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Performance of chittaratha (*Alpinia galanga*) intercropped under normal and double sucker system of planting banana var. Nendran.

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Banana is an important fruit crop having great socio-economic significance in India. The spatial arrangement of plants in a plantation is very important and usually involves a choice between physiological efficiency and practical utility. Crop intensification and diversification are the only viable alternatives to promote the agrarian economy. The experiment has been laid out in factorial randomized block design replicated thrice for two consecutive seasons to evaluate the feasibility of intercropping under the two planting patterns of banana – normal planting (single sucker per pit) and double sucker system (two suckers per pit). The intercrops studied were cucumber followed by amaranthus, colocasia and chittaratha along with a control (no intercrop). Results showed that intercropping can be practiced in both systems of planting banana successfully for generating additional income. Growing Chittaratha is more economic than pure crop. Moreover, the incorporation of the intercrop residues had the added advantage of soil nutrient improvement.

Keywords: Banana, Chittaratha, Double sucker system, Intercropping, Crop intensification.

1. Introduction

Banana is one of the most important fruit crops of the world as well as India. Its culture in India is as old as Indian civilization. Banana variety Nendran is the most popular commercial cultivar in Kerala owing to its adaptability to varying environments, excellent fruit quality attributes, yield stability and sustained income. In spite of its predominance as a fruit crop, its productivity in Kerala is low due to poor management practices adopted. Banana cultivation being a high input high risk enterprise has to be ensured of its economic advantage particularly to the small and marginal farmers who invest most often borrowed capital for the cultivation. Inefficient use of resources not only results in increased cost of production and reduced profitability but also proves detrimental to the natural resources. In recent years more emphasis is being given to obtain higher productivity and profitability by adopting various means. A new concept of increasing the plant density by accommodating more number of suckers per pit at a wider spacing has proven successful in increasing the productivity of banana. Besides higher yield, HDP also helps to reduce labour cost increase the efficiency of input utilization and wider spacing in between rows provides more room for intercropping. After planting there is a lag period of about five to six months, before which the banana plants will occupy the space completely and this provides ample scope of planting of at least one inter crop. The present research is perhaps the first attempt with focus on altering plant geometry of main crop banana to accommodate more suckers facilitating wider interspace for intercropping, reducing the labour cost and utilizing the resources efficiently for system profitability and sustainability.

2. Materials and Methods

An experiment was conducted at the Instructional Farm attached to the College of Agriculture, Vellayani, Kerala to study the effect of crop intensification and resource management on the productivity enhancement in banana. The efficacy of intercropping was evaluated under two systems of planting in banana. The planting pattern included normal planting with one sucker at 2 m x 2 m spacing and modified planting with two suckers per pit at 3 m x 2 m spacing. The intercrops studied were cucumber followed by amaranthus, colocasia and chittaratha along with a control (no intercrop). The experiment was laid out in factorial randomized block design replicated thrice.

For planting banana pits of 50 cm x 50 cm x 50 cm were dug to accommodate one and two suckers as per the treatments. In normal planting method single sucker was planted at the centre of the pit whereas in modified planting, two suckers were planted towards the sides of the pit at a spacing of 30 cm between plants. The growth, yield and nutrient uptake of major nutrients were studied. Plant and soil samples were analyzed using the standard procedures [1, 3].

Chittaratha is a perennial herb with non-tuberous pungent rootstock. The economic part is rhizome, which is a major constituent of many formulations of indigenous system of medicine for relieving throat inflammation, stimulating digestion, purifying blood, improving voice and marinating youthful vigour. The crop can be harvested in 18 months. Therefore a single intercrop is raised during two crops of banana (main crop). They were planted in ridges at 60 cm x 40 cm spacing such that four rows of four plants each were accommodated in each interspace under modified planting and two rows of four plants each under normal planting. In this context, the effect of planting pattern on the productivity and economics of banana with Chittaratha as an intercrop is discussed here. The harvested rhizomes of Chittaratha were individually separated and washed to remove the soil. Rhizomes were dried in shade. Height of four observational plants from each plot was measured at harvest. The height was measured from the ground level to the growing leaf bud. Mean plant height per plot was worked out and expressed in cm. Biomass yield, rhizome yield, length, spread and weight were recorded.

The experimental data were analyzed statistically and the critical difference values were computed for comparison and interpretation of data [2].

3. Results and Discussion

The height of the plant registered higher value under modified system (168.7 cm). Biomass yield and rhizome yield were more under normal planting with values being 29.81 and 15.56 t ha^{-1} respectively. The length, spread and weight were 43 cm, 26 cm and 210 g $plant^{-1}$ under normal planting pattern and 68.7 cm, 35.3 cm and 450 g $plant^{-1}$in double sucker system (Table.1). Growing intercrops did not influence the height and girth of the pseudostem. The interaction effect of intercrop with planting pattern was observed to be insignificant (Table. 2 & 3). Total yield per hectare also was not influenced by intercrops and its interaction with planting pattern. From the economic point of view also, raising intercrop is an added source of income to farmer. Growing chittaratha is more economic than pure crop. However when compared with other intercrops it is less economic since the expenditure for initial establishment is high and returns will be obtained only after 18 months (Table. 4). Table.5.indicated that intercrops had significant influence on shelf life. Banana intercropped with chittaratha recorded maximum shelf life (10.33 days) whereas colocasia recorded the minimum (8.67) days). When compared with the initial soil nutrient status, available N and K content of the soil after the experiment showed marked improvement. Inorganic fertilizers added to all experimental plots along with recycled residue might have contributed to enhancement of nutrients in soil. However the available phosphorus content was reduced than initial status with pure crop in modified system of planting. This could be attributed to the increased uptake of phosphorus by pure crop of banana under modified system. Hence it could be inferred that addition of required amount of nutrients along with proper incorporation of crop

residue is ideal for enhancing soil nutrient status in a banana based cropping system. In addition raising intercrops with proper recycling of crop residues is not causing any deterioration to soil. Moreover the added advantage of soil nutrient improvement was also observed by this practice (Table. 6).

