Agriculture

Subsistence Economy

Seeding rice.

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Agriculture

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I. SUBSISTENCE AND COMMERCIAL AGRICULTURE

Agricultural activities in Limau Village are devoted principally to satisfying family subsistence requirements, but nowdays the commercial cultivation of coconut palms is practised on a limited basis. This chapter describes the general features of both commercial and subsistence agriculture through an analysis of the management of several typical family farms.

1. A Case Study of Family Farm Management

The Sm's family (HN 34) provides a good example of a typical, middle-class farm family in Limau. At the end of October 1976 this family had five tracts of land under cultivation (Table 1). Three tracts (1, 2 and 3) were used for cultivating subsistence crops, and two (4 and 5) were devoted to the commercial cultivation of coconuts.

The first field (1) is located on a gently sloping hillside to the north of the village. It was exploited eleven years ago, and although in the first year upland rice was apparently sown, banana suckers were planted there from the second year (Photo. 1). Seven kinds of banana are cultivated there now; *koi jawa*, *pisang golontalo*, *p. raja*, *p. putih*, *koi gohu*, *selewati* and *kosuta*. The land was first used for shifting cultivation, such as but because of favorable conditions it was quickly developed for the permanent cultivation of bananas.

Table 1. Fields of Sm's family

location	year of exploitation	cultivated crops
(1) Doku ma ake	exploited 11 years ago	Bananas (7 varieties) are cultivated.
(2) Jobubu	exploited in 1973	Manioc, sweet potatoes cultivated in 1974. On a part of the field upland rice were sown. Field barn was built. Manioc and sweet potato were planted in July, 1976.
(3) Akelamo	exploited in 1974	Upland rice was sown in January, 1975. Before sowing rice bananas and coconuts were planted (destroyed largely by wild animals.)
(4) Dena ma bane	Coconuts (47 mature plants, 50 young plants, and 35 new plants)	
(5) Tiabo	Coconuts (68 mature plants)	

The second field (2), located in Jobubu, to the northwest of the village, is situated at the foot of the hill, and consists of northern and southern portions. The cultivated area totals some 15.5 *are* and is bounded by a bamboo fence (*garao*) (Fig. 1), which is quite rare in Limau. The southern part of this land was exploited in 1973, and in January–February 1974 manioc and sweet potato were planted there. The harvest of these crops was completed by May–June 1976, and the field was replanted with manioc and sweet potato in July 1976. At the end of October 1976, the southern part (about 9.5 *are*) of this field was planted with manioc and sweet potato, but the crops were badly distributed and became heavily infested with *alang-alang* (*Imperata cylindrica*) (Photo. 2). Moreover, apart from some bananas, the northern part (about 6 *are*) was almost abandoned. In January–February 1974, however, just after the exploitation of the land, 7.5 kg of upland rice was sown. It was claimed that on this part of the field about 1.5 sacks of rice was harvested in July–August. When thrashed this amount is reduced by some 50 percent, so about 40–50 kg was harvested.

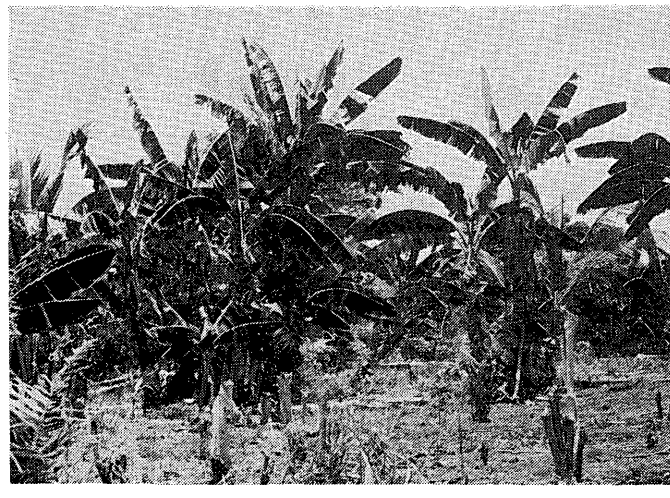


Photo. 1. Banana field.

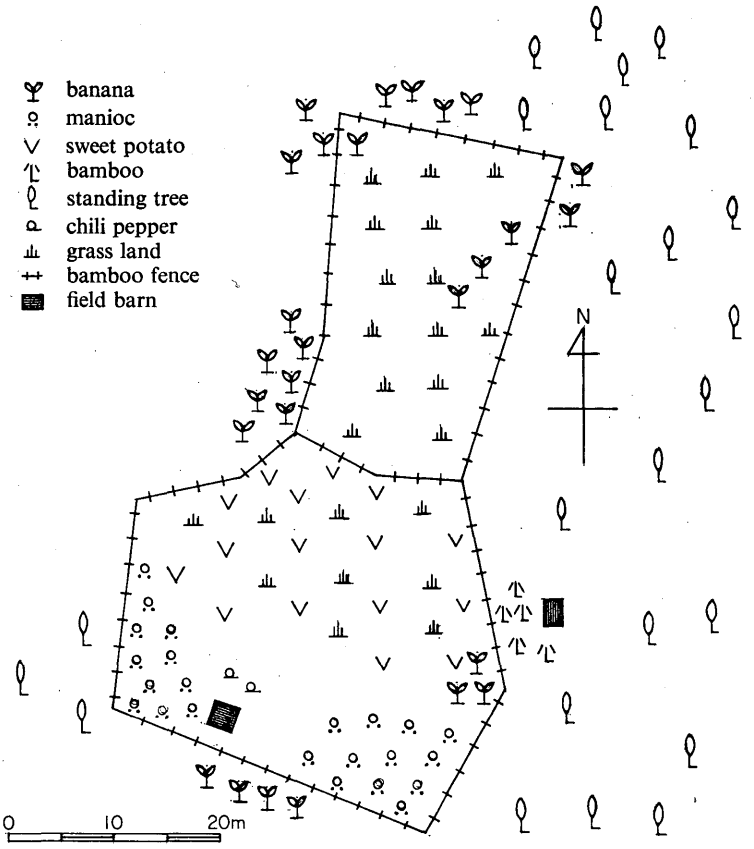


Fig. 1. Sm's swidden in Jobubu.

Photo. 2. Sm's swidden in Jobubu.

At the southern end of this field is a collapsed barn (*toro ma tahu*)[1] surrounded by a small patch of cultivated vegetables (chili pepper etc.). In the one or two years since the exploitation of the land began, the Sm's family had a barn surrounded by a small kitchen garden in this location. But they had a baby, and being short of labor for weeding and other chores reluctantly allowed the condition of the land to decline, and finally abandoned the barn and kitchen garden. At the time of field research they were supplied with vegetables by their neighbor (HN 35), Ym, the father of Sm's wife, who had a kitchen garden at Akelamo.

Sm's farm land (3) is located at Akelamo, about one and a half hour's walk southwest of the village. The land was used in 1974 and upland rice sown in January, 1975. A harvest of 22.5 kg was claimed for this land, from which it can be assumed that upland rice was cultivated on some 15–20 *are*s. Only 4 sacks of rice were harvested, owing to the depredations of deer and wild boar. In addition, the banana suckers and coconut seedlings set-out in this land prior to the sowing of rice were also heavily damaged by wild animals, such that only 20 banana plants and about 20 young cacao trees of the total planted among the growing rice now remain there.

These 3 tracts comprised the land farmed by the Sm family for subsistence purposes in October 1976. Subsistence production from the cultivated fields is supplemented by sago from the Sm's two sago palm tracts located in the nearby swamps. In addition, the family owned 2 tracts of land devoted to coconut plantations. Of these the land at Dena ma bane (4) was relatively recently opened-up, and is situated on a large sand deposit to the south of the village (Photo. 3). On the other hand, the land near the sand deposit at the mouth of the Tiabo River (5), further to the south, has long been exploited and is now occupied by coconut palms more than twenty years old.

Photo. 3. New coconut field on the sand deposit, south of the settlement.

1) For convenience, this structure is referred to here as a barn, despite its multiple functions for grain and tool storage, as a guard house and temporary living quarters.

Table 2. Fields of Ay's family

location	year of exploitation	cultivated crops
(1) Akelamo	exploited in 1964	Upland rice, bananas were cultivated in the first year, after which it was converted to a cacao plantation.
(2) Sokiki	exploited in 1974	Planting bananas.
(3) Akelamo	newly exploited in 1976	Scheduled planting of upland rice after December 1976.
(4) Dena ma bane	exploited in 1955	200 coconuts planted in 1976.

The Sm's can be regarded as a typical Limau subsistence farm family. The Ay's (HN 39), on the other hand, can be regarded as a typical example of the emerging commercially oriented farm family. The management of their farm at the end of October 1976 is illustrated in Table 2. The use of their two subsistence tracts is as follows: Field (2) was exploited in 1974 and then converted to banana cultivation; and field (3) was exploited in 1976, when upland rice was to be sown. Field (1) was exploited about 12 years ago, and is now under commercially cultivated cacao. However, a regular yield cannot be expected because of inadequate management. Also the coconut plantation (4) at Dena ma bane is much larger compared with those of other families.

2. The Conditions of Commercial Crop Production

According to our informant, Ay, only a few families own coconut plantation larger than his and earn money by selling copra. Those with more land, Ad, the village headman (HN 8), Ps (HN 19), Hy (HN 41), together with Ay himself, comprise a privileged class in the village. The owner of the largest field is a village headman, who obtains about 2 MT of copra per harvest. Next comes Ps, who gets about 1 MT per harvest. There are generally three harvests per year in this part of Halmahera. Copra is sold usually at either Soasio or Tobelo, where it fetched about Rp. 110/kg, at the time of this survey. One ton of copra yields some Rp. 110,000, a large amount of money for income-poor Limau.

Yet the owner of a coconut plantation has production expenses, particularly for the large input of labor required for harvesting and transport to market. Harvesters must climb the tree, remove the fruit, open the nuts, remove and dry the copra, and then finally bag and ship the dried copra to market. Plantation owners employ the poor of Limau or those from the neighboring village for these tasks. Wages appear to be fixed according to task. For example, Rp. 25/tree is paid for climbing and removing the fruit. The village headman employed two young men from other villages to harvest particular sections of his coconut plantations. The headman divided the income received equally between himself and the two laborers. Operating a copra-producing enterprise appears to be a labor-intensive operation, and labor costs appear to comprise a large percentage of the total production expense.

Other than by the people mentioned above, and particularly the village headman

and Ps, only small quantities of copra are produced in Limau. Moreover average Limau farm families such as Sm, have smaller tracts of coconut palm with few mature trees, thus they derive only a small income from copra production. No other commercial crops are cultivated in Limau, or at least were not systematically cultivated in Limau at the time of this survey. Yet even on a small-scale a coconut plantation provides some cash income and is an attractive proposition. This accounts for the increase in coconut planting across the old sand deposit to the south of the village, and is the reason why many villagers are slowly beginning to add coconuts to the crop assemblage cultivated in the swidden.

