FARMSTEAD DEVELOPMENT AS A WAY TO IMPROVE LIVESTOCK PRODUCTION IN NICARAGUA

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1.0. Nicaragua - General Information.

1.1. Introduction

Nicaragua is one of the Latin American countries in which the economy is mainly dependent on agricultural and livestock production and as such is classified as a less developed country. Both crop and livestock production are important for a country not only as a means of supporting the economy but also providing basic needs such as food and employment. Dealing with the particular case of Nicaragua, the objectives of this report are:

A. To present a general picture of the current status of Nicaraguan Agriculture.

B. To present some ideas about how to improve the capacity of production especially at the small farm level, as well as the improvement of the whole agricultural system.

C. To present a review of the factors involved in planning a farmstead, and to propose one adapted to the country's present conditions.

D. To discuss the necessity for farm buildings, and to provide examples of those considered suitable for use in the country at the present time.

1.2. Location and historical background.

Nicaragua is one of the five Central American Republics. She lies within the tradewind belt and region of warm equatorial currents. Its latitude is 10^{o} 45' to 15^{o} 10' N and its longitude is 83^{o} 15' to 87^{o} 40' W. Nicaragua is bounded on the east by the Atlantic Ocean, on the west by the Pacific Ocean, on the south by Costa Rica, and by Honduras and El Salvador on the north.

Nicaragua was discovered by Columbus on the twelfth of October of 1502, when endeavoring to find a passage to the Indian Ocean. He rounded the northeasterly point which he called Cabo Gracias a Dios, in thanksgiving to God for more favorable winds. The knowledge of the gold ornaments of the Meso American Indians lead to the first Spanish colonizing expedition out of Panama in 1519, under Gil Gonzalez Davila and in 1524, under Francisco Hernandez de Cordoba, who founded Granada and Leon. These expeditions were the beginning of 300 years of colonial rule, which ended in 1821, with the first independence from the Spanish domain.

Following independence from Spain, Nicaragua passed to the British trade sphere. As late as 1871, the economy was not unified around any stable export to the world market; the predominant aspects were production of meat and land-based subsistence. The economy of the country in such times was a reflection of the one in the two older cities, Granada with dominant merchant and cattle raising interest as opposed to the artisans of Leon.

In the mid-nineteenth century, the United States became quite interested in Nicaragua, as the California Gold Rush made clear the need for a nearby, cheap overland route from the Atlantic to the Pacific Ocean. The San Juan River and Lake of Nicaragua were used as a short route to make the crossing. Then the idea of a canal in Nicaragua took form, and perhaps it was unfortunate for Nicaraguan agriculture that so much faith was placed on wealth from a possible canal project. This probably diverted attention from the more realistic problem of developing a permanent and prosperous agriculture.

Economic factors such as farming activities concentrated in one region, Granada (production of indigo, cacao, coffee, food crops, and cattle), opposed to the isolation of Leon, the other population center, brought problems which resulted in turbulent political life and an epoch of continuous war that also became another impediment to encourage the development of a progressive agriculture. Nevertheless, at the present time, the country still has the resources to create a better and prosperous agricultural system.

1.3. Population.

Based upon the 1971 census, Nicaragua has a population of about 2.5 million which for the country's total area of 45,698 square miles (118,357 square kilometers) corresponds to a density of 54.7 inhabitants per square mile (21.2 inhabitants per square kilometer). The density has been increasing from 23.1 in 1950, to 38.9 in 1967. The density figures, however, vary in what can be classified as zones with sharp variations within the country due to the distribution of the population, (table 1 and figure 1).

Table 1. Nicaraguan Population Density and Growth by Counties.

1950 and 1967

	Area Sq. Mile	Population		Density*	
		1950	1967	1950	1967
The Republic.....	45,698	1,057,023	1,776,967	23.13	38.89
The Pacific Zone.	7,034	585,593	1,033,513	83.25	146.93
Chinandega.....	1,800	81,836	153.125	45.46	85.07
Leon.....	2,021	123,614	175,482	61.16	86.83
Managua.....	1,403	161,513	380,966	115.12	271.53
Masaya.....	210	72,446	92,161	344.98	438.86
Granada.....	373	48,732	77,523	131.00	208.40
Carazo.....	398	52,138	78,063	131.00	196.14
Rivas.....	830	43,314	76,197	52.19	91.80
The North and Central Zone...	12,972	388,521	627,006	29.95	48.34
Contales.....	1,910	50,529	85,119	26.45	44.56
Boaco.....	1,924	50,039	77,128	26.01	40.09
Matagalpa.....	2,623	135,401	188,118	51.62	71.72
Jinotega.....	3,697	48,554	88,948	13.13	24.06
Esteli.....	849	43,742	78,267	51.52	92.19
Madriz.....	679	33,178	55,965	48.86	82.42
Nueva Segovia..	1,290	27,078	53,461	20.99	41.44
Atlantic Zone....	25,682	82,909	116,448	3.23	4.53
Rio San Juan...	2,876	9,089	18,124	3.16	6.30
Zelaya.....	22,816	73,820	98,324	3.24	4.30

*Density (inhabitants per square mile).

Source: Johnson Research Associates, 1970.

THIS BOOK CONTAINS NUMEROUS PAGES WITH DIAGRAMS THAT ARE CROOKED COMPARED TO THE REST OF THE INFORMATION ON THE PAGE.

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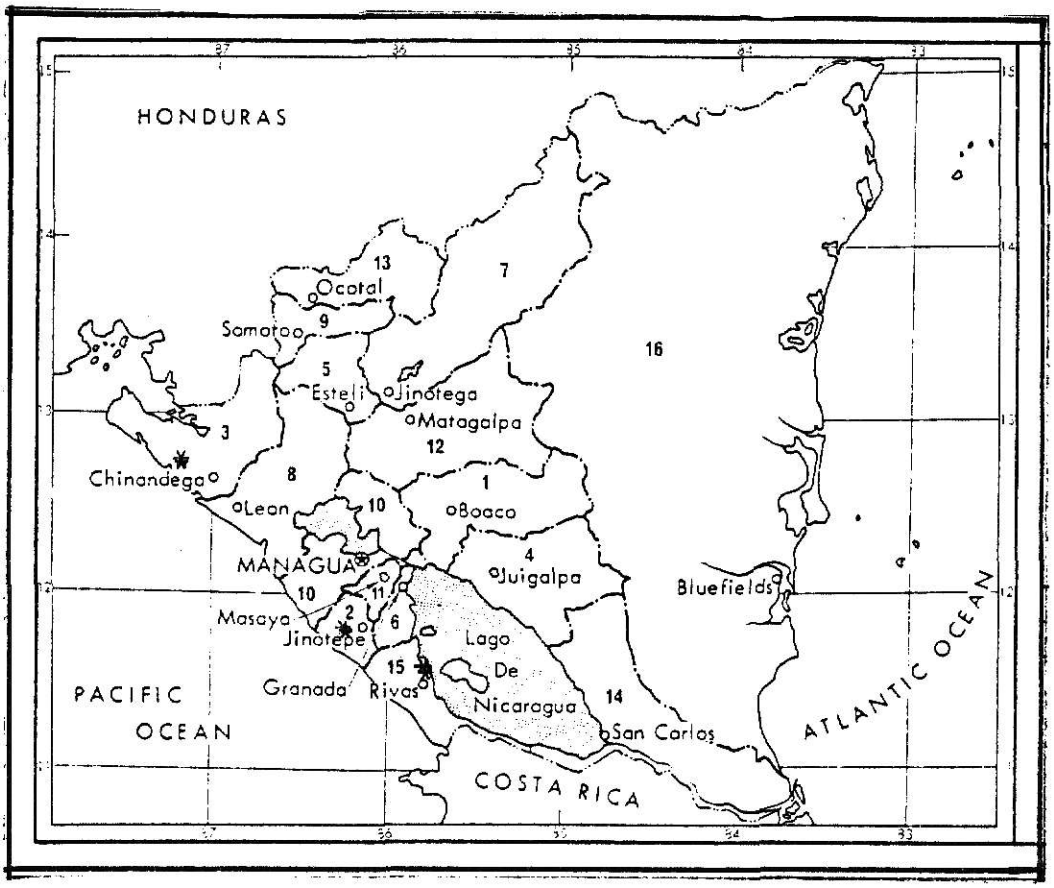


1. Boaco
2. Carazo
3. Chinandega
4. Chontales
5. Esteli
6. Granada
7. Jinotega
8. Leon
9. Madriz
10. Managua
11. Masaya
12. Matagalpa
13. Nueva Segovia
14. Rio San Juan
15. Rivas
16. Zelaya

Figure 1. Counties in Nicaragua.

Source: Johnson Research Associates, 1970

1.4 Natural Features.

1.4.a.Geographical.

Nicaragua has an area of 45, 698 square miles. It's roughly trapezoid form is dissected by mountains extending from northwest to southwest with lower elevations to the east.

The landform of the country breaks into four main groups: coastal highlands of the west, central lowlands, central highlands, and Caribbean lowlands.

Coastal Highlands

The coastal highlands are represented by the Diriamba Highland, locally called "Las Sierras", located between the Pacific Ocean and the counties of Managua and Granada. Most of the larger and older coffee plantations are concentrated here. To the north and west of the Managua Lake, there are low hills and an ash blanketed coastal plain close to the port of Corinto. The central range of volcanic peaks emerge after a lowland gap in a hilly area dominated by "El Cosiguina" forming the southern cape of the Gulf of Fonseca. To the south of "Las Sierras" the hills trail off into the low country of Rivas Isthms, lying between the Nicaragua Lake and the Pacific Ocean.

Central Lowlands

The central lowlands is the zone in which the two fresh water lakes, Managua and Nicaragua are located and

the active chain of recent volcanos; some form several islands in the Nicaragua Lake. The cones and calderas of this chain are responsible for the fertile ash found in the area.

Central Highlands

The central highlands to the north and east of the central lowlands extending from east to west are the volcanic ridges and plateau. They comprise a portion of the Cordilleran System, which starts in Alaska to the north, and ends in the Tierra del Fuego and Cabo de Hornos in Argentina to the south. Several mountain chains are included, such as Cordillera Isabellia, Dariense, Huapi, Yolaina and Amerrisque. They are separated by a deep river valley draining to the Atlantic. The area is settled and has coffee and beef production as well as subsistence farming.

