32. The Amarasi subdistrict, West Timor, is dominated by *Leucaena leucocephala* fallows, from which cropping fields are cleared on a rotational basis (Piggin, Chapter 24). Here, a mature *Leucaena* fallow has been cut and burnt and is ready for planting. Binel, South Central Timor, Nusa Tenggara Timor, Indonesia. (Photo: Peter Kerridge)

33. In addition to soil rejuvenation, the *Leucaena* is cut and carried as fodder for tethered or penned cattle, making a critical contribution to farm incomes. The Amarasi system provides a promising model for the intensification of fallow management in tandem with livestock husbandry. Amarasi, Nusa Tenggara Timor, Indonesia. (Photo: Colin Piggin)

34. Another system sees *Leucaena* planted in hedgerows on steeper slopes, with crops occupying the alleys between them. The hedgerows contribute nutrients from *Leucaena's* N-fixation and from mulched prunings, as well as stabilizing sloping soils, preventing erosion, and building up natural terraces. Watublapi, Sikka, Flores, Nusa Tenggara Timor, Indonesia. (Photo: Colin Piggin)

35. The sloping uplands of Naalad, in the Philippines, were deforested during the Spanish colonial era. According to oral history, farmers began to rehabilitate the anthropogenic grasslands in the mid-1800s by broadcasting *Leucaena leucocephala* in swidden fallows, smothering out *Imperata* and fixing atmospheric N. Soil conservation benefits were later added by erecting 30 cm long *Leucaena* stakes at regular intervals along the contours and piling smaller branches against the stakes, resulting in fascine-like structures (Lasco, Chapter 27). In addition to enhancing fallow functions, the *Leucaena* is harvested for firewood and is sold in nearby Cebu City.

36. Upland rice cultivation in a swidden field opened from a *Leucaena* fallow in Sto. Tomas, Occidental Mindoro, the Philippines. Rice is cultivated for one season, followed by two to five years of *Leucaena* fallow, after which upland rice is again cultivated. (Photo: Ken MacDicken)

37. Originally brought to West Timor by the Dutch as a ground cover for their teak plantations, *Acacia villosa* has since escaped and now often dominates fallows in the Camplong area. Shortly after the maize harvest, *A. villosa* rapidly regenerates to form a leguminous ground cover.

38. *Schleinitzia novo-guineensis* is a fast-growing leguminous tree commonly found in fallow vegetation on a number of small islands in Milne Bay Province, Papua New Guinea. Believing that it improves soil fertility, villagers protect self-sown seedlings or actively transplant them into yam gardens (Bourke, Chapter 31). (Photo: Michael Bourke)

39. The ancient Naga practice of managing alders within their swidden plots may have wide replication potential across the Himalayan foothills where *Alnus nepalensis* is endemic (Cairns et al., Chapter 30). This three-year-old fallow will soon be pollarded in preparation for the cropping phase. Even though the trees are widely spaced so as not to interfere with cropping, each alder stump provides an elevated platform from which five to six coppices are allowed to grow to form a full fallow canopy. Khonoma Village, Kohima District, Nagaland.

40. In China's Yunnan Province, many ethnic minority groups also manage *Alnus nepalensis* as an improved fallow (Guo et al., Chapter 29). However, shifting cultivators in Yunnan use a more sequential system in which the trees are completely cleared when reopening the fallow. After cropping, an alder forest is re-established either through natural regeneration or intentional planting. Tengzhong County, Baoshan Prefecture, Yunnan.

41. *Casuarina oligodon* landscapes are a common sight in the highlands of Papua New Guinea, where an estimated 1.3 million people plant *Casuarina* trees in their fallows (Bourke, Chapter 31). Farmers begin by collecting wild seedlings and transplanting them into their sweet potato gardens toward the end of the cropping phase. Once established, the *Casuarina* self-seeds and germinates whenever farmers disturb the site by clearing the fallow in preparation for planting. Near Chuave district of Simbu Province, PNG.

42. When reopening *Casuarina* fallows, several approaches may be taken, depending on how the wood will be used. Trees cut at waist height are used for fencing needs. Alternatively, the trees may be killed by ring barking and eventually harvested for firewood, or, if there is no immediate need for the wood, the side branches are often pruned back heavily (shown) to return biomass to the soil and reduce shading. The trees are then maintained through successive swidden cycles. Simbu Province, PNG highlands.

