Alley Farming in the Humid and Subhumid Tropics

Proceedings of an international workshop held at Ibadan, Nigeria, 10–14 March 1986
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Alley Farming in the Humid and Subhumid Tropics

Proceedings of an international workshop held at Ibadan, Nigeria, 10–14 March 1986

Editors: B.T. Kang and L. Reynolds

Jointly organized by the International Institute of Tropical Agriculture, Ibadan, Nigeria, and the International Livestock Centre for Africa, Addis Ababa, Ethiopia

Supported by the International Development Research Centre, Ottawa, Ont., Canada, and the United States Agency for International Development, Washington, DC, USA

/Cultivation systems/, /agricultural production/, /humid zone/, /tropical zone/, /Africa/ — /agricultural productivity/, /Leguminosae/, /soil fertility/, /agroforestry/, /on-farm research/, /nitrogen fixation/, /intercropping/, /forage/, /conference reports/, /recommendations/, /lists of participants/.


Technical editor: W.M. Carman

A microfiche edition is available.

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Abstract / Résumé / Resumen

Abstract — An urgent challenge facing scientists working on upland food-crop production in many parts of the humid and subhumid tropics is the need to find viable, sustainable, and environmentally sound alternatives to the ancient shifting cultivation and bush-fallow, slash-and-burn cultivation systems. As a food-cropping and livestock-production technology, alley farming requires a low level of inputs and helps conserve soil resources while sustaining long-term farm productivity. This publication presents the results of an international workshop on alley farming in the humid and subhumid tropics. Held in Ibadan, Nigeria, 10–14 March 1986, the workshop was attended by 100 participants from 21 countries. The theme of this workshop was the development of more productive, sustainable farming methods with low inputs in the humid and subhumid tropics using alley farming techniques. This book reviews the present state of alley farming research and its application, discusses the use of woody species in tropical farming systems, highlights training and research needs, and proposes the establishment of channels for collaborative research.

Résumé — Les scientifiques s'intéressant aux cultures vivrières en zones d'altitude dans de nombreuses régions des tropiques humides et sub-humides doivent répondre à un besoin urgent : trouver des solutions de rechange viables, soutenables et environnementalement saines aux anciennes méthodes de rotation des cultures et mise en jachère et de culture sur brûlis. A titre de technique de culture et d'élevage, l'agriculture en couloirs ne nécessite que peu d'intrants et contribue à conserver les sols, tout en favorisant la productivité agricole à long terme. Cette publication présente les résultats d'un atelier international sur l'agriculture en couloirs dans les tropiques humides et sub-humides qui s'est tenu à Ibadan, au Nigéria, du 10 au 14 mars 1986 et qui a réuni 100 participants de 21 pays. L'atelier portait sur la mise au point de méthodes culturales plus productives et plus durables ne nécessitant que peu d'intrants pour les régions des tropiques humides et sub-humides, grâce aux techniques de l'agriculture en couloirs. Le livre fait le point sur la recherche actuelle en matière d'agriculture en couloirs et ses applications, discute de l'utilisation des arbres dans les systèmes agricoles en milieu tropical, met en lumière les besoins en matière de formation et de recherche et propose l'établissement de canaux aux fins de la recherche en collaboration.

Resumen — Un reto urgente al que se enfrentan los científicos que realizan investigaciones sobre la explotación de cultivos de montaña en muchas zonas húmedas y subhúmedas de los trópicos, es la necesidad de encontrar alternativas viables, sustentables y correctas desde el punto de vista del medio ambiente, al antiguo método de cultivos migratorios y a los sistemas de cultivo en barbecho y de corte y quema. Como tecnología utilizada para cultivos alimentarios y la producción ganadera, la agricultura de pasillo o entresurcos necesita pocos medios y ayuda a conservar los recursos del suelo en tanto mantiene la productividad agrícola a largo plazo. Esta publicación presenta los resultados de un grupo de trabajo internacional sobre agricultura de pasillo o entresurco en las zonas húmedas y subhúmedas de los trópicos, celebrado en Ibadán, Nigeria, del 10 al 14 de marzo de 1986, y al que asistieron 100 participantes de 21 países. El tema de este grupo de trabajo fue el desarrollo de métodos de cultivo más productivos y sostenidos con pocos recursos en las zonas húmedas y subhúmedas de los trópicos, utilizando técnicas de agricultura de pasillo o entresurco. Este libro revisa la situación actual de la investigación sobre la agricultura de pasillo o de entresurco y su aplicación, discute el uso de especies maderables en sistemas de cultivo tropicales, subraya la necesidad de realizar investigaciones y dar cursos de capacitación y propone la creación de canales para la investigación conjunta.
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Collaboration in alley farming research

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Abstract — Alley farming affords the opportunity for agronomists, animal scientists, socioeconomists, and foresters to collaborate to improve the livelihood of farmers of Africa. The history of alley farming and alley cropping is discussed. Concepts of networking for Africa are presented.