Caribbean Lowland

The Caribbean Lowlands popularly called "La Costa" comprises about one-third of the total area. It is low in elevation and is composed of alluvial plains and valleys. Toward the eastern coast is swampy land with numerous estuaries and lagoons. The region is no longer isolated. It is accessible by road but still requires more roads for adequate transportation.

1.4.b. Nicaraguan Soils.

The soils of Nicaragua are described in a recent study made for the American University (Johnson Research Associated, 1970). "Except for scattered areas of less leached soils on the northern and higher areas of the central highlands, the mature soils of Nicaragua are all of the lateritic type, which when fully developed are reduced by weathering to a mixture of iron and aluminum oxides with some residual clay mineral and silica. As such, they tend to be highly infertile." However, the terrain of Nicaragua is sufficiently rugged so that even in the wetter eastern and central portions there are significant areas of new alluvials deposits, usually in the valley floors and delta plains of the rivers.

The soils derived from the weathering of volcanic lava and ash are far more fertile. There are some local areas of soil of the terra rossa type, derived from the weathering of limestone. These, like the volcanic soils, are good. Together with some of the upland soils and some of the alluvial soils of the mountain valleys of the western part of the central highlands, they support the bulk of agricultural production.

In Nicaragua as in other countries of Central America, there are major common soil groups (Martinez, 1967). They are described in the following paragraphs.

Lithosols.

The Lithosols are recent thin surface soils over bedrock, with shallow, poorly developed profiles and with some stones. They can be found in mountainous areas with poor vegetation. These soils are in general of light color, low in organic matter, well drained, with pH varying according to the parent material from which they originated. Examples of these type of soils can be found in Jinotega, Matagalpa, Boaco and Chontales. Because they are generally found on steep slopes, these soils are considered of poor agricultural value and are used for grazing or not used at all.

Regosols.

These soils are very similar to the Lithosols in their young profile, poor development, light color, low content of organic matter, and variable pH. However, they differ from the former in the fact that they are located on deep unconsolidated soft mineral deposits, such as sand dunes, and loess. They are not stony and are found in plains and valleys. In Nicaragua, they are near the main rivers, on sand beaches along the coast, and over deep consolidated deposits of volcanic ashes and tufas. Even though these soils are not completely developed, they are valuable due to their moderate fertility and good physical condition. They are used for pastures and sometimes for production of legumes and corn.

Young alluvial soils.

These are alluvial soils formed over other alluvials (Pliestocen). They have profiles lightly developed with an agnostic horizon of easy formation. In the plains, these soils are of medium texture, moderate to well drained, relatively high organic matter, and with a pH ranging from neutral to slightly acid. During the rainy season, they are used for cultivation of rice, corn, beans, banana and plantain in the elevated areas. The low areas are mainly used for pastures that are quite productive even though poorly drained. During the dry season, these soils are used for production of vegetables, watermelons, cantaloupes and other fruits of commercial value.

Volcanic soils of recent formation.

These are recent soils formed from volcanic ash, sand, and tuffs produced in recent activities of the volcanos. They can be found in the foothills of the Santiago and Cerro Negro volcanos. Farmers consider these soils of medium value due to the steep slope and medium natural fertility. They are used for pasture, corn and vegetables.

Volcanic lagoon originated soils.

These soils are highly valued by the farmer due to their high content of organic matter and natural fertility. Compared with soils from volcanic origin they have a higher saturation percentage and pH. They are generally flat. These soils are widely used for cotton production in Leon and Chinandega.

Andosoles.

These are mineral soils derived from weatherization of volcanic materials named from the Japanese word "ando" meaning dark soils. They have a high retention capacity with an A horizon that is friable and relatively deep with high content of organic matter and low apparent density. These soils are highly valued due to their high productivity and are generally used for cotton production.

Old alluvial soils.

These are soils formed over alluvions of old terraces (Pliocen) with more developed profiles than the recent alluvial soils. These soils are used for production of rice, corn, sorghum, beans, tobacco, sugar cane, peanuts, cotton, and many other crops.

Planosols.

These are well developed soils that show the effect of the action of soil formation factors. They have low depth, low organic matter, and high clay content. Their productivity is low so they are generally used for pasture but can be used for sugar cane when a good drainage system is installed. They are generally found in Managua and Matagalpa.

Grumosols.

These are also soils located in plains that are similar to the planosols and sometimes called "tropical black clays."

They are practically useless because the clay content is so high that they make it very difficult to use machinery during either the rainy season or the dry season. Like the planosols, they are found in Managua and Matagalpa.

Old Volcanic Soils.

These are soils derived from volcanic material but where the weathering action has been enough to show properties similar to those of the latosol soils. The A horizon is relatively thin with medium to low organic matter and low fertility. They are commonly called brown soils of the forest and used for corn, beans, sugar cane, coffee, citrus and pastures. They are located near the boundary of San Marcos, to the south of Managua.

Latosols.

These soils are found in the Atlantic litoral with many different profile types depending upon the climatic degradation. They are of low fertility but used for production of many kinds of subsistence crops such as rice, corn, beans, vegetables, pineapples, citrus, rubber, coffee and bananas.

1.4.c. Climate.

The climate of Nicaragua can be roughly classified into three major types: tropical rainforest, tropical savannas and mild tropical highlands (Figure 2). The predominant type is the wet tropical covering more than one-third of the country.

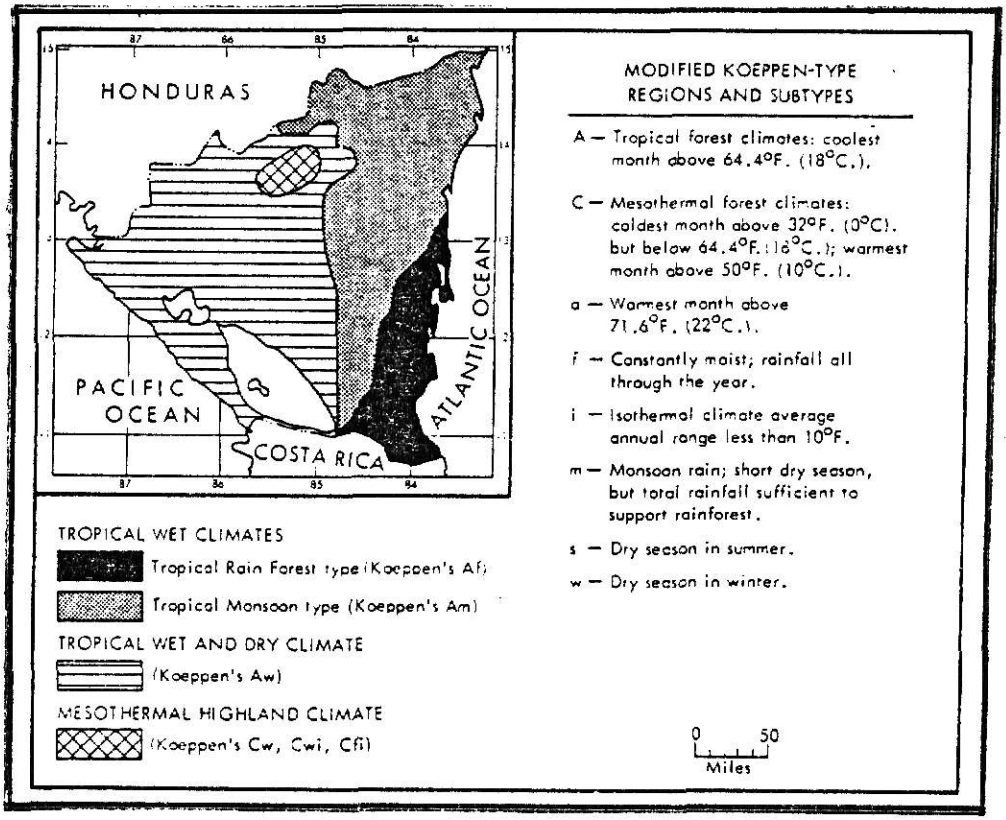


Figure 2. Nicaragua's Climate

Source: Johnson Research Associates, 1970.

The intermittent rainstorms from the trade winds of the Atlantic Ocean tend to persist, especially in the south, providing the lower east coast with practically year-round rainfall. There is a tendency toward dryness from January to April. The wet and dry tropical climate, lie to the west. There is a marked rain shadow effect as altitudes fall from east to west which add to the seasonal character of the rain and accounts for the delimitation of the six-month wet season. The mild tropical highland is a small zone that can be considered a micro-climatic region.

In general, there is a small range in temperature over the year and between day and night in both the east and the west. The rainfall season varies from nine to twelve months in the east and six months in the west. Examples of rainfall and temperatures are shown in Tables 2 and 3.

The best soils are located in areas with an annual drought period of about six months. Also, there are fairly extensive areas of reasonable fertile soils in the center part of the country with an extended rainfall season and favorable temperatures. These areas are adapted to the growth of a wide range of crops.

Table 2. Mean Monthly and Annual Rainfall at Four Centers in Nicaragua.

Center	Bluefields	Chichigalpa*	Diriamba*	Granada
County	Zelaya	Chinandega	Carazo	Granada
# Years Recorded	22	47	25	56
	mm	mm	mm	mm
January	270	1	16	5
February	100	1	6	2
March	72	3	6	7
April	77	25	8	23
May	326	255	222	158
June	482	343	320	291
July	649	193	162	165
August	518	273	184	175
September	321	413	331	278
October	324	499	436	291
November	360	84	82	74
December	369	78	39	19
Annual	3,868	2,097	1,812	1,488

Source: Report of the FAO Mission for Nicaragua - November 1950.

*See location in Figure 1.

Table 3. Monthly Mean Temperature, 1942-1949, at Four Centers in Nicaragua.

Location	Granada	Managua	San Carlos	San Jorge*
January	79	80	77	77
February	80	81	78	79
March	81	83	79	80
April	83	86	80	81
May	82	85	79	81
June	81	82	78	79
July	82	82	79	78
August	81	82	79	79
September	81	82	79	78
October	81	82	78	78
November	81	81	78	78
December	80	80	78	77

Source: Report of the FAO Mission for Nicaragua - November 1950.

*See location in Figure 1.

1.4.d.Hydrology

Nicaragua divides into three hydrological regimes. The rivers reaching the Atlantic Ocean, the less important rivers going to the Pacific Ocean, and those going to either the Nicaragua or Managua Lakes.

The rivers flowing to the Atlantic are: Rio Coco, Huahua Prinzapolka, Grande de Matagalpa and its tributary Rio Tuma where the first hydroelectric installation was constructed. Farther south are the rivers Siquia and Punta Gorda. These rivers drain all the water coming from mountains and plains of the zone.

