PROBLEMS

IN

MILPA AGRICULTURE

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The following remarks are based chiefly upon my experience in El General, Costa Rica, where I have lived for most of the past fifteen years. For eight of these years I have farmed on a small scale. El General is the name given to the expanded basin at the head of the valley of the Río Térraba, the major river in the Pacific drainage of southern Costa Rica. The lower parts of the basin lie at about 1500 feet above sea-level. Cultivation extends far up the surrounding mountain slopes, but most of the farm lands are situated between 2000 and 4000 feet.

The rainfall is heavy, available records showing a range from 2333 to 4243 millimeters (92 to 167 inches) per year. There is a single dry season at the beginning of the year, in January, February and March. February, the driest month, is in some years practically without precipitation. The native vegetation is rain forest, comparing favorably in density and luxuriance with that along much of the Caribbean coast of Central America.

The soils in El General are of two sharply contrasting types. Most fertile are the *playas,* or vegas, and terraces along the impetuous, rocky rivers. Here the rich soil is dark, often almost black, light and friable in texture, but nearly everywhere burdened with rocks, ranging in size from coarse gravel to huge boulders. On much of my farm it is difficult to dig a hole big enough to plant a fruit tree. Moreover, the continuity of these *playas* is broken by frequent banks of cliffs and numerous minor watercourses. Only here and there are small areas of this dark, rich soil, seldom exceeding a few acres in extent, sufficiently free from rocks to permit ploughing. Back from the principal rivers, the land is mostly hilly, with steep slopes. Beneath the thin humus layer that soon vanishes when the forest is destroyed, the soil is a stiff, red residual clay, deep and almost free of rocks, but of limited fertility. On the lower reaches of long mountain slopes, the red soil is more fertile than on low, isolated ridges. Apparently wash and leaching from above account for the greater fertility of the longer slopes.

Few of the farmers possess ploughs, and probably not five percent of the land devoted to crops is cultivated in the conventional manner. For special crops, such as peanuts and vegetables, small areas are dug with the spade; but the chief crops are planted in ground which is never stirred in any way. There are three principal methods of preparing the land: burning, chopping without burning, and scraping.

Maize, the principal crop of the region, is regularly planted in burnt-over land. Primary forest—fast disappearing—is generally felled in December and January, as it requires several months to dry. *Breñon,* or second-growth, is cut usually in February and is ready for burning in a week or two, according to the size of the bushes and trees and the dryness of the weather. After the first rains of March or early April, the maize is planted in the blackened ground, between the litter of charred trunks and thicker boughs which the fire has not completely consumed. With a *macana* or iron-tipped pole, the sower opens a shallow hole, drops in about six grains taken from a gourd or tin tied to his waist, then moves two steps forward and repeats the process. If the cornfield occupies land which had been covered by forest or tall *breñon* of several years growth, a good crop may often be obtained without any cleaning or cultivation. In ground which after bearing several crops has been invaded by aggressive weeds, the field must be cleaned once or even twice by chopping down these weeds above the surface of the ground. A heavier infestation may necessitate scraping off the weeds at the level of the soil with a *machete de raspar;* but cultivation rarely involves the stirring of the ground.

For rice, an important crop in the lower parts of the valley (chiefly below 2500 feet) the burnt-over field must be cleared of the unconsumed trunks and branches—a laborious process. The planter then punches shallow holes with a pointed stick, at about one-foot intervals, while an assistant, often a boy, follows and drops a pinch of rice seed into each. Rice generally receives a cleaning or two with the *machete de raspar.*

Burning, of course, is feasible only during the drier months at the beginning of the year. At other seasons sowing must be done without the aid of fire. Beans are often planted in small quantities between the maize, but ripen during rainy months when harvest is difficult. The principal crop of beans is sowed in late October or November and matures in January, when the pods can dry and be threshed out in the field. For this crop a light *breñon* is preferable. The bean seed is broadcast through the low, dense vegetation, which is then cut down with machetes and chopped up (picado) so that it lies close to the ground. The bean vines sprout up through the mulch of stems and leaves, finally covering them over. No cultivation or cleaning of the crop is necessary or even feasible. A *postrera* or after-crop of maize is sometimes sowed in the same fashion, usually in September, preferably in a fairly old and heavy *breñon.*

A third method of preparing the land is by scraping off the vegetation at the surface of the ground with

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a *machete de raspar*. Land so treated is called *raspado*. Since rice will not flourish in the *picado*, if planted in the wet season, the ground is prepared by scraping. Compared with the two foregoing methods of preparing the land, this is slow, expensive work, rarely used for large areas.

In a tropical region of heavy rainfall, most of the mineral nutrients available in the upper layers of the soil seem to be promptly seized by the luxuriant vegetation. The fertility of the soil is locked up in the tissues of the plants which it supports; it becomes available for fresh growth as these plants or their parts die and decay. Soluble nutrients not incorporated into vegetable tissues would seem to be rapidly leached out by the heavy rains.

