THE PROBLEM OF SCALE IN THE VENEZUELAN AGRARIAN REFORM

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IN THE

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by

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TABLE OF CONTENTS

THE PROBLEM OF SCALE IN THE VENEZUELAN AGRARIAN REFORM

INTRODUCTION

Size of the economic unit in agriculture always has been one of the most important problems that research men have found it necessary to face, regardless of the situation and stage of development of the agricultural sector.

Such importance takes root in the fact that in agriculture the size of the firm is one of the determinant factors that influences many important decisions that are made at the farm level.

Farm operators are interested in the nature of returns to scale from the standpoint of profits. The nonfarm population is interested in farm size not only from the standpoint of efficiency but also of political and sociological ends.

It can be said that to choose the correct size is more important to a farmer than to most other businessmen because of the slow turnover of capital in

agriculture and the continuity of farm business, especially as compared to small nonfarm business.

The problem is particularly important in Venezuela where a process of Agrarian Reform is now taking place. The purpose of the Reform is to redistribute land in order to raise the level of living of the "campesino" population, integrating them with the rest of the economy, and making the country self sufficient in the basic crops.

The Agrarian Reform has consisted of a system of land settlements. The government clears the land, builds houses and roads, and in many cases develops irrigation programs. The boundaries of each individual holding are determined in advance in a rather arbitrary way, and once the settlement is established and the parcels distributed, there is not generally any possibility of increasing the amount of land alloted to any farmer due to the structural characteristics of the settlement; this circumstance gives greater dimension to the problem treated in this paper.

I think that at this time, after the first thrust of the Agrarian Reform is over, it is necessary

to halt for evaluating the work already done, and determine the causes of failure that have been observed in some areas. The chief aim of this research is to help in this task.

Objectives of the Study

Using the technique of Simplified Programming, I am going to study one of the settlements of the Agrarian Reform (The Bocono River Settlement), and determine if the size of the individual allotments are sufficient for giving an adequate level of living to the settler, and permit an efficient use of family labor. If the technique used in this paper demonstrates itself practical and adapted to this kind of problem, it will be very helpful for evaluation of work already done and for future settlement projects.

THE VENEZUELAN AGRARIAN REFORM

Antecedents

In Venezuela when the Agrarian Reform was initiated, 74 percent of the farm acreage was in 6,800 farm units.[1] Basically it reflected the organization of society in Spain at the time of the colonization, and the superimposition of this pattern on native crops through large land grants gave origin to the "latifundios." It is the destruction of latifundismo rather than other more positive goals, such as family farming or better land use, that provide the emotional and political purpose of the recent reforms.

The "latifundios" generally consist of large extensive cattle ranches and large commercial farms. These farms are responsive to market factors and have been aided by government credit, price supports, and

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[1] La creacion de Nuevas Unidades Agricolas. Informe del Segundo Seminario Latino-americano sobre Problemas de la Tierra. F.A.O. Chile 1961.

technical assistance. These large size farms usually are mechanized, especially those producing cereal crops and cotton.

On the opposite side, a large part (266,000 units) were of less than five hectares and had 2.2 percent of the agricultural land in the same period.[1] The extraordinarily rapid growth of population in recent decades has aggravated the small farm ("minifundio") problem through further subdivisions. Even though there has been spontaneous migrations into new farming areas, the system of small land holdings has been repeated. Most of the producers are at the margin of the market economy and represent neither a force providing farm commodities to the market nor an effective demand for industrial products. They generally lack not only land but other inputs necessary to raise productivity, and the institutional services such as schools, roads, and hospitals are conspicuously lacking in the minifundio area.

The minifundio type of production unit is commonly called "conuco." This underdeveloped system of agricultural production has the following characteristics:

[1]La creacion de Nuevas Unidades Agricolas. Informe del Segundo Seminario Latino-americano sobre Problemas de la Tierra. F.A.O. Chile 1961.

There is no use of machinery and work animals; all operations depend exclusively on human force. The tools used are very primitive such as machete, axe, and planting stick. No plow is used. Crop rotation is not practiced; the common procedure is to farm the same land 2 or 3 years and when yields decrease the producer moves to another place where he clears the land and starts over again; this primitive slash and burn subsistence farming brings erosion and land depletion. This production unit yields only barely enough for subsistence, so, the peasant in order to complete his diet hunts and fishes. He is also forced to work temporarily as a wage earner in order to get enough for living.

Generally the size of the production unit is of less than five hectares, but this is not the only criterion for defining "minifundio," because the size has to be considered as a function of soil capacity and intensity of use. A farm of five hectares with good land efficiently utilized does not represent a minifundio.

To deal with this agrarian situation and to promote and coordinate the agricultural development of the country, the Agrarian Reform Act was promulgated on March 5, 1960.

Analysis of the Dispositions of the Agrarian Reform Act

Method of Land Acquisition. For purposes of the Act the land owned by the nation, states, and municipalities can be used in the Agrarian Reform, and also privately owned land if the person obtained ownership of it through illicit enrichment while performing public services. Land reserved for urban and industrial development is not included.

When the publicly owned land is insufficient or inadequate, privately owned land may be expropriated if it is not considered to be fulfilling its social function in its present use. The Act defines fulfilling social function as efficient operation, efficient work, and management as well as owner financial responsibility and accomplishment of all provisions concerning work and agricultural contracts. More specifically, privately owned land can be expropriated under the

following conditions: 1) if operated by other than the owner, 2) land suitable for better use that is devoted to extensive cattle production, and 3) uncultivated land.