43. Shifting cultivators in Luang Prabang Province of Lao P.D.R. have responded to rising timber prices by converting increasing dryland areas into teak (*Tectona grandis*) plantations (Hansen et al., Chapter 34). This has raised concerns that the best agricultural land may be tied up in the long term. Most farmers also have difficulty waiting 20 or 30 years before harvest, and are tempted to sell either the land or the harvest rights to urban speculators.

44. Many farmers in China found that after the Green Revolution they were able to meet all their food needs from intensive cropping of valley bottoms. No longer needing their dryland fields to grow food, they turned to growing valuable trees through taungya planting. Although smallholder tree cropping of *Cunninghamia lanceolata* has a long history in China (Menzies and Tapp, Chapter 35), it has expanded in scale in recent years and, in Tengzhong county of Baoshan prefecture, Yunnan Province, *C. lanceolata* (shown) and *Taiwania flousiana* have displaced many of the traditional alder fallows, such as that illustrated in color plate 40.

45. Upland farmers have a comparative advantage in producing tree products along with ruminant livestock, and both provide commodities in high demand. This suggests that silvipastoral systems, such as this Philippine example of grazing cattle under a *Gmelina arborea* fallow crop (Magcale-Macandog and Rocamora, Chapter 37), are a promising approach to managing fallow land more productively. Claveria, Misamis Oriental, Philippines. (Photo: Damasa Magcale-Macandog)

46. Tala-andig swiddenists at Bukidnon, Mindanao, in the Philippines, have developed an improved fallow system that converts degraded grasslands into valuable timber stands. *Paraserianthes falcataria* seeds are broadcast into *Imperata* swards before they are slashed and burned in preparation for cultivation. The fire scarifies the *P. falcataria* seeds, causing them to germinate in tandem with planted food crops. After crop harvest, the *P. falcataria* dominates the fallow succession and can be harvested for timber when 10 to 12 years old. Midway through the fallow, *P. falcataria* begins to contribute seeds to the soil seedbank, so that after tree harvest the subsequent burning of remaining slash sets the cycle in motion again.

47. A market for pulp wood has persuaded many upland farmers in Yenbai Province of northern Vietnam to plant *Styrax tonkinensis* (shown) and *Manglietia glauca* into their swidden fields in a taungya system. The trees achieve marketable size within 10 to 12 years, after which the fallow is reopened for cropping and the logs sold to the pulp mill. In this way, shifting cultivation has been transformed into defacto permanent land use with a food crop–pulp wood rotation. The system has led to increased forest cover in the province.

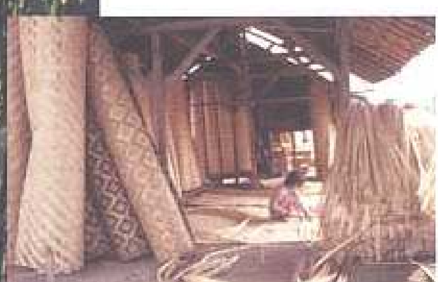
48. Natural vegetative strips have been widely adopted by farmers at Claveria, Misamis Oriental, Philippines, as a low input alternative to conventional alley cropping. Some of them later relay plant *Gmelina arborea* along the vegetative strips, creating contour rows of marketable trees (Suson et al., Chapter 33). Cropping of annuals inside the alleyways stops when the trees form a canopy and shading becomes intense. The system then reverts from agrosilviculture to silvipastoral (shown). (Photo: Wilbur Sitoy)

49-50. In the Kerinci area of West Sumatra, Indonesia, high cinnamon prices and secure individual land tenure have stimulated many shifting cultivators to interplant *Cinnamomum burmannii* into their fields in a taungya system (Suyanto et al., Chapter 65; Werner, Chapter 67). Intercropping of food crops between the rows of trees is discontinued when shading becomes excessive. Harvest (inset) usually occurs when the trees are 10 to 12 years old and the cycle begins anew. (Photos: Suyanto)

51. Shifting cultivators in Yenbai Province of northern Vietnam are using their local species, *Cinnamomum cassia*, in a similar system (Hien, Chapter 62). Most of the bark is exported, the leaves are processed for oil, and the timber is used to make furniture and packing crates. Such a heavy harvest index leaves little for this fallow system to contribute to soil rejuvenation.

