AN ECONOMIC ANALYSIS OF RANGE IMPROVEMENT IN THE CATTLE BREEDING AREA OF BUENOS AIRES PROVINCE

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This is to certify that the

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ABSTRACT

AN ECONOMIC ANALYSIS OF RANGE IMPROVEMENT
IN THE CATTLE BREEDING AREA OF
BUENOS AIRES PROVINCE

By

Jorge Joaquin Giminez Dixon

Beef production has long been a keystone of the Argentine economy. At present it is the single most important activity of her agricultural sector. However, during recent years, the growth in cattle numbers has been rather slow. Research is needed to find ways to increase the productivity of the cattle industry.

One possible means of increasing the growth rate in the cattle industry is the establishment of improved permanent pastures. The objectives of this research were (1) to present an analysis of the conditions under which the installation of improved permanent pastures can be profitable on individual ranches of the cattle breeding area of Buenos Aires province, and (2) to show what technical and economic information is relevant and necessary for an economic evaluation of such investments.

Surveys were obtained from 30 ranches in Ayacucho and Rauch counties of Buenos Aires province. From these data and other published and unpublished sources, two basic systems of beef production were analyzed. The "traditional system" utilized no improved pastures. The

"modern system" utilized various proportions of improved permanent pastures ranging from 5 per cent to 40 per cent.

The analysis examined the profitability of improved permanent pastures with and without the addition of fertilizers and with and without owned equipment. Returns to investments in improved permanent pastures ranged from 5.37 per cent to 7 per cent without the addition of fertilizers and when hiring the work on a custom basis. When owned equipment was used rather than hired contractor services, the internal rate of return ranged from 9.83 per cent to 11.80 per cent without the addition of fertilizers. Under the assumption of fertilization of improved pastures, internal rate of return ranged from 7.23 per cent to 9.8 per cent utilizing custom operators and 8.67 per cent to 11.48 per cent when using fertilizer and owned equipment. Whether the improved pasture was a good investment depended upon the rate of interest charged. If the opportunity cost of money were 12 per cent, none of the investments in improved pasture programs would be profitable. At 8 per cent a number of programs would be profitable.

Several other conclusions were reached. One difficulty with showing a good rate of return for improved permanent pastures is that all cattle sales are made by the head rather than on the basis of weight. While cattle might achieve higher weights on improved

permanent pastures, this could not be taken into account because of the traditional manner in which cattle are sold. Second, the study uncovered a high proportion of ranchers who are absentee owners. The high degree of absentee ownerships suggests that the adoption of new technology may be rather slow. Third, there are other innovations relating to livestock such as improved breeding, fertility tests, sanitation practices, and provision of minerals through which ranch output might be increased with less additional capital outlay than that required for the installation and management of new mixtures of grasses and legumes. Educational efforts on these subjects could be highly productive.

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CHAPTER I

INTRODUCTION

The Pampean region and other fertile lands give Argentina an important position in the world production of beef. Argentina ranks fifth among the countries of the world in existing cattle inventories behind the United States, Russia, Brazil and China. Argentina is the only country in the world where cattle outnumber people two to one. Beef production has long been a ekystone in the Argentine economy, and at present it is the single most important activity of her agricultural sector, contributing nearly one third of the total value of her agricultural output.[1]

The importance of beef cattle production in Argentina stems not only from its size but also from its ability to earn foreign exchange. Argentina continues to be the leading exporter of beef and veal. During the period 1961-1965 the exportation of livestock products amounted to 44.6 per cent of the total value of exports. Beef and veal represent 45.6 per cent of total livestock

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[1]Darrell F. Fienup, Russell H. Brannon, and Frank Fender, Argentina the Sleeping Giant, A Study of the Problems and Opportunities of its Agriculture (Buenos Aires: 1967).

products exported (see Table 1). It is then clear to what extent the beef industry contributes to Argentina's economic growth through the earning of hard currency.

TABLE 1.--Argentina: Value of exports, 1961-65.

Commodity	1961	1962	1963	1964	1965
	Million dollars	Million dollars	Million dollars	Million dollars	Million dollars
Beef and veal	183	211	285	294	282
Pork	3	2	6	4	2
Mutton and lamb	12	14	15	9	13
Wool	142	145	161	129	112
Hides and skins	79	92	78	58	50
Dairy products	32	28	32	31	29
Other livestock products	65	50	88	65	75
Total livestock products	516	542	665	590	563
Grains	217	370	307	526	602
Other crops	171	237	219	169	219
Other exports	60	67	174	125	109
Total exports	964	1,216	1,365	1,410	1,493

Source: Argentina's Livestock and Meat Industry. FAS-M-188. U. S. Department of Agriculture-Foreign Agricultural Service, June, 1967.

Lack of Output Expansion and Levels of Productivity Unchanged

Whereas a critical aspect of Argentina's economic development are her prospects for sales of beef abroad, cattle numbers have failed to achieve any significant

rate of growth. Over a period of 20 years--between 1946 and 1966--cattle numbers increased merely 13 per cent. That Argentina has lagged behind many other countries as far as the increase in cattle population is concerned is shown in Table 2.

TABLE 2.--Cattle population--number of head.

Country	1946	1965	Percentage increase
Argentina	41,300,000	43,000,000	4.1
Brazil	45,600,000	81,500,000	78.7
Uruguay	6,800,000	8,500,000	25.0
Colombia	13,200,000	16,000,000	21.2
United Kingdom	9,600,000	11,679,000	21.6
France	15,100,000	20,155,000	33.5
Italy	6,900,000	8,970,000	30.0
Australia	13,900,000	19,500,000	40.2
New Zealand	4,700,000	6,810,000	44.9
Mexico	12,900,000	28,400,000	120.2
Canada	9,700,000	11,900,000	22.7
United States	82,235,000	107,152,000	30.3

Source: Humberto Volando, "Cattle and Meats in a Crossroad," 1965.

An extensive system of production characterizes the cattle industry in Argentina. Grasses furnish virtually the entire feed supply since under normal conditions no grain or supplements are fed. The Agricultural Census of 1960 indicates that there were 175 million hectares in farms and ranches of which 24 million were devoted to livestock production. Almost 90 per cent of the area in

livestock was covered by unimproved natural pastures. Fienup et al.[2] noted that an insignificant increase in carrying capacity of 4 per cent took place in the total pasture area of the Pampean region between 1935-1939 and 1960-1963. Furthermore, they observed that the constancy of carrying capacity in spite of substantial increase in the seeding of improved pastures over the period points to the fact that the productivity of the natural pastures may actually be decreasing due to overgrazing, especially during dry periods, and the resulting erosion and invasion of weeds. Reca[3] in turn found an absence of technical change in the productivity of pasture in the Pampean region from 1945-1965.

Presently the possibility of incorporating additional land in livestock production in the Pampean region has been exhuasted. As long as cattle and sheep are raised almost exclusively on pasture, an increase in cattle numbers without an improvement in the productivity of the grazing areas can only be attained at the expense of the area planted to crops or by reducing sheep numbers.

On the other hand, it has been estimated that through the establishment of improved permanent pastures,

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[2] Ibid.

[3] Lucio Reca, "The Price and Production Duality Within Argentine Agriculture" (unpublished Ph.D. dissertation, University of Chicago, 1967).

carrying capacity in some large sections of the Pampean region probably could be doubled or even tripled if certain practices were adopted. Thus for example, according to Morgan,[4] in the Pampas the carrying capacity of cattle on natural pastures is 0.6 to 1 animal unit per hectare; on temporary pasture (annual or perennial) 1.2 to 1.8 units; on seeded perennials (including alfalfa) 1.8 to 2.2 units. The latter could reach 2.4 to 3 units with rotational grazing and 3.3 to 3.7 units with the use of supplementary rations of silage, hay or grains.

In an attempt to increase the cattle population and beef production, public encouragement is being offered to producers to improve the productivity of their rangelands through the seeding of artificial pastures. Two Government programs are now under way. The "Program for the Establishment of Mixed Permanent Pastures, the Improvement of Existing Ones, and the Preservation of Forage" was initiated in 1965, under the National Commission for the Promotion of Agriculture (PROAGRO) in cooperation with the National Institute of Agricultural Technology (INTA) and the Bank of the Argentine Nation. The principal aim of this program is to stimulate beef

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[4] Q. Martin Morgan, "Argentina's Livestock and Meat Industry" (Washington, D.C.: U. S. Department of Agriculture, Foreign Agricultural Service, June, 1967).

production by means of a pasture program embodying three main lines of action: (a) the establishment of permanent mixed pastures on an area now covered by natural pastures, (b) the improvement of existing pure alfalfa permanent pastures by converting them into perennial legumes and grasses, and (c) forage preservation either as hay or silage, against normal seasonal periods of scarcity, and fundamentally against the intense droughts which occur rather regularly in certain production areas. In accordance with the estimations made the proposed program would increase the carrying capacity of ranges in the Pampean region from 0.89 to 1.07 animal units per livestock hectare, through the establishment of new permanent mixed pastures on 5,385,000 hectares. These hectares are at present covered by natural pastures. About 6,957,800 hectares presently in pure alfalfa would be improved by conversion into perennial legume and grass mixtures. This represents a real increase of 5,043,340 animal units, which would mean, more specifically, that present cattle numbers would increase by 5,715,785 head and present sheep numbers by 4,728,131.[5] This program will be carried on over a period of five years. The National Commission for the Promotion of

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[5]National Development Council (PROAGRO), Program for the Establishment of Mixed Permanent Pastures, The Improvement of Existing Ones, and the Preservation of Forage, Mimeograph, 1963.

Agriculture in close cooperation with the Bank of the Nation has been extending credits for the seeding of improved pastures. In 1965, loans were given to 5,900 producers for a total value of 1,770 million pesos for seeding of 800,000 hectares to pastures; in the first 8 months of 1966, the loans benefited 7,700 producers and had a value of 3,401 million pesos for the planting of 907,000 hectares.[6]

The "Balcarce Livestock Development Project" prepared by the National Institute of Agricultural Technology (INTA) in cooperation with the National Development Council is designed to be carried out on the cattle breeding area of Buenos Aires Province, integrated by 36 countries. The objective of this program is to increase the cattle population for breeding purposes and their beef production through the establishment of 191,500 hectares of improved mixtures of grasses and legumes and the introduction of new techniques. The program will include a total of 750 ranches where carrying capacity is expected to increase from 0.86 to 1.65 animal units per average improved hectare. The calculations made also anticipate increases in calving rates, which would rise from 75 to 90 per cent (difference between the present and final situation) as regards

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[6]Morgan, op. cit.

cows, and from 65 to 80 per cent for heifers calving for the first time.

Increased calving rates would be forthcoming as a consequence of more adequate feeding of breeding cows resulting from the new pastures as well as from the adoption of improved health practices for the total cattle population of the ranches included in the project. Finally, it has been estimated that liveweight per head of cattle would increase from 170 to 220 kilograms for weaning calves and from 400 to 440 kilograms for culled cows.[7]

At the completion of the program (after a period of five years) beef production on the 750 ranches should increase by 32,485 liveweight tons, which means a 55.7 per cent increase over their present beef production. This program was initiated in 1968.

The Economic Feasibility of Range Improvements

It is indeed possible for Argentine ranchers to increase beef production by way of adding improvements to their rangelands when these result in greater production efficiency. Nevertheless, it is not enough to know that ranges can be improved successfully. A wide

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[7]National Institute of Agricultural Technology, The Balcarce Livestock Development Project, Mimeograph, 1965.

gap between the physically possible and the economically feasible may well exist.

There are a number of ways whereby ranges can be improved and carrying capacity increased. The replacement of native grasses by seeding improved permanent pastures, better fencing, the development of watering facilities, weed control and the fertilization of native and artificial pastures are all practices which have been recommended to Argentine cattlemen to increase the carrying capacity of their rangelands.

In investigating the relative profitability of range improvements, those factors affecting the returns from and the costs of each alternative must be carefully evaluated. Although this is evident, research on range improvement has largely been done on a piecemeal basis in Argentina. The emphasis has been placed in the seeding of mixtures of permanent grasses and legumes in order to increase carrying capacity. Little attention has beeh given to the physical and economic benefits which may result from the adoption of alternative practices to improve ranges. Moreover, costs and returns associated with different levels of intensity have been disregarded.

However, studies on range improvement have been undertaken only very recently. Consequently, definitive

data on rangeland production are very often sketchy, difficult to obtain, or non-existent.

Nevertheless, the nature of the improvements which can be adopted, the size of the project, the different levels of intensity to apply, the responses which may be expected, and how the improved ranges are to be managed are major factors to consider in evaluating the relative profitability of alternative long-term investments on range improvement.

Accurate estimates of the change in total income expected from range improvements and the change in total costs associated with them are necessary but are not sufficient to insure an optimum investment decision. The time aspects of investments must also be taken into account.

On the one hand, if a cattleman does not invest in range improvements, he could invest his funds in other lines. Consequently, the returns foregone elsewhere must be considered when a certain investment is evaluated. On the other hand, the time between incurring cost and realizing benefits may have substantial indirect cost in terms of deferred income or adjustments in ranch operations.

When a range is removed from use due to seeding, the rancher whose stock normally graze it must make some adjustment in his operations. Most ranchers will adjust

by (a) reducing the size of their ranch business so that just enough livestock are kept on the ranch to match the decline in pasture output, (b) leasing additional rangelands, or (c) paying grazing fees to other ranchers.

Operators of small ranches who cannot stand the additional expense of feeding animals displaced by nonuse of the seeded area, nor to afford a reduced income while waiting for the seeded range to be ready for use, may find it impossible to improve their rangelands through the replacement of native grasses with new species.

Whether the adoption of any specific practice will be profitable to an individual rancher depends upon: (1) the output forthcoming with and without the use of the practice, (2) product and factor prices involved, (3) the length of the planning period, and (4) the interest to charge on the money invested.

But even though the analysis indicates that a particular practice may be profitable, we cannot say that a rancher should invest in it as long as there exist alternative ways by which he can increase his profit still further. In other words, a given practice may be a "more" but not the "most" profitable way of improving livestock production.

Only through a comparison of the earning abilities of the various range improvement alternatives can the most profitable course of action be decided upon.

Livestock and Pasture Management

Three main factors determine the nature of the response resulting from the utilization of a pasture: (1) the characteristics of the stand which constitutes the pasture, (2) the kind of livestock or even the class of animals that graze the pasture, and (3) the management of both pasture and animals by an operator.

A range of unimproved native grasses may be highly productive in terms of kilos of livestock or livestock products produced per hectare when managed by an efficient operator whereas the best of artificial pastures may produce little in the hands of a poor operator.

In other words, high yields per animal unit grazed or per hectare devoted to livestock production may result from efficient management of pastures and livestock rather than from the adoption of any particular technology to improve the existing range. An optimal result cannot be expected through good pasture management if the herd is poorly managed or vice-versa.

In the light of the above mentioned an adequate evaluation of the benefits from range improvement can be made only in the context of the total ranch operation.

Furthermore, the use of new technologies by a ranch operator may demand from him a greater management effort than before their adoption. The old saying "the eye of the master fattens the cattle" implies that efficient range and herd management is an art. The increase in the management effort demanded by the introduction of new practices should not be disregarded. It is indeed possible that an investment in range improvement may not appear advantageous to a landlord if as a result of it he must readjust the ranch business that he used to conduct in a completely routinized fashion with much delegation of decisions.

The most relevant relationships which are associated with range improvement have been indicated in order to call attention to the scope and character of the task of a complete economic analysis.

Certainly such an analysis is a formidable but not hopeless task. It can be accomplished as long as sufficient data concerning essential physical and economic relationships are available to permit full application of the principles. Meanwhile, and in the absence of complete information, the principles outlined can be applied to data now existing and to additional data as they are developed.

Objectives of Study

The objectives of this study were:

1. To present an analysis of the conditions under which the installation of improved permanent pastures can be profitable on individual ranches of the cattle breeding area of Buenos Aires province.
2. To show what technical and economic information is relevant and necessary for an economic evaluation of such an investment.

Method of Study

Two basic systems of beef production were analyzed. One is identified as the "traditional system" carried on with no improved permanent pastures. The other is called the "modern system," where cattle are also grazed on improved permanent pastures. A ranching system may be defined as an overall plan by which the range and cattle of a particular type are managed for the entire period during which the animals are raised and/or fattened. Only systems which produce feeder calves (weaning calves) were considered. The study of the cow-calf operations was applied specifically to the conditions of the cattle breeding area of the Pampean region.

Primary data for this study were obtained from a sample of 30 ranchers suggested by county extension

agents of the National Agricultural Technological Institute (INTA), professional agricultural workers and other ranchers. The 30 ranches in the survey were located in the Ayacucho and Rauch counties of Buenos Aires province. Their operators were interviewed by the author in the winter of 1968, when data were obtained for the period from July 1, 1967 to June 30, 1968. All data came directly from the ranchers, their records, or their respective foremen.

With the aid of experienced persons closely acquainted with the beef enterprises of the area the 30 ranches were selected so that: (1) only strictly beef cattle ranches with little or no income from cash crops were included in the sample, (2) one third of the ranches had no improved permanent pastures and two thirds used improved mixtures of permanent grasses and legumes, and (3) the sample included a large proportion of medium-sized ranches of about 2,000 hectares.

A non-probability sampling method was used in selecting the sample. The judgment of experienced persons familiar with beef production in the breeding area of Buenos Aires province was used to choose what was believed to be the best sample for this particular study, given the resources and the time available to conduct the survey.

During the personal interviews held by the author with the operators of the ranches, data were secured relative to the organizational and operating characteristics of the enterprises including: ranch inventories, breeding practices, pasture management and feeding methods, health practices, labor utilization and cattle marketing. Records were also obtained on production data (inputs and outputs) and regarding the cattlemen's attitudes toward the establishment of improved permanent pastures.

The primary data thus obtained were used in establishing the organizational characteristics of ranches, the management systems followed, input-output relationships and most of the values for a budget analysis of a typical ranch unit representing the traditional system of beef production as well as of ranch units under a modern system of production. Data were also gathered from both published and unpublished sources to determine production relationships and to secure relevant cost and price data. Emphasis was placed on collecting both published and unpublished reports of experiments on the effects of range improvement practices conducted by range specialists.

These primary and secondary data were used as a basis for sythesizing model cattle breeding operations. This implies that the conclusions of the analyses

conducted are not for actual operations but result from synthesizing model operations. They represent "potentials" under certain management and other conditions specified for each system.

Standard techniques of partial budgeting were utilized in developing investment and operating capital requirements for the various systems of cattle breeding based on the utilization of different types of pastures.

The empirical data collected provide the basis to analyze and compare the relative profitability of the alternative pasture systems through the evaluation of several hypothetical situations.

Chapter Organization

This study consists of seven parts. In Chapter II basic background information is given about the geographic organization of the cattle industry indicating the location of production in relation to markets. The area selected for study is identified as a part of the entire system, and its fundamental characteristics are determined through different ratios. The organizational structure of ranches within the selected area, size of farms, land use and specialization of enterprises are described. Chapter III contains a description of the "traditional system" of production. Detailed information is given with relation to the organization of

ranches, herd management, pasture management, input data and rates of production. Chapter IV provides similar information regarding the "modern system" of production. In Chapter V, initial costs, yearly maintenance costs, and operating costs associated with pasture improvement are described and analyzed. An evaluation of the profitability of range improvement is given in Chapter VI with the description of the procedure followed for such an analysis. The economic results to be expected with and without the adoption of improved permanent pastures are contrasted. Finally, Chapter VII contains a summary of the findings and the conclusions.

CHAPTER II

THE AREA SELECTED FOR STUDY

Geographic Zones of Production

Argentina stretches 2,150 miles in length from north to south and is, in places, 980 miles wide. Pasture and grazing lands are found in almost all areas of the nation; however, in studying the geography of beef production five main regions can be identified: (1) Northeast, (2) Northwest, (3) East Central, (4) West Central, and (5) South (see Figure 1).

The Northeast

This includes the Argentine Chaco to the west of the Río Paraná and the provinces of Corrientes and Misiones to the east. The Argentine Chaco is a huge area of lowlands covered with scrub, forest and grassy savannas, the trees sometimes impenetrable and sometimes set widely apart on grassland. A vertical line drawn down the center of the Chaco will roughly delimit an eastern area of sufficient rainfall from a western area of deficient rainfall. This is a land of large ranches basically interested in the grazing of cattle but growing crops as a sideline.

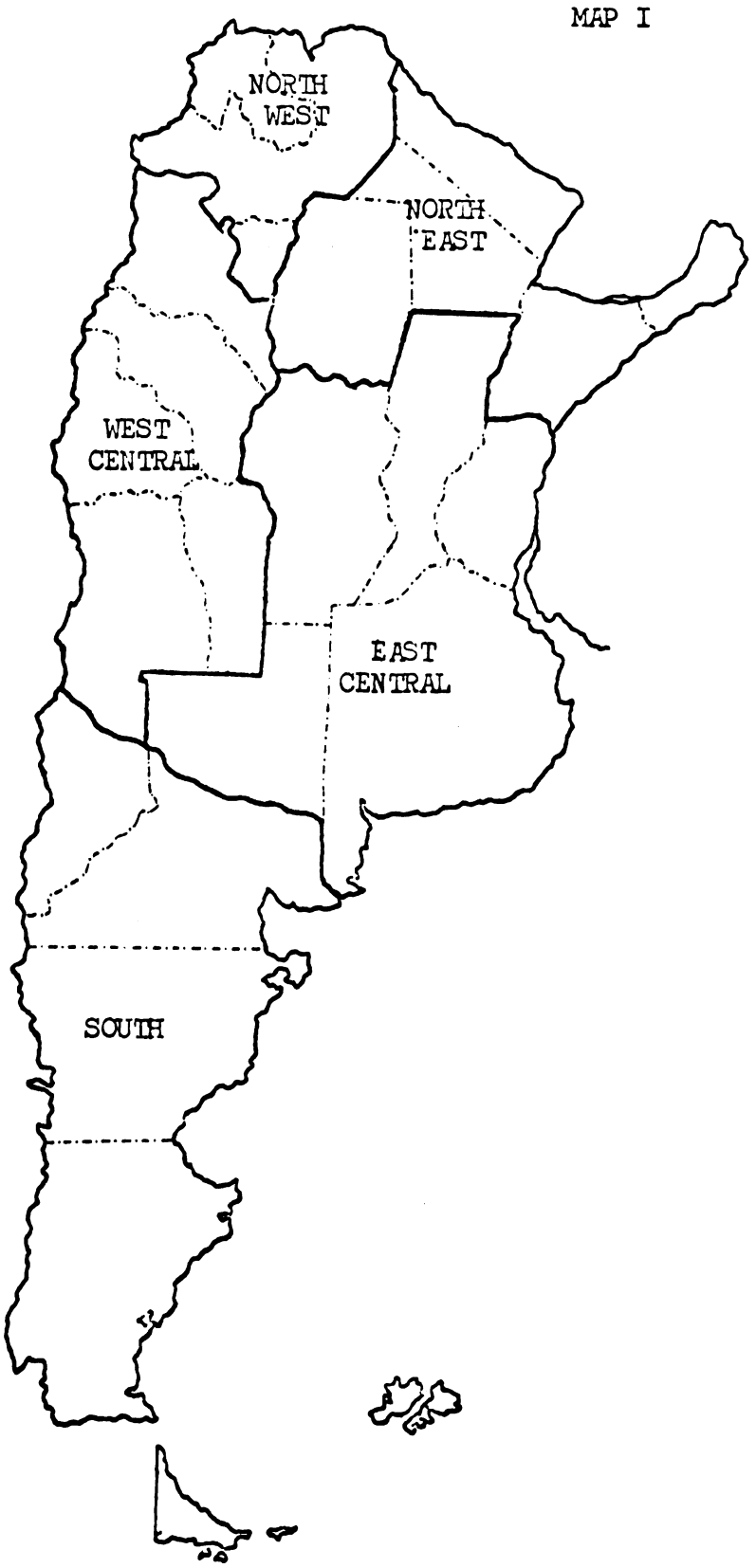

Figure 1. --Beef Production Areas in the Argentine Republic

Between the Rivers Paraná and Uruguay lie the provinces of Corrientes and Misiones. The normal rainfall is 78 inches a year, but the rains are not spread uniformly and drain off so quickly into the swamps that a rainfall of 50 inches, which is not unusual, may be insufficient to prevent drought. Corrientes sometimes suffers from summer drought. The rough pastures are burnt off in spring to rid them of unpalatable grasses. This is also a land of large ranches raising 3.3 million cattle mostly of unimproved breeding in the north portion, but in the south where the grass is better there are improved cattle and over 3 million sheep.

The Northeast region ranks second in cattle numbers, contributing 12.1 per cent to the nation's total (see Table 3).

The Northwest

Included in this zone are a high dry land prolongation into Argentina of the Bolivian Altiplano; broad valleys, forested mountains and, in its eastern boundary, the scrub forest of the Chaco. The provinces of Salta, Jujuy and Tucumán embraced within their limits contained 756 thousand cattle, June 30, 1967.

The East Central Zone

This includes the plains known as the Pampean prairies that stretch over almost the entire province of

TABLE 3.--Rank of regions in number of cattle, on farms and ranches, June 30, 1967.

Region and Province	Number of Head	Per cent
Country's Total	51,227,064	100.0
East Central	42,037,298	82.1
Buenos Aires	20,247,640	39.5
Córdoba	8,288,946	16.2
Santa Fe	6,833,143	13.4
Entre Rios	4,550,569	8.9
La Pampa	2,117,000	4.1
Northeast	6,171,866	12.1
Corrientes	3,338,566	6.5
Chaco	1,164,000	2.3
Formosa	847,300	1.7
Sgo. del Estero	686,100	1.3
Misiones	135,900	.3
West Central	1,869,200	3.6
San Luis	1,151,900	2.2
Mendoza	306,100	.6
La Rioja	221,100	.4
Catamarca	155,500	.3
San Juan	34,600	.1
Northwest	756,800	1.4
Salta	432,900	.8
Tucumán	258,200	.5
Jujuy	65,700	.1
South	391,900	.8
Neuguén	193,300	.4
Rio Negro	121,000	.2
Chubut, Santa Crus, Tierra del Fuego, Antártida e Islas del Atlántico Sur	77,600	.2

Source: National Meat Board, Reseña Anual (Buenos Aires, 1967).

Buenos Aires, the southern halves of Entre Ríos and Santa Fe, the eastern half of Córdoba, and the northeastern part of La Pampa. Very likely no other country in the world possesses such an area of rich black soils where the climate is moderate and the rainfall generally adequate in a continuous chunk of land. The Pampean region is almost as big as Texas and larger than France. The outer limits of the Pampas are no more than 400 miles from the port of Buenos Aires as the crow flies.

The eastern part of this region is usually called the Humid Pampa, and the western part the Dry Pampa. Rainfall averages 36 to 39 inches at the eastern edge of the Pampean region, decreasing to 20 inches at the western boundary. Rainfall in the Humid Pampa is adequate most of the years for the growing of grain crops and the best kinds of forage crops. As a general rule, drought does not constitute a serious probelm even though critical conditions do occur at times in the summer months and affect crops requiring abundant water, such as corn. Wind erosion and aridity are limits to the potential of the Dry Pampa.

The excellence of the breeding cattle in the Pampas is general. The upgrading of the herds began many years ago with the importation of pedigree bulls from England--the first shorthorn was imported in 1827 and the first Aberdeen Angus in 1876. Cattle breeding

operations are concentrated mostly in the eastern part of Buenos Aires province, south of the capital city. Fattening operations predominate in the western portion of the region.

Cattle production is most heavily concentrated in this zone and Buenos Aires, unquestionably, is the center of this concentration. With 82.1 per cent of the cattle and farms and ranches, June 30, 1967, the East Central Zone is by far the major area of beef production in the country (see Table 3). Buenos Aires is the leading province with 39.5 per cent of the total cattle numbers.

Different cattle raising areas within the Pampa region have been identified by grouping the various counties according to their characteristics as favoring (1) breeding, (2) breeding and fattening, and (3) fattening operations, as can be seen in Figure 2, prepared by the National Commission for the Promotion of Agriculture (PROAGRO), which followed the method outlined in CAFADE's Statistical Publication No. 1.[8] The ratio "young steers plus steers divided by cows" was used as an indicator for the final grouping into production areas. Under the hypothesis that all calves born in a given county were

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[8]Comisión Administradora del Fondo de Ayuda Económica (CAFADE), "Beef Production Areas in the Pampean Region - Criteria for Determining Them," Operación Carnes (Buenos Aires: 1959).

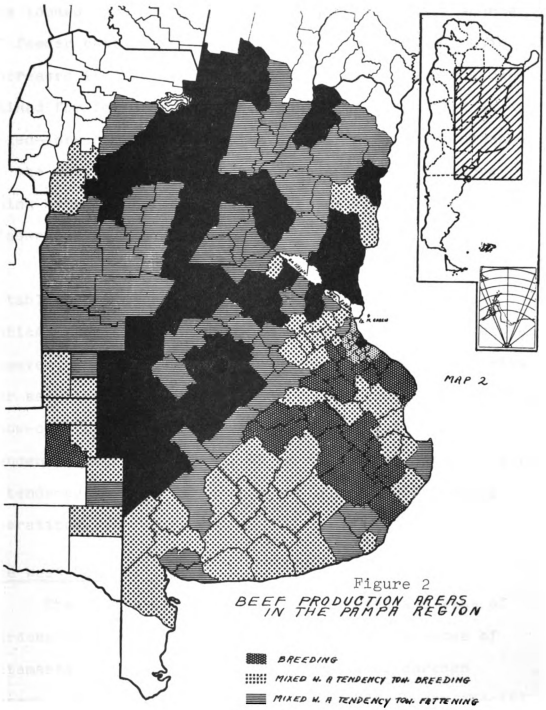
MAP 2
BEEF PRODUCTION AREAS
IN THE PAMPA REGION
BREEDING
MIXED W. A TENDENCY TOW. BREEDING
MIXED W. A TENDENCY TOW. FATTENING
FATTENING
BUENOS AIRES SUBURBAN AREA

Figure 2

sold to be fattened outside the area the ratio would be zero. Hence, when the ratio approximated zero the county was looked upon as a breeding zone, serving as a source of feeder cattle for the fattening area. As the ratio increased it indicated that some animals were being retained for fattening and the county was identified as a mixed--breeding and fattening--area. A further increase of the ratio showed that steers and young steers were being brought in from other areas and the county was classed as a fattening area.

