Towards an Understanding of *Milpa* Agriculture: The Belize Case

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Agricultural output in many developing countries is inadequate to meet the demand generated by their rapidly growing populations. A shortage of food, a lack of employment, and a scarcity of foreign exchange can often all be traced to the poor performance of agriculture. In Belize (British Honduras) and in countries as diverse as Indonesia, Brazil, and the Philippines, the government tends to accept the recommendation of national and international planners to develop agriculture by means of large-scale, mechanized projects. Too frequently, however, experts overlook the potential for increasing output by making marginal improvements in the indigenous agricultural system. This paper describes one such indigenous system, *milpa* agriculture in Belize, and possible means of increasing its productivity. We suggest hypotheses in an attempt to stimulate discussion as to the appropriate agricultural development path for Belize and similar predominantly smallholder agricultural sectors.

Agriculture is the most important economic sector in Belize, contributing 40 percent of the gross national product and approximately 75 percent of total domestic exports in 1969, the most recent year for which data are available. About one-third of the cropped area is devoted to maize, 60 percent of which is in *milpa*. Almost 70 percent of the labor force is directly or indirectly employed in agriculture. The future of the country rests largely on the development of the agricultural sector because there

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are no known mineral deposits, and the forests, which have been the major economic base for years, are becoming exhausted.

The major agricultural policy issue facing the government is the choice of an appropriate agricultural development strategy. Broadly stated, the alternatives are either to encourage the formation of large estate-type production units or, at the other extreme, to increase the productivity of the smallholders or milperos, who make up the bulk of the farming population.

Present government policies favor the first alternative through a series of incentives aimed at foreign investors. These policies, which encourage large-scale private agricultural investment without direct government involvement, require little extension and social action, while smallholder development requires substantial direct involvement. Any such direct involvement must, however, be based on an assessment of the problems and potentials of the milpa system. This study provides that assessment for Cayo District of Belize.

Shifting Maize Production in Belize

Belize is 150 miles long and 70 miles wide at its widest point. It lies on the Caribbean side of Central America, bordering the Yucatan Peninsula of Mexico on the north and Guatemala on the west and south. Its tropical climate has a mean annual rainfall ranging from 55 inches inland to nearly 150 inches on the coast. The study area in Cayo District is near the Central Agricultural Farm (the country's primary agricultural research station), which recorded an annual average of 57 inches of rainfall between 1961 and 1971.

The northern half of the country and coast is characterized by flat to rolling land. The southern interior is hilly to steep and contains the Mayan Mountains, rising 3,000 feet in some areas. Over 45 percent of the land is covered by forests, about three-fourths is rain forest, and most of the remaining is pine forest, with some coastal mangrove swamps.

The country is sparsely populated with scattered villages. Population density averages 14 persons per square mile, but approximately 45 percent of the 125,000 (1970) inhabitants live in Belize City and its immediate vicinity.

Of the nation's 2.16 million acres of land, 38 percent is classified as "suitable for agriculture," but only 10.4 percent (223,698 acres) were in production in 1971. Cattle grazed on over half of the land in production, with the remaining portion utilized for crops—primarily sugarcane, maize, rice, and citrus.

The distribution of land ownership is extremely skewed. Half the "suitable agricultural land" was privately held, and 94 percent of these free-

1 Development Incentive Ordinance of 1960 (Belize City: Government Printer, 1960). This law still provides the basic policies for agricultural development.


4 Department of Agriculture, Annual Report 1971.
holdings were owned by 7 percent of the landowners. Large tracts of land have been sold since 1960 to foreign entrepreneurs and Mennonite immigrants from Canada and Mexico.

The Study Farmers and Farms. After discussions with agricultural officials and visits to a number of potential study areas, we selected for study three Mayan farming villages in Cristo Ray, San Antonio, and Bullet Tree Falls. A random sample of 10 percent of the farmers in each village was chosen from the agricultural officer's listing, giving a set of 21 sample farms. While this sample is small, the objective of this study is to understand the farming system, and for that purpose it proved to be adequate.

Except for the cattle owners, who often live away from the village on their rancho, the typical milpero lives with his family in a central village. The average household head was 44 years old, had farmed 25 years, and had supported a family of 7.3 persons. But the milpero is not a stranger to the world outside his village. Over 15 percent had previously held permanent jobs, cutting mahogany, or working at sawmills or sugar plantations. About half of the farmers had "worked out" on seasonal jobs during the preceding year. Their employment included logging, sawmilling, picking oranges, cutting sugarcane, pulling pine resin, carpentry, cattle tending, or working as chicleros, and as hired laborers for the neighboring Mennonite farmers. In fact, working out is the typical way in which the farmers presently raising cattle originally accumulated capital to begin their operations.

The Milpa. The traditional farm site, or milpa, is located some distance from the farmer's house. Farmers living on their ranchos cultivate areas within a 5- to 10-minute walk from their homestead, but those residing in the main village plant more distant sites—averaging a 25-minute walk. Average farm size was 52.2 mecate (6.7 acres) in 1972 and 60.4 mecate (7.7 acres) in 1973.

Four basic land tenure patterns exist in the areas studied. First, use of Crown land can be secured by purchasing a milpa permit for $5 per year. Second, an occupancy lease, generally for 20 years, may be obtained from the government for $.50 per acre per year. More commonly, leases are drawn for a minimum of 5 acres. Acquiring a lease gives the lessee the right later to buy the land by location ticket, a contract purchase agreement. With a location ticket, the purchaser is given 5 years to develop one-half to three-fourths of the land for permanent use.

Agricultural Census.

Most information was collected by means of personal interview. In addition, 18 of the milpas (farms) were visited and plant population counts were taken. Finally, 12 of the farmers provided samples of their stored maize for analysis.

A chiclero taps the latex of the sapodilla tree; this latex is a principal ingredient of chewing gum.

A mecate is equal to approximately one-eighth of an acre. Another frequently used measure of area is the manzana, equal to 2.05 acres or 16 mecate.

Discussion with Mark A. Koening, Land Officer, 15 August 1973.

All monetary references are in Belizean dollars. One Belizean dollar equalled US$.60 in 1973.
ments are made in yearly installments of 20 percent of the predetermined sale price ($12-$15 per acre) with complete payment made within 5 years. Failure to meet any of these requirements results in forfeiture of permanent land rights. Finally, there are private rental agreements, negotiated between renter and owner. In the area studied, private cropland rent ranged from $1.80 to $2.00 per acre per year.