52. A mature 15-year-old rattan garden in Rantau Lajung, Pasir District, East Kalimantan. (Photo: Carmen Garcia, CIFOR)

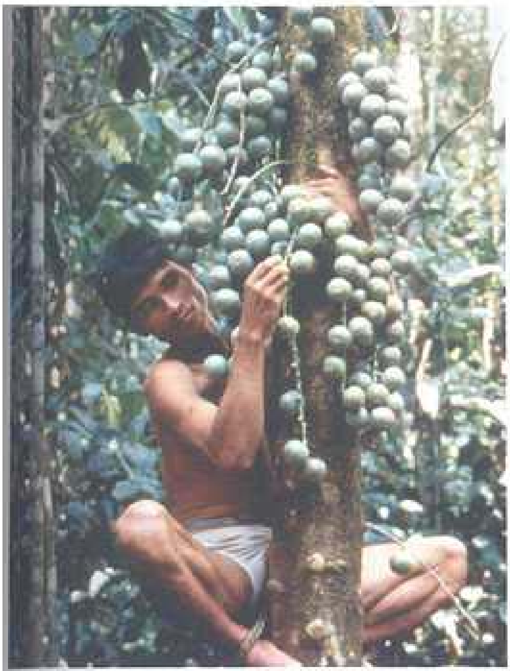
53-54. This fallow regrowth in Hoa Binh province of northern Vietnam looks deceivingly like a coniferous forest. It is, in fact, bamboo. Many shifting cultivators manage bamboo fallows and harvest the poles when reopening the land for arable cultivation (inset). Bamboo is fire resistant due to underground rhizomes; it regenerates rapidly and quickly shades out light-demanding weeds, and it rejuvenates soil through rapid accumulation of biomass and nutrients and high rates of litterfall (Hien, Chapter 62; Ty, Chapter 55).



55–56. Sundanese farmers in Ciwidey, West Java, practice an intensive fallow system based primarily on marketable bamboo species. This practice is remarkable for its adaptability to Java's high population densities. The steady supply of bamboo has spawned booming local industries in woven bamboo walling (inset) and furniture construction.

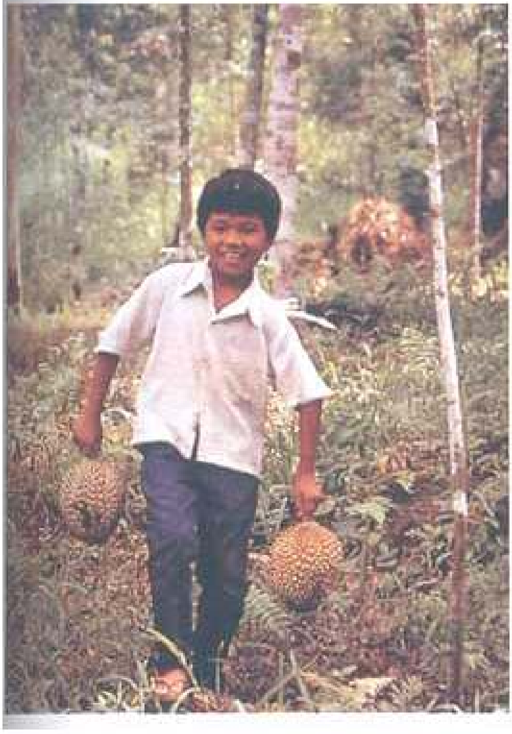
57 and 58. Farmers in northern Lao P.D.R. have long harvested the inner bark of paper mulberry (*Broussonetia papyrifera*), growing wild in bush fallows. Development of a local industry for processing it into a coarse textured parchment has encouraged many farmers to retain *B. papyrifera* growing in rice swiddens and to experiment with propagation (inset) (Fahrney et al., Chapter 40). Paper mulberry is of immense interest because it can produce a harvestable product within the short two to three year fallows that predominate across much of Southeast Asia's uplands. (Main photo: Keith Fahrney)