The study made by PROAGRO did not attempt to establish boundary lines for these areas with mathematical precision, which would be practically impossible. However, the following values were set as general limits for each type of operation: 0 to 20%, breeding operation (cow-calf operations); 20 to 40%, mixed activity with a tendency towards breeding; 40 to 60%, mixed activity with a tendency towards fattening; and over 60%, fattening operations.

The West Central Zone

The fourth division south of Tucumán and west of Córdoba includes the Cuyo region and the provinces of Catamarca and La Rioja with their areas of parched desert. The semi-arid and arid areas offer very special problems for livestock production, as they are

characterized by drought and propensity to erosion, but, at the same time have certain ecologic conditions which are suitable for breeding. Within its limits, 1,869,000 cattle were on farms, June 30, 1967.

The South

South of the Río Colorado is the vast plateau known as Patagonia. Most of the land is devoted to sheep raising. There were more than 16 million sheep in the area in 1963. Because of the high winds and insufficient rainfall there is little or no agriculture except in the north, in the valley of the Colorado and Negro rivers. Some cattle are raised in both valleys where irrigation permits the growing of alfalfa; 392 thousand head of cattle were on farms in Patagonia in 1967.

Area Selected for Study

The selection of the area studied was made taking into account the main objective, namely, to analyze under what conditions the installation of improved permanent pastures can be profitable on individual ranches. This implies a comparison of the physical and economic results to be expected from alternative pastures systems--i.e. with and without the use of improved permanent pastures.

Outside the Pampean region the establishment of improved permanent pastures has been recent and very limited in scope. Hence, the necessary data for an

economic evaluation of the new practice is most difficult, if not impossible, to obtain. In the Pampean beef fattening area, ranch operations are usually carried on with the use of improved permanent pastures. Therefore, the installation of improved species of permanent grasses and legumes may be regarded as a common practice, rather than as the adoption of a new technology.

Consequently, the cattle breeding area of the Buenos Aires Province was selected for study. Here the adoption of improved permanent pastures has increased substantially in the last years--from 101 thousand hectares to 271 thousand hectares between 1960 and 1966--but nevertheless a large proportion of ranching operations is still conducted on unimproved native grasses. As pointed out earlier Buenos Aires is the leading province in regard to cattle production with 39.5 per cent of the total cattle numbers.

The area under consideration has a flat topography which encompasses low lands with poor surface and internal drainage. Heavy soils with a high percentage of clay and inadequate drainage are easily flooded, offering few if any possibilities for cash crops. These soils characteristics, most common in the area, limit its usefulness for livestock grazing. Accordingly cow-calf operations and sheep herds are the main productive activities to be found.

The climate of the area is mild though frosts are frequent during winter. Annual rainfall averaged 37 inches in a period of 10 years (from 1957 to 1966). Because of the climatic conditions which prevail there is a shortage of forage in late winter and native grasses have peaks of production in spring and fall so that the number of animals carried in spring would overgraze the same pasture in the summer and winter periods of low production. However this effect can be lessened through the establishment of improved pastures and better management.

The area studied is located in the eastern part of the Buenos Aires province and includes 21 counties. These counties are: Ayacucho, Castelli, Chascomús, Dolores, General Alvear, General Belgrano, General Guido, General Lavalle, General Madariaga, General Paz, Las Flores, Magdalena, Maipú, Mar Chiquita, Monte, Pila, Rauch, Roque Pérez, Saladillo, Tapalque and Tordillo. Each county was selected on the basis of similarity within the area of native vegetation, climate and system of range cattle production.

Although the survey of cattlemen was conducted in Ayacucho and Rauch counties, the ranches of this area are representative of range and ranching conditions extending over all of the counties above mentioned. This can be seen in Table 4 where the main characteristics

TABLE 4.--Basic characteristics of Ayacucho and Rauch counties as compared with 19 other counties of the cattle breeding area of Buenos Aires province, 1966.

Area	Ratio of cash crop area to total area operated	Ratio of livestock area to total area operated	Grazing pastures			Animal Units per Hectare in Livestock	Ratio of Steers plus Young Steers to Cows
			Annual	Perennial	Native		
			Ratio to livestock area				
Ayacucho & Rauch	7.4	89.5	8.9	5.9	85.2	.86	21
Other 19 counties	8.6	83.7	5.8	5.7	88.5	.80	23

Source: Boletín Estadístico de la Provincia de Buenos Aires, Segundo Trimestre, 1967.

that predominate in beef production are given for both counties and the rest of the area.

Statistical Information Related to the Area Selected for Study

Information concerning the number of farms, size distributions and percentages of farms with livestock is given on the basis of the data contained in the National Agricultural Census of 1960. The present status of the area with relation to the use of land, livestock numbers and other fundamental characteristics is based on data contained in publications issued quarterly by the Ministry of Economics of Buenos Aires Province (i.e. Statistical Bulletins Year 1967).

According to the 1960 census data, there were 16,181 farms in the area of which 90 per cent had cattle, 54 per cent had sheep and 36 per cent had hogs. The high percentage of farms with cattle in all the counties clearly indicates the importance of beef production in the area (see Table 5).

Farm numbers and size are shown by both acreage and head of cattle on farms in Tables 6 and 7. The data show that in 1960, 63.3 per cent of the farms covered no more than 200 hectares each, but included only 12.8 per cent of the total agricultural area. On the other hand, from more than 1,000 hectares to 2,500 hectares

TABLE 5.--Percentage of farms reporting livestock by counties and species, 1960.

Census Region	Species of Livestock		
	Cattle per cent	Sheep per cent	Hogs per cent
Ayacucho	93	82	26
Castelli	86	51	21
Chascomús	96	48	27
Dolores	86	50	38
General Alvear	94	71	47
Gral. Belgrano	88	37	37
General Guido	95	81	17
Gral. Lavalle	90	75	12
Gral. Madariaga	84	60	31
General Paz	95	25	25
Las Flores	85	55	52
Magdalena	92	25	24
Maipú	93	79	20
Mar Chiquita	85	74	26
Monte	94	19	34
Pila	95	71	24
Rauch	93	93	35
Roque Pérez	81	33	61
Saladillo	85	36	62
Tapalqué	93	74	29
Tordillo	90	77	24
Total area	90	54	36

Source: National Agricultural Census, 1960.

TABLE 6.--Classification of farms according to land areas--21 counties of Buenos Aires province, 1960.

Class Range (Hectares)	Number of Agricultural Operations	Ratio of Number of Farms in each Class to total Number %	Total Area in Use (Thousands of Hectares)	Ratio of Area comprised in each class to total area %
0 - 200	10,236	63.3	703	12.8
201 - 400	2,381	14.7	689	12.5
401 - 1,000	1,811	11.2	1,124	20.5
1,001 - 2,500	765	4.7	1,146	20.9
2,501 - 5,000	275	1.7	954	17.4
5,001 - 10,000	72	.4	475	8.6
Over 10,000	27	.2	403	7.3
Land without fencing and boundary limits	614	3.8	-	-
Total	16,181	100	5,498	100

Source: National Agricultural Census, 1960.

TABLE 7.--Classification according to head of cattle on farms--21 counties of Buenos Aires province, 1960.

Class Range Number of Head	Number of Farm Operations	Ratio of Number of Farms in each class to total number %	Total Number of Head of Cattle Thousands	Ratio of Head of Cattle comprised in each class to total cattle %
0- 200	10,510	72.3	607	16.3
201- 400	1,932	13.3	547	14.7
401- 600	726	5.0	355	9.5
601- 800	364	2.5	252	6.7
801-1,000	218	1.5	193	5.2
1,001-2,000	472	3.3	651	17.4
2,001-3,000	169	1.2	413	11.1
3,001-4,000	64	.4	224	6.0
4,001-5,000	28	.2	125	3.4
5,001-6,000	13	.1	72	1.9
6,001-7,000	10	.1	63	1.7
7,001-8,000	6	-	43	1.2
8,001-9,000	6	-	50	1.3
9,001-10,000	4	-	38	1.0
Over 10,000	8	.1	97	2.6
Total	14,530		3,737	100

Source: National Agricultural Census, 1960.

was the class interval that included the largest aggregate area.

In regard to cattle numbers it can be seen that ranches which had more than 1,000 and up to 2,000 head of cattle were contained in the size class interval with the highest percentage of the total cattle inventory. Moreover, in 1960 ranches with over one thousand head of cattle represented only 5.5 per cent of all of the cattle enterprises but accounted for almost one half of the total number of cattle in the area. This indicates that beef production was concentrated to a considerable extent among producers who operated ranches of more than one thousand head.

Table 8 contains statistical data on each of the counties constituting the area with relation to: total area of farmland, cropland acreage; area devoted to livestock production (divided into improved annual or permanent pastures and native pastures); livestock inventory broken down into cattle, sheep and horses and type of livestock operations expressed in terms of the ratio of steers plus young steers to cows and the sheep-cattle ratio.

It will be seen from this table that all of the counties selected are fit primarily for livestock production and devoted mostly to cattle breeding operations.

TABLE 8.--Land use and livestock inventory--21 counties of Buenos Aires province, October, 1966.

Counties	Total Area in use for Agr. Operations	Annual Crops Area	Area devoted to Livestock - Grazing Pastures -				Livestock Inventory			Ratio of Steers Plus Young Steers to Cows	Ratio of Sheep to Cattle
			Annual	Perennial	Native	Total	Cattle	Sheep	Horses		
			Thousand Hectares				Thousand Head				
Ayacucho	632	50	60	33	473	566	472	897	14	23	1.90
Castelli	204	12	6	7	163	176	137	122	4	29	.89
Chascomús	368	21	18	19	273	310	357	159	11	27	.45
Dolores	183	4	4	3	152	159	101	99	4	31	.98
Gral. Alvear	305	52	22	22	203	247	186	262	6	12	1.41
Gral. Belgrano	185	21	14	14	127	155	153	73	5	25	.48
Gral. Guido	224	6	10	6	185	201	147	239	4	18	1.63
Gral. Lavalle	207	-	2	2	155	159	144	143	3	39	.99
Gral. Madariaga	278	9	9	13	196	218	172	345	6	28	2.00
Gral. Paz	115	11	6	5	84	95	114	18	5	23	.16
Las Flores	292	37	21	14	204	239	177	259	10	14	1.46
Magdalena	267	13	8	8	222	238	238	55	7	21	.23
Maipú	209	7	8	9	161	178	138	271	4	20	1.97
Mar Chiquita	292	28	23	20	200	243	176	489	7	28	2.77
Monte	150	14	13	17	96	126	137	38	5	31	.28
Pila	305	14	10	10	255	275	174	169	8	14	.97
Rauch	397	26	22	22	312	356	266	492	10	18	1.85
Roque Pérez	139	39	9	10	71	90	95	34	7	25	.36
Saladillo	241	61	14	16	136	166	167	116	13	23	.70
Tapalque	402	34	20	16	319	357	277	393	8	19	1.42
Tordillo	136	2	1	1	127	129	96	95	4	30	.98
Total	5,533	462	300	271	4,118	4,689	3,928	4,773	150	23	1.22

Source: Statistical Bulletin of Buenos Aires province, Second Quarter, 1967.

The limited suitability for crops in the area is clearly indicated by the fact that of the total acreage under agricultural operation--5,533 thousand hectares--only 462 thousand hectares are used for annual cash crops, and 4,689 thousand hectares are devoted to pasture for livestock. This is reflected by the small proportions of the acreage of farmland that is devoted to cash crops in each county. This proportion varies from a maximum of 28.4 per cent in Roque Pérez to a minimum of .3 per cent in General Lavalle, with an average of 8.3 per cent for the whole selected area.

Furthermore, that livestock production is best adapted to the conditions of the area can be deduced from the extensive acreage devoted to ranching. On the average 84.7 per cent of the area under operation is dedicated to livestock production, with a high of 95.1 per cent in Tordillo and a low of 64.9 per cent in Roque Pérez.

Livestock production is mainly carried out on natural pastures as indicated in Table 8. Of the total livestock area (i.e. 4,689,000 hectares) 300,000 hectares are used for annual forage crops, 271,000 hectares for improved permanent pastures and 4,118,000 hectares are covered with unimproved native pastures. Therefore, 87.8 per cent of the area in livestock is occupied by native pastures, 6.4 per cent by temporary pastures and 5.8 per cent by improved permanent pastures. The

proportion of the livestock area used for improved pastures (annual and perennial) varies from a high of 24.4 per cent in Monte to a low of 1.6 per cent in Tordillo.

Stocking rates, i.e. the ratios between cattle, sheep and horse inventories--each expressed in uniform (cow) units--and the acreage devoted to livestock operations, range between a minimum of .60 livestock units per hectare in livestock in Dolores, to a maximum of .95 in Chascomús with an average of .81 for the whole area. It should be pointed out that these ratios refer to animal units per hectare of pastureland, which of course includes natural pasture and annual and/or improved permanent pastures, in accordance with the stock on farms and ranches in October, 1966. They indicate livestock densities at a moment of time rather than carrying capacities.

Following the criteria adopted by the National Commission for the Promotion of Agriculture (PROAGRO) and the National Institute of Agricultural Technology (INTA), rates of stocking were estimated by taking all livestock as uniform units, with the cow as the representative unit and establishing these equivalences: 1 cow is equivalent to 1 bull or stag, or ox, 1.25 heifer (from mating to calving), 1.25 steer (from 18 to 27 months), 1.67 heifer (from weaning to mating), 1.67 young steer (from weaning to 18 months), 2.5 calves (from birth to weaning),

5 sheep, 1 full grown horse. Sheep units were made up as follows: 1 ewe is equivalent to 1 ram, 1 wether, 2 hogs, 2 lambs. For horse units the following equivalents were taken: 1 full grown horse is equivalent to 2 horses under three years.

The area is well adapted to cow-calf type of operations. This is shown by the ratio of steers plus young steers to cows given in Table 8. In the breeding areas the outstanding feature of the cattle inventory is the predominancy of brood cows over the steers and young steers categories and as a result the ratios are low as compared to the ratios corresponding to mixed areas and particularly fattening areas where the latter categories prevail. The ratios under consideration vary from 12 per cent in General Alvear to 38 per cent in General Lavalle, with an average of 23 per cent for the area analyzed.

That cow-calf operations are most frequent in the area is also indicated by the ratios of cattle units to cows. They vary from a minimum of 1.46 cattle units per cow in General Alvear to a maximum of 1.77 in General Lavalle with an average of 1.61 cattle units per cow for the whole area. With regard to these ratios it must be taken into account that the total number of animal units that integrate a given herd divided by the number of cows in the herd could be less than one and one-half cattle

units, if all calves were to be sold at weaning time (cow-calf operations). On the other hand, if the young stock were kept up to two years of age (cow-yearling operations) the cow unit could be equivalent to two or more cattle units.

Finally the ratios of sheep numbers to cattle numbers also shown in Table 8 indicate that mixed livestock operations are common in the area, with limits ranging from .16 sheep per existing cattle in General Paz to 2.77 in Mar Chiquita, and a general average of 1.22 sheep per head of cattle.

CHAPTER III

THE TRADITIONAL SYSTEM OF BEEF PRODUCTION

Cattle breeding is the main enterprise in the eastern part of Buenos Aires province, since a high proportion of the land is best suited for pasture. As indicated in Chapter II soil characteristics and poor drainage restrict successful cash crop production.

Despite the importance of the beef enterprises in the area, there exists a widespread belief among professional agricultural workers and range specialists that herds and pastures are generally poorly managed.

This suggests an excellent opportunity for increasing beef production through the adoption of modern technologies. However, as previously stated, a wide gap between the physically possible and the economically feasible may well exist. It can be expected that ranches who have settled into a traditional system of beef production will adopt new technologies provided that they are profitable.

In determining the relative profitability of new production practices that can be applied in the cattle breeding area of Buenos Aires province, knowledge is

needed of the resources that are presently being utilized by ranchers and the level of returns resulting from the use of these resources.

Hence, an important step in the early stages of this study was the collection of information regarding current methods of production, the resources being used by ranchers at present and the costs and returns involved.

Much of the data pertaining to ranch organizational and operating characteristics, herd management, pasture practices, inputs used and costs and returns were obtained by interviewing the operators of 11 ranches with no improved permanent pastures included in the sample of 30 ranches located in Ayacucho and Rauch counties that were visited in the winter of 1968.

As a previous step a letter was sent to the ranchers suggested by county extension agents of the National Agricultural Technological Institute (INTA), explaining the purpose of the inquiry and requesting their cooperation. Most of the ranchers contacted by means of registered letters (to be sure the communication has been delivered) were willing to cooperate. Responses were not obtained only in 3 cases out of 30 letters sent. The ranchers who did not respond were replaced with others who gave a favorable answer to the request for cooperation.

Once the 30 ranchers who were willing to cooperate had been individualized, the dates on which the respective interviews were to be held were set up with the aid of county agents. Planning the interviews through previous appointments made it possible to avoid not-at-home problems, so that substantial time was gained during the survey.

Two-thirds of the ranch operators interviewed were the owners of the cattle enterprises. The data which did not come directly from the ranch owners were provided by their respective foremen. In each case the foremen had been authorized in advance by the owners to give the needed information. Without such a previous authorization foremen would have refused any information concerning the cattle business.

When the schedules were taken to the persons who were to furnish the information the purpose of the investigation was again explained. In order to reduce unwillingness on the part of respondents they were given the assurance that their information would be held in confidence and in no way would be related to the individual ranch. Nevertheless, in general ranchers were more willing to give detailed information on questions related to ranch organization and operation, herd and pasture management than on questions about income from the ranch enterprise.

Data were collected by the author by asking questions to ranch operators who were thought to have the desired information in face-to-face meetings. A formal list of questions--a questionnaire--was used in the study. The ranch schedule used is shown in Appendix I. Questionnaire data in Tables 1 to 8 provided information about land utilization by ranchers and the nature and amount of the physical capital inputs involved in ranching operations. Questions 9 to 25 were devised to yield information on: (1) the adjustments which were made by ranchers to meet variations in pasture production, (2) the reaction of ranchers regarding pasture developments, (3) the practices followed and resources used for the establishment and maintenance of improved permanent pastures, (4) pasture management, and (5) carrying capacities of different types of pastures.

Questions 26 to 34 refer to herd management. Their purpose was to individualize: (1) the composition of livestock inventories with particular emphasis on cattle, (2) breeding practices, and (3) cattle production rates. Questions 35 to 47 were formulated for the purpose of gathering information on: (1) labor requirements and (2) materials used annually on the ranch and other elements of ranch operating costs.

Before the final questionnaire was ready for the field a preliminary draft was made and pretested under

field conditions. Three ranchers roughly similar to those who were covered in the final study were interviewed during the pretest work. The author obtained from them relevant information. Thus, it was possible to find out whether or not the issue in each question was clear to the respondent. It was also possible to observe questions which caused embarrassment or resistance, the point at which respondents began to get bored and impatient, and the places where relaxed cooperation seemed to break down. As a result of the pretest, wording of some questions was improved, some questions were eliminated from the questionnaire, others added and question sequence was somewhat altered.

With the questionnaire used, about 2 calls a day were completed.

These visits and consultations with extension and research personnel provided insights into the production practices presently carried on by ranchers in the traditional system of production (i.e. with no improved permanent pastures), as well as with regard to input-output relationships and costs and returns associated with the cattle enterprises.

The information collected was used in synthesizing a model cattle breeding operation that represented typical conditions under the traditional system of beef production. In turn, this synthesized operation served

as a basis to compare the present system of beef production (carried on without the use of improved permanent pastures) with improved production methods based on the adoption of alternative pasture programs.

Ranch Organization

The 11 ranches studied averaged 1,902 hectares in size. Of this acreage 95 per cent was devoted to livestock production. Farm buildings, roads, yards, and wasteland occupied the remaining 5 per cent. Of the total area in livestock 90 per cent was covered with unimproved native pastures and 10 per cent was planted to temporary pastures (corn in the summer and oats during winter time). The average ranch had 11 pastures that were watered by 6 stock wells. A house for the ranch owner and housing facilities for each of the laborers hired year-round, a barn, a garage or workshop, chute and pens were the construction found on all of the visited ranches. Two-thirds of the ranchers do not own cropping equipment. They hired the tillage work done. Most frequently, vehicles consisted of a pickup truck and an automobile.

These ranches carried, on the average, 1,379 cattle units including calves. The average herd inventory was composed of 855 breeding cows, 171 replacement heifers of breeding age, 176 yearling heifers and 43 bulls.

Herd Management

Quality and Breed of Cattle

Quality of livestock was uniformly good on most of the ranches studied and was being improved on five of them through the use of purebred bulls. Two of the ranches also had herds of registered brood cows, but the majority of their cow herds were grade cattle. Even though almost half of the cattlemen interviewed used registered bulls with their herds, none of them reported using registered bulls exclusively.

The Angus breed predominated. It was found in all but two of the ranches. These two were stocked with Shorthorn.

Breeding Practices

Pasture breeding was used in all cases. Although there were few instances in which young heifers were pastured separately, on the whole very little controlled breeding was practiced. On most ranches the bulls were pastured with the cows and heifers.

On two of the ranches the bulls were kept with the brood cows the entire year. Most cows followed the natural calving pattern and a high proportion of the calves were dropped in the spring. The remaining operators reported following a winter-spring calving

program. In this program cows usually begin calving in June and calves are dropped through December so that the calving period lasts about 7 months.

For all ranches studied, slightly more than two-thirds of the calves were weaned from April to June when they reached the age of ten months.

On the 11 ranches in the study, an average of one bull was kept for every 20 cows. The number of years of service for which the bulls were used varied between 4 and 6 years with an average of about 4 years of useful service.

All of the replacement cows were raised on the ranches. The average age at which cows were culled was 9 years. Heifers were bred to calve at two years of age in all but two ranches. On these, first-calf heifers were 18 months at breeding time. The average cow was kept in the herd about 7 years.

No rancher followed the practice of pregnancy-testing cows. Fertility testing of bulls also was not used by any rancher.

Health Practices

For all ranches studied the level of health and sanitation practices was low. In few cases were preventive measures taken before diseases or parasites were present on the ranch. This was especially true of

Bangs disease and internal parasites. Of the 11 ranches studied, all vaccinated for foot-and-mouth disease; 8 vaccinated all calves for blackleg; 2 vaccinated calves for malignant edema; 7 vaccinated all adults for Anthrax; 4 vaccinated replacement heifers for Bangs; 2 tested the breeding herd for Bangs and 3 treated the cattle for internal parasites (worms).

Death losses for cows averaged 3 per cent per year; for heifers on to two years old, 2.5 per cent; and for calves, 5 per cent of total calves born.

Labor Requirements

Practically all of the ranchers interviewed provided only management and supervision. Hired labor performed all other functions. Just one in eleven participated himself in physical labor. Seven lived only part-time on the ranch and were permanent city-dwellers. The average ranch (1,906 hectares) was operated with a working force of 4 men (1 "Encargado" or a "Capataz"--foreman--and 3 peones) hired on a year-round basis, with additional labor being hired during the seasonal work peaks (about 25 days of seasonal help for branding, castrating, and marketing cattle). Some ranch operators reported that they did not need the entire labor force during the whole year, but through experience had found

it was better to keep a dependable man during the slack periods than to depend on finding help only when needed.

The average number of animal units per year-round hired man amounted to 360 on the ranches studied.

Marketing of Cattle

All of the 11 herds were basically cow-calf operations with individual variations in handling the calf crop. Most of the calves were sold at weaning time in the fall as feeder calves. They were sold to be finished on ranches generally located in the fattening area in the western part of Buenos Aires province.

The calves marketed for finishing in the fattening region were sold by the head rather than by weight in all cases. Therefore no records could be obtained with regard to liveweights at the time of sale. Nevertheless the ranchers estimated that calves were sold at approximately 170 kilograms of liveweight.

In the breeding area ranchers have access to the following outlets for disposal of their cattle.

1. The animals may be sold at cattle auction markets called "remate-ferias" which are located throughout the area. They receive cattle and sell to buyers on an auction basis. Bidding and selling are open to the public. All have fixed facilities for handling cattle owned by individuals, partnerships or corporations.

2. Cattle may be consigned to a commission firm which will act as the producer's agent in offering the animals for sale on a private basis. A commission firm may be a privately owned and operated agency or it may be a cooperative. Commission firms usually maintain established places of business, including yards, space and pens. When trading is carried on, bids and offers are not cried out as in the case of an auction market and no public announcement is made of the agreed price.

3. Cattlemen may sell their cattle through livestock dealers. They are independent operators who buy and sell livestock for a profit. They do not maintain an established market or place of business at which the livestock are bought and sold. Cattle are usually bought by them on order for feeders (invernadores).

4. One stockman who raises feeder stock may sell them directly to another stockman who will finish the animals.

Most producers employ the services of a commission firm and let professional sellers move their animals through an auction market or by private dealings.

Rate of Production

The number of calves weaned for each one hundred cows and heifers exposed to breeding will be taken as the measure of rate of production. Previously it was

pointed out that, in all of the ranches studied, cattle sales were made by the head. Therefore liveweight production of beef based on the use of scales by ranchers could not be determined to establish production rates in terms of kilograms of beef produced per cattle unit or per hectare of pastureland.

Besides, since cow-calf operations were carried on at all ranches, their income was determined mainly by the sale of the calf crop at, or shortly after, weaning time.

The ratio of calves raised to weaning to the number of cows in the breeding herd for the ranches was as follows:

Average Calf Crop	Highest Calf Crop	Lowest Calf Crop
Per cent	Per cent	Per cent
70	79	52

These relatively low calf percentages can be attributed to several factors, such as: (1) cows in poor breeding condition because sufficient forage was lacking before mating time, (2) calves were left with the cows too long, (3) barren cows were not checked for pregnancy, (4) fertility tests for bulls were not performed, (5) animals lacked essential minerals, (6) internal parasites, and (7) brucellosis.

Pasture Program

The most difficult problem to be solved in the management of grazing arises from seasonal variations in pasture output.

According to results of analytical work done by Piñeyro[9], annual yields of native pastures per unit of land, expressed in terms of kilograms of total digestible nutrients (TDN), in the breeding area of Buenos Aires province are as follows:

TABLE 9.--Annual yields of forage, k. of T.D.N., in cattle breeding region of Buenos Aires province.

Season	Native Pasture	
	Land Type I	Land Type II
Summer	200	250
Fall	250	150
Winter	150	50
Spring	600	400
Total	1,200	850

Source: Martin E. Piñeyro, "The Argentine Agriculture: Past and Potential Contributions to Country-wide Economic Growth" (unpublished Ph.D. dissertation, University of California, 1968).

These measurements of the seasonal output of native pastures show that half of the total annual yield occurs

[9]Martin Enrique Piñeyro, "The Argentine Agriculture: Past and Potential Contributions to Country-wide Economic Growth" (unpublished Ph.D. dissertation, University of California, 1968).

during spring and more than two-thirds of the total occurs during the spring and fall months.

In order to adjust to seasonal pasture production a rancher may take some of these steps: (1) He may carry just enough cattle on his ranch so that pasture is adequate in the periods of lowest pasture production. Surplus pasture in the best months goes unused or excess growth accumulates to be consumed later. (2) He may plan his cattle raising operation on the basis of the expected average annual pasture production. Deferred grazing, hay or silage is carried over from best months to be fed in poor months. (3) He may provide supplementary pasture during periods of poor yields. For example, he may plant oats as temporary winter pasture, corn and/or sorghum in the summer. (4) He may purchase feed concentrates to supplement pasture forage. (5) Cattle production may be allowed to vary with pasture yields. Thus beef cattle may be allowed to lose weight during the periods of low pasture production. (6) Cattle may be bought and sold during the season to fit pasture production. (7) Grazing fees may be collected from other ranchers when there is surplus pasture and paid to other ranchers when cattle must be grazed outside the ranch because enough forage is lacking.

The eleven ranchers visited were asked how they adjusted their cattle program to the seasonal variability

of pasture yields. The responses are shown in Table 10.

More than two-thirds of the ranchers interviewed indicated that they adjust to the seasonal variation in pasture yields by providing supplementary pastures, mainly oats during the winter. Two of the ranchers indicated that their cattle programs were based on what they expected pasture production to be during the seasonal low production period. Two other ranchers indicated that they allowed feed intake and cattle production to drop in periods of low pasture production.

None of the ranchers interviewed indicated any attempt on their part to level out the pasture supply by making hay or silage in the "lush" months and feeding it in the poorer months. No concentrates were bought in order to supplement pasture forage. Only two ranchers gave salt to their cattle in order to correct mineral deficiencies.

Ranchers were also asked how the year-to-year variability of pasture yields affected their cattle enterprise. Most of the ranchers replied that they were obliged to sell cattle when forage was lacking because of adverse weather conditions. Even though drought sometimes disrupts cattle production and causes financial losses, none of the ranchers interviewed provided for emergency adjustments, such as hay storage or silage to

TABLE 10.--Adjustments made by 11 ranchers to seasonal variations in pasture production, Ayacucho and Rauch counties of Buenos Aires province, 1968.

Type of adjustment made	Number Reporting
1. Supplementary pastures are provided in periods of low production. Oats during winter time. Corn in the summer.	7
2. Just enough cattle are carried on the ranch so that pasture is adequate in the periods of lowest pasture production. Surplus pasture in the best months goes unused or excess growth accumulated to be consumed later.	2
3. Cattle are allowed to lose weight during the periods of low pasture production (i.e. cattle production drops with decline in pasture output).	2
4. The cattle raising operation is planned on the basis of the expected average annual pasture production. Deferred grazing, hay or silage is carried over from best months to be fed in poor months.	0
5. Concentrates and/or roughage are purchased to supplement pasture forage.	0
6. Cattle are bought and sold according to the circumstances in order to fit pasture production.	0
7. Grazing fees are collected when there is surplus pasture and paid if enough forage is lacking.	0
Adjustments made by 11 ranchers to year-to-year variations in pasture production	
1. Cattle numbers are adjusted to fit pasture production. Cattle are sold when it appears that pasture output will be low, and additional cattle are bought when the pasture outlook is good.	7
2. The cattle breeding operation is programmed to assure enough pasture in poorer years. Pasture feed goes unused in years of better weather.	4
3. Just enough cattle are kept on the ranch to meet forage production in average years. Excess forage production from years of better than average weather are stored as hay or silage to be fed in poor years.	0
4. Cattle production is planned to fit the available forage in the better years. In years when pasture yields are low, hay is bought, additional land is rented and/or grazing fees are paid.	0

be fed in poor years to minimize the effects of bad weather. Four of the ranchers indicated that their cattle breeding operations were programmed to assure enough pasture in the poorer years. Pasture feed went unused in years of better weather.

Production of Forage for Grazing

A common measure of forage production from rangelands is the annual units of livestock grazed on these lands during the year. An annual unit of grazing is defined as the quantity of forage necessary to maintain a mature cow for a year.