It has been said of rain forest in tropical Africa that "it lives on its fallen leaves"; doubtless this is true in the Americas, especially on the poorer residual soils. When the vegetation is burned, those nutrient elements not driven off by the heat remain in the ash, are in part leached into the ground by the rain, and fertilize it for the maize or other crop. Very good yields are obtained by this method. When the *picado* is used, the decaying mulch more slowly releases its nutrient elements for the benefit of the crop plants. Maize planted in *picado* yields much less heavily than in burnt land; better spacing and freedom from root-competition doubtless account in part for the superior yield on burnt fields, but fertilization by the ash is important. When the spontaneous vegetation is scraped off and cast aside, as in the *raspado* method of working, much of the fertility of the land is removed and poorer yields result.

Although these methods of working are certainly not beyond reproach, where slopes are steep and rainfall well in excess of a hundred inches per year, ploughing and deep cultivation would expose the soil to erosion and severe leaching, probably with disastrous results.

In humid tropical climates, harvest and storage of grains present great difficulties. In El General, maize is always stored in the husks; its freedom from infestation by weevils depends upon how well the husks enclose the ear. If these are firm and tight, forming a long, slender beak projecting beyond the tip of the cob, insects find difficulty in entering and the grain will keep for many months; if they are loose and permit the access of weevils, the maize will soon be reduced to powder.

I have noticed no differences in the keeping qualities of various sorts of maize; preservation under local conditions depends upon the adequacy of the enveloping husks. Hence in any corn-breeding project the character of the husks must be considered no less than the grain itself. The great ears of hybrid maize which "outgrow their clothes" would be of little use to farmers who lack adequate means of storing them. Even when kept in the husk, the loss of maize may amount to 20 percent or more during the first four or five months. Often it is difficult to market the crop earlier than that, because the isolated farmer must wait for roads to dry and rivers to become fordable. Yet rarely can he afford an elaborate or expensive drying plant, or a granary better than a shed with thatched roof and walls of split trunks or sticks. Possibly an inexpensive method of treating the husks with some insecticide might be developed.

Beans keep well if stored in the dust and debris with which they are mixed after being beaten from the pods. When clean they soon succumb to weevils. Rice, after drying in the sun, can be preserved in the husks, in sacks or wooden boxes. After threshing it is exceedingly vulnerable to weevils.

Throughout tropical America, millions of people must wrest a living from farms no more promising than those of which I have been writing. Often their lands, long overworked, are less cooperative and productive. Is *scientific agriculture* possible for these farmers on the marginal lands? Too often we believe that to be scientific we must have elaborate equipment and all the latest gadgets. But the scientific man in he who through observation and experiment learns to achieve his ends through the most effective use of whatever means he may happen to have. There is a scientific way of moving a stone with a stick; there is a scientific, no less than an unscientific, way of farming if we possess only a few rocky acres and a machete.

Practically all of the agricultural experiment stations in tropical America are situated on the richer lands. Their findings are chiefly of use to the more prosperous agriculturists who own such lands and have the capital and equipment to work them on a large scale. The methods developed by these stations may not be directly applicable by the poorer farmers who have been forced off to the rocky and broken lands and who most need guidance and encouragement. These farmers can be helped only by those who have some immediate experience of their particular problems, their limitations, their peculiar psychology. The agricultural journals which may fall into their hands, the extension service men who from time to time advise them, are in general wholly unacquainted with their problems, and hence are more likely to confuse or antagonize than to help them. If you tell a man who is farming a rocky hillside that he needs a plough and a tractor, an expensive granary to store his produce, he may laugh, he may become angry, he may feel frustrated; he is not likely to be grateful for the advice or to benefit from it.

We all lament the burning of organic matter, we are all aware of the loss of fertility it entails. Yet in many agricultural communities of the tropics, it is useless to tell the farmer that he must not employ fire, for without its aid in preparing his rocky or hilly field he will starve. It is more profitable to teach him to burn as lightly as is compatible with the production of a crop and to take precautions to prevent his fire from spreading out of bounds. He must be taught that only when given long periods of rest can soil subjected to

burning preserve some measure of fertility; he should be helped to plan the use of his land with a view to the future. He should be made fully aware of the necessity of preserving the forests and of their relation to the continued flow of the rivers. He needs help in the problems of storage, especially of maize; but he will not be able to afford expensive or elaborate installments. He needs improved varieties of crop plants, but varieties tested in relation to his own peculiar lands and methods of work, not in relation to more favorable conditions elsewhere. He needs help in developing a better diet, more easily digested, richer in vitamins and proteins. Above all he must be shown; he must see with his own eyes that the suggested improvements are feasible under his own difficult circumstances, not merely told how they work on somebody else's fatter lands at a distance.

Perhaps the greatest desideratum of agriculture in the humid tropics is the substitution of perennial for annual crop plants. In regions where vegetation flourishes throughout the year, the culture of short-lived anual herbs like maize, beans and rice is exceedingly wasteful of land and labor. Could perennial subsistence crops be substituted for these, a smaller area of cultivation would support a man; and the annual attack upon the spontaneous vegetation with axe, machete and fire would diminish in intensity. Perhaps eventually there will be developed trees and perennial shrubs whose fruits and nuts will provide an adequate diet, substituting the anuual grains whose cultivation so oppresses the land. But to bring about such a change will require much patient research, and much education.