The frequency of each type of tenure arrangement varied considerably among villages. In San Antonio, milperos who grew only maize preferred the milpa ticket, which permitted them to farm a new site annually. Those who raised cattle chose to secure an occupancy lease with the intention of eventually purchasing the land on a location ticket. Most of the land near Bullet Tree Falls was part of a large estate owned by one absentee landlord. Almost all the local farmers had to obtain annual rental contracts at rates substantially higher than the supply price of similar quality land to farmers in other villages where land was available through the milpa permit, or location ticket. Although many of these residents had cleared and substantially improved the land, they held no permanent tenure rights—a growing concern to many of the milperos, who believed they were about to be evicted. Finally, the village of Cristo Ray represented an intermediate pattern with an approximately equal number of farmers holding occupancy leases and private rental contracts.

The Milpa Farming System

An agricultural system is a unique response to environmental, social, economic, and cultural factors with each agricultural system representing a point in an evolutionary process. As Wrigley observed,

The more one sees of traditional agricultural practices, apparently methodless and jumbled, the more one realizes how well adapted most of them are to continued production with the tools available.13

To clarify the particular traditional agriculture of Belize and the potential for improvement of that system, we describe the management practices and rationale for these practices, as explained by the sample of farmers interviewed.

Site Selection. In January or February, the milpero will select the area he intends to farm during the forthcoming season. Frequently, he chooses a site he has seen while hunting or perhaps one near an old farm. At that time, he chops a survey line around the site to indicate to others that the area has been claimed. The principal factors considered in site selection are age of bush, soil type, slope, and indicator plants.

Bush for farming is classified by its age. Wamill has from 1 to 5 years of vegetative growth, high wamill from 6 to 20, and high bush has never been cut. In general, high bush is preferred because of its superior fertility, soft loose soil, and the absence of such weeds, as can chim. In some instances, the soil under high bush is so rich and thickly rooted that it is expected to give better yields the second year of cultivation than the first. In sharp contrast to his preference, the average milpero cleared bush that was only 9.1 years old, with 38 percent of the farmers planting on sites which

had been fallow less than 5 years. The shortage of choice land was particularly acute in Bullet Tree Falls, where the milpas were planted on sites where the bush averaged only 3.8 years.

To the milpero, soil type is another important consideration in site selection. *Pus loom*, a soft, deep, loamy soil ranging in color from gray to black, was identified as best for maize farming. It is preferred for its innate fertility, its capacity to quickly absorb and hold water from the early rains, and the ease with which it can be worked. In addition, 7 other general soil types were characterized on the basis of color and texture.

Although well-drained flat land is preferred for milpa, the shortage of level areas necessitates cultivation of the hills. The tops of the higher slopes are generally considered too dry, and crops planted there are susceptible to lodging (premature toppling) when battered by the annual tropical storms. On the other hand, milpas planted in the foothills and lowlands are vulnerable to flooding in wet years. Consequently, the most desirable land is on the sides of hills that have adequate drainage and some protection from the wind.

Some farmers suggested that the presence of the *mohoe* tree, *chicah* tree, *cahoon* palm, and *mushan* bush (bay cedar) indicated a good site. Areas to be avoided include clay soils, which are difficult to cultivate; white clays, which contain excessive amounts of limestone; and pebble-laden soils, which the milperos believe are heated by the sun and burn the plant roots. Young *wamill*, grassy fields, and sites where tiger bush grows are avoided since milpas planted in these areas will be severely infested with weeds.

Farmers generally agree that in a good year when rainfall is adequate but not excessive, maize, will thrive in most environments. On the other hand, under unfavorable conditions the vulnerability of the crop to drought or flooding can make elevation and soil type decisive factors. In response to this uncertainty, farmers typically hedge in several ways; they take advantage of different soil types, rainfall variations, and different age of bush by making two farms—each at a separate location. Furthermore, most farmers cultivate all elevations of a hillside. In dry years, the crop sown in the foothills grows best; in wet years, maize growing on the side and top flourishes. Consequently, in site selection each farmer strategically plays out his own “game against nature,” trying to avoid total crop failure, regardless of what tricks the weather may play.

Most farm sites are planted to *milpa* maize for only one year. However, if the bush is very old or the milpero feels the site is particularly productive in the first year, he will plant the same land a second year, as did 18

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12 Virgin bush was estimated as 20 years old in making this computation.
13 Soil samples were collected from 18 of the respondents' farms and analyzed at the University of Illinois soils laboratory in Urbana. The pH averaged 7.62 and the soils were low in phosphorus, but potassium was available in sufficient quantities.
14 Only 10 percent of the farmers planted 2 separate *milpa* sites in 1972 compared with 60 percent in 1973. This increase in the number of sites and area planted is the consequence of the drought in 1973, which forced many farmers to abandon their first farm and replant at a new site.
percent of the respondents. While a site cleared of very old bush is expected to produce a better yield the second time it is farmed, yields decrease if successive plantings are made on *wamill*. Not only will the second year *wamill* farm be infertile, but it will also be infested with weeds and the soil will be hard and dry (hot). Finally, it is believed that insect damage increases with successive plantings—especially the problem of ants eating the newly sown seed.

Although the factors discussed above are considered important, few farmers actually have the opportunity to search for the best land. Approximately one-third of the respondents held occupancy leases, which required them to farm the land to which they held a claim. While these *milperos* can still select the best areas within their holding, only the farmers holding the *milpa* permit can fully utilize the traditional site selection criteria in seeking farm sites. In fact, many farmers prefer the *milpa* permit precisely because it gives them the opportunity to use the best available land.

_Land Clearing._ The first step in land preparation is slashing the *low bush* and felling large trees on the selected site. While most of this work is done in March, slashing and felling may start as early as January and continue through May, depending upon farm size, age of bush, and the farmer's expectations as to when the seasonal rains will begin.

When working *high bush*, the *milpero* first cuts the low vegetation close to the ground with a machete. Then the large trees are felled with an axe. Next, the branches of the fallen trees are chopped off so that all of the debris mats close to the ground. This sequence of operations insures that both undergrowth and trees will be cut up and dry thoroughly when exposed to the sun. In contrast, farmers working *low bush* typically combine slashing and felling in one activity.

After felling, *wamill* must be allowed to bake in the sun for two or three weeks while *old bush* requires a month or more to dry adequately. Proper drying is essential to successful farming since only parched bush will support a fire hot enough to clear the field of debris, kill green weeds, destroy ungerminated weed seeds, "soften the soil" by burning underground roots, and destroy soil insects and fungi.

The government requires the *milperos*, before burning the dried field, to secure a fire permit from the Agriculture Department and cut a firebreak around their farms. Yet, only about one-third actually make a firebreak since they believe this is necessary only when *high bush* is being burned or when the farm is near a populated area. Farmers making a firebreak typically clear a path four to six feet wide around the area to be burned. This operation is done in April, just prior to burning the farm, to insure that the firebreak will be green and thereby resist burning.