3. Modelling the Crop Combination

As shown above, commercial agriculture in Limau has, with few exceptions, developed rather slowly, and agriculture in this village continues to center on the production of such subsistence foods as bananas, upland rice, manioc and sweet potato, mainly by slash-and-burn cultivation on mountain and hill slopes. Use of the swidden begins with forest clearance and burning, and each crop is cultivated on the newly opened lands. But soil erosion together with weed and brush infestation creates poor land conditions. Lands are therefore fallowed after a period of cultivation. Slash-and-burn cultivation leads to rapid physical and biological change in the land during the 3–4 years between field clearance and fallowing. Each household must therefore solve the problem of the optimal combination of subsistence crops grown on several fields, when the duration of field use varies.

	condition in October 1976		condition in 1977
land type	old banana field (exploited 10–15 years ago) used perennially		
	swidden (exploited 3–4 years ago) partially abandoned manioc, sweet potato, banana		
	swidden (exploited 2 years ago) mixed cultivation of vegetative planting crops in surrounding kitchen garden with field barn banana, manioc, sweet potato		
	swidden lands scheduled to be cleared this year scheduled for upland rice and banana to be sowed and planted next January (and a few manioc, sweet potato)		
	lands for coconut (newly-planted) the harvest is scheduled in five-six years (its climax is 20 years later)		

Fig. 2. Types of swidden at Limau and the general model of rotation.

Although the Sm family has been depicted as a standard farm household, a general model is needed to account for other cases and to accommodate the various combinations of the cultivated land of each household. As shown in Table 1 and 2, a standard Limau farm family maintains in principle three fields devoted to subsistence crops. One is an old banana field, the best land of which is often used for 10–15 years in succession. The other two fields are typical swiddens devoted to the mixed cultivation of banana, manioc and sweet potato. A field barn is built in one of the two better swiddens, around which a kitchen garden is often made for the intensive cultivation vegetables or other minor crops.

Although in principle each Limau household makes it a rule to exploit a new swidden every year, this is not always done in practice, as is revealed by the cases of Sm and Ay. Some families do not make a new swidden every year. Thus when one of the two swiddens become 3–4 years old it is abandoned owing to the infestation of weeds and undergrowth. Sm's field (2), mentioned above, is a typical example of a half-abandoned field, and when once each year one swidden becomes infested the productive capacity diminishes conspicuously, leading to the need swidden. Thus as new swiddens are exploited the old fields are gradually abandoned. The model in Fig. 2 shows the transformation from new to old fields, as well as an outline of agricultural management.

II. SWIDDEN LAND USE AND SCALE OF OPERATION

1. Swiddens and their Utilization

The features of Limau agriculture have been examined above from the viewpoint of subsistence and commercial agriculture, and considering the kind of arable land that each family attempts to cultivate. It was shown that subsistence cultivation is preferred to other forms. There follows below an examination of the location of agricultural activities and the techniques used in Limau subsistence agriculture. This is done via a detailed analysis of the land use of two typical swiddens in this village. The first swidden belongs to Dj (HN 14), one of the average farmers of Limau, and the second is owned by Ps, one of the largest farmers in this village.

1) Land Use in Dj's Swidden

A fairly big swidden cultivated by Dj is located on the gentle slopes of the mountain that lies southwest of Limau Village, and which are reached after a 45 minute walk through a swamp containing sago and nipa palm. The swidden is surrounded by mature forest to the east and to the south and west by bamboo groves. The north abuts on formerly cultivated land that was apparently abandoned to fallow a few years ago. At first this swidden seems to be part of a series of cultivated fields, but, as it is indicated in Fig. 3, the field is divided into a northwestern part and a southeastern section by a bamboo fence at its center. The east side of the northwestern part lies adjacent to Ah's (HN 24) small tract of some 8.6 *are*.

The northwestern part (about 29 *are*) was exploited in 1974. In the center of

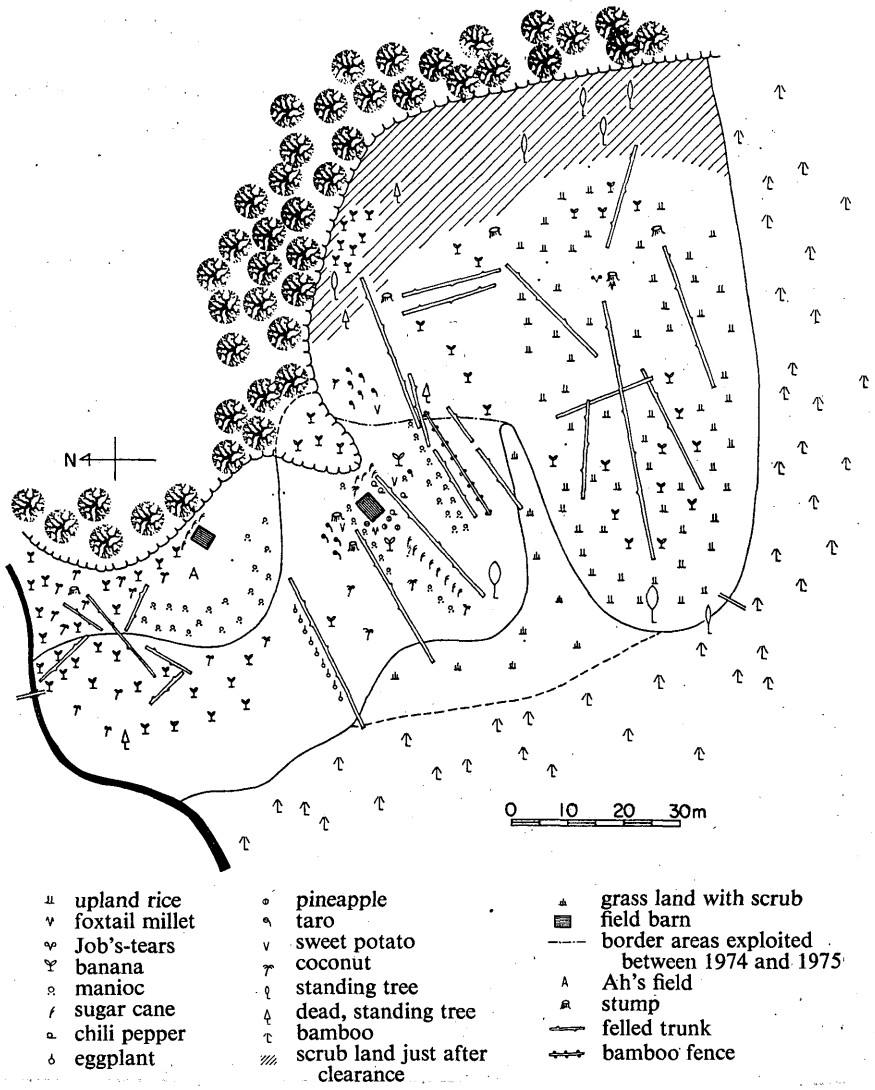


Fig. 3. Dj's swidden.

the field was a barn, at the time of research, around which there was a kitchen garden cultivating bananas, sugar cane, manioc, sweet potato, taro, pineapple, chili pepper, tomato and a small amount of foxtail millet. After exploitation in 1974, banana suckers and the coconut seedlings were widely planted (probably in January–February, 1975) to the northwest of the barn. Banana and coconuts were also planted in Ah's swidden, but most crops planted by Dj were heavily damaged by wild boar. In September 1976, the land was cultivated again after weeding, the felling of several previously uncleared trees, and burning. Some banana suckers, coconut seedlings and eggplants were planted quite haphazardly, and most of the land was being fallow-

Photo. 4. Young bananas interplanted among the rice.

ed. According to Dj, upland rice was to be sown among the bananas and coconuts in December 1976—January 1977 (Photo. 4).

To the southeast of the barn, in an area that was cleared in 1974, nothing was planted immediately after burning until manioc, sweet potato and coconuts were probably planted several months later. The productivity of the manioc and the sweet potato was low, having been severely damaged by wild boar. Mr. and Mrs. Dj planned to cultivate manioc and sweet potato in 1976, and so in September they began to construct a bamboo fence to prevent the entry of wild boar, but the shortage of labor made completion of the fence impossible, except for some 20 m (Photo. 5). Apart from about 30 *are*, exploited in 1974, excluding the kitchen garden, this land produced

Photo. 5. Bamboo fence in the swidden.

only a small harvest of manioc during the 18 months from the beginning of 1975 until mid-1976, and most other crops (banana and sweet potato) also were damaged by wild animals. Although we assume that the land northwest of the barn, which was burned for a second time, produced only a small harvest, even where the land was not reburned, no crops were found other than a small patch of manioc. On the other hand, 20–30 young sweet potato plants, planted only a day or so before our research began, occupied only a small area on the south side of the barn. The arable land around Limau therefore appears to be greatly underused, and intensive agriculture certainly was not practised on Dj's land.

The southeastern part of Dj's land was cleared and burned in September–October, 1975, one year earlier than the northwestern part. In principle the land was cleared only by Mr. and Mrs. Dj, who have not depended on cooperative labor for quite some time. Before clearance the land was occupied by huge trees of the kind that still grow on the mountain slopes to the east of the field. Even now stumps with big buttress remain in the field as do many unburned tree trunks. It is impossible for a man and wife alone to fell the huge trees, and they were assisted by other laborers, as in the case of Ps.

As noted above, after the clearance and burning of this land, which took place from September through the end of October, nothing other than a few banana suckers was planted until upland rice was sown in approximately June of the next year. Because almost a year passed between the time of burning and use of the field, a strip some 20 m wide adjacent to the forest on the east was densely infested by weeds and undergrowth, hence part of the field could not be cultivated, and only about 35 *are* was actually utilized. Some 29 *are*, about 75 percent of the total area of the field, was used to cultivate upland rice.

Sowing was done using the cooperative labor of four men and four women. The men used digging sticks to make holes in the soil, into which the woman dropped

Photo. 6. Foxtail millet and large buttress.

the rice seeds. In all, 1.5 oil cans, containing 22.5 kg of seed were used to sow this 29 *are* tract with rice. It took 10 people (the 4 men and 4 women plus Mr. Dj and his wife) half a day to sow the rice. Upland rice ripens in about 4 months, so the harvest was scheduled for October 1976, but owing to abnormally droughty conditions and the ensuing water shortage almost the entire crop was lost. Only taro, sweet potato and banana were harvested in the northern 25 percent of the field.

In addition, foxtail millet (about 10–20 plants) and some Job's-tears were cultivated separately near the huge tree stump in the center of the field (Photo. 6). They were sown at the same time as the rice. A small quantity of foxtail millet is also cultivated on the south side of the barn. Foxtail millet and Job's-tears are not important foodstuffs among the Galela, but are used only in rituals such as those involved in the wedding ceremony. Accordingly, small patches of those plants are commonly found in the swidden.

2) Ps's Swidden

Dj's field is situated in a flat, basin-like area between two ridges, but Ps's is located on the ridge that projects seaward from the main ridge of Limau Village. As shown in Fig. 4, his field consists of three parts; a western, gently sloping area of about

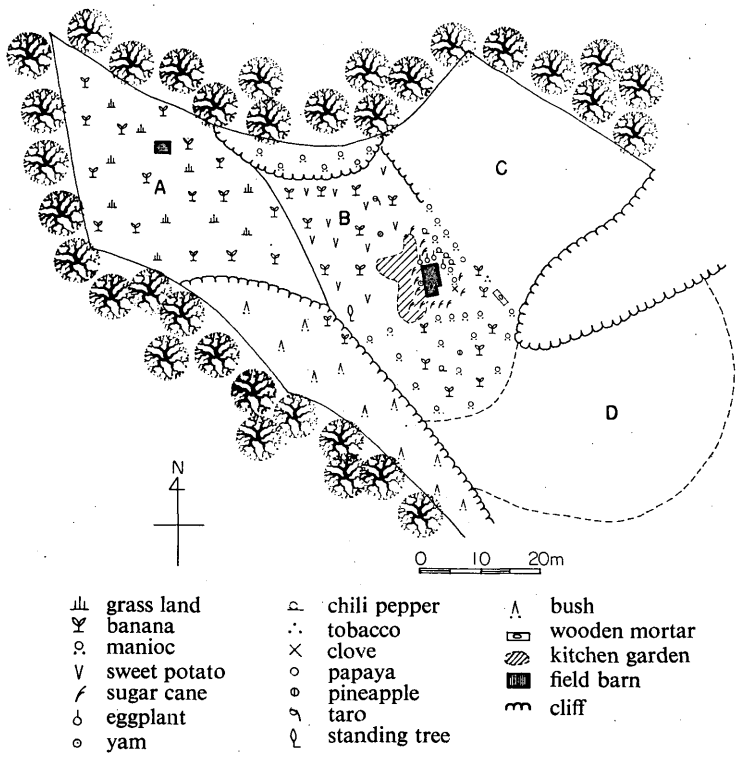


Fig. 4. Ps's swidden.

