Effect of Stem Cut-Back on Yield and Yield Components of Intercropped Cassava

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ABSTRACT

Maize/cassava intercropping is practiced widely in tropical cropping systems; however, it is still largely restricted to the small-holder farmer. The major constraints to large-scale production include high labor costs and lack of adequate machinery for operations in intercropping systems. Investigations were carried out to determine the feasibility of mechanizing maize/cassava intercropping, using available planting and harvesting machinery not originally designed for this purpose. Cassava was cut back at 3 heights (80, 60, and 40 cm) at maize harvest to simulate the damage to it if the maize was to be harvested mechanically. Cassava was left uncut in the control plot, and the cassava was left in the field for 12 months.

For cassava planted in the first season (April to August), cutting caused a significant decline in tuber yield and number per plant, but did not affect the leaf area index, stem diameter, number of branches, and final plant height. For cassava planted in the second growing season (September to December), there were no significant differences among treatments in all variables studied. The savings in labor costs adequately compensated for the yield decline in the first season. It is feasible to mechanize maize/cassava intercropping, and agricultural engineers should design machinery suitable for this and other mixed cropping systems.

Introduction

Intercropping is practiced widely in tropical cropping systems. Its advantages over sole cropping have been documented (Webster and Wilson, 1966; Wrigley, 1969; Igbozurike, 1971; Norman, 1974; and Wilson and Lawson, 1980). In West Africa, traditional agriculture shows a great diversity of crop combinations. Norman (1974) in a study of intercropping combinations in Zaria Province of Kaduna State of Nigeria reported seven most frequent crop combinations covering 61% of the area under cropping. Uzozie (1971) identified nine primary crop combinations in the four eastern states of Nigeria. A common feature of these combinations was the presence of a root crop (cassava or yam/cocoyam) and a grain crop (maize). One of the most popular combinations was maize and cassava.

Despite the prevalence and importance of intercropping throughout the developing world, benefits are still restricted to the smallholder or peasant farmers. Only recently have systematic efforts been made to understand and modernize intercropping. The difficulty of introducing a farm mechanization program into a system dominated by crop mixtures is regarded as a disadvantage of intercropping (Norman, 1974). The growing together of two or more crops which are morphologically and physiologically different calls for different tools and techniques of production. The benefits of intercropping can be extended to large-scale, mechanized production if the constraints to a large-scale, maize/cassava intercropping are overcome. The major constraints include lack of appropriate planting patterns, lack of adequate machinery, scarcity of labor during peak operations and high labor costs.

Mechanization of small farms with animal power has resulted in increased returns by expansion of cultivated area (Renaut, 1974). However, animal draught is inefficient and suitable only for completely-cleared and naturally-light soils (Jurion and Hensy, 1969). The absence of livestock tradition, lack of suitable grazing land, and the tse-tse fly have greatly reduced and restricted the scope for animal power in the humid parts of West Africa (Curfs, 1976).

In Nigeria, labor is expensive and scarce. Wages have tripled within the past 5 years. There is a shortage of labor during peak operations of land preparation, planting, and harvesting. The drudgery of traditional farming is not attractive to the young and educated, who are being lured away from rural areas to the towns. When the labor force starts to decline, all the increase in demand for agricultural products will have to be met by raising the productivity of labor (Abercrombie, 1972). Very little time is available for harvest of maize in maize/cassava intercrop resulting in huge field losses.

Investigations at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, were to determine the feasibility of selectively mechanizing maize/cassava intercropping, using available machinery, and to obtain information that may guide agricultural engineers in designing machinery suitable for this and other mixed cropping systems.

Materials and Methods

A simulation trial was conducted in 1980 and 1981 at the IITA experimental farm in southwestern Nigeria. The bimodal character of rainfall distribution in the region results in two distinct growing seasons, (April to July, and August to November). Total annual rainfall varies from 1,000 to 1,400 mm. The soil is classified as Oxic Paleustalf (USDA) or Ferric Luvisol (FAO), and is derived from fine-grained biotite, gneiss and schist parent materials.