On the other hand, farms of no more than 150 hectares or its equivalent in inferior land can not be expropriated when they fulfill their social function, except when it is considered necessary for integrated development of the area, or there is not enough public land to meet the demand. In this case the payment is made under the most favorable conditions for the owner.

The normal procedure for expropriation begins with the denunciation of the property, raised by individuals with the right to ask for land endowment. This is followed by a judicial decision through mediation of the National Agrarian Institute, and opportunity is provided for introduction of facts and information. The court decides if the land should be expropriated and tries to reach a compromise regarding the price.

For land appraisal the following factors are considered: 1) average production of the last six

years, 2) declared value for tax purposes, and 3) market price of the farm in the last ten years and of similar farms in the last five years.

The payment is made in cash up to $22,000 (Bs 100,000); beyond that amount, part is paid in cash and part in Agrarian bonds, with proportions varied according the total value.

Principles and Procedures for Land Adjudications. In order to receive land under the Reform Program, the applicant must commit himself to work on his farm, have at the present insufficient land or no land at all. When land is subdivided, the following priorities in endowment are followed: 1) the occupants, renters and colonists that already have been working on the land being subdivided, 2) people that have been displaced from other areas that are in the development process, 3) other family heads according to the number of dependents, 4) young people coming out of the military service, 5) individuals with degrees in Agriculture vocational schools.

Size of Individual Allotment. The Act specifies that the shape and area of the allotments will depend on the agronomic conditions of the area. The main objective is that the individual could perform most of the farm labor by himself and with family help, and that the productive capacity be enough for his economic improvement and productive efficiency. The person may request additional land if he has numerous dependents, and he shows that the plot that he already has is insufficient to support his family and also that he has efficiently worked the allotment that already owns.

The amortization of the property is over 20 or 30 years, but never an annual quantity of more than five percent of the gross receipts from the products raised on the land.

Facts of the Venezuelan Agrarian Reform

There are some special facts of the Venezuela Agrarian Reform that are worth establishing in order to get a clearer view of the situation. It has been estimated that 300,000 farmers will ultimately benefit from the Agrarian Reform. By the end of 1964 71,000

families were already on settlements.[1] The major impact currently tends to be of social nature, making the small producers better consumers and to some extent reducing their migration to tthe cities.

In Venezuela the amount of land in government hands far exceeds the land privately owned, and the Agrarian Reform has been accomplished without violence. In some cases it has been necessary to expropriate land, but compensation has been based on market value and payment made mostly in cash.

From the economic standpoint, it is true that the whole program is costly, but this a product of lack of experience and lack of fiscal control of expenditures, and both can be remedied.

Some of the early settlements have been deserted almost completely, and generally there is a tendency of farmers to abandon their settlements within two or three years. The universality of this problem has been pointed out by Arthur Lewis.[2] He also asserts that acreage per

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[1] Informes Mensuales, (Instituto Agrario Nacional, Caracas, Dec., 1964).

[2] Arthur Lewis, "Thoughts on Land Settlements," Journal of Agricultural Economics (June, 1954). (Reprinted in Agriculture in Economic Development, edited by Carl Eicher and L. Witt, McGraw-Hill, 1964.)

settler is one of the factors on which success or failure depends. He states in the same article that

> Two principles determine how much land the settler should have: (a) it must be enough to make a living; (b) it must not be more than he can cultivate. Most settlement agencies make the mistake of thinking that the latter is more important than the former . . . and so after a while he (the settler) quits.

Settlement Process. During the ten year period prior to the Agrarian Reform Act the colonization agencies managed to settle approximately 10,000 families (one half of them in 1959),[1] making enormous investments in roads, houses, machinery, irrigation, and model villages in a small number of land settlements. These investments benefited relatively few people and looked rather extravagant to foreign observers. Thus, we can read in the report of a mission of the International Bank for Reconstruction and Development in 1960

> . . . the mission considered that the settlement programs in Venezuela to date do not meet the purposes of the Agrarian Reform Act . . . they are of a capital intensive type

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[1] Thomas F. Carroll, "The Land Reform Issue in Latin America" in Latin American Issues edited by Albert Hirschman (New York: The Twentieth Century Fund, 1961).

> and too high cost . . . have benefited relatively few farmers . . . and the contribution to national output has not been commensurate with the expenditures involved.[1]

No attempt was made to develop individual or community initiative or to put the projects on a sound economic basis.

During the first year of the Act the Agrarian Institute granted over 25,000 titles. Initially the expropriations were made on land confiscated from supporters of the dictatorial regime deposed in 1958 under special emergency legislation. Also a large number of land owners were anxious to sell their estates to the National Agrarian Institute at favorable market prices.

Through 1962 the process of expropriations and distribution was carried out at high pace, but in 1963-64 it slowed down due on one hand to technological reasons such as lack of trained technicians, insufficient extension services, shortness of credit and on the other hand to financial limitations.

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[1]The International Bank forReconstruction and Development, The Economic Development of Venezuela (Johns Hopkins Press, 1961).

The agencies in charge of the Reform have considered it necessary to give maximum priority to the social and economic consolidation of the settlements already established. At the end of 1964, land had been granted to 71,000 families in 700 settlements with a total area of 1.8 million hectares.

The new administration plans to grant land to 129,000 families more in the period 1965-1969.

NATURE OF THE SIZE

DETERMINATION PROBLEM

Size determination is the most important task in farm planning, because once established the rest of the farm operations will depend on it.