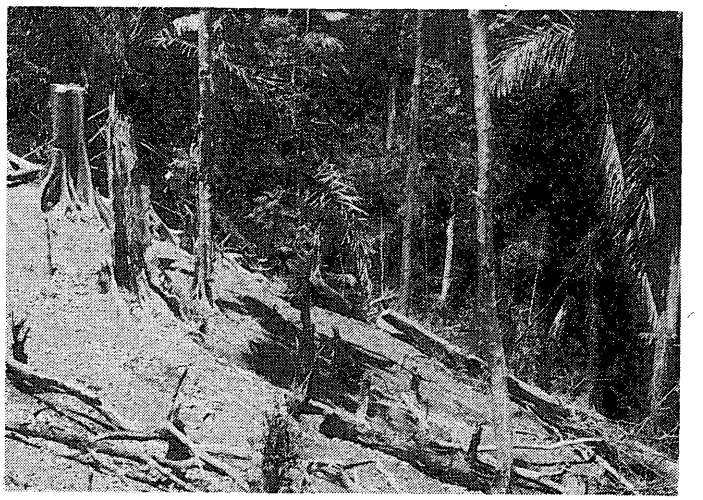


Photo. 7. Ps's swidden, Section C.

9.8 *are*, (A), a flat area of 10.8 *are* at the top of the ridge (B), and a steeply sloping eastern portion of 9.6 *are* (C). To the west and north the field is surrounded by mature tropical rain forest, and stumps of huge trees are particularly evident in areas A and C, which testifies to the nature of vegetation prior to field clearance (Photo. 7). All these sections of the field were cleared and burned in December 1975. Most of the labor was performed by the owner, Ps and his son, Is (HN 17), but the huge trees were felled using cooperative labor that involved villagers, including Yg (HN 20), Yb (HN 16), Ts (HN 15) and Dj (HN 14). In return, Is and Ps provided one day's field clearance labor to each of the eight villagers who had helped them. This exchange of labor among the Christians in Limau is known as *ma-koki-rio*.

After clearance and burning in December, 1975 section A remained unused until April–May 1976, when bananas were planted throughout the field. Then in June–July rice was interplanted among the bananas. However, the dry spell that persisted until the end of October 1976 destroyed all the rice, although the bananas grew well. In section B, after field clearance, manioc and sweet potato were planted in January–February 1976. Later, banana, various kinds of vegetables, taro, yam and sugar cane were interplanted gradually with the manioc and the sweet potato. The vegetables were intensively cultivated around the barn (see below, Fig. 7). The Ps' field shows a distinctively mixed cropping pattern in section B, and they used a higher plant density than did Dj. The Ps' land is the most intensively cultivated in Limau. Sweet potato was heavily cultivated in the northern part of section B, and manioc in the southern part. The sweet potato was planted in January and harvested in mid- to late September, and early to mid-October. Sweet potato was immediately replanted in the same location as the debris remaining from the first crop was removed. The manioc harvest begins at the end of October. As discussed below, the manioc field is replanted quickly if a piece of stem is planted immediately after harvesting. At

Photo. 8. Ps's swidden, Section D.

any given time manioc in each stage of growth is found in the southern part of this field. This is particularly evident during the harvesting season.

At the time of our field study section C was not in use. It had remained uncultivated since the first period of clearance, in December 1975, and was cleared and burned again in August, 1976. It is assumed that only the large trees were felled and burned at the end of 1975 and that a considerable quantity of undergrowth and lighter vegetation remained. Field clearance and burning was done again in August 1976 by Ps and his son.

Because of field preparation in 1975 and 1976, the land was ready for cultivation at any time in October 1976. However, it was not immediately utilized and banana was scheduled for planting in December 1976 and January 1977, followed later by upland rice. Yet their land was not cultivated until a year later. It illustrates a peculiar case where land preparation is not immediately followed by cultivation. This situation, which is sometimes observed at Limau, illustrates the generally extensive land use practices of the villagers.

As the above data shows, another new swidden, with an estimated area of less than 10 *are* (D) is being exploited temporarity on slope land (Photo. 8). Section B faces it on the south and it is located on the slope that extends from the back ridge connected with B to the eroded valley to the southwest of C. Clearance and burning of this tract was completed by October 1976, and banana and rice were scheduled to be planted concurrently with those on C. The Ps planned to be sown about 45 kg of rice and expected to harvest about 15 gallon of rice from sections C and D.

3) The Barn (Field Hut) and its Environs

Each household erects a barn (*toro ma tahu*) on their best quality swidden land.

Around the barn a kind of intensely cultivated kitchen garden planting minor such as sugar cane, manioc and vegetables is developed.

Figure 5 and 6 show the structure of Dj's barn and aspects of the land use sur-

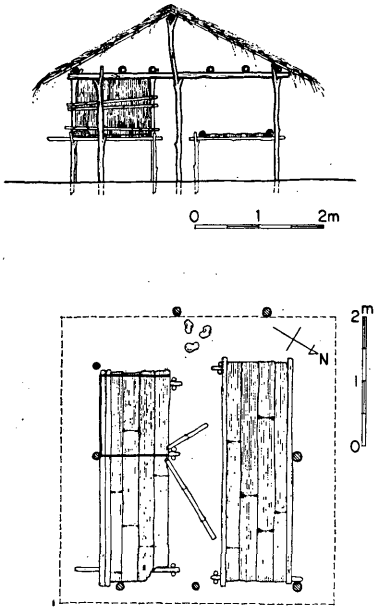


Fig. 5. The structure of field barn of Dj.

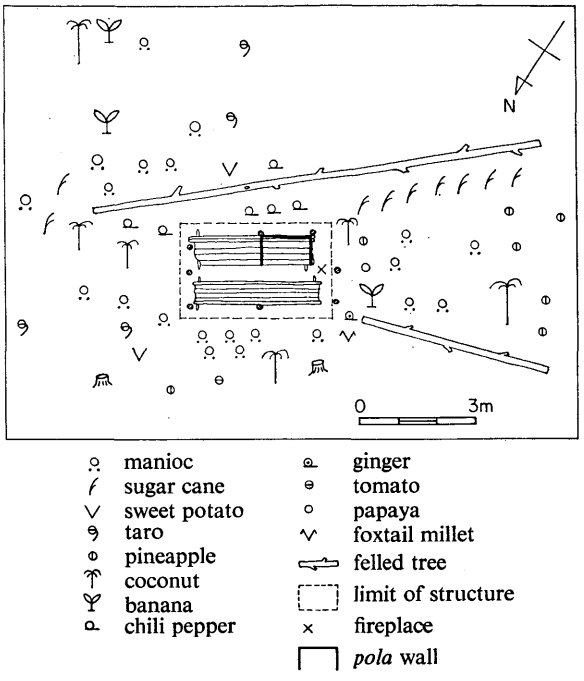


Fig. 6. Land use surrounding Dj's field barn.

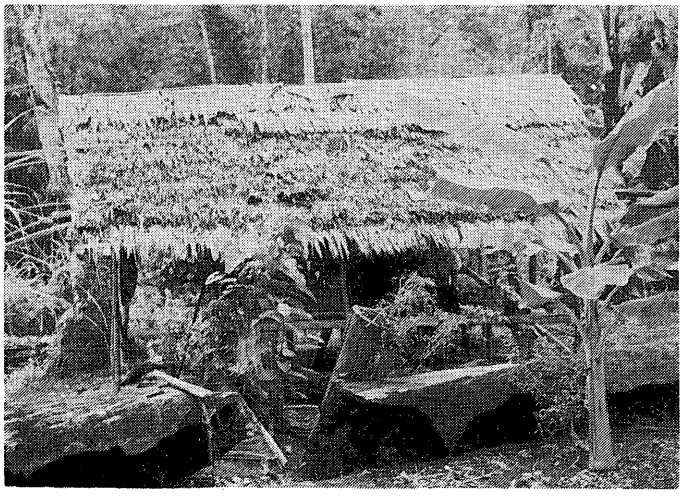


Photo. 9. Dj's field barn.

rounding it (Photo. 9). Figure 7 depicts that belonging to Ps. The barn is a tumbledown structure with a gabled roof, thatched with *katu*. It contains a platform on which is a granary (*pola*), surrounded by a *katu* wall. The barn also contains a bench for resting and sleeping (*dangi*), about 3 m long. Apart from the *pola*, the barn has no walls. Because at the time of our survey the rice crop had been destroyed by drought, the *pola* was used as a lumber room.

The *pola* and *dangi* in Dj's barn contained *tatapas*, *porochos* (a small, circular winnowing basket made from nipa palm leaves) and *lelu* (a small mortar used to pound banana), and various bamboo tools such as carrying baskets, water container, a spear, a saw and other items.

Ps's barn (Fig. 7, Photo. 10) contained various types of winnowing baskets (*tatapa*, *porocho*), small square baskets (*pigi*), carrying baskets (*puraka*), hoes (*pako*), axes (*basu*), bush knives (*taito*), all of which together with plates, cups and so on, were scattered in a disorderly fashion. Noteworthy is that several *moluka*, a large, hollow bamboo cylinder 2–2.5 m long (the same length as the bamboo water container [*kiloha*]) for storing unhulled rice, were placed on the *dangi* and *pola*. Beneath the eaves on the west of the barn palm wine is stored in a large crock (*rube*) (Photo. 11). Sugar cane, manioc, chili pepper, eggplant, tomato, pumpkin and other plants are cultivated immediately around the barn, and manioc, sweet potato, taro and some-

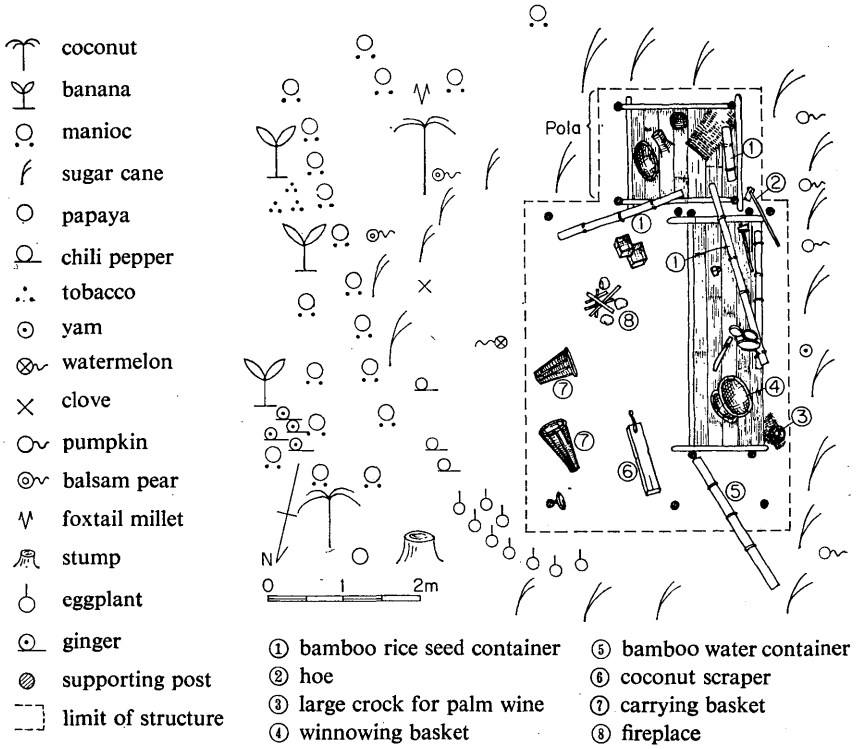


Fig. 7. Ps's barn and the cultivated plants surrounding it.

