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EFFECT OF SPACING AND INTERCROPPING WITH COWPEA ON WEED GROWTH IN BANANA

Mool Chand Singh[1] and C V Sairam[2]

[1]ICAR-National Bureau of Plant Genetic Resources, New Delhi – 110 012, India
[2]ICAR-Agriculture Technology Application Research Institute, Zone-VIII, Bangalore-560024

Abstract: A field experiment was conducted during 2009-10 and 2010-11 at Panniyur in the Kannur district of Kerala to study the effect of spacing and intercropping with cowpea on weed growth in banana. Four spacing with cowpea as intercrop were used as treatments. Results revealed that adopting high planting density and growing initially an intercrop of cowpea, weed growth could be drastically curtailed throughout the growth of the banana crop and obtain higher yield. Commercial viability of this system of weed control has been demonstrated in a number of front line demonstrations in Kerala.

Keywords: Banana, cowpea, intercropping, spacing, weed.

Introduction

Banana, one of the most important tropical fruits of the world, grown in India in an area of 4.66 lakh hectares with an annual production of 142.09 lakh tones (Anonymous, 2002). This contributes to 11.67 per cent of total area and 24.29 per cent of total production of fruit crops in India. In Kerala it is grown in 72,570 ha with a production of 57, 4260 tonnes. Commercial banana plantings suffer to a great extent from competition with weeds for both nutrients and soil moisture and weed population become deleterious for growth and yield of banana (Bauri *et al*., 2010). Under the normal planting distances followed in India and elsewhere, rhizomatous and stoloniferous weeds (*Cynodon dactylon* and *Cyperous rotundus*) and many broad leaved species flourish and compete severely with the banana plants especially during the early stages of crop growth. As the crop develops full canopy and shade the soil, weed growth decreases although not completely eliminated.

It is estimated that weed control accounts for approximately 50% of the total cost of banana production (Hammerton, 1981). Weed control in banana using herbicides has been investigated in detail and the merits and demerits of contact and systemic herbicides have been studied (Badgujar *et al*., 2003). Since chemical weed control has yet to become popular among banana farmers in India, any major step towards other forms of weed management

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would be most appropriate. The cost, non-availability of labour during peak season and the tediousness of the work are some of the disadvantages of hand weeding. However, sowing of a fast growing crop such as cowpea the inter row space could be helpful to keep weeds in check.

Commercially, the semi-dwarf banana cv. Robusta belonging to the Cavendish banana (*Musa*, AAA group) is planted at distances ranging from 1.8 to 2.1 meters in square system giving an average yield of 30-50 t/ha (Randhawa *et al*., 1973). Since banana plants could tolerate shade to a great extent (Samson, 1980), the possibility of increasing the plant population per unit area was explored for higher yield, besides ensuring less weed growth

Materials and methods

The experiments were carried out at the experimental farm of Krishi Vigyan Kendra, Panniyur in the Kannur district of Kerala, during 2009-10 and 2010-11. The Panniyur lies between latitudes 11^0 40' to $12^0$48' North and longitudes 74^0 52' to 76^0 07' East. The soil of the experimental field was sandy loam having pH 5.6. Initial available soil nutrient status showed low in nitrogen (235.5kg/ha), high in available phosphorus (52.5kg/ha) and medium in available potassium (384.3kg/ha). Planting of banana suckers in the square system was done on 23rd June,2007 and 20th June, 2008, keeping four spacing viz.,1.2m x 1.2m (6944 plants/ha), 1.5m x 1.5m (4444 plants/ha), 1.8m x 1.8m ( ) and 2.1m x 2.1m (2227 plants/ha) The corresponding net plants observed for yield were 36, 24, 20 and 16, respectively .The experiment was laid out in a completely randomized block design with 3 replications. A basal dose of 2 kg vermicompost and 250 g of mineral mixture /plant was given one month after planting. Further, a uniform dose of 200 g N ,180g $P_2O_5$and 225g K $_2$O/plant was applied in three split doses at 2,4 and 6 months after planting of the suckers.

An intercrop of cowpea (*Vigna unguiculata*) variety 'Pusa Komal' was sown 20 days after planting the suckers at the seed rate of 50kg/ha. Before sowing, superphosphate at the rate of 100 kg/ha was broadcast all over the field. Two months after planting (flower initiation), the cowpea plants were pulled out and spread over the field taking care not to obstruct the irrigation arrangements. Two sprays of 0.2% malathion were applied to the cowpea during its growth period for the control of insects and banana plant as a precaution against insect vectors of the bunchy top disease. Observations on biomass production of cowpea (top growth) were recorded from five plots measuring one m^2 and N, P, K content of vegetative parts were determined using standard procedures . Growth and yield parameters of banana were recorded. To record the amount of weed growth in each treatment, five spots each

measuring one m^2were selected. From these spots weeds were collected periodically and their dry weights were recorded. Observation on the light interception by the developing canopies of growing banana plants in the various treatments were recorded with the help of a lux meter on bright and sunny days. Direct and reflected lights were measured both at ground level and at 1.5m above the ground level. The weight of bunches from each plant were recorded at the time of harvest and yield/ ha in different treatments were calculated. The economics was worked out with the cost of cultivation at current prices at the end of experiment and gross realization and net returns at prevailing market prices of the produce.

Result and discussion

Growing cowpea as an intercrop to banana resulted in the developments of dense canopy covering the entire ground area and suppressed weed growth completely for a period of 75 days. Weed growth was checked for a further period of 60 days by mulching the soil with uprooted cowpea plants.

