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Land Tenure and the Potential for the Adoption of Alley Farming in West Africa

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Alley farming was developed as a means of maintaining soil fertility in fields under permanent cultivation in Africa, as population pressure makes the traditional practice of slash-and-burn combined with fallowing unsustainable. It is an agroforestry system under which food crops are grown in alleys formed by hedgerows of leguminous trees and shrubs. Studies have shown that it works, but farmers are only taking it up very slowly. Recent work suggests that land tenure might be a factor in the spread of alley cropping.

In humid West Africa, soils are low in organic matter content, fragile and easily degraded when the vegetation cover is lost. This has become a serious problem with the advent of agricultural intensification, made necessary by the exponential growth of the human population and the need for more agricultural land. The period of fallow, which restores natural fertility under the traditional bush fallow slash-and-burn system, has drastically decreased, and so declining soil fertility, increased erosion and reduced crop yields have become major problems for agricultural development.

Alley cropping was developed by the International Institute of Tropical Agriculture (IITA) as a technology to solve these problems. It is an agroforestry system in which food crops are grown in alleys formed by hedgerows of leguminous trees and shrubs. The hedgerows are periodically pruned and the prunings are applied as a mulch to improve soil fertility, control erosion and increase crop yields. Thus, alley cropping may eliminate or at least drastically reduce the need for long fallow periods to restore natural fertility (Kang et al., 1990).

Although crops overwhelmingly dominate the farming system in humid West Africa, livestock, particularly small ruminants, are an integral component of the system accounting for 10-20% of farm income. The poor quality and inadequate quantity of feeds, especially during the long dry season, is one of the major constraints to small ruminant production. To overcome this problem, the International Livestock Centre for Africa (ILCA) has developed methods of using leguminous trees as a source of protein-

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rich feed for animals. A portion of the tree foliage from alley-cropped fields may be fed to animals rather than being laid on the ground as a mulch. Such a system is called alley farming. The system may be modified to produce only trees, using narrower rows, or to form intensive feed gardens for animals, using tree-grass combinations (Kang *et al.*, 1990).

Following on-station research, both IITA and ILCA have tested these technologies on farms in southern Nigeria. Both on-station and on-farm studies have shown that alley cropping is more profitable than conventional bush-fallow cropping (see, for example, Ngambeki, 1985; Sumberg *et al.*, 1987; Ashraf, 1990; Ehui *et al.*, 1990). However, the rate of adoption of the technology is still very low. There may be several reasons for this, including the absence of appropriate land tenure systems. Tangible benefits from growing trees in alley farms become available after 1-2 years, and once they are established, the trees may continue to provide useful yields for at least 8-10 years. If the potential benefits of the technology can be clearly seen by the user, the incentive for adoption will be higher. Derivation of long-term benefits will however require long-term secure access to land.

ILCA's on-farm monitoring records show that in and around the on-farm study areas in southern Nigeria, 248 farmers planted 294 alley plots between 1984 and 1991, but alley cropping was discontinued on 104 plots. Farmers gave a variety of reasons for discontinuation, mainly related to technical problems of tree establishment and management (Table 1). Information about land tenure was not recorded, however.

Table 1 Reasons given for the discontinuation of alley farming on fields on southern Nigeria.

Reasons for discontinuation	% discontinued alley fields
1. Poor establishment/poor growth due to poor soil/shading by trees or crops	24.0
2. Weedy plot/weeded out/purposely destroyed/ poor handling/poor management	26.0
3. Farmer moved/died/left village/old age/ sick	23.1
4. Lost interest/lack of interest	7.7
5. Land used for building or other purposes	3.8
6. 1 and 2 above	12.5
7. 2 and 4 above	2.9
Total	100.0
(N)	(104)

Source: Unpublished record, ILCA

Records were also available for 141 alley plots, of which 91 (64.5%) were cultivated by the same farmer from the time of planting until 1991, and 50 (35.5%) were taken over by a different farmer some time after planting. Alley farming was discontinued in about the

same proportion of plots under both categories (Table 2). However, information on the conditions under which the plots changed hands was not available. For example it was not known whether the plots changed hands due to purchase, lease, division within the family for inheritance, or other reasons. So no relationship between land tenure and the discontinuation of alley farming could be established.

