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Interaction Effect of Plant Density and Nutrient Management in Cashew (*Anacardium occidentale* L.) under Jharkhand Condition

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A B S T R A C T

A field experiment was conducted under All India Coordinated Research Project on Cashew, Zonal Research Station**,** Darisai, Birsa Agricultural University, Ranchi, Jharkhand India during the year 2017-2018 to study the interaction effect of planting density and nutrient management on growth and yield of cashew variety BPP 8.The experiment was laid out in a split plot design with three planting densities [S1 =10m x 5m (200 plants/ ha); S2 =6m x 4m (400 plants/ ha) and S3 =5 m x 4 m (500 plants/ha)] along with three levels of fertilizer (M1 =75-25-25, M2 =150-50-50 and M3 =225-75-75 kg NPK ha^{-1}) and replicated three times. The overall results indicated significant influence of both planting density and nutrient management on growth and yield of cashew, however, non significant effect was observed in their interactions. Among the planting densities, adoption of planting densityS2=6mx4m (400 plants/ha) not only realized significantly better vegetative growth, i.e., mean tree height (4.47 m), mean stem girth (62.40 cm), mean canopy spread N-S (4.97 m), E-W (4.85 m) but also mean flowering lateral/m2 (20.4), nut yield attributing parameters such as mean nut weight (7.20 g), mean apple weight (51.53 g) and mean nut yield kg/tree (5.74 kg/tree) as well as cumulative nut yield for three harvests per plant basis (22.96 kg/plant). The result also revealed that interaction of 10m x 5m planting density and moderate level fertilizer (150-50-50 kg NPK ha^{-1}) found highest vegetative growth; mean tree height (4.64 m), mean stem girth (65.40 cm), mean canopy spread N-S (6.61 m), E-W (6.96 m), mean nut weight (7.86 g), mean nut yield kg/tree (6.63 kg/tree) as well as cumulative nut yield for three harvests per plant basis (10.73 kg/plant).

Introduction

Cashew (*Anacardium occidentale* L.) an Anacardiaceae family member is native of North East Brazil. It is an important horticulture crop contributing substantially to the national income through export. It is becoming one of the important commercial plantation crops, which today is deemed as the source of dollar earning crop for the country. In India, the crop is cultivated in an area of 9.79 lakh ha with an annual production of 7.25

lakh tons (NHB, 2012). The highest productivity is observed in Maharashtra and Kerla with a value more than one ton per ha. Among the several factors that influence the cashew productivity in the country; planting of traditional varieties with low yield potential, poor adoption of production and protection technologies etc. are the major causes. Even new plantation of cashew with high yielding varieties/ hybrids, the low productivity is contributed by improper planting density as well as nutrient management practices. In India, usually cashew is grown as a rainfed crop, cultivated in neglected land which otherwise unsuitable for any other crop (Rejani and Yadukumar, 2010). The lower status of nutrients in cashew plantations is the chief cause of low productivity of cashew in India. Further, the situation is aggravated due to limited or no use of fertilizer and organic manures leading to multiple nutrient deficiencies in Indian cashew plantations (Saroj *et al.,* 2014).

Maintenance of optimum plant population is seems to be an important aspect to be studied for this export oriented crop in order to increase the productivity. As most of the cashew plantations are senile plantation and cultivated in marginal as well as waste lands with low fertility status, the productivity of cashew is generally poor. In most parts of the country, the farmers hardly apply any fertilizer or organic manures as per requirement of the plant. Hence, keeping these problems in view, the present study was undertaken to study the efficacy of plant density and fertilizer dose to increase the production and productivity of cashew under Jharkhand conditions.

Materials and Methods

The field experiment was conducted at All India Coordinated Research Project on Cashew, Zonal Research Station**,** Darisai, Birsa Agricultural University, Ranchi, Jharkhand India during the year 2017-2018 to study the interaction effect of planting density and nutrient management of cashew plantation. The experiment was laid out in split plot design with three planting density of S1 10 m x 5 m), S2 (6 m x 4 m) and S3 (5 m x 4 m) as main plots while three doses of fertilizer such as M1 (75-25-25), M2 (150- 50-50) and M3 (225-75-75) NPK kg ha^{-1} as sub plot with four replications. Each treatment consists of six plants. The grafted cashew plants of variety BPP 8 was planted during 2000. The experimental soil was red lateritic in texture with pH of 4.8. All the recommended practices except plant density and nutrient were adopted uniformly in all the treatments. During the initial years of growth, lower branches were removed uniformly for convenience of cultural operations and also to give a proper canopy shape to the plantation. The cashew tree was de-topped first after attending a height of near about 3 meter. Pruning was adapted uniformly to all the plants in the experiment as per the requirements. The vegetative growth parameters such as plant height, trunk girth, canopy height and canopy diameters in E-W and N-S directions were recorded. Similarly, nut yield and yield attributing parameters were recorded from individual plants from each treatments year wise and mean data were considered for statistical analysis. Fresh and dry weight of a sub sample of 50 nuts from each tree was determined.

