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Production potential in the intercropping sequence of medicinal yam (*Dioscorea floribunda*) with pigeonpea (*Cajanus cajan*) and rubber (*Hevea brasiliensis*)*

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In the present investigation perennial plants sp., viz medicinal yam (*Dioscorea floribunda* Mart. & Gal.), rubber (*Hevea brasiliensis* Mull. Arg.) and pigeonpea [*Cajanus cajan* (L.) Millsp.] were taken up for the experiment. The latter, although a perennial is invariably grown as an annual crop were intercropped to examine the possibility of exploiting their full yield potential.

A 3-year-experiment (1990–93) was undertaken at the Tripura Forest Development and Plantation Corporation farm, Agartala (latitude 23°28 N, longitude 99°16 E, altitude 35 m, annual precipitation 2100 mm). The soil was sandy loam, pH 5.5–5.6, organic carbon 6-8 g/kg, 78 - 85 µg/g available P and 63-67 µg/g available K. The climate is subtropical high lands with predominantly summer rainfall and cool dry winter with the temperature range of 18–36°C with minimum variation throughout the year. Rain occurs from April and continues up to October and the main rain is during June–September.

A randomized block design was adopted with 5 cropping systems: Pure stand of medicinal yam (*Dioscorea floribunda*), pigeonpea (*Cajanus cajan*) and rubber (*Hevea brasiliensis*), mixed cropping of medicinal yam–rubber and medicinal yam–pigeonpea. In case of pure stands of rubber the replicate plots were marked out from an exisiting plantation. In pure stands, the spacing for medicinal yam and pigeonpea in pure stands was 75 cm x 60cm while that of rubber it was 6 m x 3 m. In intercrop also rubber saplings were planted in 6 m x 3 m apart with 6 rows of medicinal yam. Pigeonpea was sown in alternate rows with medicinal yam in the intercropping treatment with each plot comprised 4 rows 30 m long spaced 75 cm apart. To minimise the errors for productivity index (Land equivalent ratio) in the mixtures, they were replicated twice in each block (180 m²) with 4 replications. Land equivalent ratio (LER) represent the relative land area required as sole crops to produce the same yields as intercropping (Willey 1979). Calculation was done for each mixed experimental unit using data for sole crop from the same block and statistically analysed in the usual method. A value of <1 indicates that the cropping were less productive than sole. Medicinal yam tubers were cut into pieces (approximately 40–50 g) and treated by dusting the cut ends with Benomyl (Benlate) 50 WP in talcum powder to prevent tuber rot. These treated tuber pieces were kept in nursery shade under sand for sprouting. Cultural practices were followed throughout the growing season. All plots received a basal dressing of 50 kg/ha each of NPK 3 days prior to planting. The sprouted medicinal yam tuber pieces were planted in the first week of July at the beginning of the rainy season. Seeds of pigeonpea were sown in third week of July. Fertilizer consisting of (25–25–25 kg/ha) NPK were applied 5 weeks after planting of tuber pieces. Remaining dose of N (25 kg/ha) was applied between the medicinal yam rows 15 weeks after initial planting of tuber in the sole or mixed either pigeonpea or rubber. The medicinal yam plants were staked (1.8 m in height) singly after 2 weeks of planting the tubers. Rubber plants were initially planted in July 1983. An additional amount of 250 g (10:10:1.5 ; N:P:K) of fertilizer was administered as band to each rubber plant.

Seedlings of pigeonpea were thinned at 10 cm height equally to space plants/plot. Tubers of medicinal yam were harvested at 33 months after planting. At harvest, mature seeds of pigeonpea were cleaned and grain weight was calculated for each experimental plot. Similarly, latex was tapped from the rubber plants (150 tapping days in a year) to determine latex yield from each unit. Data for yield of latex and seeds from individual plot were clubbed together annually as pooled yield of 3 years. This was done for the sake of uniformity in yield data as yield of medicinal yam could be recorded only once in 3 years. A combined data analysis was adopted, with years considered fixed, as described by Fisher (1977).

The productivity of medicinal yam, pigeonpea, rubber in pure stands and medicinal yam–pigeonpea, and medicinal yam–rubber cropping system were compared for higher yield under intercropping than sole. Yields of dry-tuber of medicinal yam and pigeonpea were significantly higher in

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Table 1. Yields[a] in pure stands and mixture and equivalent areas of mixed crops (tonnes/ha) (pooled yield of 3 years).

Pure stand yield	
Medicinal yam (dry tuber)	9.2456 ± 1.2701*
Rubber (latex)	9.6873 ± 0.5396*
Pigeonpea (grain)	5.7210 ± 0.6602*
Mixed yield	
Medicinal yam (dry tuber)	6.9430 ± 0.6187*
Rubber (latex)	9.6873 ± 0.3532
Pigeonpea (grain)	2.8086 ± 0.0310*
Equivalent areas of mixtures	
Medicinal yam – rubber	1.7512 ± 0.0011*
Medicinal yam – pigeonpea	1.2539 ± 0.0340*

[a]Values are means ± SE, and differences between crops within pure, mixture and equivalent areas of mixed crops are significant at P<0.05 (*).

pure crop in comparison to mixture, while latex yield of rubber remained same for both pure and mixed (Table 1). The yields of the intercropped medicinal yam significantly (P<0.05) lower than that of the sole crop. Intercropping decreased dry tuber yield of medicinal yam by 25%, the mean yields being 9.245 and 6.943 tonnes/ha for sole and intercropped medicinal yam, respectively.

In the cropping system experiment, ie medicinal yam–pigeonpea and medicinal yam–rubber had an land equivalent ratio of >1 significantly. The trend for equivalent area of medicinal yam–rubber (1.75) mixture was generally for higher values in comparison with medicinal yam–pigeonpea (1.25). Pure crop yield of rubber indicate that the same population pressure as the mixed crops, taking 1 rubber or 30 medicinal yam plants as 1 plant unit a relation implicit in the plant densities adopted. Medicinal yam–pigeonpea mixtures yielded significantly less than pure stands probably for the considerable effects on the pigeonpea from competition of medicinal yam which were not compensated by equivalent increase in medicinal yam yield/plant when the adjacent row of medicinal yam was replaced by pigeonpea. There was marked difference (P<0.05) in productivity between the systems. During early growth of rubber, wide row space should facilitate (up to 12 years) growth of medicinal yam (1 rubber plant or 30 medicinal yam plant constitutes 1 plant/unit) later it could be uneconomic because of shade by the spreading rubber canopy. The effect of competition between the crops is due to their differences in growth cycles and growth habits for which their maximum demands on the environment occur at different times (Andrews 1972). These effects of intercropping on land equivalent ratio were significant (P<0.05). Generally, intercropping medicinal yam with rubber or pigeonpea enhanced the LER.

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