

CASHEW-BASED FARMING SYSTEM

R. C. MANDAL, N. YADUKUMAR and E. MOHAN

National Research Centre for Cashew, Puttur 574 202, Karnataka, India

ABSTRACT

With a view to find out suitable intercrops in the early stages of cashew plantation (for first 5 years), an attempt has been made at National Research Centre for cashew, puttur to grow cashew as main crop and pigeonpea, tapioca (annuals); pineapple, papaya (biennials) and tree species like *Casuarina*, *Acacia*, *Subabul* (Perennials) as inter and mixed-crops and these are being compared with a cover crop (*Mucuna* sp.) and a control (without any inter crop).

Preliminary studies indicated that both the food crops as intercrop can be successfully grown in the laterite undulating land. Growth of fruit crops and tree species were found to be very satisfactory under rainfed condition. It is thus possible to utilize the wider interspace (spacing 8m x 8m) profitably during the pay-back period of cashew and thereby to get additional income which has been illustrated in this paper.

INTRODUCTION

In Dakshina Kannada, cashew has already been successfully brought under cultivation over a sizeable area. This is situated in the Western Coast, lies between 12.25°N latitude and 75.42° E, longitudes, at an altitude 90 m above MSL and is characterized by highly undulating topography. This region has the warm climate of humid tropics with temperature ranging from 22°–38°C, relative humidity 75 to 85 per cent and mean annual precipitation about 3500 m which keeps plantations evergreen and provides a dense vegetation. The soils are mainly laterite or gravelly in hill tracts, porous and mostly acidic in reaction. Because of undulating topography, soil erosion is a constant feature in the exposed areas.

The large canopy cover of the grown up cashew trees protects the top-soil from erosion; but at its early growth period, a systematic inter and mixed-cropping system including compatible combination of crops,

having varying morphological frame and rooting habits, will be desirable and such a cropping system will be ideal to maintain a balanced eco-system (Mandal 1984). Cashew-based farming system, especially in the first 5-6 years of orchard establishments can enhance the overall return per unit area.

In cashew plantations, so far no systematic efforts are made to grow intercrops and therefore, there is a need for developing suitable cashew-based farming system and work out its economics. Research efforts are therefore required for understanding root and canopy architecture of different crop species, the energy input and output, PAR, the influence of different crop combinations on micro and macro-climate (Bavappa and Mandal, 1984). Attempts are now made for in-depth study of the inter-species competition for nutrients, light and moisture, changes in micro-climate, total biomass production and the economic returns of the total system. Keeping these points in view, an experiment has been initiated including food crops, fruit crops,

cover crops and forest species as inter/mixed crops in cashew plantations. The preliminary observations made in the initial stage of the experiment revealed certain facts which are discussed in this paper.

MATERIALS AND METHODS

The experiment was laid out in 1987 at National Research Centre for Cashew, Puttur in a RBD (3 replications) with 9 treatments. The cashew grafts of the variety M 10/4 were planted at 8m x 8m apart and in the wide interspace, the following inter/mixed crops were planted 1.5 m away of the main cashew crop, by adopting recommended spacings, to both main and intercrop. The details of the experiment are given in Table I.

The recommended doses of fertilizers were given to both main and intercrops. In addition, 2 kg of poultry manure/pit was applied to cashew and tree species, and 1 t/ha poultry manure was applied to pigeonpea, tapioca and cover crop plots at the time of planting.

Morphological observations like height, girth and canopy of cashew, tree species and fruit crops were taken one year after planting, while shoot and root weight of tapioca, shoot weight and yield of pigeonpea, were recorded at the time of seasonal harvest. Light interception by the main crop and all the intercrops (except cover crop) were measured with the help of 'Portable Photosynthetic System'.