The sighting of mid-April storm clouds alerts the *milpero* that it is time to fire his farm. The consequences of misjudging the weather conditions can be calamitous. Successful weed control requires that the maize be planted immediately after burning. Thus, if the farmer prematurely fires

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18 Burning the farm has the effect of breaking up the soil, since subsurface roots are also burned, and increasing the water absorption capacity of the soil.
his farm—before the dependable seasonal rains arrive—soil moisture will be inadequate to allow him to plant his maize, but sufficient to germinate weed seeds. Consequently, he will be required to invest a great deal of time weeding his farm. On the other hand, if it rains heavily before the farmer burns his milpa, the leaves will drop off the dried vegetation—forming a wet mat on the ground. Since this debris will never burn, the milpero will have to abandon the site, and, if it is not too late, slash a new farm in young bush.

Burning is usually done on a hot breezy day in the early afternoon so that the bush will be dry when the fire starts but the late afternoon dew will help keep the flames from raging out of control. As a further precaution, the milpero first ignites the downwind edge of his farm, letting it burn upwind before igniting the upwind sides. After the fire has burned itself out, usually one to two hours later, the farmer returns home.

**Seed Selection and Planting.** Typically, the milpero plants seed that he has saved from the previous year’s harvest.\(^{16}\) Those not using their own seed purchase it from a relative, from the government, or in town. Farmers reported that seed costs from 10-30 cents per quart, with an average price of 15 cents per quart for local types and 42 cents per pound for hybrid Poey T-66 or synthetic VS-550.

Farmers take great care in choosing their seed. Just before planting time, the largest ears are selected from the storage bin. The kernels at both ends of the ear are broken off, leaving only the large middle grains for seed. Care is taken to sort through the remaining grain, removing kernels which have been damaged by weevils or show signs of fungus damage (black hearts).

Several different types of maize are grown, distinguished primarily by color. Local white types were planted exclusively by 57 percent of the farmers because they are easiest to sell in the local market: it is believed that tortillas made from white maize flour do not harden after cooling. While local yellow types are believed to make a more nutritious feed for livestock than the white varieties and to be capable of longer storage because their harder kernel makes them more resistant to weevils, they are difficult to sell locally due to taste prejudice.\(^{17}\) Poey T-66, a hybrid variety promoted by the Ministry of Agriculture, was grown by only 3 milperos, who preferred it as green maize since the ears were larger than local types.\(^{18}\) Also, the few market-oriented farmers selling large quantities of maize to wholesalers praise its high yield potential. Some milperos observe that Poey T-66 is more drought resistant than local types.

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\(^{16}\) The 87 percent of the farmers who planted their own seed had planted the same seed germ for an average of 16.5 years. Consequently, a substantial amount of selection has occurred, resulting in significant varietal improvement.

\(^{17}\) The equilibrium moisture value of yellow maize is 1.5 percent greater than white maize. This means that yellow maize may be safely stored at 1.5 percent greater moisture level than white maize. D. W. Hall, *Handling and Storage of Food Grains in Tropical and Subtropical Areas*, FAO Agricultural Development Paper no. 90, 1970, p. 54.

\(^{18}\) Agricultural Officer Alfanso Tzul suggested that most farmers had grown small quantities of improved varieties to determine for themselves whether they outyielded local types.
since the Mennonites, who grow only Poey on their mechanized fields, have high yields during dry years when milpa maize yields poorly. On the other hand, substantial losses may occur when Poey T-66 is stored by traditional methods for more than a few months. Because the husk does not completely enclose the ear, it is very susceptible to weevil damage.19

Since farmers expect the heavy rains to fall in June, May is the traditional planting month. Most milperos sow after the first heavy shower following burning. This precipitation not only softens the soil but also settles the ash which covers the field (particularly when cultivating where high bush grew) and provides the moisture necessary for seed germination. If rain does not come immediately after burning, the age of the bush is the primary factor determining the number of days the farmer can safely wait before beginning to plant. If the vegetation is young, the milpero tends to plant immediately after burning—taking advantage of the existing soil moisture, which would be quickly evaporated by the sun shining on a bare field. The older the bush the longer the farmer may wait for favorably heavy rains, since postponing planting on land where high bush grew will not result in as severe a weed infestation as when planting is postponed on young bush. However, sowing is seldom postponed for more than three weeks after burning. It is generally recognized that planting later than a few days after burning will give the weeds a head start on the maize seedlings, thereby increasing the time the milpero must spend weeding his farm.

Corn is generally sown in May. Many farmers avoid early April plantings because a prolonged dry spell frequently occurs during July, just when April plantings would be flowering and in need of moisture. Also, the early rains are undependable, often letting up and leaving the fragile small seedlings to bake in the sun. Finally, milpas planted early are more severely damaged by predators than those sown during May. June-July plantings are considered risky because late-planted maize develops a weak root system, making it susceptible to lodging. Consequently, maize sown in July is frequently blown down by the late season tropical storms before it is fully mature. While only two respondents admitted planting by the phases of the moon, other informants suggest that this practice may be extensively followed by older farmers. These individuals believe that maize sown during a full moon (in contrast to a new moon) grows shorter and develops a stronger root system, making the plant more resistant to lodging. Also, these farmers contend that maize planted during the full moon is damaged less by weevils.20

Since the rains were extremely late in 1973, many of the farmers staggered their planting and, in some instances, replanted or made new farms in an attempt to compensate for the absence of moisture. In fact, some milperos were still planting in August in a desperate attempt to salvage a crop after their original plantings had failed.

Sowing is done with the aid of a "dibble stick"—a sapling approximately

19 VS-550, a synthetic white variety promoted by the Government, is also susceptible to weevil damage for the same reason.

20 When the moon is full, Mopan Mayans traditionally believe that all living things are mature and strong; in contrast, during the new moon most trees and plants are believed to be weak like newborn babies.
4 inches in diameter and 5½ feet long, which is sharpened to a point. The milpero thrusts the dibble stick into the ground, rotates it to broaden the hole, and withdraws the tool. Recommended planting depths range from 1½ to 4 inches, with the seed planted approximately 1 inch deeper in dry soil than in wet ground.

While some milperos favor as few as 2 and as many as 8 seeds per dibble, the average rate reported was 5.6 seeds per hill. The recommended seed rate per manzana (2.05 acres) ranges from 5 to 24 quarts, but averages 12.8 quarts (63,600 seeds/manzana). Paradoxically, data collected indicates that in 1972 and 1973 the farmers actually sowed on the average 23 quarts per manzana, almost double the recommended rate. The discrepancy may be partially explained by the need to replant sections of the farm and by the fact that, since most farmers do not actually measure the area of their farms, the size of holdings may be underestimated.