In the depression formed by the lakes are gathered the waters from part of the central area and the surplus is discharged by the San Juan River. This river drains both lakes.

Intermittent streams form the rivers going to the Pacific. The rivers Viejo and Negro are the most important.

1.5. Economy.

The Nicaraguan economy depends on agriculture as its most important sector, employing 50% of the labor force. About half of the agricultural output is exported and agriculture comprises around 75% of the total exports. Cotton and coffee alone contribute over two-thirds of the agricultural exports.

CHAPTER II

2.0. Nicaragua's Agriculture and Farming

2.1. Agriculture's role.

Agriculture in Nicaragua plays an important role. Generally speaking, the role of agriculture is controlled by the supply and growth of capital, the rate of agricultural expansion relative to population growth, and the rate of expansion of the non-agricultural sectors (Hopkins, 1969). Nicaraguan agriculture may accomplish well these three aspects, but is far from doing it at the present time. Land and the farmer conditions need to be known to understand the agricultural situation.

2.2. The land aspect.

2.2.a. Agricultural regions.

Nicaragua can be divided into five major agricultural regions as follows: (Montes, 1962).

A. - A region of about 3000 square miles between the Pacific Ocean and Lake Nicaragua, mostly flat with good soils. The region produces corn, rice, sugar cane, beans, cotton, sesame, fruits, vegetables, tobacco, beef and milk.

B. - A small region of about 1000 square miles immediately to the north of the region above with very fertile soils of volcanic origin. It produces corn, rice, beans, cotton, sesame and sugar cane, with milk

production in the area near Managua.

C. - North of region B and in the northwestern part of the country, an area of over 1500 square miles with fertile volcanic soils. This region produces corn, rice, beans, cotton, sugar cane, sesame and cattle.

D. - A mountainous area located east of the lakes, mostly at elevations of 1500 to 5000 feet, with good soils and producing corn, beans, coffee, vegatables, fruits, other crops and cattle. Transportation is poor. There were large areas in forest, and timber could be an important product.

E. - The eastern two-thirds of the country, with elevations mostly between sea level and 1000 feet, produces cattle, subsistence crops and timber.

2.2.b. Rural Settlements.

Rural settlements are characterized by several locally and regionally distinctive patterns in Nicaragua. Basically, there are the large "haciendas" introduced by the Spanish, and the individual farm or small rural villages where subsistence agriculture based on maize is still dominant. Scattered remnants of the pattern of shifting agriculture is found in the eastern interior in the rainforest and jungles. More recently, patterns associated with new crops have been imposed on the traditional patterns, for example, cotton and coffee.

2.2.c. Land tenure.

The agricultural regions and settlements have different forms of tenure under which land is held. The most common forms of tenure are:

A. Ownership

B. Ownership with additional land rented

C. Renting for cash or a share of product

D. Squatting

E. Land use by "colonos"

F. Ejidatarios - community use of the land

G. Others.

A study of the land tenure situation in Nicaragua is limited by the lack of primary data. Until 1963 there was no information at all. The data available at this time is organized chiefly according to size of farm rather than to form of tenure. A major problem in Nicaragua is the existence of many small farms usually classified as sub-family famrs considered too small to support a family. Land distribution in Nicaragua is unequal. Half of all farms are under seven hectares (17 acres) in size and account for only 3.5% of the total occupied area. Farms of over 348 hectares (860 acres) represent only 1.5% of the number but account for over 40% of the land in use (Maturana, 1963). A recent study pointed out the fact that of the total land available in farms with size greater than 35 hectares, one-half is used in extensive pastures, one-third is not used at all, even though it can be exploited, and only one-seventh is used for annual or perennial crops (SIECA, 1977a.).

Another problem is the insecurity of tenure. Around 30% of all farm workers are tenants, sharecroppers or squatters. They not only lack the resources needed for efficient cultivation but are deprived by their precarious tenure of access to credit that might help them improve. These two problems, together with a poor location and the use of old technology are responsible for stagnation in the traditional agricultural sector.

2.3. The Nicaraguan farm population.

2.3.a. Classification.

The Nicaraguan farm population may be classified according to type of job, tenure, and economic status. At the bottom of the classification is the itinerant farm worker. Next, comes the regular or permanent farm laborer whose wages are similar to those of the seasonal or itinerant worker. In third place is the group of permanent or semi-permanent workers on large farms. They resemble a laborer more than they do independent tenants because they operate small areas of land without being able to make decisions concerned with the land. Fourth in the scale are the renters. Such a form of tenure was widely used in the past. Finally, owners represent a wide range of size of holdings and welfare levels. The group includes the owner-operator as well as the absentee one. Many small farmers are able to gain only a bare subsistence living from their farm. At the top of this group are owners with large holdings. They are usually an absentee-owner. The overwhelming majority of estates are operated with the aid of administrators because the owner is usually mainly

concerned with urban business or activity and knows very little about agriculture. Only a few farmers operate the large farm by themselves (Feder, 1971).

2.3b. Literacy problem.

The current complexities of practical farming may be attributed partly to the developing technologies and partly to the wide diversity of natural and economic conditions under which the farmer must operate. The farmer's objective is to maximize his farm output. In achieving this end, traditional methods learned from his father no longer provide a safe guide. To face the increasing demand for technical knowledge, a farmer needs to be educated. This is not the case in Nicaragua where illiteracy is quite high and no provisions have been made to solve the problem. The rate of illiteracy for the rural area of the country is 66% based upon the last census report (Wilkie and Reich, 1977). To build an adequate agricultural system, the education of the farmer needs to be considered first. An essential need for a progressive agriculture, and probably the most important in the long run, is in providing elementary and secondary education for farm children was cited in a recent report. An economically efficient agriculture could not exist with a high proportion of illiterate farmers (Pan American Union, 1966).

2.4. Dualism of the Agriculture.

In Nicaragua, the action of the factors discussed has created a dualism in the agricultural sector. The cultivation of certain export crops is based upon modern methods, and tends to pre-empt much of the available credit, the best soils, and the terrain most suitable for mechanization. As a consequence, these crops show relatively high yields. On the other hand, the large subsistence sector is characterized by primitive methods and low productivity. Indeed, the gap between these two aspects of Nicaraguan agriculture appears to be widening rather than closing since many farmers of the intermediate-sized holdings, who have in the past operated in the border of commercial agriculture, are threatened with reduction to the subsistence level by their financial and technical incapacity to employ modern methods.

Two conditions are required to solve the gap in the agricultural sector by using modern technology. First, the farmer should know and trust the process sufficiently to use it. Second, the farmer should be connected to a supply source which enables him to obtain the materials needed for its application. Knowledge and trust are dependent on education and agricultural extension. The supply of materials at the farm implies a level of institutional and commercial organization that gets the necessary materials to the right place at the right time. This can be accomplished in Nicaragua by setting a suitable plan to do so.

2.5. Agricultural development.

2.5a. An immediate necessity.

Table 4 shows data on the production of crops and cattle and their demand that illustrates the need for promoting agricultural development. Much remains to be done before the country becomes self-sufficient in providing enough food for the people and having some for export to shape up a solid economic system for the country.

Agricultural development and rural prosperity are interrelated with the cause effect relationship moving both directions. The higher the level of living of a farmer, the greater is his capacity to respond to programs for agricultural development. The significance of agricultural development is the influence it has on increasing the general prosperity of a country. Rural prosperity is a part of the general welfare of the state and therefore, is a part of the general objective to be served by agricultural development.

2.5b. Elements of agricultural development.

The process through which a people's agriculture becomes more productive, is dependent on many elements. Those elements which are observed to contribute to agricultural development are classified into three groups: attitudes, services and public programs, and social and legal framework which support and provide means for the frequent changes necessary in a progressive agriculture (Mosher, 1966).

Table 4.

Nicaragua: Demand and Supply for Food (specified agricultural Commodities). In metric tons (1000).

Commodity	Per Capita Food Demand Kg Per Year	1962 Total Food	1962 Total Demand	1970 Total Food	1970 Total Demand	1980 Total Food	1980 Total Demand
Corn	62	94	114	128	155	197	240
Rice	14	21	22	29	31	49	52
Wheat	11	23	24	32	34	56	59
Beans	14	21	23	27	31	42	48
Sorghum	14	21	39	28	53	44	82
Sugar	48	72	76	98	103	144	152
Garden Vegetables	11	17	19	24	27	41	46
Potatoes	3	4	4.4	5	6	9	10
Bananas	114	171	190	228	240	313	329
Poantains	78	117	127	156	170	213	232
Beef	13	20	21	28	29	51	54
Pork	2	3	3.1	4	4.2	7	7.4
Chickens	1	2	2.1	3	3.1	6	6.3
Eggs	3	4	4.3	5	5.4	12	13
Milk	225	338	367	487	529	953	1036
Coffee	2	3	3.1	4	4.1	8	8.2
Vegetable Oils	-	7	7.1	9	9.2	17	17.3
Animal Fats	.84	na	na	na	na	na	na

These estimates took into consideration several nonfood uses including animal feed, forage, seed, and waste and spoilage.

Source: Batelle Memorial Institute, 1969.

Attitudes

The attitudes could be classified from the viewpoint of those that are affected by agricultural development. They are different for farmers, technicians serving agriculture, businessmen, government officials and the general public. The farmer's attitudes have considerable effect on the rate of agricultural development. One is confidence that it is possible to improve agriculture. Another is willingness to take responsibility for the results of choices, knowing that frequently a change could be less productive than was hoped. Farmers desire better homes, better health, and a better standard of living which provide an incentive to increase production. The government's attitude toward providing public programs for agricultural development, investment in land improvement, in roads, in storage, irrigation, buildings, etc. and the general public's attitude and understanding of the process of agricultural development and the necessity for its development are important.

Services and Public Programs.

The second group of elements is composed of services and public programs which are essential to agricultural development. Agricultural development requires new knowledge. This knowledge comes as a result of study and research. Research is needed in soils, crops, livestock and farming practices. In a dynamic agriculture, education must equip people to understand, evaluate,

and take responsibility. Education must equip people to make choices between varieties of crops, types of livestock, choices in allocation of land and labor, selection of equipment and application of fertilizers. Agricultural education for the young must be for both future farmers and for technicians to carry on all of the varied services and programs needed. Rural extension education is also needed to keep people up to date. An adequate general education system has to be implemented to better achieve these programs.