Introduction

This workshop is an attempt to examine and focus on an overall strategy for alley farming as one important component of agroforestry — how to improve the amount of land under continuous production for food crops and maintain soil fertility. Alley cropping is observed to be a viable alternative where bush-fallow and slash-and-burn agriculture is being practiced.

Some researchers report that the biomass produced by widely spaced trees pruned periodically may be too low to really add significant amounts of organic matter. However, Kang et al. (1984) found, over a 3-year period in Ibadan, that the annual yield of Leucaena prunings averaged 6.7 t/ha of dry matter. This is considerably less than what the production of solid forestry plantings might be. However, when the residues of the interplanted food crops in alley farm are added to the Leucaena, a considerable sum of organic matter is being returned to the soil. For example, the harvest index of tropical maize is generally 1:2; that is, one part of grain to two parts of stalk, leaves, and roots. So, if a grain yield of 1 t is obtained, 2 t of residues remain for soil building.

Long-term trials on maize at the International Institute of Tropical Agriculture (IITA) indicate that, with good management, an annual yield of 3–6 t/ha of grain is possible. In some areas, considerable organic matter is being returned to the soil, where about 6 t/ha of Leucaena prunings as well as 6–12 t/ha of maize residues are being added yearly. Hybrid maize may increase this total and the residues of a second-season cowpea crop could add approximately 1 t of high-nitrogen residues.

History

Alley farming trials began at IITA shortly after the Institute’s research program began. A yam-Leucaena staking experiment was conducted in 1973; in 1975-76, several trials were established that still exist today. Early trials used the legume
species, *Leucaena leucocephala*. *Gliricidia sepium* was introduced in 1977 and, more recently, *Flemingia congesta*. Nonleguminous species in experimental plots at IITA headquarters are *Alchornea cordifolia*, *Acioa barterii*, and *Gmelina arborea*. Many of these same species are being used in studies at Onne, the substation near Port Harcourt in southeastern Nigeria. This location has acid Ultisols (pH 4.5); therefore, responses are different from those at trials on the Alfisols of Ibadan (pH 5.6).

In 1979, B.T. Kang established an observational nursery at IITA, Ibadan, and Onne. The nursery included 34 legume and nonlegume forestry species and varieties. Since 1980, 30 on-farm alley farming trials have been established by IITA; many more were started in 1981 by the International Livestock Centre for Africa (ILCA). Most of the ILCA trials also involve feeding studies for small ruminants.

**Training**

IITA and ILCA are, at present, offering 3-week training courses on alley farming in Ibadan. Three 1-week training courses have been carried out in collaboration with the Food and Agricultural Organization and the Federal Department of Forestry in Nigeria. IITA and ILCA have also offered technical training courses.

**Collaborative research**

A collaborative research network for alley farming should include on-station and on-farm component research experiments. Perhaps more emphasis should now be placed on on-farm research. This will not be easy in Africa and, therefore, considerable attention and training must be devoted to methodology during the early years.

One method that might be adapted for alley cropping was formulated by the Asian Cropping Systems Working Group in collaboration with the International Rice Research Institute (IRRI). It aims for a manageable research process that is particularly suited for small farms and that treats agricultural research as dependent on site. The research activities, therefore, focus on the description and classification of the environment, on the design of improved cropping systems, on the testing of these systems on individual farms, and on formulating production programs.

This model was originally designed for cropping systems but could easily be adapted for alley farming. The following paragraphs describe the phases of on-farm research in this model.

**Site selection**

One or more geographical areas representative of a large, homogenous production zone are selected. The areas should be earmarked for development by the national government. In this way, support for production programs will be given when the potential for production increases has been demonstrated.
Site description

When researching cropping patterns, the first activity is to describe existing patterns, the physical environment, constraints to production, and the socioeconomic environment. The characteristics of the farm environment will decide research priorities at the site and supporting research stations. At this time, the area is also divided into different land types, each of which may require a different production recommendation.

Cropping-pattern design

Designing cropping patterns includes designing alternative patterns that are well adapted to the area: patterns that consider physical and socioeconomic characteristics, the performance of cropping patterns, and the available technology for the crops in the pattern. There are numerous practices that must be specified for all crops in each pattern. Many can be specified on the basis of existing knowledge and local methods. Others warrant separate experiments to establish optimal input levels. This component-technology research may be conducted in national, regional, or other experiment stations, or at the cropping research site.

Testing cropping patterns

The designed cropping patterns and selected management components must be tested in their respective environments in farmers' fields. Farmers participate in the testing by managing the patterns with frequent advice and constant monitoring from research staff. Based on the agronomic and economic performance of these cropping patterns, problems that would limit intensification of production can be identified and fed back to discipline- or commodity-oriented researchers. This scheme helps orient the research to solve the specific problems of the target farmers.

Applied research

The most profitable cropping pattern from the testing phase should be evaluated in many sites within the environmental complex for which they were designed. In this phase, the researchers should include other institutions responsible for formulating and implementing production programs.

