early rain could provide an effective green ground cover, less prone to fire hazard, in the savanna regions. The plants can be eradicated mechanically with the residue providing mulch suitable for no-tillage cropping. The potential contribution of N to the soil and protein for human and animal consumption are other factors that warrant further investigation of Cajanus cajan in savanna cropping systems.

On-farm trials—Leucaena-maize systems

The main objectives of the long-term, alley cropping farm trials that began in 1980 are as follows: (1) to identify and enlist the cooperation of a set of participating farmers, representing a range of farming systems and farmer types involved in the production of yam and maize in Nigeria; (2) to instruct the farmers on the agronomy of the prototypical Leucaena-maize-yam alley cropping system; and (3) to see to the establishment of the Leucaena hedgerows as an understory intercrop with first season maize in preparation for use as live in situ yam vine staking next year.

Trials were established on 9 plots at 6 different locations across the yam belt of Nigeria (Fig. 46). Periodic visits were made to each site to provide basic guidance and monitor progress. In all cases, the farmers were encouraged to feel free to modify the system to fit their needs. Information on such modifications provides for a better understanding of the working principles of appropriate alley cropping systems for smallholder conditions.

One potential variant, which aroused considerable interest among farmers for whom the labor costs of weeding are a major farm management constraint, is the use of Leucaena shade to control Imperata cylindrica and other heliophytic weeds. Although this use of alley cropping has yet to receive systematic attention, a possibility might be to rotate a 1 or 2 year closed-canopy fallow through a large field set up for alley cropping. If, for example, the field were divided into 4 sections, three-fourths could be in alley crop production in any given year with the remaining one-fourth in rotating fallow. Research is needed to evaluate the actual weed control potential of this alley cropping modification, but farmers indicate any innovation that minimized the herbicide need would be a major step toward making no tillage and mulch farming techniques more widely acceptable.

Linear programming model of Leucaena/rice alley cropping system

A linear programming model was developed to evaluate the economic attractiveness of an experimental Leucaena–rice alley cropping system under West African smallholder conditions. Using production data representative of upland family rice farms in Sierra Leone and N response data from the Rokup Rice Research Station in Sierra Leone, the model was used to explore the relative profitability of various rice growing activities at 0, 20, 40, 60, 80 and 100 kg N/ha from 3 different sources: urea, ammonium sulphate and in situ Leucaena hedgerows.

The main results indicate that under the conditions of smallholder production in the model, it is consistently more profitable to grow rice with N from Leucaena hedgerows than from either of the 2 mineral N sources. Furthermore, with labor as the limiting production factor, the 2 components of the Leucaena/rice alley cropping system always combine in the same economically optimal proportions of 0.37 ha (3,700 linear meters) of Leucaena hedgerow to 1.28 ha for rice, grown in the alley between the hedgerows, for an optimum field size of 1.65 ha.

In order for rice production with urea or ammonium sulphate to become competitive with Leucaena-based rice