

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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Editors: B.T. Kang and L. Reynolds



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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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Alley cropping in Cameroon

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Abstract—The Cameroon Institute of Agronomic Research introduced alley cropping to lowland farmers of the high-rainfall forest zone in 1984. Preliminary results from the on-station trials show differences in growth rates between *Leucaena* species and cultivars.

Introduction

Crop production and agricultural productivity in the lowland, high rainfall forest zone of Cameroon are hampered by land-preparation difficulties, low soil fertility, and the high cost of fertilizers. To improve the crop yields of lowland farms, alley cropping was introduced in 1984 within the Farming Systems Programme of the Cameroon Institute of Agronomic Research. In the alley cropping target area, small farmers still practice slash-and-burn agriculture and mixed cropping (Atayi and Ndjeunga 1985). In this system, short cropping periods alternate with long fallow periods to restore soil fertility. During the fallow period, plant cover protects the soil from erosion, improves soil fertility, and reduces soil temperature and weed infestation (Nye and Greenland 1965).

Because farmers cannot afford expensive chemical fertilizers, it is necessary to develop low-input, soil-management technologies that can sustain crop production. One of these technologies is alley cropping. Because intercropping is another characteristic of lowland agriculture, it is important that intercropping studies are added to the alley cropping system.

The addition of nitrogen to the soil by woody, leguminous species is one of the major advantages of alley cropping. Kang et al. (1984) reported that 15 t of fresh *Leucaena* prunings annually provided 160 kg/ha N, 15 kg/ha P, and 150 kg K/ha to sandy Entisol of Nigeria. Guevarra et al. (1978) reported annual nitrogen fixation as high as 500 kg N/ha under favourable growing conditions in Hawaii. Rachie (1983) reports a nitrogen yield of 127 kg/ha for 4-month-old *Leucaena* plants grown in the Cauca Valley of Colombia. With alley cropping, farmers will be able to crop one portion of the land for many years. Consequently, less labour will be needed to clear the forest and to cut trees. Moreover, soil fertility can be maintained and improved; agricultural production and productivity in the area will, therefore, increase.

Study area and methods

Biophysical characteristics

The Cameroon Institute of Agronomic Research has divided Sierra Leone into three major environmental zones: highland; lowland, high-rainfall forest; and lowland, low rainfall. The lowland, high-rainfall forest zone is located between 2 and 5° N and 10 and 16° E. The main characteristic of the zone is the evergreen and semideciduous forest, which covers more than 60% of the arable land. Slash-and-burn agriculture and mixed cropping are practiced by almost all small farmers. The soils are acid, highly weathered Ultisols and Oxisols with low-activity clay and low nutrient reserves.

Four crops are always present in the field: cassava, groundnut, maize, and plantain. These crops are intercropped among themselves and with various vegetables. Sheep, goats, and chickens are raised in the area; cattle are not. Important cash crops are cocoa, coffee, and oil palms. Food crops are cultivated by women; men usually take care of cash crops. There are two cropping seasons: March–June and August–December. On-station trials were carried out in the high-rainfall forest zone in the Yaoundé area.

On-station stage

On-station research in alley cropping is projected to last 7 years (1982–1988). From 1982 to 1984, many leguminous tree seeds were imported from areas with the same environment as the Cameroonian lowlands. The seeds were planted and managed similarly. The most adapted legumes were *Leucaena leucocephala* cv. K-28 and cv. Cunningham and *Leucaena diversifolia*. Intercropping studies were conducted during the same period. Techniques to intercrop maize and groundnut, maize and cassava, and maize and cowpea or soybean were set up. In 1985, associated crops were planted in established alleys to evaluate the effects of *Leucaena* prunings on mixed crops. Soil and growth parameters will be studied. *Leucaena* seeds will be produced for distribution to selected farmers.

On-farm stage

The on-farm stage will last 3 years (1989–1991). The on-station package will be tried in selected farmers' fields. The reactions and behaviour of the farmers will be monitored. This feedback will help to modify the package to better fit farmers' conditions.

Extension stage

The extension phase will last at least 3 years. If the package is well accepted, it will be extended throughout the lowland, high-rainfall forest zone. By this time, it is hoped that other leguminous trees adapted to this zone will have been found.

Results and discussion

Of all the woody leguminous species tested between 1982 and 1984, only four showed promise. Seven months after planting, *L. diversifolia* was the tallest (>2 m), followed by *L. leucocephala* cv. Cunningham; cv. K-636 and cv. K-28 showed the least growth (<1.5 m). All *Leucaena* cultivars grew quickly during the first 3 months. The fastest growth rates were observed with *Leucaena diversifolia* and cv. Cunningham. Six months after planting, the growth rate was very low. *Leucaena diversifolia* gave the highest aboveground biomass yield 7 months after planting (>3 t). Cultivar K-636 gave the lowest yield (<2 t). There was no difference in biomass yields between cv. K-28 and cv. Cunningham (Fig. 1).