The good planning of the allotment is a powerful tool for stimulation of the agricultural development, assuring the continuing work of the farmer on his land apportionment, helping also to orient the programs of credit and extension to make maximum contribution to production.

The background information necessary for preparing the plans consists in the knowledge of predominant crops and agricultural practices of the region, as well as services available (credit, extension, schools, roads, and electricity) and availability of production factors and their prices. In the same way, it is indispensable to know the input - output relations of the enterprises considered. Also important in farm planning is the predetermination of the level

of income that is desired to reach for each individual family.

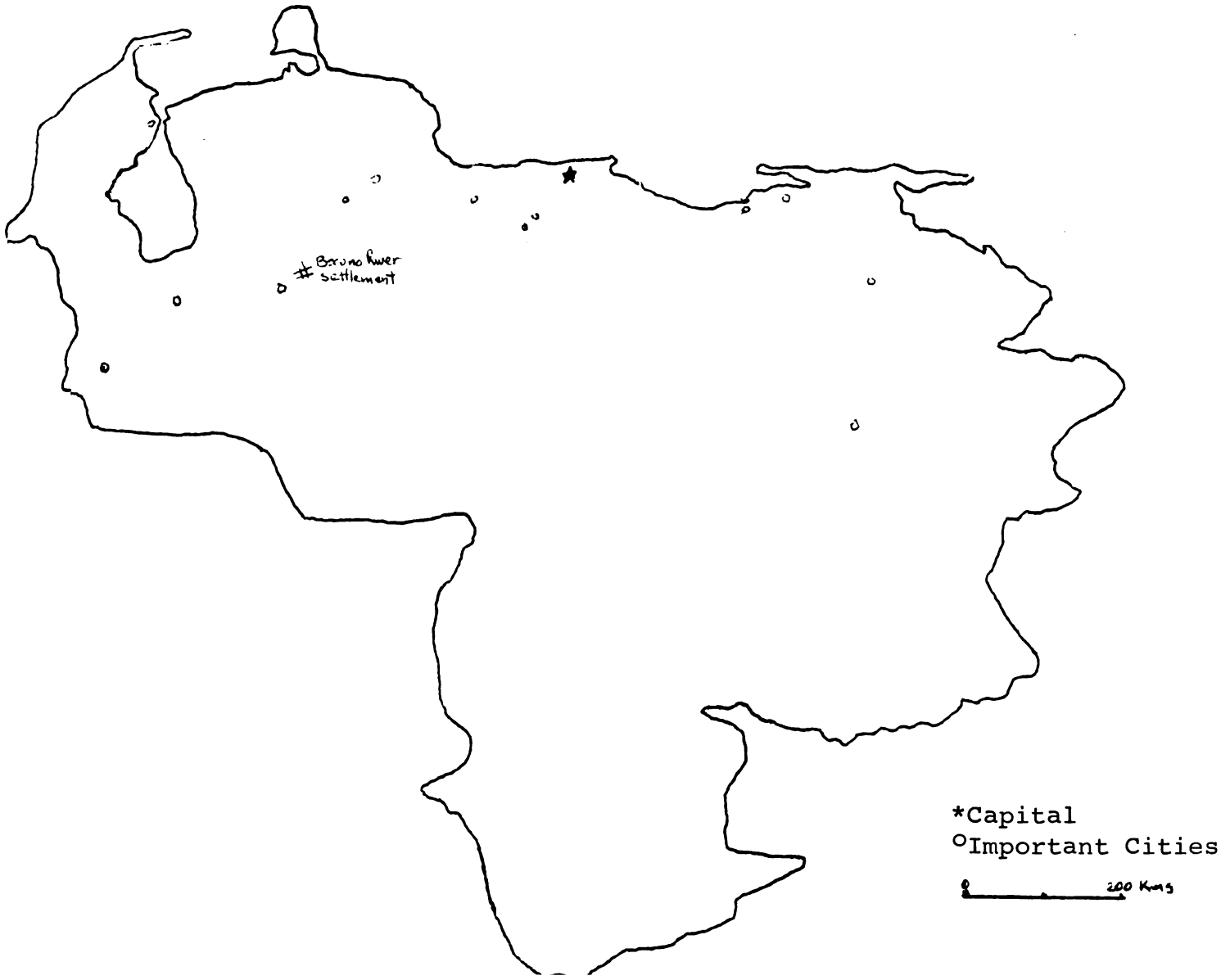
SETTLEMENT TO STUDY

The system used for land distribution in the Venezuelan Agrarian Reform is of land settlements. There are already about 700 of them in different stages of development, devoted to production of various crops and livestock enterprises.

For this study I have chosen the Bocono River Settlement. It is located in Barinas State, between the plains and the Andes in the west part of the country. (See Map 1) It now is in its first stage of development (part of the land has been cleared, the two main irrigation channels have been completed, and the houses are in the process of construction). I had two reasons for choosing this particular settlement; one is that I have good information of that region, and the other is that this settlement is located in an area that is familiar to me, therefore, making it easier to evaluate the feasibility of the obtained results.

Soils in the settlement are of medium fertility, medium texture loams of varied depths. Drainage is

Map 1.--Location of the Bocono River Settlement.



generally not a problem. In general, soil characteristics are highly similar over all the settlement.

Farms for 700 families are being developed. When the project is completed, all the land will be under irrigation. The organization of the settlement is that of individual farms. Each farm will have 10 hectares of land, and each family will be a social and economic unit that will live in its own house and will work on its own allotment. Cooperative services will be formed for obtaining production factors and marketing of products.

