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PERFORMANCE OF TURMERIC AND SWEET POTATO-COWPEA PLANTED AS INTERCROPS AT TWO INTERCROPPING INTENSITIES UNDER FOUR DIFFERENT DENSITIES OF ARECANUT*

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ABSTRACT

Growth attributes of intercrops like turmeric, and sweet potato–cowpea were partially influenced by either arecanut plant densities or intercropping intensities. At 2.7 × 2.7 m spacing of arecanut, sweet potato produced 174 leaves at 60% intercropping intensity and cowpea produced 287 leaves per plant. Biomass production was higher at 1.8 m × 3.6 m at 60% intercropping intensity in turmeric, while wider spacing (3.6 m × 3.6 m) at 60% intercropping intensity was ideal for high biomass production in sweet potato. Intercrops behaved differently in yield attributes in response to plant densities of arecanut and intercropping intensities. In turmeric, yield increased with narrower spacings while in sweet potato wider spacings were optimum in enhancing yield attributes and yields. Turmeric and sweet potato responded to 60% intensity with 5228 kg/ ha and 4549 kg/ha compared to 3764 kg/ ha and 3743 kg/ ha at 40% intensity respectively. Cowpea yielded better with wider spacings.

INTRODUCTION

Research work on mixed and intercropping in arecanut plantation was initiated three decades ago. Banana, betelvine, tapioca, black pepper, pine-apple, jack, coconut were successfully grown in arecanut plantation (Bavappa, 1951). Abraham (1956) reported that ginger, turmeric, black pepper and cardamom were also successfully grown as intercrops in arecanut garden. Bhandary (1974) showed that varying amounts of additional income can be obtained by intercropping. Since no intercropping studies in arecanut suited to semi dry maidan tract of Karnataka were available, the current investigations were taken up to elucidate the comparative performance in the growth and yield of the intercrops like turmeric and sweet potato–cowpea under Hirehalli conditions.

MATERIALS AND METHODS

This investigation was conducted during 1978-80 at the Central Plantation

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Crops Research Institute, Research Centre, Hirehalli, Karnataka in an arecanut garden with 17 year old palms planted at varied spacings. The experiment was laid out in a split plot design with spacings of 1.8m × 3.6m (1543 palms/ha), 2.7m × 2.7m (1371 palms/ha), 2.7m × 3.6m (1028 palms/ha) and 3.6 × 3.6m (771 palms/ha) as main plot treatments. The main plot size was 216m × 108m. Two intercrops, turmeric and sweet potato–cowpea were taken as sub-plot treatments and three intercropping intensities (0, 40 and 60 per cent) as sub sub plots replicated three times. Local turmeric (8 months duration) and sweet potato (5 months duration) were raised as intercrops. In case of sweet potato, in order to equate the total duration of 8 months occupied by turmeric a high yielding cowpea (C–152) of 90–100 days duration was raised in succession after sweet potato. Turmeric and sweet potato were planted in June 1978 and May 1979 on ridges adopting a spacing of 25cm × 15cm for turmeric and 25cm × 20cm for sweet potato. A fertilizer schedule of 70 kg N, 60 kg P_2O_5 and 120 kg K_2O per ha. for turmeric and 70 kg N, 50 kg P_2O_5 and 70 kg K_2O per ha for sweet potato were applied in the form of ammonium sulphate, single superphosphate and muriate of potash respectively. The arecanut was fertilized yearly at 100 g N, 40 g P_2O_5 and 140 g K_2O per palm. Both main and intercrops received 12 and 11 irrigations in the first and second years of experimentation respectively during dry periods.

Observations in intercrops on the number of leaves, tiller/branch production and biomass production were made monthly from five randomly selected and tagged plants from each treatment. Only mean of yearly data in each character are provided. Sampling procedure and processing were according to Kvet et al (1971). Turmeric rhizomes and sweet potato tubers were hand picked after giving a light digging. Mother rhizomes and fingers were separated and cleaned. For biomass production, plant parts were separated into leaves, stem, root/tuber and other storage parts as the case may be and then dried at 80-85°C to constant weight. The weights of rhizomes and tubers were taken and expressed as kg per ha. One month after the harvest of sweet potato, seeds of cowpea were dibbled at 40 cm × 25 cm during March 1979 and Feb. 1980. The soil of the experimental site was clayey loam with a pH of 6.3 and E.C. 0.25 mmhos/cm. It had an organic matter of 0.95%, total N of 2.06%, P_2O_5 of 0.3% and total K_2O of 0.62% in the 0 to 25 cm depth.