59. *Tembawang* forest gardens (above) are man-made forests that have a structure and floristic composition that closely resemble natural forest. Outsiders, unaware of their existence, have often mistaken them for natural forests. Jambi, Sumatra. (Photo: Andy Gillison, CIFOR)



60. Tembawang forest gardens supply a diversity of products. Harvested species may be planted, tended, or merely tolerated when they occur spontaneously. This Dayak is collecting fruit that has medicinal properties. Ella Ullu Bukit Baka Raya National Park, West Kalimantan. (Photo: Alain Compost)

61. Under pressure to intensify their land use, Pwo Karen in the buffer zone of Huay Khakhaeng Wildlife Sanctuary, in western Thailand, have begun to develop swidden plots into banana-based agroforests, known locally as *sagui gru* (Srithong, Chapter 52). Bananas are interplanted into upland rice during the cropping phase in standard taungya practice. Once established, the bananas provide protective shade for further enrichment planting with kapok, betel nut, mango, pomelo, jackfruit, coconut, papaya, and numerous useful shrubs and herbs, gradually developing a complex agroforest. (Photo: Payong Srithong)



62. Durian (*Durio zibethinus*) forest gardens in West Kalimantan are thought to have their origins in seeds that were casually jettisoned from houses and field huts in swiddens. Farmers expanded on existing gardens and planted new ones in the early 1970s when access to distant markets suddenly made durian a valuable commodity. This is a similar agroforest in Maninjau, West Sumatra, Indonesia. (Photo: Genevieve Michon)

63. The resin producing (damar) agroforests of Krui, Sumatra, were established by relay planting *Shorea javanica* into swidden fields during the cropping phase (Michon et al., Chapter 45). The system probably evolved from traditional practices of tapping damar resin from *S. javanica* trees that grew naturally on forest lands and intensified into increasingly elaborate management regimes over the past century. Similar resin tapping systems are scattered across Southeast Asia: in northern Sumatra, *Styrax benzoin* and *S. paralleloneuron*; northern Lao P.D.R., *S. tonkinensis* (see color plate 64) and *S. benzoides*; southwestern China, *Pinus yunnanensis* and *Toxicodendron vernicifera*; and the southern Philippines, *Agathis philippinensis*. Krui, West Lampung, Sumatra, Indonesia. (Photo: Genevieve Michon)

64. Shifting cultivators in Nam Bak district of Luang Prabang, Lao P.D.R., manage *Styrax tonkinensis* as a useful fallow species to tap its *benzoin* resin (Fischer et al., Chapter 46). Indigenous to the area, the seeds of *S. tonkinensis* are scarified in the burning operation to clear swidden fields. It germinates together with crops of glutinous rice and, after a single year of cultivation, it is left to dominate the subsequent fallow succession. Tapping (shown) begins when the trees are six years old and can continue until they're 10 to 14 years of age. This traditional system is now under threat because of falling resin prices and shortening fallow periods.

65. The rubber (*Hevea brasiliensis*) agroforests of Sumatra and Kalimantan, Indonesia, known as "jungle rubber," are established by taungya planting rubber seedlings into swidden fields (shown). The subsequent fallow is thus dominated by rubber trees. Tapping may begin when the trees are about eight years old and continue until latex productivity declines between 20 and 30 years of age (Penot, Chapter 48). At this time, the rubber-enriched fallow is slashed and burned in preparation for another cycle. Although the origins of jungle rubber are in shifting cultivation, the farmers' main objective has shifted to the "fallow crop" and the arable cropping phase has become a means to achieve that end (Werner, Chapter 67). Muara Bungo, Jambi Province, Sumatra, Indonesia. (Photo: Hubert de Foresta)

66. This tea plantation in Shangyun township of Tengzhong county, Baoshan district, in China's Yunnan Province, is planted under an *Alnus nepalensis* canopy, because farmers widely recognize that the species has soil building properties (Guo et al., Chapter 29). This practice began as recently as 30 years ago when farmers observed that tea grown under *Alnus* had higher productivity and less insect damage. As a valuable by-product of the system, *Alnus* logs are used as firewood for processing tea, for construction of tea boxes, and as a substrate in culturing several kinds of mushrooms.

67. Chinese walnuts (*Juglans* sp.), such as this grove in Quingshui village, in Tengzhong county, Baoshan district, in Yunnan, have also been a major income earner in parts of southern China.