From these observations, it can be concluded that these cultivars of *Leucaena* have low to medium adaptation. This is probably due to soil acidity at the test site (pH < 5.0).

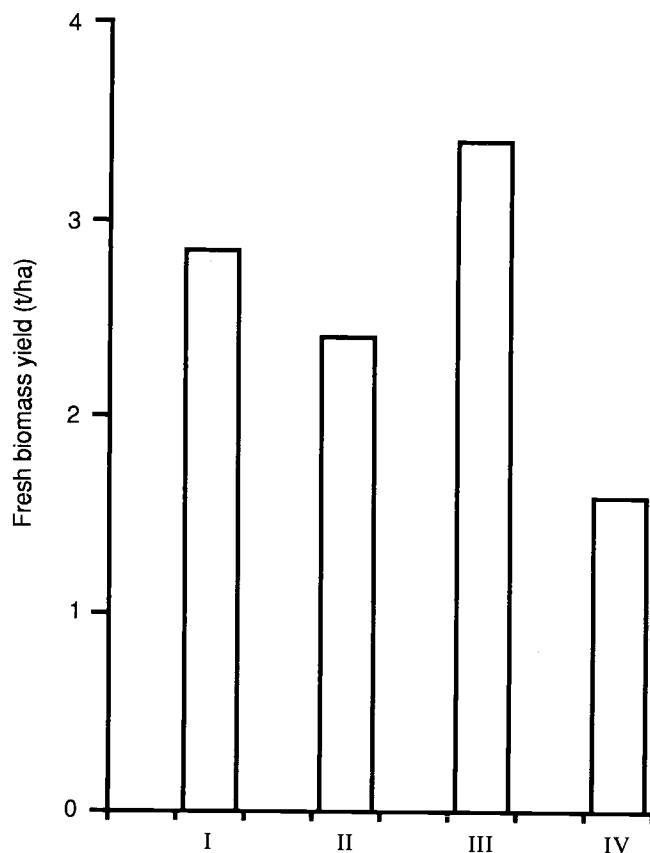


Fig. 1. Aboveground biomass yield of four varieties of *Leucaena* at Yaoundé (7 months after planting). I, *L. leucocephala* cv. Cunningham; II, *L. leucocephala* cv. K-28; III, *L. diversifolia*; IV, *L. leucocephala* cv. K-636.

Edea agroforestry experiment

From 1978 to 1982, an agroforestry trial was carried out at Edea in the Littoral Province of Cameroon (Maimo 1983). One objective of the experiment was the introduction of local and exotic leguminous tree species that could be used for various purposes by farmers in the forestry industry. Exotic seeds were introduced from similar agroecological zones abroad. Observations at 18 months after planting showed that only 3 of the 28 introduced species gave good growth: *Albizia falcata*, *Albizia lebbek*, and *Phytoloba colobium*. This agroforestry project lasted only 4 years and was discontinued.

In 1986, the trials at Yaoundé were intercropped with maize and groundnut and with maize and cassava. The effects of *Leucaena* prunings on the crops were evaluated.

Conclusion

Alley cropping retains the basic components of traditional bush fallow agriculture and introduces important improvements. This makes sustained and continuous cultivation of food crops possible. Biological recycling of nutrients, soil conservation, suppression of weeds, and reduced work load are major benefits of alley cropping for the farmers.

Alley cropping is still a very new technology in Cameroon. Preliminary observations have shown that *L. leucocephala* cv. K-28 and cv. Cunningham have a low to medium adaptability in the lowlands of Cameroon. Introduction and evaluation of new leguminous woody species are needed to identify more suitable materials for alley cropping on acidic soil. Because traditional farmers practice intercropping, more research in this area will also be conducted.

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References

- Atayi, E.A., Ndjeunga, J. 1985. Agro-socio-economical report of NTUI Division. Institute of Agronomic Research, Njombe, Cameroon. Annual Report.
- Guevarra, A.B., Whitney, A.S., Thompson, J.R. 1978. Influence of intra-row and cutting regimes on the growth and yield of *Leucaena*. *Agronomy Journal*, 70, 1033–1037.
- Kang, B.T., Wilson, G.F., Lawson, T.L. 1984. Alley cropping, a stable alternative to shifting cultivation. International Institute of Tropical Agriculture, Ibadan, Nigeria.
- Maimo, A.M. 1983. Final technical report on the Agroforestry Research Project, Edea, Cameroon. Institute of Agronomic Research, Njombe, Cameroon.

- Nye, P.H., Greenland, D.J. 1965. The soil under shifting cultivation. Commonwealth Bureau of Soils, Rothamsted Experiment Station, Harpenden, UK. Technical Communication 51.
- Rachie, K.O. 1983. Intercropping leguminous trees with annual crops. *In* Huxley, P.A., ed., Plant research and agroforestry. International Council for Research in Agroforestry, Nairobi, Kenya. pp. 103–116.