Water is a major factor both in extending cultivable area and in increasing production of the farm. So, irrigation and drainage systems need to be developed. In the same way, transportation is a necessity to provide access to the marketing centers. Increasing storage capacity will be required to build up grain reserves and to store increased production. As agricultural conditions become less traditional and more progressive, a well planned credit system will be needed to increase production and meet the demands for supplies. Since a progressive agricultural system is dependent on an increasing array of specialized equipment and supplies which must be purchased, farmers need an increasing variety of implements, fertilizers, building materials, fuel, power, seeds, etc. A source of supply must be assured to have such supplies always on time. Price and wage policies, marketing facilities, pest and disease control are others that have to be included.

Land and labor.

Finally, the third group of elements of the agricultural development is made up of the labor force and the land it works. Evidence from even small-farm agricultural areas in many parts of the world exists to show that increasing intensity of agricultural production per unit of land usually results in considerable increases in employment. It is pointed out also that greater amounts of irrigation permitted more double cropping and further increased the demand for labor (Stevens, 1977).

Nicaragua is still waiting for agrarian reform even though a law was enacted in 1963. Resources have been wasted as in the case of the "Rigoberto Cabezas" project where the mounting of only preinvestment studies cost $500,000 (Nelson, 1973). No matter what is the resulting tenure, the essential requirement remains for the transformation of the agricultural sector from one based on sussistence production to a primarily science-based agriculture (Stevens, 1977).

A well developed program will close the gap in the Nicaraguan agricutlural sector.

CHAPTER III

3.0. A Nicaraguan Farmstead

3.1. Farm enterprise outlook.

In Nicaragua, the outlets for farm commodities can be placed in two groups. First, the group for export such as cotton, coffee, and sugar; and second, the group produced chiefly for local consumption such as maize, beans, rice, sorghum, sesame, vegetables and fruits. The export group is produced chiefly on large farms. Those in the group used for local consumption are more often raised on small farms but in the last few years there has been a trend to raising rice, corn and beans by the large farms.

Cotton production is mechanized on large farms where tractor-drawn equipment is used for land preparation and planting. Research is being conducted to help the cotton producer and they have their own experimental extension service located in the area where most of the cotton is grown. The use of fertilizer is a necessity in those areas where the soil's original fertility has diminished because of continual planting. In the Managua area, an estimated 55 to 110 kg/ha of fertilizer such as 10-30-10 plus urea is used. In Leon, the average amount applied is 45 to 65 kh/ha. In Chinandega, a more fertile area, about 32 to 45 kg/ha is applied (Harness and Robert, 1970).

Coping with insects is a high cost operation because of the use of airplane spraying. Applications may average 20 to 25 per season and they are made on a regular schedule. Some producers are using the

insect-count methods to hold down the costs.

The cost of cotton production is increasing because of more extensive use of farm machinery, fertilizer and insecticides most of which must be imported. The country has 34 active gins that provide enough drying and lint cleaning equipment to handle the production of cotton.

Sugar and coffee production are also mechanized. Coffee is raised by medium and large farms and is produced mainly to the south of Managua and the region of Matagalpa and Jinotega in the north central part of the country. Coffee was the main export crop before the increasing production of cotton and currently could be in second place. These crops are not suited for the small farmer since the capital investment for fertilizers, pesticides, labor, etc., is high and the small farmer cannot take the risk for an unsuccessful season.

The basic grains, corn, rice, beans and sorghum are grown by all types of farms all over the country (SIECA, 1977b).

3.2. The livestock industry.

In Nicaragua, cattle production is the main component of the livestock industry with poultry and swine at a lower scale. The greatest potential for livestock development is offered by the Caribbean coastal area. However, only limited development for beef cattle has occurred in the region (Morgan, 1973). Cattle have been traditionally raised in the areas with greatest population density, the Pacific and Central region. This was probably due to the fact that transportation facilities were not available until the mid 1950's. The conditions are

favorable in the regions but in the Pacific area there is competition for land from crops such as cotton, sugar, rice, etc., and there is the long dry season lasting from five to six months when pastures dry up and water becomes scarce. Only a few of the larger and more favorably located ranches irrigate some of their pasture while some producers use silage and make hay. The advantage of the silo was introduced to Nicaragua by Professor Jewell B. Knight, who was brought to the country in 1928 from the United States Department of Agriculture (Work and Smith, 1946).

Currently interest is increasing for feedlot operations. Corn is the main silage crop. Protein supplement is either whole gin-run uncrushed cottonseed or cottonseed cake. Cottonseed meal or cake and byproducts are being used in feedlot operations. Eventual success is dependent upon a continuous supply of feedgrains at reasonable prices.

Significant increases in production depend largely upon improvement in production and management practices such as upgrading of breeding stock, pasture improvement, supplemental feeding and veterinary care. A beef export industry exists in addition to the traditional cattle enterprise. Ranchers who import breeding stock and upgrade the native criollo cattle through cross-breeding, primarily with American Brahman sires, generally deliver their slaughter cattle to export slaughtering plants (Morgan, 1973).

There has been some improvement in dairy farms. Total cow milk production increased slightly from 200 thousand metric ton to 220 in the period 1972-1974 (See table 5).

Table 5. Nicaragua's Livestock Number and Production.

Class	1961-65	1972	1973	1974
Number (1000 Head)				
Cattle	1,672	2,670	2,750	2,600
Swine	423	630	640	600
Sheep	1	2	2	2
Goats	7	8	8	8
Chickens	2,167	3,200	3,300	3,400
Production (1000 m.t.)				
Pig meat	4	10	10	10
Beef meat	35	62	60	52
Poultry meat	1	3	3	3
Offals edible	8	15	15	13
Lard	1.5	3.6	3.6	3.5
Milk	158	200	200	220
Cheese	11	15	15	16
Butter	2.7	3.7	3.7	3.7
Hen eggs	9.1	13.2	13.5	13.8

Source: FAO Yearbook, 1974.

Poultry and swine production may become a whole new industry in the future and probably are the type of enterprise that could prove to be best suited for the small farm on a combination basis such as corn-poultry of corn-hog. Poultry rearing is a valuable addition to farm production. In addition to eggs and meat, poultry provide manure that is of great value on the farm (Werner, 1968). Even a small poultry flock provides a means of producing high quality food products at home. It must be considered that production of egg and poultry meat at home is not always economical for the United States conditions and this does not apply to Nicaragua's stage of development (Holleman, 1977).

Poultry and swine production, when using sound practices of breeding, feeding, and management usually are profitable. Some small farmers are actually raising a few cattle combined with poultry in addition to land cultivation. If they were provided with the inputs required, either the addition of poultry or swine production to the farm might provide a source for better diet and income for the farmer's family.

3.3. The farmstead.

3.3a. Introduction.

The term farmstead is used to include a limited area within the farm occupied by buildings, corrals, fences and gates and used generally as a center of operation for farm work and activities. It is where the livestock are housed and cared for, and all the crops are processed and stored. Furthermore, the farmstead, and particularly the farmhouse, is the center around which the farm family revolves.

The planning of the farmstead is very important. The greatest opportunity for bringing to reality a well arranged farmstead is afforded by the farm on which no buildings exist. Each farm has different conditions that influence the planning of the farmstead, so no one plan will offer the best solution for a large number of farms. The present conditions in Nicaragua allow more for the planning of a simple farmstead than a complicated one; simple in the fact that the purpose of the farm will be limited to agricultural production with some combination of livestock. This does not imply that the farmstead could not be flexible enough so as to make possible remodeling if necessary based upon progress attained by the farmer and the demand for change of enterprise which he may have in the future.

3.3b. Site location considerations.

Few farms offer conditions where every factor of farmstead planning could be the ideal. In this sense, farmstead planning is a compromise of making the best use of existing conditions. In planning the farmstead, one phase of the problem is the selection of the site. Several factors enter into consideration.

Accessibility to the highway.

A network of all-weather roads should reach a large percentage of the farms. If the location of the farmstead is not close to a highway, an all-weather drive should be built from the farmstead to the road so the farmer can make use of

this convenience to deliver crops and livestock to market and to obtain supplies.

Accessibility to the field and pastures.

The location and arrangement of fields is important in determining the location of the farmstead with respect to the farm. Field arrangement is dependent upon many factors such as topography, drainage, soil condition, and others. The farmstead should provide accessibility to all fields with a minimum travel for workers or vehicles for field operations. Thus, the disposition of the fields accounts for ease of access and efficiency in the use of equipment when available. Probably the best field arrangement is the one that makes it possible to carry out the farming operation in the long direction of fields. The disadvantage is that more fences are required and farms are not always located on level land. Also, if an erosion problem exists, soil conservation practices will require the use of terrace and contour farming. This means that the fields no longer could be laid out in a rectangular shape and access to the field must be provided for the farmer to carry out operations and transport crops from the field without crossing terraces.

Location of the site.

A location in the center of the farm provides the minimum travel distance to all fields but is impractical because it produces an isolated site. A corner location provides maximum access but is also impractical because distance of travel to the fields

at the opposite corner is a maximum and direction of expansion may be limited. A satisfactory arrangement is obtained by locating the farmstead near the center of one side of the farm that is next to an all-weather road. This provides easy access to fields, minimizes travel distance and provides for expansion.

Drainage.

Drainage is one of the most important factors to be considered. Selecting the site which offers natural drainage simplifies the problem considerably. If good natural drainage is not available, conditions must be improved by using underground drains or surface gutters. A location fairly well up on a moderate slope of two to six percent permits the drainage of surface water away from the buildings. Locating near the top of the slope also affords good air drainage. If these conditions are not found, selection can be based upon the other criteria and grading could be used to obtain the desired condition for drainage.

Water supply.

An abundant supply of potable water is needed for a satisfactory farmstead plan. In many cases the water supply will be taken from streams, so treatment is required to make such water good for consumption. Distance from the site to the river does not represent any problem because water can be conveyed through pipes. Another possible source of supply is wells.

The chances for obtaining a satisfactory site must not be jeopardized by placing this too low in the criteria used to govern the choice.

Sewage disposal must be considered but is not included as a critical factor since many methods are available.

Nature of soil.

Soils of lower fertility should be used to locate the buildings since the better cropland is left for production. A wide variation in quality and value of the land will be found and the best selection will come from the judgment of the total land. Sandy soils are well suited for location of the farmstead since they favor plant growth and are well drained but they are also subject to shifting or slipping. In general, the lots for the livestock may be located on land of poor quality but good drainage must exist.

Utilities.