68. In recent years, improved roads and access to markets have allowed many shifting cultivators to produce more perishable cash crops, most notably semi-temperate fruits and vegetables. Many highland communities have prospered by exploiting their ecological niche and producing such crops for lowland markets. This plum (*Prunus* sp.) orchard was taungya planted into a dryland field in Songshupo village, also of Tengzhong county in Yunnan province.

conditions, they will optimize their limited labor by selecting for cultivation those parts of the farm that yield the highest output. Fujisaka and Cenas (1993) found, similarly, that farmers with parcels of flat or gently sloping land tended to focus their attention on them, neglecting their steeper hedgerow fields when labor and other inputs were limiting. One farmer commented that, even assuming that parcels of flat and sloping land were equal in terms of soil fertility, he would still choose to work the flat land because it was easier to till and there was less water stress. Therefore, if the ratio between land and labor is low, farmers may have no choice but to do something to improve the productive capacity of their farm. This is the case with farmers in the central Philippines province of Cebu who, with an average farm size of less than 1 ha, invest in labor-intensive activities to make their land more productive. These observations fit the intensification model propounded by Raintree and Warner (1986).

To better understand what prompts farmers to fallow their hedgerowed, alley farming fields, we also interviewed a group of farmers who continuously cultivated their pruned-tree alley farms without fallowing them. Unfortunately, they are now few in number, but they gave two prominent reasons for continuing to farm their hedgerow fields (see Table 33-8). One was that it was necessary to continuously cultivate in order to prevent stray animals from destroying the hedgerows, and the second was that farm size was very limited. The first issue, hedgerow destruction by stray animals, needs further investigation.

The average farm size of those farmers who claimed limited area as their reason for continuously cultivating their alley farm was 1.5 ha. This is one-fourth of the average farm size (5.36 ha) of those farmers who fallowed their alley farms. As well, the proportion of their total farm occupied by hedgerow fields was much higher. An average of 57% of their total farm area had been contoured with tree hedgerows. If these farmers were to abandon their alley fields, the average area left for cultivation would be only 0.65 ha, which is quite small for maize farming. They had much less flexibility to allow any of their farm land to be fallowed. These farmers were asked if they had noticed any decline in crop production. Eighty-three percent said they had, while the rest said they could not tell because they had applied large doses of fertilizer from the beginning. Fortunately, all of these farmers had resources sufficient to surmount the nutrient depletion problem. Implicit in the survey result is that alley farming, without external nutrient application, cannot sustain continuous cropping. But when the farm area is large, fallowing and shifting is perhaps more profitable than maintaining soil fertility by importing nutrients. Szott et al. (1991) are straightforward in their verdict on alley farming in the context of continuous cropping under acid, infertile soils: it is not sustainable without nutrient importation. The main reasons are native soil infertility and insufficient recycling of nutrients from the prunings.

Table 33-8. Reasons That Farmers Continued Cropping Their Alley Farms

Reason	*Number*	*%*
Prevent animals from destroying the hedgerows	4	36
Farm area is small; cannot afford to fallow	3	27
Has the financial resources to continuously crop; finds present area too small for his farming operations	1	9
Hedgerow field is easier to work; the slope is not as steep as the rest of the farm	1	9
Hedgerowed field is near the house	1	9
Prevents the spread of mulberry as a weedy species	1	9

Table 33-9. Productivity of Contour Hedgerowed Fields Compared to Fallowed Open Fields (tonnes/ha)*

Cropping	*Products*	*No Hedgerows*	*With Hedgerows*
First	Maize yield	2.29 b	3.41 a
	Woody biomass	—	29.68
Second	Maize yield	0.69 b	1.40 a
	Woody biomass	—	3.39
Third	Maize yield	0.41 a	0.65 a
	Woody biomass	—	0

Note: * In a row means with different letters are significantly different at LSD 0.05 = 0.59.