Production program

As soon as promising cropping patterns are identified and their management is specified, a production program can be started by extension institutions. The research team should be involved in formulating the program and training the extension workers who will be involved.
Networking

Perhaps "networking" is a buzzword of the 1980s; however, many agricultural-development leaders believe networking to be one of the most viable ways to transfer improved technology to national programs or institutions. A recent survey in sub-Saharan Africa indicated that 24 networks were being conducted by French government agencies and that 27 others existed among international agricultural research centres (IARCs), regional programs, and national programs (R.W. Cummings, personal communication, 1986). There are three types of networks:

- **Information-exchange networks** organize and facilitate exchange of ideas, methodologies, and results of current research.

- **Scientific-consultation networks** involve a country-by-country focus on important common research areas. These projects are initiated and implemented independently by the participating institutions that meet regularly and provide other means to exchange information on research (as in information-exchange networks).

- **Collaborative-research networks** involve joint, intercountry planning, implementing, and monitoring of research on problems of mutual concern to countries within a region. These networks could include information exchange, technical collaboration, and training.

There are 18, 14, and 19 information-exchange, scientific-consultation, and collaborative-research networks in Africa, respectively. Numerous donors are involved and several donors often jointly support the same network. At least seven of the CGIAR-supported international research centres are represented.

IITA participates in the following networks and sends out additional specific germ-plasm nurseries on country requests:

- **Semi-Arid Food Grain Research and Development Project (SAFGRAD)** (maize and cowpea): 26 semi-arid African countries.


- **African Biological Control Programme (ABCP).**

- **International Rice Testing Programme (IRTP) — Africa**: cooperation with IRRI and the West African Rice Development Association (WARDA).

- **West African Regional Cooperative for Research on Plantains (WARCORP).**

- **West African Farming Systems Research Network (WAFSRN).**

Collaborative research is also needed for root and tuber crops in East, Central, and Southern Africa; cowpeas in the sub-Saharan areas; *Striga* spp. and *Imperata cylindrica*, which are two devastating weeds of Africa; and alley farming.

Successful networks use the bottom-up approach; i.e., the national program defines objectives and needs and the IARC provides training, coordination, facilities, germ plasm, and back-up research. Networks can be simple and narrowly
defined or broad based. An example of a broad-based network is SAFGRAD. It deals with the improvement of several crops and involves several national and international institutions.

To succeed, a network needs common objectives, agreed upon by all parties, and a full-time coordinator. The coordinator, who must be a knowledgeable and respected scientist, is usually the key to a network's success and must motivate and plan. Ideally, the coordinator should have no other duties and assignments. A network requires annual workshops or planning meetings during which its progress is reviewed, objectives redefined, methodology discussed, and duties assigned by country and coordinator. Other requirements for a viable network are monitoring tours, back-up research, and training.

One network in which IITA is involved is WARCORP. Dr George Wilson of the Farming Systems Programme spends about 80% of his time as the coordinator of WARCORP. The cooperative aims of WARCORP are to improve plantain production by:

- creating an awareness of the importance of plantains;
- strengthening national research capabilities;
- coordinating research to reduce repetition and duplication;
- rapidly disseminating findings and recommendations;
- training research, extension, and production personnel; and
- encouraging national and international support for research and development.

Decisions on experiments are made at WARCORP's annual meetings, usually held in December. The experiments are chosen based on the priorities of the region or country; the cooperative's priorities; the interest and specialization of the scientist; and the funds available. At the meetings, which rotate among countries and research institutions, scientists report not only on research supported by WARCORP but also on related work supported by their institutions and other sources. (For more information, consult IITA Research Briefs, 6(1), March 1985.)

Research needs

Management studies must involve the systems approach, not only of the food crops but also of the alley crop species. How can the aboveground and below-ground competition be reduced? What are the various trade-offs between crop yields, economic returns, and environmental conservation? What are the on-farm constraints to alley farming? Planting trees is alien to a farmer in the humid or subhumid areas. They have cut and burned trees all their lives — never planted them. Alley farming is a technology that will require more education than other improved technologies. There are also social challenges, such as land tenure, that must be recognized.

ILCA (1985) has reported promising results from browsing and cut-and-carry systems that use the alley farming system. However, much more research is needed. The Technical Advisory Committee recommended to CGIAR, in its 1985 priorities for international agricultural research, that the present allocation for
resource management and conservation research be increased from 7 to 16% (Swaminathan 1986). Alley farming certainly merits inclusion in such new funding endeavours: it not only seeks to better manage a farmer’s resources for higher productivity but also tries to conserve the farm for future generations. The old saying of “one should live today as if it were the last, but a farmer should farm as if it were forever” is true.

IITA and ILCA seek to be catalysts in imparting greater relevance to the research priorities and strategies of national and regional institutions. Both institutions can more easily identify and solve the knowledge gaps of alley farming through the power of cooperation. What will be the on-farm constraints in different agroecological areas? If each cooperating institution can study a piece of the puzzle, then the final solution will be accelerated. Alley farming must not only make practical sense but also economic cents for the farmer.

References

