NUTRIENT MANAGEMENT IN HIGH DENSITY CASHEW PLANTATION UNDER COASTAL SANDY SOILS OF ANDHRA PRADESH

K.M. YUVARAJ*, M.L.N. REDDY AND K. UMAMAHESWARA RAO

Dr. Y.S.R. Horticultural University, All India Co-ordinated Research Project on cashew, Cashew Research Station, Bapatla, Andhra Pradesh

ABSTRACT

A field experiment was conducted at AICRP on Cashew, Cashew Research Station, Dr.YSR Horticultural University Bapatla in Andhra Pradesh. To study the effect of different plant densities with different levels of fertilizers on growth and yield of cashew variety BPP-8 (H2/16). The experiment was laid out in a split plot design with three planting densities (10 x 5 m^2, 200 plants ha^{-1}), 6 x 4 m^2 (400 plants ha^{-1}) and 5 x 4 m^2 (500 plants ha^{-1}) along with three levels of fertilizer (75:25:25, 150:150:50 and 225:75:75 NPK kg ha^{-1}) replicated four times. The results revealed that adoption of high density planting systems with different levels of fertilizers, the maximum plant height (5.55 m) and canopy surface area (79.96 m^2) was recorded in at a spacing of 10 X 5 m^2 with a fertilizer dose of M_1 75:25:25 NPK kg ha^{-1}. The maximum flowering intensity was recorded in S_1M_3 (16.83 and 10 X 5 m^2). The maximum number of nuts per panicle was recorded in S_2M_2 (3.82) with a fertilizer dose of M_2 (3.46). The annual nut yield per tree was highest in S_1 (10.69 kg per tree) with a fertilizer dose of M_2 (150:50:50) and cumulative nut yield also highest in the same treatment S_1M_2 (51.78 kg ha^{-1}).

INTRODUCTION

Cashew (*Anacardium occidentale* L.) is an export oriented crop of our country which has earned a foreign exchange of Rs. 5097.34 crores during 2014-15. Although India ranks first in production, processing and export of kernel in the world, but productivity of existing cashew plantation is very poor, hardly 722 kg ha^{-1} as compared to other countries. The leading states of cashew production in India are Maharashtra, Goa, Andhra Pradesh, Karnataka, Kerala, Tamilnadu, Odisha and West Bengal. Andhra Pradesh contributes about 1.26 mha with a production of 1.0 lakh MT (Hubballi *et al.*, 2013). Among the several Factors influenced the cashew productivity in the country as well as state are use of traditional varieties of low yield potential, large area under seedling plantation and poor adoption of scientific orchard management practices are the major causes. 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 other wise unsuitable for any other crop (Rejani and yadukumar, 2010). Adoption of high density planting (HDP) system has been practiced in other perennial crops like Mango, Guava etc. in order to increase yield per unit area (Gunjate *et al.*, 2009, Paulo and Furlani, 2010). Maintenance of optimum 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 and waste lands with least fertility status, further aggravated the productivity of the crop. In most parts of the country including A.P, the Farmers hardly apply any fertilizer or organic fertilizers as per requirement of the plant. Hence, keeping these problems in view, the present study was undertaken to study the efficiency of plant density and fertilizer doses to increase the production and productivity of cashew.

MATERIALS AND METHODS

The field experiment was conducted at AICRP on Cashew, Cashew Research Station, Bapatla, Dr YSR Horticultural University AndhraPradesh during 2002 to 2015, to study the efficiency of high density planting systems with different doses of fertilizer requirement

*Corresponding author, E-mail: kmyr9491779770@gmail.com

of cashew plantation. The experiment was laid out in split plot design with three planting densities of S_1 10 x 5m^2 (200 plants ha^{-1}), S_2 6 x 4 m^2 (400 plants ha^{-1}) and S_3 5 x 4 m^2 (500 plants ha^{-1}) in main plots while three doses of fertilizers such as M_1 (75:25:25), M_2 (150:50:50) and M_3 (225:75:75) NPK kg ha^{-1} as subplots replicated four times. Each treatment consists of six plants. The grafted cashew plants of variety BPP-8 (H2/16) was planted during 2002. All the package of practices followed except plant density and fertilizers were adopted as per the treatment. The vegetative growth parameters such as plant height, trunk girth, canopy height and canopy diameter in E-W and N-S directions were recorded. Then the ground coverage by canopy was worked by using following procedure.