The applicability of the results from this study are primarily to the Bocono River Settlement, but other settlements with similar characteristics may use it directly or modified according to the circumstances.

METHOD OF STUDY

The technique used for this study is of Simplified Programming that I think adapts itself most satisfactorily to this kind of study. This technique, using the same principles of Linear Programming,[1] tries to allocate the available resources between the various activities demanding them, in such a way that profits are maximized within limits determined by the bundle of resources available. This method provides a convenient way to determine how to assign limited resources among different opportunities according to designated courses and assumed relationships. It systematizes the process of selecting the most desirable course of action from a number of available courses of action, thereby giving to management information for making better decisions about resourses under control.

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[1]Linear Programming generally refers to the computational method used in prescribing production pattern which maximizes profits of firms, minimizes costs of producing a specified commodity, or related types of aggregative analysis.

Simplified Programming refers to a particular arrangement of the problem information and data, together with special computational steps used in solving the problem under that arrangement. This technique is not very sophisticated, but well adjusted to the needs and also has the advantage that once the basic relationships are obtained, many alternatives may be tested rapidly.

The first step is to establish an objective; in this case it is going to be efficient use of family labor, and obtaining a farm family level of income equivalent to approximately 80 percent of an unskilled factory worker; thus, between Bs 8,000 and Bs 10,000 per year.[1]

The second step is to determine a set of known and definable resource restrictions with the necessary assumptions, in order to keep the problem within the computational bounds of the model. The more closely these assumptions parallel the real world situation, the more accurate and useful will be the results of

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[1] Plan de la Nacion. Oficina Nacional de Coordinacion y Plaificacion. Caracas 1963.

the study. In this case, the resources that are going to be considered as limiting are land and labor; capital is not considered a limiting factor for the types of farming to be considered because enough short term credit will be available, and machinery will be rented from the service center that will be organized on the settlement.

The amount of available land has been already established at 10 hectares. In the case of labor, I computed the monthly labor force available based on: workable days in a year, family composition, and family work capacity. Workable days are obtained by subtracting from total days, Sundays, holidays and estimated heavy rainy days. The average family composition is: head of the family, wife and five children.[1] There are differences in age composition between families, but I consider that they can be generalized in the following way: head of the family would work 8 hours a day at 100 percent effectiveness, wife and children would work 16 hours a day at 50 percent effectiveness. So, we have two workable man-days available in each

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[1] Estudio Sociologico de Bocono. Instituto Agrario Nacional. Caracas 1963.

family unit. The first column in Table 1 shows the monthly amounts of labor expressed in man-days.

The next step is the preparation of a budget for each enterprise to be considered, because we are interested in the amount of each resource per hectare of crop and the net income per unit to be used in planning the farm. The information needed for the enterprise budget and labor requirements was obtained from a survey made by the Central Office of Coordination and Planning,[1] partially checked and adjusted with unpublished material of the National Agrarian Institute[2] and estimations from the Ministry of Agriculture.[3] Variable costs include: seeds, fertilizers, insecticides, fungicides, tractor and other machinery expenses, small tools and supplies, transportation of the products to concentration points or to the market, water use and others. In addition, as protection

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[1] Proyectode Desarrollo integral de Bocono. Oficina Central de Coordinacion y Planificacion. Caracas 1963.

[2] Typed material from Instituto Agrario Nacional. Caracas 1960-62.

[3] Estimados de Costos de Produccion. Ministerio de Agricultura y Cria Caracas 1963.

Table 1.--Resource Situation and Requirements for Enterprises.

Total Available		One Hectare										
		Sesame	Soy-beans	Tobacco[1]	Cotton	Corn May	Corn July	Yucca	Bananas	Beans	Peanuts	Pine-apple
Land	10 ha[2]	1.0	1.0	1.125	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Labor												
Jan	52 md[3]	1.0	-	40.0	8.0	-	-	5.0	7.5	-	8.0	4.0
Feb	48 "	2.0	-	37.0	1.0	-	-	8.0	5.5	-	7.0	7.0
Mar	48 "	-	-	31.0	1.0	-	-	9.0	5.5	-	13.0	6.0
Apr	46 "	-	-	-	7.0	1.0	-	1.0	3.5	-	-	24.0
May	442 "	-	1.0	20.0	-	1.0	-	4.0	2.5	1.0	-	20.0
Jun	42 "	-	1.0	-	-	4.0	-	4.0	6.0	1.0	-	27.0
Jul	40 "	-	2.0	-	-	3.0	2.0	1.0	11.5	4.0	-	20.0
Aug	48 "	-	-	-	-	-	4.0	1.0	8.5	3.0	-	1.0
Sep	44 "	-	2.0	7.0	-	2.0	3.0	-	7.0	2.0	-	1.0
Oct	40 "	1.0	-	20.0	2.0	1.0	-	-	3.0	-	-	3.0
Nov	44 "	1.0	-	29.0	7.0	-	3.0	1.0	7.5	-	1.0	19.0
Dec	52 "	4.0	-	10.0	6.0	-	-	14.0	3.5	-	1.0	20.0
Net Income Bs		272	154	3,942	732	246	325	891	755	413	705	3,692

[1]One hectare of tobacco uses more than one hectare of land because it is necessary to have seedbed and some kind of structures for curing the tobacco leaves.

[2]Hectares

[3]Man-days

against unforeseen circumstances I added ten percent of the current expenses. Fixed costs were not considered because all the machinery is going to be rented, and buildings and land are charged in a lump sum and can not be distributed among the enterprises until the farm plan is made.