In 1980, the experiment started in August, and in April of 1981. The land was prepared conventionally (ploughing, harrowing and ridging). Based on soil tests, fertilizer (60 kg N, 60 kg P and 30 kg/ha K) was applied before ridging. Corn (TZPB) was planted with a rolling injection planter set to give 40,000 plants/ha on 1 m ridges. Cassava was planted by hand 1 m apart on the same ridge as maize, giving a population of 10,000 plants/ha. A preemergence application of a mixture of atrazine (2-chloro-4-ethylamino-6-isoprophylamino-s-triazine) and metolachlor [2-chloro-N-(2-ethyl-6-methylphenyl-)-N-(2-methoxy-1-methylethyl) acetamide] at 2.5 kg/ha was used to control weeds. The maize was handpicked at maturity, 4 months after planting. At the same time, cassava was cut back at heights of 80-, 60-, and 40-cm above ground, to simulate the anticipated damage if the maize was harvested mechanically. In the control, cassava was left uncut. The experimental design was randomized complete block with four replications. Growth and recovery rate of cassava was monitored by periodic measurements of plant height and leaf area. Cassava yield and yield components were determined at 11 months after cutting back.

Results and Discussion

In the first growing season (April to July) stem diameter, number of branches and plant height were not significantly different among treatments (Table 1). Leaf area index did not show any trend. Cutting significantly reduced tuber yield by reducing the number of tubers per plant. For cassava planted in the second growing season (September to December) there were no significant differences in stem diameter, number of branches, plant height, tuber yield and number of tubers (Table 2).

Cutting the cassava set back growth and bulking, resulting in lower tuber yields of cut stands compared with the control. Tuber yield in cassava is greatly influenced by the rate and duration of bulking (Enyi, 1973; Wholey and Cook, 1974). Production of new leaves and branches in the cut cassava attracted carbohydrates away from the tuber and any deposition sites. The longer duration of bulking in the control resulted in its ability to produce and fill a greater number of roots. It was observed that cut stands rapidly produced young leaves and retained leaves longer than the control stands during the dry spell (December to February). This, however, did not compensate for the foliage lost by cutting.

The ability of cassava to recover rapidly from physical damage, even at 4 months after planting, and its long growing period suggest that maize may be harvested mechanically in a maize/cassava intercrop without doing irreparable damage to the cassava savings in labor costs and time by mechanically harvesting the maize would adequately compensate for any yield reductions in cassava.

Table 1. Effect of cutting height on tuber yield, number of tubers, number of branches, stem diameter, leaf area index and plant height of cassava (1982).

Cutting height (cm)	Dry tuber yield t/ha	Number of tubers	Number of branches/ plant	Stem diameter (cm)	Leaf area index	Plant height (cm)
0	17.6	9.7	83.8	4.0	7.9	364
80	14.2	7.3	60.5	4.0	8.5	344
60	13.1	7.2	64.0	3.8	6.7	344
40	13.1	7.2	67.5	3.8	9.1	361
CV(%)	9.7	13.2	21.1	6.3	14.2	3
LSD (0.05)	2.2	1.7	24.3	0.4	4.4	19

Table 2. Effect of cutting height on fresh tuber yield, dry tuber yield, number of tubers, stem diameter, plant height, (1981).

Cutting height (cm)	Fresh tuber yield t/ha	Dry tuber yield t/ha	Number of tubers/ plant	Stem diameter (cm)	Plant height (cm)
0	30.5	12.2	6.3	3.0	330
80	29.9	12.0	5.5	3.0	317
60	27.2	11.1	5.5	2.8	310
40	27.2	10.9	5.5	2.7	306
CV (%)	14.9	14.7	8.4	9.8	6
LSD (0.05)	6.8	2.7	0.8	0.5	29

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