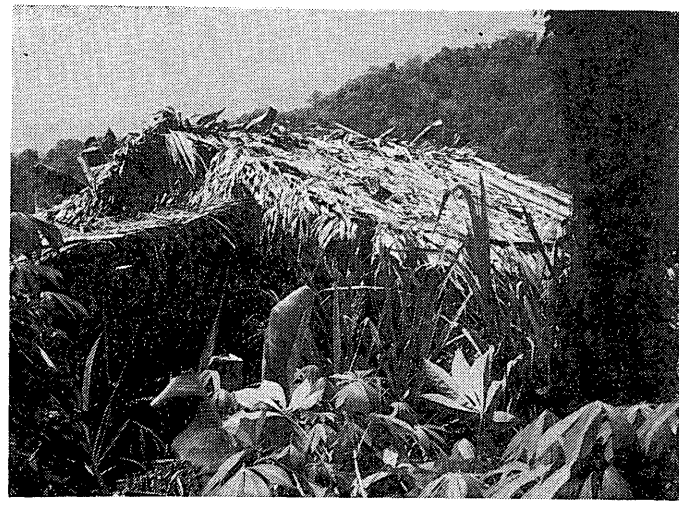


Photo. 10. Ps's field barn.

Photo. 11. Palm wine stored in a large crock.

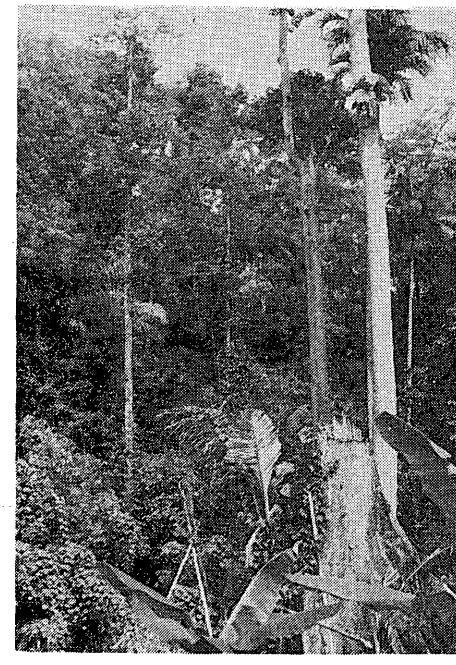


Photo. 12. A swidden surrounded by mature rain forest.

times yam are planted just beyond this inner planted area. Not infrequently, ginger, pineapple, papaya, several kinds of melon and foxtail millet are also scattered among these crops. A characteristic feature of the kitchen garden is the interplanting of many different crops.

4) Summary of Swidden Land Use

Detailed study of the swiddens of Dj and Ps revealed certain basic characteristics of shifting cultivation as practised in Limau. These main characteristics are:

(a) More than 50 percent of Limau swiddens are made in tracts of mature forest (Photo. 12), which, when properly managed, maintains good soil conditions and prevents excessive lateritization;

(b) Polyculture is widely practised (Photo. 13) and the minor crops are generally interplanted among the four main crops, banana, upland rice, manioc, and sweet potato, which are usually planted in a specific type of location. Job's-tears or foxtail millet is often sown among the upland rice and banana, and banana and taro are interplanted with manioc and sweet potato. Land within 5–6 m of a field barn is typically used as a polycultural kitchen garden, and in Ps's kitchen garden, for example, more than 20 different crops are cultivated in an area of less than 1 *are*;

(c) Upland rice is an important swidden crop, and as noted above, it is often one of the crops sown in part of a new swidden. But Dj did not sow rice in the swidden that he cultivated in 1974, but planted only banana, manioc and sweet potato soon after burning. Upland rice is cropped only in a part of the first year swidden, after which it becomes a banana field, the bananas having been planted concurrently with the rice. Rice might be regarded as only a preliminary crop prior to banana cultivation. Since rice can be harvested only once, in contrast to bananas, manioc and sweet potatoes, the area under rice cultivation is relatively smaller than for other crops. Leaving aside the question of food preferences, upland rice may be less important in Limau than other crops, including bananas; and

(d) Another feature of agriculture in Limau is the lackadaisical style of farm management. Most newly cleared land is left unused, or only partially used, for periods often amounting to more than a year. Because insufficient attention is paid to the

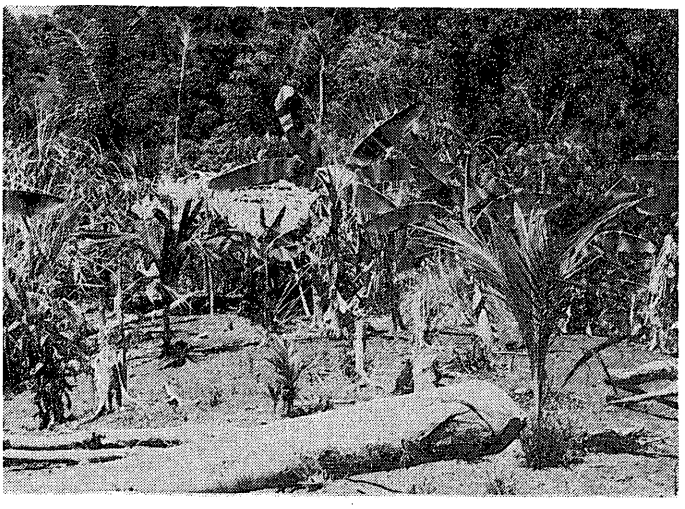


Photo. 13. Polyculture in a swidden.

field after planting, crops are often damaged by animals and sometimes by drought. Although the villagers know the technology of bamboo fence construction, few fences to guard against wild boars are found in Limau. Yet subsistence production in Limau is more stable than anticipated, perhaps in part because of the dependence on various kinds of perennial banana, with varying harvest times, and partly because large amounts of sago starch are available (see below).

2. Average Area per Plot and per Household

Table 3 shows empirically derived data of swidden land in Limau. These data were used to calculate the average size of swiddens and the average field area cultivated by a household. The term "plot" is used here to refer to an individual field, a series of which may be exploited concurrently.

Using Ps's land as an example, A and B comprise a single plot, whereas C is a separate plot because, although these three fields were exploited simultaneously, A and B were cultivated in April–May in one year and in January–February of the next, whereas C remained in use for a year after clearance. Following these definitions the largest plot (about 45.5 *are*) among the measured plots belongs to Ss (HN 2)who burned it in September, 1976, and the smallest plot (about 8.6 *are*) belongs to Ah (HN 24). The latter adjoins Dj's land and it functions like a kitchen garden. But the average area of the eight plots measured is about 22.6 *are*. This is remarkable considering that a swidden plot in India and parts of Southeast Asia, where mainly millets and upland rice are cultivated, covers an area of 40 *are* or more than 1 ha.

For household subsistence it is usually necessary to own three plots, comprising an old banana field, an old and a new swidden. Our preliminary calculations showed that an average household owns 67.8 *are* of farm land. However, old fields are invaded by weeds and undergrowth, which often reduces the area under cultivation. This could not be measured during field study, but the rate of reduction appears to be high, judging from the case of Dj's land; the eastern part of which was cultivated in 1975 and which was overgrown with a strip of forest 20 m wide until he began to

Table 3. Swidden size in Limau

	plots	area
Ps	A & B	20.6 *are*
—	C	9.6
Sm	(2)	15.5
Dj	exploited, 1974	29.
—	exploited, 1975	35.
Ah	exploited, 1974	8.6
Ss	exploited, 1974	16.8
—	exploited, 1976	45.5
	average	22.6

Table 4. A comparison of swidden size per household

area	ethnic group	average size of swidden per household (acre)	(hectare)	source
Taiwan	Tayal	3.4	1.45	"Survey Report", 1937
Taiwan	Bunun	5.0	2.00	ditto
Taiwan	Paiwan	4.5	1.80	ditto
Philippines, Mindoro	Hanunóo	4.4	1.75	Conklin, 1957
North Burma	Kachin	2.5-3.0	1.0-1.2	Leach, 1950
North Laos	Lamet	3.5	1.4	Izikowitz, 1951
North Borneo	Land Dayak	3.5	1.4	Geddes, 1950
North Borneo	Iban	4.0	1.6	Freeman, 1955
North India	Paharia	4.6	1.84	Sasaki, 1970
South Japan (Itsuki)	Japanese	3.4	1.45	Sasaki, 1972

Source: [SASAKI 1970].

cultivate the field. Although dependent on location, it is clear that more than 10–15 percent of the cultivated area is lost each year by weed infestation. From this we presume that the cultivated area per a household in Limau amounts to about 60 *are*.

According to data assembled earlier [SASAKI 1970: 117], the average cultivated swidden area in India, Southeast Asia and Japan, where millets and upland rice are mainly grown, is 1.4–1.8 *hectare* per household (Table 4). In comparison, the swidden size per household in Limau, is relatively small, being less than half that of other parts of Southeast Asia. An explanation of this phenomenon requires more research, but the Limau data are similar to those of Melanesia where tuber crops (taro, yam, sweet potato) dominate.

According to Barrau [1958: 75–76], the size of swiddens cultivated per capita per year in Melanesia is about 1000–1500 square yards (0.25–0.30 acre), according to examples from Fiji, where an average five member family owns 1.25–1.50 acre (50–60 *are*). On the other hand, data from the central highlands of New Guinea [WADDELL 1972: 43], indicate that the average subsistence swidden area per household is 64–70 *are*. These data indicate that the size of swiddens in Limau approximates those in Melanesia rather than of Southeast Asia.

In Limau the rate of upland rice cultivation is relatively low, whereas the rate of vegetatively reproduced cultigens (banana, tuber crops, sugar cane, palms etc.) is high. In other words, a vegetative planting type of swiddening, as conducted in Melanesia, is practised in Limau. This may account for the similarity between the swiddens of Limau and those of Melanesia.