Technology level for this settlement will be high compared with the current peasant level of technology (as described in page 5). Tractors, plows and other equipment will replace human force, fertilizers and insecticides--unknown resources before--will be used and irrigation will supplant or supplement the unpredictable rain. But this is still not an optimum level and even it will be lower than the present level of technology on commercial farms. This is understandable if we realize the immense jump that represents the change from the peasant type of farming to this new system. Yet it is expected that when the settlers become familiar with the new techniques, the young people receive training, and research of experimental stations is extended to such problems as fertilization rate and crop rotations, the resources will be employed even more efficiently.

As an example of the specific factors considered, a budget for a selected crop will be shown:

PEANUTS (Current Expenses per hectare)

Item	Amount	Cost Bs/unit	Total Bs
Tractor 50 HP[1]	19 hrs.	10	190
Equipment for:[1]			
Plowing			
Discing			
Furrowing			
Planting			
Cultivating	14 hrs.	2	28
Thrashing	5 hrs.	10	50
SubTotal			268
Fertilizers			
5-10-10	350 Kg	.30	105
Seed	60 Kg	2.75	165
Insecticides	20 Kg	1.50	30
Fungicides	-	-	-
Small tools			25
Sacks[2]	40 units	1.00	10
Transportation to the market[1]	1400 Kg	.04	56
Irrigation water			100
SubTotal			759
Unforeseen			76
Total			835

[1]Provided by cooperative.

[2]Sacks will be used four years.

Yield:	1,400 Kgs/Ha
Price:	1.10 Bs/Kg
Total Income:	1,540 Bs
Net Income:	705 Bs

Crops considered for the farm plan are those that are common to that region along with other profitable crops that have good possibilities. These crops have good marketing potential, existing all of them currently in deficit in Venezuela except tobacco, whose exportation is beginning now. Venezuela imported in 1962, among others, 19,722 metric tons of corn (a metric ton is equivalent to 2,205 pounds), 12,150 m.t. of beans, 21,025 m.t. of sesame and 3,368 of cotton.[1]

Livestock enterprises were not considered due to the following reasons: 1) poultry requires large investments in buildings, equipment and birds, that will make this unpractical because intermediate and long term loans are restricted at the present time; 2) swine have the same problem of requirement of capital and also in recent years there have been problems

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[1] Anuario Estadistico Agropecuario 1962. Ministerio de Agricultura y Cria Caracas 1963.

in the swine market related to the apportionment of packers' pork demand between imported and domestic production; 3) in Venezuela areas larger that 10 hectares are needed for cattle to be profitable.[1]

After the budgets are made, the next step is to elaborate the computational tables. Table 1 shows the resource requirement for hectare of crop. It contains the bundle of resources available (the first column shows 10 hectares of land followed by the labor available per month) and the amount of each resource required per hectare of each enterprise.

Table 2 was prepared by dividing each resource requirement for each crop into the amount of resource available. The lowest number under each enterprise in Table 2 is the maximum amount of that enterprise that can be included in the farm plan. The maximum net income for each crop in this table is determined by multiplying the maximum amount that can be produced by the net income per unit of the enterprise shown in Table 1.

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[1]Beef is produced in large extensions of land with little labor and expenditures, so it is difficult to compete in cost with these conditions.

Table 3 shows the net return per unit of each resource for the enterprise considered. It is obtainable by dividing the amount of each resource per hectare of crop into the net return per hectare of that enterprise.

For planning the farm, another table has to be elaborated, the first row of the table showing the original unused amounts available of each resource. Using Tables 2 and 3, the combination of an enterprise that produces as much farm income as possible from the bundle of resources, would be determined. In this case the number of enterprises and resources considered makes the selection of enterprises a little more complicated, because we face choices of two or more crops that form a circle--one leads to the other successively. In those situations I tried to explore all possible ways in order to be sure to keep in all useful alternatives and give not only the best of them, but several others that could be used as options. To demonstrate the procedure for elaborating the farm plan, I will describe one of the plans made.

Table 2.--Maximum amount of each enterprise.

Total Available	Sesame	Soy-beans	To-bacco	Cotton	Corn May	Corn July	Yucca	Bannanas	Beans	Peanuts	Pine-apple
Land 10 ha	10.0	10.0	8.9	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Labor											
Jan 52 md[2]	52.0	-	1.3	6.5	-	-	10.4	6.9	-	6.5	13.0
Feb 48 "	24.0	-	1.3	48.0	-	-	6.0	8.7	-	6.9	6.9
Mar 48 "	-	-	1.5	48.0	-	-	5.3	8.7	-	3.7	8.0
Apr 46 "	-	-	-	6.6	46.0	-	46.0	13.1	-	-	1.9
May 42 "	-	42.0	2.1	-	42.0	-	10.5	16.8	42.0	-	2.1
Jun 42 "	-	42.0	-	-	10.5	-	10.5	7.0	42.0	-	1.6
Jul 40 "	-	20.0	-	-	13.3	20.0	40.0	3.4	10.0	-	2.0
Aug 48 "	-	-	-	-	-	12.0	48.0	5.6	16.0	-	48.0
Sep 44 "	-	22.0	6.3	-	22.0	14.7	-	6.3	22.0	-	44.0
Oct 40 "	40.0	-	2.0	20.0	40.0	-	-	13.3	-	-	13.3
Nov 44 "	44.0	-	1.5	6.3	-	14.7	44.0	5.9	-	44.0	2.3
Dec 52 "	13.0	-	5.2	8.7	-	-	3.7	14.9	-	52.0	2.6
Max. Net Income	2720	1540	5125	4612	2460	3250	3297	2567	4130	2609	5907

[1]Hectares

[2]Man-days

Table 3.--Return per unit of resource.

