Intercropping with Cassava
Proceedings of an international workshop held at Trivandrum, India, 27 Nov - 1 Dec 1978
Editors: Edward Weber, Barry Nestel, and Marilyn Campbell
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Central Tuber Crops Research Institute (Indian Council for Agricultural Research)
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Intercropping Systems with Cassava in Kerala State, India

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In Kerala State, India, about 42% of farmers have less than 0.2 ha of land. These small and marginal farmers, out of necessity, have to adopt intercropping systems to obtain maximum returns per unit area. Cassava, predominantly used as a subsidiary food, with less than 10% made into starch, is grown here with coconut, mango, jack fruit, and other annual crops like Colocasia, Amorphophallus, ginger, pineapple, and banana. Such a cropping mixture can be widely found throughout the length and breadth of Kerala, which has a rural population density of 549 people/km²; every available space is well utilized. The common inputs in more than 80% of the cassava farms are confined to the application of cattle manure and wood ash. Commercial fertilizers are seldom used in these farms and even if they are used, it is not the recommended dosages.

The farmers widely practice intercropping of cassava in coconut gardens. However, cassava is not adapted to shade, and plants grown under shade are etiolated with poor tuber development. The results of the experiments conducted in coconut gardens indicate that this is not an economic proposition. However, new technology has now been developed to grow high-value crops like clove, nutmeg, and cocoa in coconut gardens.

Cassava as a monoculture is being practiced in major areas, especially on marginal lands with undulating topography. The farmers generally plant cassava during the premonsoon showers in the month of May until July as a first season crop and at some places during September–October as a second season crop, taking advantage of the southwest and northeast monsoon showers, respectively (Appendix 1). The most common method of land preparation is forming mounds using human labour. Power-driven implements are seldom used for land preparation.

Cassava is planted with a spacing of 90 × 90 cm and the crop slowly builds up a canopy during its early stage of growth; it takes 3–3½ months to grow enough canopy to cover the entire field. The solar radiation available in between the rows at the early growth phase of cassava can be well exploited by raising short-duration leguminous/nonleguminous crops.

Trials were conducted at the Central Tuber Crops Research Institute Farm with the object of developing suitable technology for an intercropping system with cassava.

Materials and Methods

An experiment was carried out using a split-plot design, with the combinations of method of planting and level of fertility in the main plot and the intercrops in the subplots.

Treatment — Main plot: (a) The main methods of planting were, for M1, 90 × 90 cm and for M2, paired-row method; (b) levels of fertility were for F1, FYM @ 12.5 metric tonnes (t)/ha and recommended dose of NPK for main crop, i.e., 100:100:100 kg/ha, and F2, recommended dose of the main crop plus recommended dose for intercrops. Subplot: The intercrops were green gram (Phaseolus aureus), groundnut (Arachis hypogea), maize (Zea mays), soybean (Glycine max), and sunflower (Helianthus annuus).

For comparison, a control plot without any intercrop was also maintained.

The physicochemical properties of the soil were: type, sandy clay loam; texture, medium; pH, 4.5; available N, 238 kg/ha; available P₂O₅, 16.8 kg/ha; available K₂O, 94 kg/ha.

A high-yielding semibranched variety of cassava, H-97, evolved at the Central Tuber Crops Research Institute, was planted during May–June. The seeds of intercrops were sown immediately after the planting of cassava. In the M1 treatment, one row of maize and two rows of other crops were maintained in between two rows of cassava. In the M2 treatment, two setts of cassava were planted at a spacing of 45 cm leaving 135 cm space in between two consecutive paired rows. Two rows of maize and four
rows of other crops were maintained in the M2 treatment. Under both treatments, the plant populations were maintained uniformly.

Plant height, plant spread (canopy diameter), tuber yield, and yield of intercrops were recorded. As well, the economics of intercropping were calculated.

**Results and Discussion**

Canopy diameter and plant height are presented in Fig. 1 and 2.