Table 2 Changes in land control and the status of alley farming.

Land control in 1991 compared to planting	Number of plots	% fields in 1991	
		With alley farming	Without alley farming
Same farmer	91	78	22
Different farmer	50	74	26
Total	141	77	23

Source: Unpublished record, ILCA

Francis (1987) reported that land tenure systems in southeastern Nigeria were different from those in the southwest of the country and that these had implications for the adoption of alley farming. In the southwestern on-farm research site, most farmers had a long-term, individual, heritable right to use the land. Though they might not always have individual ownership, the arrangements were not unfavourable for adoption of a technology like alley farming. In the southeastern research site, land fell into three categories; land in the compound, near fields and distant fields. While compound land is controlled and used by the individual household, the use of near and distant fields are to a varying degree controlled by the extended family and influenced by community-level decisions. Because these lands are reallocated for use after every fallow cycle, the same person or family may not get the same plot every time. There may therefore be little incentive to start alley farming on these fields.

Given this background, it was felt that the study of land tenure should be extended beyond southern Nigeria to cover the forest and savanna zones of Cameroon, Nigeria and Togo, in order to get a representative picture of the potential for alley farming in West Africa. The objective of this project was to determine whether the areas in which alley farming had been tested were representative and to clarify what types of land tenure were favourable for alley farming.

Methodology

The relationship between land tenure status and the potential for adoption of alley farming was studied by examining three sets of issues. First, the general land tenure characteristics in the study areas were studied in order to predict, on a *a priori* theoretical

basis, whether the existing land tenure systems were congenial for alley farming. For example, widespread private ownership would be a favourable condition for adopting alley farming because it provides long-term security.

Second, current tree and land management practices were studied. In West Africa, land and tree tenure are often separated, particularly in the case of commercial trees such as oil palm and cocoa, and management practices may vary accordingly. Since examples of alley farming are not widespread in West Africa, land and tree management under these commercial systems were examined in order to predict, again on an a priori theoretical basis, whether the practices related to different land tenure systems were congenial for alley farming.

Third, an empirical study of the land tenure status of alley-cropped and non-alley-cropped farms and of maintained and discontinued alley farms was conducted in Nigeria. A good number of alley farms were established by IITA and ILCA under their on-farm research programme in the forest and savanna regions of Nigeria. Some farmers also voluntarily established alley farms after observing the ILCA/IITA farms. The National Livestock Projects Division, a Nigerian Federal Agency for dissemination of livestock technologies, also adopted alley farming and established alley farms in several states in southern Nigeria. In each case, some alley farmers discontinued alley farming at some stage, while others continued to practice it. This study was limited in scope because data on alley farming are not available in Togo and Cameroon, and even in Nigeria most farmers established only one alley plot, so the tenure status of that particular plot might not be representative of the farm as a whole.

A pilot survey was conducted with samples drawn from forest and savanna zones in Nigeria and Cameroon and from maritime (savanna) and plateau (forest) zones in Togo. The objective was to sharpen the research questions and see their suitability and relevance. Then a detailed survey was conducted which included 240,146 and 400 households, respectively, in Nigeria, Cameroon and Togo. The Nigerian sample included 133 alley farming adopters and 107 non-adopters. Among alley farming adopters, 84 had functional alley farms at the time of the survey and 49 had discontinued alley farming. Data were collected through single-visit interviews using a questionnaire (for *a more detailed description of the methodology used in each country*, see Fabiyi *et al.*, 1991; Foli *et al.*, 1991; Lawry and Stienbarger, 1991; Tonye *et al.*, 1991).