The number of animal units that can be grazed per hectare for one year is one way of calculating the annual units of grazing produced per unit of land. Alternatively, grazing capacity can be calculated as the number of hectares which will support an animal unit for 12 months.

Annual stocking rates, expressed in terms of uniform animal (cow) units per livestock area, including native pastures and temporary forage crops, were calculated for each of the ranches studied. The information obtained from the ranch survey indicated that the average number of animal units per hectare was .77 for the eleven ranches visited. The rates of stocking ranged from a minimum of .53 animal units per hectare in livestock to a maximum of .91. In general, stocking rates increased

as the acreage of annual (temporary) pastures also increased.

The rates of stocking were calculated for the whole area devoted to livestock production in each ranch through the year, since none of the ranchers kept records indicating the number of head of cattle grazed on different pastures by months.

It should be pointed out that stocking rates can be taken as a measure of carrying capacities only under the assumption that pastures are being properly managed. Carrying capacity means the ability of noncropland to furnish feed for livestock such that they are maintained in good flesh and make normal growth. Also, carrying capacity implies maintenance of soil fertility and vegetative cover including the palatable species.[10]

When the proper numbers of animal units are grazed on a range, so that the vigor of the forage plants is not impaired and sufficient stubble is left to give adequate protection for new growth, the stocking rate will adjust to the carrying capacity of the range. The optimum results will be obtained from such stocking in contrast with either too heavy or too light stocking.

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[10]Marion Clawson, The Eastern Range Livestock Industry (New York: McGraw Hill Book Co., 1959).

Very little information is available with relation to the carrying capacity of native pastures in the breeding area of Buenos Aires province.

Optimum rates of stocking under continuous grazing which produce the highest gain per hectare without sacrificing gain per head, length of grazing season, or vigor of vegetation have yet to be determined.

In a few instances carrying capacities have been estimated taking into account present stocking rates. Thus, for example, Josifovich[11] has reported that in the Salado River Basin (i.e. in the breeding area of Buenos Aires Province), carrying capacities vary from .65 to .78 animal units per hectare per year. Barletta and Petroni[12] found that on a ranch located in Ayacucho county the carrying capacity of native pastures was .75 animal units per hectare per annum. These figures suggest that as an average over a number of years in the area studied one and one-third hectares of native grasses will support an animal unit for a 12 month grazing season.

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[11]J. Josifovich, "Areas Forrajeras de la Argentina, Características, Recursos y Problemas," Informe General de I.D.I.A., No. 213 (September, 1965).

[12]Ulises M. Barletta and Ricardo I. Petroni, "Factores edáficos limitantes al cultivo de la festuca, alfalfa y trébol blanco en el partido de Ayacucho," I.D.I.A., No. 164 (August, 1961).

During the survey of ranchers it was determined that oats and corn were used exclusively to supplement natural pastures. Corn was planted to be grazed during the summer in few cases. It was used mainly as a method of wintering beef cows by the grazing of cornstalks (i.e. deferred grazing). Oats were planted to be grazed in the late fall, winter, and spring time.

Pastures of oats alone may furnish grazing at the rate of 1.09 steers per hectare on a yearlong basis and 1.64 steers per hectare for an eight month growing season, according to Amigo.[13] The grazing rate per hectare of corn pasture amounts to 3 head of cattle for about 3 months as reported by Goodsell.[14]

Since grazing of temporary pastures in the breeding area sometimes must be delayed until the soil is sufficiencly dry and firm to withstand trampling it may be concluded that one hectare of annual forage crops (i.e. oats, corn) represents the proper carrying capacity for one animal unit on a yearly basis.

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[13]Alberto Amigo, "Costos de Instalación y Manejo de Praderas," Operación Carnes, Temas de Divulgación, No. 16, CAFADE, 1961.

[14]Wylie D. Goodsell, James R. Gray, and John Hildebrand, "The Beef Grass Grain Economy in the Pampas," Special Report to DAFADE and USAID/Argentina, unpublished, 1962.

Reaction of Ranchers Regarding New Pasture Developments

The reason why an individual rancher has not installed improved permanent pastures can be explained by several factors: (1) Specific site characteristics that make the land suitable only for forage production of native grasses. (2) Lack of knowledge of forage plants well adapted to the ecological conditions of the area. (3) The rancher's belief that it will not pay him to establish improved permanent pastures. (4) Economic incentive not strong enough to induce the greater management effort that implies the use of improved permanent pastures. (5) Capital limitations that preclude the removal of the land from grazing until the range is again ready for use or inability to afford the initial cost of installation. (6) Higher alternative rates of return that the rancher can earn within the year by investing his funds in other assets. (7) The existing tax system may discourage investment in pasture improvement. (8) The rancher's attitude toward the risks involved in establishing improved permanent pastures.

The eleven ranchers visited were questioned about their reasons for not having improved permanent pastures. Their replies to this question are summarized in Table 11.

As can be seen from this table, in the opinion of 3 of the ranchers interviewed, the installation of

TABLE 11.--Reason why ranchers had to avoid new pasture developments; 11 ranchers of Ayacucho and Rauch counties, 1968.

Type of response given	Number of ranchers responding
1. Artificial pastures well adapted to the ecological conditions of the area are not known.	3
2. It would not pay, since the change in total income expected to result from the installation of artificial pasture is less than the change in total costs associated with it.	3
3. Capital limitations	
(a) I would invest in pasture improvement if I owned more funds but I don't want to go in debt to improve pastures.	2
(b) I would invest in pasture improvement if I could obtain credit, or if credit were available under easier terms.	0
4. The economic incentive to install an artificial pasture is not strong enough (i.e. I have a comfortable set-up, why extend myself).	1
5. Higher alternative returns rate can be earned within the year by investing owned funds in other enterprises.	1
6. Risk and uncertainty:	1
(a) Pasture improvement entails added risks and uncertainties because of the possibility of stand failure.	
(b) To the uncertainty of forage stand must be added the uncertainty of cattle prices.	
7. Land suitable only for forage production of native grasses.	0
8. The existing tax system does not encourage investment in pasture improvement.	0

improved permanent pastures would increase their costs by more than their returns. Lack of knowledge with relation to the existence of permanent forage plants well adapted to the ecological conditions of the area were the responses given by 3 other ranchers. Capital limitation was the restrictive factor in two cases. Economic incentive not strong enough, better investment opportunities in other lines of production and risk aversion were the replies obtained respectively from each of the remaining ranchers.

Income Potential of the Cow-Calf Enterprise Under the Traditional System of Production

In order to compare the relative profitability of alternative pasture programs, it becomes necessary to estimate as a first step the streams of costs and returns to be expected from the beef enterprise under the traditional system of management--i.e. without the use of improved permanent pastures.

The sample budget which will follow has been worked out for an assumed ranch situation to illustrate the calculation of costs and returns from the cattle enterprise when no improved permanent pastures have been installed.

Although the primary data obtained from the survey of ranch operators gave insights into the characteristics

of ranches on which beef cow herds are kept, common production practices, and input-output relationships, it should be emphasized that the analysis is not for actual operations but is the result of synthesizing a model operation.

The synthesized operation reflects a representative ranch unit rather than an average. It encompasses a total extension of 2,000 hectares, practically equal to the ranch acreage which has been regarded as typical in the cattle breeding area of Buenos Aires province (i.e. 2,073 hectares).[15] It represents a strictly cow-calf operation with no income from other sources. This fact greatly simplifies the accounting procedure since it becomes unnecessary to allocate production costs between cattle and sheep. Finally a level of management somewhat better than the average in relation to health and sanitation practices is assumed for the synthesized model.

Price and Cost Assumptions for the Budget

The prices used in this analysis are approximately current prices paid and received. They are not to be interpreted as predictions or forecasts of prospective prices for any future period. Prices received are

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[15]Dario Bignoli, "Programa Integral de Aumento de la Producción de Carne Vacuna en la Región Pampeana," Consejo Federal de Inversiones, Tomo 1 (1964).

averages for the period June, 1967-July, 1968. Prices paid were determined from retail merchants and local agricultural extension agents.

The assumption was made that the budgeted enterprise produces feeder cattle which would sell by the head for a price that is the same regardless of weight. Receipts for feeder cattle were based on culling rates of 17 per cent of cows (14 per cent of cows to replace as old and 3 per cent culled by selection). Calves sold as feeders were estimated to be 70 per cent of the females exposed to breeding.

Steer calves sold as feeders were estimated to bring m$n. 10,055 per head; heifers calves m$n. 8,871 per head and cull cows sold to be fattened m$n. 11,619 per head.

Hides resulting from death losses were the only livestock products taken into account.

The cost or input items were separated into the following categories.

Annual Pasture Expenses

Out of the 2,000 hectares of the synthesized ranch operation, 1,900 hectares were estimated to be directly productive, the remaining 100 hectares being occupied by farm buildings, fences, roads, yards and wasteland.

It was assumed that 90 per cent of the land used for pasturing cattle was covered with unimproved native pastures and 10 per cent of the acreage in livestock was planted annually to temporary pastures. It was also estimated that two-thirds of the temporary pasture was seeded in oats and one-third planted to corn. The estimated annual costs per hectare of establishing temporary pastures based on the reported practices on the sampled ranches are shown in Table 12. It was assumed that the seeding of all temporary pastures was custom hired.

The carrying capacity of native grasses was assumed to be .75 animal units per hectare per year and that of temporary pastures seeded, 1 animal unit per hectare on a yearlong basis. Finally it was estimated that the full carrying capacity of the area in livestock was being used for direct grazing by cattle.

Health and Sanitation Costs

With relation to the veterinary and medical expenses incurred annually the following assumptions were made: (1) that ranchers vaccinated the cattle over eight months of age for foot-and-mouth disease three times a year, bulls double doses and calves twice a year; (2) that all calves were vaccinated for blackleg and all cattle eight months old and over for anthrax;

TABLE 12.--Estimated annual cost per hectare of establishing temporary pasture by hiring contractor services, Ayacucho and Rauch counties, 1967-1968.

Operation	Times over	Cost per unit m$n	Total Cost per Hectare m$n
Temporary Winter Pasture: Oats (1)			
Land Preparation			
Plowing	1	1,300	1,300
Disking	1	750	750
Harrowing	2	275	550
Sowing	1	800	800
Seed: 90 Kg., m$n 13 per Kg.			1,170
Total			4,570
Temporary Summer Pasture: Corn (2)			
Land Preparation			
Plowing	1	1,300	1,300
Disking	1	750	750
Harrowing	2	275	550
Sowing	1	800	800
Seed: 20 Kg., m$n 45 per Kg.			
Total			4,300
Weighted average per Hectare of Temporary Pasture (3)			4,480

(1) Oats includes two-thirds of the total acreage in artificial pasture.
(2) Corn includes one-third of the total acreage in artificial pasture.
(3) Weighted by the proportion of total acreage in oats and corn.

(3) that all replacement heifers were vaccinated for brucellosis; (4) that all the ranchers treated their cattle for internal parasites by using Fenotiacina as a preventive measure and (5) that all applied treatments against fly worms when needed.

Hired Labor

The labor cost used in this analysis is the cash outlay for hired labor which must be incurred under the assumption that salaries and wages are being paid according to the established Law, 12.921 "Statute of the Peon." By this Law ranch operators must provide ranch dwellings as a supplement to money wages, but it was assumed that they did not furnish board, since typically they did not.

The assumption was made that ranch operators provided only management and supervision, and hired labor provided all other functions.

Four men (one "Encargado"--manager--and three "peones"--cow hands) were estimated to constitute the working force hired on the ranch the year round. Besides the men hired on a year-round-basis it was assumed that 25 days of additional labor was being hired during the seasonal work peaks.

Labor required year round was assumed to be hired according to established Laws, at the following rates: "Encargado"--manager--m$n. 28,400 per month; "peones"--

cow hands--m$n. 18,000 per month each. Seasonal workers were estimated to be paid at the rate of m$n. 795 per day.

In establishing labor costs, social benefits were also computed. These amounted to 43 per cent of the fixed wages as follows:

Minimum salary family	12	Per cent
Annual bonus	8.33	"
Pension	7.56	"
Holidays with pay	7.00	"
Stability in employment	7.00	"
Seniority	1.11	"
TOTAL	43.00	Per cent

Improvement Repairs Cost

It was assumed that the time spent in repair of cattle buildings was a part of the year's total work. With regard to the repair of fences and water facilities it must be noted that according to the ranch survey, much of this time was actually being spent on construction of new improvements or extensive repair of old ones. This time should not all be charged to one year's operation. Moreover, the time spent on repairing fences and water facilities varied from zero for some of the ranches visited to several weeks per year in others.

The annual cost of repairing fences including materials was estimated to amount to 5 hours of labor (half a wage) per kilometer of fences. The amount spent on repairing water facilities was estimated to amount to 6 days of work annually. These estimates were based on information given by the ranchers interviewed.

Bull Depreciation

In the synthesized budget, the cost of bulls is assumed to be m$n. 55,000 and it is assumed that the bulls have an average of four years useful service. The salvage value is assumed to be m$n. 30,000 (670 kg. x m$n. 44.77 per kilogram). Thus, the average loss in value is m$n. 25,000 and annual depreciation is m$n. 6,250 per bull.

Hauling and Marketing Expenses

It was assumed that cattle were marketed at auctions located at an average distince of 60 kilometers from the ranch. The cost to a rancher for hiring truck transportation over this distance was estimated to be m$n. 7,500 per truckload which may haul 50 weaning calves or 30 mature cows. Hence, the transportation cost of each calf from the ranch to the market place amounted to m$n. 150 per head, and of each cow to m$n. 250 per head.

Auctions usually assess charges for services rendered on a straight percentage basis. Auction market charges were estimated to be 3.1 per cent of the sale value of cattle. Of this total, 2 per cent was charged as a commission fee, 1 per cent as a handling charge and .1 per cent has to be paid to the Auctioneer's Association, according to Law 7.014 Art. 38, b.

Tax Costs

The major part of the tax cost is based on the amounts that must be paid as a sales tax on livestock when cattle are sold. The sales tax amounts to 1.2 per cent of the value of sales and the tax on livestock represents .2 per cent of the sales value. In addition to these taxes a Municipal tax of m$n. 100 per head of cattle must be paid whenever cattle are sold.

Income Under Present Conditions

The income level of the beef cattle enterprise is determined by many factors. Some of these are: ranch improvements, herd size, pasture programs, calving percentages and market prices.

The effect of these variables on the economic results to be expected from the traditional system of production, measured in terms of net cash income, is shown in this section with input-output information, and costs and returns budgets. The budgets are in two

parts: one, showing the physical input-output characteristics of the ranching operation such as fencing, water facilities, herd composition, acres of pasture and calving percentage; the other shows the costs and returns associated with the beef enterprise. These include gross income, expenses and net cash income (see Tables 13 and 14).

In addition a beef cattle budget has been prepared for a "ranch unit" consisting of 2,000 hectares. This ranch unit is used as the measuring unit because it may be regarded as representative of medium size operations in the cattle breeding area of Buenos Aires province as previously stated. Estimated returns are shown for the ranch unit as a whole.

The beef cattle budget consists of three parts. The first part includes the capital items such as investment on fences, water facilities and livestock. Livestock values were set at their estimated market prices. The values assigned to ranch improvements were their current replacement costs, taking into account that comparisons will be made between ranches with alternative pasture programs where the construction of new fences and water facilities will have to be undertaken. Part two gives production items, including the number and value of animals and livestock products sold. It was assumed that 20 per cent of the cows would be replaced--

TABLE 13.--Physical inputs and outputs associated with the traditional system of beef production, Ayacucho and Rauch counties, 1968.

Item	Unit	Quantity
Total land used	Hectares	
Pastureland	Hectares	1,900
Roads, yards and waste	Hectares	100
Total Land	Hectares	2,000
Owned Improvements		
Fences	Meters	31,000
Stock wells	Number	6
Livestock Inventory		
Cattle inventories		
Brood cows	Number	900
Heifers over 2 years	Number	180
Heifers over 1 year	Number	185
Bulls	Number	45
Calves weaned	Number	630
Other Livestock		
Horses	Number	20
Pasture Hectares per Ranch		
Improved Temporary pasture	Hectares	190
Native Pasture	Hectares	1,710
Pasture Production; Carrying capacity Pasture hectares per animal unit		
Improved Temporary pasture	Hectares	1
Native Pasture	Hectares	1.5
Beef Production		
Cull cows sold (1)	Number	153
Calves sold (2)	Number	445
Livestock products: Hides	Number	56
Calving rate	Per cent	70

(1) Average weight of cull cows sold is estimated to be 400 kilograms.
(2) Average weight of weaned calves sold is estimated to be 170 kilograms.

TABLE 14.--The traditional system of production. Budgeted investment, expenses and income, 200 hectares beef cattle enterprise on a pasture program without improved permanent pastures with a stocking rate of .775 animal units per hectares in livestock. Ayacucho and Rauch counties, 1968.

	Unit	Number	Animal Units	Hectares	Price	Unit Cost	Total
					m$n	m$n	m$n
Capital items							
Fences	Meter	31,000				250	7,750,000
Stock wells	Each	6				360,000	2,160,000
Brood cows	Head	900	900			23,000	20,700,000
Heifers over 2 years	Head	180	144			14,000	2,520,000
Heifers over 1 year	Head	185	111			11,000	2,035,000
Bulls	Head	45	45			55,000	2,475,000
Calves weaned	Head	630	252				--
Horses	Head	20	20			25,000	500,000
Total			1,472				38,140,000
Production items							
Cull cows sold	Head	153			11,619		1,777,707
Heifer calves sold	Head	130			8,871		1,153,230
Steer calves sold	Head	315			10,055		3,167,325
Hides: cows	Each				800		21,600
young animals	Each				300		9,300
Total receipts							6,129,162
Annual Input items							
Annual pasture outlay	Hectare			190		4,480	851,200
Salt and minerals	Pesos						29,100
Labor hired	Pesos						1,442,165
Veterinary and Medicines	Pesos						172,465
Bull Depreciation	Pesos						281,250
Improvement repairs	Pesos						24,441
Hauling and Marketing	Pesos						294,046
Texes	Pesos						145,578
Total Specified Costs							3,211,145
Returns Above Specified							2,918,017

Grazing: Temporary Pasture	190	190	Stocking rate: 1.0 AU/Ha.
Native Pastures	1,282	1,710	Stocking rate: .75 AU/Ha.
Total	1,472	1,900	

14 per cent old, 3 per cent dead and 3 per cent culled by selection--with heifers two years old and over. Calf crop was estimated as a per cent of cow and heifers exposed to breeding. Cattle inventory represents an average of beginning and ending and includes 20 per cent of cows to be replaced during the year. Hence, calf crop was calculated over 720 brood cows and 180 heifers from 2 to 3 years of age that were exposed to breeding. Part three contains the annual input items which include annual expenses and pasture requirements for this particular cattle production system. The land requirements include the acreage of temporary pastures and native pastures associated with the "traditional" system of production. The annual units of livestock grazed on improved temporary pastures and native grasses are also shown.

These budgets will enable a later comparison between the results to be expected from the "traditional system" (with no improved permanent pastures) and those which may be obtained if improved pasture programs were adopted.

They are partial budgets since only those items are considered which may vary by the establishment of improved permanent pastures. Thus, for example, among the capital investment items shown, ranch buildings are excluded since it is assumed that the installation of

improved permanent pastures will imply the construction of new fences and water facilities but not of new buildings.

CHAPTER IV

THE MODERN SYSTEM OF BEEN PRODUCTION

Two basic factors affect the profitability of improved permanent pastures, namely, the costs associated with the adoption of the new practice, and the amount of beef production resulting from the inclusion of the pastures in the total beef production system.

Changes in beef production can be attributed exclusively to the seeding of new pastures provided that the same ranch organization and management practices prevail after the new pastures have been installed and, the ranch inventory is kept constant but for the added improvement. On the other hand, it is rarely true that the establishment of improved permanent pastures will leave management and all other factors of production unchanged.

When an improved pasture program is adopted it should be assumed that herd and pasture management will also be improved along with the pasture program. Moreover, the installation of improved permanent pastures, without expanding cattle numbers, may do little to improve a rancher's income. The organization and operational characteristics of a ranch unit should be

adjusted to the increased carrying capacity of the ranch, in most cases, for an economical utilization of ranch resources. In turn, more fences and/or water facilities are more likely to be needed as a result of an increase in the herd size.

In other words, the results to be obtained from the seeding of improved permanent pastures depend upon the simultaneous development of other improvements and the parallel increase of cattle numbers. Then, specific results should be identified with the adoption of a certain system of beef production, rather than with the utilization of a particular resource. In this connection it should be emphasized that it is the prospective difference between beef producing systems carried on with and without the use of improved permanent pastures that need to be analyzed as a basis for choosing between each alternative.

The main organizational characteristics of ranches where improved permanent pastures are utilized, the management practices followed by their operators, the resources used, and the production rates obtained under improved technological levels, will be described and contrasted with those common in the so called "traditional" system of production described in Chapter III.

Primary data for this study were provided by 19 ranchers who had installed improved permanent pastures.

These producers were included in the sample of 30 ranchers interviewed by the author in the winter of 1968.

The information furnished by the 19 ranchers who conducted their operations with the use of improved permanent pastures, together with data from the National Institute of Agricultural Technology (INTA) and reports of professional agricultural workers, were used in delineating improved systems of beef production which appear to be suited to the conditions of the cattle breeding area of Buenos Aires province.

Ranch Organization

The average size of the 19 ranches studied was 2,068 hectares. Of this acreage practically the same percentages as in the traditional system were devoted to livestock production and occupied by the farmstead, roads, corrals, yards and wasteland. Native grasses covered about 70 per cent of the pasture area, 17 per cent was seeded to improved permanent pastures, and 13 per cent was devoted to temporary pastures, mainly corn in the summer and oats during the winter. The pasture program with regard to annual pastures was then, on the average, similar in both acreage and forage plants, to that followed in the traditional system. When improved permanent pastures were being used, the average ranch had 13 pastures that were watered by 8 stock wells.

That is, there were as an average two more paddocks and water facilities per ranch than on the traditional system. The situation concerning ranch buildings was quite similar in both systems. Most of the ranchers with improved permanent pastures had some cropping equipment but nevertheless in half of the cases the tillage work was custom hired. The number and types of vehicles owned were similar in both situations.

Finally it should be pointed out that differences were not noticeable between the two systems under consideration, in regard to the average composition of cattle inventories for the cow-calf type of operation.

Herd Management

Quality and Breed of Cattle

The quality of the cattle was also good in these ranches. Six of the ranchers visited had purebred bulls and eleven used unregistered bulls of registered percentage ("puros por cruza"). Four ranchers had herds of purebred cows but as in the case of the traditional system of production, most of the cow herds were grade cattle.

It was found that the Angus breed was predominant, being followed in order of importance by Hereford and Shorthorn.

Breeding Practices

Pasture breeding was the rule. Only in one case was the practice of corral breeding being used. However breeding was controlled to a larger extent than in the traditional system and in half of the ranches bulls were pastured with the heifers separately from the cows. In no case were the bulls kept with the brood cows the year round. The breeding season was from September to February on most ranches. Calving began then in June and continued through November. Calves borne in June were usually weaned in March at an age of 9 months.

The system of beef production with and without the use of improved permanent pastures virtually did not differ in replacement practices for the breeding herd. Thus, the average age at which cows were culled was about the same in both cases as was the number of years of service for which the bulls were used.

Approximately one third of the ranches with improved permanent pastures had adopted the practice of testing cows for pregnancy through rectal feeling and about the same proportion used a fertility test of their bulls. No such practices were followed in any of the ranches representing the traditional system of production.

As can be seen in general, breeding practices were somewhat better on the ranches having improved

permanent pastures as compared to those of the traditional system. A shorter breeding and calving season, a month earlier weaning on the average, and the performance of fertility tests suggests a higher level of cattle management practices on the part of the ranchers who had installed permanent pastures.

Health Practices

As far as can be ascertained from the information secured from producers, there was also some difference between the ranches representing each system in the level of health and sanitation practices carried out. About the same proportion of the producers vaccinated for foot-and-mouth disease, blackleg, malignant edema and Anthrax, whether permanent pastures had or had not been installed. On the other hand a larger proportion of the producers with improved permanent pastures vaccinated for Bangs and treated the cattle for internal parasites than did ranchers in the traditional system.

Nevertheless the two types of operations--with and without improved permanent pastures--differed little in percentage death loss in the various classes of cattle.

Labor Requirements

The operators of ranch enterprises with improved permanent pastures provided mainly management and supervision, hiring all other functions as was true of the

ranchers classed in the traditional system of production. Out of the 19 ranchers visited 13 had their permanent residence in a city and commuted periodically to their ranches.

The working force on the ranch of average size (2,068 hectares) was composed of 1 manager or foreman and 4 cow-hands hired the year round, plus 40 days of seasonal help during work peaks.

Because of differences in organization and operating methods of the ranches with improved permanent pastures there was a larger variation among them in the amount of labor used per unit of livestock than was the case between ranches belonging to the traditional system of production. However the average number of animal units handled per year-round hired man was approximately the same whether or not improved permanent pastures had been installed.

Marketing of Cattle

Ranchers with improved permanent pastures sold their cattle through the same marketing channels as those described in Chapter III. As in the traditional system of production cattle were always sold by the head to be fattened outside the area. That is to say, the survey of ranches did not reveal any difference between ranches with and without improved permanent pastures

concerning the marketing agencies used, the type of cattle sold (i.e. feeders) or the form of sale (i.e. by the head).

On the other hand, the age of young cattle at the time of marketing, or what may be called the age-pattern of marketing was not the same in all cases. Nine of the ranchers visited sold their calves at weaning time. Calves born during the fall were nursed until they were weaned and sold as with ranches in the traditional system of production. Most of the calf crop was held over to be marketed as feeder yearlings on five of the ranches with improved permanent pastures. On the remaining five ranches surveyed, about equal amounts of feeder calves and feeder yearlings were sold.

No ranchers selling predominantly yearlings were found during the survey among ranches without improved permanent pastures. This indicates that a calf operation may be preferred on ranches where the supply of forage available for wintering calves was limited. According to the ranchers who marketed yearlings they favored this type of operation mainly in order to attain greater flexibility in selling their cattle.

Calf Crop

The number of calves weaned for each 100 animals exposed to breeding ranged from a minimum of 68 to a

maximum of 87 with an average of 80 in the 19 ranches where improved permanent pastures had been installed. Therefore, on the average the per cent calf crop was higher on ranches with improved permanent pastures than on ranches where the traditional system of production was followed.

This increased calf crop may be attributed to both a better management of the herd and to the installation of improved permanent pastures. It should be remembered that about a third of the ranchers with improved permanent pastures required fertility tests of their breeding herds whereas none of the ranches visited in the traditional system had adopted such practices. Moreover, a larger proportion of the ranchers who had installed permanent pastures vaccinated for Bangs and treated their cattle for internal parasites than ranchers with unimproved ranges.

As a matter of fact a substantial increase in the calf crop of the cattle breeding area of Buenos Aires province could be achieved with the establishment of improved permanent pastures if at the same time improved cattle management practices were adopted.

The National Institute of Agricultural Technology (INTA)[16] has estimated that in the area above mentioned,

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[16]National Institute of Agricultural Technology, The Balcarce Livestock Development Project, Mineograph, 1965.

the adoption of improved technologies would raise calving rates up to 90 per cent for cows and to 80 per cent for heifers calving for the first time on ranches with an average size of 1,490 and 3,450 hectares.

These new technologies include the seeding of improved mixtures of permanent grasses and legumes, lowering of stocking rates during critical periods and a better distribution of cattle on the range through the construction of 50 hectare paddocks. They would result in a more adequate feeding of breeding cows, and consequently, the per cent calf crop would be influenced by the adoption of such an improved pasture program.

With relation to herd management important factors which would raise the percentage of calves weaned are: the strict selection of fertile breeding cows by pregnancy tests through rectal feeling and the adoption of an energetic sanitary action program comprising the total cattle on ranches. Finally improved herd management practices would imply mating in the months of November, December and January permitting weaning and selling at 8 months time, i.e. April, May and June.

Pasture Programs

According to the information received from the ranchers visited they had seeded part of their range-lands to improved permanent pastures for the main

purpose of increasing carrying capacity and thereby obtaining an increased calf crop.

The percentages of the areas devoted to livestock production which had been improved in each ranch by the establishment of permanent pastures varied from a maximum of 46 per cent to a minimum of 3 per cent. On the average about 17 per cent of the land used for pasturing cattle was improved with mixtures of permanent grasses and legumes.

None of the operators in the survey sample attempted to improve all of their rangeland. They all agreed that it was not worthwhile to replace with artificial pastures the best species of native forage plants. These native species constitute good natural pastures over some portions of the range.

The seeded mixtures of grasses and legumes tried did not provide uniform grazing all year long and therefore they were supplemented in all cases with annual forage crops.

Only one of the ranchers interviewed made hay from surplus pasture growth. The other 18 adjusted to seasonal variations in pasture output through the use of temporary pastures as the single way to supplement the permanent pastures.

Three of the ranchers in the survey used sorghum as a temporary summer pasture, but corn was the standard

supplementary pasture crop for early spring pasture in 11 of the ranches. In two cases barley and wheat were also used as winter forage crops.

The use of temporary pastures as supplements to native grasses and seeded permanent pastures provided a more uniform and full season of grazing than was true when ranchers had not improved their ranges. However the problem of providing abundant forage of good quality throughout the year still existed on the visited ranches, even though in less degree, since, as in the traditional system, practically no hay or silage was being produced.

Ranchers with improved permanent pastures basically did not differ from those with unimproved ranges in the way they reacted to year-to-year variations in pasture production.

Ten of the ranchers interviewed indicated that when drought came the prompt marketing of cattle was their way to minimize losses.

According to five other ranchers the outstanding requisite in guarding against the penalties of drought was conservative stocking year in and year out, i.e. to them it was important to stock ranges on the conservative side as drought insurance.

Three ranchers said that they retained a reserve of ungrazed pasture for use only during the critical period of each year. This assured them needed forage at that

time. If forage became short on the range before the reserve supply would normally be used, they could then adjust the numbers of livestock.

Only one of the ranchers kept a reserve of hay as drought insurance. He was convinced that, since during drought the cost of harvested feeds and pasturage increases greatly and cattle prices fall, it was not sound business to wait until drought prevailed before seeking solutions.

Finally it should be pointed out that as in the traditional system no hay or concentrates were bought during the year in order to supplement pasture forage. Out of the 19 ranches visited 10 fed salt and minerals to their cattle, whereas only 2 out of 11 did the same in the traditional system.