The dry weight was recorded after sun drying the nuts for at least 5 to 6 days. The weight per nut including shell was determined at 14% moisture as per the industrial standard (Kuppelwieser, 1989). The nut yield $tree^{-1}$ was computed by mean nut weight x total number of nuts $tree^{-1}$. Economics of plant density cum fertilizer trial was also calculated. The statistical analysis was carried out by adopting the procedure suggested by Panse and Sukhatme (1989).

Results and Discussion

Efficacy of planting density and nutrient management on vegetative growth of cashew nut

The data presented in Table 1 revealed significant influence of planting density and level of fertilizer dose for all vegetative growth parameters under study. Planting density of 6m x 4m (S2) accommodating 400 plants/ha induced significant impact on mean tree height (4.47 m), mean stem girth (62.40cm) and mean canopy spread E-W (4.85 m) followed by planting density of 5m x 4m (S3) accommodating 600 plants and lowest vegetative growth found in high planting density i.e. 10m x 5m (S1) accommodating 200 plants/ha. But Tripathy *et al.,* (2015) found maximum vegetative growth on planting density 10m x 5m where accommodating 200 plants/ha.

While, similar significant increased in al vegetative growth parameters were recorded at moderate fertilizer doses M2 (150-75-75 kg NPK/ha) was observed maximum vegetative growth mean tree height (4.86 m), mean stem girth (68.39cm) and mean canopy spread N-S (5.62 m) and E-W (4.95 m) followed by high fertilizer dose M3 (225-75-75 kg NPK/ha).

Interaction effect between tree densities and fertilizer dose on growth of cashew at Darisai centre (Var.: BPP-8)

The results on interaction effect of plant density and nutrient management in cashew plantation recorded significant influence for all the vegetative growth parameters under study (Table 2). However, relatively better vegetative growth in-terms of mean tree height (4.92 m), trunk girth (65.40 cm) and mean canopy diameter (6.61-6.96 m) were recorded in the plants receiving higher nutrients (M2 and M3) with wider spacing of 10 m x 5 m. On the other hand, relatively poor vegetative growth was recorded in cashew receiving lower nutrients, M1 @ 75-25-25kg NPK ha-1 having closer planting density of 5 m x 4 m, (3.65 m, 47.60 cm and 3.30-3.59 m mean tree height, trunk girth and mean canopy diameter, respectively).These interaction results clearly indicated that normal planting density with higher nutrient management while reduction in vegetative growth under closer planting under lower nutrient management condition, which might be due to accommodation of more number of plants with reduced level of nutrients. Similar results found by Tripathy *et al.,* (2015) but he observed interaction effect of plant density and nutrient management in cashew plantation indicated non-significant influence in all the vegetative growth parameters under study.

Efficacy of planting density and nutrient management on nut yield and nut yield attributing parameters in cashew plantation

The data on efficacy of planting density and nutrient management at 3rd harvest stage in cashew plantations revealed significant variations among different planting density and nutrient management for nut yield and yield attributing parameters. Planting of cashew at wider spacing of 10 m x 5 m (200 plants / ha) recorded significantly highest number of mean flowering lateral/m^2 (22.6), mean nut weight (7.32 g) as well as apple weight (56.49 g) and less number of flowering days (82 days) than rest of the planting density. While, highest nut yield kg/plant (5.74 kg/plant) and cumulative yield for three harvests kg/plant observed in medium planting density 6m x 5m (400 plants/ha). This might be due to better vegetative growth of the plants under wider spacing, as observed in the present study.