III. CROPS AND AGRICULTURAL TECHNIQUES

1. Crops at Limau

Approximately 40 crops cultivated by Limau villagers were identified during field research. The principal crops, which mostly fall into 6 categories, are listed in Table 5. Other plants remain to be identified, although some information on them

Table 5. Cultivated crops in Limau

	English	Galela	Botanical Identification
(1)	**Staple Food Crops**		
	banana	*bole*	Cultivated banana
	rice	*tamo*	*Oryza sativa* L.
	manioc*	*nasibiu*	*Manihot esculenta* Pohl
	sweet potato*	*gumi*	*Ipomoea batatas* (L.) Lamark
(2)	**Sub-staple Food Crops**		
	taro	*dilago*	*Colocasia esculenta* (L.) Schott
	taro*	*dilago gogomo*	*Xanthosoma violaceum* Schott
	taro	*kiha*	*Alocasia macrorrhiza* (L.) Schott
	yam	*ubi*	*Dioscorea alata* L.
	yam	*siapu*	*Dioscorea esculenta* Burkill
	foxtail millet	*bobootene*	*Setaria italica* Beauv.
	Job's-tears	*rore*	*Coix lachryma-jobi* L. var. *ma-yuen* (Roman) Stapf.
	sorghum	*guwapo* or *jagun timur*	*Sorghum bicolor* Moench
	maize*	*ngoko* or *kahitela*	*Zea mays* L.
	breadfruit	*amo*	*Artocarpus communis* G. Forst.
(3)	**Beans and Vegetables**		
	groundnut	*boci*	*Arachis hypogaea* L.
	green gram	*temelo*	*Phaseolus aureus* Roxb.
	cowpea	*gaahu kakaku*	*Vigna sinensis* Endle
	eggplant	*fofoki*	*Solanum melongena* L.
	tomato*	*tomate*	*Lycopersicon esculentum* Mill.
	onion	*bawang sasawala*	*Allium cepa* L.
	spring onion	*rau*	*Allium fistulosum* L.
	leek	*goda*	*Allium tuberosum* Rottl.
	chili pepper*	*rica*	*Capsicum annuum* L.
	ginger	*goraka*	*Zingziber officinale* Rosc.
	turmeric	*gurati*	*Curcuma domestica* Valeton
	pumpkin*	*sambiki*	*Cucurbita* sp.
	balsam pear	*popare*	*Momordica charantia* L.
	watermelon	*samanka*	*Citrullus vilgaris* Schrad
	gourd	*walu*	*Lagenaria siceraria* (Molina) Standley
	papaya*	*papaya*	*Carica papaya* L.
	pineapple*	*nanas*	*Ananas comosus* Merr.
	sugar cane	*uga*	*Saccharum officinarum* L.
	(species) of saccharum	*dodilibu*	*Saccharum edule* Hassk
(4)	**Favorite Food Crops**		
	tobacco*	*tabako*	*Nicotiana tabacum* L.
	betel nut	*moku*	*Areca catechu* L.
	betel vine	*bido*	*Piper betle* L.
	sugar palm	*seho* or *lebeno*	*Arenga pinnata* Merr.
(5)	**Commercial Crops**		
	coconut	*igo*	*Cocos nucifera* L.
	cacao*	*cocolat*	*Theobroma cacao* L.
	clove	*cinke*	*Syzygium aromaticum* Merr et Perry
(6)	**Semi-cultivated Crops**		
	(species of) Ipomoea	*takako* or *kanko*	*Ipomoea aquatica* Forsk
	amaranth	*tona ma gaahu*	*Amaranthus* sp.

Note: *=Crops of New World origin.

was collected from the villagers. The unidentified plants are of only minor importance.

1) Staple Food Crops

The four main staple food crops, banana, manioc, sweet potato and upland rice, are of the greatest importance for the people of Limau because they provide the material for *ino*, the villagers' principal food. These crops are widely cultivated at the center of the swiddens. Among them the banana is indispensable (Photo. 14).

Banana

Banana plantations among the Galela, including Limau, are discussed in detail by Yoshida (this volume, pp. 119–137). Yet aspects of their cultivation require further elaboration to clarify the importance of bananas in this district. Yoshida identifies almost 60 varieties of banana cultivated in the Galela Sub-district, most of which exist in Limau. But only 5 of them are consumed uncooked. Besides, 4 varieties were recently introduced from other regions. Most bananas in the Galela Sub-district are cultivated for cooking, and those which can be eaten uncooked are often harvested while still unripe and are cooked. Most bananas cultivated in Limau are used as staple foodstuffs.

The Limau villagers classify bananas into two groups; male bananas (*o bole ma nau*) and female bananas (*o bole ma bedeka*) (Table 6). Bananas are not monoecious, hence this division is based on crop usage. Male bananas are large plants that grow slowly and bear large fruits, whereas female bananas are plants of small stature that grow quickly and produce small fruits.

The male banana group is subdivided into those which produce only one harvest (a new bud must be transplanted because it bears no fruits on the parent plant), and those which produce many crops (parent plant puts forth new buds and bears fruits). Most of the former sub-group have long been cultivated in the Galela Sub-district, whereas those of the latter are relatively recent introductions. Most bananas now

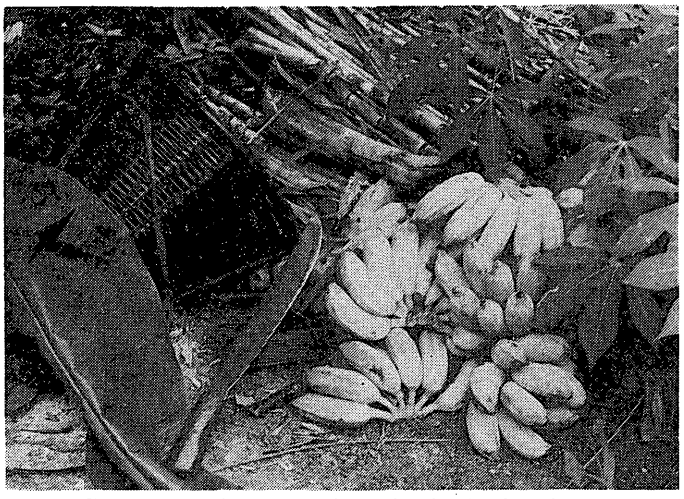


Photo. 14. Banana and manioc in the field barn.

Table 6. Varieties and use of cultivated bananas

female (*o bole ma bedeka*)		male (*o bole ma nau*)	
a) harvestable within 6 months		a) harvestable only once	
kakuba	△	*mora*	●
gapi	△	*sangate*	●
tabaga	●	*selewati*	●
bului	●	*dadaka*	△
p. banjarmasin	×	*saranga*	●
p. mas	×	*ngala moi*	●
ruwodo	●	*siwala*	△
namo ma uru	●	*tifa ma suro*	●
ngongopa	●	*kasiala*	●
b) harvestable after 6 months		b) yields multiple harvests	
galipapo	●	*p. gorontalo*	△
bau ma pau	△	*p. putih*	△
papoko	●	*p. raja*	△
koi manado	●	*p. sangir*	●
dedena	×	*p. susu*	×
koi nyonya	●	*koi jawa*	×
		koi gohu	△
		kosuta	●
		gogusumutu	●

Notes p = *pisang* (banana) ●=cooking banana △=mostly eaten cooked
×=eaten raw ?=use uncertain (must probably be cooked)

cultivated in Limau are *pisang gorontalo*, *koi jawa* (alias *p. ambon*), *p. raja*, *p. sangir*, *p. putih*, all of which have been introduced to the Sub-district and all bear crops in succession. We therefore presume that bananas of Galela origin were gradually and recently replaced by introduced, better-yielding varieties, and that this process is continuing at an accelerating pace.

The category of female bananas is subdivided into those which produce a crop within 6 months and those which require a longer period. Female bananas are less widely cultivated than males, but *pisang banjarmasin* and others are popular owing to the rapidity of their growth. This kind of banana is often planted soon after the swidden has been opened.

The differential growth period also occurs among male bananas, with *pisang raja* and *koi jawa* growing in nearly 6 months, *pisang putih* in 7–8 months, and *p. sangir* and *p. gorontalo* in 8–9 months or longer. Thus each household cultivates a mixture of banana varieties to ensure a continuous supply of this staple foodstuff, which is harvested every 2–3 days throughout the year. Our data revealed that at least 6–7 varieties of banana, and sometimes as many as 26, are cultivated in Limau swiddens. Banana cultivation, which provides a staple food year-round, is a fundamental aspect of the Galela agricultural system.

Manioc, Sweet Potato and Upland Rice

Manioc and sweet potato follow the banana in importance in Limau. Both of these tuber crops originated in the New World and were probably introduced into this part of Southeast Asia sometime after the 16th century. Like the banana, they are planted and harvested throughout the year, and they can be cooked like banana or sago starch. These factors may account for the rapid acceptance and spread of manioc and sweet potato in this region. In Limau, both crops are planted on land of a similar quality and at approximately the same time. For manioc, 2–4 pieces of stem, about 20–30 cm long, are planted together (Photo. 15), and for sweet potato 2–3 pieces of vine are planted together. They are simply planted in a small hole made with a weeding knife (*sionga*, Photo. 23), digging stick or hoe, and unlike in the highlands of New Guinea, mounding of the earth is not practised.

In Limau, harvesting of sweet potato generally begins 4–5 months after planting and manioc 7 months after planting. It is not necessary to harvest tuber crops all at once, rather, harvesting can be staggered providing that planting was also staggered. Thus Limau agriculture which incessantly produces staple foods through a year comprises the cultivation of bananas, manioc and sweet potato. Most of the manioc cultivated in the Limau area is low in hydrocyanic acid, but some bitter manioc (*nasibiu waringi*) is cultivated in the swidden. (For the methods of extracting the acidic principle and cooking, see Ishige, this volume, pp. 298–303.)

Only upland rice among the staple foods at Limau is sown and harvested during distinct seasons. Generally, upland rice is sown in January–February and harvested in June–July, but sometimes it is sown in June and harvested in September. Only a

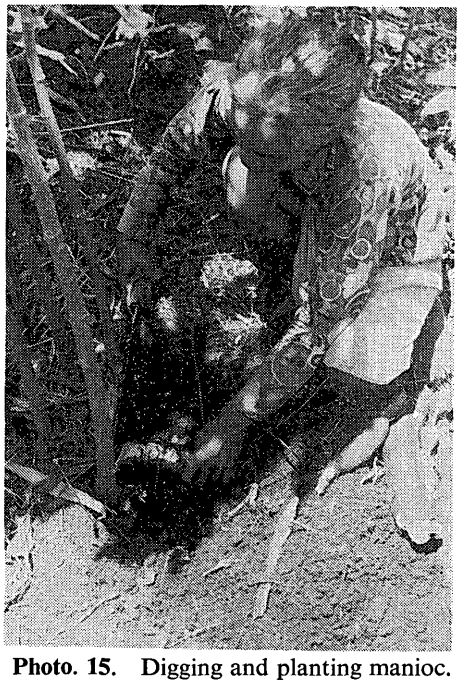


Photo. 15. Digging and planting manioc.

few traditional varieties of rice, including *druruino*, nonglutinous rice with a white epidermis, and some newly introduced varieties are cultivated in this village. It bears reiterating that rice has a relatively minor economic role in Limau; it is sown over a small area and its yields are unreliable. The Galela dialect contains the term *tamo ma loha* ("usual rice") which implies nonglutinous rice, and *tamo o goro-goro* ("sticky rice") for the glutinous variety. The former is widely cultivated.

2) LESSER STAPLE CROPS

Although of lesser importance than banana, manioc and sweet potato, and relatively little cultivated, another group of crops is considered to be an integral part of staple foods (*ino*).