*Crop Production.* After planting, the crop is continually subject to a variety of hazards. Ants attempt to carry away the seed as soon as they are put into the ground. For the first two weeks after germination, blackbirds uproot the young seedlings. The severity of these risks is verified by the fact that 42 percent of the farmers replanted a portion of their milpa. As the seedlings grow, ground moles chew and weaken the roots. When the ear emerges from the stalk, woodpeckers destroy the ear by boring the internode. As the ears begin to fill with milk, both the pyan pyan bird and woodpeckers drill the ear sheath, preventing ear development. When the maize matures, deer, pisote, picarry, droves of squirrels, raccoons, and flocks of ravenous parrots devour the ripening ears. While some of these animals eat only a few grains from the ear, their breaking of the sheath make the grain more susceptible to weevil infestation.

The type and extent of damage caused by wild animals varies greatly from area to area. Blackbird, woodpecker, and pyan pyan generally attack farms near villages. Picarry and pisote tend to be more of a menace on milpas located away from the populated areas in high bush. Finally, parrots and raccoons prey primarily on riverside farms.

There are few effective ways to control these animals. When the seedlings are young, most farmers visit their farms early in the morning and late in the afternoon to scare away blackbirds. Some milperos build snares to catch ground moles. If signs of large mammals are observed, the milpero visits his farm with his dogs and attempts to shoot the intruders. Frequent visits to the milpa also serve as a preventive measure, since human scent is believed to ward off predators. Yet, as the maize matures, animal damage is increasingly difficult to prevent, since such a wide variety of species attack the ripening ears. Only the farmer's constant presence would serve as a significant deterrent.

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21 These estimates were made by dividing total reported seed sown by reported area planted.

22 In addition to ants, some farmers identified the cutworm and wireworm as pests, but did not consider these insects to cause significant damage. Stemborer does not appear to infest the maize, probably because the field is rotated annually.

23 According to two farmers, animal damage has been much greater since 1961 when Hurricane Hattie swept across the country, extensively destroying wild fruit trees—the traditional food of the animals.
The existence of such a great number of predators justifies the milpero's high planting rate. In fact, an actual plant count made just prior to harvest identified an average population of 25,925 plants per manzana (12,650/acre), at a rate of 4.9 plants per hill (each hill averages 16.9 square feet). This compares with the reported seed rate of 63,600 grains per manzana, so it appears that only 41 percent of the seed actually grew to maturity.

While maize is the central crop in the milpa system, approximately 87 percent of the milperos planted supplemental crops. Species observed on various milpas included red kidney beans, cocoyams, sweet potatoes, black beans, local squash, soup yams, pepper, cotton, ginger, sesame seed, okra, pumpkin, cho-cho, rice, plantain, tomato, melon, banana, cassava, and sugar cane. While one milpero identified 14 different crops planted on his milpa, the average farmer reported growing 5 different crops. The most important were maize, red kidney beans, black beans, cocoyams, sweet potatoes, and plantain.

Intercropping does not mean indiscriminate mixing of different crops throughout the field. In general, each crop has a typical location. For example, rice is planted in a low spot likely to be waterlogged during the rains; black beans are planted in September at the base of the maize plants, utilizing the stalk to support its vine; and other crops are generally planted in patches within the maize so they can be easily located by the milpero when he wants to harvest them. Most intercropped plants are sown after the maize has been planted. The longer maturing crops such as plantain, banana, cassava, yams, and sweet potatoes are left in the field after the maize is harvested, ripening up to a year after being planted.

For the milpero, intercropping has several advantages over monoculture. First, intercropped fields are believed to be easier to weed than fields where each crop is planted separately. Second, farmers contend that it takes too much time to clear and plant separate fields. Third, since maize matures in four months, the simultaneous cultivation of crops with longer growth periods maximizes the use of cleared land. Fourth, the maize stalks provide the shade and the support required by the black beans. Fifth, intercropping reduces the need for weeding since the ground cover provided by the pumpkin and squash foliage helps to shade out the weeds. Finally, the sowing of crops of different duration insures the farmer that he will be able to harvest some of his produce, even under extremely variable weather conditions.

Weeding. While intercropping reduces weed infestation, the milpero must still contend with three types of weeds. Can chin (maize grass) competes with the young seedling for light, water, and nutrients. Fortunately, the maize plant tends to shade out this grass if the crop is planted soon after field burning. Eb Cho and tzotz-ak are broad-leaved surface runners which climb up the maize stalk and choke the growing plant if not controlled. Finally, the stumps which are left after slashing quickly

24 A 20' x 20' plot was randomly selected on each of 18 milpas. A plant count per hill and hill count per plot was made on each plot.

25 Many other types of weeds and grasses are found in specific localities, but the three mentioned were most frequently cited by the milperos as problems.
sprout woody vegetation which must be pruned. For cutting away the ground vegetation, the *milpero* uses a machete and forked stick. To trim the woody regrowth, he simply employs a machete.

The first weeding is started in July when the maize reaches a height of two to three feet (one and one-half months old) and may be continued until the flowering stage. Usually, weeding is carried out soon after a rain to minimize damage to the maize plants. Some farmers contend that weeding should be postponed until the *can chim* grass is ready to go to seed for in that case one weeding will be adequate; on the other hand, many farmers contend that if weeding is postponed so long, the maize seedlings will grow into weak thin-stemmed plants very susceptible to lodging. In dry years, such as 1973, most farmers strongly advise against weeding. It is their belief that since the weeds shade the soil removing them exposes the soil and maize roots to the sun, thereby accelerating the evaporation of scarce moisture. Consequently, they believe weeding during a drought causes the maize to burn up.26

Harvesting. Harvest practices vary among agro-environments. *Milperos* who farm near the riverside suffer extensive losses from parrots. In an attempt to reduce this damage, these *milperos* break the stalk below the ear when the grain is fully mature, but before it is completely dry. It is believed that the parrots will think the crop has been harvested and overlook the partially hidden ears. One disadvantage of this practice is that it shortens the period over which harvesting can be extended. Because broken ears tend to rot at the juncture between the ear and the stalk, they must be harvested immediately after drying, or the ears will fall to the ground and be eaten by animals or rats. Consequently, in the Cayo area breaking the maize is an accepted cultural practice only in parrot-infested areas such as Bullet Tree Falls.