Pasture Improvement

Range improvement had been undertaken in all of the ranches visited through the seeding of mixtures containing grasses and legumes.

Several advantages have been attributed to mixtures of grasses and legumes over pure stands. These include a greater possibility of success in establishing the stand, a greater variety of forage, a longer grazing period, and more rapid and complete occupancy of the land.

Grasses by themselves cannot produce the best yields unless they have a ready source of nitrogen for growth. On the other hand nitrogen accumulated in the soil by growth of legume plants can be used efficiently by the perennial grasses included in the mixture.

White clover, red clover, or yellow sweet clover were commonly used by the operators in the sample to provide a readily available supply of nitrogen for the benefit of the grasses included in the mixtures.

These clovers were seeded on poor soils mainly for the purpose of building up soil fertility and improving the structure of the soil.

Unfortunately the nitrogen that these legumes supplied in many instances stimulate the grasses to the extent that they crowd and weaken the clovers. Thus during the survey it was found that frequently clovers included in the initial mix had been replaced by the grasses in the mixtures. This was particularly true of clovers sown on wet, poorly drained soils. They had been gradually replaced by tall wheatgrass.

Usually the mixtures of grasses and legumes sown had been recommended to the ranchers interviewed by extension agents or other professional agricultural workers.

On lowland areas (soil type Solonetz and clay alkaline), tall wheatgrass, fescue, white clover, red

clover, yellow sweet clover Madrid var. and hybrid clover or strawberry clover were the species used to integrate different mixtures.

On intermediate lands (soils type solonetz-solodizado) the following species were sown in different combinations: perennial rye grass, orchard grass, fescue, tall wheatgrass, white clover, red clover, yellow sweet clover and hybrid clover or strawberry clover.

Four ranchers with upland soils (type Brunizen and Solod) used alfalfa, orchard grass, harding grass, perennial rye grass, red clover, white clover, and hybrid clover or strawberry clover to constitute various mixtures.

Finally, flats subject to flooding had been seeded with tall wheatgrass alone in one of the ranches surveyed. This grass furnished pasturage for the beef cattle far better than the original native grasses, both in amount and quality. It was not so palatable as the other grasses seeded in the mixtures during the cured stage of its growth but was eaten readily when other grasses were not available.

Pasture Production

As in the case of ranches in the traditional system of production, none of the ranchers with improved permanent pastures kept records that would indicate the

number of head of different classes of cattle that were grazed on individual pastures throughout the year. Therefore it was impossible to ascertain from the survey stocking rates on improved permanent pastures, temporary pastures and native pastures, separately.

Stocking rates were calculated for the total hectares devoted to livestock production on each ranch. They ranged from a minimum of .76 animal units per hectare in livestock per year, to a maximum of 1.08 with an average of .92 for the 19 ranches studied.

On the average the establishment of improved permanent pastures had increased stocking rates from .77 animal units per hectare in livestock the year round in ranches of the traditional system to .92 in ranches where improved permanent pastures had been installed.

It is noted that the mixtures of grasses and legumes adopted to the intermediate and low lands of the cattle breeding area of Buenos Aires province, to which no fertilizers are added, may support 1.50 uniform (cow) animal units per hectare in a yearlong basis, as estimated by the National Institute of Agricultural Technology (INTA).[17]

The level of grass and livestock production to be expected from these mixtures when they are established

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[17] Ibid.

with the addition of fertilizers are not yet known with certainty. Nevertheless, substantial increases in forage yields through fertilization have been attained consistently in experimental work conducted by the Agricultural Experiment Station of Balcarce, in the cattle breeding area of Buenos Aires province since 1965.

Thus, for example, the addition of 150 kilograms of Ammonium phosphate (18-47-0) per hectare, to intermediate lands (soils type solonetz-solodizado) seeded with improved mixtures of grasses and legumes resulted in an increased carrying capacity, as is shown in Table 15, constructed with unpublished data obtained from the Balcarce Agricultural Experiment Station.

TABLE 15.--Yields from improved mixtures of grasses and legumes in one cutting.

Location of Experiment (County)	Yield of Green Forage--Kilos per Hectare	
	Without Fertilization	With Fertilization
Las Flores	5,100	13,500
Las Flores	7,400	12,000
Las Flores	3,000	6,050
Las Flores	10,500	24,500
Rauch	6,750	25,550
Balcarce	2,080	9,000

As reported by José A. Tomás[18] improved mixtures of grasses and legumes fertilized with phosphates in the cattle breeding area produced between 80 and 200 hundred per cent more forage than the same pastures without fertilization.

Estimated Costs and Returns for the Cow-Calf Operation when Improved Management and Pasture Programs are Adopted

The costs and returns for alternative pasture programs and management practices on individual ranches must be known in order to determine which alternative would be most profitable. The analysis of the empirical data obtained from the survey gives only a composite picture of what ranch operators are doing. However, it does not provide a precise tool for evaluating programs which may be profitable because of the many variables included. Therefore, budgets were synthesized using empirical data, grazing data reported by professional agricultural workers and data furnished by the Agricultural Experiment Station of Balcarce in the Buenos Aires province.

Pasture improvement with and without fertilization was considered in this analysis. In each case five improved pasture programs were included. They differ from one another only in the acreage involved in each

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[18] José A. Tomás, "Como ganar 540 kgs. de carne por hectárea," Anales de la Sociedad Rural Argentina, No. 3 (March, 1969).

program. It was assumed that 5 per cent, 10 per cent, 20 per cent, 30 per cent and 40 per cent of the total area devoted to livestock production in the synthesized model of the traditional system was seeded each time to improved mixtures of grasses and legumes without the use of fertilizers in one instance and with fertilization in another instance, so as to determine later the relative profitability of such alternatives.

Throughout the remainder of this study these five pasture programs will be referred to as Program I, II, III, IV and V, with fertilization and without fertilization, respectively.

The physical inputs and outputs associated with the various alternatives considered are shown in Tables 16 and 17.

These inputs and outputs were estimated in accordance with the following assumptions:

1. In each pasture program the same percentage of the total area devoted to livestock production was sown in temporary winter and summer forage crops as in the traditional system.

2. The installation of improved permanent pastures resulted in an increased carrying capacity per hectare in livestock. The grazing rate on improved mixtures of grasses and legumes without fertilization was 1.5 animal units per hectare on an annual basis--i.e. double that

TABLE 16.--Physical inputs and outputs associated with the establishment of improved permanent pastures without fertilization--Ayacucho and Rauch counties, 1968.

Item	Unit	Pct. of Livestock area seeded to Improved Permanent Pastures				
		5	10	20	30	40
		Quantity	Quantity	Quantity	Quantity	Quantity
Total Land Use	Hectares					
Pasture land	Hectares	1,900	1,900	1,900	1,900	1,900
Roads, yards & waste	Hectares	100	100	100	100	100
Total land	Hectares	2,000	2,000	2,000	2,000	2,000
Owned Improvements						
Fences	Meters	32,000	32,000	33,000	34,000	35,000
Stock wells	Number	6	7	7	8	8
Cattle Inventories						
Brood cows	Head	930	977	1,050	1,122	1,205
Heifers 2 years	Head	188	195	210	224	241
Heifers 1 year	Head	194	200	216	230	248
Bulls	Head	47	49	52	56	60
Calves weaned	Head	681	733	840	953	1,024
Other Livestock						
Horses	Head	20	21	23	24	26
Pasture Hectares	Hectares					
Improved Perm. Past.	Hectares	95	190	380	570	760
Improv. Temp. Past.	Hectares	190	190	190	190	190
Native Pastures	Hectares	1,615	1,520	1,330	1,140	950
Carrying Capacity Animal Units per hec.						
Improv. Perm. Past.	Ratio	1.5	1.5	1.5	1.5	1.5
Improv. Temp. Past.	Ratio	1	1	1	1	1
Native Pastures	Ratio	.75	.75	.75	.75	.75
Beef Production						
Cull Cows sold	Head	160	166	178	190	205
Calves sold	Head	487	533	624	723	776
Calving rate	Per cent	72.5	75	80	85	85

TABLE 17.--Physical inputs and outputs associated with the establishment of improved permanent pastures with fertilization--Ayacucho and Rauch counties, 1968.

Item	Unit	Pct. of Livestock area seeded to Improved Permanent Pastures				
		5	10	20	30	40
		Quantity	Quantity	Quantity	Quantity	Quantity
Total Land Use	Hectare					
Pasture Land	Hectare	1,900	1,900	1,900	1,900	1,900
Roads, yards & waste	Hecatre	100	100	100	100	100
Total Land	Hectare	2,000	2,000	2,000	2,000	2,000
Owned Improvements						
Fences	Meters	32,000	32,000	33,000	34,000	35,000
Stock Wells	Number	6	7	7	8	8
Cattle Inventories						
Brood Cows	Head	1,025	1,148	1,390	1,627	1,878
Heifers 2 years	Head	205	230	278	325	376
Heifers 1 year	Head	211	237	286	335	387
Bulls	Head	51	57	70	81	94
Calves Weaned	Head	743	871	1,113	1,383	1,596
Other Livestock						
Horses	Head	23	25	29	34	39
Pasture Hectares						
Improv. Perm. Past.	Hectares	95	190	380	570	760
Improv. Temp. Past.	Hectares	190	190	190	190	190
Native Pastures	Hectares	1,615	1,520	1,330	1,140	950
Carrying Capacity						
Animal Units per hec.	Ratio					
Improv. Perm. Past.	Ratio	3	3	3	3	3
Improv. Temp. Past.	Ratio	1	1	1	1	1
Native Pastures	Ratio	.75	.75	.75	.75	.75
Beef Production	Head					
Cull cows sold	Head	174	195	236	277	319
Calves sold	Head	532	624	826	1,048	1,209
Calving rate	Head	72.5	75	80	85	85

of natural pastures. In turn, by adding fertilizer the carrying capacity of the improved mixtures was doubled. Pastureland area was utilized for grazing in all cases to its full carrying capacity.

3. The per cent calf crop increased from 70 per cent in the traditional system to 72.5 per cent, 75 per cent, 80 per cent and 85 per cent when pasture programs I, II, III, and IV were adapted, respectively, as a consequence of more adequate feeding of brood cows and a better distribution of the cattle on the range through additional fencing and water facilities. Once 30 per cent of the total area in livestock (1,900 hectares) had been seeded to improved pastures, further increases in the acreage sown with the new mixtures did not result in an increase of the per cent calf crop. Therefore, the number of calves weaned per each 100 cows and heifers exposed to breeding was 85 in Pasture Program V as it was in Pasture Program IV.

4. The cattle inventory remained constant in composition for all cases. Replacements ratios and death losses did not change from the establishment of improved permanent pastures.

The same assumptions made for the traditional system of production with relation to prices, annual pasture expenses, health and sanitation practices, minerals and salt, bull depreciation, improvement repairs, hauling

and marketing and taxes hold when improved pasture programs were adopted.

With relation to labor costs it was assumed that additional amounts of labor would be hired in accordance with the increased cattle numbers resulting from the adoption of the various pasture programs.

Finally, with relation to the fertilized mixtures, it was assumed that the fertilization of the improved grasses and legumes with ammonium phosphate would need repeating in each of the following 10 years after their installation. This assumption is based on the estimation made by the Balcarce Agricultural Experiment Station,[19] in computing the annual costs associated with pasture improvement with the addition of fertilizers, in the cattle breeding area of Buenos Aires province. It was estimated that 50 kilograms of ammonium phosphate (18-47-0) would need to be applied per hectare each year, in order to double the forage output through fertilization during a period of 10 years. Thus the annual fertilization cost amounted to m$n. 2,050 per hectare: 50 kilos of 18-47-0 at $33 per kilogram plus the fertilizer application (m$n. 400 per hectare).

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[19]National Institute of Agricultural Technology, "Costo de Producción," Balcarce Agricultural Experiment Station, Mimeograph, 1967.

Income Expected from Improved Management and Pasture Programs

Receipts, expenses and net cash income were calculated for the 2,000 hectare cow-calf operation in the cattle breeding area of Buenos Aires province, under the assumed conditions associated with the establishment of improved permanent pastures and varying calf crops.

The respective budgets were prepared providing information concerning expected or estimated income potential from various production practices and pasture programs.

These budgets (Tables 18 to 27) are similar to that presented in Chapter III with relation to the traditional system of production in order to facilitate comparisons. They also consist of three parts. Part one includes the capital items associated with each pasture program. Production items are included in part two. Part three contains the annual input items. The total number of animal units that can be grazed on the "ranch unit" the year round according to the kind of pasture program adopted is shown in the budgets.

Estimates of the differences in costs and returns stemming from the adoption of the various pasture programs will be used when the relative profitability of the different alternatives is analyzed in Chapter VI.

TABLE 18.--Budgeted investment, expenses and income, per ranch unit with 5 per cent of the area in livestock seeded to improved permanent pastures, without fertilization, with a stocking rate of .81 animal units per hectare of pastureland. Ayacucho and Rauch Counties, 1968.

Items	Unit	Number	Animal Units	Hectarea	Price	Value or Amount m$n.	Total Value or Costs m$n.
CAPITAL ITEMS							
Fences	Meters	32,000				250	8,000,000
Stock Well	Each	6				360,000	2,160,000
Improv. Perm. Past.	Hectare			95		12,912.50	1,226,687
Brood Cows	Head	939	939			23,000	21,597,000
Heifers 2 years	Head	188	150			14,000	2,632,000
Heifers 1 year	Head	194	116			11,000	2,134,000
Bulls	Head	47	47			55,000	2,585,000
Calves weaned	Head	681	272			--	--
Horses	Head	20	20			25,000	500,000
TOTAL			1,544				40,834,687
PRODUCTION ITEMS							
Cull Cows Sold	Head	169			11,619	1,161	1,859,040
Heifers Calves Sold	Head	149			8,871		1,295,166
Steer Calves Sold	Head	341			10,055		3,428,755
Hides: Cows	Each	28			800		22,400
Young Animals	Each	34			300		10,200
TOTAL RECEIPTS							6,615,561
ANNUAL INPUT ITEMS	Pesos						
Annual Past. Outlay	Pesos			190		4,480	851,200
Salt and Minerals	Pesos						30,720
Labor Hired	Pesos						1,500,209
Veterinary and Medicines	Pesos						181,852
Bull Depreciation	Pesos						293,750
Improvement Repairs	Pesos						25,011
Hauling and Marketing	Pesos						317,122
Taxes	Pesos						157,285
TOTAL SPECIFIED COSTS							3,357,149
Returns Above Specified							3,258,412

Grazing: Improv. Perm. Past.	143	95	Stocking rate: 1.5 UA/Ha
Improv. Temp. Past.	190	190	Stocking rate: 1.0 UA/Ha
Native Pastures	1,211	1,615	Stocking rate: 0.75 UA/Ha
	1,544	1,900	

TABLE 19.--Budgeted investment, expenses and income, per ranch unit with 10 per cent of the area in livestock seeded to improved permanent pastures, without fertilization, with a stocking rate of .85 animal unit per hectare of pastureland. Ayacucho and Rauch Counties, 1965.

Items	Unit	Number	Animal Units	Hectarea	Price	Value or Amount m$n.	Total Value or Costs m$n.
CAPITAL ITEMS							
Fences	Meters	32,000				250	8,000,000
Stock Well	Each	7				360,000	2,520,000
Improv. Perm. Past.	Hectare			190		12,912.50	2.453,375
Brood Cows	Head	977	977			23,000	22,471,000
Heifers 2 years	Head	195	156			14,000	2,730,000
Heifers 1 year	Head	200	120			11,000	2,200,000
Bulls	Head	49	49			55,000	2,695,000
Calves weaned	Head	733	242			--	--
Horses	Head	21	21			25,000	525,000
TOTAL			1,615				43,594,375
PRODUCTION ITEMS							
Cull Cows Sold	Head	166			11,619		1,928,754
Heifer Calves Sold	Head	196			8,871		1,472,586
Steer Calves Sold	Head	367			10,055		3,690,185
Hides: Cows	Each	29			800		23,200
Young Animals	Each	36			300		10,800
TOTAL RECEIPTS							7,125,525
ANNUAL INPUT ITEMS	Pesos						
Animal Past. Outlay	Pesos			190		4,480	851,200
Salt and Minerals	Pesos						32,310
Labor Hired	Pesos						1,538,904
Veterinary and Medicines	Pesos						190,821
Bull Depreciation	Pesos						306,250
Improvement Repairs	Pesos						26,148
Hauling and Marketing	Pesos						341,287
Taxes	Pesos						169,623
TOTAL SPECIFIED COSTS							3,456,543
Returns Above Specified							3,668,982

Grazing: Improv. Perm. Past.	285	190	Stocking Rate:	1.5 UA/Ha
Improv. Temp. Past.	190	190	Stocking Rate:	1.0 UA/Ha
Native Pastures	1,140	1,520	Stocking Rate:	0.75 UA/Ha
TOTAL	1,615	1,900		

TABLE 20.--Budgeted investment, expenses and income, per ranch unit with 20 per cent of the area in livestock seeded to improved permanent pastures, without fertilization, with a stocking rate of .925 animal units per hectare of pastureland. Ayacucho and Rauch Counties, 1968.

Items	Unit	Number	Animal Units	Hectarea	Price	Value or Amount m$n.	Total Value or Costs m$n.
CAPITAL ITEMS							
Fences	Meters	33,000				250	8,250,000
Stock Well	Each	7				360,000	2,520,000
Improv. Perm. Past.	Hectare			380		12,912.50	4,906,750
Brood Cows	Head	1,050	1,050			23,000	25,150,000
Heifer 2 years	Head	210	168			14,000	2,940,000
Heifer 1 year	Head	216	129			11,000	2,376,000
Bulls	Head	52	52			55,000	2,860,000
Calves weaned	Head	840	335			--	--
Horses	Head	23	23			25,000	575,000
TOTAL			1,757				48,577,750
PRODUCTION ITEMS							
Cull Cows Sold	Head	178			11,619		2,068,182
Heifer Calves Sold	Head	204			8,871		1,809,684
Steer Calves Sold	Head	420			10,055		4,223,100
Hides: Cows	Each	31			800		24,800
Young Animals	Each	42			300		12,600
TOTAL RECEIPTS							8,138,366
ANNUAL INPUT ITEMS	Pesos						
Annual Past. Outlay	Pesos			190		4,480	851,200
Salt and Minerals	Pesos						35,520
Labor Hired	Pesos						1,635,643
Veterinary and Medicines	Pesos						208,643
Bull Depreciation	Pesos						325,000
Improvement Repairs	Pesos						27,854
Hauling and Marketing	Pesos						389,230
Taxes	Pesos						194,100
TOTAL SPECIFIED COSTS							3,667,190
Returns Above Specified							4,471,176

Grazing:				
Improv. Perm. Past.	570	380	Stocking Rate:	1.5 AU/Ha
Improv. Temp. Past.	190	190	Stocking Rate:	1.0 AU/Ha
Native Past.	997	1,330	Stocking Rate:	0.75 AU/Ha
TOTAL	1,757	1,900		

TABLE 21.--Budgeted investment, expenses and income, per ranch unit with 30 per cent of the area in livestock seeded to improved permanent pastures, without fertilization, with a stocking rate of 1 animal unit per hectare of pastureland. Ayacucho and Rauch Counties, 1968.

Items	Unit	Number	Animal Units	Hectarea	Price	Value or Amount m$n.	Total Value or Costs m$n.
CAPITAL ITEMS							
Fences	Meters	34,000				250	8,500,000
Stock Well	Each	8				360,000	2,880,000
Improv. Perm. Past.	Hectare			570		12,912.50	7,360,125
Brood Cows	Head	1,122	1,122			23,000	25,806,000
Heifers 2 years	Head	224	179			14,000	3,136,000
Heifers 1 year	Head	230	139			11,000	2,530,000
Bulls	Head	56	56			55,000	3,080,000
Calves weaned	Head	953	380			--	--
Horses	Head	24	24			25,000	600,000
TOTAL			1,900				53,892,125
PRODUCTION ITEMS							
Cull Cows Sold	Head	190			11,619		2,207,610
Heifer Calves Sold	Head	246			8,871		2,182,266
Steer Calves Sold	Head	477			10,055		4,796,235
Hides: Cows	Each	33			800		26,400
Young Animals	Each	46			300		14,400
TOTAL RECEIPTS							9,226,911
ANNUAL INPUT ITEMS	Pesos						
Annual Past. Outlay	Pesos			190		4,480	851,200
Salt and Minerals	Pesos						38,760
Labor Hired	Pesos						1,766,581
Veterinary and Medicines	Pesos						226,565
Bull Depreciation	Pesos						350,000
Improvement Repairs	Pesos						28,421
Hauling and Marketing	Pesos						440,719
Taxes	Pesos						220,436
TOTAL SPECIFIED COSTS							3,922,682
Returns Above Specified							5,304,229

Grazing: Improv. Perm. Past.	855	570	Stocking Rate:	1.5 AU/Ha
Improv. Temp. Past.	190	190	Stocking Rate:	1.0 AU/Ha
Native Pastures	855	1,140	Stocking Rate:	0.75 AU/Ha
TOTAL	1,900	1,900		

TABLE 22.--Budgeted investment, expenses and income, per ranch unit with 40 per cent of the area in livestock seeded to improved permanent pastures, without fertilization, with a stocking rate of 1,075 animal units per hectare of pastureland. Ayacucho and Huanta Counties, 1968.

Items	Unit	Number	Animal Units	Hectarea	Price	Value of Amount m$n.	Total Value or Cost m$n.
CAPITAL ITEMS							
Fences	Meters	35,000				250	8,750,000
Stock Well	Each	8				350,000	2,800,000
Improv. Perm. Past.	Hectare			760		12,912.50	9,813,000
Brood Cows	Head	1,295	1,295			23,000	27,715,000
Heifers 2 years	Head	241	193			14,000	3,374,000
Heifers 1 year	Head	248	149			11,000	2,728,000
Bulls	Head	60	60			55,000	3,300,000
Calves weaned	Head	1,074	429			--	--
Horses	Head	32	32			25,000	650,000
TOTAL			2,042				59,210,500
PRODUCTION ITEMS							
Cull Cows Sold	Head	305			11,119		3,381,895
Heifers Calves Sold	Head	264			8,871		2,341,944
Steer Calves Sold	Head	512			10,055		5,148,160
Hides: Cows	Each	50			500		25,000
Young Animals	Each	51			300		15,300
TOTAL RECEIPTS							8,916,099
ANNUAL INPUT ITEMS	Pesos						
Annual Past. Outlay	Pesos			190		4,480	851,200
Salt and Minerals	Pesos						41,670
Labor Hired	Pesos						1,840,287
Veterinary and Medicines	Pesos						243,611
Bull Depreciation	Pesos						375,000
Improvement Repairs	Pesos						29,558
Hauling and Marketing	Pesos						473,682
Taxes	Pesos						236,881
Fertility Test	Pesos						
TOTAL SPECIFIED COSTS							4,091,889
Returns Above Specified							5,824,210

Grazing: Improv. Perm. Past.	1,140	760	Stocking rate:	1.5 AU/Ha
Improv. Temp. Past.	190	190	Stocking rate:	1.0 AU/Ha
Native Pastures	712	950	Stocking rate:	0.75 AU/Ha
TOTAL	2,042	1,900		

TABLE 23.--Budgeted investment, expenses and income per ranch unit with 5 per cent of the area in livestock seeded to improved permanent pastures, with fertilization, with a stocking rate of .88 animal units per hectare of pastureland. Ayacucho and Rauch Counties, 1968.

Items	Unit	Number	Animal Units	Hectarea	Price	Value or Amount m$n.	Total Value or Cost m$n.
CAPITAL ITEMS							
Fences	Meters	32,000				250	8,000,000
Stock Well	Each	7				360,000	2,520,000
Improv. Perm. Past.	Hectare			95		18,265.50	1,734,937
Brood Cows	Head	1,025	1,025			23,000	23,575,000
Heifers 2 years	Head	205	164			14,000	2,870,000
Heifers 1 year	Head	211	126			11,000	2,321,000
Bulls	Head	51	51			55,000	2,805,000
Calves Weaned	Head	743	297			--	--
Horses	Head	23	23			25,000	575,000
TOTAL			1,686				44,400,937
PRODUCTION ITEMS							
Cull Cows Sold	Head	174			11,619		2,021,706
Heifer Calves Sold	Head	160			8,871		1,419,360
Steer Calves Sold	Head	372			10,065		3,740,460
Hides: Cows	Each	30			800		24,000
Young Animals	Each	37			300		11,100
TOTAL RECEIPTS							7,216,626
ANNUAL INPUT ITEMS	Pesos						
Annual Past. Outlay	Pesos			190		4,480	851,200
Salt and Minerals	Pesos						33,510
Labor Hired	Pesos						1,598,790
Veterinary and Medicines	Pesos						198,440
Bull Depreciation	Pesos						318,750
Improvement Repairs	Pesos						25,932
Hauling and Marketing	Pesos						345,927
Taxes	Pesos						171,597
Annual Fertilization	Pesos			95		2,050	194,750
TOTAL SPECIFIED COSTS							3,738,896
Returns Above Specified							3,477,730

Grazing:	Improv. Perm. Past.	285	95	Stocking rate: 3.0 AU/Ha
	Improv. Temp. Past.	190	190	Stocking rate: 1.0 AU/Ha
	Native Pastures	1,211	1,615	Stocking rate: 0.75 AU/Ha
	TOTAL	1,686	1,900	

TABLE 24.--Budgeted investment, expenses and income, per ranch unit with 10 per cent of the area in livestock seeded to improved permanent pastures, with fertilization, with a stocking rate of 1. animal units per hectare of pastureland. Ayacucho and Rauch Counties, 1968.

Items	Unit	Number	Animal Units	Hectarea	Price	Value or Amount m$n.	Total Value or Cost m$n.
CAPITAL ITEMS							
Fences	Meters	32,000				250	8,000,000
Stock Well	Each	8				360,000	2,880,000
Improv. Perm. Past.	Hectare			190		18,262.50	3,469,875
Brood Cows	Head	1,148	1,148			23,000	26,404,000
Heifers 2 years	Head	230	184			14,000	3,220,000
Heifers 1 year	Head	237	142			11,000	2,607,000
Bulls	Head	57	57			55,000	3,135,000
Calves Weaned	Head	861	344			--	--
Horses	Head	25	25			25,000	625,000
TOTAL			1,900				50,340,875
PRODUCTION ITEMS							
Cull Cows Sold	Head	195			11,619		2,265,705
Heifers Calves Sold	Head	193			8,871		1,712,103
Steer Calves Sold	Head	431			10,055		4,333,705
Hides: Cows	Each	34			800		27,200
Young Animals	Each	43			300		12,900
TOTAL RECEIPTS							8,351,613
ANNUAL INPUT ITEMS	Pesos						
Animal Past. Outlay	Pesos			190		4,480	851,200
Salt and Minerals	Pesos						37,980
Labor Hired	Pesos						1,788,693
Veterinary and Medicines	Pesos						224,243
Bull Depreciation	Pesos						356,250
Improvement Repairs	Pesos						27,069
Hauling and Marketing	Pesos						400,007
Taxes	Pesos						198,782
Annual Fertilization	Pesos			190		2,050	389,500
TOTAL SPECIFIED COSTS							4,273,724
Returns Above Specified							4,077,889

Grazing: Improv. Perm. Past.	570	190	Stocking rate: 3.0	AU/Ha
Improv. Temp. Past.	190	190	Stocking rate: 1.0	AU/Ha
Native Pastures	1,140	1,520	Stocking rate: 0.75	AU/Ha
TOTAL	1,900	1,900		

TABLE 25.--Budgeted investment, expenses and income, per ranch unit with 20 per cent of the area in livestock seeded to improved permanent pastures, with fertilization, with a stocking rate or 1.225 animal units per hectare of pastureland. Ayacucho and Rauch Counties, 1968.

Items	Unit	Number	Animal Units	Hectarea	Price	Value or Amount m$n.	Total Value or Cost m$n.
CAPITAL ITEMS							
Fences	Meters	33,000				250	8,250,000
Stock Well	Each	8				360,000	2,880,000
Improv. Perm. Past.	Hectare			380		18,262.50	6,939,750
Brood Cows	Head	1,390	1,390			23,000	31,970,000
Heifers 2 years	Head	278	222			14,000	3,892,000
Heifers 1 year	Head	286	171			11,000	3,146,000
Bulls	Head	70	70			55,000	3,850,000
Calves Weaned	Head	1,112	445			--	--
Horses	Head	29	29			25,000	725,000
TOTAL			2,327				61,652,750
PRODUCTION ITEMS							
Cull Cows Sold	Head	236			11,619		2,742,084
Heifer Calves Sold	Head	270			8,871		2,395,170
Steer Calves Sold	Head	556			10,055		5,590,580
Hides: Cows	Each	42			800		33,600
Young Animals	Each	56			300		16,800
TOTAL RECEIPTS							10,778,234
ANNUAL INPUT ITEMS	Pesos						
Annual Past. Outlay	Pesos			190		4,480	851,200
Salt and Minerals	Pesos						47,040
Labor Hired	Pesos						2,127,850
Veterinary and Medicines	Pesos						276,384
Bull Depreciation	Pesos						437,500
Improvement Repairs	Pesos						28,775
Hauling and Marketing	Pesos						515,463
Taxes	Pesos						257,045
Animal Fertilization	Pesos			380		2,050	779,000
TOTAL SPECIFIED COSTS							5,320,257
Returns Above Specified							5,457,977

Grazing: Improv. Perm. Past.	1,140	380	Stocking rate: 3.0	AU/Ha
Improv. Temp. Past.	190	190	Stocking rate: 1.0	AU/Ha
Native Pastures	997	1,330	Stocking rate: 0.75	AU/Ha
TOTAL	2,327	1,900		

TABLE 26.--Budgeted investment, expenses and income, per ranch unit with 30 per cent of the area in livestock seeded to improved permanent pastures, with fertilization, with a stocking rate of 1.45 animal units per hectare of pastureland. Ayacucho and Rauch Counties, 1968.