Table 1: Effect of planting pattern on chittaratha

Observations	Normal planting pattern	Modified planting pattern
Height of the plant at harvest (cm)	161.3	168.7
Yield of the rhizome (t ha^{-1})	15.56	12.37
Biomass yield (t ha^{-1})	29.81	23.66
Dry matter partitioning (%) Shoot:	25.3	16.3
Root:	5.2	3.3
Rhizome:	69.5	80.4
Root studies at harvest		
Length (cm)	43.0	68.7
Spread (cm)	26.0	35.3
Weight (g)	210	450

Table 2: Effect of planting pattern and intercrops on the pseudostem height (cm) of banana (first crop) at 2, 4 and 6 MAP

Treatments	Pseudostem height in cm					
	Year I			Year II		
	2 MAP	4 MAP	6 MAP	2 MAP	4 MAP	6 MAP
Normal planting + No intercrop	46.50	185.00	332.67	93.83	176.67	323.00
Normal planting + Chittaratha	31.33	153.67	327.33	84.17	144.67	282.00
Double sucker planting + No intercrop	44.17	197.33	322.33	87.83	161.33	302.50
Double sucker planting + Chittaratha	56.53	202.00	339.67	88.58	152.33	295.00
CD(0.05)	NS	NS	NS	NS	NS	NS

Table 3: Effect of planting pattern and intercrops on the pseudostem girth (cm) of banana at 2, 4 and 6 MAP

Treatments	Pseudostem girth in cm					
	Year I			Year II		
	2 MAP	4 MAP	6 MAP	2 MAP	4 MAP	6 MAP
Normal planting + No intercrop	13.67	46.60	66.20	27.50	45.33	65.00
Normal planting + Chittaratha	9.83	40.33	66.83	26.67	39.37	60.67
Double sucker planting + No intercrop	14.27	45.73	59.93	27.17	41.27	58.83
Double sucker planting + Chittaratha	15.43	46.87	63.27	27.17	38.10	55.67
CD(0.05)	NS	NS	NS	NS	NS	NS

Table 4: Effect of planting pattern and intercrops on the yield and net income of banana

Treatments	Pooled Yield (t ha^{-1})	Pooled Net income (Rs.)
Normal planting + No intercrop	26.47	271612
Normal planting + Chittaratha	26.04	308796
Double sucker planting + No intercrop	31.55	349249
Double sucker planting + Chittaratha	35.21	416623
SEm	1.370	16977.6
CD(0.05)	NS	NS

Table 5: Effect of intercrops on the shelf life of banana

	Shelf life (days)	
Intercrops	**Year I**	**Year II**
No inter crop	9.17	9.67
Cucumber - Amaranthus	9.67	9.67
Colocasia	8.67	9.17
Chittaratha	10.33	9.83
SEm	0.346	0.233
CD (0.05)	1.051	-

Table 6: Effect of planting pattern and intercrops on soil nutrient status after the experiment, kg ha^{-1}

	Available Nitrogen	**Available Phosphorus**	**Available Potassium**
Initial soil status	103.50	7.20	82.40
Normal planting + No intercrop	163.07	7.87	370.35
Normal planting + Chittaratha	112.90	7.76	432.47
Double sucker planting + No intercrop	148.44	6.50	573.14
Double sucker planting + Chittaratha	169.34	8.49	342.27
SEm	2.791	0.150	19.377
CD	8.465	0.455	58.781

Highest uptake of nitrogen was registered with chittaratha as intercrop in both systems during first year and chittaratha under normal system registered higher values during second year. Since these treatments registered higher dry matter production, uptake which is a product of the nutrient content and dry matter was also higher. Chittaratha crop being in vegetative stage during the first year which might have reduced its nutrient requirement and thus enable increased uptake by banana. Moreover incorporation of more crop residues in this system also might have improved nitrogen uptake. When banana was grown as pure crop highest uptake of phosphorus was seen under normal planting pattern while banana intercropped with chittaratha registered higher phosphorus uptake under modified system owing to increased dry matter production. Significantly higher total potassium uptake was recorded with colocasia in normal system and with chittaratha in modified system of planting during first year. However pure crop in normal system registered higher uptake values during second year. This could be attributed to increased absorption of potassium by pure crop of banana (Table. 7).

Table 7: Effect of planting pattern and intercrops on the nutrient uptake by different parts of banana, kg ha^{-1}

	Year I			**Year II**		
Treatments	**N**	**P**	**K**	**N**	**P**	**K**
Normal planting + No intercrop	227.90	76.20	798.60	189.40	25.41	566.60
Normal planting + Chittaratha	245.30	57.80	684.70	193.00	24.40	425.60
Double sucker planting + No intercrop	233.20	59.30	751.80	179.10	26.42	493.70
Double sucker planting + Chittaratha	311.80	97.10	879.50	176.60	28.16	447.30
SEm	12.820	5.370	56.510	7.560	0.844	14.770
CD	38.880	16.280	171.420	-		44.820

4. Conclusion

Raising profitable intercrops is suggested as a viable alternative for the better utilization of resources and increasing income. Growing Chittaratha is more economic than pure crop. System approach seeks to increase the benefits derived from crop production by efficient utilization of natural resources resulting in sustainable productivity of crops.

5. References

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