Besides the control of weeds, the enormous biomass produced which later formed a mulch on the soil was advantageous in reducing the soil moisture evaporation, supply of humus and fairly large amounts of N, P and K for the growth of banana plants (Table 1). The amount of N added to the soil by cowpea biomass itself justified the cost of the initial cowpea seed material used for sowing.

The data taken from 6^{th} months onwards show that with increase in plant population, weed growth also decreased considerably (Table 2). The weed population was almost negligible in case of close planting like 1.2x1.2 and 1.5x1.5, while regular sprays of paraquat were required to suppress weed growth in 1.8x1.8 and 2.1x2.1m spacing.

Decrease in growth of weeds was thus a direct consequence of reduced light intensities at ground level (Table 3). With increase in time, light intensity at ground level was further found to be considerably reduced both within and between treatments mainly due to increase in size of the plant canopy structure.

Highest values for pseudo stem height, pseudo stem girth and total number of leaves per plant were recorded with the spacing of 2.1x2.1m (2227 plants/ha) followed by 1.8x1.8m. The shortest time to flowering and to harvest were also recorded with 2.1x2.1m, followed by 1.8x1.8m. The highest number of fingers/bunch, finger length, finger girth and bunch weight were recorded with the spacing of 2.1x2.1m followed by 1.8x1.8m. No significant difference was observed between 1.5x1.5m and 1.2x1.2m spacing. Highest banana yield (174.39 t/ha) was obtained with the spacing of 1.2x1.2m and was significantly superior to other spacing

(Table 4). There was 19.50, 52.49 and 102.80% increase in banana yield with 1.2x1.2m spacing over 1.8x1.8 and 2.1x2.1m, respectively. Results of this investigation are comparable to those observed by Chadha (1999).

The higher banana yield obtained from these experiments show the beneficial effect of controlling weeds by suitable agro- techniques like intercropping with leguminous cover crops contributing to improvement of soil structure and fertility.

Under the high density planting systems like1.2x1.2 and 1.5x1.5m spacing, the increased number of plants per unit area also contributed largely to produce higher yields, besides imparting natural control of weeds due to the development of high canopy structure and low light intensities prevailing at ground level. The highest net return (Rs.148000/ha) was recorded with 1.2x1.2m spacing, suggesting that this was the most efficient planting method.

Table 1. Biomass production and NPK content in cowpea variety 'Pusa Komal' intercropped with banana

Particulars	Content (kg/ha)
Fresh weight of above ground organs	56048.00
Dry weight	5498.49
Nitrogen (N)	133.12
Phosphorus (P_2O_5)	14.24
Potash (K_2O)	46.97

Table 2. Effect of planting distance and intercropping cowpea on dry weight of weed growth (g/m^2) in banana

Planting distance (m)	Dry weight of weeds (g/m^2)		
	Months after planting		
	6	8	12
1.2x1.2	42.58	14.00	0.57
1.5x1.5	106.31	61.33	3.00
1.8x1.8	181.19	119.00	10.23
2.1x2.1	211.11	175.99	23.78
CD at 5%	39.89	14.39	2.70

Table 3. Light intensity in lux as affected by various planting distances in banana

Planting distance (m)		Light intensity (Lux)					
		Months after planting					
		6		8		12	
		Ground level	150 cm high	Ground level	150 cm high	Ground level	150 cm high
1.2x1.2	Direct	980	1590	1333	2006	347	452
	Reflected	320	590	366	873	13	33
1.5x1.5	Direct	2030	3690	3073	4019	777	1277
	Reflected	530	1150	886	1566	50	147
1.8x1.8	Direct	13170	21720	21319	35066	2438	5344
	Reflected	2100	3720	3712	5146	136	397
2.1x2.1	Direct	36100	49633	52133	56599	6612	11751
	Reflected	4316	6923	6566	8399	431	1042

Table 4. Effect of planting distance and intercropping cowpea on growth and yield contributing characters of banana

Planting distance (m)	Pseudo-stem height (cm)	Pseudo-stem girth (mm)	No. of leaves	Days to flowering	Flowering (%)	Days to harvesting	No. of fingers/bunch	Length of finger (cm)	Finger girth (mm)	Bunch weight (kg)	Biomass (t/ha)
1.2x1.2	157.6	61.0	30.0	299	85.08	403	126.4	20.1	11.3	14.9	691.67
1.5x1.5	158.7	62.6	30.9	296	93.49	377	136.2	20.4	11.6	15.3	510.16
1.8x1.8	161.5	65.4	31.2	277	99	376	142.3	20.9	11.8	16.7	388.05
2.1x2.1	165.8	66.5	31.7	282	98.75	382	143.6	21.2	12.00	17.6	294.36
CD at 5%	6.8	2.0	1.1	32.4	5.77	50.7	10.6	0.6	0.8	1.3	50.00

Table 5. Effect of planting distance and intercropping cowpea on yield and economics of banana

Planting distance (m)	Yield t/ha	Total cost of production (Rs.)	Gross income/ha (Rs.)	Net income/ha (Rs.)
1.2x1.2	174.39	48188	196188	148000
1.5x1.5	145.44	47591	163620	116029
1.8x1.8	114.36	46188	128655	82467
2.1x2.1	85.99	45911	96354	50433
CD at 5%	17.64	---	---	---

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