	Sesame	Soy-beans	To-bacco	Cotton	Corn May	Corn July	Yucca	Bananas	Beans	Peanuts	Pine-apple
Land	272	154	3,504	732	246	325	891	755	413	705	3,692
Labor											
Jan	272	-	99	92	-	-	178	101	-	86	923
Feb	136	-	107	732	-	-	111	137	-	101	527
Mar	-	-	127	732	-	-	99	137	-	54	615
Apr	-	-	-	105	246	-	891	216	-	-	154
May	-	154	197	-	246	-	223	302	413	-	185
Jun	-	154	-	-	62	-	223	126	413	-	137
July	-	77	-	-	82	163	891	66	103	-	185
Aug	-	-	-	-	-	82	891	89	137	-	3,692
Sept	-	77	563	-	123	108	-	108	206	-	3,692
Oct	272	-	197	366	246	-	-	252	-	-	1,231
Nov	272	-	136	105	-	108	891	101	-	705	194
Dec	68	-	394	122	-	-	64	216	-	705	185

Farm Plan 1. From Table 2 we select the enterprise that gives the greatest maximum net income. In this case that enterprise is pineapple, which gives Bs 5,907 as maximum net income. Before putting this crop in the program, the resource that will limit this enterprise should be determined; June labor limits pineapple production to 1.6 hectares. Table 3 shows that the highest net return per man-day in June is beans. The factors that will limit beans are July labor and land (Table 2). In this case I am going to consider the resource land (other plans may be made considering July labor). Table 3 shows that the highest net return per hectare is pineapple, forming a circle with beans--one directs us to the other. In this case I am going to consider pineapple as the first crop (other plans may be made considering beans as the first crop).

Table 1 is used to determine the hectares that can be used in pineapple, and once this decision is made, it determines the amount of each resource that will be used by that crop.

June labor limits pineapple to 1.5 hectares. The first used row in Table 4a (Farm Plan 1) is computed by multiplying 1.5 hectares of pineapple times the amount of resource used per hectare of pineapple. The amount of each resource required for 1.5 hectares of pineapple is then subtracted from the original unused row of resources to determine the new unused row, which is the amount of each resource left that can be used by other enterprises.

The next step is to refer to Table 2 to determine the enterprise other than pineapple which will give the greatest maximum net income. This enterprise is tobacco. The limiting factors for this crop are January and February labor; let us consider January labor this time. Table 3 shows that the net return per man-day in January is sesame. Land limits this crop, and Table 3 shows tobacco is the crop other than pineapple (already considered) that gives the highest crop net return per hectare. So, I considered tobacco as the second enterprise of this plan.

November labor limits tobacco to .5 hectare. The second used row in Table 4 is computed by multiplying .5 times the amount of resource used per

Table 4a.--Farm Plan 1

	Land	Jan. Labor	Feb. Labor	Mar. Labor	Apr. Labor	May Labor	June Labor	Jy. Labor	Aug. Labor	Sept. Labor	Oct. Labor	Nov. Labor	Dec. Labor	Net Income
Unused	10ha	52.0	48.0	48.0	46.0	42.0	42.0	40.0	48.0	44.0	40.0	44.0	52.0	
Pineapple	1.5	6.0	10.5	9.0	36.0	30.0	40.5	30.0	1.5	1.5	4.5	28.5	30.0	5,538
Unused	8.5	46.0	37.5	39.0	10.0	12.0	1.5	10.0	46.5	42.5	35.5	15.5	22.0	
Tobacco (.5ha)	.6	20.0	17.5	15.5	-	10.0	-	-	-	3.5	10.0	14.5	5.0	1,971
Unused	7.9	26.0	20.0	23.5	10.0	2.0	1.5	10.0	46.5	39.0	25.5	1.0	17.0	
Peanuts	1.0	8.0	7.0	13.0	-	-	-	-	-	-	-	1.0	1.0	705
Unused	6.9	18.0	13.0	10.5	10.0	2.0	1.5	10.0	46.5	39.0	25.5	-	16.0	
Beans	1.5	-	-	-	-	1.5	1.5	6.0	4.5	3.0	-	-	-	620
Unused	5.4	18.0	13.0	10.5	10.0	.5	-	4.0	42.0	36.0	25.5	-	16.0	8,834

hectare of tobacco.

The amount of each resource used by the .5 hectare of tobacco is subtracted from the last unused row of resources to determine the net amount of resources remaining after pineapple and tobacco have been put in the farm plan.

In the same way are determined the other crops --peanuts and beans--that form this farm plan. Net income of this plan is Bs 8,834 using 4.6 hectares of land and practically all May, June, and November labor.

In the other tables, alternatives are explored and farm plans elaborated.