Table I. Crops grown in the HDMSC system

Treatments	Variety	Spacings (m)	Plants/plot (Nos.)	Population/ha (No.)
Main Crop				
Cashew	M 10/4	8 x 8	6	156
Inter/mixed crop				
(a) Annual food crops				
Tapioca	M-4	1.0 x 0.75	280	7,300
Pigeonpea (Redgram)	ICPL-87	0.75 x 0.40	920	23,000
(b) Biennial fruit crops				
Pineapple	Kew	0.55 x 0.40	600	15,625
Papaya	Honeydew	2.8 x 2.4	44	1,056
(c) Forest species				
<i>Casuarina</i>	Local	2.0 x 2.0	55	1,430
<i>Acacia</i> spp.	Local	2.0 x 2.0	55	1,430
Subabul	Local	2.0 x 2.0	55	1,430
(d) Cover crop				
<i>Mucuna</i> sp.	Local	2.0 x 2.0	55	1,430
(e) Control (no intercrop)				
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RESULTS AND DISCUSSION

The preliminary observations on the main and inter/mixed crops were recorded during 1988, after one year of their growth period, except redgram and tapioca which was done at the time of their harvest.

Cashew

More height, girth and spread of the main crop was recorded in the plots inter/mixed cropping with redgram, pineapple, *Mucuna* spp., *Casuarina* and *Acacia*, while the corresponding values were minimum when intercropped with tapioca, indicating thereby competition by tapioca in the initial growth stage of cashew (Table II). The canopy coverage of cashew was ranging from 1.3 to 3.2 % of the given area. The light interception by cashew in different intercropping plots ranged from 68.88 to 75.26 % within one year of its growth period (Table III).

Food crops

Tapioca: At the time of harvest (after 10 months of planting), average height of

shoot was 2.28 metres which was more than double the height of cashew plant (1.0 m) in the same plot. Average root length of tapioca was 30.43 cm. Tapioca plants utilised maximum light, intercepting (86.29%) of light. The root and shoot ratio was found to be 1.25 : 1.97 showing high harvest index and the total fresh tubers harvested from the interspace worked out to 6.25 tonnes/ha.

The cost of production worked out to Rs 2244/ha and the amount realised from the sale of fresh tubers @ Rs. 1.00/kg was Rs. 6250/ha. However, there was not much local demand of tapioca for home consumption in Dakshina Kannada.

Redgram: The variety ICPL-87 developed by ICRISAT which is a semi-dwarf and a determinate type, was planted in July and harvested during December. The total biomass production was 46 g/ha (dry weight of shoot and pods) out of which the grain yield turned out to be only 2.08 g/ha, because the crop was frequently attacked by pod borer, especially *Heliothis armigera*.

Table II. Growth characters of cashew as affected by inter/mixed cropping systems (Av. of 3 replications)

Treatment	Height (cm)	Girth (cm)	Av. canopy EW & NS (cm)
Cashew+Tapioca	99.0	10.49	103.2
Cashew+Redgram	121.6	13.16	156.3
Cashew+Pineapple	124.9	13.03	160.7
Cashew+Papaya	110.4	11.00	117.3
Cashew+ <i>Mucuna</i> spp.	111.8	12.18	130.9
Cashew+ <i>Casuarina</i>	118.0	12.64	131.9
Cashew+Subabul	106.6	11.05	118.2
Cashew+ <i>Acacia</i>	115.9	11.09	118.5
Cashew alone (Control)	109.2	10.96	131.8

Table III. Ground coverage and light interception by cashew and inter/mixed crops (%)

Treatment	Ground coverage/plot			Light interception by cashew	Light interception by intercrops
	Cashew	Inter-crop	Total		
Cashew+Tapioca	1.3	75	76.3	72.4	86.3
Cashew+Redgram	3.0	75	78.0	73.0	69.3
Cashew+Pineapple	3.2	63	66.2	75.0	97.6
Cashew+Papaya	1.7	13.9	15.6	72.5	79.6
Cashew+ <i>Mucuna</i> spp.	2.1	30.0	32.1	68.9	—
Cashew+ <i>Casuarina</i>	2.7	16.7	19.5	71.6	85.8
Cashew+Subabul	2.1	5.7	7.8	72.6	50.7
Cashew+ <i>Acacia</i>	1.7	38.0	39.7	74.4	61.6
Cashew alone (Control)	2.1	—	2.1	75.3	—

in spite of spraying and dusting of insecticides at flowering and pod formation stages. The cost of cultivation was calculated at Rs. 2832/ha in the first year of its cultivation in a virgin land and the amount realised from the redgram seeds was only Rs. 3328/ha (@ Rs. 16/kg), thereby realising the net profit of Rs. 496/ha only.