Construction of a “barn” for storing the harvested maize is typically postponed until October when the *milpero* can estimate his yield and determine the size of barn he will need. After choosing a high site in the center of the farm, the *milpero* constructs four stone corner foundations approximately two feet high. This raises the floor of the barn off the ground and insures good air circulation. Particular care is taken to face the broad side of the rectangular barn into the wind—taking advantage of the drying effect of the prevailing breezes. After laying wooden poles across the four corners, the farmer builds up the sides with poles placed horizontally on top of each other, tying each firmly to the preceding layer. After the sides are completed, the bin is covered with a thatched roof.

While half of the *milperos* store their maize on their *milpa*, it is becoming increasingly common for farmers to keep their harvest only temporarily at their farm site. After harvesting, 33 percent of the respondents moved their maize to a permanent barn near home and 17 percent stored their crop in a bin adjacent to their kitchen. While this change partially arises out of the need to make the maize more readily available to the farmer’s family while he is working out, it also represents an attempt to reduce rodent damage and protect the crop from theft.

26 Possibly the burning is really a nitrogen deficiency which surfaces in dry weather when the plant is incapable of utilizing available nitrogen.
The milpero harvests his crop at two different stages of maturity. In July or August, approximately two and one-half months after planting, green maize is harvested for both household consumption and cash sales. On hot days in October through November (four to five months after planting) dry maize is picked.27

A variety of methods are used to determine if the dry maize is ready to be harvested. All farmers wait for the ears to bend over and hang downward. Further checks include examining the end of the ear to see if it is dry; biting a sample of the grain to check the hardness; shelling a sample of grain, then dropping the kernels in an empty box and listening for a distinctive sound; or examining the cob to see if it is hollow. If the ears are harvested and stored before the maize is sufficiently dry, the kernels will develop black hearts, a characteristic sign of fungus damage. Several farmers warned that leaving the maize in the field too long increased the probability of weevil infestation, germination on the cob, animal damage, and being blown down by the wind. On the other hand, a few milperos contended that maize can be safely left in the field on the stalk until as late as February.

While some farmers harvest half a day and spend the afternoon carrying the ears to their barn, others pick before storing only enough to make one layer. At the barn, the farmer separates the large ears from the small ones. The large ears are packed tightly in layers, silk end down, to protect the grain from rain, and to make the interior of the bin impenetrable to rats. Many farmers sprinkle lime between each layer, hoping that the dust will burn the eyes of any intruding rats and protect the grain from weevils. Since the small ears are considered unfit for eating, they are dumped into a smaller bin and fed to the chickens and horses.

Yields vary both between farms and between seasons. Interfarm yield differences were largely attributed to the location of the farm. Sixteen farmers identified soil type as the primary factor constraining yield, one identified terrain, and one the age of bush. Three farmers considered the difference in rainfall between farms most important; four farmers, luck or God's will.28 Only one respondent blamed poor yields on a factor totally controllable by the milpero—weeding. Approximately 95 percent of the respondents attributed interyear yield variations to weather conditions, primarily rainfall. Over the past 10 years, the milperos recollected that they had obtained very good yields in 20 percent of the years, average yields in 52 percent of the years, and very poor yields in 28 percent of the years.

Yields are difficult to estimate for several reasons. First, over half of the farmers harvested green maize. In most instances, this is picked a few ears at at time, with no records kept of the total harvest. Second, before storing, the large ears are separated from the small ones, which are seldom

27 Some farmers harvest by the moon, stopping three to four days before the full moon and resuming the harvest three to four days after the new moon. The crop is left in the field so long after maturing to insure that it is thoroughly dried.

28 Those farmers who referred to luck or God's will as important factors affecting yield did so because they attributed weather conditions to luck and God.
measured. Consequently, when a farmer is asked about his yield, he usually includes only the large ears stored in his barn.

We attempted to estimate 1972 yields, based on the farmers' memory of quantity harvested in green maize, large ears, and small ears. Computed yields ranged from 7.5 cargoes per manzana to 43.2 cargoes per manzana. Average yield was estimated to be 23.5 cargoes per manzana. Converted to a per acre shelled maize basis, average yield would be 874 lbs. per acre, with the maximum being 1,685 lbs. per acre and lowest yield being 293 lbs. per acre.29 The most broad-based estimate of milpa yield in Belize was made in 1970 by a British survey team. Their estimate of milpa yields was based on harvesting 46 random sample plots, each .0099 acres in area, on traditional farms in Cayo District. They found mean yield to be 1,279 lbs. of shelled maize per acre (with a standard deviation of 603 lbs. per acre), with median yield being 1,260.30 Due to the large interyear yield fluctuations, these two estimates should be interpreted as complementary—indicating the general yield level and extent of seasonal variation.

Farmers with permanent storage facilities near their homes generally transfer their harvested crop immediately after picking. On the other hand, those utilizing farm-site storage carry their maize to their homesteads as needed. Approximately 70 percent of the farmers interviewed use horses as pack animals for transferring their harvest. From 1 to 3 horses are loaded with 2 cargoes per horse.31 Milperos who carry their maize on their backs typically haul one-half cargo of ears or 1 cargo of shelled maize per trip.

After the ears are brought to the homestead, they are stored until needed for domestic use or sale. Shelling is accomplished by rubbing two peeled ears against each other until all of the kernels have fallen off. One of the clean cobs is retained to shell other ears until the cob is worn out. Then a new cob is taken to continue the shelling.

A random sample of 10 ears of maize in the husk, collected from the barns of 12 milpa farmers, were shelled and analyzed for storage losses. The average moisture content was 15 percent; 5 percent of the grain showed fungus damage; and 9 percent had been penetrated by weevils after storage under traditional methods for 9 months.32 Although the sample size is too small to generate conclusive evidence, it appears that

29 This estimate of average yield compares favorably with Carter's figure of 754.9 lbs. of shelled maize per acre for Guatemala milpa agriculture. William E. Carter, New Lands and Old Traditions: Kekchi Cultivators in the Guatemalan Lowlands (Gainesville: University of Florida, 1969), p. 137.


31 One cargo equals 300 large ears of maize. Farmers estimate that 1 cargo of shelled maize equals 45-60 quarts of maize. Actual measurement based on a random sample of cargo-size ears found 1 cargo to equal 47 quarts of shelled maize weighing 80 lbs. at 15 percent moisture. These conversion ratios will vary between samples, however, depending on ear size and moisture content of the maize.

32 A random sample of 100 grains was selected from each shelled ear. An examination of these grains for weevil and fungal damage provided the information presented here.
storage losses are modest when the crop is stored under the *milpero*’s traditional system.