Radius of canopy (m), r = (D1 + D2)/4

D1: Canopy spread in E-W direction (m)

D2: Canopy diameter in N-S direction (m)

Ground coverage by canopy (m^2), A= r^2

% of ground coverage by canopy = Ground coverage by canopy/Actual area on the ground

Similarly, nut yield and yield attributing parameters were recorded from individual plants from each treatment year wise and mean data were considered for statistical analysis. The dry weight of a sub sample of 50 nuts from each tree was determined. The dry nut weight was recorded after complete sun drying of 5-6 days. The weight per unit including shell was determined at 14% moisture as per the industrial standard (Kuppelweiser, 1989). The yield per tree was calculated as follows.

Nut yield = Mean nut weight x Total number of nuts per tree.

The statistical analysis was carried out by adopting the procedure suggested by Panse and Sukhatme (1989).

During the initial years of growth, lower branches were removed uniformly for convenience of intercultural operations and also to give a proper canopy shape to the plantation. Pruning was adapted uniformly to all the plants in the experiment as per the requirements.

RESULTS AND DISCUSSION:

The results are presented in Table-1.The mean plant height canopy height and mean stem girth and mean canopy diameter was found to be non-significant at different levels of spacing and significant at different levels of fertilizers. The maximum plant height (5.55 m) was recorded in (M_1)75:25:25 NPK kg ha^{-1} with a spacing of (S_1)10 X 5 m^2. The interaction between spacing and fertilizers was found to be non-significant in plant height, canopy height and canopy diameter.

The mean canopy surface area was found to be non-significant at different levels of spacings and fertilizers. However the maximum (79.96 m^2) canopy surface area was recorded in at spacing of 10 X 5 m^2 with fertilizer levels of M_1 75:25:25 NPK kg ha^{-1}. The interaction between spacing and fertilizers was found to be non-significant.

The yield parameters are presented in Table-2. The flowering intensity was found to be significant at different levels of spacings and fertilizers. The maximum flowering intensity was recorded in M_3 (16.83) and S1 (10 X 5 m^2). The interaction between spacings and fertilizers was found to be non-significant. The mean number of nuts per panicle was found to be non-significant at different levels of spacing and significant at different levels of fertilizers. The maximum number of nuts per panicle was recorded in M_2 (3.46) with a spacing of S_2 6 X 4 m^2. The interaction between spacing and fertilizers was found to be non-significant. The nut weight was found to be significant at different levels of spacings and fertilizers. The highest nut weight was recorded in S_1M_2 (7.96) with a spacing of 10 X 5 m^2. The interaction between spacing and fertilizers was found to be significant.

The cashew apple weight was found to be non-significant at different levels of spacings and fertilizers. However the highest apple weight was recorded in S_1M_1 (53.62 g). The interaction between spacings and fertilizers was also found to be non-significant.

The annual mean nut yield per tree was highest in (10.69 Kg per tree) in 10 X 5 m^2 spaced trees applied with fertilizer levels at 150:50:50 Kg ha^{-1} (S_1M_2). The cumulative nut yield are also highest in the same treatment i.e. S_1M_2 (51.78 Kg ha^{-1}). Similar report of higher nut yield was also reported by Yadukumar *et al.* (2000);

Yadukumar *et al*. (2011) and Rejani *et al*. (2013). Results have indicated that at closer densities vegetative parameters are higher values at initial stages up to 11th years and at wider densities yields are higher.

The results obtained from planting densities cum fertilizer levels it is evident that trees planted at closer densities i.e. 5 X 4 m² apart have given higher plant height, trunk girth, canopy diameter and canopy height at initial stages up to 11th year. Regarding yield the mean annual nut yield and mean cumulative nut yield were per tree was also highest in S_1M_2 treatments 10.69 Kg per tree in to wider spaced trees 10 X 5 m² spaced trees applied with fertilizer levels of 150:50:50 NPK kg ha^{-1}.