Table 4b.--Farm Plan 2

	Land	Jan. Labor	Feb. Labor	Mar. Labor	April Labor	May Labor	June Labor	July Labor	Aug. Labor	Sept. Labor	Oct. Labor	Nov. Labor	Dec. Labor	Net Income
Unused	10ha	52md	48.0	48.0	46.0	42.0	42.0	40.0	48.0	44.0	40.0	44.0	52.0	
Pineapple	1.5	6.0	10.5	9.0	36.0	30.0	40.5	30.0	1.5	1.5	4.5	28.5	30.0	5,538
Unused	8.5	46.0	37.5	39.0	10.0	12.0	1.5	10.0	46.5	42.5	35.5	15.5	22.0	
Cotton	1.4	11.2	1.4	1.4	9.8	-	-	-	-	-	2.8	11.2	8.4	1,024
Unused	7.1	34.8	36.1	37.6	.2	12.0	1.5	10.0	46.5	42.5	32.7	4.3	13.6	
Peanuts	2.8	22.4	19.6	36.4	-	-	-	-	-	-	-	2.8	2.8	1,974
Unused	4.3	12.4	16.5	1.2	.2	12.0	1.5	10.0	46.5	42.5	32.7	1.5	10.8	
Beans	1.5	-	-	-	-	1.5	1.5	6.0	4.5	3.0	-	-	-	619
Unused	2.8	12.4	16.5	1.2	.2	10.5	-	4.0	42.0	39.5	32.7	1.5	10.8	
Sesame	1.5	1.5	3.0	-	-	-	-	-	-	-	1.5	1.5	6.0	408
Unused	1.3	10.9	13.5	1.2	.2	10.5	-	4.0	42.0	39.5	31.2	-	4.8	9,563

Table 4c.--Farm Plan 3

	Land	Jan. Labor	Feb. Labor	March Labor	April Labor	May Labor	June Labor	July Labor	Aug. Labor	Sept. Labor	Oct. Labor	Nov. Labor	Dec. Labor	Net Income
Unused	10ha	52md	48.0	48.0	46.0	42.0	42.0	40.0	48.0	44.0	40.0	44.0	52.0	
Cotton	6.2	49.6	6.2	6.2	43.4	-	-	-	-	-	12.4	43.4	37.2	4,538
Unused	3.8	2.4	41.8	41.8	2.6	42.0	42.0	40.0	48.0	44.0	27.6	.6	14.8	
Yucca	.4	2.0	3.2	3.6	.4	1.6	1.6	.4	.4	-	-	.4	5.6	356
Unused	3.4	.4	38.6	38.2	2.2	40.4	40.4	39.6	47.6	44.0	27.6	.2	9.2	
Beans	3.4	-	-	-	-	3.4	3.4	13.6	10.2	6.8	-	-	-	1,404
Unused	-	.4	38.6	38.2	2.2	37.0	37.0	26.0	37.4	37.2	27.6	.2	9.2	
Beans[1]	6.2	-	-	-	-	6.2	6.2	24.8	18.6	12.4	-	-	-	2,560
Unused	-	.4	38.6	38.2	2.2	30.8	30.8	1.2	18.8	24.8	27.6	.2	9.2	8,850

[1]Beans uses the same land of cotton. See Table 5.

Table 4d.--Farm Plan 4

	Land	Jan. Labor	Feb. Labor	March Labor	April Labor	May Labor	June Labor	July Labor	Aug. Labor	Sept. Labor	Oct. Labor	Nov. Labor	Dec. Labor	Net Income
Unused	10ha[1]	52md	48.0	48.0	46.0	42.0	42.0	40.0	48.0	44.0	40.0	44.0	52.0	
Peanuts	3.5	28.0	25.9	45.5	-	-	-	-	-	-	-	3.5	3.5	2,467
Unused	6.5	24.0	22.1	2.5	46.0	42.0	42.0	40.0	48.0	44.0	40.0	40.5	48.5	
Yucca	.25	1.25	2.0	2.25	.25	1.0	1.0	.25	.25	-	-	.25	3.5	222
Unused	6.25	22.75	20.1	.25	45.75	41.0	41.0	39.75	47.75	44.0	40.0	40.25	45.0	
Beans	6.25	-	-	-	-	6.25	6.25	25.0	18.75	12.5	-	-	-	2,581
Unused	-	22.75	20.1	.25	45.75	34.75	34.75	14.75	29.0	31.5	40.0	40.25	45.0	
Beans[1]	3.5	-	-	-	-	3.50	3.50	14.00	10.5	7.0	-	-	-	1,445
Unused	-	22.75	20.1	.25	45.75	31.25	31.25	.75	18.5	24.5	40.0	40.25	45.0	
Sesame[2]	6.25	6.25	12.5	-	-	-	-	-	-	-	6.25	6.25	25.0	1,700
Unused	-	16.5	7.6	.25	45.75	31.25	31.25	.75	18.5	24.5	33.75	34.0	20.0	8,415

[1]Beans uses the land of peanut. See Table 5.

[2]Sesame uses the same land of beans. See Table 5.

Table 4e.--Farm Plan 5

	Land	Jan. Labor	Feb. Labor	March Labor	April Labor	May Labor	June Labor	July Labor	Aug. Labor	Sept. Labor	Oct. Labor	Nov. Labor	Dec. Labor	Income
Unused	10ha	52md	48.0	48.0	46.0	42.0	42.0	40.0	48.0	44.0	40.0	44.0	52.0	
Cotton	6.2	49.6	6.2	6.2	43.4	-	-	-	-	-	12.4	43.4	37.2	4,538
Unused	3.8	2.4	41.8	41.8	2.6	42.0	42.0	40.0	48.0	44.0	27.6	.6	14.8	
Beans	3.8	-	-	-	-	3.8	3.8	15.2	11.4	7.6	-	-	-	1,569
Unused	-	2.4	41.8	41.8	2.6	38.2	38.2	24.8	26.6	36.4	27.6	.6	14.8	
Beans[1]	6.2	-	-	-	-	6.2	6.2	24.8	18.6	12.4	-	-	-	2,560
Unused	-	2.4	41.8	41.8	2.6	32.0	32.0	-	8.0	24.0	27.6	.6	14.8	
Peanuts	.3	2.4	2.1	3.9	-	-	-	-	-	-	-	.3	.3	210
Unused	-	-	39.7	37.9	2.6	32.0	32.0	-	8.0	24.0	27.6	.3	14.5	8,877

[1]Beans uses the same land of cotton. See Table 5.