Productivity Assessment

The WH treatment produced two economic products: firewood from hedgerow biomass and maize grain. The NH treatment yielded maize alone. Total biomass yield from the WH treatment was therefore much higher than that from the NH treatment (Table 33-9). Maize yield was higher in the WH treatment than in the NH treatment for all three crops, although the difference was statistically significant only for the first two. The higher maize yield in the WH treatment is attributed to several factors. During the fallow period the biomass contribution from litterfall leads to a much higher deposition of organic matter in the WH treatment than in the NH. The shading cast by the trees may also have reduced the rate of oxidation of this organic matter, as a result of lower soil thermal conditions (Main unpubl). This may have allowed a greater accumulation of soil organic matter. The presence of trees in the system may also have improved soil fertility more effectively than the natural grass or *Chromolaena* fallows because of higher rates of N-fixation. Pruning applications during the cropping seasons may also have made significant nutrient contributions through the rapid recycling of the green manure biomass. The trees may also have, to some degree, tapped nutrients deeper in the subsoil during the long fallow period than could be reached by the weedy fallow plants in NH. Analysis of the soils data is awaited to confirm these possibilities. Comparative measurements of soil loss confirm that the tree hedgerows formed very distinct natural terraces that nearly eliminated any evidence of soil erosion. We also noted that the hedgerow vegetation was attractive as natural latrines for people working in the field, possibly causing some gain in nutrients over the years from this source.

The woody biomass yield was a substantial 30 tonnes/ha when the fields with hedgerows were opened up for the first cropping (Table 33-9). This was the accumulated biomass from four years' fallow. The harvest of wood at the beginning of the second cropping was reduced to one-tenth of the initial amount. It was the accumulation from one dry season of only a few months between the first cropping and the second. There was no fallow break between the second and third crops, so virtually no woody biomass was available at the beginning of the third crop.

Profitability Assessment

Table 33-10 compares the costs and returns for maize production in the WH and NH treatments. Maize production costs were slightly higher for the WH treatment, due mainly to higher harvesting and processing costs because of a higher yield. The costs and returns of the firewood production from the hedgerows are not considered in this analysis. The sales of maize from the WH treatment were considerably higher than for the NH in each of the three crops. This resulted in a profit margin for WH that was 68% higher from the first crop. Yields declined in both treatments, but were lower in NH. This resulted in negative returns for NH in both the second crop, minus US$38/ha, and the third crop, minus US$49/ha. Profit margins remained positive in WH, but declined to very modest levels of US$179/ha and US$20/ha for the second and third crops, respectively. Therefore, the hedgerow fallow treatment dramatically increased profitability in the first crop after opening up the land and enabled a modest profitability to continue for one or two more crops. By comparison, four years of natural fallowing under *Chromolaena* and grass was able to ameliorate soil fertility only enough to permit a single profitable maize crop. This suggests that natural fallowing on these soils would require a longer period than just four years to enable cropping to be sustained beyond a single season.

Firewood collection costs, and the value of firewood sales, were omitted from the above analysis. Firewood from the hedgerow species was found to be difficult to market in Claveria. According to retailers, household consumers prefer firewood over coffee or *ulayan*, a local tree. These woods are believed to have a greater heating capacity and ability to make good charcoal than the usual tree species from hedgerow strips. Bakeries, on the other hand, are more concerned with volume than firewood quality. They have recently tapped cheaper sources of firewood from small sawmills that are proliferating along the highways of Misamis Oriental and offering the offcuts from milling *Paraserianthes falcataria*. Sawmill firewood costs 1997US$0.19 for a bundle 143 by 305 cm. A conventional bundle harvested locally in Claveria is 15 by 73 cm and sells for between 1997US$0.04 and $0.05. Therefore, firewood coming from the sawmills is cheaper since their bundles are seven times larger for less than five times the price. In addition, firewood from the sawmills is delivered in bulk with free transport. They are able to sell it cheaply because it is a waste product of their operations.

The economic advantage of growing firewood in farm hedgerows may be minimal when the farm is near the forest or other woodlots. However, we conducted interviews in an area where access to firewood was difficult. We wanted to determine how long it took to collect firewood, the number of bundles collected per collection event, the number of bundles consumed per week, and the time needed to split and pile it. This data was used to compute the volume of consumption and the labor costs. Based on our survey, farmers who do not have their own on-farm source of firewood nevertheless do not buy firewood. Therefore, in Claveria, it is more practical to consider the production of firewood as a source of savings in labor in areas where firewood is not readily available, rather than to consider it as a source of earnings. Savings in the sourcing of firewood contributes to socioeconomic well-being.