Fruit crops

Pineapple: This is a biennial fruit crop commonly grown in laterite tracts of this region. This has established well and the growth observations were recorded. The average height of each plant was 85.66 cm bearing 53 to 56 leaves. The crop intercepted light by 97% in the first year which appears to be the highest of intercrops. The crop is at the fruiting stage. The cost of cultivation worked out to Rs. 10,250/ha in the first year. Out of this, Rs. 3000 being the cost of pineapple suckers and the remaining amount spent for opening 1 metre width, 1½ metre depth trenches of convenient length for planting suckers, fertilizer application and weeding.

Papaya: This is a biennial fruit crop which was planted after the establishment of the main cashew crop. Within five months of its planting, the canopy of the crop has covered 13.89%. The plants have already started flowering. At this stage, these plants intercepted light upto 79.60%.

The cost of cultivation worked out to be Rs. 2800/ha which includes initial cost of opening pits, manure, etc.

Cover crop

Mucuna spp. was found to be the best cover crop in rubber plantations and particularly in laterite soils of the Dakshina Kannada district and hence this was included as cover crop in cashew. The crop was established by planting of cuttings which has been established but covered only 30% of the given area, because of gap filling.

Tree species

Casuarina: The casuarina plants attained just double the height of cashew in the same

plot (Casuarina 239.7 cm; Cashew 118.0 cm). The canopy coverage was also more (16.75%) in casuarina which is only 2.7% in case of cashew. Both crops have covered so far totally 19.45% of the given area. Casuarina has also utilised maximum sunlight, by intercepting upto 85.83 per cent. The crop is allowed to grow straight by cutting side branches upto 50 cm height, the biomass of which worked out to be 1.5 tonne dry weight/ha which has been recycled by incorporating around the base of the plant.

The cost of cultivation/ha in the initial year was Rs. 3000/ha. This includes the cost of opening 60 cm³ sized pits also.

Leucaena (Subabul): In the first year, the average height of the subabul plant was more than the height of the main crop (subabul 141.3 cm, cashew 106.0 cm). The ground coverage by the canopy of subabul plants was only 5.66% of the given area which is minimum among all the intercrops, only because the canopy did not develop much as compared to the height. The coverage by cashew plants was only 2.1% of the area and both crops have thus covered only 7.76% of the given area. Light measurements showed that subabul plants utilised only 50.66% of the fallen light in the first year (Table III). Initially some of the subabul plants suffered from attack by goats and rabbits but later the same was protected by providing thorny bamboo fence around each plant. As a result, the cost of cultivation has slightly increased which worked out to Rs. 3500/ha.

Acacia: The average height of *Acacia* plants was 119.26 cm which was more than the height of cashew plants (115.9 cm) in the same plot. The area covered by acacia plants was 38.06% of the given area which is more than double as that of casuarina. Cashew and acacia plants put together have covered 39.7% of the given area within one year. *Acacia* plants intercepted 65% of the fallen light in the plot (Table III).

Thus, out of the tree species tried, *Acacia* spp. has grown very fast and covered 38% of the given area in the very first year of planting. This indicates that the main crop is likely to suffer due to lack of light from second year onwards, suggesting thereby lopping of lower branches at least up to two metres height of the acacia plants in stagewise as and when branches touch each other.

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REFERENCES

- BAVAPPA, K. V. A. and MANDAL, R. C. 1984. Seminar on eco-development of Western Ghats. Kerala Forest Res. Instt., Peechi, 17-18 Oct. Session III. pp. 25.1-25.10.
- MANDAL, R. C. 1984. Subsidiary crops in plantations. Seminar on Subsidiary Crops in Plantation. Coffee Planters' Assoc., Chikmagalur, 8th June.