Taro and Yam

Three species of taro are cultivated, *dilago* (*Colocasia esculesta* L. Schott), *dilago gogomo* (*Xanthosoma violaceum* Schott), *kiha* (*Alocasia macrorrshiza* L. Schott), together with a tuber crop known as *belo*, which looks like *Colocasia* but which has not been identified botanically. None is widely cultivated, but *dilago* is the most common, and is grown in the kitchen garden (Photo. 16), near a barn, or in the swidden, scattered among the manioc and sweet potato plants. In this village the main corm of *dilago* rather than the small tubers are eaten. To grow *dilago*, the villagers plant a short piece of main corm together with some 10–20 cm of stem. On the other hand, the small tubers of *Xanthosoma violaceum* are eaten and young tuber shoots are used for planting it. The large tubers of *Alocasia macrorrhiza* are eaten. *Pus* (a kind of *Alocasia* resembling *kiha*) is too bitter for food use. *Dilago gogomo* and *kiha* are cultivated on a extremely small-scale. In Limau taro is not intensively cultivated,

Photo. 16. Taro cultivated in the kitchen garden.

Photo. 17. Yam in the swidden.

rather it is interplanted on a small-scale among the other crops. This is characteristic of taro cultivation throughout the whole of northern Halmahera.

Yam is less important than taro, and, except for Ps' swidden, only one example of *ubi* (*Mal.*, *Dioscorea alata*) was found under cultivation (Photo. 17). However, some villagers recall that *D. esculenta*, which has thorny vines and bears many small tubers, was cultivated formerly. Although not identified in the vernacular at Limau, the tuber of *D. esculenta* is called *siapu* in Duma Village (Table 5), where, it is said *ubi merah* (*Mal.*, red yam) and *ubi putih* (*Mal.*, white yam) are called *palamea* and *besala*, respectively. These names and varieties have disappeared from Limau.

Foxtail Millet

In Galela villages, including Limau, several types of millet are cultivated on a small-scale. They include foxtail millet (*bobootene*, *Setaria italica* Beauv.) sorghum (*guwapo*, in *Mal. jagun timor*, *Sorghum bicolor* Moench), and Job's-tears (*rore*, *Coix lachryma-jobi* L. var. *ma-yuen* [Roman] Stapf). The botanical characteristics of the millets collected during the course of the field survey were analyzed by Sakamoto *et al.* (see in this volume, pp. 181–190). Included are 5 foxtail millets, 3 sorghums and 2 Job's-tears.

Each of the foxtail millets, which were gathered in the villages of Laloga, Limau and Ngidiho, has a yellow or orange lemma with long bristle of spikelets. The grams are relatively small and have high shattering habit, rather old characteristics. The foxtail millet from Limau was obtained in Dj's field and is characteristic of those cultivated by other villagers. The foxtail millets around Limau are limited to 1–2 varieties. The foxtail millet from Duma, also in the Galela Sub-district, produces large grains. Because it has larger and bare grains, it is better than that of Limau or

Laloga. Further, according to analyses by Sakamoto, a strain of foxtail millet at Duma, which is clearly distinguished from others by the number of leaves and the bristle of the spikelets, probably belongs to a different variety. It can be assumed that in the villages around L. Galela, the central Galela area, more varieties of foxtail millets were observed than in Limau or Laloga, which are peripheral areas.

Although the foxtail millet at present cultivated is almost certainly all non-glutinous, according to an informant at Duma varieties known as *bobootene da tataro* (black foxtail millet) and *bobootene da sosawara* (red foxtail millet) were cultivated in earlier times. The former, which was not widely cultivated, tasted sticky hence it was probably a species akin to the glutinous one. The latter, however, was supposed to be non-glutinous foxtail millet. Conceivably, a small quantity of glutinous foxtail millet was distributed around L. Galela in times past.

However, foxtail millet together with sorghum and Job's-tears, are not grown on a large-scale, but are cultivated only in a corner of the swidden or kitchen garden. Although long-cultivated, no fields devoted to millet production as a staple crop were observed, which indicated that foxtail and other millets are not of fundamental importance in the economy, even if they were once more widely cultivated and economically more important. But the Galela customarily eat *waji* (a gruel made of with polished foxtail millet [*marake*] and coconut milk, heavily sweetened with sugar) at important rituals, such as the wedding ceremony. Thus despite its low level of production foxtail millet is a socially important crop in Limau.

Sorghum and Job's-tears

No cultivation of sorghum was observed in Limau, but some villagers mention that *jagun timor* and *guwapo* (kinds of millet) are sometimes cultivated in the swidden. The sample listed in Sakamoto: (Table 3, p. 183) was obtained at Togawa, a village on L. Galela. Examination revealed that both *jagun timor* and *guwapo* are different kinds of sorghum. However, it is noteworthy that they are quite different in the form of the panicle and grain. According to Sakamoto, *jagun timor* is characterized by compact panicle shape, yellow lemma and brown grain, whereas the *guwapo* is characterized by having a spreading shape, blackish-brown lemma, grains entirely enclosed by lemmas, even when mature, and yellowish grey grain. The latter apparently resembles a primitive form. Thus *guwapo*, by virtue of its formal characteristics, is undoubtedly a representative of the old varieties, and sorghum cultivation in this region may have a fairly ancient history. On the other hand, *jagun timor* is clearly a relatively recently introduced variety, judging from its Indonesian name. Further, according to Sakamoto, the starch grain of *guwapo* is glutinous whereas that of *jagun timor* is non-glutinous. It can be said with assurance that two sorghum varieties exist in this region; old and new.

Both varieties of Job's-tears collected are glutinous. At Laloga it is said that three kinds of Job's-tears (the grain colors are red [chocolate-brown in reality], black and white) were formerly cultivated, but only the white variety now exists. The same situation occurs in Limau (Photo. 18). These Job's-tears are eaten as a sweet

Photo. 18. Job's-tears in the swidden.

or mashed gruel (see Ishige, this volume, pp. 296–297). A rarely found wild Job's-tears, called *mumurutu* in Limau, occurs in the Galela Sub-district. Its seeds are used for ornaments (bracelet or necklace), and it is not used for food.

3) Other Crops

Many other crops in addition to those which provide staple food crops are cultivated by the Limau villagers. Above all, vegetables and favorite food crops are widely and intensively cultivated mixed together in the swidden, especially in the kitchen garden.

As mentioned by Ishige (this volume, p. 281), tomato (*tomate*), onion (*bawang sasawala*), spring onion (*rau*), leek (*goda*), chili pepper (*rica*), ginger (*goraka*) and turmeric (*gurati*) are cultivated to provide flavorings and spices, whereas eggplant (*fofoki*), cowpea (*gaahu kakaku*), groundnut (*boci*), green gram (*temelo*), pumpkin (*sambiki*), balsam pear (*popare*), gourd (*waru*), and a kind of *Saccharum* (*dodilibu*) are vegetables that provide side dishes (*shihode*).

Watermelon and pineapple are always eaten raw as a snack, but in addition to providing a fruit eaten in this way the young leaves of papaya often provide greens. Sugar cane stems are mostly chewed raw, as a snack, but some households press it to extract the juice that is made into a syrup for cooking (see Ishige, this volume, pp. 279–280). *Dodilibu*, like sugar cane, is a member of the genus *Saccharum*. Although

Photo. 19. Eggplant in the swidden.

these plants are quite similar in form, the unripe glumous flower of *dodilibu* are cooked as greens and the stem is not used. Of the 20 or so greens cultivated, eggplant, tomato, chili pepper and sugar cane, which are discriminated by variety, are most widely grown in Limau. Pumpkin, balsam pear, *dodilibu* follow in importance.

Favorite commodities such as tobacco (*tabako*), betel nut (*moku*) or betel vine (*bido*) are usually scattered in the swidden for cultivation. Nowdays they are less widely cultivated, since they have become commercially available. Moreover almost no villagers younger than 50 years of age chew betel. The sugar palm (*seho* or *lebeno*) is not used for making black sugar or syrup, but liquor (*saguere*) is made from the sap. It is caught in a bamboo container and left until it ferments. Sugar palms generally occur individually around the perimeter of the swidden or in secondary forest. They seem not to be deliberately planted, but rather are wild plants protected during field clearance and burning.

The vines and leaves of a kind of *Ipomoea* (*kanko* or *takako*), found in pools in the swamps are cooked, and an amaranth (*tona ma gaahu*) that grows on the outskirts of the village and around the swiddens provides a vegetable. It is possible that these now wild plants were formerly cultivated. Nowdays they are not planted but simply protected and used when available.

2. Aspects of Agricultural Techniques

In the preceding part swidden land use and cultivated crops of Limau Village have been discussed. This part deals with some aspects of agricultural techniques.

1) Exploitation of Swidden Land

The exploitation of land for swidden cultivation begins with field site clearance.

This is done by felling the larger trees with an axe and slashing the smaller vegetation with a bush-knife. When dry, the cut vegetation is burned. In Limau, clearance of field sites may begin in July–August, but most of this work is done in November–December. Burning usually takes place between 2–8 weeks after felling and slashing, when the debris has had time to dry. Generally, field site clearance in Limau is completed by the end of January.

(i) Techniques of Field Site Clearance

In Limau, as noted earlier, swiddens often are cleared in tropical rain forest that appears to be close to the climax stage. In such cases, when huge trees are cleared, only the axe and bush knife are used, and family units perform the work for an extended period. Cooperative work appears to be limited to such labor-intensive tasks as constructing a scaffold to cut very large trees above the buttress.

Thus in this area of mature tropical forest, labor input for field site clearance is high in comparison with other areas that support secondary forests with trees of a smaller size. Nevertheless, in the Limau area the custom of cooperative work is poorly developed, and as a result each family has a demanding work load. This limits site clearance in mature forest to intervals of 2–3 years despite the annual clearance of a swidden.

The techniques typically used in Limau for making a swidden are best illustrated by referring to an example of a typical household, that of Ss. The new field exploited by Ss in 1976 is located on southern slope, about a half mile southwest of the village, on a tributary ridge that extends eastward from the main western ridge. Before the new swidden was made in 1976, 16.8 *are* of this slope had been cultivated for 2 years by Ss, who, assisted by 6 villagers, had cleared the area in 2 days. During the first year upland rice was cultivated, followed by bananas (Fig. 8).

The forest on the south slope of the ridge was cleared and a 45.5 *are* swidden established adjacent to the west side of the earlier field, in about July, 1976. Ss worked alone and took about 3 weeks to complete site clearance. He cut the small undergrowth with a bush-knife and felled the large trees with an axe. To fell trees with trunks larger than 1 m in diameter he constructed a scaffold (*rari-rari*), sometimes 5 m high, to cut the above the buttress. Usually, felling started at the top of the slope and gradually proceeded forward the lower elevation. Ss usually worked about 4 hours each day, from 7–11 a.m., and cut down an average of 2 such trees per day. Felling of all trees on the 45.5 *are* field site took about 3 weeks, giving clearance rates of some 216.7 m^2/day or about 54.2 m^2/hour, assuming that he regularly worked 4 hours per day. As noted above, he earlier cleared 16.8 *are* in 2 days with the help of 6 villagers, a clearance rate of some 40 m^2/man-hour. From this it appears that cooperative work is less efficient; a consequence, perhaps, of such social diversions as time spent chatting.