RESULTS AND DISCUSSION

Leaf production in turmeric did not show any significant change due to intercropping under various spacings of arecanut or at different intensities of intercrop (Table I). The mean data showed a range of 13.5 to 15.4 leaves per turmeric plant. Leaf production in sweet potato under spacing of 2.7 m × 2.7 m at 60% intercropping intensity produced significantly higher number of leaves (174) compared to 40% intercropping intensity (151). In cowpea, significantly higher number of leaves (287) was produced when arecanut spacing was 2.7 m × 2.7 m compared to those of other spacings (182 to 221). Interactions indicated that at a given

le I. *Number of functional leaves produced by turmeric, sweet potato-cowpea as influenced by intercropping intensities at varied levels of spacings of arecanut. (Mean data of two years)***

Treatment	Intercrops and intensities of intercropping								
	Turmeric			Sweet potato			Cowpea		
Arecanut spacings	40%	60%	Mean	40%	60%	Mean	40%	60%	Mean
1.8 m × 3.6 m	14.3	14.1	14.2	144	128	136	162	203	182
2.7 m × 2.7 m	14.5	14.6	14.5	151	174	162	311	262	287*
2.7 m × 3.6 m	14.6	12.5	13.5	151	134	142	203	238	221
3.6 m × 3.6 m	14.3	16.5	15.4	161	156	159	215	189	202
Mean	14.4	14.4	—	152	148	—	223	233	—
CD for spacings	NS			NS			59		
CD for intensities	NS			NS			NS		
CD for spacings at the same intensities	NS			NS			29		
CD for intensities at the same spacing	NS			20			28		

* Significant (0.05)

** (Yearly, 7, 6 and 3 observations were made at monthly intervals in turmeric, sweet potato and cowpea respectively).

ntensity of 40 per cent intercropping, 2.7 m × 2.7 m spacing was significantly superior to the rest of spacings and that narrow spacing of 1.8 m × 3.6 m was significantly inferior to all the rest. With 60 per cent intensity, spacings of either 2.7 m × 2.7 m or 2.7 m × 3.6 m produced significantly more number of leaves than other spacings of 1.8 m × 3.6 m and 3.6 m × 3.6 m which were on par. Even the spacing of 2.7 m × 3.6 m (238) was on par with 1.8 m × 3.6 m (203).

The data on the number of tillers/branches produced by turmeric and sweet potato – cowpea indicated that there were no significant differences in the number of tillers either due to changes in arecanut spacings or intercropping intensities. There were no interaction effects also. In the case of sweet potato also the number of branches produced in various treatments did not differ statistically. Intercropping intensities also did not have any effect on branching. The differences in various interactions also did not show any significant variation with respect to number of branches. The same trend was observed in case of cowpea grown after the harvest of sweet potato.

The biomass production of turmeric was maximum (8393 kg/ha) under the narrow spacing of arecanut 1.8 m × 3.6 m) and it was significantly superior to wider spacings of arecanut (3.6 m × 3.6 m) (Table II). The same trend was seen at 60% intensity. The biomass production in the other two spacings did not differ significantly among them-

Table II. *Biomass production of intercrops of turmeric and sweet potato–cowpea as influenced by intercropping intensities at varied levels of arecanut spacings (kg/ha) (Mean data of two years)***

Treatment	Turmeric			Sweet potato–cowpea		
Arecanut spacings	40%	60%	Mean	40%	60%	Mean
1.8 m × 3.6 m	6,706	10,080*	8,393	9,266	11,304	10,285
2.7 m × 2.7 m	5,406	8,506	6,957	12,486	11,356	11,922
2.7 m × 3.6 m	5,226	8,273	6,750	13,374*	14,596*	13,985
3.6 m × 3.6 m	5,327	6,326	5'827	12,406	14,236*	13,323
Mean	5,667	8,297*	—	11,883	12,873	—
CD for spacings	2,214			NS		
CD for intensities	998			NS		
CD for spacings at the same intensities	2,412			3,798		
CD for intensities with same spacing	996			NS		

* Significant (0.05)

** (Yearly; 7, 6 and 3 observations were made at monthly intervals in turmeric, sweet potato and cowpea respectively).

selves statistically but showed a declining trend with increase in the spacing of arecanut. The biomass production was significantly more (8297 kg/ha) at 60% intercropping intensity when compared to 40% (5667 kg/ha). However, interactions indicated that 60% intensity provided significantly higher biomass production in turmeric at the first three spacings but not with the last spacing of 3.6 m × 3.6 m. In case of sweet potato–cowpea, neither the spacings for arecanut nor the intercropping intensities influenced the biomass production in general. However interaction indicated that at 40% intensity the biomass production was highest (13,374 kg/ha) with 2.7 m × 2.7 m spacing which was significantly superior to the spacing of 1.8 m × 3.6 m (9,266 kg/ha).

Intercrops fared well under an arecanut spacing of either 2.7 m × 2.7 m or 3.6 m × 3.6 m in producing higher number of leaves, and tillers. The intercropping intensity of 40% seemed to be good for these attributes. While biomass production increased with 1.8 m × 3.6 m spacing with 60% intensity in turmeric and at wider spacing in case of sweet potato.