**Marketing, Capital, and Income**

Maize is grown primarily as a food crop for household use but also as a source of cash. Despite the fact that one-third of the farmers did not expect the remaining stock from their 1972 harvest to last until the 1973 crop was harvested, several farmers reported marketing substantial quantities of maize during the 1972-73 year. Three farmers sold an average of 6.6 cargoes of green maize. Sixty percent of the respondents marketed an average of 16.6 bags of dry shelled maize (100 lbs. per bag). Of the 12 farmers marketing maize, 5 sold it at the Cayo retail market, 3 sold to neighbors, 3 sold to wholesale buyers (maize mill and tortilla factory) in Cayo, and 1 sold to a large cattle operator.

Prices received varied substantially, depending on the month in which the produce was marketed. Table 1 shows prices paid by three Cayo wholesalers during 1972-73.\(^3\)\(^3\) Intramonth price fluctuations were due to supply and demand factors and discounts imposed on weevilly or wet maize.\(^3\)\(^4\) These middlemen also suggested that interfirm price differences were partly due to the low volume of purchases. Hence, a wholesaler might have been willing to pay only $6 per 50 quarts because his stock was adequate and he had no available storage space. On the other hand, another firm with a shortage of maize might have been willing to pay $8 per 50 quarts on the same day.

### TABLE 1

**Maize Market Prices**  
(Per 50 Quarts)

<table>
<thead>
<tr>
<th>Date</th>
<th>Corn Mill 1</th>
<th>Corn Mill 2</th>
<th>Tortilla Factory*</th>
</tr>
</thead>
<tbody>
<tr>
<td>August, 1972</td>
<td>8.00</td>
<td>7.00</td>
<td></td>
</tr>
<tr>
<td>September</td>
<td>8.00</td>
<td>7.00</td>
<td></td>
</tr>
<tr>
<td>October</td>
<td>4.00-5.00</td>
<td>5.00-6.00</td>
<td>5.00</td>
</tr>
<tr>
<td>November</td>
<td>5.00</td>
<td>5.00-6.00</td>
<td>5.50</td>
</tr>
<tr>
<td>December</td>
<td>5.00</td>
<td>6.00</td>
<td>5.50</td>
</tr>
<tr>
<td>January, 1973</td>
<td>5.00</td>
<td>6.00</td>
<td>7.00</td>
</tr>
<tr>
<td>February</td>
<td>5.50</td>
<td>6.00</td>
<td>7.00</td>
</tr>
<tr>
<td>March</td>
<td>6.00</td>
<td>6.00</td>
<td>7.00</td>
</tr>
<tr>
<td>April</td>
<td>6.00</td>
<td>7.00</td>
<td>7.00</td>
</tr>
<tr>
<td>May</td>
<td>6.00-7.00</td>
<td>8.00</td>
<td>8.50</td>
</tr>
<tr>
<td>June</td>
<td>7.50-8.00</td>
<td>8.00</td>
<td>8.50</td>
</tr>
<tr>
<td>July</td>
<td>9.00</td>
<td>9.00</td>
<td>8.50</td>
</tr>
<tr>
<td>August</td>
<td>9.25</td>
<td>11.00</td>
<td>8.50</td>
</tr>
</tbody>
</table>

**Source:** Data collected by researchers.

*Purchased mainly from government.

bNo available data.

\(^3\)\(^3\) Since none of the purchasers keep written records, these data are based on the buyers’ memory.

\(^3\)\(^4\) Wholesale purchasers in the market center of the study area were reported to have bought wet maize as cheaply as $2.50 per 50 quarts from farmers badly in need of cash.
The price reported by the sample farmers marketing maize ranged from $4 to $8.25 per 50 quarts. Six of the milperos sold dry maize during October, November, or December and thus received the year’s lowest price. The other half benefited from the seasonal price rise by selling in May or later. One farmer strategically sold a portion of his supply each month from October through August.

None of the sample farmers sold to the Marketing Board because its purchase price was substantially below the local market price.\(^{35}\) Still, the Marketing Board agent had purchased grain from local farmers, especially residents of Bullet Tree Falls and other nearby villages. Most of the government’s purchases were made during December and January when the maize had dried to a minimum of 20 percent and the local market price was depressed.

Opinion varied among the milperos as to whether maize growing has increased or decreased. Sixty-three percent of the milperos believed that farmers were growing more maize today than in earlier years. This increase in output was attributed by them to both the higher price and improved market demand of recent years. One respondent suggested that poor weather and low yields had forced milperos to plant larger areas. Twenty-six percent suggested acreages were no different than earlier years, with one farmer observing that high prices encouraged large planting which would again depress the price. In contrast, eleven percent felt acreages were smaller, partly due to the low yields.

Capital. Tools used by the milpero include the machete, axe, scabbard for carrying the machete, files for sharpening the axe and machete, and tote bags for transporting the harvested crop. The only farm building utilized was the maize storage barn. The cost and expected use life of these items are shown in Table 2. Using the average farm size of the sample as typical (7.74 acres), the average cash equipment cost per acre amounts to $2.35.

**TABLE 2**

*Milpa Capital Inventory*  
(Per Farm)

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost (per item)</th>
<th>Use Life</th>
<th>Cost/Year (per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machete</td>
<td>$3.00–3.75</td>
<td>2 per season</td>
<td>$7.00</td>
</tr>
<tr>
<td>Axe</td>
<td>5.00–5.50</td>
<td>5 years to life</td>
<td>1.00</td>
</tr>
<tr>
<td>Scabbard</td>
<td>2.50–3.00</td>
<td>1 year</td>
<td>2.75</td>
</tr>
<tr>
<td>Files</td>
<td>1.00–1.50</td>
<td>2–6 per year (depending on farm size)</td>
<td>5.00</td>
</tr>
<tr>
<td>Tote bag</td>
<td>.20–1.00</td>
<td>2–6 per year</td>
<td>2.40</td>
</tr>
<tr>
<td>Barn*</td>
<td>8.00–12.00</td>
<td>1 year</td>
<td>10.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$28.15</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Data collected by researchers.  
*Value of labor input. Permanent buildings require a new roof each year.

\(^{35}\) As of August 1973, the Marketing Board paid $3.70/cwt. for 13 percent moisture maize. A discount of $.05 per ½ percent moisture above 13 percent was applied to the base price. The Marketing Board agent interviewed stated that the average moisture content of purchased maize was 16.5 percent.
Labor Utilization. From data supplied by the farmers from memory, we estimated the total use of labor to range from 32-43 man days per acre. The distribution between tasks is shown in table 3. According to the respondents, a shortage of labor for weeding and planting sets the upper limit on farm size. Still, while hired labor was employed for planting (10 milpas), slashing and felling (7 milpas), and harvesting (2 milpas), none of the respondents hired labor for weeding.