Table.1 Efficacy of planting density and nutrient management on vegetative growth of cashew nut (2017-2018)

Treatment	Mean tree height (m)	Mean stem girth (cm)	Mean canopy spread (m)	
			N-S	E-W
S1	3.32	51.40	4.17	3.25
S2	4.47	62.40	4.97	4.85
S3	4.10	56.30	4.87	4.17
SE(m) ±	**0.09**	**4.48**	**0.17**	**0.21**
CD@5%	**0.28**	**3.46**	**0.52**	**0.64**
M1	3.64	57.60	4.34	4.14
M2	4.86	68.39	5.62	4.95
M3	3.87	59.90	5.21	4.61
SE m±	**0.12**	**1.46**	**0.17**	**0.19**
CD@5%	**0.37**	**4.41**	**0.52**	**0.60**

Table.2 Interaction effect between tree densities and fertilizer dose on growth of cashew at Darisai centre (Var.: BPP-8)

Treatment	Mean tree height (m)	Mean stem girth (cm)	Mean canopy Spread (m)	
			N-S	E-W
S1M1	3.85	54.20	5.95	6.12
S1M2	4.64	65.40	6.61	6.96
S1M3	4.24	58.60	6.45	6.68
S2M1	4.56	47.60	4.50	4.84
S2M2	4.10	53.40	4.35	4.78
S2M3	4.92	51.40	4.10	4.46
S3M1	3.95	48.40	3.30	3.59
S3M2	3.65	52.20	3.65	3.77
S3M3	4.59	49.65	3.85	3.94
SEm ±	**0.09**	**2.48**	**0.27**	**0.29**
CD (5%)	**0.28**	**7.53**	**0.86**	**0.91**
CV (%)	**12.45**	**14.36**	**13.18**	**13.38**

Table.3 Efficacy of planting density and nutrient management on nut yield and nut yield attributing parameters in cashew plantation

Treatment	Flowering Days	Mean flowering lateral/ (m^2)	Mean nut wt(gm)	Mean apple wt(gm)	Mean nut yield (kg/tree)	Cumulative Yield for three harvests Kg/plant
S1	82	22.6	7.32	56.49	4.38	8.96
S2	90	20.4	7.20	51.53	5.74	22.96
S3	94	21.6	7.95	49.76	3.10	15.50
SE m±	1.5	0.32	0.08	1.39	1.35	7.05
CD@5%	3.6	0.96	0.28	4.80	4.06	21.16
M1	86	19.4	7.71	60.06	4.24	8.48
M2	102	20.6	6.71	62.76	6.31	11.56
M3	93	23.5	7.33	64.97	4.95	9.05
SEm±	**1.9**	**0.45**	**0.08**	**1.16**	**0.64**	**1.5**
CD(5%)	**3.9**	**1.10**	**0.23**	**3.45**	**1.96**	**4.1**

Table.4 Interaction effect between tree densities and fertilizer dose on yield parameters of cashew under spacing cum fertilizer trial at ZRS, Darisai, E. Singhbhum, BAU, Ranchi centre during the year 2017-18

Treatment	Flowering Days	Mean flowering lateral/ (m^2)	Mean nut wt(gm)	Mean apple wt(gm)	Mean nut yield (kg/tree)	Cumulative Yield for three harvests Kg/plant
S1M1	88.00	27.30	7.30	64.75	5.56	8.86
S1M2	105.00	32.30	7.86	56.85	6.63	10.73
S1M3	91.00	21.30	7.10	61.40	4.80	8.05
S2M1	97.00	28.30	7.65	53.55	4.10	7.40
S2M2	88.00	36.30	7.74	55.74	3.90	7.95
S2M3	88.00	23.30	7.60	58.63	2.65	6.80
S3M1	84.00	26.30	7.50	63.25	2.40	6.00
S3M2	82.00	31.30	7.20	46.75	2.75	7.35
S3M3	79.00	29.30	7.00	54.80	1.95	5.75
SEm±	**3.31**	**2.39**	**0.17**	**2.43**	**0.23**	**0.27**
CD(5%)	**9.84**	**7.13**	**0.49**	**7.24**	**0.61**	**0.81**
CV (%)	**14.38**	**13.46**	**12.18**	**15.26**	**12.26**	**12.47**

Similarly, among the three different levels of nutrients supplied to the plantations, the results indicated significantly highest mean flowering laterals/m^2 (23.6), average nut weight (7.71 g), mean apple weight (62.76g), mean nut yield (6.31 kg/plant) and cumulative yield of three harvests (11.56 kg/plant) by application of nutrients @150-50- 50kg NPK ha-1(M2) followed by @ 225-75-75 kg NPK ha-1(M3) than lower dose of M1 (Table 3) which might be due to the fact that under moderate to high dose of nutrients, the cashew plants may uptake better as well as utilization of nutrient, in term of better vegetative growth parameters and nut yield attributing parameters.