Items	Unit	Number	Animal Units	Hectarea	Price	Value or Amount m$n.	Total Value or Cost m$n.
CAPITAL ITEMS							
Fences	Meters	34,000				250	8,500,000
Stock Well	Each	9				360,000	3,240,000
Improv. Perm. Past.	Hectare			570		18,262.50	10,409,265
Brood Cows	Head	1,627	1,627			23,000	37,421,000
Heifers 2 years	Head	325	260			14,000	5,264,000
Heifers 1 year	Head	335	201			11,000	3,685,000
Bulls	Head	81	81			55,000	4,465,000
Calves Weaned	Head	1,383	552			--	--
Horses	Head	34	34			25,000	850,000
TOTAL			2,755				73,110,625
PRODUCTION ITEMS							
Cull Cows Sold	Head	277			11,619		3,218,463
Heifer Calves Sold	Head	356			8,871		3,158,076
Steer Calves Sold	Head	598			10,055		6,958,060
Hides: Cows	Each	49			800		39,200
Young Animals	Each	69			300		20,700
TOTAL RECEIPTS							13,394,499
ANNUAL INPUT ITEMS	Pesos						
Annual Past. Outlay	Pesos			190		4,480	851,200
Salt and Minerals	Pesos						56,250
Labor Hired	Pesos						2,485,434
Veterinary and Medicines	Pesos						332,562
Bull Depreciation	Pesos						506,250
Improvement Repairs	Pesos						29,342
Hauling and Marketing	Pesos						639,823
Taxes	Pesos						319,963
Annual Fertilization	Pesos			570		2,050	1,168,500
TOTAL SPECIFIED COSTS							6,389,324
Returns Above Specified							7,005,175

Grazing: Improv. Perm. Past	1,710	570	Stocking Rate: 3.0	AU/Ha
Improv. Temp. Past.	190	190	Stocking Rate: 1.0	AU/Ha
Native Pastures	855	1,140	Stocking Rate: 0.75	AU/Ha
TOTAL	2,755	1,900		

TABLE 27.--Budgeted investment, expenses and income, per ranch unit with 40 per cent of the area in livestock seeded to improved permanent pastures, with fertilization, with a stocking rate of 1.67 animal units, per hectare of pastureland. Ayacucho and Rauch Counties, 1968.

Items	Unit	Number	Animal Units	Hectarea	Price	Value or Amount m$n.	Total Value or Cost m$n.
CAPITAL ITEMS							
Fences	Meters	35,000				250	8,750,000
Stock Wells	Each	9				360,000	3,240,000
Improv. Perm. Past.	Hectare			760		18,262.50	10,409,625
Brood Cows	Head	1,878	1,878			23,000	43,194,000
Heifers 2 years	Head	376	301			14,000	5,264,000
Heifers 1 year	Head	387	232			11,000	4,257,000
Bulls	Head	94	94			55,000	5,170,000
Calves Weaned	Head	1,596	638			--	--
Horses	Head	39	39			25,000	975,000
TOTAL			3,182				84,729,500
PRODUCTION ITEMS							
Cull Cows Sold	Head	319			11,619		3,706,461
Hiefer Calves Sold	Head	411			8,871		3,645,981
Steer Calves Sold	Head	798			10,055		8,023,890
Hides: Cows	Each	56			800		44,800
Young Animals	Each	80			300		24,000
TOTAL RECEIPTS							15,445,132
ANNUAL INPUT ITEMS	Pesos						
Annual Pasture Outlay	Pesos						851,200
Salt and Minerals	Pesos						64,950
Labor Hired	Pesos						2,841,174
Veterinary and Medicines	Pesos						380,043
Bull Depreciation	Pesos						587,500
Improvement Repairs	Pesos						30,480
Hauling and Marketing	Pesos						737,500
Taxes	Pesos						368,963
Annual Fertilization	Pesos			760		2,050	1,558,000
TOTAL SPECIFIED COSTS							7,420,076
Returns Above Specified							8,025,056

Grazing: Improv. Perm. Past.	2,280	760	Stocking rate: 3	AU/Ha
Improv. Temp. Past.	190	190	Stocking rate: 1	AU/Ha
Native Pastures	712	950	Stocking rate: 0.75	AU/Ha
TOTAL	3,182	1,900		

CHAPTER V

COSTS ASSOCIATED WITH PASTURE IMPROVEMENT

The total cost associated with the establishment of improved permanent pastures is the sum of several component costs which depend on the method of improvement selected, the size or scale of the project, and the type and intensity of utilization of the improved range.

In analyzing the relative profitability of any pasture program all of the associated elements of costs must be considered.

Range improvement costs may be divided into three major classes: (1) initial cost, (2) yearly maintenance costs, and (3) operating costs. Initial costs include items that are expended within a finite time period. Maintenance and operational costs are those that must be incurred during the life of the improvement program.

Initial Costs

Initial costs include the expenses that must be incurred in seeding native ranges with improved species of grasses and legumes as well as other costs associated with the adoption of the new practice. Thus, for example, fencing may be required to control the grazing on the

improved areas. Water facilities may have to be developed on the seeded area before it can be utilized by livestock. Acquisition of additional livestock often is required to utilize all of the new forage produced. Purchases of additional machinery may be needed if the improvement work is to be carried out with owned equipment.

Range seeding and pasture management may thus include some or all of the following initial costs:

1. Seedbed preparation
2. Planting
3. Application of fertilizer
4. Seed
5. Fertilizers
6. Deferred grazing (Nonuse until the new grass is established)
7. Pest control (Measures to protect seeding against hares)
8. New fencing
9. New water development
10. New agricultural machinery and equipment
11. New cattle chutes and pens
12. Additional cattle numbers

Costs of Seeding

The cost of seeding native ranges with improved permanent pastures depends on specific site characteristics which determine the species to be used in the

mixtures and the mechanical operations to be performed in preparing the seedbed and sowing the new grasses and legumes.

Costs will also vary whether or not the improved mixtures are to be established with the addition of fertilizers. Finally different cost will result if the tasks pertaining to soil preparation and seeding are undertaken using owned equipment or through hiring contractor services.

In order to estimate seeding costs, budgets were constructed with items selected on the basis of the frequency with which different practices and materials were used by the ranchers surveyed, and taking into account the information provided by the Agricultural Experiment Station of Balcarce of the National Institute of Agricultural Technology.[20]

The following assumptions were made in estimating the respective inputs:

1. Mixtures used for seeding purposes. Two mixtures were considered. One with plant species best suited for "intermediate lands" (soils type solonetz solodizado) included a mixture of 12 kilograms of perennial rye grass, 3 kilograms of orchard grass, 5 kilograms of fescue, 5 kilograms of tall wheatgrass,

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[20]Balcarce Agricultural Experiment Station, "Costs of Production" (mimeograph, 1967).

3 kilograms of yellow sweet clover and 2 kilograms of white clover. The other mixture recommended to be seeded in "low lands" (soils type solonetz and clay alkaline) comprised 8 kilograms of fescue, 8 kilograms of tall wheatgrass, 3 kilograms of yellow sweet clover and 1 kilogram of hybrid clover or strawberry clover. It was assumed that 50% of the improved pastures would be established in the intermediate lands and 50% in the low parts, so as to include in this analysis the two main types of soils to be found in the cattle breeding area.

2. The improved mixtures of grasses and legumes were to be established with and without the addition of fertilizers.

3. The installation of the different mixtures involved in each case the performance of these operations: 1 plowing, 3 disk harrowings, 2 spike harrowings, 1 seeding and 1 herbicide spraying. The application of fertilizer was also considered under the assumption that the fertilization of the mixtures would take place.

4. The different tasks were performed by hiring contractors services by those ranchers who did not own cropping equipment. Custom hiring did not take place when the machinery needed for the establishment of the improved pastures was already available on the ranch.

The costs of the different tasks involving the use of owned machinery were operating costs only. They do not include the fixed costs of depreciation, interest, housing, insurance, or taxes, as these costs were to be incurred regardless of the installation of improved pastures.

5. Finally "nonuse cost"--i.e. the additional expense of feeding animals displaced by nonuse of a seeded area--was estimated under the assumptions (a) that the range was made unavailable during one year, until the new grasses and legumes were ready for use and (b) that the carrying capacity, before seeding, averaged .75 animal units per hectare per month.

The initial costs of installation associated with the various alternatives are summarized in Table 28.

The estimated per hectare costs of establishing improved permanent mixtures of grasses and legumes are described in Tables 29 to 32.

Fence Cost

Fencing requirements are closely related to pasture management. Thus, for example, rotation grazing whereby a pasture is fenced into a number of separate enclosures of equal size to be grazed alternately, has been devised to reduce uneven grazing. If there are enough of these enclosures, the grass can be pastured

TABLE 28.--Initial costs of establishing improved permanent pastures.

Pasture Program	Has.	Custom Hiring		With Owned Equipment	
		Per Ha.	Total	Per Ha.	Total
Without Fertilization		m$n.	m$n.	m$n.	m$n.
Pasture Program I	95	12,912.50	1,226,687	8,862.50	841,937
Pasture Program II	190	12,912.50	2,453,375	8,862.50	1,683,875
Pasture Program III	380	12,912.50	4,906,750	8,862.50	3,367,750
Pasture Program IV	570	12,912.50	7,360,125	8,862.50	5,051,625
Pasture Program V	760	12,912.50	9,813,500	8,862.50	6,735,500
With Fertilization					
Pasture Program I	95	18,262.50	1,734,937	14,012.50	1,331,187
Pasture Program II	190	18,262.50	3,469,875	14,012.50	2,662,375
Pasture Program III	380	18,262.50	6,939,750	14,012.50	5,324,750
Pasture Program IV	570	18,262.50	10,409,625	14,012.50	7,987,125
Pasture Program V	760	18,262.50	13,879,500	14,012.50	10,649,500

TABLE 29.--Estimated per hectare costs of establishing improved permanent pastures without fertilizing and hiring contractor services, Ayacucho and Rauch counties of Buenos Aires province, 1967-1968.

Operation			Times over	Cost per Operation	Total Cost per Ha.
Mixture for "intermediate lands"					
Seedbed preparation					
Plowing			1	1,300	1,300
Disking			3	750	2,250
Harrowing			2	275	550
Sowing			1	800	800
Herbicide spraying			1	450	450
Seed: Rye grass	12 kgs. at	m$n.	250 per kg.		3,000
Orchard grass	3 kgs. at	m$n.	180 per kg.		540
Fescue	5 kgs. at	m$n.	125 per kg.		625
Tall wheatgrass	5 kgs. at	m$n.	110 per kg.		550
Yellow sweet clover	3 kgs. at	m$n.	180 per kg.		540
White clover	2 kgs. at	m$n.	400 per kg.		800
Herbidide: M.C.P.A.	1.5 lts. at	m$n.	250 per lt.		375
Nonuse for 1 year (1)					2,250
				Total Cost	14,030
Mixture for "low lands"					
Seedbed preparation					
Plowing			1	1,300	1,300
Disking			3	750	2,250
Harrowing			2	275	550
Sowing			1	800	800
Herbicide spraying			1	450	450
Seed: Fescue	8 kgs. at	m$n.	125 per kg.		1,000
Tall wheatgrass	8 kgs. at	m$n.	110 per kg.		880
Yellow sweet clover	3 kgs. at	m$n.	180 per kg.		540
Strawberry clover	1 kgs. at	m$n.	1,400 per kg.		1,400
Herbicide: M.C.P.A.	1.5 lts. at	m$n.	250 per lt.		375
Nonuse for 1 year (1)					2,250
				Total Cost	11,795
Average Cost per Hectare of Improved Permanent Pasture (2)					12,912.50

(1) It is assumed that grazing fees are paid to other ranchers at the rate of m$n. 250 per animal unit per month.

(2) Under the assumption that 50% of the improved pastures are established in the intermediate lands and 50% in the low lands.

TABLE 30.--Estimated per hectare costs of establishing improved permanent pastures without fertilizing and using owned equipment, Ayacucho and Rauch counties of Buenos Aires province, 1967-1968.

Operation	Equipment Tractor 45 HP	Times over	Total Hours/ hectare	Total Cost per Ha.
Mixture for "intermediate lands"				m$n.
Seedbed preparation				
Plowing	4 - 14 HP	1	1.50	
Disking	40 - 20 HP	3	2.00	
Harrowing	6 - Tandem	2	0.67	
Sowing	28 - Discs	1	0.50	
Spraying	- Sprayer	1	0.33	
		Total	5.00	
Labor: 5 hours per ha, at m$n. 135.40 per hour				677
Fuel and lubrication:				
Gas-oil: 27.30 liters at m$n. 16 per liter:				437
Oil: 0.854 liters at m$n. 185 per liter:				158
Grease: 0.230 kilograms at m$n. 123 per kilo:				28
				1,300
Seed (1)				6,055
Herbicide (2)				375
Nonuse for 1 year (3)				2,250
			Total Cost	9,980
Mixture for "low lands"				
Plowing, disk and spike harrowing, sowing and spraying				1,300
Seed (1)				3,820
Herbicide (2)				375
Nonuse for 1 year (3)				2,250
			Total Cost	7,745
Average Cost per Hectare of Improved Permanent Pasture (4)				8,862.50

(1) Seed, (2) herbicide and (3) nonuse for 1 year the same amounts shown in Table 29.

(4) Under the assumption that 50% of the improved pastures are established in the intermediate lands and 50% in the low lands.

TABLE 31.--Estimated per hectare costs of establishing improved permanent pastures with the addition of fertilizer and hiring contractor services, Ayacucho and Rauch counties, 1967-1968.

Operation	Times over	Cost per operation	Total Cost per Ha.
Mixture for "intermediate lands"		m$n.	m$n.
Seedbed preparation			
Plowing	1	1,300	1,300
Disking	3	750	2,250
Harrowing	2	275	550
Fertilizing	1	400	400
Sowing	1	800	800
Herbicide spraying	1	450	450
Seed (1)			6,055
Herbicide (2)			375
Nonuse for 1 year (3)			2,250
Fertilizer: Ammonium Phosphate (18-47-0) 150 kilograms at m$n. 33,000 per ton			4,950
		Total Cost	19,380
Mixture for "low lands"			
Seedbed preparation			
Plowing	1	1,300	1,300
Disking	3	750	2,250
Harrowing	2	275	550
Fertilizing	1	400	400
Sowing	1	800	800
Herbicide spraying	1	450	450
Seed (1)			3,820
Herbicide (2)			375
Nonuse for 1 year (3)			2,250
Fertilizer: Ammonium Phosphate (18-47-0) 150 kilograms at m$n. 33,000 per ton			4,950
		Total Cost	17,145
Average Cost per Hectare of Improved Permanent Pasture (4)			18,262.50

(1) Seed, (2) herbicide and (3) nonuse for 1 year the same amounts shown in Table 29.

(4) Under the assumption that 50% of the improved pastures are established in the intermediate lands and 50% in the low lands.

TABLE 32.--Estimated per hectare costs of establishing improved permanent pastures with the addition of fertilizer and using owned equipment, Ayacucho and Rauch counties of Buenos Aires province, 1967-1968.

Operation	Equipment Tractor 45 HP	Times over	Total Hours/ hectare	Total Cost per Ha.
Mixture for "intermediate lands"				m$n.
Seedbed preparation				
Plowing	4 - 14 HP	1	1.50	
Disking	40 - 20 HP	3	2.00	
Harrowing	6 - Tandem	2	0.67	
Fertilizing	F - Spreader	1	0.67	
Sowing	28 - Drill	1	0.50	
Spraying	- Sprayer	1	0.33	
		Total	5.67	
Labor: 5.67 hours per ha. at m$n. 135.40 per hour				767.70
Fuel and lubrication:				
Gas-oil: 32.50 liters at m$n. 16 per liter:				520.00
Oil: 0.980 liters at m$n. 185 per liter:				181.30
Grease: 0.252 kilograms at m$n. 123 per kilo:				31.00
				1,500.00
Seed (1)				6,055
Herbicide (2)				375
Nonuse for 1 year (3)				2,250
Fertilizer (4)				4,950
			Total Cost	15,130
Plowing, disk and spike harrowing, sowing, fertilizing and spraying				1,500
Seed (1)				3,820
Herbicide (2)				375
Nonuse for 1 year (3)				2,250
Fertilizer (4)				4,950
			Total Cost	12,895
Average Cost per Hectare of Improved Permanent Pasture (5)				14,012.50

(1) Seed, (2) herbicide and (3) nonuse for 1 year, the same amounts shown in Table 29.

(4) Fertilizer: the same amounts shown in Table.

(5) Under the assumption that 50% of the improved pastures are established in the intermediate lands and 50% in the low lands.

down quickly to the desired level as soon as it has grown to a height suitable for grazing. Pastured areas continuously grazed, on the other hand, demand less fencing than rotationally grazed pastures. In any case, rational pasture management calls for adequately sized paddocks, which in turn may imply an extra cost of fencing, depending upon the size and shape of the fields that already exist on the ranch.

Fence costs per kilometer vary according to the kind and spacing of posts, the number of rods between successive posts and the kind and number of strands used in constructing the fence.

In establishing fencing requirements for calculation purposes the following assumptions were made:

1. The average-size field of improved pasture was 95 hectares.
2. The number of paddocks set up and the amount of meters of new fences constructed were: 2 paddocks and 1,000 meters in Pasture Programs I and II; 4 paddocks and 2,000 meters in Pasture Program III; 6 paddocks and 3,000 meters in Pasture Program IV and 8 paddocks and 4,000 meters in Pasture Program V.
3. Wire fences were constructed using red quebracho wood posts set at 12 meters from each other,

7 lapacho wood rods per intervals, 5 smooth and 2 barbewire strands.

The estimated cost per kilometer of wire fence is presented in Table 33.

TABLE 33.--Estimated cost per kilometer of wire fence, Ayacucho and Rauch counties of Buenos Aires province, 1967-1968.

Type of Cost	Unit	Quantity	Price	Cost per km.
Wire			m$n.	m$n.
Smooth No. 17-15	Roll	5	6,500	32,500
Barbed Wire	Roll	6	5,000	30,000
Quebracho	Number	84	1,000	84,000
Lapacho rods	Number	585	60	35,100
Labor	Meter	1,000	45	45,000
Other costs: Hauling, stays, staples, gates				23,400
Total Cost				250,000

In accordance with the assumptions and estimations made the construction of new fences amounted to: m$n. 250,000 for Pasture Programs I and II, m$n. 500,000 for Pasture Program III, m$n. 750,000 for Pasture Program IV and m$n. 1,000,000 for Pasture Program V.

Water Development Cost

Stock wells were considered to be the most reliable source of stock water by the ranchers interviewed. The windmill was the common source of power for lifting water from wells. Only in a few instances had it been replaced by gasoline motors and pumps. Galvanized steel storage tanks (the so-called Australian tanks) were most frequently used on the ranches surveyed to store moderate supplies of water to be furnished to livestock through pipes and troughs.

The major costs demanded to install this kind of water development are the drilling, the casing, pipes and rods, the windmill and tower and the storage tank. Costs per well vary according to variations in depth to water, strata to be drilled through, requirements for casing and pipe, windmill sizes and tower heights, and storage tank capacities.

New water-facility requirements were calculated taking into account the number of paddocks to be set up when improved permanent pastures are installed, the number of wells already in existence on the ranches visited and increases in the carrying capacity of the range. They implied the construction of two additional wells for either pasture program IV and V and of one extra water point for either pasture program III or II, when pasture improvement took place without the

addition of fertilizers. When more cattle may be added to the ranching enterprise, as the result of the fertilization of the improved pastures, new water facilities implied the construction of one extra water point for pasture program I, two additional wells when pasture programs II or III are adapted and three additional wells for either pasture program IV or V.

The estimated cost per stock well including storage tank is given in Table 34.

New water facilities represented these additional investments: m$n. 360,000 for Pasture Programs II and III, and m$n. 720,000 for Pasture Programs IV and V, to be carried out without fertilization. When the addition of fertilizer was contemplated, new water developments amounted to: m$n. 360,000 for Pasture Program I, m$n. 720,000 for either Pasture Program II or III, and m$n. 1,080,000 for either Pasture Program IV or V.

Investment on Livestock

It has been assumed that cattle numbers would be adjusted so as to take advantage of the added carrying capacity of the areas devoted to livestock resulting from the installation of improved permanent pastures.

In order to build up herds, heifer calves may be retained from the weaned annual production. Otherwise, pregnant cows may be purchased to be incorporated as

TABLE 34.--Estimated cost per stock well, Ayacucho and Rauch counties of Buenos Aires province, 1967-1968.

Type of Cost	Unit	Quantity	Price	Cost per Well
			m$n.	m$n.
Drilling cost	Meter	12	7,000	84,000
Casing, pipe and rod	Meter	30	500	15,000
Windmill and tower	Number	1	125,000	125,000
Troughs	Number	2	6,000	12,000
Galvanized steel storage Tanks	Number	1	70,000	70,000
Labor	Well	1	45,000	45,000
Other costs: cylinder, transportation charges, etc.				9,000
Total Cost				360,000

soon as the newly established pastures are in condition to be grazed. In one case or the other increased livestock inventories will represent additional investments.

The investment that each extra head of livestock represents was estimated according to the following market prices for the period June, 1967-July, 1968: Brood cows m$n. 23,000, replacement heifers over two years m$n. 14,000, replacement heifers over one year m$n. 11,000, bulls m$n. 55,000 and horses m$n. 25,000.

The increase in livestock numbers corresponding to the adoption of the various pasture programs, with and without the application of fertilizer, and the additional investment that they represent are shown in Tables 35 and 36.

Maintenance Costs

Various annual costs related to the maintenance of a good stand of new grasses and legumes but which are not associated with initial investment may be incurred. Thus, an intensive program of pasture production should give particular attention to such cultural practices as fertilization, weed control and mowing of the established pastures to remove mature herbage, in order to insure maximum production of high quality pasturage.

Moreover, the maintenance of a balance of legumes and grasses in a mixture is also influenced to a considerable extent by grazing management. In most cases the legumes dictate the grazing management since they must be favored to persist in mixed seedings. In general, the competitive ability of a plant in mixtures depends upon its height and density. No two speices of plants are equal in their competitive abilities at all times of the year. Hence, grazing must be managed to favor the least aggressive species in pasture mixtures. On the other hand, if the more aggressive species cannot

TABLE 35.--Change in livestock numbers and inventory values from the adoption of alternative pasture programs without fertilization, Ayacucho and Rauch counties of Buenos Aires province, 1967-1968.

Class of Livestock	Percentage of the livestock area seeded to permanent pastures									
	5		10		20		30		40	
	Added Head	Value m$n.	Added Head	Value m$n.	Added Head	Value m$n.	Added Head	Value m$n.	Added Head	Value m$n.
Brood cows	39	897,000	77	1,771,000	150	3,450,000	222	5,106,000	305	7,015,000
Heifers 2 yrs.	8	112,000	15	210,000	30	420,000	44	616,000	61	854,000
Heifers 1 yr.	9	99,000	15	165,000	31	341,000	45	495,000	63	693,000
Bulls	2	110,000	4	220,000	7	385,000	11	605,000	15	825,000
Horses	-	--	1	25,000	3	75,000	4	100,000	6	150,000
Added Investment		1,218,000		2,391,000		4,671,000		6,922,000		9,537,000

TABLE 36.--Change in livestock numbers and inventory values from the adoption of alternative pasture programs with the addition of fertilizer, Ayacucho and Rauch counties of Buenos Aires province, 1967-1968.

Class of Livestock	Percentage of the livestock area seeded to permanent pastures									
	5		10		20		30		40	
	Added Head	Value m$n.	Added Head	Value m$n.	Added Head	Value m$n.	Added Head	Value m$n.	Added Head	Value m$n.
Brood cows	125	2,875,000	248	5,704,000	490	11,279,000	727	16,721,000	978	22,494,000
Heifers 2 yrs.	25	350,000	50	700,000	98	1,372,000	145	2,030,000	196	2,744,000
Heifers 1 yr.	26	286,000	52	572,000	101	1,111,000	150	1,650,000	202	2,222,000
Bulls	6	330,000	12	660,000	25	1,375,000	36	1,980,000	49	2,695,000
Horses	3	75,000	5	125,000	9	225,000	14	350,000	19	475,000
Added Investment		3,916,000		7,761,000		15,353,000		22,731,000		30,630,000

be subdued by grazing, clipping at the time of their strongest growth becomes necessary if the desired plant competition is to be insured.

For instance, it has been pointed out that if the perennial ryegrass of a white clover-perennial ryegrass mixture were allowed to reach full height particularly in the spring, the clover that normally comes on later would be weakened and eventually suppressed.

Nevertheless, it should be emphasized that mowing of the improved permanent pastures to control weeds or to remove surplus growth was a practice not undertaken by the ranchers surveyed who conducted extensive types of pasture operations. Neither were fertilizers used on new seedings of grasses and legumes.

Therefore, the costs of fertilizing were computed on the basis of the experiments and recommendations made by the Agricultural Experiment Station of Balcarce. The other items classed as maintenance costs in this study were the annual costs of keeping fences and water facilities operating and in good repair. The annual cost of repairing fences including materials was estimated to amount to 5 hours of labor (half a wage) per kilometer of fences. The amount spent on repairing water facilities was estimated to amount to 6 days of work per stock well, annually.

Operational Costs

Operational costs are defined as the additional expenses required annually because of the adoption of new pasture programs which affect the organization and management of the cattle business.

These additional costs result primarily from the change in the carrying capacity of the ranch unit associated with the installation of improved permanent pastures which in turn leads to an increase in cattle numbers.

Thus, it was assumed that the addition of more cattle to a ranch herd would increase the following cost items: hired labor, salt and minerals, veterinary and medicines, bull services, hauling and marketing and taxes.

The added expenses associated with each pasture program were estimated under the assumptions made in Chapter III related to the physical inputs used in the modern system of beef production.

The increases in annual expenses, including maintenance costs, that correspond to each pasture program are shown in Tables 37 and 38.

Finally, the initial costs associated with the different pasture programs previously described in this Chapter are summarized in Tables 39 and 40.

TABLE 37.--Change in annual expenses resulting from the adoption of alternative pasture programs without fertilization, Ayacucho and Rauch Counties, 1967-1968.

Type of expenses	Percentage of the livestock area seeded to permanent pastures				
	5%	10%	20%	30%	40%
Added Expenses	m$n.	m$n.	m$n.	m$n.	m$n.
Labor hired	58,044	96,739	193,478	324,416	398,122
Veterinary medicines	9,387	18,356	36,178	54,100	71,146
Salt and minerals	1,620	3,210	6,420	9,660	12,570
Bull depreciation	12,500	25,000	43,750	68,750	93,750
Hauling and marketing	23,076	47,241	95,184	146,673	179,636
Taxes	11,707	24,045	48,522	74,858	91,303
Improvement repairs	570	1,707	3,413	3,980	5,117
Total Added Expenses	116,904	216,298	426,945	682,437	851,644

TABLE 38.--Change in annual expenses resulting from the adoption of alternative pasture programs with the addition of fertilizer, Ayacucho and Rauch Counties, 1967-1968.

Type of expenses	Percentage of the livestock area seeded to permanent pastures				
	5%	10%	20%	30%	40%
Added expenses	m$n.	m$n.	m$n.	m$n.	m$n.
Labor hired	156,625	346,528	685,685	1,043,269	1,399,009
Veterinary medicines	25,975	51,778	103,919	160,097	207,578
Salt and minerals	4,410	8,880	17,940	27,150	35,850
Bull depreciation	37,500	75,000	156,250	225,000	306,250
Hauling and marketing	51,881	105,961	221,417	345,777	443,720
Taxes	26,019	53,204	111,467	174,385	223,385
Improvement repairs	1,491	2,628	4,334	4,901	6,039
Annual Fertilization[1]	194,750	389,500	779,000	1,168,500	1,558,000
Total added expenses	498,651	1,033,479	2,080,012	3,149,079	4,179,831

[1]Custom hiring the application of fertilizer. If owned equipment were used to apply the fertilizer, total expenses added annually would amount to m$n. 479,651, m$n. 995,479, m$n. 2,004,012, m$n. 3,035,079 and m$n. 4,027,831 for Pasture Programs I, II, III, IV and V, respectively.

TABLE 39.--Initial investment associated with the adoption of alternative pasture programs, without fertilizing, Ayacucho and Rauch Counties, 1967-1968.

Type of Investment	Percentage of the livestock area seeded to permanent pastures				
	5%	10%	20%	30%	40%
Custom hiring the tillage work for planting improved pastures					
Initial investment	m$n.	m$n.	m$n.	m$n.	m$n.
Livestock	1,218,000	2,391,000	4,671,000	6,922,000	9,537,000
Fences	250,000	250,000	500,000	750,000	1,000,000
Water facilities	--	360,000	360,000	720,000	720,000
Seeding of improved pastures	1,226,687	2,453,375	4,906,750	7,360,125	9,813,500
Total	2,694,687	5,454,375	10,437,750	15,752,125	21,070,500
Using owned equipment to perform the tillage work					
Livestock	1,218,000	2,391,000	4,671,000	6,922,000	9,537,000
Fences	250,000	250,000	500,000	750,000	1,000,000
Water facilities	--	360,000	360,000	720,000	720,000
Seeding of improved pastures	841,937	1,683,875	3,367,750	5,051,625	6,735,500
Total	2,309,937	4,684,875	8,898,750	13,443,625	17,922,500

TABLE 40.--Initial investment associated with the adoption of alternative pasture programs, with fertilization, Ayacucho and Rauch Counties, 1967-1968.

Type of Investment	Percentage of the livestock area seeded to permanent pastures				
	5%	10%	20%	30%	40%
Custom hiring the tillage work for planting improved pastures					
Initial investment	m$n.	m$n.	m$n.	m$n.	m$n.
Livestock	3,916,000	7,761,000	15,353,000	22,731,000	30,630,000
Fences	250,000	250,000	500,000	750,000	1,000,000
Water facilities	360,000	720,000	720,000	1,080,000	1,080,000
Seeding of improved pastures	1,734,937	3,469,875	6,939,750	10,409,625	13,879,500
Total	6,260,937	12,200,875	23,512,750	34,970,625	46,589,500
Using owned equipment to perform the tillage work					
Livestock	3,916,000	7,761,000	15,353,000	22,731,000	30,630,000
Fences	250,000	250,000	500,000	750,000	1,000,000
Water facilities	360,000	720,000	720,000	1,080,000	1,080,000
Seeding of improved pastures	1,331,187	2,662,375	5,324,750	7,987,125	10,649,500
Total	5,857,187	11,393,375	21,897,750	32,548,125	43,359,500

CHAPTER VI

THE PROFITABILITY OF RANGE IMPROVEMENT

The central purpose of this study was to determine to what extent the extra investment associated with the installation of improved permanent pastures would prove to be profitable to individual ranchers of the cattle breeding area of Buenos Aires province.

The possible adoption of alternative pasture programs, with and without fertilization, was analyzed. Each of these plans was given detailed study with complete designs, and with careful estimates of investment costs and operation and maintenance costs, as well as of the returns to be expected from the various alternatives.