Wages are always paid in cash, never in kind. For slashing and felling, the rate is based on the age of the bush: from $12 per manzana for low

| TABLE 3 | ESTIMATED LABOR INPUTS FOR Milpa Maize  |
|-----------------|----------------------------------|-----------------|
| **LABOR INPUT** | **MAN HOURS/ MANZANA** | **MAN HOURS/ ACRE** | **MAN DAYS (7 HOURS)/ FARM (7.74 ACRES)** |
| Site selection and marking | 1 | .5 | 1 |
| Brushing and felling* | 51-93 | 25-45 | 28-50 |
| Firebreakb | 10 | 5 | 6 |
| Firing | 1 | .5 | 1 |
| Planting maize* | 15-37 | 7-18 | 8-20 |
| Intercroppingd | 103 | 50 | 55 |
| Watching* | 12 | 6 | 7 |
| Weedingf | 30-45 | 14-22 | 16-24 |
| Breaking | 16 | 8 | 9 |
| Granary building | 12 | 6 | 7 |
| Harvesting and packingg | 70-115 | 33-55 | 37-61 |
| Carryingh | 35 | 17 | 19 |
| Shellingi | 59-76 | 29-36 | 32-41 |
| Total | 415-556 | 201-269 | 226-303 |

**SOURCE:** Data collected by researchers.

*Age of bush determines labor input per mecate for this operation as follows: 0 to 5 years, 3.2 man hours per mecate; 6 to 10 years, 4.4; 11 or more years, 5.8; average, 4.4. These estimates compare favorably with the estimate of Alfonso Tzul (Cayo District Agricultural Officer) that a man can brush and fell 1.5 to 2 mecales per 5-hour day.

*bEstimate based on data collected from the 6 milperos who actually made a firebreak.

*While the respondents reported spending an average of 37 man days per manzana on this task, Tzul suggested 15 man days in wet soil and 20 man days in dry soil to be more typical.

*Since it was impossible to collect data on intercropping through an interview, this estimate is taken from Carter, New Lands and Old Traditions, p. 135.

*This estimate is based on the response of 6 milperos who could remember time spent on this activity, although 21 of the 22 respondents said they did spend some time watching for wild animals.

*Due to drought, approximately half of the respondents did not weed their farm. The 12 milperos who weeded recalled spending an average of 23 hours per manzana. In normal years, Tzul suggested weeding would take 30 to 45 hours per manzana, so this estimate is used.

*Since harvesting had not yet been started, Tzul's estimate of 3-5 cargoes/day is used here.

*This estimate assumes a yield of 23.7 cargoes per manzana with the farmer carrying an average of 2 cargoes per trip by horse, each trip totalling 3 hours.

*Based on a shelling rate of 2.5 to 3 hours per cargo.

**Milpa** maize production is primarily carried out by men; women participate only in shelling the harvested crop.

**These wage rates were in effect during the 1973 farming season. Recent information suggests that wages increased as much as 40 percent from 1973 to 1974.
bush to as much as $35 per manzana for old bush. Less common is the practice of paying a daily wage rate ranging from $2.00 to $2.50 per half day (7:00 a.m. to 12:00 noon). Planters are paid from $0.50 to $0.75 per quart or $2.00 to $3.00 per half day.\(^{38}\) Although none of the respondents hired labor for weeding, $2.00 to $3.00 per half day was the suggested wage rate. Harvesters are paid from $.50 to $.80 per cargo, or from $2.00 to $3.00 per half day of work.

In general, the milperos did not feel acreages could be increased easily. When asked why they did not plant large areas, 55 percent of the respondents said they could not cultivate more land without cash to hire additional labor. Nineteen percent of the respondents indicated that they were occupied with other work; but bad weather, risk, sickness, and poor land were also identified as reasons.

Income Analysis. The data presented—describing the input-output relationships in milpa agriculture—provide a basis for generating the measures of returns and income shown in table 4. The table shows income measures for the average size milpa under average, good, and very good yields assuming the maize was sold at harvest (November), midseason (March), and preharvest (August) prices. This matrix uses the average estimated yield of 874 lbs per acre; a yield of 25 percent above average as a good yield (1,100 lbs. per acre); and a yield of 50 percent above the average as the very good yield (1,300 lbs. per acre). The resulting range covers most of the observed yields.

Gross income minus cash expenses under the assumed product prices and yield expectations generate the net income per acre. Cash expenses totaling $4.50 per acre (excluding labor) are estimated so as to include: tools and equipment, $2.35; land, under occupancy lease, $.50; and opportunity cost of seed maize, $1.65. To take advantage of the specified postharvest price increases, the farmers must store the maize 4 and 9 months respectively. Storage cost is primarily the value of the maize destroyed by weevils, rodents, and fungus. As mentioned previously, survey data suggest that under traditional storage methods, weevil losses after 10 months are approximately 9 percent of volume and fungal losses are 5 percent of volume. In this calculation, losses of 5 percent after 4 months and 10 percent after 9 months of storage are assumed for March and August sales, respectively.

Using labor as the residual claimant, with the assumed yields and product prices, the daily returns to labor (7-hour day) are calculated for two levels of labor input. Labor input ranges from 29 to 39 man days per acre when yields are approximately 874 lbs. per acre. Since the value of the intercropped produce is not known, the intercropping labor input is subtracted, resulting in a labor estimate (exclusive of intercropping) of 22 to 32 man days per acre. Yields of 1,100 and 1,300 lbs. per acre require increased labor for harvesting, carrying, and shelling of 25 percent and 50 percent respectively. At 1,100 pounds per acre the labor input is estimated to be 25 to 36 man days per acre and at 1,300 lbs. per acre, the labor input

\(^{38}\) Only in Bullet Tree Falls, the least remote of the three villages, did farmers prefer to pay a daily wage. There they believed that if paid by the quart, the planting would be done carelessly.
## TABLE 4
ESTIMATED INCOMES FROM MILPA-RAISED MAIZE IN BELIZE, 1973