At the present time many farmsteads do not have utilities such as electricity, mail and telephone. The best decision concerning location is to leave the farmstead close to any main road in order to keep expenses down when such utilities may be added to the farm.

Off-farm factors.

Particular interest must be given to any rural developments since that may alter the criteria selection basis. Concern

must be given to local laws and regulations, especially those related with odors and problems of intolerance by city or small town people.

3.3c. Building location considerations.

There are a number of factors for locating a building if a satisfactory farmstead is to be secured. Some farmstead site selection factors may affect building location. Others to be considered follow.

Size of farm.

The size of farm influences the number, size and location of buildings. Different conditions will be found around the country and should be considered in the study to help the farmer decide on the type of enterprise best suited for him, Independent of the size, it has been stated for the United States conditions, that the farmstead may represent five percent of the cropped land area (Neubauer and Walker, 1961).

Type of farm and volume of production.

The kind, size, and arrangement of the farm buildings are dependent on the type of farming. The types of farm might be one engaged in a single crop, or a combination of crops, or a combination of crops with livestock, or specialized situations. On the one hand, a farmer may try to get as much of his own needs as possible from his farm depending only on his production; while on the other, a farmer may rely instead on increased farm productivity to justify buying most everything he may need. Included

in this must be the possibility of a balanced use of the land where the fields can be used in rotation for different purposes, which in turn, helps to maintain the soil's fertility and allows a farmer to get more than one product from the land.

Orientation.

Prevailing wind and sun are factors to be considered both when dealing with a new site or replanning an existing one. Orientation should be such as to make proper use of all available sunlight at all times of the year. Exposure to breezes should be utilized in hot weather. Nicaragua is located to the north of the equator. Locating the building to face east would be desirable and serves a dual purpose to avoid the most intense sunlight and to catch the breeze as much as possible from the prevailing northeast and southwest wind. It is particularly important to locate the dwelling so as to carry the odors away from it.

Distance factors and efficiency.

The primary purpose of the farmstead is to make it possible to get the maximum service with a minimum of time and labor. Fire hazard makes it inadvisable to place the buildings too close but efficiency demands they be placed to prevent walking long distances and avoid needless steps. Table 6 gives some distances between buildings on a typical five-acre farmstead in the United States used for general purpose farming. Typical chore routes

are an average of measured distances on farmsteads with similar conditions, and represent walking distances between entrances of buildings as compared to the direct and shortest line between them. The figures can be used only as a guide for the Nicaraguan farmstead situation.

The farmstead and its projection in time.

At the present time, it is difficult for the great majority of Nicaraguan farmers to foresee future development of their farm making it difficult to plan the farmstead to be efficient and satisfactory in the future. Generally speaking, the farmstead needed must serve current needs with capacity to handle increased production, and it should be flexible enough to be used if a change of enterprise or introduction of mechanization is adopted.

3.3d. Buildings required in the farmstead.

It is not surprising that investment in buildings is subordinated on most farms regardless of the type and size since the demand on capital for production is so great. However, building construction is required to improve actual conditions. Different buildings should be required. The single most important building is the farmhouse.

The Farmhouse.

In order to design and plan farmhouses adapted to needs, information must be available indicating actual conditions

Table 6. Typical Distances for a 5-Acre Farmstead.*

Route	Direct Distances (ft.)			Typical Chore Route
	Typical	Minimum	Maximum	
House to road	120	100	200	190
House to barn	120	100	200	130
House to poultry house	100	50	150	120
House to hog house	200	200	300	220
House to machine shed	60	50	100	100
Barn to poultry house	90	75	150	110
Barn to hog house	120	100	200	170
Barn to granary	65	50	100	100
Hog house to corn crib	30	20	50	60
Poultry house to hog house	60	50	100	110
Poultry house to granary	40	20	100	55
Service court width	80	60	100	
Driveway width	20	16	30	
Paved driveway width	10	8	12	

*Average desirable distance is 75' between service buildings.

1 Acre = 0.4046 hectare = 0.574 Manzanas.

Source: (Neubauer and Walker, 1961)

prevailing in the farm home. Generally speaking, in a majority of cases there is evidence that the farmhouse is inadequate to provide for even the minimum essentials of housing in rural Nicaragua. The farm home has been largely ignored as a farm building problem but in this case it must be considered as such.

It would not be reasonable to provide shelter for livestock without having cared for the farmer's family. Therefore, even if the farmer does not have the capital for a suitable dwelling, at least a plan for a portion that may be built as a nucleus of the future home should be provided and then it can be added to in the future. Most farmers would not be able to secure the service of an architect or an engineer, so the best solution is to consider that the climate in the country is not variable and a unit designed for use in one area may serve in others. The objective would be to produce a functional plan that will provide the facilities for human occupancy and the conduct of household activities.

A typical farmhouse as considered here would be a single-family house in which all facilities for health, sanitation, comfort, and labor saving must be provided as a part of the dwelling unit. The functions of the farmhouse are to provide facilities for the preparation and service of food, for sleep and rest and for recreational and social activities. Based upon the conditions of the Nicaraguan farmer, the house should be designed for eventual expansion to the following: a living room, dining room, kitchen, bathroom and two to three bedrooms. The living and dining rooms may be put together. No matter how they are combined, each house would be designed to eventually have five to eight rooms. Dimensioning of the house is out of the scope of this report and should be done by an architect.

Livestock Shelters.

Dairy Cattle

The management of dairy cattle, as now practiced in Nicaragua, permits the animals to move about freely in enclosed lots or pastures. This allows the use of simple and economical construction of the feeding and shelter buildings. Limited storage of milk may be provided since delivery to regional storages and processing facilities is made daily. The type of shelter that should be used is close to that known in the United States as a "loose-housing system." Since cows are on pasture most of the year, building requirements would be simplified. Milking is done by hand but a milking room would be added as herd size increases.

Beef Cattle

Management of beef cattle is similar to the management of dairy cattle in the fact that a feedlot and pasture are used. The simple plan consists of an open shed or shade shelter in conjunction with natural protection such as trees or embankments. The structure should be of pole type construction with a roof made of materials available locally. Shelter space per head should be approximately 40 square feet for mature beef animals, and from 20 to 30 square feet for yearlings and calves (Larson and Hegg, 1976). As the number of cattle to be handled increases, a corral should be designed and located so as to facilitate the movement of the cattle in a short time.

Swine

Under Nicaraguan climatic conditions, solid floors with open construction will provide adequate housing for pigs except for young pigs in farrowing houses. Pigs confined to pastures can make use of sun shades made of poles and a palm-thatched roof to provide adequate environmental conditions after they are six to ten weeks old. Farrowing houses should be used to provide the newborn pig with a suitable environment of around 90° F (32° C). In general, a shade shelter can be used to take care of young pigs after they reach about six weeks of age.

Poultry

The poultry house is typical of relatively light structures. Structures vary in size from small units for the production of home supplies to medium and larger ones for the production of eggs and meat for sale. Even though not all of them will be required at the present time, poultry facilities might include:

A. Small or large houses for laying hens;

B. Buildings for growing broilers for meat; and

C. Facilities for hatcheries, a specialized business.

As egg production increases, an egg processing and storage room would be added.

Feed storage buildings.

The amount of grain to be dried and stored at some Nicaraguan farms is too small to justify the use of artificial drying systems and expensive storage facilities. Farmers usually sell the grain at harvest and then buy it back for consumption later in the year; since losses may be large, this practice may be economical for the farmer. Government storage facilities now provide for 136,400 metric tons and farmers should make use of them where the location is satisfactory. Nevertheless, drying and storage facilities would be needed as farms increase in size and productivity in order to reduce deterioration and losses and to have a source of feed supply.

The regular incidence of a drought period from December to May creates a shortage of pasture in the western part of the country making storage necessary to maintain the condition and productivity of livestock by providing an adequate feed supply. If silage is used, the trench silo is recommended since it can be built easily and at a low cost. Vertical silos would serve the same purpose but they are expensive. When hay is used, a storage unit should be provided.

Drying as a way to reduce the moisture content of crops to a safe level for storage is very important. The popular way of drying being used is the shallow layer with direct exposure to the sun. Better results may be obtained by having concrete floors constructed for that purpose or by trying to introduce

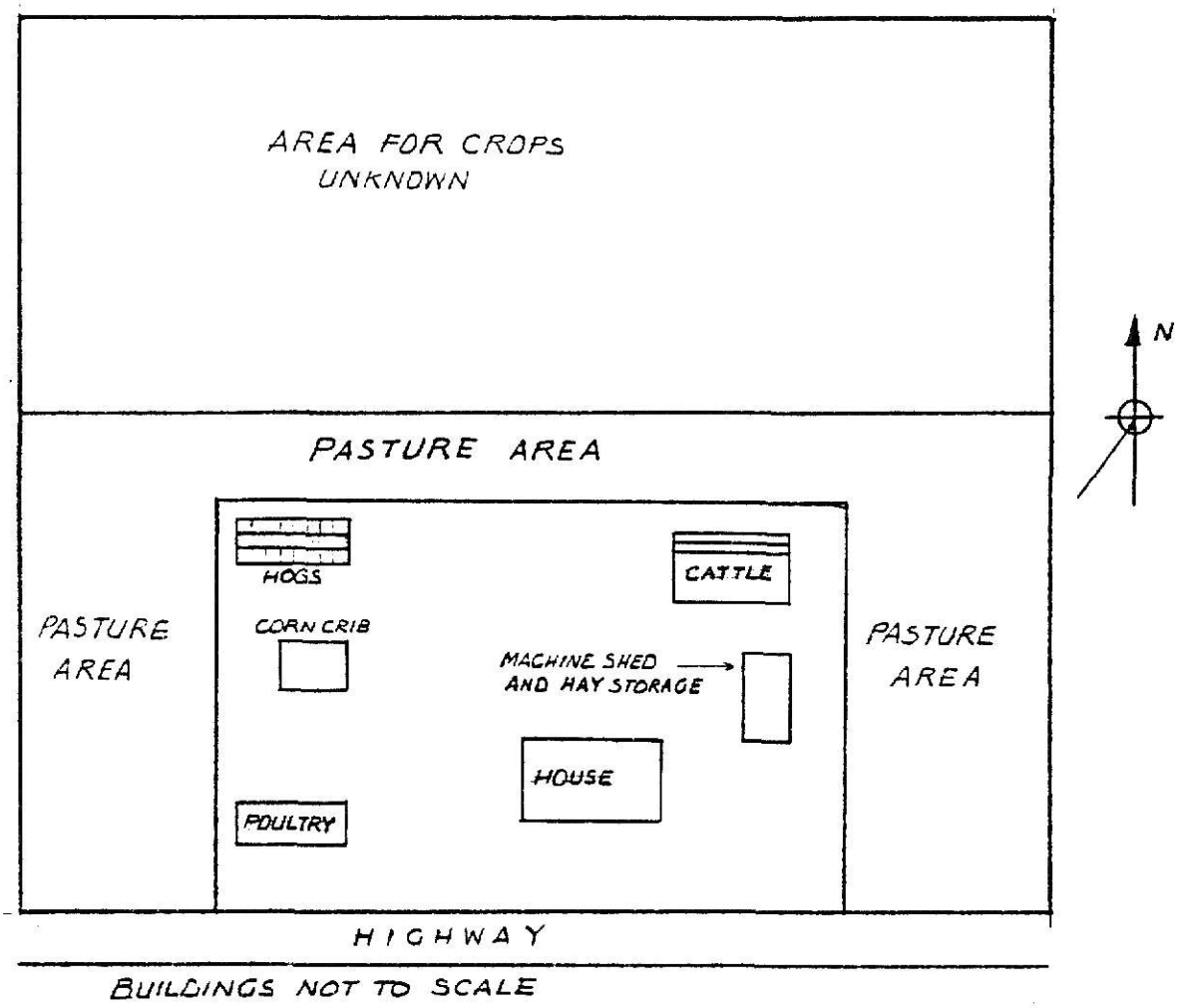
the use of solar driers which has been used and tested with good results in other contries with similar climatic conditions Lindbland and Druban, 1976).