The data on the yield of various intercrops are presented in Table III. In general averaged over intensities of intercropping there were no differences in turmeric yield because of variation in arecanut spacings (5259 to 3336 kg/ha). However, 60% intercropping intensity of turmeric significantly recorded higher yield of 5228 kg/ha when compared to 40% intensity with 3764 kg/ha. In sweet potato, the tuber yield showed a significant difference between

Table III. *Yield of intercrops of turmeric and sweet potato-cowpea as influenced by intercropping intensities at varied levels of arecanut spacings. (kg/ha) (Mean of two years)*

Treatment	Intercrops and intensities of intercropping								
	Turmeric			Sweet potato			Cowpea		
	40%	60%	Mean	40%	60%	Mean	40%	60%	Mean
1.8 m × 3.6 m	4,490	6,028*	5,259	3,227	3,706	3,466	505	794	649
2.7 m × 2.7 m	4,240	5,322	4,781	3,453	3,841	3,647	679	789	734
2.7 m × 3.6 m	3,579	5,639	4,608	3,991	5,102	4,546	759	840	799
3.6 m × 3.6 m	2,747	3,926	3,336	4,302	5,546*	4,924*	790	891	841
Mean	3,764	5,228*	—	3,743	4,549*	—	683	828*	—
CD for spacing		NS			1,139			NS	
CD for intensities		676			492			63	
CD for spacings at the same level of intensities		NS			122			220	
CD for intensities at the same level of spacings		1,352			384			126	

* Significant (0.05)

he spacing of 1.8 m × 3.6 m (3466 :g/ha) and 3.6 m × 3.6 m (4924 kg/ha). ncreasing arecanut spacing showed a radual increase in the tuber yield. mong intercropping intensities, 60% ntensity recorded significantly higher ield (4549 kg/ha) compared to 40% ntensity (3743 kg/ha). The data also ndicated that irrespective of the levels f spacings, increasing the level of ntensity from 40 to 60 per cent increased he yield significantly. Irrespective of ntensities of intercropping, there was a oncomitant and significant increase in weet potato yield with every increase n the level of spacing. Though cowpea ields increased with the increase in the evel of spacings of arecanut from 649 :g/ha to 841 kg/ha from 1.8 m × 3.6 m o 3.6 m × 3.6 m spacings of arecanut, he differences were not significant. Interactions indicated that at the same level of spacing of 1.8 m × 3.6 m, 60% intensity was superior to 40% intensity.

These results indicate that the intercrops behaved differently in growth and yield attributes with differing plant densities of arecanut and varying intercropping intensities. Leaf number particularly with sweet potato and cowpea were high with 2.7 m × 2.7 m spacing and increased further with wider spacing but with 40% intercropping. Turmeric was not greatly influenced with wider spacings perhaps due to errect nature of leaves compared to spreading nature of both sweet potato and cowpea. Thus, biomass production was high with spacing of 1.8 m × 3.6 m and 60% intercropping intensities in case of turmeric. While wider spacings were

helpful in producing high biomass in sweet potato and cowpea, the response to intercropping intensities depended on the spacings provided for the main crop. Wider spacings tended to increase the branching in both sweet potato and cowpea leading to greater vegetative growth, higher biomass production and thus higher yields. In sweet potato, wider spacing of 3.6 m × 3.6 m was superior in tuber yields (4924 kg/ha) over those of lower spacings of 1.8 m × 3.6 m (3466 kg) and 2.7 m × 2.7 m (3647 kg). The 60% intensity gave higher yields of 4549 kg than 40 per cent intensity with 3743 kg. Interaction indicated at either 40 or 60 per cent of intensity, there was increase in sweet potato yields with increase in the spacings. At each spacing there was an increase in yield from 40 per cent intensity to 60 per cent intensity of intercropping. At the same level of intensity of intercropping either at 40 per cent or 60 per cent, the variations in spacing did not bring differences in turmeric yields. At the same level of spacing of 1.8 m × 3.6 m, a significantly higer yield of 6028 kg per ha was obtained at 60 per cent intensity compared to 4480 kg per ha with 40 per cent intensity. Similarly, with 2.7 m × 2.7 m spacing 60 per cent intensity provided 5322 kg per ha which was significantly superior to 4240 kg per ha obtained with 40 per cent intensity. The turmeric yields were higher with 1.8 m × 3.6 m spacing (5259 kg) compared to 3.6 m × 3.6 m spacing (3336 kg). Muralidharan et al (1976) and Singh and Roy (1977) indicated that wider spacings are as good as narrower spacings for arecanut. However, the current studies involving spacings of arecanut as well as intercropping intensities suggest that a narrower spacing of 1.8 m × 3.6 m with the resultant altered plant geometry is ideal for turmeric as an intercrop at 60 per cent intensity while wider spacings of arecanut may be thought of for sweet potato and cowpea as intercrops. The salient results are that the yields averaged over two years at arecanut spacings of 1.8 m × 3.6 m and 2.7 m × 2.7 m were on par (188.8 and 186.6 q/ha) and were significantly higher compared to lower yields obtained at 2.7 m × 3.6 m and 3.6 m × 3.6 m (162.4 and 118.3 Q/ha). Neither intensities (161 to 170 Q/ha) nor kinds of intercrops (160 to 174 Q/ha) could bring any significant change in per hectare yield of areca palms. However, considering the advantage of higher income, a spacing of 1.8 m × 3.6 m for arecanut with 60 per cent intensity of turmeric can be recommended for general cultivation.

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