The Hanunóo of Mindoro Island, Philippines, where mature tropical forests are similar to those of Halmahera Island, can clear sub-climax secondary forests

Table 7. Clearance labor by forest type

	cleaning land/hour	character of forest
	m^2	
Indonesia, Galela	40–60	dense, woody, second growth in tropical rain forest area
Philippine, Hanunóo	50–65	medium to dense, woody second growth in tropical rain forest area
	100	bamboo second growth
India, Paharia	100–120	bush second growth in tropical monsoon forest area

at a rate of some 60 m^2/hour, whereas secondary growth bamboo is cleared at a rate of 100 m^2/hour [CONKLIN 1957: 52]. The Paharia tribe, swidden cultivators in tropical monsoon forests of Rajmahal Hill, Bihar State, India, clear secondary forest about 10 years growth at a rate of 100–120 m^2/hour [SASAKI 1970: 256–260]. These data reveal that in relatively uniform tropical secondary forests near to the sub-climax, field site clearance requires about twice the input of labor than does low secondary growth with comparatively few large trees (Table 7).

As shown above, Limau villagers do not have enough labor to clear new field sites each year, despite the need for them.

The Ritual before the Field Site Clearance

Before beginning site clearance, Galela traditionally ask such spirits as *Moro*, *meki* and *ibilisi*, who reside in the forest, to vacate the area. Conjurers (*usu-usu*) were used to pray for the spirits. A sorcerer went to the forest taking with him a potion made from leaves and roots of various trees (species unidentified), which, while praying, he splashed around the area to be cleared. After this ritual an interval of 7 days, which is needed for the spirits to depart, was left before field clearance started. But in Limau Village nowdays this ritual is hardly performed. Yet many villagers still believe in the spirits and instead of employing a sorcerer they themselves go to the forest and perform the ritual (see Ishige, this volume, pp. 238–239). Ss, who appears to be regarded by his peers as the most progressive man in Limau, performed this ritual before starting the work.

Although before felling there were more than 12 large trees in Ss' field, one huge *Niha*, remained uncut (Fig. 8). He performed a brief and simple ritual at the foot of this tree before starting the field clearance work. The ritual consists of placing a piece of ginger (*goraka*) near the base of the tree, and then bringing the ginger close to his mouth, all the while chanting a spell. The spell must be chanted in the Ternate language, and because Mr. Ss speaks Galelan in daily life, he reads it from a piece of paper for fear of making mistakes. It is not known why the Ternate language is used. While chanting, he uses the bush-knife to cut small pieces of bark, and places the ginger, as a tribute, between them. With this the ritual ends. Such a large tree left standing in a swidden is called a "king tree" (*o gota ma karano* in Gelelan and *kayu raja* in Indonesian). It must never be felled.

Field site clearance begins after this ritual has been performed. After an interval of one month needed for the cut vegetation to dry, the field site is burned. Most Limau villagers perform a minor ritual immediately before setting fire to the dry vegetation.

(ii) Techniques of Burning

The Ritual of Burning

The same ritual also is performed to ask spirits to vacate a section of forest. Ss chanted a spell from four quarters while standing at the base of the king tree. This begins from the side facing the sea, then from the "upward" side, next from the side facing the mountains, and finally from the "downward" side (see Yoshida, this volume, pp. 37–38). For details of the incantation, made once from each quarter before the fire is set (see Ishige, this volume, p. 423).

The Operations of Burning (*Patupa*)

In Limau the main time for field site clearance is usually December–January. But Ss began this task in about July, and so could burn his field in the middle of September, which is comparatively early.

Generally, Limau villagers clear a firebreak (*pobare*) about 2–3 m wide around the field before setting fire to the debris. Ignition is usually from the leeward, proceeding to the windward. Ss performed these tasks in the following order (numbers refer to those shown in Fig. 8):

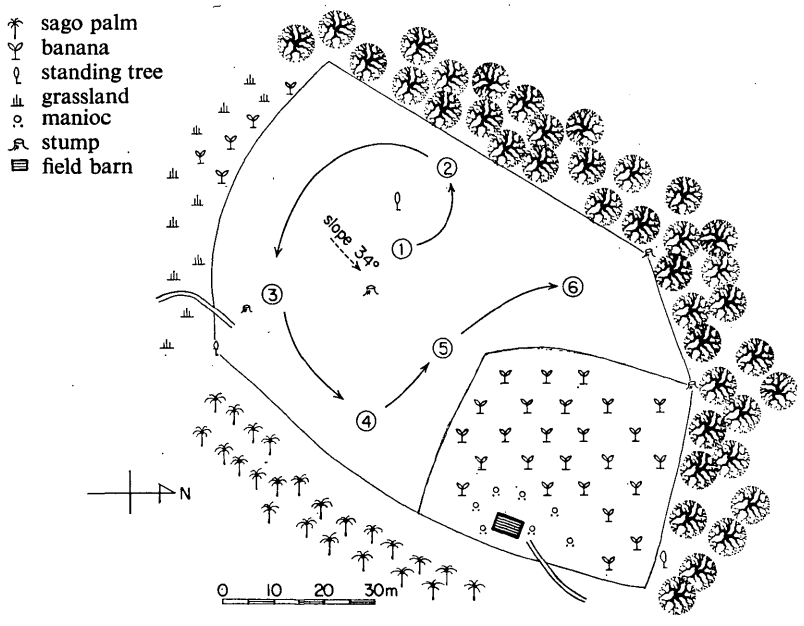


Fig. 8. The swidden of Ss. Burning was performed in the numerical order shown.

the debris at the base of the "king tree" (*niha*), situated at the center of the field, was ignited (1); the fire was permitted to spread northwestward and up-slope (2); it was then directed downward toward the southeast corner of the field (3); the fire was allowed to spread toward the lowest elevations of the field (4); and finally it was permitted to spread naturally, thus completing the work (5) and (6).

Ss requested a few villagers to help, but the details of this work are not known. It is noteworthy that he ignited at the center of the field and allowed the fire spread upward, and then directed it downwards along the slope. Many informants, including Ps, mentioned that wind direction is an important consideration in deciding where to set the fire, and sometimes they ignited at the bottom of the slope. From the direction of the wind they probably know where to set the fire and in which direction to let it spread. They set fire to a part of the field, lead the fire downward along the slope, and then let it spread upward. Regardless of the details, from the example of Ss' behavior it is clear that, as in other parts of Southeast Asia, the Galela employ the technique of diverting the direction of the fire downward when they burn a slope (Photo. 20).

2) THE AGRICULTURAL CYCLE AND CULTIVATION

(i) Timing and Techniques of Planting and Sowing

After field site clearance and burning Limau villagers plant and sow staple food

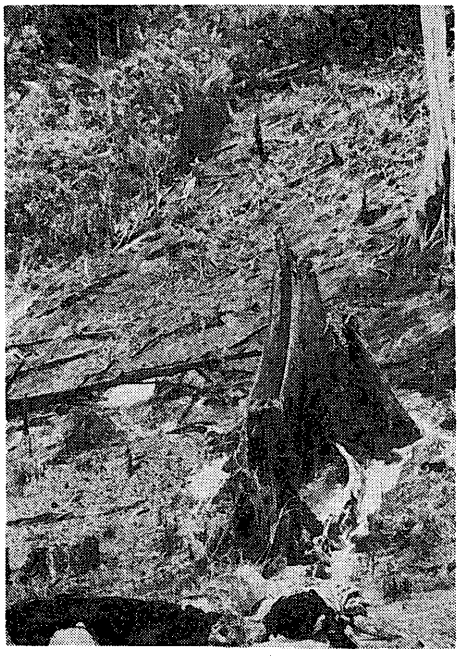


Photo. 20. The swidden of Ss after burning.

crops in the new field. Because of the uniformly hot and humid climate and the lack of an obvious dry season, most crops grow easily regardless of the time of planting. Nevertheless, agricultural operations tend to be concentrated at specific times of the year.

Figure 9 illustrates the planting and sowing times of specific crops in Limau Village. Thirty-three percent of the cases sampled used the land in the manner of Type 1, described below. Between the time of forest clearance and burning, and January, bananas, manioc and coconuts, among other crops, were planted on part of land and upland rice added to the same area in January–February (Photo. 21). Ss, for example, planted bananas in a part of his field in mid-October. This was rather early, since rice sowing was not scheduled about January of the following year. The early planting of bananas resulted from the early burning. Normally, burning takes place from December to the beginning of January, as noted earlier, so the planting of crops that reproduce vegetatively, such as the banana, is carried out from 2–5 weeks earlier than the sowing of upland rice.

An alternative type, type 2, entails the planting of crops that reproduce vegetatively after the germination of the upland rice sown in January–February. Such crops are interplanted in vacant spots among the rice plants or around the perimeter of the field. These two types of planting are somewhat different, but as the plants grow the fields of both types look similar, hence there is little basis for separating these two types. The few instances of another planting sequence (Type 3) encountered can be regarded as a sub-group of the first type except that the season for planting bananas and rice is 1–2 months earlier than in Type 1.

Compared with the type of field that combines the cultivation of plants which reproduce vegetatively with upland rice, planted in January–February, types 4 and 5 are planted mainly with manioc, sweet potato and banana (recently coconut has been

Type

① Bananas, manioc and coconut palms are planted before January and upland rice is sown on the same land in January-February.

② Upland rice is sown in January-February, followed later by the interplanting of manioc and coconuts.

③ Bananas are planted in October and upland rice is sown on the same land in November.

④ Manioc, sweet potato and bananas are planted in January-February.

⑤ Bananas and coconuts are planted mainly in January-February.

⑥ Bananas and sweet potatoes are planted first, and upland rice is sown on the same land in June-July.

⑦ The early-ripening variety of rice is sown in May and two harvests taken per year.

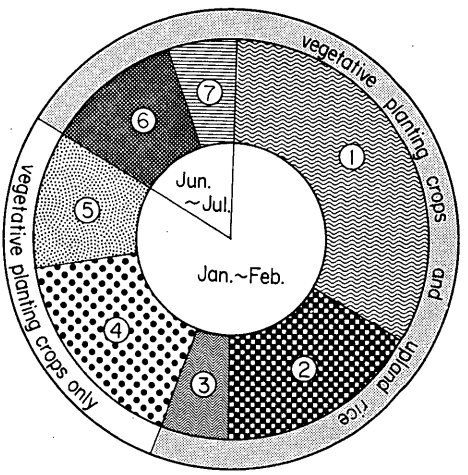


Fig. 9. Seven types of planting and sowing staple crops.

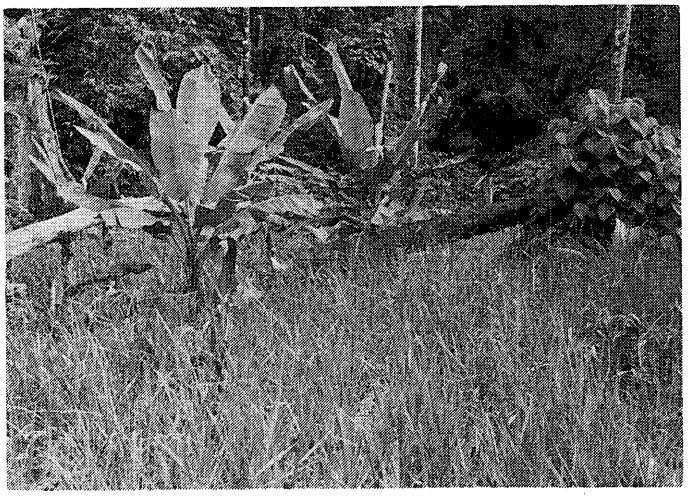


Photo. 21. Bananas interplanted with rice.

added), in January–February, after burning. Rice is not inter-planted in this type of field. The field B cultivated by Ps and part of belonging to Sm's field on Jobubu are typical cases that illustrate this type of mixed cultivation.