The advantages of implementing the use of a similar type of drier is that no fuel cost is involved and it can be designed to meet the requirement of each farmer in particular and used for different crops. The disadvantages are that they will be most useful at certain hours of the day and would not be usable during heavy rainfall periods. This will make it difficult to use them in the Atlantic zone of Nicaragua.

A different approach to the drying and storage problem would be to integrate farmers into a cooperative system so they would be able to obtain capital to invest in storage and drying units to satisfy their needs.

3.3e. The farmstead proposal.

Farmsteads in a given region of Nicaragua will represent a different problem that requires a special solution compared to those in another region. A general purpose farmstead is provided as a typical example but every farm will require features peculiar to its type and condition. It is intended that the construction materials to be used will be local and with preference to those that assure durability and low maintenance such as brick, concrete, wood and others. Figures 3, 4 and 5 show the farmstead location and facilities to be used.



Distances Recommended in feet	
House-Highway	150-200
House-Poultry	100-150
House-Cattle	200
House-Hogs	200-250
Hogs-Crib	30
Poultry-Crib	30

Figure 3. Farmstead Distribution

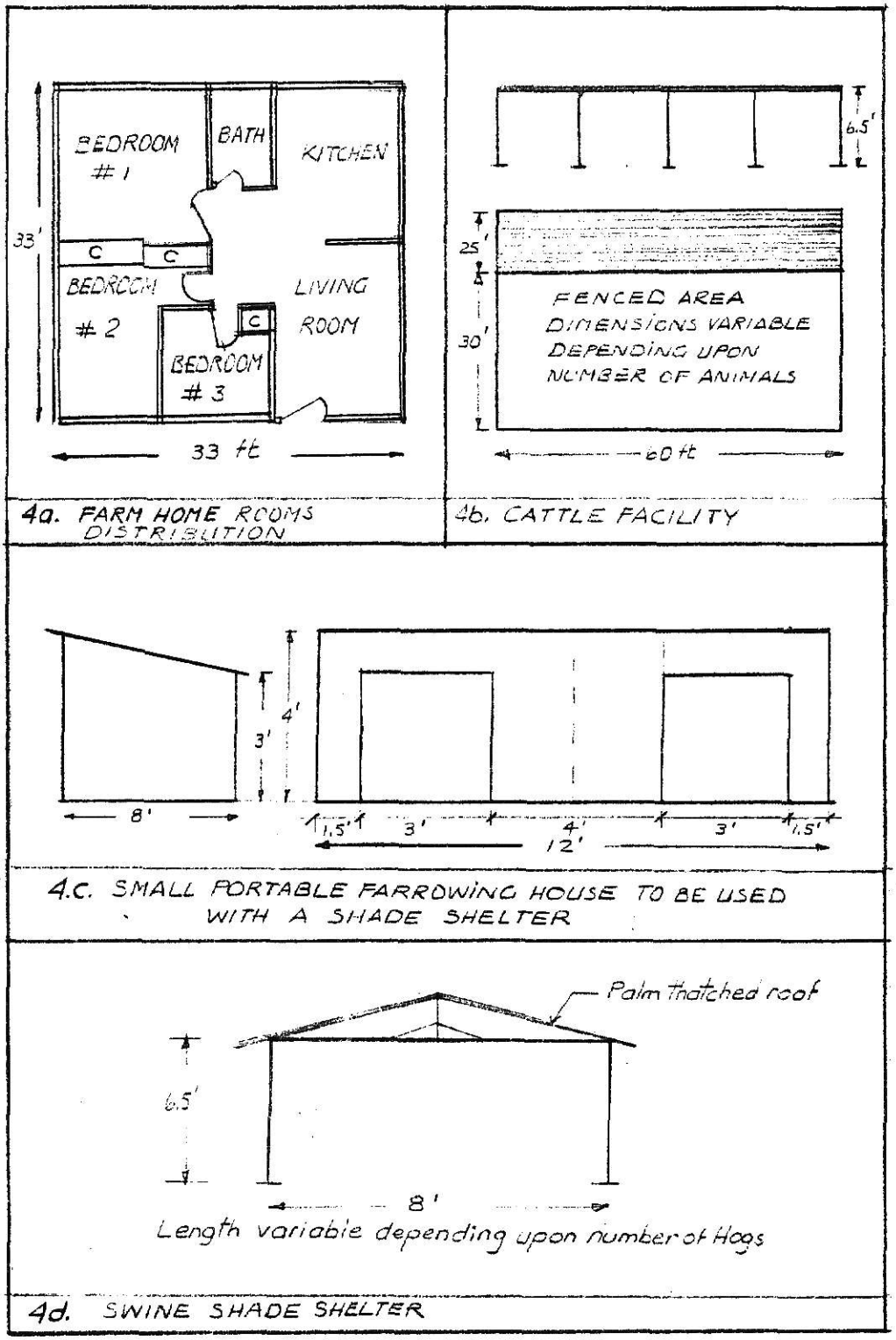


Figure 4. Farm Home and Facilities for the Livestock.

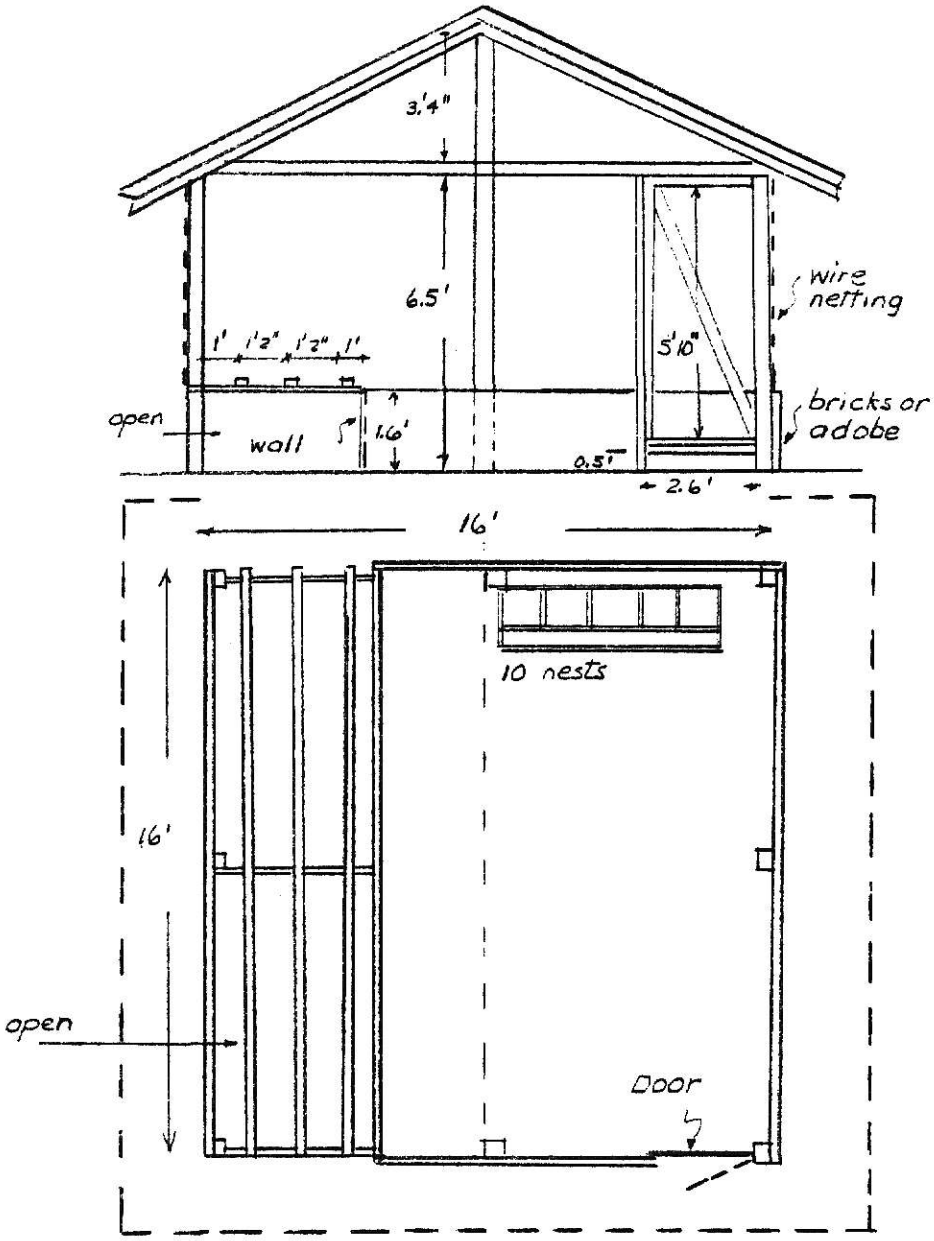


Fig. 5. Poultry House for 50 Laying Hens.

3.3.f. The farm house.