CONCLUSION:

It may be concluded from the present study that planting density as well as levels of fertilizer have significant influence on growth and yield in cashew. Lower plant density (200 plant ha^{-1}) with moderate levels of fertilizer (150:50:50 kg ha^{-1}) increases vegetative growth, yield and yield attributing parameters. The study also indicated that in case of high density planting system yields are higher at initial years up to 8th year while 11th harvest onwards in wider density yields are higher.

REFERENCES:

Gunjate, R.T., Kumbhar, A.R., Thimaiah, I.M and Amin, S.M. 2009. Growth and fruiting of some mango cultivars under high density plantation in arid conditions of Gujarat (India). *Acta Horticulturae* (ISHS). 820:463-468.

Hubballi, V.N. 2013. Cashew development in India: *Strat egies non-traditional states. National confer ence on cashew: Strategies for cashew devel opment-"Non-traditional States"*, Nov. 2013, Ranchi, Jharkhand, 22-29.

Kappelwieser, 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*. ICAR, New Delhi.

Paulo, E.M and Furalani 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 conservation technique in cashew grown along steep hill slopes. *Scientia Horticulture*.126. 371-378.

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

Yadukumar, N., Bhaskara Rao., E.V.V and Nayak, M.G., 2002. *High density planting ofcashew. NRCC Techical Bulletin*. No. 8. 23.

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

Table-1: Effect of spacing and levels of fertilizers on vegetative growth parameters in cashew plantation after 11th harvest (Year of planting 2002).

Treatments spacings	Mean tree height (m)	Stem girth (cm)	Canopy height (m)	Canopy diameter (m)	Canopy surface area (m^2)	Ground coverage by canopy (%)
S$_1$: 10 X 5 m^2 (200 plants ha^{-1})	5.55	93.05	5.07	7.16	69.39	141.50
S$_2$: 6 X 4 m^2 (400 plants ha^{-1})	5.21	99.02	4.74	7.47	73.32	145.14
S$_3$: 5 X 4 m^2 (500 plants ha^{-1})	4.79	73.43	4.39	6.76	59.21	126.00
SEM+_	0.166	4.24	0.16	0.33	5.07	7.26
CD 0.05	NS	NS	NS	1.09	NS	NS
Interactions	NS	NS	NS	NS	NS	NS
Fertilizers						
M1- 75:25:25	5.28	92.93	4.84	7.29	79.96	99.86
M2- 150:50:50	4.96	85.30	4.52	7.11	63.76	160.19
M3- 225:75:75	5.31	87.28	4.83	6.35	58.41	152.55
SEM+_	0.100	2.58	0.11	0.33	5.07	8.61
CD at 0.05	0.31	7.65	0.34	1.09	NS	NS
Interaction	NS	NS	NS	NS	NS	NS

Table-2: Effect of spacing and levels of fertilizers on yield attributing parameters of cashew plantation after 11th harvest (Year of planting 2002)

Treatments spacing	Flowering laterals/m^2	Mean No. of nuts/ panicle	Mean No. of nuts/m^2	Mean nut weight (g)	Nut yield/ tree (kg)	Cumulative nut yield (kg tree^{-1})	Apple weight (g)
S$_1$: 10 X 5 m^2 (200 plants ha^{-1})	24.29	2.63	20.26	7.48	8.17	51.36	49.94
S$_2$: 6 X 4 m^2 (400 plants ha^{-1})	26.13	3.82	28.01	7.49	10.69	51.78	48.87
S$_3$: 5 X 4 m^2 (500 plants ha^{-1})	26.31	3.51	24.35	7.27	10.57	35.48	49.55
SEM+_	0.82		1.06	0.114	0.335		1.13
CD 0.05	2.43		NS	0.45	NS		3.83
Interactions							
Fertilizers							
M1- 75:25:25	26.31	3.12	25.46	7.60	7.96	36.10	51.66
M2- 150:50:50	25.38	3.46	26.18	7.96	7.40	40.57	47.43
M3- 225:75:75	26.38	2.87	24.05	7.40	7.51	30.87	49.27
SEM+_	0.82	0.22	2.58	0.087	0.37		2.21
CD at 0.05	2.43	NS	0.86	0.26	NS		NS
Interaction		0.20	1.50	0.152	0.65		3.83