Maximum canopy diameter recorded in the control plot was on a par with cassava intercropped with green gram. The control was significantly superior to the rest of the treatment combinations. Plant height (Fig. 2) increased significantly when cassava was intercropped. However, the effect on maize was more pronounced as compared to other crops. The results also suggest that the increase in plant height of cassava was in proportion to the height of the intercrops. This is probably due to mutual shading and competition for sunlight.

There were significant differences in tuber yield among treatments (Fig. 3). The control registered significantly increased tuber yield over intercrop treatments. In all cases, application of fertilizers to both crops (F2 treatment) resulted in maximum tuber yield.

The gross returns of the intercropped treatment indicated that maximum gross returns were obtained when groundnut was intercropped with cassava. These values were significantly superior to all other treatments and the control.

Of those crops intercropped with cassava for 4 years at this institute, groundnut alone has given consistently good results. The performance of soybean was poor, probably due to the low pH of the soil. Although green gram fared well, the yield was not remunerative. In the case of maize, there was a reduction in yield due to lack of vigour, indicating its poor compatibility with cassava. Though sunflower established well under prolonged dry spells, the crop growth, seed set, size of head, and, consequently, the yield were reduced considerably. This indicated that economic cultivation of sunflower as an intercrop with cassava is not feasible under Kerala conditions due to the poor moisture-holding capacity of the soil.
Agronomic Practices to be followed for Groundnut Intercropping with Cassava

A bunching variety of groundnut is preferred to a spreading type. After planting the cassava setts, the seeds of groundnut are sown at a spacing of 30 cm between rows and 20 cm within rows, so that two rows of groundnut intercrop can be accommodated in between two rows of cassava. A seed rate of 40–50 kg/ha is recommended by dibbling two seeds per hill. In the acid laterite soils of Kerala, application of 1000 kg of lime as basal dressing was found to give higher yields for both groundnut and cassava. If the calcium status of the soil is poor, proper pod formulation may not take place. A basal dose of 50:100:50 kg each of NPK/ha should be given uniformly to both crops. One month after sowing the seed, a fertilizer mixture containing 20 kg/ha each of P and K and 10 kg N has to be given to the intercrop along with earthing up. Once the pod formation has started, the soil should not be disturbed as it will adversely affect the development of the pods. The groundnut crop matures within 120 days. After the harvest of the pods, the hulums are incorporated in the soil along with top dressing (50 kg each of NK/ha) for the main crop. Cassava can be harvested 10 months after planting.

The major problems encountered by farmers wishing to follow the above practices are high cost of fertilizers and lack of quality seeds of desirable varieties of groundnut.

Acknowledgments

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(Appendix I follows)
Appendix 1.
Environmental description of Kerala State, India.

<table>
<thead>
<tr>
<th>Month</th>
<th>Max temp (°C)</th>
<th>Min temp (°C)</th>
<th>Rainfall (mm)</th>
<th>Evaporation (mm)</th>
<th>Sunshine (h)</th>
<th>Relative humidity (%)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>31.1</td>
<td>20.4</td>
<td>Trace</td>
<td>141.3</td>
<td>292.9</td>
<td>71/60</td>
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<tr>
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<td>31.3</td>
<td>21.2</td>
<td>10.5</td>
<td>147.3</td>
<td>253.1</td>
<td>68/61</td>
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<tr>
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<td>26.0</td>
<td>177.8</td>
<td>288.5</td>
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<td>193.2</td>
<td>128.2</td>
<td>187.0</td>
<td>83/77</td>
</tr>
<tr>
<td>May</td>
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<td>23.9</td>
<td>210.6</td>
<td>137.4</td>
<td>188.2</td>
<td>85/77</td>
</tr>
<tr>
<td>Jun</td>
<td>30.2</td>
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<td>113.3</td>
<td>110.9</td>
<td>175.1</td>
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</tr>
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<tr>
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