The house would have an area of approximately 100 square meters. Foundations would be of concrete with brick walls where economically possible. Wood beams or metal trusses would be used for roof support. Recommended location would be near the road. Natural ventilation and light should be provided using the best orientation for the location. Windows should be located in the windward direction. The farm house should be located upwind of the prevailing wind direction from the animal housing facilities.

3.3.g. The cattle facility.

A shade shelter in an enclosed area with convenient access to pastures would be used. A hay storage unit or trench silo would be located as close as possible to the shade shelter. Hay and silage would be used when pasture was scarce, but cattle would use pasture as the main source of feed. A distance of 200 feet from the house is recommended to locate the facilities.

3.3.h. Swine facilities.

Facilities for swine management are required even where a few pigs are kept to use waste products such as food refuse from kitchen, garden, etc. The hog shelter and at least one small farrowing house unit will be constructed. A corn crib or a granary will be constructed with preference between the hog and poultry facilities. The facilities will be located far enough from the house. A distance of 200 feet is advisable.

3.3.i. Poultry house.

A house with open but screened wall is required. The flock should be reasonably close to the house since care for them might be assumed by the farmer's wife or other family members. A distance of 150 feet from the house would be recommended.

3.3.j. Equipment storage.

If the farmer owns even a single piece of equipment, storage would be provided using a simple shed.

3.4. The farmstead future outlook.

The farmstead discussed will take care of the requirements for raising a small number of livestock, and pursuing the goal of becoming self-sufficient. The shelters proposed would be suitable to serve this purpose and would be satisfactory until the farmer started selling farm products. Once he reached that level, there would be a shift toward specialized type of farming. In that case, the farmer would begin to specialize in swine or poultry production. Then there would be a demand for specialized production facilities.

If poultry production were chosen, two choices of housing would be available: the deep litter or the cage system. The cage system has some advantages such as making culling possible, uniform egg production through the year, elimination of canibalism, and there is less trouble with regard to interior parasites. The hens need a well balanced ration.

Birds kept on deep litter are less sensitive to differences in the diet (Hartman and King, 1963). The initial investment for cage houses is higher than for deep litter houses. Thus, the deep litter system would be more suitable for poultry produces in rural areas who did not have the capital for a mechanized system. The use of either the cage or deep litter system would be decided by the requirements of the farmer and available resources. However, cages would be used for large mechanized systems where the farmer or an employee can take care of several thousand birds. Figure 6 shows examples of facilities for poultry production and figure 5 is an example of the deep litter house that may be used with different dimensions.

Where there are plans to go to specialized swine production on the farm, probably the best way to start would be to use something similar to the pasture management system since the purpose is to feed out pigs with minimum building investment. In the future, it can be changed to partial or total confinement when a multiple-litter farrowing schedule is adopted and pasture facilities could be converted to housing for breeding stock. Figures 7 and 8 show examples of facilities for swine production. If similar facilities cannot be built because of economic limitations, the hogs should have as much shade as it is practical to provide. The shade space recommended (Midwest Plan Service, 1977) is 15 to 20 sq ft/sow, 20 to 30 sq ft/sow and litter, 4 sq ft/pig to 100 lbs, and 6 sq ft/pig over 100 lbs. Shades could be constructed of materials available at the farm such as wood poles with palm or straw for the roof. It is advisable, that permanent facilities be constructed

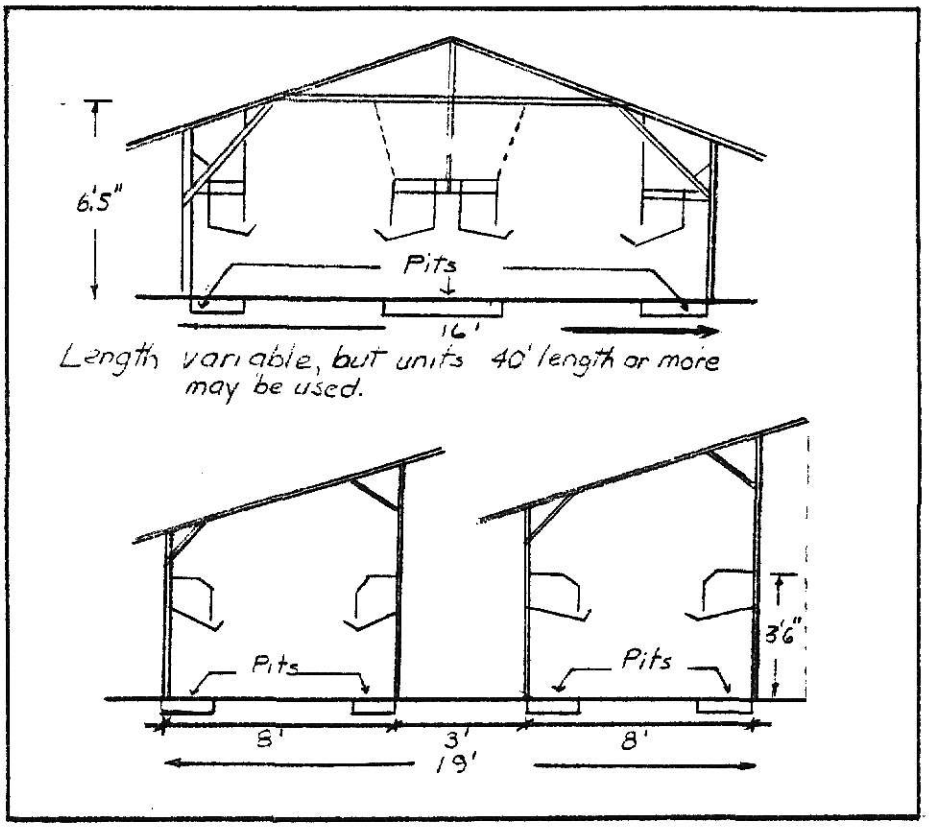


Fig. 6. Alternative Cage System for Use in Poultry Production.

no matter what the size of production will be if the farm purpose is to be dedicated to swine production only.

During the planning and construction of facilities, waste management must be considered to deal with the use or disposal of manure. As a first requirement, all the floors must be solid, either a concrete floor or a stoned floor. In both cases, labor is required to wash or scrape the wastes from the floor. Floors should be sloped with waterers located where manure accumulation is desired. A storage gutter might be used when manure is to be handled as liquid. Locating these facilities at least 300 feet from the farm home would be desirable.

Unless the farm is located in a cash crop area, storage facilities for grain used as the feed must exist on the farm. Facilities must exist for storage of concentrate. Concentrates are available in sacks and provision for storage has to be considered in order to lower the cost for delivery. Both facilities can be combined into a single structure that should be placed close to the livestock area.

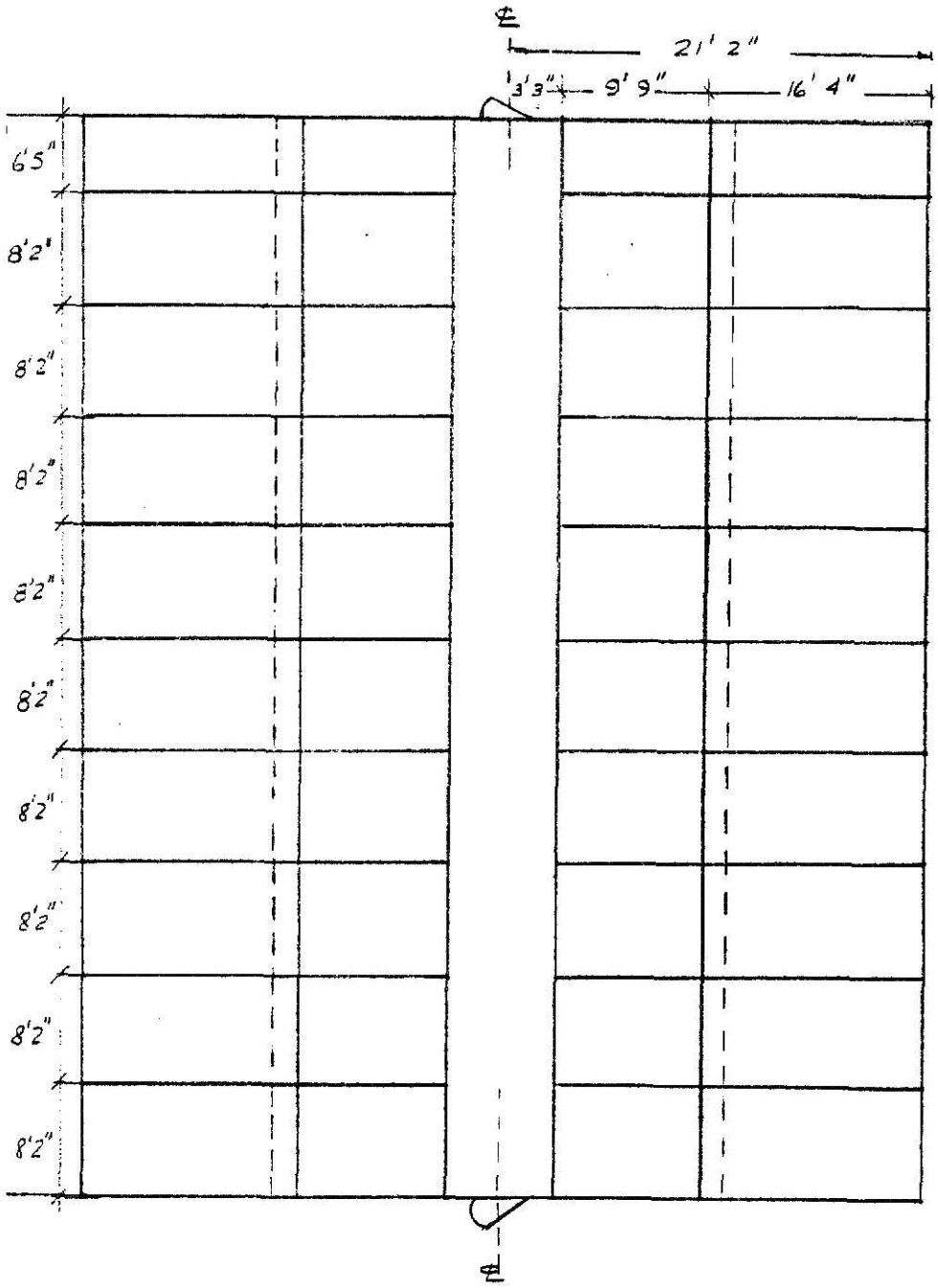


Figure 7. Swine House for Small Production.