Table 33-10. Costs and Returns of Maize Production: Contour Hedgerow Fallow System vs. Open Field Fallow System, after Four Years of Fallow (1997US$/ha)

	First Crop		*Second Crop*		*Third Crop*	
	NH	*WH*	*NH*	*WH*	*NH*	*WH*
Costs						
Maize	277	331	246	242	172	176
Firewood	43	221	43	29	43	-
Total	320	552	280	271	215	176
Sales	687	1022	208	421	123	196
Net profit	367	470	(81)*	150	(92)*	20

Note: Values in parentheses indicate net loss. NH = No Hedgerows; WH = With Hedgerows.

The amount of firewood produced in the first two crops is estimated to provide an assured supply for three years. The amount of cumulative labor saved is substantial, but the cost of processing firewood in newly opened fields is quite high, involving 43 man-days. The high labor investment in cutting and processing the wood obtained in a tree fallow, and the difficulty in marketing it in communities such as Claveria, raises the question of whether there is sufficient incentive for farmers to process and produce firewood. This is time that might be used for other income-generating enterprises. Secondly, can the farmer store large volumes of firewood practicably, for example, 12,000 bundles from a hectare of hedgerows? It may be argued that it is more practicable and useful to burn the bulk of the woody biomass and plow the ash into the soil to improve crop productivity.

Conclusions

Our data indicate that hedgerow fallows have the potential to offer greater system benefits than traditional fallows. However, only one-third of the farmers interviewed in Claveria used hedgerow fallowing as a conscious strategy in managing their farms. Many fallowed their land when yields declined and the returns to their labor in maintaining the hedgerow fields was no longer as remunerative as other uses of their time. The high labor investment required to open fallowed hedgerow fields is a constraint in bringing these fields back into cultivation. Our results showed that the yields and profitability of maize were substantially higher in hedgerow fields after fallowing than in fields following natural fallows. However, in both cases yields declined sharply after the first crop, and returns were negative or near zero by the third season. This indicates that although hedgerowed fields, after four years of fallow, offer distinct advantages over natural fallows of the same duration, the former system does not enable dramatically longer periods of sustained cropping.

This study suggests that farmers are likely to be attracted to this farming system when their farm enterprise has the following characteristics:

- If the farm labor force is relatively low in relation to the total farm area. A low labor-to-land ratio indicates that there is adequate area to practice fallowing. If the farm is too small, fallowing is not practicable. Likewise, if the farm is quite large, the farmer may fallow and open more land each year rather than invest in hedgerow technology to increase returns per hectare.
- If the farm has both relatively flat land and sloping land, the farmer has the option to choose which parcel will yield the highest returns to investment. Sloping fields with hedgerows may be fallowed and farmed less intensively than the flatter fields.
- If the farmer owns the land or the land tenure is otherwise secure. This is a prerequisite for investments such as contour hedgerows.
- If the farmer is unable to buy mineral fertilizers because the farm is remote or he lacks cash. In such cases, the only practical way to restore fertility is through fallowing.
- If the farmer lacks a draft animal. In the absence of animal draft power, *Imperata cylindrica* and other grass weeds are extremely difficult to control. The shading of weeds by the tree hedgerows tends to suppress them during the fallow period, making it easier to open the land at the start of cropping. Farmers practicing manual cultivation also usually have lower returns to labor for land preparation. They would be more likely to find hedgerow fallowing attractive than would farmers with access to a draft animal.
- If the farmer is able to prevent fires, which are an ever-present threat in grassland areas. Fires can damage or destroy tree hedgerow systems. The risk of fire must be low or the heavy labor investment in establishing and maintaining a hedgerow system may not be worthwhile.

Our work indicates that there are yield and profit advantages to be gained from fallowing tree hedgerows on sloping lands. It may therefore be an attractive practice for some upland farmers. However, this recommendation is clearly restricted to farmers whose enterprise meets the conditions listed above. This suggests that the practice is probably not suitable for many upland farmers. Prior to this study, there had been little or no research on the practice of fallowing hedgerowed fields. Further work is needed to validate our findings in other environments, where the practice may be considered suitable for recommendation.

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