Results and discussion

General characteristics of land tenure

Tenure systems in the study areas generally treat land and trees as separate entities. Individual members of households often farm discrete parcels of land but control over the allocation of land parcels ordinarily rests in the hands of a larger corporate group or its representative, usually based on lineage. This may be of matrilineal, patrilineal or double-descent types. Women are rarely allocators of land rights; even their right to use

land generally comes through men, either from a husband as a part of his holdings or from other male family members. Group rights to and control over land allocation rarely belong to groups larger than the village, where descent is direct and demonstrable. At a lower level, the head of a family, be it extended or nuclear, allocates land-use rights to members of his immediate family who will actually work the land. The rights to allocate pasture may reside at a higher level than that for farmland (Stienbarger, 1990; Lawry and Stienbarger, 1991).

With population pressure increasing, the amount of land under higher level lineage control is diminishing and land is being loaned, pledged, rented and sold, although such transactions may not have the sanction of law. Farmers using land under a temporary arrangement are prohibited from making long-term investments such as planting trees. Under the system of fallow rotation practiced in West Africa, a land user may not get access to the same plot of land at the end of each rotation. Even if an individual is accorded long-term use rights for farming, the land often reverts to communal grazing after the crop is harvested.

Fields owned or used by the sample households were found to fall into four tenure categories: (1) purchased or received as a gift, (2) divided inheritance, (3) undivided inheritance and (4) secondary access. Land held under divided inheritance means that land is divided among the heirs, giving each full control over their own parcel of land. Land held under undivided inheritance means that land passes to heirs collectively, with the result that no one person has absolute control over any part of the land. Secondary access generally implies that land is obtained through a rental agreement, pledge or loan.

The land area under each tenure system could not be measured. Assuming that the number of fields under the control of each household was proportionate to the land area, the relative importance of each system was estimated (Table 3). In all three countries, purchases and gifts accounted for a tiny share of the fields, indicating a poorly developed land market. Only purchased and divided inheritance land provides the long-term security that is required for alley farming. In Cameroon and Nigeria, 66 and 54% of fields came under these categories, providing good opportunities for alley farming. In Togo, only 36% of fields were under these categories, with 31% under secondary access and 33% under undivided inheritance. Therefore, two-thirds of the land area in Togo was under tenure that is unfavourable for alley farming.

Table 3 Distribution of sample fields according to tenure status in Nigeria, Cameroon and Togo.

Tenure status	% fields by country			
	Nigeria	Cameroon	Togo	All
Purchased/gift	5.7	10.0	11.1	9.4
Divided inheritance	48.6	56.0	25.2	37.3
Undivided inheritance	33.8	33.6	32.8	33.2
Secondary access	11.9	0.4	30.9	20.1
Total	100.0	100.0	100.0	100.0
(N)	654.0	411.0	1240.0	2305.0

Ch0-Square = 296.11, d.f. = 6, P= 0.000.

Land and tree management practices

Rights over trees may be held separately from rights over the land they grow on, and may depend on whether the trees were planted or self-sown, who planted and owns them (the state, a group, an individual, male or female), what species they are, what spatial planting arrangements are used, how they are used (subsistence or commercial), the form in which they are used (gathered, cut, harvested or standing), how they are disposed of (destroyed, lent, leased, pledged, sold or given away) and under what tenure system the land is held (inherited, purchased, rented, pledged, sharecropped or leased). When all these aspects are combined, some tree tenure rights will appear to be partial and overlapping, thus creating problems for long-term investment in tree planting (Stienbarger, 1990).

In order to study current land and tree management practices as they relate to the tenure status of the land, six characteristics were compared: location of the field, soil fertility, fallowing frequency, use of external inputs such as chemical fertilizers, incidence of tree planting, and incidence of commercial and fruit trees. The results are summarized in Table 4. In general, compared to purchased and divided inheritance fields, fields under undivided inheritance and secondary access were located far from the household, were of poorer fertility, were fallowed less frequently, were fertilized/mulched at a lower rate, were less frequently planted with new trees, and had fewer fruit and other commercial

Table 4. Land and tree management practices by tenure status in Nigeria, Togo and Cameroon.