It was assumed that the adoption of any of the improved pasture programs would imply the simultaneous construction of new fences and water facilities and the parallel increase of cattle numbers. Therefore, with relation to each pasture program, the additional cost of fencing, developing new water facilities, and holding increased cattle numbers, together with the initial costs of seeding the improved mixtures of grasses and legumes, are to be regarded as single packages of investment funds.

Accurate estimates of the additional costs associated with each pasture program are necessary but are not sufficient to insure optimal investment decisions.

Investment funds may be allocated to pasture improvement with the expectation of an increased flow of income over some future period of time. Likewise, the costs associated with such an investment are distributed over time.

Because costs and returns accrue at different dates, a straightforward comparison between alternatives, based on the respective sums of all receipts minus the sum of all disbursements can be grossly misleading. Different significance must be attached to the same amounts if they occur at different times. Otherwise, one would be disregarding the basic fact that a peso return at some future date is not equal to a one peso cost today. Hence, in order to make optimal investment decisions, all of the added returns and costs that are expected to be associated with the investment over the entire life of the project, are to be compared at the same point in time.

In this chapter two procedures are used to compare the alternative series of costs and receipts involved in each pasture program. The results that are achieved without the use of improved permanent pasture (i.e. the

"traditional system") were taken as a basis for comparison. The procedures followed are:

1. The determination of the prospective internal rate of return which corresponds to the investment in each pasture program, i.e. of the discount rate that makes the present value of the program's receipt stream equal to the present value of its cost stream, or in other words, the rate of discount which makes the present value of the expected change in net worth associated with a given pasture program equal to zero. The calculated returns are then compared with a minimum rate of return that is attractive in the particular circumstances.

2. The maximization of "present worth," i.e. the present value of receipts minus the present value of costs, using a stipulated minimum attractive rate of return as an interest rate.

As a first step common to both procedures, for each pasture program estimates were made of (a) the amounts of prospective money receipts, (b) the amounts of prospective money disbursements, and (c) salvage values, given the time span over which the improved permanent pastures can be utilized.

The annual expected returns from the adoption of the various pasture programs were estimated under the assumption of constant production rates. Yearly cash

expenses were also assumed to be constant throughout the life of each program.

The initial costs associated with the different pasture programs and the uniform series of the respective additional annual costs were described in Chapter V and summarized in Tables 37 to 40.

The additional income flows derived from the investments on the various pasture programs may be obtained by comparing the budgets incorporated in Chapters III and IV. A more detailed description is given in Table 41.

The economic evaluation of range improvement would be relatively simple if it were not for the presence of uncertainty in determining expected values--yield, price and life of the stand. There is always a possibility that all or part of a seeding may fail. To the uncertainty of forage stand must be added the uncertainty of livestock prices and production.

Because of possibility of failure to get a stand of grass (partial or total) and price risk with respect to the products produced and factors purchased, ranchers may discount expected returns. As a matter of fact, the more cautious the ranchers are, the more they will discount returns in order to acquire safety margins.

To the extent that uncertainty is involved in range improvement, discounting may be applied not only because of time but also because of "risk" itself. Thus

TABLE 41.--Added receipts from adopting alternative pasture programs, Ayacucho and Rauch Counties, 1967-1968.

Annual Additional Sales	Percentage of the livestock area seeded to permanent pastures									
	5%		10%		20%		30%		40%	
	# of Head	Value m$n.	# of Head	Value m$n.	# of Head	Value m$n.	# of Head	Value m$n.	# of Head	Value m$n.
	Without the Application of Fertilizers to the Improved Pastures									
Cull cows	7	81,333	13	151,047	25	290,475	37	429,903	52	604,188
Heifers calves	16	141,936	36	319,356	74	656,454	116	1,029,036	134	1,188,714
Steer calves	26	261,430	52	522,860	105	1,055,775	162	1,628,910	197	1,980,835
Hides	4	1,700	7	3,100	15	6,500	23	9,900	29	13,200
Total value of additional sales		486,399		996,363		2,009,204		3,097,749		3,786,937
	Fertilizing the Improved Permanent Pastures									
Cull cows	21	243,999	42	487,998	83	964,377	124	1,440,756	166	1,928,754
Heifers calves	30	266,130	63	558,873	140	1,241,940	226	2,004,846	281	2,492,751
Steer calves	57	573,135	116	1,166,380	241	2,423,255	377	3,790,735	483	4,856,565
Hides	9	4,200	19	9,200	40	19,500	50	29,000	78	37,900
Total value of additional sales		1,087,464		2,222,451		4,649,072		7,265,337		9,315,970

ranch operators might want to discount incomes of the future at higher rates than the assumed minimum attractive rates of return.

The exact rates of discount and hence the profitability of pasture investment will be affected by the degree of uncertainty with which individual ranchers view future prices, yields and techniques and their capital position and, hence, their ability to withstand setbacks in the future.

The Planning Periods and Salvage Values

Professional agricultural workers believe that the mixtures of grasses and legumes considered in this study have a normal life expectancy of about 5 years, when no fertilizers are applied to the improved pastures. In accordance with this it was assumed that each pasture program without fertilization would last 5 years. The life of the improved pastures was assumed to be 10 years with fertilization at the time of establishing the seedings and in each of the following years. This is the life span taken into account by the Balcarce Agricultural Experiment Station in computing the costs of pasture improvement that imply the addition of fertilizers. Five and ten years are therefore the lengths of time for which the different computations were made.

It was also assumed that no expected returns accrue after the end of the expected life of the improved pastures which might be attributable to them. Under this assumption it was regarded that they have a zero salvage value.

On the other hand, the salvage value of livestock at the end of the respective time periods was estimated to be equal to one hundred per cent of their inventory value at the beginning of each period. We assumed previously that livestock inventories remained constant in content and value throughout the planning period.

With relation to fences and water facilities it was assumed that they will continue to be used for a better distribution of cattle on the range at the end of the five and ten year planning periods. It is generally agreed that even an unimproved permanent pasture of native grasses should not be in one unit. Turning cattle into a large pasture often causes waste by trampling and spotty grazing. It is then better to divide a large pasture into several parts and graze each separately. When this is done there is less waste of forage and the grass has a chance to recover before it is again grazed off.

Therefore, there will be unexhausted services embodied in the resources under consideration at the end of the respective planning periods, since the types of

fences and water facilities described in Chapter V have a total useful life of 50 years and 30 years, respectively, according to the estimates made by Frank et al.[21]

Taking into account the initial construction costs of these improvements, their useful lives and the respective planning periods (i.e. 5 and 10 years), the corresponding salvage values were estimated.

Assuming a depreciation of a straight line nature, the value of fences and water facilities in t years after its construction can be approximated by the formula:

$$Vt. = \frac{C\ (n-t)}{n}$$

where: Vt = Value of the resource after t years

C = Initial construction cost

n = Total life expectancy of the resource

t = Number of years after construction

Thus, for example, if a fence which would cost $750,000 to construct were expected to last 50 years, we would consider that five years' use since the time it was built would exhaust one-tenth of its original cost. Therefore, as long as it continues to be used for its original purpose (i.e. a better distrubution of

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[21]Rodolfo G. Frank, Guillermo M. Caplan, and Alejandro F. Donatti, "Manual de Costos de Producción Agropecuarios," Vademecum Fruticola Argentino, Volumen IV (1968). Published by the Association of Argentine Fruit Producers.

cattle on the range), it would be valued after five years of its installation at $675,000. Taking this amount as a salvage value means that we permit depreciation of one-tenth of the cost of the depreciable item during the first five years of its life.

The salvage values which correspond to each pasture program are presented in Table 42.

Calculation of Prospective Rates of Return

The internal rate of return has been defined as the discount rate that makes the present value of the cost stream from a given project equal to the present value of its receipts stream.

With relation to the investment on each pasture program, the internal rate of return was determined by a process of successive approximations. The present values of increases and decreases in net worths over the planning period were calculated assuming different rates of interest. Then, the respective internal rate of return was found by linear interpolation. It should be noted that where present values of expected changes in net worth have been computed for interest rates separated by 1% or less, the possible error from linear interpolation is relatively small.

Present values were calculated as of the zero date of the series of payments being compared. Because

TABLE 42.--Salvage values associated with alternative pasture programs, Ayacucho and Rauch counties of Buenos Aires province, 1967-1968.

Salvage Values	Percentage of the livestock area seeded to permanent pastures				
	5%	10%	20%	30%	40%
	m$n.	m$n.	m$n.	m$n.	m$n.
	At the end of 5 years (1)				
Livestock	1,218,000	2,391,000	4,571,000	6,922,000	9,537,000
Fences	225,000	225,000	450,000	675,000	900,000
Water Facilities	--	300,000	300,000	600,000	600,000
Total	1,443,000	2,916,000	5,421,000	8,197,000	11,037,000
	At the end of 10 years (2)				
Livestock	3,916,000	7,761,000	15,353,000	22,731,000	30,630,000
Fences	200,000	200,000	400,000	600,000	800,000
Water Facilities	240,000	480,000	480,000	720,000	720,000
Total	4,356,000	8,441,000	16,233,000	24,051,000	32,150,000

(1) Pasture Programs carried out without fertilization.
(2) Pasture Programs carried out with fertilization.

initial costs are already at zero date, no interest factors were applied to first costs.

The present value of the expected additional receipt flows and of the expected cost increases were calculated by multiplying the respective amounts by the corresponding uniform payment present value factor, given the length of the planning period and the assumed interest rates. To convert salvage values to their present values at zero date a single payment present value factor was used.

The internal rate of returns computed for the various pasture programs are presented in Table 43.

TABLE 43.--Internal rates of return associated with the investment on alternative pasture programs, Ayacucho and Rauch, 1967-1968.

Type of Program	Percentage of the livestock area seeded to permanent pastures				
	5%	10%	20%	30%	40%
	Internal Rate of Return on Extra Investment (%)				
Without Fertilization					
Hiring contractor services	5.37	6.19	6.76	6.99	5.38
Using owned equipment	9.83	10.54	11.58	11.80	9.98
With Fertilization					
Hiring contractor services	7.23	7.58	8.80	9.80	8.98
Using owned equipment	8.67	9.07	10.50	11.48	10.63

The present value calculations to determine the prospective rate of returns are illustrated in Appendix II Tables 1-24.

Internal Rates of Return as a Basis for Decision Making

When funds are invested in any particular pasture program, the opportunity is foregone to obtain a return from the investment of the funds elsewhere. The opportunity foregone may be either within the ranching enterprise or outside of it.

Computing expected rates of return permits a ranch operator to compare possible returns from investing in different pasture programs with the returns attainable from other forms of ranch capital to take advantage of those investment opportunities which yield the highest returns.

Confronted with the alternative of investing his own funds or to lend them out, the rancher could determine whether the rate of return on the planned investment exceeds the market interest rate. If so, it pays him to use the funds himself. Otherwise, he would be ahead by lending the funds at the going rate of interest.

Moreover, in deciding whether to invest with borrowed funds, a ranch operator knowing the expected rate of return on the contemplated investment would be aware of the fact that it will pay him to invest through

external financing as long as the expected rate of return exceeds the interest rate charged on the loan.

In any case, before reaching a decision as to whether or not to invest on a particular pasture program, a rancher should compare the prospective return with the prospective return obtainable from alternative investments that he believes are of comparable risk.

Thus, for example, if the consequence of investing in a given pasture program with an internal rate of return of 7% were to forego some other investment that would yield 10%, it would not be sensible to undertake the given pasture program.

For a rancher who knows the prospective rate or return associated with a given pasture program, the relevant question then becomes: what investment opportunities, if any, are likely to be foregone as the result of adopting the proposed program? In other words, if the investment in the specific pasture program is not made, what return is likely to be obtainable from the same funds invested elsewhere?

Without knowledge of the prospective rates of return from alternative investment opportunities, a rancher cannot establish how much he is going to sacrifice by undertaking a particular pasture program (i.e. how much he could have earned by investing his funds in other use).

An optimal investment decision with relation to the adoption of a given pasture program yielding a known return may be reached once the returns obtainable from alternative investments have been determined, but it is not within the scope of this study to analyze the investment opportunities which may be opened to cattlemen in order to ascertain their prospective rates of return. Furthermore, there is no one figure which may be taken as a minimum attractive rate of return appropriate to all circumstances. It is reasonable that the lowest rate of return deemed sufficient to justify a particular investment should be much higher in some cases than in others, depending on the willingness of the decision maker to undertake the risks associated with the proposed investment.

Nevertheless, it should be pointed out that in accordance with Bignoli et al.[22] the total capital invested on a ranching operation in the cattle breeding area of Buenos Aires province yielded a return of 2.87% in 1964. Portalis[23] estimated that a return of 2.60% could be expected from investing in a cow-calf enterprise in 1967.

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[22]Bignoli, op. cit.

[23]Jaun R. Portalis. "Bases para la Promoción Ganadera del Norte Argentino," Conferencia pronunciada en la Sede de la Asociación Argentina de Cebú, Mimeograph, May, 1967.

Taking such returns as a basis for evaluating the relative profitability of pasture improvement, it would appear that a rancher who does not own cropping equipment should adopt Pasture Program IV--which implies the seeding with improved pastures of 30% of the area in livestock--yielding a return of 9.80% under the assumption that fertilizers were applied to the improved mixtures of grasses and legumes.

On the other hand, for an individual rancher, the rate of return obtainable from the opportunity foregone might be much higher if investment alternatives external to the ranch were considered.

Lending funds at interest is one example of investment alternatives outside the ranching enterprise. Large well-known corporations in relation to which reduced risk of loss is recognized were borrowing at from 27.37% to 44.92% per annum in 1967, according to Vendrell.[24] Since the rate of inflation as measured by the increase in wholesale prices during the same period was 25.8%,[25] the real rate of interest on this type of investment--i.e. the rate of return on investment

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[24]Alada J. L. M. Vendrell, "Costo del dinero en la Argentina," Fundación de Investigaciones Económicas Latinoamericanas (FIEL), Tomo 1 (1968).

[25]Fundación de Investigaciones Económicas Latinoamericanas, Indicadores de Coyuntura, Tomo No. 35 (January, 1969).

measured in pesos of constant purchasing power--ranged from 1.25% to 15.2%.

The Maximization of "Present Worth"

Another criteria for making optimum investment decisions is that of determining the present value of all added returns minus the present value of all added costs, which are likely to be associated with each of the alternative courses of action, given a stipulated minimum attractive rate of return used as an interest rate.

This method has been referred to as the maximization of "present worth," a term which is often used to mean the present value of receipts minus the present value of costs.[26]

A rancher who is confronted with an opportunity to invest in a particular pasture program should undertake it if the project has a positive present worth, once the respective streams of additional costs and receipts are discounted at the chosen rate of interest.

A rancher who must decide among several pasture programs that are mutually exclusive should choose the one which has the highest (positive) present worth when the streams are discounted at the selected rate of interest.

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[26]Roland N. McKean, Efficiency in Government Through Systems Analysis (New York: John Wiley & Sons, Inc., 1958).

In "present worth" comparisons, the interest rate selected for use in equivalence calculations has been defined as "the minimum attractive rate of return."[27]

The choice of a minimum attractive rate of return obviously has a great influence when decisions are made between alternative investment opportunities.

In determining a minimum attractive rate of return, a rancher should take into account the return that he could earn in the next-best investment opportunity open to him.

As pointed out earlier it was not within the scope of this study to determine the lowest rate of return which ranchers may deem sufficient to justify their investments on pasture improvement in light of the alternative investment opportunities that may be open to them and the risks involved in each type of investment.

Therefore, in order to illustrate the procedure under consideration, it is assumed first that an interest rate of 8% is the minimum attractive rate of return for ranchers who contemplate the adoption of new production programs based on the installation of improved permanent pastures. If the tillage work for planting the improved pastures were to be custom hired, none of the pasture programs which exclude the use of fertilizers should be

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[27]Eugene L. Grant and Grant Ireson, Principles of Engineering Economy (New York: The Ronald Press Company, 1960).

adopted. The projects' internal rates of return are less in all cases than the minimum attractive rate of return so that they will have a negative present worth when the chosen rate is used to discount the respective streams of costs and receipts.

Under the assumption that the different tasks would be performed through hiring contractors services, the seeding of 570 hectares to improved mixtures of grasses and legumes with the addition of fertilizers (Pasture Program IV) should be undertaken because it offers the highest (positive) change in Net Worth, when the streams are discounted at 8%.

If instead of 8% taken as a minimum attractive rate of return a 10% rate were chosen, only the use of equipment already in existence on the ranches would make profitable some seedings. Under this new assumption Pasture Program IV, carried out with the addition of fertilizers, again appears to be the most profitable since as in the first case it has the highest (positive) present worth, when the streams (i.e. costs and returns) are discounted at 10%.

The changes in Net Worth to be expected in accordance with the different assumptions made are summarized in Table 44.

TABLE 44.--Present value of expected changes in net worth for alternative pasture programs, Ayacucho and Rauch counties, 1967-1968.

Type of Program	Rate of Discount	Percentage of the livestock area with improved pasture				
		5%	10%	20%	30%	40%
Hiring Contractor Services						
Without Fertilization (1)	8%	-237,313	-355,209	-430,786	-529,713	-1,839,084
With Fertilization (2)	8%	-292,299	-312,991	1,244,811	3,789,978	2,765,963
Using Owned Equipment						
Without Fertilization (1)	10%	- 13,274	82,783	465,252	801,972	- 12,356
With Fertilization (2)	10%	-443,031	-599,828	613,451	2,717,572	1,528,899

(1) Over a 5 year Planning Period.

(2) Over a 10 year Planning Period.

It is pointed out that the purchase of new equipment in order to install improved permanent pastures with owned machinery in place of custom hiring the tillage work to be done represents an investment which is not justified. In all cases the purchase of new machinery would make pasture programs with or without fertilization less profitable than the same programs conducted through the hiring of contractor services to perform the necessary tasks, once the time value of money is taken into consideration.

On the other hand, if a rancher already owned sufficient machinery to perform the tasks related to pasture improvement in due time, custom hiring would not take place.

Appendix Tables 46-69 of Appendix II describe the procedure followed to determine the present value of the changes in Net Worth associated with the adoption of each pasture program under the different assumptions made.

CHAPTER VII

SUMMARY AND CONCLUSIONS

Land capability in the Southeastern part of the Buenos Aires province makes it necessary to devote a high proportion of the area to livestock grazing.

In an attempt to expand the beef industry in this region, technical recommendations have been made available to guide ranchers in seeding ranges to improved mixtures of grasses and legumes.

Indeed, through the installation of improved permanent pastures an increased quantity and better quality of range forage can be achieved. In turn, an increased beef production will be forthcoming as the result of the adoption of such improvements whenever carrying capacities and rates of gain are augmented, death losses are lowered and calf crops are raised.

On the other hand, the investments necessary for range improvements are at a high level currently. In most cases in the Pampean region the installation of improved permanent pastures will have to be complemented with the construction of new fences and water facilities for a better distribution of the cattle on the range, as well as with the acquisition of additional cattle.

In other words, an optimal utilization of the increased carrying capacity of rangelands resulting from the establishment of artificial pastures is more likely to be based on the development of other types of investments including the expansion of cattle numbers undertaken at the same time or shortly thereafter.

It is true that Argentine ranchers may increase beef production by making better use of their rangelands with better management and wisely-chosen range improvements. However, it is not enough to know that ranges can be improved successfully through the adoption of new technologies. What is physically possible may not be economically feasible.

It was with these thoughts in mind that this study was undertaken. The specific objectives of this study were (1) to analyze the conditions under which the installation of improved mixtures of grasses and legumes in the poorly drained and intermediate soils of the cattle breeding area of Buenos Aires province can be profitable on individual ranches, and (2) to show what technical and economic information is relevant and necessary for this analysis and to illustrate procedures used to determine whether any particular pasture program would be profitable.

Two basic systems of beef production were analyzed. One is identified as the "traditional system" carried on

with no improved permanent pastures. The other is called the "modern system" where improved mixtures of grasses and legumes have been installed.

In both cases, only ranching operations based on the sale of calves at weaning time, to be finished on ranches outside the area, were considered.

Pasture improvement with and without fertilization was included in this analysis. In each case five improved pasture programs were considered.

They differ from one another in the acreage involved in each program. It was assumed that 5 per cent, 10 per cent, 20 per cent, 30 per cent and 40 per cent of 1,900 hectares (i.e. the total area devoted to livestock production in the traditional system) was seeded each time with improved mixtures of grasses and legumes, so as to determine the relative profitability of these alternatives.

Improved quantity and quality of forage may result in some or all of the following benefits: (a) greater carrying capacity, (b) increased calf crops, (c) higher rates of gain by cattle and (d) lower death losses.

The installation of improved permanent pastures resulted in a greater carrying capacity and increased calf crop percentages proportionate to the acreage seeded up to a certain limit.

The seeding of improved mixtures of grasses and legumes and their rational management through the construction of new fences and water facilities by allowing a better feeding of brood cows may lead to higher calving rates and thereby to an improvement of the per cent calf crop.

On the other hand, once cows are adequately fed throughout the year by the installation of improved pastures the calving rate will reach a biological maximum, unless other technologies such as the strict selection of fertile animals and pregnancy test through rectal feeling are introduced.

The improvement of calving rates and consequently of the calf crop percentage tended to be associated with range improvement up to the point where the new mixtures of grasses and legumes represented 30 per cent of the total area in livestock.

In other words, it was assumed that the highest calf crop percentage that could be attained through the installation of improved pastures corresponded to the adoption of Pasture Program IV, which implied the seeding of 570 hectares to improved mixtures of grasses and legumes (i.e. 30 per cent of the total area in livestock).

Under this assumption Pasture Program IV appears to be the most profitable in terms of the change in Net Worth to be expected from the establishment of improved

permanent pastures. No pasture program would be adopted unless it were associated with an improved calf crop percentage.

Therefore, in order to illustrate the relative profitability of pasture improvement, it may be assumed that no more than 40 per cent of the total area in livestock would be seeded with the new mixtures.

An important source of data for the study was a survey of ranch operators made in the Ayacucho and Rauch counties of Buenos Aires province in 1968. Personal interviews of a sample of 30 ranch operators were conducted by the author. These ranchers were selected in accordance with the advice received from county agricultural extension agents. Eleven of the ranchers visited had no improved permanent pastures and 19 had seeded their ranges to improved mixtures of grasses and legumes.

Based on information obtained through the survey, supplemented by published and unpublished reports of Agricultural Experiment Stations, Faculties of Agronomy and Veterinary, other institutions and specialists associated with the ranch industry, physical resource requirements for each of the selected pasture programs were estimated by setting up specifications for "synthesized model operations" and computing the requirements

for establishing, maintaining and operating the improved permanent pastures.

The synthesized model operations represent the conditions most commonly found in the cattle breeding area of Buenos Aires province.

The additional costs of the resources required by the various pasture programs were based on 1967-1968 averages.

In establishing the costs of seeding with and without fertilization two different situations were examined. One assumed that ranchers would hire all work on a custom or contract basis. As pointed out in Chapters III and IV most ranchers depended on contracted services to have the tillage work done. Rates or costs associated with the contracted operations were obtained from some of the ranchers interviewed as well as from firms that operated in the area performing different agricultural tasks for a fee or custom rate. The other recognized the possibility that excess capacity with relation to cropping equipment may exist on some ranches. Therefore computations were also made under the assumption that the machinery needed for the establishment of improved permanent pastures was already available on the ranch. It is emphasized that the purchase of new machinery for the installation and maintenance of improved pastures is not justified taking into account the number of days that

the equipment can actually be used per year. To buy equipment in order to install permanent pastures would represent an overinvestment for a rancher who does not have sufficient amount of work to have ownership costs as low as the cost of hiring the work to be done on a custom basis.

Two techniques of economic analysis were used to appraise the profitability of the selected pasture programs. The first procedure was to determine the prospective internal rate of return corresponding to the investment on each pasture program under the assumptions made with relation to cattle prices, factor costs, yield differences and planning periods.

When improved permanent pastures were to be established without the addition of fertilizers by hiring the work to be done on a custom basis, the prospective internal rates of return associated with the investment on each pasture program were: 5.37% for Pasture Program I, 6.19% for Pasture Program II, 6.76% for Pasture Program III, 6.99% for Pasture Program IV and 5.38% for Pasture Program V. When owned equipment was used rather than hired contractor services, the prospective internal rates of return became: 9.83% for Pasture Program I, 10.54% for Pasture Program II, 11.58% for Pasture Program III, 11.80% for Pasture Program IV and 9.98% for Pasture Program V.

Under the assumption that the fertilization of the improved permanent pastures would take place, the following internal rates of returns were calculated (a) when seedbed tasks and ammonia phosphate fertilizer applications were contracted operations: 7.23% for Pasture Program I, 7.58% for Pasture Program II, 8.80% for Pasture Program III, 9.80% for Pasture Program IV and 8.98% for Pasture Program V; (b) when the different tasks were performed by using owned equipment: 8.67% for Pasture Program I, 9.07% for Pasture Program II, 10.50% for Pasture Program III, 11.48% for Pasture Program IV and 10.63% for Pasture Program V.

As can be seen the profitability of pasture improvement in terms of internal rate of return increases in all cases from Pasture Program I to Pasture Program IV and then declines when Pasture Program V is undertaken.

In any case, before reaching a decision as to whether or not to invest in a particular pasture program, a rancher should compare the prospective return with the prospective return obtainable from alternative investments that he believes are of comparable risk. That is to say, in order to make an optimal decision, he must establish some minimum acceptable rate of return in light of the opportunities foregone. This minimum attractive rate of return should be sufficient to

justify his investment on the given pasture program when the risks involved are taken into account.

The internal rates of return from pasture improvement may be lower than the prospective returns attainable from other investment opportunities open to ranchers. Under these circumstances, no pasture improvement should take place.

Therefore, once it has been determined to what degree the prospective returns from pasture improvement differ from those from other investment opportunities available to ranchers, it would be possible to support action programs to induce the establishment of improved permanent pastures as a way to increase beef production if this were required by the public interest.

Thus, for example, the promotion of pasture improvement by the Government through official credit institutions may be expected to succeed only on the condition that the interest charged on this type of loan were less than the calculated internal rates of return for the respective projects.

The second procedure used in evaluating the profitability of pasture improvement involved a discounting process that produced comparable results but made possible a direct comparison among alternative pasture programs.

When a choice is to be made among alternative pasture programs that are mutually exclusive, the one should be selected which has the highest (positive) present worth, once the streams of costs and returns have been discounted at a stipulated minimum attractive rate of interest.

Selecting an interest rate of 8% as the standard of attractiveness to be applied with relation to investments on pasture improvement, it appears that none of the pasture programs without fertilization should be undertaken when the different tasks had to be performed through custom hiring. Here the present value of the expected change in net worth over the planning period is negative in all cases. Under the assumption that fertilizers were used, Pasture Program IV appears to be the most profitable since it has a positive present worth equal to m$n. 3,789,978, which is the highest when the streams are discounted at 8% over a 10 year planning period.

When the different tasks associated with pasture improvement can be done with equipment already available on the ranch most pasture programs are profitable, even if an interest rate of 10% is chosen as the minimum attractive rate of return. Here again, Pasture Program IV to be carried out with fertilization appears to be

the most profitable in terms of the expected change in net worth over the life of the project.

These results clearly indicate that the mixtures of grasses and legumes to be established and maintained with the addition of fertilizers are more profitable to a considerable extent than the same mixtures without fertilization.

The Evaluation of Alternative Pasture Improvement Programs

The results shown with relation to the profitability of alternative pasture programs that can be adapted in the cattle breeding area of Buenos Aires province have the following limitations.

First, of the different techniques that can be used to increase forage production, only the seeding of native ranges with improved species of grasses and legumes was analyzed. Thus, for example, the use of fertilizers to improve the native range was not examined. It should be pointed out, however, with relation to the fertilization of natural grasses that sufficient physical information for an economic evaluation is not yet available. Furthermore, resource and time limitations precluded the consideration of pasture programs other than those studied.

Second, another type of cattle operation than the one used could not be expected to give the same results.

If, for example, an improved permanent pasture were successfully installed, the original cow-calf system of production might be changed for a cow-calf-yearling type of operation, or a mixture of production methods be adopted instead: some calves being sold at weaning time as feeder calves, and others being wintered and sold as feeder yearlings.

Third, the profitability of each pasture program was estimated under the assumption of constant production rates and yearly cash expenses. If the original carrying capacity were to fall and output from the original investment were reduced, future returns would be lower than those calculated. The same would happen if expected costs were to increase in later years when the pasture becomes older and requires more maintenance.

Fourth, if the seedings could reasonably be expected to last longer than the planning periods adopted, this would affect the returns to be expected from the respective investments.

Fifth, it was assumed that no returns will accrue after the end of the expected life of an improved pasture. However the benefits to be obtained from an improved pasture rarely end abruptly; usually they eventually taper off.

Sixth, Pasture Program IV, with or without fertilization, appears to be the most profitable under the

assumption that further increases in the acreage to be seeded with improved permanent pastures would result in an increased carrying capacity but left unchanged calving rates. If the highest calving rate attributable to a better feeding of brood cows were to be attained through the seeding of a higher or lower percentage of the total area in livestock with improved pastures than 30 per cent, other pasture programs could be more profitable.

Seventh, as an illustration two interest rates (8% and 10%) were selected to be taken as the minimum attractive rates of return for ranchers who are confronted with alternative investment opportunities under different conditions. The results could change if other rates of interest are used to discount the streams of costs and receipts.

We may conclude that the findings of this study may be used directly for decision making by an individual rancher to the extent that the actual conditions pertaining to his particular investment project (such as, expected inputs and outputs, prices, planning period and rate of discount) are reflected by the data developed in accordance with the assumption made.

In addition to the implications for individual ranch operators there are some general implications for policy, namely:

1. It was not possible to determine from the survey of ranchers price differentials among the cattle sold by the ranchers interviewed which could be attributed to differences in the live weight of the cattle marketed. As indicated in Chapter III, all cattle sales were made by the head rather than on the basis of price per kilogram of live weight.

Therefore, in calculating internal rates of return it was assumed that the animals of a given class (i.e. cull cows, feeder heifers and feeder steers) would bring the same price per head whether or not they had been raised on improved permanent pastures.

This implies that the adoption of improved permanent pastures does not result in higher rates of gain by cattle, or that differences in live weight are disregarded when feeder cattle are bought.

However, improved quantity and quality of forage from the adoption of improved permanent pastures may result in higher rates of gain by cattle in addition to increased carrying capacity and calf crops.

