programa es dirigido por el Gerente de APA y un coordinador de éste.

OBJETIVOS DEL PROGRAMA

1. - Proteger la Salud Humana y el Medio Ambiente con campañas permanentes sobre el uso racional de los Plaguicidas y Fertilizantes.

2. - Orientar sobre el uso adecuado y eficiente de estos productos.

3. - Procurar mejores rendimientos con el buen uso de los Agroquimicos.

FORMA DE ACCION DEL PROGRAMA

Se desarrolla un plan Educativo y de concientización que comprende las áreas de transporte, almacenamiento y aplicación adecuada para prevenir accidentes de trabjo con estos; asi como primeros auxilios.

Se imparten gratuitamente y sin fines comerciales charlas, Conferencias, Seminarios, etc,. dirigidos a Profesionales y técnicos, estudiantes, distribuidores, agricultores, transportistas, bodegueros y cualquier persona vinculada con la manipulación de Agroquímicos. Se persigue inicialmente capacitar personas que sirvan como agentes multiplicadores y se utilizan a si mismo los medios masivos de comunicación como Prensa radial, escrita y televisada, además se distribuyen afiches, folletos y manuales.

RELACION DEL PROYECTO CON OTROS SIMILARES

Actualmente el Program "Manejo Seguro de Plaguicidas y Fertilizantes" es el unico en su clase que se esta desarrollando en el país.

Si tenemos conocimiento a traves de la Federación Centroamericana y del Caribe de Organizaciones Proveedoras de Insumos Agropecuarios, FECCOPIA, y la Agrupación Internacional de Asociaciones Nacionales de Fabricantes de Productos Agroquimicos, CIFAP, a las cuales APA, pertenece como miembro Activo, que otros paises están llevando a cabo Programas similares, diseñados a las necesidades propias de cada uno de ellos.

PROYECTOS A FUTURO

Para 1992 se a obtenido inicialmente un donativo de ¢ 700.000.00 de fondos AID administrados por SETEFE para el Proyecto de Fortalecimiento al Programa "Manejo Seguro de Plaguicidas y Fertilizantes", con esto se ampliará la cobertura de este Programa que la Asociación de Proveedores Agrícolas esta desarrollando desde 1986.

PROGRAMA "MANEJO SEGURO DE PLAGUICIDAS Y FERTILIZANTES'

RESUMEN DE ACTIVIDADES REALIZADAS

PERIODO AGOSTO/86 - DICIEMBRE/91

1 - REUNIONES

A - 10 AUDIENCIAS CON MINISTROS Y PRESIDENTES DE AUTONOMAS.

B - 20 REUNIONES CON REPRESENTANTES DE ORGANISMOS INTERNACIONALES. BID, AID, FAO, EPA, OIRSA, ROCAP.

C - 60 REUNIONES CON TECNICOS, DOCENTES Y ALUMNOS DE EMPRESAS UNIVERSIDADES E INSTITUTOS AGRICOLAS.

D - 400 REUNIONES CON REPRESENTANTES DE OFICINAS GUBERNAMENTALES, PRIVADAS Y DE SERVICIO.

E - 138 CAPACITACIONES PARA 3.700 PERSONAS.

F - 12 REUNIONES CON REPRESENTANTES DE ORGANIZACIONES AMBIENTALISTAS Y ECOLOGICAS.

G - 8 SEMINARIOS DE PARTICIPACION.

2 - DISTRIBUCION DE MANUALES Y AFICHES

A - 900 MANUALES DE LA EPA
B - 350 MANUALES DE GIFAP
C - 150 MANUALES DE FUSADES.
D - 150 CODIGOS DE CONDUCTA DE LA FAO
E - 6700 AFICHES

3 - PUBLICIDAD POR MEDIO DE PRENSA ESCRITA, HABLADA Y TELEVISADA

A - 28 PUBLICACIONES EN PRENSA ESCRITA
B - 2300 CUÑAS RADIALES
C - 2 PRESENTACIONES EN TELEVISION
D - 1 VIDEO DE 10 MINUTOS

RESUMEN DE CAPACITACIONES SOBRE MANEJO SEGURO DE PLAGUICIDAS Y FERTILIZANTES.

Del 1º de Julio de 1989 al 30 de Diciembre de 1991.

CLASE DE PARTICIPANTES	1989		1990		1991		TOTAL	
	CAPACIT.	ASIST.	CAPACIT.	ASIST.	CAPACIT.	ASIST.	CAPACIT.	ASIST.
1- Agricultores de Cooperativas del sector reformado.	3	39	15	359	9	249	27	647
2-Estudiantes de Agricultaura y Medicina	6	226	6	88	8	313	20	627
3-Lideres Comunales (Promotor de Salud y controladores de Paludismo)	1	28	7	271	8	458	16	757
4-Propietarios y Empleados Agricolas de fincas y haciendas particulares.	7	192	5	166	7	166	19	524
5-Profesionales y Técnicos	7	139	9	228	6	134	22	501
6-Socorristas de la Crúz - Roja Salvadoreña	--	--	10	252	7	186	17	442
7-Empleados de Bodegas y personas que manipulan plaguicidas en las empresas de Agroquimicos.	--	--	10	111	1	6	11	117
8-Propietarios y vendedores de Agroservicios	--	--	--	--	5	66	5	66
9-Empleados de Beneficios de Café	--	--	--	--	1	19	1	19
TOTAL	24	624	62	1479	52	1597	138	3700