Table 4f.--Farm Plan 6

	Land	Jan. Labor	Feb. Labor	March Labor	April Labor	May Labor	June Labor	July Labor	Aug. Labor	Sept. Labor	Oct. Labor	Nov. Labor	Dec. Labor	Net Income
Unused	10ha	52md	48.0	48.0	46.0	42.0	42.0	40.0	48.0	44.0	40.0	44.0	52.0	
Pineapple	1.5	6.0	10.5	9.0	36.0	30.0	40.5	30.0	1.5	1.5	4.5	28.5	30.0	5,538
Unused	8.5	46.0	37.5	39.0	10.0	12.0	1.5	10.0	46.5	42.5	35.5	15.5	22.0	
Sesame	5.5	5.5	11.0	-	-	-	-	-	-	-	5.5	5.5	22.00	1,496
Unused	3.0	40.5	25.5	39.0	10.0	12.0	1.5	10.0	46.5	42.5	30.0	10.0	-	
Beans	1.5	-	-	-	-	1.5	1.5	6.0	4.5	3.0	-	-	-	619
Unused	1.5	40.5	25.5	39.0	10.0	10.5	-	4.0	41.5	39.5	30.0	10.0	-	
Corn	1.5	-	-	-	-	-	-	3.0	6.0	4.5	-	4.5	-	487
Unused	-	40.5	25.5	39.0	10.0	10.5	-	1.0	35.5	35.0	30.0	5.5	-	8,140

Table 5.--Months in which the crops are on the land.

Crops	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Banana	x	x	x	x	x	x	x	x	x	x	x	x
Beans					x	x	x	x	x			
Corn(May)				x	x	x	x	x	x	x		
Corn(July)							x	x	x	x	x	
Cotton	x	x	x	x						x	x	x
Peanuts	x	x	x								x	x
Pineapple	x	x	x	x	x	x	x	x	x	x	x	x
Sesame	x	x								x	x	x
Soybeans					x	x	x	x	x			
Tobacco	x	x	x	x	x				x	x	x	x
Yucca	x	x	x	x	x	x	x	x	x	x	x	x

Limitations

The main limitations refer to the data; its accuracy will be reflected in the results of the study. The method can not improve the data; in this case the information obtained is believed to be satisfactory for planning purposes.

CONCLUSIONS

In the case under study the size of the plot already established seems fairly adequate. Six alternatives give a net income[1] of more than Bs 8,000 a year (more than the pre-established minimum limit), and in two plans land is not used up but labor exhausted in some critical months. I would not consider these two plans as evidence that the allotment is larger than needed, because in Plan 1 the situation is caused by the cultivation of tobacco. Tobacco has a very high labor demand, and as said before it is an export product whose foreign market is not completely established yet. In the other case (Plan 2) the land not used for crops may be planted to green pasture (leguminous crop plowed in), that in the long run will increase soil fertility.

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[1] This net income does not include amortization of land and house that will be around Bs 200 per year.

In respect to utilization of available labor, there was excess of labor in some months in every plan, but this can be used for repairs, work in small vegetable or fruit gardens, and to take care of some hens or pigs for improving family diet.

It is necessary to make clear that the results obtained for this settlement are valid as long as the labor requirements by enterprise are those established in the study;[1] these requirements are the average with the present improved conditions and level of technology. If more machinery is employed or it is more efficiently used, the man-days per hectare of crop will be lower and consequently each settler will be able to cultivate more land and the net income will increase. This can be true also if the feasibility of work exchange among settlers that have different crop programs are considered, or if the possibility of using hired labor from other areas are considered. In reference to the first prospect, there is no previous experience regarding workability on settlements, but this system

[1]Land in this case is less restrictive than labor, alternatives where explored with land as unlimited factor, but labor was exhausted in critical months and land used only held forth 10.5 hectares.

of work exchange is found among neighbors in many communities. At present very little labor is hired in the settlement areas and the availability of hired workers in the future is questionable.

Taking this into account, it would be desirable where the peasant density permits it to set aside land to permit expansion. The amount of land and the location of parcels within the settlements for permitting flexibility have to be studied. Also it would be appropriate to examine the present Agrarian Act in reference to conditions in which additional land can be granted. At the present, it only contemplates this possibility when the amount of land is considered insufficient but does not make provisions with respect to an optimum economic size. And even admitting that the immediate agrarian problem can be solved with the establishment of a minimum size which raises greatly the net income of the farmers, it is still essential to plan for the future.

As a further point which has general relevance to this study, I think that this technique provides a way for evaluating the pattern of settlements of the

National Agrarian Institute that in most cases had been one of distribution of parcels of three or four hectares. This size was determined arbitrarily and without consideration of the basic principles stated in the Agrarian Reform Act. In some cases this lack of study can be understood due to the pressure for starting the Reform. This could be amended by making studies "a posteriori" and proceeding to reallocate land to farmers, but this has not been done. A real problem is the tendency of the Agrarian Reform agencies to continue the same settlement policy. The technique applied in this study is helpful for planning future settlements and making contributions for improving the present situation.

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