Management practices	Purchased/divided inheritance	Undivided inheritance	Secondary access
Distance from household	Close	Far	Very far
Soil fertility	Good	Moderate	Poor
Fallowing	Frequent	Less frequent	Less frequent
Input use	High	Medium	Low
Incidence of tree planting	High	Medium	Low
Incidence of commercial/fruit trees	High	Medium	Low

trees. These characteristics confirm Francis's (1987) earlier finding from southeastern Nigeria that more distant farms are likely to be jointly controlled, leading to poor management of the soil.

The results also showed that purchased and divided inheritance fields are well managed and planted with trees. Therefore, land under such tenure would be congenial for the adoption of alley farming, and in Nigeria and Cameroon, this applies to a significant proportion of the land. Land under secondary access and undivided inheritance would also benefit from alley farming to improve soil fertility, but such land provides the

poorest long-term security and incentive for planting trees as indicated by current practices. In Nigeria, Cameroon and Togo respectively, 45, 34 and 62% of the land comes under these unfavourable categories.

Tenure status of alley, non-alley and ex-alley farms

Because alley farms were available only in Nigeria, the results of this section are directly relevant only for that country, though general lessons may be drawn. Three levels of comparisons were made to establish the relationship between land tenure and the adoption of alley farming. First, the tenure status of all fields of farms who adopted alley farming and those who did not were compared. It was found that adopters had a significantly higher proportion of their fields under more secure tenure than non-adopters (Table 5). Second, the tenure status of alley and non-alley fields of adopters were compared and no significant differences were observed, indicating that adopters were indifferent to the tenure status of the field in which they planted alley trees.

Table 5. Tenure status of fields of farms adopting and not adopting alley farming in southern Nigeria.

Tenure status	Adopters (%)	Non-adopters (%)	Total (%)
Purchased/gift	4.9	6.5	5.7
Divided inheritance	54.2	42.4	48.6
Undivided inheritance	32.5	35.3	33.8
Secondary access	8.4	15.8	11.9
Total	100.0	100.0	100.0
(N)	345.0	309.0	654.0

Chi-Square = 13.333, d.f. = 3, $P = 0.004$

Third, the tenure status of functional alley fields was compared with those fields where alley farming had been discontinued. Functional alley fields were significantly more likely to be under secure tenure (Table 6) than fields where it was discontinued.

Table 6. Land tenure status of functional and discontinued alley fields in southern Nigeria.

Tenure status	Functional (%)	Discontinued (%)	Total (%)
Purchased /gift	8.3	4.1	6.8
Divided inheritance	67.9	30.6	54.1
Undivided inheritance	14.3	57.1	30.1
Secondary access	9.5	8.2	9.0
Total	100.0	100.0	100.0
(N)	84.0	49.0	133.0

Chi-Square = 27.72, d.f. = 3, $P = 0.000$

From the foregoing it would appear that security of land tenure has a positive relationship with the initial adoption and continuation of alley farming. Although some discontinuation might have been influenced by technical problems, it is likely that unfavourable land tenure also played a significant part. It is possible that less attention was given to alley farms under less secure tenure, leading to their poor performance and discontinuation.

Conclusion

The study showed that in Nigeria, Cameroon and Togo 66, 54 and 36% of the land was under a tenure system that provided long-term security, and was therefore favourable for alley farming. In Nigeria, the adoption and maintenance of alley farming was associated with security of tenure. These results indicate that land tenure plays a significant role in the adoption, continuation and discontinuation of alley farming. The adoption of any technology progresses over time from more favourable to less favourable situations. Since a significant proportion of the land in each country was under a favourable tenure system, land tenure is not likely to be a major constraint to the adoption of alley cropping yet.

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