The degree of finish is important in feeder and stocker cattle as it influences the length of time required for an animal to attain a given degree of finish as a slaughter animal. Feeder cattle with a better degree of finish should bring higher prices than animals of the same quality with less weight.

Nevertheless, as pointed out earlier, feeder calves were commonly sold by the head at private treaty as well as at auctions. Sales by the head without reference to the weight of the cattle leave much to be desired in terms of pricing accuracy since the buyer is obliged to estimate the quantity as well as the quality he is purchasing. Sales on this basis tend to operate to the disadvantage of the producer.

The profitability of each pasture program might be substantially increased if the rates of gain at the time of sale were reflected in higher cattle prices per head. In other words, if new pasture programs are to pay it may require improvement in the marketing system as well as the production system.

2. A high proportion of the ranchers visited during the survey had their permanent residence in Buenos Aires or one of the other large cities. These absentee owners employ managers or foremen to operate the ranches they own. They spend a few days each month on the ranch and live with their families for a couple of months in the ranch mansion during vacation time.

Absentee arrangements are in general inefficient. In accordance with Schultz[28] the economic basis for such inefficiency rests on the proposition that in approaching

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[28]Theodore W. Schultz, Transforming Traditional Agriculture (New Haven and London: Yale University Press, 1964.

modern agricultural conditions the current operating decisions and the investment decisions in ranching are not only subject to many small changes which entail spatial, seasonal, mechanical and biological subleties that cannot be routinized, but also constantly require the adoption of new, superior, agricultural factors that are developed as a consequence of the advance in useful knowledge.

The decision to deal with these subleties, and especially to take advantage of the advance in useful knowledge, cannot as a rule be made efficiently under absentee arrangements for the simple reason that it is not possible for the absentee parties to become sufficiently informed. Absentee owners have not been successful generally in developing the necessary incentives and in delegating responsibility for decisions.

The adoption of new technology requires the manager to broaden his knowledge, obtain new experience, and develop sound judgement and decision capacity in new contexts. Such requirements accompany the adoption of better pasture and herd management which implies increased intensity, higher capital requirements, wider range in production alternatives, more complicated technology, and added reliance on labor and other services.

This means that the use of new technologies imposes greater demands on management which in general will not be fulfilled under absentee arrangements.

3. The ultimate decision of whether to invest in a particular pasture program is dependent not only upon a favorable comparison of costs and returns, but also upon an examination of alternative ways of increasing beef production.

There are other innovations which relate to livestock such as improved breeding, fertility tests, and sanitation through which ranch output may be increased with less additional capital outlay than that required for the installation and management of new mixtures of grasses and legumes.

So, even though budgeting may indicate that range improvement will be profitable, the individual rancher may increase net ranch income most by putting his money and effort into some other projects or operations. For example, a rancher might increase his income more from adoption of known but heretofore unused techniques than by seeding a particular piece of rangeland. It should be pointed out that while the per cent calf crop is influenced by the use of improved pastures, there are other important factors which may also raise the percentage of calves weaned such as (1) care in keeping only sound pregnant cows and in selecting full grown pregnant

heifers as replacements, (2) use of young bulls, scattering bulls on the range and getting rid of poor-working or old bulls, (3) earlier weaning, (4) provision of more salt and minerals to the cattle, and (5) testing and vaccinating for brucellosis and treating the cattle for internal parasites (worms).

Only a comparison of the earning abilities of the various alternatives through which ranch output might be increased will reveal the most profitable course of action.

4. Changes and adjustments in beef cattle operations may involve new investments in fencing, water facilities, enlarged and improved pastures, modern equipment and expansion of cattle numbers. In many cases the cost of adjusting the cattle enterprise may be so large as to make the use of borrowed funds the only alternative open to ranchers.

Lenders' knowledge and understanding of alternative systems of cattle breeding become essential if ranchers are to be helped in working out sound financing programs. In making loans to cattle producers, bankers must be familiar enough with ranching methods and practices to properly evaluate the relevant management factors that influence the income-producing capacities of alternative systems of cattle breeding.

A rate-of-return-type analysis of alternate possible financing plans would be useful for people in the farm credit field. However, when a proposed investment is to be financed by borrowing addition to considering the question "Will it be profitable?" it is also necessary to consider the question "Can the required repayment obligation be met?" This analysis implies that various possible plans for repayment of the borrowed money should be considered.

To the extent that ranchers are confronted with the problem of controlling enough capital to establish economically optimum ranch organizations, the degree of financial success that they may achieve in attempting to incorporate new methods of production will depend upon decisions relating to acquisition and use of credit. It is to be realized that an investment will not pay unless it can ultimately be repaid with interest. Thus, an understanding of ranching methods that enables lenders to "tailor" repayment terms according to the particular needs of cattlemen is required.

The technical and economic information that is relevant and necessary for determining the profitability of investing in a particular pasture program has been revealed through this analysis. As the specific conditions taken into account may vary especially with relation to the discount rates selected, yield differences

and the length of the planning periods, there can be no single answer to the question: If it profitable to install artificial pastures in the poorly drained or intermediate soils of the cattle producing area of Buenos Aires province?

Consequently the major emphasis of this analysis has been focused on determining whether investments in pasture improvement would be profitable. They can be used as guides for ranchers who contemplate the adoption of similar pasture programs.

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APPENDICES

APPENDIX I

RANCH SCHEDULE

RANCH SCHEDULE
RESEARCH PROJECT

Ranch N° ....
Page N° 1

Name of Operator ..... Province.....

Mail Address..... Partido.....

Person Interviewed..... Cuartel.....

Interviewer..... Railway Station.....

Date of Call: 1st..... 2nd..... Distance from the ranch....km.

GENERAL RANCH INFORMATION

1. Land Use. Year 1967-1968

Acreage	Hectares
Devoted to agriculture (cash crops)	
Planted to temporary winter pastures	
Planted to temporary summer pastures	
Planted to improved permanent pastures	
Occupied by natural pastures	
Occupied by farmstead, roads, buildings, yards	
Waste land	
TOTAL HECTERES OPERATED	

2. INVENTORY OF AVAILABLE RESOURCES

Land Resources

Land Capability	Hectares
Suitable only for natural pastures (Non tillable)	
Suitable only for improved permanent pastures (Tillable: poor grade cropland in area better suited for permanent pastures)	
Suitable for crop production (Tillable)	
Waste Land (too wet for vegetation or barren, too steep, rocky and eroded for vegetation, not suitable for cultivation or pasture.	

IMPROVEMENTS

3. BUILDINGS

Item	Size	Constr. Materials			Year Built
		Floor	Walls	Roof	
Rancher's dwelling					
Workers' dwelling					
Barns					
Livestock shelters					
Bins					
Granaries					
Silos					
Machine sheds					
Shops					
Garage					
Deep tanks					
Corrals					
Other					

4. FENCES

Type	Meters	N° of strands		Posts		Stakes		Year Built
		Smooth	Barbed	Kind	Spacing m.	Kind	N° between posts	
Boundary								
Cross								

WATER DEVELOPMENT. -STOCK WELLS-

5. WELLS POWERED BY A WINDMILL SETUP

Well N°	Tower height Feet	Wheel width Feet	Strata drilled through m.	Depth to water m.	N° of troughs	Year Built
1.						
2.						
3.						
4.						
5.						

6. WELLS POWERED BY A PUMPING EQUIPMENT

Well N°	Strata drilled through m	Depth to water m.	Type pumping equipment	N° of troughts	Year Built
1.					
2.					
3.					
4.					
5.					

7. STORAGE TANKS

AUSTRALIAN TANKS: Galvanized steel-concrete bottom

Tank N°	Number of Sections	Capacity -liters-	Year Built
1.			
2.			
3.			
4.			
5.			

Ranch N°.....
Page N° 4.

8. POWER, MACHINERY AND EQUIPMENT

ITEM	N°	Size	Year New	ITEM	N°	Size	Year New
Power							
Tractor				Cultivator			
Tractor				Escardillo			
Auto				Mower			
Jeep				Rake			
Pickup				Baler			
Truck				Field chopper			
Electric power motor				Silage cutter			
Combustion motor				Sprayer			
Windcharger				Spreader			
Vehicles				Fertilizer spreader			
Sulky							
Car (two wheeled)				Combine			
Wagon				Corn picker			
Stock trailer				Corn grinder			
Other				Other			
Machinery				Ranch			
Plows:				equip-			
(de mancera)				ment			
(de asiento)				Saddles			
(para tractor)				Tools			
multiple				Fuel barrels			
(de discos)				Fuel tanks			
Harrow				Other			
Disk-Harrow							
Roller							
Grain drill							
Broadcaster							
Corn planter							

Adjustments made by the rancher to seasonal variations in pasture production.

9.- How do you adjust your ranching operation in order to meet seasonal variations in pasture production? (Note here exactly what he says)

_____

_____

_____

_____

Possible adjustments which may be made. (Code for Question above)

1. Just enough cattle are carried on the ranch so that pasture is adequate in the periods of lowest pasture production. Surplus pasture in the best months goes unused or excess growth accumulate to be consumed later.
2. The cattle raising operation is planned on the basis of the expected average annual pasture production. Deferred grazing, hay or silage are carried over from best months to be fed in poor months.
3. Supplementary pastures are provided in periods of low production. Oats, barley, rye and/or wheat during winter time. Corn and/or sorghum in the summer.
4. Concentrates and/or roughage are purchased to be fed in periods of lowest pasture output.
5. Cattle are allowed to lose weight during the periods of low pasture, production (i.e. cattle production drop with decline in pasture output.
6. Cattle are bought and sold according to the circumstances in order to fit pasture production.
7. Grazing fees are collected when there is surplus pasture and paid if enough forage is lacking.

Adjustments made by the rancher to variations in annual pasture output.

10.- What kind of adjustments do you make in order to meet year-to-year variations in pasture production? (Note here exactly what he says)

_____

_____

_____

Possible adjustments to be made (Code for Question 11)

1. The cattle breeding operation is programmed to assure enough pasture in poorer (i.e. drought or flood) years. Pasture feed goes unused in years of better weather.
2. Just enough cattle are kept on the ranch to meet forage production in average years. Excess forage production from years of better than average weather are stores as hay or silage to be fed in poor years.
3. Cattle production is planned to fit the available forage in the better years. In years when pasture yields are low, hay is bought, additional land is rented and/or grazing fees are paid.
4. Cattle numbers adjusted to fit pasture production. Cattle are sold when it appears that pasture output will be low, and additional cattle are bought when the pasture outlook is good.
5. Purchase feed concentrates to supplement pasture forage.

eaction of the rancher regarding new pasture developments

f no adjustments have been made in terms of pasture improvement, ask the following uestion:

1.- What is the reason for you not having an improved permanent pasture? (Note here exactly what he says, listing the reasons in order of importance)

1st. Reason _____

_____

2nd. Reason _____

_____

3rd. Reason _____

_____

Possible answers ranchers may give for not having pasture improvement (Code for question 1).

1. Land suitable only for forage production of native grasses.
2. Artificial pastures well adapted to the ecological conditions of the area are not known.
3. It would not pay, since the change in total income expected to result from the installation of artificial pastures is less than the change in total costs associated with it.
4. The economic incentive to install an artificial pasture is not strong enough. (i.e. I have a comfortable set-up, why extend myself?)
5. Capital Limitations:
   (a) I would invest in pasture improvement if I owned more funds but I don't want to go in debt to improve pastures.
   (b) I would invest in pasture improvement if I could obtain credit, or if credit were available under easier terms.
6. The existing tax system does not encourage investment in pasture improvement.
7. Higher alternative returns rate can be earn within the year by investing owned funds in other enterprises.
8. Inflation makes it more profitable to buy additional land than to invest in pasture improvement.
9. Risk and uncertainty:
   (a) Pasture improvement entails added risks and uncertainties because of the possibility of stand failure.
   (b) To the uncertainty of forage stand must be added the uncertainty of cattle prices.

If improved permanent pastures have been installed, ask the following questions:

12. What decide you to invest in pasture improvement?_____

_____

_____

_____

13. Would you invest more in pasture improvement if you owned more funds? (For example, if you were unexpectedly to inherit a substantial amount of money, would you use it to increase the investment in pasture improvement?).

    1. Yes_____ 2. No _____, In any case, Why? _____

    _____

    _____

    _____

14. If yes, When? _____; How much? _____ hectares.

15. Did you use your own funds to install permanent pastures? 1. Yes_____2. No_____

16. If borrowed funds were used, did you use all of the credit you were entitled to obtain for pasture improvement? 1. Yes_____ 2. No_____

17. If the answer is no, ask: If you believe that you could borrow (more) money to install more improved permanent pastures, can you give me one or more reasons why you have not already done this?

_____

_____

_____

_____

_____

Possible reasons ranchers may give for not using more credit to increase investment in pasture improvement (Code to question 17).

1. There's no more land suitable to install artificial pastures on the ranch.
2. I'm not satisfied with the results obtained from the pastures already installed.
3. I would like to install more artificial pastures but the amount of credit at my disposal is not enough to do it.
4. The present terms of credit are not convenient.
5. I would have to go in debt more than I want to.
6. I don't need new improved pastures bad enough to go in (additional) debt for it.
7. I prefer to use my borrowing capacity to undertake other kind of investments, which may yield a more certain or a higher rate or return.
8. I have security and ample volume with my present set-up. Why should I extend myself?

TURE SYSTEMS

What type of pasture system do you use?

a. Continuous grazing_____

b. Rotation grazing using:
   1. Permanent fences _____
   2. Electric wire _____

c. Deferred grazing _____

COMBINATIONS OF PERMANENT GRASSES AND LEGUMES USED ON THE RANCH

Mixtures of grasses and legumes Species and varieties	Has.	Seed kilos per Ha.	Year of Seeding	Normal life expectancy -Years-	Condition of the pasture			Origin of Seed (1)
					Good	Fair	Poor	
A.								
B.								
C.								

. ANNUAL GRASSES AND LEGUMES PLANTED FOR FORAGE PRODUCTION

Type of Pasture Species and Varieties	Pure Stand Has.	Seeding Associated with:	Has.	Seed used per Ha. Pure Stand	Associated seeding
Winter Pastures A. B. C. D. E.					
Summer Pastures A. B. C. D.					

(1) Origin of Seeds

I.N.T.A.
Private breeders
Seed Retailers
Cooperative
Import Firms
Home grown
Neighbors
Other

21. How many head of cattle (mature cows) do you estimate that can be grazed per hectare each month (or else each season) on the different pastures of your ranch?

Kind of Pasture	Grazing Periods											
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.
NATURAL PASTURE												
	Spring:			Summer:			Fall:			Winter		
IMPROVED PERMANENT (1)												
	Spring:			Summer:			Fall:			Winter		
TEMPORARY WINTER (2)												
TEMPORARY SUMMER (2)												

(1) Code in blanks of question 19.
(2) Code in blanks of question 20.

22. NONUSE UNTIL A NEW PASTURE IS ESTABLISHED -ready for normal use-

Type (1) of Pasture	Has.	Date of Seeding	1st.Grazing Period Class of Cattle.....			2nd.Grazing Period Class of Cattle.....			3rd. Grazing Period Class of Cattle.....		
			From	To	N° of Head	From	To	N° of Head	From	To	N° of Head

Code in blanks of question 19.

Ranch N° .....
Page N° 10.

23. PASTURE PRODUCTION AND UTILIZATION

Type of Pasture	Direct Grazing	Hay Production Harvested		Hay Production Sold	Seed Production Harvested		Seed Production Sold	Silage Production Harvested		Silage Production Sold	Consumed on ranch	
	Has.	Has.	Tons. Ha.	Tons	Has.	Kilos Ha.	kilos	Has	Tons. Ha.	Tons.	Product	Tons kgs.
Permanent Pastures												
Alfalfa												
Other												
Temporary winter												
Oats												
Barley												
Rye												
Wheat												
Other												
Temporary summer												
Corn												
Sorghum												
Other												

24. PURCHASED FEED

Item	Unit	Quantity bought	Class of livestock fed	N° of Head
Concentrates				
Corn				
Oats				
Barley				
Rye				
Cottonseed meal				
Other				
Roughages				
Legume (alfalfa hay)				
Legume hay and grass				
Grass hay				
Silage				
Other				
Salt				
Minerals				
Vitamines				
Other				

25. PRACTICES FOLLOWED, EQUIPMENT AND LABOR USED FOR THE ESTABLISHMENT AND MAINTENANCE OF IMPROVED PERMANENT PASTURES

Kind of Pasture Established: (1) .....Hectares.....

Operation -Possible methods used-	Times Over	Equipment			Labor Hours per Ha
		Power	Machine used	Size	
Seedbed Preparation					
1. Plowing					
2. Disking					
3. Harrowing					
4. Rolling					
5. Fertilizing					
Planting					
6. Inoculating legume seed					
7. Drilling					
8. Broadcasting					
9. Harrowing-to cover seed-					
10. Rolling -to compact soil-					
Cultivating- during first year-					
Weed control					
11. Weed cutting					
12. Weed spraying					
Overgrowth control					
13. Mowing -to cut down overgrowth-					
Pest Control					
14. Treating against use of rodents					
15. Treating against use of insects					
Fencing					
16. To protect seeding against the use of livestock.					
Yearly Maintenance Operations					
Weed control					
17. Weed cutting					
18. Weed spraying					
Overgrowth Control					
19. Mowing of the pasture					
Pest Control					
20. Treating against insects					
Fertilization					
21. Annual use of fertilizer					
Maintenance of fences					
22. Around seedings.					

(1) Code in blanks of question 19.

26. NUMBERS OF BEEF ANIMALS AND OTHER LIVESTOCK. 196701968.

Class of livestock	On hand at Present	Died	Ranch consumed	Bought	Sold	On hand a Year ago	Sale weigh
Beef Cattle		Number of Head					kilo
Cows							
Heifers 2 years old and over							
Heifers 1 to 2 years old							
Steers 2 years old and over							
Steers 1 to 2 years old							
Heifers from weaning to 1 year							
Steers from weaning to 1 year							
Calves from birth to weaning							
Young bulls							
Mature bulls							
Total beef cattle							
Milk cows							
Saddle horses							
Draft horses							
Colts							
Total horses							
Ewes							
Bucks							
Whethers							
Borregos							
Borregas							
Lambs							
Total sheep							
Total swine							
Total Poultry							

27. PERCENT CALF CROP

Group	Number of Head				
	Exposed to breeding	Barren	Calves born	Calves died	Calves weaned
Cows					
First calf heifers					
Total					

28. BREEDS OF CATTLE AND QUALITY OF THE STOCK ON RANCH.

	Purebred		Unregistered (1)		Commercial	
	Brood Cows	Bulls	Brood Cows	Bulls	Brood Cows	Bulls
	Number of Head					
Angus						
Shorthorn						
Hereford						
Other						

(1) Unregistered cattle of registered parentage (Puro por cruza)

29. BREEDING PRACTICES

Range breeding ?.... Corral breeding?.... Artificial?...Year round?.....
Seasonal? From... To...

Pregnancy diagnosis		Fertility Test	Cow-Bull Ratio		Breeding age			
					Cows		Bulls	
Cows	Heifers	Bulls	Cows and Heifers exposed breeding	Mature Bulls	First	Last	First	Last
Number of Head					Months	Years	Months	Years

30. ANNUAL REPLACEMENT OF COWS

Average age at which cows are culled (years).....		
Item Source of replacement of cows	N° of Head	For each 100 cows
Ranch raised heifers kept annually to replace cows		
Cows purchased annually for replacement		
Item Replacements Ratios		
Old cows culled and sold annually		
Barren cows sold annually		
Cows died replaced annually		
Total Number of Cows replaced annually		

31. ANNUAL REPLACEMENT OF HEIFERS OF BREEDING AGE

Item Replacement ratios	N° of Head	For each 100 heifers
Barren heifers replaced annually		
Heifers died from weaning to breeding		
Weaned heifers kept annually for replacement-Total-		

32. REPLACEMENT OF BULLS

Number of years the average bull is kept in service.....		
Item Replacement ratios	N° of Head	For each 100 bulls
Old bulls sold annually		
Barren bulls sold annually		
Bulls died replaced annually		
Total Number of bulls replaced annually		

Ranch N°.....
Page N° 15.

33. CALVING AND WEANING

Practices	Calving and weaning times											
	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.
	Number of Head											
Calving: Calves born												
	Spring Percentage %			Summer Percentage %			Fall Percentage %			Winter Percentage %		
Weaning: Calves weaned												
	Spring Percentage %			Summer Percentage %			Fall Percentage %			Winter Percentage %		

Average Age at which calves are weaned	Average Age at which calves are sold	Sale weights Weaning	
		Steers	Heifers
Months	Months	kilos	kilos

34. HEALTH AND SANITATION PRACTICES

Veterinary Medicine Vaccines on Control	Product Brand	Number of Dosis	Veterinary Services	Number of
Foot and mouth			Assistance during calving	
Carbunclo bact.			Vaccinating	
Mancha-Neumoenteritis			Testing for Bangs	
Gangrena gaseosa			Testing for T.B.	
Bangs			Other	
Enteque				
Hipocalcemia				
Mastitis				
Poisoning				
Internal parasites - worms-				
External parasites -lice, ticks, sarna-				
Flies worms (bichera)				
Other				

5. RANCH OPERATING COSTS

LABOR UTILIZATION

HIRED LABOR - 1967-1968

Permanent labor: -i.e. working full time on the ranch year round

Type of labor	N° of men employed	Monthly wage	Total annual	Annual Benefits				Total benefits	Annual salaries
				Social laws	Food	House	Other		
		m$n.	m$n.	m$n.	m$n.	m$n.	m$n.	m$n.	m$n.
1. Mayordomo									
2. Encargado									
3. Capataz									
4. Peones (caballo)									
5. Peones(de a pie)									
6. Tractorista									
7. Mecánicos									
8. Cocinero									
9. Empleados de escritorio									
10. Puestero									
11. Other									

6. SEASONAL LABOR -i.e. seasonal help used for branding, dehorning, castrating, and other.-

Task performed	N° of men-days employed	Wage per day	Total annual	Annual Benefits				Total benefits	Total paid yearly
				Social laws	Food	House	Other		
		m$n.							m$n.
1.									
2.									
3.									
4.									

7. OPERATOR AND FAMILY LABOR

Family Members	Live on the Ranch		Residence			Kind of Work	
	Year round	Temporarily	Ranch	Town	City	Management Supervision	Pysical
Producer							
Wife							
Children 18 years old							
Less than 18 years							

38. CUSTOM HIRE

Task Performed (1)	Work (2) Unit	Amount Paid		Non-cash Payments	Total Paid	N° of days	N° of men	Man year Equivalent
		Per Unit m$n.	Total m$n.	m$n.	m$n.			

(1) Land preparation, mowing, silage cutting, harvesting, fencing, other.

(2) Hectare, Ton., Meter, kilometer, other.

39. GRAZING FEES PAID AND COLLECTED

Type of pasture	Class of livestock	N° of Head	N° of Months	Season	Fees:paid Head/Month	Collected Head/Month
Natural pastures						
Improved permanent pastures						
Temporary winter pastures						
Temporary summer pastures						

40. INSURANCES

Type of insurance	Total paid m$n.
Ranch service buildings	
Vehicles	
Tractors	
Breeding stock	
Other	

41. REPAIRS

Annual Repairs Expenses	Total paid m$n.
Ranch buildings	
Fences	
Water facilities	
Power and machinery	
Other	

- MARKETING OF LIVESTOCK AND RANCH PRODUCTS

Class of livestock and Ranch Products sold annually	Unit	Market where sold		Method of Delivery (2)	Transportation costs per unit	Marketing (3) Charges Total per unit m$n.	Marketing Costs Total per unit m$n.
		Type (1)	Distance from ranch kilometers				

(1) 1. Auction (Remate Feria)
2. Dealer
3. Other ranchers
4. Local butcher who slaughters
5. Terminal market
6. Packer
7. Packer buyer
8. Other

(2) 1. On foot
2. Railroad
3. Owned truck
4. Hired truck
5. Other

(3) 1. Commission for selling
2. Yardage
3. Feed (if the animals are fed)
4. Other

45. TAXES

Type of Tax	Land m$n. per Hectare	Livestock m$n. per head	Vehicles and other m$n. per unit
Federal			
Provincial			
Municipal (local)			

44. MATERIALS USED IN PASTURE IMPROVEMENT

Crop Treated (1):	Materials used to install artificial pastures				Materials used annually			
Item	Product Brand	Unit	Quantity per Ha.	Total Has.	Product Brand	Unit	Quantity per Ha.	Total Has.
Inoculating material								
Herbicide								
Insecticide								
Poison								
Fertilizer								
New fences								

(1) Code in blanks of questions 20 and 21.

45. FUEL AND LUBRICANTS USED IN OPERATING THE RANCH

Item	Unit	Quantity used per Year
Gasoline		
Gas-oil		
Kerosene		
Oil		
Grease		
Other		

46. MISCELLANEOUS ITEMS

Item	Total spent m$n.
Telephone and electricity (chargeable)	
Association fees and journals	
Containers (envases)	
Blacksmith's shop tools	
Carpenter's workshop tools	
Legal and bookeeping fees	
Other	

47. LIVESTOCK PRODUCTS SOLD

Item	Unit	Quantity sold
Wool		
Hides		
Pelts		
Other		

APPENDIX II

PRESENT VALUE OF EXPECTED CHANGES IN NET WORTH FOR ALTERNATIVE PASTURE PROGRAMS

APPENDIX TABLE 1.--Present value of expected changes in Net Worth for alternative pasture programs, without fertilization and custom hiring the tillage work, assuming an interest rate of 8% and a 5 year planning period.

Item	Program I 95 Has. m$n.	Program II 190 Has. m$n.	Program III 380 Has. m$n.	Program IV 570 Has. m$n.	Program V 760 Has. m$n.
I. Returns					
Expected additional returns per year	486,399	996,363	2,009,204	3,097,749	3,786,937
Estimated salvage value	1,443,000	2,916,000	5,421,000	8,197,000	11,037,000
II. Costs					
Initial cost of installation	2,694,687	5,454,375	10,437,750	15,752,125	21,070,500
Expected cost increases per year	116,904	216,298	426,945	682,437	851,644
III. Present value summary					
a. Present value of additional returns	1,942,046	3,978,179	8,022,149	12,368,382	15,120,103
b. Present value of salvage value	982,091	1,984,600	3,689,478	5,578,796	7,511,672
c. Total present value of added returns	2,924,137	5,962,779	11,711,627	17,947,178	22,631,775
d. Initial cost of installation	2,694,687	5,454,375	10,437,750	15,752,125	21,070,500
e. Present value of additional costs	466,793	863,613	1,704,663	2,724,766	3,400,359
f. Total present value of added costs	3,161,480	6,317,988	12,142,413	18,476,891	24,470,859
g. Difference (c-f)					
PRESENT VALUE OF THE EXPECTED CHANGE IN NET WORTH	-237,313	-355,209	-430,786	-529,713	-1,839,084

APPENDIX TABLE 2.--Present value of expected changes in Net Worth for alternative pasture programs, with fertilization and custom hiring the tillage work, assuming an interest rate of 8% and a 10 year planning period.

	Item	Program I	Program II	Program III	Program IV	Program V
		95 Has.	190 Has.	380 Has.	570 Has.	760 Has.
		m$n.	m$n.	m$n.	m$n.	m$n.
I.	Returns					
	Expected additional returns per year	1,087,464	2,222,451	4,649,072	7,265,337	9,315,970
	Estimated salvage value	4,356,000	8,441,000	16,233,000	24,051,000	32,150,000
II.	Costs					
	Initial cost of installation	6,260,937	12,200,875	23,512,750	34,970,625	46,589,500
	Expected cost increases per year	498,651	1,033,479	2,080,012	3,149,079	4,179,831
III.	Present value summary					
	a. Present value of additional returns	7,296,970	14,912,824	31,195,645	48,750,992	62,510,904
	b. Present value of salvage value	2,017,656	3,909,787	7,518,963	11,140,183	14,891,559
	c. Total present value of added returns	9,314,626	18,822,611	38,714,608	59,891,175	77,402,463
	d. Initial cost of installation	6,260,937	12,200,875	23,512,750	34,970,625	46,589,500
	e. Present value of additional costs	3,345,988	6,934,727	13,957,047	21,130,572	28,047,000
	f. Total present value of added costs	9,606,925	19,135,602	37,469,797	56,101,197	74,636,500
	g. Difference (c-f)					
	PRESENT VALUE OF THE EXPECTED CHANGE IN NET WORTH	-292,299	-312,991	1,244,811	3,789,978	2,765,963

APPENDIX TABLE 3.--Present value of expected changes in Net Worth for alternative pasture programs, without fertilization and using owned equipment, assuming an interest rate of 10% and a 5 year planning period.

	Item	Program I	Program II	Program III	Program IV	Program V
		95 Has.	190 Has:	380 Has.	570 Has.	760 Has.
		m$n.	m$n.	m$n.	m$n.	m$n.
I.	Returns					
	Expected additional returns per year	486,399	996,363	2,009,204	2,097,749	3,786,937
	Estimated salvage value	1,443,000	2,916,000	5,421,000	8,197,000	11,037,000
II.	Costs					
	Initial cost of installation	2,309,937	4,684,875	8,898,750	13,443,625	17,992,500
	Expected cost increases per year	116,904	216,298	426,945	682,437	851,644
III.	Present value summary					
	a. Present value of additional returns	1,843,832	3,776,993	7,616,450	11,742,885	14,355,445
	b. Present value of salvage value	895,388	1,810,603	3,366,007	5,089,681	6,853,094
	c. Total present value of added returns	2,739,220	5,587,596	10,982,457	16,832,566	21,208,539
	d. Initial cost of installation	2,309,937	4,684,875	8,898,750	13,443,625	17,992,500
	e. Present value of additional costs	443,157	819,938	1,618,455	2,586,969	3,228,395
	f. Total present value of added costs	2,753,094	5,504,813	10,517,205	16,030,594	21,220,895
	g. Difference (c-f)					
	PRESENT VALUE OF THE EXPECTED CHANGE IN NET WORTH	-13,274	82,783	465,252	801,972	-12,356

APPENDIX TABLE 4.--Present value of expected changes in Net Worth for alternative pasture programs, with fertilization and using owned equipment, assuming an interest rate of 10% and a 10 year planning period.