Interaction effect between tree densities and fertilizer dose on yield parameters of cashew under spacing cum fertilizer trial

The interaction effect of both planting density and nutrient management on yield parameters were found to be non-significant statistically except nut yield kg/tree and cumulative nut yield for three harvests kg/ha. However, relatively better flowering laterals/m2(32.30), mean nut weight(7.86 g) was observed at moderate fertilizer dose M2 (150-50-750 kg NPK/ha) and higher planting density 10m x 5m (200 plants/ha), while highest mean apple weight found at lowest fertilizer dose M1 and highest planting density S1. Early flowering (79-84 days) was noticed at high density planting S3 (5m x 4m) with different doses fertilizer while, late flowering was observed in more spacing with different doses of fertilizer.

Highest nut yield kg/plant (6.6kg/ha) and cumulative nut yield for three harvests (10.73 kg/plant) was observed at higher planting density 10m x 5m (200 plants/ha) with moderate fertilizer dose M2 (150-50-50 kg NPK/ha) followed by lowest fertilizer dose M1(75-25-25 kg NPK/ha). Whereas, lowest yield parameters, mean flowering laterals, mean nut weight (7.0g), nut yield kg/plant (1.95 kg/ha) and cumulative nut yield for three harvests (5.75 kg/plant)was observed at moderate fertilizer dose M2 (150-75-75 kg NPK/ha) and higher planting density 10m x 5m (200 plants/ha).

In this investigation, we observed that high density planting in cashew plantation may decrease the nut yield gradually over the years due to proper canopy management practices were not adopted. Thus, the study also indicated that, in case of high density planting system, regular pruning should be done in order to maintain the productivity at optimum levels (Table 4).

Similarly, cumulative nut yield (kg tree-1) at 3rd harvest stage revealed highest yield at wider spacing (200 plants ha-1) followed by 400 plants ha-1and lowest being 500 plants ha-1. Similar decrease in yield with increased plant densities in coffee was also reported by Paulo and Furland (2010). Regarding the efficacy of different nutrient management on nut yield in cashew plantation over the years, the result revealed significantly highest yield by adoption of normal nutrient management, i.e. M2 @ 150-50-50 kg NPK ha-1 in all the years. The present study, thus clearly demonstrated that adoption of normal nutrient management practices has yielded better nut yield than rest of the treatment schedules in cashew orchard. The results are in conformity with Yadukumar *et al.,* (2011), Rejani *et al.,* (2013) and Tripathy *et al.,* (2015) while working in cashew under different part of the country.

References

NHB (2012). NHB Interactive: Area & Production Report, National Horticultural Board.

Kuppelwieser, W. 1989. Processing and analysis of cashews Technote No. 63,

Dept. of Primary Industries and Fisheries. J. J., Australia 2.

Panse, V.G. and Sukhatme, P.V. 1989. Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research, New Delhi, Pp. 21

Paulo, E.M. and Furaland Jr, E. 2010. Yield performance and leaf nutrient levels of coffee cultivars under different plant densities. Scientia Agricola (Poracicaba, Braz), 67(6): 720-726.

Rejani, R. and Yadukumar, N. 2010. Soil and water conservationtechnique in cashew grown along steep hill slopes. Scientia Hort., 126: 371-378.

Rejani, R. and Yadukumar, N. 2012. A nutrient delusion support system for rainfed cashew. J. Plantation Crops, 40(1): 40-49.

Rejani, R., Adiga, J.D. and Yadukumar, N. 2013. Performane of different varieties of cashew under high density planting system. J. Plantation Crops, 41(1): 28-33.

Rupa, T.R. and Kalivanan, D. 2012. Management of acid soil for sustainable production of cashew in India-distribution, properties and management for sustainable crop production. The 8th International Symposium on Plant –Soil Interaction at low PH, University of Agricultural Sciences, Bangalore, Pp. 129-138.

Saroj, P. L., Krishna Kumar, N.K. and Janakiraman, T. 2014a. Converting wastelands into goldmine by cashew cultivation. Indian Hort., Pp. 49-56.

Tripathy, P., Sethi, K., Patnaik, A. K., Mukherjee, S. K. and Saroj, P. L., Efficacy of plant density and nutrient management in cashew (*Anacardium occidentale* L.) Progressive Horticulture, 47(2): 213-217.

Yadukumar, N., Rejani, R., Rupa, T.R. and Srividya, B. R. 2011. Optimal nutrient requirement and plant density for enhancing the cashew productivity. J. Plantation Crops, 30(1): 26-29.

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