Capacity: 2 boars
4 sows & litter
4 farrowing & growing pens (10 pigs/pen)
10 finishing pens (4 pigs/pen)

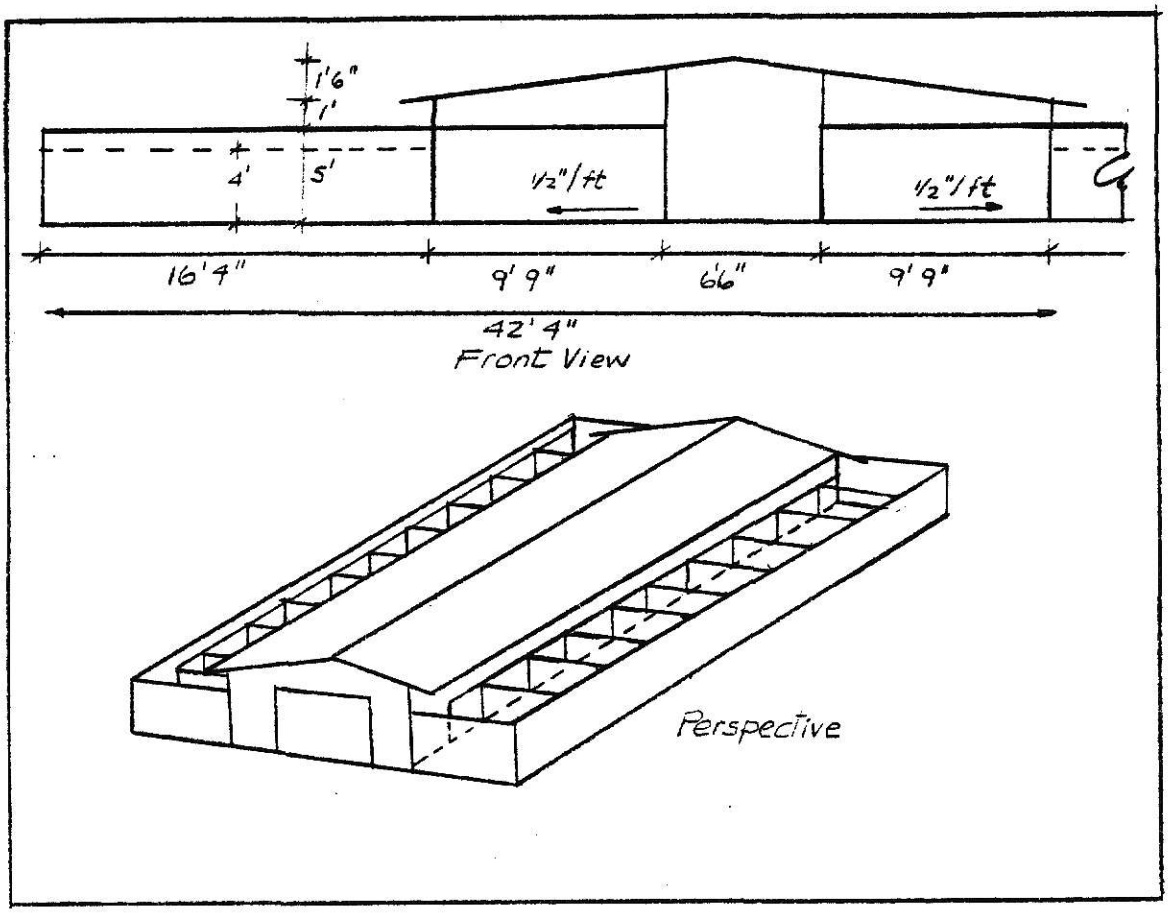


Figure 7a. Swine House for Small Scale Production.

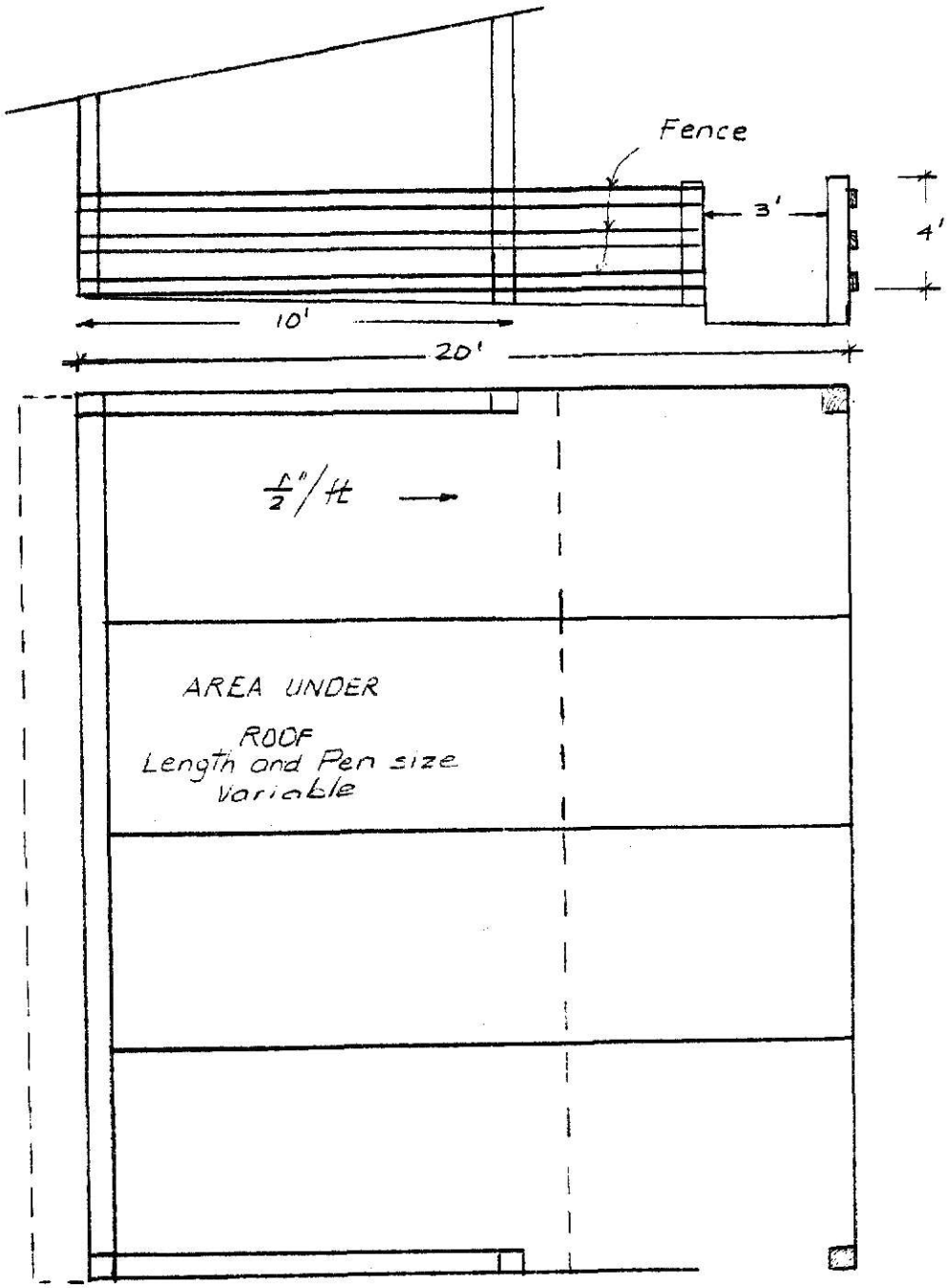


Figure 8. Swine House Facilities.

4.0. Conclusions.

It can be concluded that Nicaragua at the present time has the natural and human resources to put to work a progressive agricultural system through a well planned development program. The changes that may be expected in the future are going to be dependent upon the progress of the whole economy of the country and improvements in transportation, electrical energy, marketing, etc., for rural Nicaragua. In order to achieve the success of any program, it is required to:

1. Increase the number of rural roads and improve those already existing.
2. Extend the electrical distribution system to rural areas.
3. Popularize measures to increase production and disseminate educational materials.
4. Improve research in agriculture science, and technical guidance by improving the extension service.
5. Propagate improved strains of crop seed suited to local conditions and extend their use.
6. Improve methods of cultivation especially at the level of small farms.
7. Enforce soil conservation as a way to conserve the productivity of the land.
8. Increase the availability of the inputs required in a progressive agricultural system.
9. Increase grain storage capacity of the country, either on the farm or in the catonal agricultural centers.
10. Extend the cropping area.
11. Increase the number of field machines and implements available.
12. Promote and encourage the construction of farm buildings.

At the general level, a program is required to educate farmers of the future by reducing illiteracy in the rural areas which is one of the problems why farmers are reluctant to use new techniques.

At the large farm level, the construction of facilities such as buildings, fences, wells, grain silos, etc., must be encouraged. On the other hand, at the small farm level, it is required to help the people make the shift toward a modern agricultural system. At the same time, help for farmers to develop the use of sound management practices in a small livestock industry and look toward specialization in the future is needed. At the present time, it will improve the diet and income of the small farmer.

Finally, it must be remembered that every farm building forms part of an investment, and sometimes the need for buildings may be evaded. Any capital not applied toward the cost of a building can be used to buy fertilizer, seeds, livestock, and other inputs. Capital spent on buildings can no longer be used to buy other inputs. However, the benefits from increased investment in the land can reach a point when they are dissipated by waste of the farm resource due to lack of proper buildings.

Profits can be raised if the farm product is either improved in quality or increased in quantity. Improved quality may increase the market price and increased quantity lower the unit cost of production. Farm buildings may contribute in either way. Thus, farm buildings must be considered as a piece of equipment which is an aid to the conservation and better use of farm resources. For the Nicaraguan farmstead, the addition of a building will be an asset to the farmer.

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FARMSTEAD DEVELOPMENT AS A WAY TO IMPROVE LIVESTOCK PRODUCTION IN NICARAGUA

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AN ABSTRACT OF A MASTER'S REPORT

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ABSTRACT

This report specifically deals with the agricultural situation in a less developed country, Nicaragua. It aims at an approach toward determining the alternatives to be used for building livestock shelters for the small farm.

Some ideas are presented about how to improve the capacity of production at the small farm level, as well as, the improvement of the whole agricultural system. It explores some of the ways to promote agricultural development and transformation from a traditional agricultural system to a modern one.

Finally, the necessity for farm buildings is discussed and examples of some considered suitable for use in the country at the present time, are presented.