	Item	Program I 95 Has. m$n.	Program II 190 Has. m$n.	Program III 380 Has. m$n.	Program IV 570 Has. m$n.	Program V 760 Has. m$n.
I.	Returns					
	Expected additional returns per year	1,087,464	2,222,491	4,649,072	7,265,337	9,315,970
	Estimated salvage value	4,350,000	8,441,000	16,233,000	24,051,000	32,150,000
II.	Costs					
	Initial cost of installation	5,857,187	11,393,375	21,897,750	32,548,125	43,359,500
	Expected cost increases per year	474,451	995,479	2,004,012	3,035,079	4,027,831
III.	Present value summary					
	a. Present value of additional returns	6,661,986	13,655,964	28,566,502	44,642,299	57,242,537
	b. Present value of salvage value	1,672,812	3,254,343	6,257,471	9,272,623	12,395,111
	c. Total present value of added returns	8,334,800	16,910,307	34,824,073	53,914,922	69,637,648
	d. Initial cost of installation	5,857,187	11,393,375	21,897,750	32,548,125	43,359,500
	e. Present value of additional costs	2,947,044	6,116,780	12,313,772	18,649,225	24,749,249
	f. Total present value of added costs	8,804,431	17,510,155	34,211,522	51,197,350	68,108,749
	g. Difference (c-f)					
	PRESENT VALUE OF THE EXPECTED CHANGE IN NET WORTH	-443,331	-599,828	613,451	2,717,572	1,528,899

APPENDIX TABLE 5.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program I carried out without fertilization and hiring contractor services.

	Item	Amount m$n.	Pvf.(1)	Present Value m$n.	m$n.
	Present Value of the expected change in Net Worth over 5 years at 5%				
I.	Returns				
	Expected additional returns per year	486,399	4.32948	2,105,855	
	Estimated salvage value	1,443,000	.78353	1,130,634	
	Total present value of expected additional returns				3,236,489
II.	Costs				
	Reduction in cash balance (initial cost)	2,694,687		2,694,687	
	Expected (operating) cost increases per year	116,904	4.32948	506,133	
	Total present value of expected additional costs				3,200,820
	Present Value of expected change in Net Worth				35,669
	Present Value of the expected change in Net Worth over 5 years at 5.5%				
I.	Returns				
	Expected additional returns per year	486,399	4.27028	2,077,060	
	Estimated salvage value	1,443,000	.76513	1,104,083	
	Total present value of expected additional returns				3,181,143
II.	Costs				
	Reduction in cash balance (initial cost)	2,694,687		2,694,687	
	Expected (operating) cost increases per year	116,904	4.27028	499,213	
	Total present value of expected additional costs				
	Present Value of expected change in Net Worth				-12,757
INTERNAL RATE OF RETURN		$5\% + \frac{\text{m\$n. } 35,669}{\text{m\$n. } 48,426} (5.5\% - 5\%)$		=	5.37%

(1) Present Value Factor

APPENDIX TABLE 6.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program II carried out without fertilization and hiring contractor services.

	Item	Amount m$n.	Pvf.(1)	Present Value m$n.	m$n.
	Present Value of the expected change in Net Worth over 5 years at 6%				
I.	Returns				
	Expected additional returns per year	996,343	4.21236	4,197,040	
	Estimated salvage value	2,716,000	.74726	2,179,010	
	Total present value of expected additional returns				6,376,050
II.	Costs				
	Reduction in cash balance (initial cost)	5,454,375		5,454,375	
	Expected (operating) cost increases per year	216,243	4.21236	911,125	
	Total present value of expected additional costs				6,365,500
	Present Value of expected change in Net Worth				10,550
	Present Value of the expected change in Net Worth over 5 years at 6.5%				
I.	Returns				
	Expected additional returns per year	996,343	4.19688	4,180,966	
	Estimated salvage value	2,716,000	.73848	2,179,010	
	Total present value of expected additional returns				6,359,976
II.	Costs				
	Reduction in cash balance (initial cost)	5,454,375		5,454,375	
	Expected (operating) cost increases per year	216,243	4.19688	882,243	
	Total present value of expected additional costs				6,336,618
	Present Value of expected change in Net Worth				-17,042
INTERNAL RATE OF RETURN		6% + $\frac{\text{m\$n. } 10,550}{\text{m\$n. } 27,592}$ (6.5% - 6%)		=	6.19%

(1) Present Value Factor

APPENDIX TABLE 7.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program III carried out without fertilization and hiring contractor services.

	Item	Amount m$n.	Pvf.(1)	Present Value m$n.	m$n.
I.	Returns				
	Expected additional returns per year	3,009,364	4.1[illegible]68	8,349,609	
	Estimated salvage value	5,471,000	.72[illegible]83	3,956,679	
	Total present value of expected additional returns				12,306,288
II.	Costs				
	Reduction in cash balances (initial cost)	10,437,750		10,437,750	
	Expected (operating) cost increases per year	431,[illegible]49	4.1[illegible]68	1,774,247	
	Total present value of expected additional costs				12,211,997
	Present Value of expected change in Net Worth				94,291
	Present Value of the expected change in Net Worth over 5 years at 7%				
I.	Returns				
	Expected additional returns per year	3,[illegible]64,364	4.1[illegible]68	8,[illegible]9,139	
	Estimated salvage value	5,471,000	.71[illegible]83	3,[illegible]64,[illegible]64	
	Total present value of expected additional returns				12,133,203
II.	Costs				
	Reduction in cash balances (initial cost)	10,437,750		10,437,750	
	Expected (operating) cost increases per year	431,[illegible]49	4.1[illegible]68	1,750,[illegible]60	
	Total present value of expected additional costs				12,188,310
	Present Value of expected change in Net Worth				-55,107
INTERNAL RATE OF RETURN		6.5% + $\frac{\text{m\$n. } 94,291}{\text{m\$n. } 149,398}$ (7% - 6.5%)		=	6.76%

(1) Present Value Factor

APPENDIX TABLE 8.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program IV carried out without fertilization and hiring contractor services.

	Item	Amount m$n.	Pvf.(1)	Present Value m$n.	m$n.
	Present Value of the expected change in Net Worth over 5 years at 6.5%				
I.	Returns				
	Expected additional returns per year	3,097,749	4.15568	12,873,254	
	Estimated salvage value	8,197,000	.72988	5,982,826	
	Total present value of expected additional returns				18,856,080
II.	Costs				
	Reduction in cash balance (initial cost)	15,752,125		15,752,125	
	Expected (operating) cost increases per year	682,437	4.15568	2,835,990	
	Total present value of expected additional costs				18,588,115
	Present Value of expected change in Net Worth				267,965
	Present Value of the expected change in Net Worth over 5 years at 7%				
I.	Returns				
	Expected additional returns per year	3,097,749	4.10020	12,701,390	
	Estimated salvage value	8,197,000	.71298	5,844,297	
	Total present value of expected additional returns				18,545,687
II.	Costs				
	Reduction in cash balance (initial cost)	15,752,125		15,752,125	
	Expected (operating) cost increases per year	682,437	4.10020	2,798,128	
	Total present value of expected additional costs				18,550,253
	Present value of expected change in Net Worth				-4,566
INTERNAL RATE OF RETURN		$6.5\% + \frac{\text{m\$n. } 267,965}{\text{m\$n. } 272,531} (7\% - 6.5\%)$		=	6.99%

(1) Present Value Factor

APPENDIX TABLE 9.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program V carried out without fertilization and hiring contractor services.

	Item	Amount m$n.	Pvf.(1)	Present Value m$n.	m$n.
	Present Value of the expected change in Net Worth over 5 years at 5%				
I.	Returns				
	Expected additional returns per year	3,786,937	4.32948	16,395,468	
	Estimated salvage value	11,037,000	.78353	8,647,821	
	Total present value of expected additional returns				25,043,289
II.	Costs				
	Reduction in cash balance (initial cost)	21,070,500		21,070,500	
	Expected (operating) cost increases per year	851,644	4.32948	3,687,176	
	Total present value of expected additional costs				24,757,676
	Present Value of expected change in Net Worth				285,613
	Present Value of the expected change in Net Worth over 5 years at 5.5%				
I.	Returns				
	Expected additional returns per year	3,786,937	4.27028	16,171,281	
	Estimated salvage value	11,037,000	.76513	8,444,740	
	Total present value of expected additional returns				24,616,021
II.	Costs				
	Reduction in cash balance (initial cost)	21,070,500		21,070,500	
	Expected (operating) cost increases per year	851,644	4.27028	3,636,758	
	Total present value of expected additional costs				24,707,258
	Present Value of expected change in Net Worth				-91,237
INTERNAL RATE OF RETURN		5% + $\frac{\text{m\$n. } 285,613}{\text{m\$n. } 376,850}$ (5.5% - 5%)		=	5.38%

(1) Present Value Factor

APPENDIX TABLE 10.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program I carried out with fertilization and hiring contractor services.

	Item	Amount m$n.	Pvf.(1)	Present Value m$n.	m$n.
	Present Value of the expected change in Net Worth over 10 years at 7%				
I.	Returns				
	Expected additional returns per year	1,087,464	7.02358	7,637,890	
	Estimated salvage value	4,366,000	.50835	2,214,373	
	Total present value of expected additional returns				9,852,263
II.	Costs				
	Reduction in cash balance (initial cost)	6,260,937		6,260,937	
	Expected (operating) cost increases per year	498,651	7.02358	3,502.315	
	Total present value of expected additional costs				9,763,252
	Present Value of expected change in Net Worth				89,011
	Present Value of the expected change in Net Worth over 10 years at 7.5%				
I.	Returns				
	Expected additional returns per year	1,087,464	6.86408	7,464,440	
	Estimated salvage value	4,366,000	.48419	2,113,488	
	Total present value of expected additional returns				9,577,928
II.	Costs				
	Reduction in cash balance (initial cost)	6,260,937		6,260,937	
	Expected (operating) cost increases per year	498,651	6.86408	3,422,780	
	Total present value of expected additional costs				9,683,717
	Present Value of expected change in Net Worth				-105,789
INTERNAL RATE OF RETURN		$7\% + \frac{\text{m\$n. } 89,011}{\text{m\$n. } 194,800} (7.5\% - 7\%)$		=	7.23%

(1) Present Value Factor

APPENDIX TABLE 11.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program II carried out with fertilization and hiring contractor services.

Item	Amount m$n.	Pvf.(1)	Present Value m$n.	m$n.
Present Value of the expected change in Net Worth over 10 years at 7.5%				
I. Returns				
Expected additional returns per year	2,222,451	6.86408	15,255,081	
Estimated salvage value	8,441,000	.48519	4,095,489	
Total present value of expected additional returns				19,350,570
II. Costs				
Reduction in cash balance (initial cost)	12,000,875		12,200,875	
Expected (operating) cost increases per year	1,033,479	6.86408	7,093,883	
Total present value of expected additional costs				19,294,758
Present Value of expected change in Net Worth				55,812
Present Value of the expected change in Net Worth over 10 years at 8%				
I. Returns				
Expected additional returns per year	2,222,451	6.71008	14,912,824	
Estimated salvage value	8,441,000	.48319	3,909,787	
Total present value of expected additional returns				18,822,611
II. Costs				
Reduction in cash balance (initial cost)	12,000,875		12,200,875	
Expected (operating) cost increases per year	1,033,479	6.71008	6,934,727	
Total present value of expected additional costs				19,135,602
Present Value of expected change in Net Worth				-312,991
INTERNAL RATE OF RETURN	7.5% + $\frac{\text{m\$n. } 55,812}{\text{m\$n. } 368,803}$ (8% - 7.5%) =			7.58%

(1) Present Value Factor

APPENDIX TABLE 12.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program III carried out with fertilization and hiring contractor services.

	Item	Amount m$n.	Pvf.(1)	Present Value m$n.	m$n.
	Present Value of the expected change in Net Worth over 10 years at 8.5%				
I.	Returns				
	Expected additional returns per year	4,649,072	6.56134	30,504,142	
	Estimated salvage value	16,233,000	.44229	7,179,694	
	Total present value of expected additional returns				37,683,836
II.	Costs				
	Reduction in cash balance (initial cost)	23,512,750		23,512,750	
	Expected (operating) cost increases per year	2,080,012	6.56134	13,647,666	
	Total present value of expected additional costs				37,160,416
	Present Value of expected change in Net Worth				523,420
	Present Value of the expected change in Net Worth over 10 years at 9%				
I.	Returns				
	Expected additional returns per year	4,649,072	6.41765	29,836,117	
	Estimated salvage value	16,233,000	.42241	6,856,982	
	Total present value of expected additional returns				36,693,099
II.	Costs				
	Reduction in cash balance (initial costs)	23,512,750		23,512,750	
	Expected (operating) cost increases per year	2,080,012	6.41765	13,348,789	
	Total present value of expected additional costs				36,861,539
	Present Value of expected change in Net Worth				-168,440
INTERNAL RATE OF RETURN		8.5% + $\frac{\text{m\$n. } 523,420}{\text{m\$n. } 691,960}$ (9% - 8.5%)		=	8.88%

(1) Present Value Factor

APPENDIX TABLE 13.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program IV carried out with fertilization and hiring contractor services.

	Item	Amount m$n.	Pvf.(1)	Present Value m$n.	m$n.
	Present Value of the expected change in Net Worth over 10 years at 9.5%				
I.	Returns				
	Expected additional returns per year	7,265,337	6.27879	45,617,525	
	Estimated salvage value	24,051,000	.40352	9,705,060	
	Total present value of expected additional returns				55,322,585
II.	Costs				
	Reduction in cash balance (initial cost)	34,970,625		34,970,625	
	Expected (operating) cost increases per year	3,149,079	6.27879	19,772,406	
	Total present value of expected additional costs				54,743,031
	Present Value of expected change in Net Worth				579,554
	Present Value of the expected change in Net Worth over 10 years at 10%				
I.	Returns				
	Expected additional returns per year	7,265,337	6.14456	44,642,299	
	Estimated salvage value	24,051,000	.38554	9,272,623	
	Total present value of expected additional returns				53,914,922
II.	Costs				
	Reduction in cash balance (initial costs)	34,970,625		34,970,625	
	Expected (operating) cost increases per year	3,149,079	6.14456	19,349,705	
	Total present value of expected additional costs				54,320,330
	Present Value of expected change in Net Worth				-405,408
INTERNAL RATE OF RETURN		9.5% + $\frac{\text{m\$n. } 579,554}{\text{m\$n. } 984,962}$ (10% - 9.5%) =			9.80%

(1) Present Value Factor

APPENDIX TABLE 14.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program V carried out with fertilization and hiring contractor services.

Item	Amount m$n.	Pvf.(1)	Present Value m$n.	Present Value m$n.
Present Value of the expected change in Net Worth over 10 years at 8.5%				
I. Returns				
Expected additional returns per year	9,315,970	6.56134	61,125,247	
Estimated salvage value	32,150,000	.44229	14,219,624	
Total present value of expected additional returns				75,344,871
II. Costs				
Reduction in cash balance (initial cost)	46,589,500		46,589,500	
Expected (operating) cost increases per year	4,179,831	6.56134	27,425,292	
Total present value of expected additional costs				74,014,792
Present Value of expected change in Net Worth				1,330,079
Present Value of the expected change in Net Worth over 10 years at 9%				
I. Returns				
Expected additional returns per year	9,315,970	6.41765	59,786,635	
Estimated salvage value	32,150,000	.42241	13,580,482	
Total present value of expected additional returns				73,367,117
II. Costs				
Reduction in cash balance (initial cost)	46,589,500		46,589,500	
Expected (operating) cost increases per year	4,179,831	6.41765	26,824,692	
Total present value of expected additional costs				73,414,192
Present Value of expected change in Net Worth				-47,075
INTERNAL RATE OF RETURN	$8.5\% + \frac{\text{m\$n. } 1,330,079}{\text{m\$n. } 1,377,154} (9\% - 8.5\%) =$			8.98%

(1) Present Value Factor

APPENDIX TABLE 15.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program I carried out without fertilization and using owned equipment.

	Item	Amount m$n.	Pvf.(1)	Present Value m$n.	m$n.
	Present Value of the expected change in Net Worth over 5 years at 9.5%				
I.	Returns				
	Expected additional returns per year	486,399	3.83970	1,867,626	
	Estimated salvage value	1,443,000	.63523	916,637	
	Total present value of expected additional returns				2,784,263
II.	Costs				
	Reduction in cash balance (initial cost)	2,309,937		2,309,937	
	Expected (operating) cost increases per year	116,904	3.83970	448,876	
	Total present value of expected additional costs				2,758,813
	Present Value of expected change in Net Worth				25,450
	Present Value of the expected change in Net Worth over 5 years at 10%				
I.	Returns				
	Expected additional returns per year	486,399	3.79078	1,843,832	
	Estimated salvage value	1,443,000	.62092	895,988	
	Total present value of expected additional returns				2,739,820
II.	Costs				
	Reduction in cash balance (initial cost)	2,309,937		2,309,937	
	Expected (operating) cost increases per year	116,904	3.79078	443,157	
	Total present value of expected additional costs				2,735,094
	Present Value of expected change in Net Worth				-13,274
INTERNAL RATE OF RETURN		$9.5\% + \frac{\text{m\$n. } 25,450}{\text{m\$n. } 38,724} (10\% - 9.5\%) =$			9.83%

(1) Present Value Factor

APPENDIX TABLE 16.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program II carried out without fertilization and using owned equipment.

Item	Amount m$n.	Pvf.(1)	Present Value m$n.	m$n.
Present Value of the expected change in Net Worth over 5 years at 10%				
I. Returns				
Expected additional returns per year	996,363	3.79078	3,776,993	
Estimated salvage value	2,916,000	.62092	1,810,603	
Total present value of expected additional returns				5,587,596
II. Costs				
Reduction in cash balance (Initial cost)	4,684,875		4,684,875	
Expected (operating) cost increases per year	216,298	3.79078	819,938	
Total present value of expected additional costs				5,504,813
Present Value of expected change in Net Worth				82,783
Present Value of the expected change in Net Worth over 5 years at 11%				
I. Returns				
Expected additional returns per year	996,363	3.69589	3,682,448	
Estimated salvage value	2,916,000	.59345	1,730,500	
Total present value of expected additional returns				5,412,948
II. Costs				
Reduction in cash balance (Initial cost)	4,684,875		4,684,875	
Expected (operating) cost increases per year	216,298	3.69589	799,414	
Total present value of expected additional costs				5,484,289
Present Value of Expected Change in Net Worth				-71,341
INTERNAL RATE OF RETURN	$10\% + \frac{\text{m\$n. } 82,783}{\text{m\$n. } 154,124} (11\% - 10\%)$		=	10.54%

(1) Present Value Factor

APPENDIX TABLE 17.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program III carried out without fertilization and using owned equipment.

	Item	Amount m$n.	Pvf.(1)	Present Value m$n.	m$n.
	Present Value of the expected change in Net Worth over 5 years at 11%				
I.	Returns				
	Expected additional returns per year	2,009,204	3.69589	7,425,797	
	Estimated salvage value	5,421,000	.59345	3,217,092	
	Total present value of expected additional returns				10,642,889
II.	Costs				
	Reduction in cash balance (initial cost)	8,898,750		8,898,750	
	Expected (operating) cost increases per year	436,945	3.69589	1,577,942	
	Total present value of expected additional costs				10,476,692
	Present Value of expected change in Net Worth				166,197
	Present Value of the expected change in Net Worth over 5 years at 12%				
I.	Returns				
	Expected additional returns per year	2,009,204	3.60477	7,242,718	
	Estimated salvage value	5,421,000	.56743	3,076,038	
	Total present value of expected additional returns				10,318,756
II.	Costs				
	Reduction in cash balance (Initial cost)	8,898,750		8,898,750	
	Expected (operating) cost increases per year	436,945	3.60477	1,539,039	
	Total present value of expected additional costs				10,437,789
	Present Value of Expected Change in Net Worth				-119,033
INTERNAL RATE OF RETURN		11% + $\frac{\text{m\$n. } 166,197}{\text{m\$n. } 285,230}$ (12% - 11%)		=	11.58%

(1) Present Value Factor

APPENDIX TABLE 18.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program IV carried out without fertilization and using owned equipment.

	Item	Amount m$n.	Pvf.(1)	Present Value m$n.	m$n.
	Present Value of the expected change in Net Worth over 5 years at 11%				
I.	Returns				
	Expected additional returns per year	3,097,749	3.69589	11,448,940	
	Estimated salvage value	8,197,000	.59345	4,864,510	
	Total present value of expected additional returns				16,313,450
II.	Costs				
	Reduction in cash balance (Initial cost)	13,443,625		13,443,625	
	Expected (operating) cost increases per year	682,437	3.69589	2,522,212	
	Total present value of expected additional costs				15,965,837
	Present Value of expected change in Net Worth				347,613
	Present Value of the expected change in Net Worth over 5 years at 12%				
I.	Returns				
	Expected additional returns per year	3,097,749	3.60477	11,166,673	
	Estimated salvage value	8,197,000	.56743	4,651,224	
	Total present value of expected additional returns				15,817,897
II.	Costs				
	Reduction in cash balance (initial cost)	13,443,625		13,443,625	
	Expected (operating) cost increases per year	682,437	3.60477	2,460,028	
	Total present value of expected additional costs				15,903,653
	Present Value of Expected Change in Net Worth				-85,756
INTERNAL RATE OF RETURN		11% + $\frac{\text{m\$n. } 347,613}{\text{m\$n. } 433,369}$ (12% - 11%)		=	11.80%

(1) Present Value Factor

APPENDIX TABLE 19.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program V carried out without fertilization and using owned equipment.

	Item	Amount m$n.	Pvf.(1)	Present Value m$n.	Present Value m$n.
	Present Value of the expected change in Net Worth over 5 years at 9.5%				
I.	Returns				
	Expected additional returns per year	3,786,237	3.83970	14,540,702	
	Estimated salvage value	11,037,000	.63523	7,011,034	
	Total present value of expected additional returns				21,551,736
II.	Costs				
	Reduction in cash balance (initial cost)	17,992,500		17,992,500	
	Expected (operating) cost increases per year	851,644	3.83970	3,270,057	
	Total present value of expected additional costs				21,262,557
	Present Value of expected change in Net Worth				289,179
	Present Value of the expected change in Net Worth over 5 years at 10%				
I.	Returns				
	Expected additional returns per year	3,786,237	3.79078	14,355,445	
	Estimated salvage value	11,037,000	.63092	6,962,054	
	Total present value of expected additional returns				21,208,509
II.	Costs				
	Reduction in cash balance (Initial cost)	17,992,500		17,992,500	
	Expected (operating) cost increases per year	851,644	3.79078	3,228,395	
	Total present value of expected additional costs				21,220,895
	Present Value of Expected Change in Net Worth				-12,386
INTERNAL RATE OF RETURN		9.5% + $\frac{\text{m\$n. } 289,172}{\text{m\$n. } 301,565}$ (10% - 9.5%) =			9.98%

(1) Present Value Factor

APPENDIX TABLE 20.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program I carried out with fertilization and using owned equipment.

	Item	Amount m$n.	Pvf.(1)	Present Value m$n.	m$n.
	Present Value of the expected change in Net Worth over 5 years at 8.5%				
I.	Returns				
	Expected additional returns per year	1,087,464	6.56134	7,135,221	
	Estimated salvage value	4,356,000	.44229	1,926,615	
	Total present value of expected additional returns				9,061,836
II.	Costs				
	Reduction in cash balance (Initial cost)	5,857,187		5,857,187	
	Expected (operating) cost increases per year	479,651	6.56134	3,147,153	
	Total present value of expected additional costs				9,004,340
	Present Value of expected change in Net Worth				57,496
	Present Value of the expected change in Net Worth over 10 years at 9%				
I.	Returns				
	Expected additional returns per year	1,087,464	6.41765	6,978,963	
	Estimated salvage value	4,356,000	.41841	1,840,018	
	Total present value of expected additional returns				8,818,981
II.	Costs				
	Reduction in cash balance (Initial cost)	5,857,187		5,857,187	
	Expected (operating) cost increases per year	479,651	6.41765	3,078,232	
	Total present value of expected additional costs				8,935,419
	Present Value of Expected Change in Net Worth				-116,438
INTERNAL RATE OF RETURN		8.5% + $\frac{\text{m\$n. } 57,496}{\text{m\$n. } 173,934}$ (9% - 8.5%) =			8.67%

(1) Present Value Factor

APPENDIX TABLE 21.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program II carried out with fertilization and using owned equipment.

	Item	Amount m$n.	pvf.(1)	Present Value m$n.	m$n.
	Present Value of the expected change in Net Worth over 10 years at 9%				
I.	Returns				
	Expected additional returns per year	3,[illegible]30,451	6.41765	14,262,913	
	Estimated salvage value	8,441,000	.42241	3,565,563	
	Total present value of expected additional returns				17,828,476
II.	Costs				
	Reduction in cash balance (initial cost)	11,393,375		11,393,375	
	Expected (operating) cost increases per year	[illegible],479	6.41765	6,358,036	
	Total present value of expected additional costs				17,752,011
	Present Value of expected change in Net Worth				46,465
	Present Value of the expected change in Net Worth over 10 years at 9.5%				
I.	Returns				
	Expected additional returns per year	3,[illegible]4[illegible]1	[illegible]	13,[illegible]84,[illegible]05	
	Estimated salvage value	8,441,000	[illegible]	3,436,115	
	Total present value of expected additional returns				17,[illegible]0,415
II.	Costs				
	Reduction in cash balance (initial cost)	11,393,375		11,393,375	
	Expected (operating) cost increases per year	[illegible],479	6.27877	6,350,404	
	Total present value of expected additional costs				17,643,779
	Present Value of Expected Change in Net Worth				-283,364
INTERNAL RATE OF RETURN		9% + $\frac{\text{m\$n. } 46,465}{\text{m\$n. } 329,829}$ (9.5% - 9%)	=		9.07%

(1) Present Value Factor

APPENDIX TABLE 22.--Present value calculations for trial-and error determination of the internal rate of return on the investment in Pasture Program III carried out with fertilization and using owned equipment.

	Item	Amount m$n.	Pvf.(1)	Present Value m$n.	m$n.
	Present Value of the expected change in Net Worth over 10 years at 10%				
I.	Returns				
	Expected additional returns per year	4,849,072	6.14456	28,566,502	
	Estimated salvage value	16,233,000	.38554	6,258,471	
	Total present value of expected additional returns				34,824,973
II.	Costs				
	Reduction in cash balance (Initial cost)	21,897,750		21,897,750	
	Expected (operating) cost increases per year	2,004,012	6.14456	12,313,772	
	Total present value of expected additional costs				34,211,522
	Present Value of expected change in Net Worth				613,451
	Present Value of the expected change in Net Worth over 10 years at 11%				
I.	Returns				
	Expected additional returns per year	4,849,072	5.88923	27,373,454	
	Estimated salvage value	16,233,000	.35218	5,716,938	
	Total present value of expected additional returns				33,096,392
II.	Costs				
	Reduction in cash balance (Initial cost)	21,897,750		21,897,750	
	Expected (operating) cost increases per year	2,004,012	5.88923	11,802,088	
	Total present value of expected additional costs				33,699,838
	Present Value of Expected Change in Net Worth				-603,446
INTERNAL RATE OF RETURN		10% + $\frac{\text{m\$n. } 613,451}{\text{m\$n. } 1,216,897}$ (11% - 10%)		=	10.50%

(1) Present Value Factor

APPENDIX TABLE 23.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program IV carried out with fertilization and using owned equipment.

	Item	Amount m$n.	Pvf.(1)	Present Value m$n.	m$n.
	Present Value of the expected change in Net Worth over 10 years at 11%				
I.	Returns				
	Expected additional returns per year	7,265,337	5.88923	42,787,241	
	Estimated Salvage Value	24,051,000	.35218	8,470,281	
	Total present value of expected additional returns				51,257,522
II.	Costs				
	Reduction in cash balance (Initial cost)	32,548,125		32,548,125	
	Expecting (operating) cost increases per year	3,035,079	5.88923	17,874,278	
	Total present value of expected additional costs				50,422,403
	Present Value of expected change in Net Worth				835,119
	Present Value of the expected change in Net Worth over 10 years at 12%				
I.	Returns				
	Expected additional returns per year	7,265,337	5.65022	41,050,752	
	Estimated salvage value	24,051,000	.32197	7,743,700	
	Total present value of expected additional returns				48,794,452
II.	Costs				
	Reduction in cash balance (Initial cost)	32,548,125		32,548,125	
	Expected (operating) cost increases per year	3,035,079	5.65022	17,148,864	
	Total present value of expected additional costs				49,696,989
	Present Value of expected change in Net Worth				-902,537
INTERNAL RATE OF RETURN		11% + $\frac{\text{m\$n. } 835,119}{\text{m\$n. } 1,737,656}$ (12% - 11%) =			11.48%

(1) Present Value Factor

APPENDIX TABLE 24.--Present value calculations for trial-and-error determination of the internal rate of return on the investment in Pasture Program V carried out with fertilization and using owned equipment.

	Item	Amount m$n.	Pvf.(1)	Present Value m$n.	m$n.
	Present Value of the expected change in Net Worth over 10 years at 10%				
I.	Returns				
	Expected additional returns per year	9,315,479	6.14456	57,242,537	
	Estimated salvage value	32,150,000	.38554	12,395,111	
	Total present value of expected additional returns				69,637,648
II.	Costs				
	Reduction in cash balance (Initial cost)	43,359,500		43,359,500	
	Expected (operating) cost increases per year	4,027,831	6.14456	24,749,249	
	Total present value of expected additional costs				68,108,749
	Present Value of expected change in Net Worth				1,528,899
	Present Value of the expected change in Net Worth over 10 years at 11%				
I.	Returns				
	Expected additional returns per year	9,315,479	5.88923	54,863,890	
	Estimated salvage value	32,150,000	.35218	11,322,477	
	Total present value of expected additional returns				66,186,477
II.	Costs				
	Reduction in cash balance (Initial cost)	43,359,500		43,359,500	
	Expected (operating) cost increases per year	4,027,831	5.88923	23,720,823	
	Total present value of expected additional costs				67,080,323
	Present Value of Expected Change in Net Worth				-893,846
INTERNAL RATE OF RETURN		10% + $\frac{\text{m\$n. } 1,528,899}{\text{m\$n. } 2,422,745}$ (11% - 10%)		=	10.63%

(1) Present Value Factor

APPENDIX III

HEALTH PRACTICE AND PRICE PER UNIT OF VETERINARY MEDICINE

APPENDIX TABLE 25.--Health practices and price per unit of veterinary medicine, Ayacucho and Rauch Counties of Buenos Aires Province, 1967-1968

Practice	Unit	Price m$n.
Vaccinating for:		
Foot and mouth disease	Dose	25
Anthrax	Dose	6
Blackleg	Dose	8
Bangs	Dose	40
Treating for internal parasites		
Fenotiacine	Kilogram	4.80
Treating for external parasites		
Curabichera	Bottle	240.