Although differing with regard to the inclusion of upland rice, the planting of all 5 types of field takes place in January–February, immediately after burning, according to 80 percent of all first year fields sampled.

Upland rice can also be sown in June–July, the planting of the associated crops taking place before and after this time. An example is provided by Ps's field A, where bananas were planted in April–May and the rice sown in June–July. However, it was not learned why such a system was established in which planting and the sowing occurs some 6 months after field site clearance. Nor were the details of the procedures involved made clear. But a few reasons can be assumed for the establishment of this system. This type may have arisen after the introduction of upland rice or millets to the area. Although interesting, these topics could not be studied within the scope of the field research, and must be deferred until some future time.

Over 70 percent of the new fields sample combined the cultivation of crops that reproduce vegetatively with upland rice, a fairly high ratio. This should not, however, be taken as an indicating that upland rice is of major importance in Limau. Rice rarely occupies an entire field, as noted earlier, but, being subsidiary to bananas, the main swidden crop, is planted in only part of the field. Yet the fact that upland rice is cultivated in a part of 70 percent of the new fields sampled may indicate that rice will become more important in Limau in the future.

(ii) The Timing and Techniques of Harvesting

Although planting and the sowing of food crops in Limau extends throughout the year, it focuses in January–February, after burning. Yet the times for planting,

sowing, and harvesting are not, except for the case of upland rice, precisely defined, because crops that reproduce vegetatively, the unlike seed crops, can be harvested whenever required for immediate consumption. This is particularly true of the bananas. Since several different types with different growing periods are cultivated in a single field there is no single period of particularly intensive agricultural labor demand. In the case of the manioc, planting immediately follows the harvest so several kinds of manioc at different stages of growth occur at any given time in a single field. Under this type of agricultural system the quantity required for daily food needs can be harvested throughout the year. In practice, women from each family go to the fields every 2–3 days to harvest bananas and tubers. Except for field site preparation and planting times the Galela lack a precise agricultural calendar for crops that reproduce vegetatively. Also, there is no need for long-term crop storage facilities.

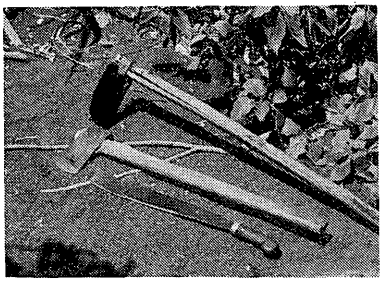
Nowadays the iron hoe (*pacul*) is sometimes used to dig holes for planting bananas (Photo. 22), the *sionga*, an all-purpose cultivating and weeding tool, shaped like broad knife, is used like a small shovel (Photo. 23). Only rarely is a bush-knife used. The *sionga* is also the tool used most frequently for planting and harvesting the tubers. Several special tools are used for sowing and harvesting upland rice, another characteristic that distinguishes the cultivation of upland rice from other crops.

(iii) Aspects of Upland Rice Cultivation

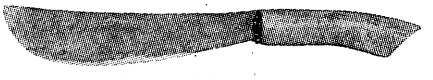
Hitherto, upland rice has been of relatively little importance in Limau but recently the villagers have tended to sow as much as possible in first year fields. Upland rice cultivation requires somewhat different techniques than does the cultivation of the other crops grown.

Rice-sowing

The main rice-sowing season occurs in January–February, after the new field has been burned. Sowing also takes place in June–July. In Limau, most agricultural work is performed by family units, but rice sowing is performed by mixed groups of men and women, ranging from a few people to several dozen. Work begins in each swidden early in the morning, and later that morning the whole field is completely sown (Photo. 24). This pattern of work may stem from the desire to maintain the rice at the same stage of growth in each plot of cultivated land.



← **Photo.22.** Hoe, axe and bush-knife.



↑ **Photo. 23.** *Sionga.*

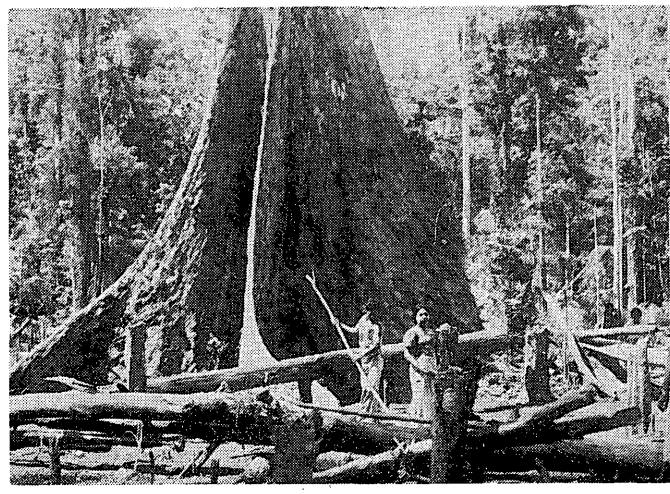
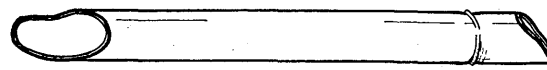


Photo. 24. Working in the rice field. A large tree must be left in the swidden.

The work pattern observed in Hj's swidden on November 1, 1976 was as follows. Seventeen males including one old man and a child, and 14 women, including an old woman, went to the field early in the morning. At the field the men made digging sticks to seed rice (*tamo tutudu*) from the trees cut in the surrounding forest. The women began work after having first preparing seeds (*tamo gisisi*) and the food for the break. Meanwhile the landowner and a few old men were observed to be walking in the nearby forest and performing a ritual, the nature of which was not clarified. Sowing is done by a male-female pair, the man digging a hole with a stick and woman dropping seed, carried in a bawboo container (*moluka*) in it (Fig. 10). They sow at intervals of 10–15 cm and use 5–10 seeds per a hole (Photo. 25). Another man follows sweeping the soil surface with a broom-like tool (*gesesa*),

digging stick to seed rice (*tamo tutudu*)



bamboo seed container (*moluka*)

0 10 20cm

Fig. 10. Digging stick and bamboo container.

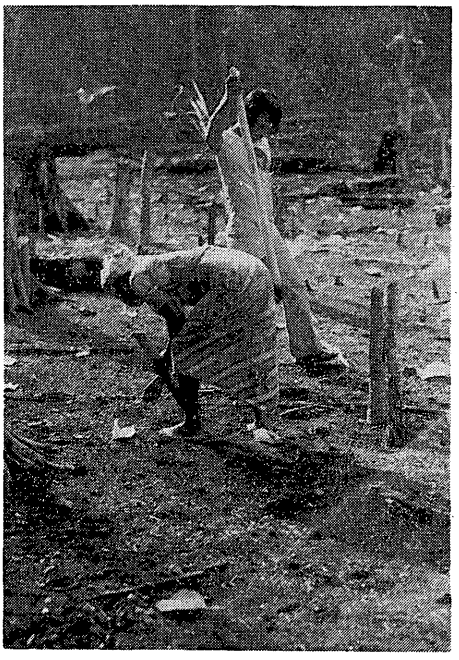


Photo. 25. A man dibbling and a woman sowing rice.

made midribs of leaflets of the sugar-palm, to fill in the holes.

Informants provided data on the same simple procedure. Although the data were derived from only a few samples, it appears that 1 *belek* (≒15 kg) of rice seeds are sowed per 8–15 *are*. In the case of Hj, 3 *belek* of seeds were used in approximately

Photo. 26. Members of the cooperate work group are invited to a feast when the job is complete.

2 hours by 12–13 sowing couples. They worked at sowing from about 8–11 a.m., taking a break of about one hour, during which the men and the women ate in separate groups. This meal seemed to consist of *waji*, (see, pp. 296-297) and rice mixed with leaves of a kind of *Ipomoea* and cooked with coconut milk. On the evening of the day when sowing was completed the whole work group was invited to feast at Hj's house (Photo. 26). After completing the cooperative labor of sowing rice, the entire work group is invited for a feast by the owner of the field.

Weeding and Harvesting the Rice Field

The rice field is weeded some 3 times during the growing period, a task mainly undertaken by women although men may sometimes assist. No special weeding tool is used. Weeds may be simply pulled-up with the hands, or the multi-purpose *sionga* is used for this job. Cooperative weeding is rare.

The rice field is prone to bird and animal damage which the villagers attempt to reduce with the aid of bamboo fences and clappers. But only few fields in Limau are fenced (whereas many rice fields appear to be protected in Duma).

In this area, rice matures in 4–5 months (that sown in the middle or at the end

Photo. 27. Reaping rice with a *gugutu*.

of January matures in late May) and the harvest peaks in June. Only part of each ear is reaped using a *gugutu* (Photo. 27), a tool with a 10 cm, round wooden handle, at the center of which is metal blade 2–3 × 10 cm, which cuts the lower part of the ear. Harvested ears are placed in a small basket (*pigu*) and eventually transferred to a carrying basket for transportation to the village.

Harvesting is rarely done cooperatively. In one example a man and his wife took 1–2 weeks to harvest an estimated 0.1 ha of upland rice sown in the swidden located center of the lower slope of Wonge. The abnormal drought conditions of 1976 precluded a through estimate of rice yields. Data from several rice fields produced an expected seed-yield ratio of 1:13.5. The harvest may be far less, about 50–65 percent of that expected.

In Limau, a storehouse with raised floor (*pola*) is constructed in a corner of a field-barn for storing unhulled rice (Fig. 5 and 7). Alternatively it may be stored in a jute bag, or in a bamboo tube (*moluka*) about 10 cm in diameter. In some villages along L. Galela or in the Sahu Sub-district of central Halmahera, storehouses with a floor raised 50–60 cm above the ground and walls of large bamboo are favored, whereas in Limau there are no such storehouses. This may suggest that in Limau the cultivation of upland rice is not considered as the main activity in the traditional cultivation system.

The Spread of Upland Rice Cultivation

In Limau, however, more than 50 percent of the first year fields contained some upland rice. There is an increasing tendency to sow an early-ripening variety sometime in May and also try to obtain two harvests per annum. In general it can be said that the importance of upland rice cultivation is becoming more widely recognized. In contrast the cultivation of the upland rice seems to have been long recognized in some villages along L. Galela which, unlike Limau, is the central area of the Galela. There the upland rice is cultivated more intensively than in Limau and the yields are greater. Moreover, the production of rice per a family is large, so storage facilities are better than in Limau. As discussed in detail elsewhere, in Sahu Sub-district, located near the cultural center of Halmahera, traditional swidden crops now play only a minor role, and upland rice has emerged as the primary staple food crop.

Throughout the whole of Southeast Asia traditional swidden crops are declining in importance and finally become quite rare as upland rice assumes a more important role. This new type of agricultural system may be termed the "upland rice dominant type" [SASAKI 1970: 38–39, 87–91]. This same process appears to be occuring on Halmahera, although, as discussed below, upland rice was already cultivated in some central parts of this island when Europeans first visited there in the 16th century. Despite a lack of details, at least it may be claimed that the cultivation of upland rice has only recently entered the district under study. The low level of rice-cultivation technology in Limau suggests that this crop has rather a short history in this village, and hence that the principal characteristics of traditional agriculture have been little modified.

It is assumed that, despite the rapid transformation of swidden agriculture throughout Southeast Asia, the traditional cultivation of Limau is well-preserved, and although slightly affected by millet agriculture, the traditions of the old vegetative planting crop cultivation have been retained. That being the case, research in this area yields precious data on the characteristic traditional agriculture of Southeast Asia and Melanesia.

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