<table>
<thead>
<tr>
<th>YIELD (lbs./acre)</th>
<th>GROSS RETURNS ($/acre)</th>
<th>NET INCOME ($/acre)</th>
<th>Daily Returns to Labor</th>
<th>NET HOUSEHOLD INCOME ($/year)</th>
<th>POTENTIAL HOUSEHOLD CASH INCOME ($/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low Labor ($/day)</td>
<td>High Labor ($/day)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>874</td>
<td>43.70</td>
<td>40.40</td>
<td>1.84</td>
<td>293.12</td>
<td>162.00</td>
</tr>
<tr>
<td>1,100</td>
<td>55.00</td>
<td>52.00</td>
<td>2.09</td>
<td>372.61</td>
<td>200.52</td>
</tr>
<tr>
<td>1,300</td>
<td>65.00</td>
<td>62.00</td>
<td>2.23</td>
<td>563.11</td>
<td>292.30</td>
</tr>
<tr>
<td></td>
<td><strong>November sales @ $0.05 per lb.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>874</td>
<td>56.81</td>
<td>50.97</td>
<td>2.31</td>
<td>372.61</td>
<td>200.52</td>
</tr>
<tr>
<td>1,100</td>
<td>71.50</td>
<td>64.93</td>
<td>2.61</td>
<td>480.66</td>
<td>308.55</td>
</tr>
<tr>
<td>1,300</td>
<td>84.50</td>
<td>77.28</td>
<td>2.78</td>
<td>576.25</td>
<td>404.17</td>
</tr>
<tr>
<td></td>
<td><strong>March sales @ $0.065 per lb.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>874</td>
<td>87.40</td>
<td>75.66</td>
<td>3.42</td>
<td>563.11</td>
<td>292.30</td>
</tr>
<tr>
<td>1,100</td>
<td>100.00</td>
<td>96.00</td>
<td>3.86</td>
<td>721.14</td>
<td>449.70</td>
</tr>
<tr>
<td>1,300</td>
<td>130.00</td>
<td>114.00</td>
<td>4.10</td>
<td>860.42</td>
<td>589.10</td>
</tr>
<tr>
<td></td>
<td><strong>August sales @ $1.0 per lb.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Computed from data collected by researchers.
is estimated to be 28 to 40 man days per acre. In the table, the extreme points in each are represented as high and low labor estimates.

The average farm size of the surveyed farms was 7.74 acres. With this area net household income from maize is calculated as the product of net income per acre and area.

Since maize is the staple food of the milperos, a large portion of their total product is consumed at home. The mean family size of the milperos interviewed was 7.3 persons and on the average each person consumed 1.2 lbs. of maize per day. Hence, average total family consumption is 3,197 lbs. of maize per year. Assuming storage losses to be 10 percent of household consumption, it would be necessary for the household to hold back 320 additional lbs. of maize in order to meet estimated household consumption requirements. Hence, for the average milpero, the household surplus of maize would be as follows:

<table>
<thead>
<tr>
<th>Lbs. of maize</th>
<th>874 lbs.</th>
<th>1,100 lbs.</th>
<th>1,300 lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>average yield</td>
<td>3,247</td>
<td>4,997</td>
<td>6,545</td>
</tr>
<tr>
<td>good yield</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>very good yield</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In actuality, some of this surplus is fed to livestock. If this surplus were sold at its opportunity cost, it would generate the potential household cash income, shown in the last column of table 4 for each of the selected selling dates.

Conclusion

The farm population of Belize is extremely diverse with respect to such factors as education, capital, location, access to land, mechanical ability, and managerial experience. Hence, it would be inappropriate to advocate a single agricultural development strategy.

The subsistence milpa sector makes a substantial contribution to the economy. It provides employment and a source of income for a large proportion of the rural population who have a very low opportunity cost of labor. At the same time, the production of milpa maize consumes extremely small quantities of capital—a factor of production in short supply in Belize. The farmers have rational bases for the production practices they follow, balancing risk, ecology, and family food needs in their annual struggle with nature. Consequently, it would appear appropriate to increase the productivity of this sector. To do so, research should focus on economically breaking the weeding and planting labor bottlenecks. The introduction of hand planters and the diffusion of granular herbicides might accomplish this. Varieties which are resistant to insect damage and consistently produce high yields under milpa conditions could be selected.39 Fertilizer trials could be conducted on a large sample of milpa farm sites

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39 Many milperos observed that Poey T-66 yields best during dry years when traditional varieties grow poorly. Also, several Mennonites stated that because Poey T-66 does not yield well under milpa conditions, they plant local varieties on their milpas. On the other hand, two field demonstrations conducted in the Toledo district by Kim Kennedy, a Peace Corps volunteer, showed that chemical fertilizer, herbicides, and insecticides applied to milpa maize produced a harvest of 3,000 lbs. per acre, and a net return of $125 per acre exclusive of labor costs.
to develop statistically valid fertilizer recommendations. Experiments could be undertaken to determine the feasibility of using legumes such as velvet beans as a green manure, thereby making possible permanent cultivation of a piece of land. Furthermore, the implementation of land reform policies which would lead to the expansion of maize production on the fertile river terraces—presently used as grazing land—would provide the milpero with a more innately productive milieu in which to implement these practices. Finally, a low-cost, low-volume maize storage system is needed. As solutions to these problem areas are found, it will be possible for the milpero to reduce his labor input per acre, increase farm size, attain higher yields, earn substantially greater family income, and produce a larger marketable surplus. If answers could be found for the problems raised, it is probable that these new technologies would lead to a transformation of subsistence agriculture into a market-oriented, smallholder commercial sector.

While mechanized maize production has a contribution to make to Belizean agricultural development, we believe that the industrialization of agriculture should proceed slowly. First, the possibility of Belizean producers successfully competing on the world export market is slight. Not only are maize yields in the United States double those on Belizean mechanized farms, but all major inputs in the production process, except land and labor, must be imported from industrialized countries. In addition, weather and soil conditions in Belize are substantially inferior for maize production to those prevailing in the U.S. Cornbelt. Consequently, the current policies to promote mechanization of maize production should be reevaluated. In order to compare the relative contribution of marginal improvements to the milpa system with mechanization, it will be necessary to undertake not only cost of production studies, but also to evaluate the importance of the externalities normally associated with mechanization, such as unemployment, foreign exchange costs of requisite purchased inputs, and supply-induced changes in the domestic price of maize which will affect rural welfare.

The marginal improvements to milpa agriculture that were cited are particularly attractive because they represent practice and inputs which are within the financial and technical grasp of small farmers throughout Belize. On the other hand, a policy of mechanization would tend to benefit and solidify the position of the already influential land-based elites. Only in the very long run would it be possible for today’s rural peasants to gain from such a policy.

40 In the Polochic Valley of Guatemala, velvet beans are planted on the milpa. Not only do the beans choke out weeds, grasses, and small trees, but after being slashed, they also provide a rich mat of humus. Milpas planted to velvet beans never revert to grassland; some fields have been planted consecutively for 14 years of dry season farming and show little indication of reduced fertility. Carter, New Lands and Old Traditions, p. 118.