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Influence of Different Levels of Nutrients and Growth Regulators on Nut Yield of Cashew

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***Abstract* – An experiment was conducted to study the influence of different levels of nutrients and growth regulators on nut yield of cashew (*Anacardiumoccidentale* L.) variety VRI -2 at State Horticultural Farm, Neyveli, and Tamil Nadu. The study was revealed that soil application of 75 percent of the recommended dose of fertilizer + 100 kg of FYM + Cow pea as an intercrop + 1.0 kg Humic acid as soil application + 3 per cent Panchakavya as foliar spray had increased the productivity viz., maximum total number of flowers panicle^{-1} (910.25),number ofhermaphrodite flowers panicle^{-1} (71.68), number of fruits panicle^{-1} (16.67), percentage of fruits panicle^{-1} (23.26), nut yield tree^{-1} (14.19kg), nut weight (5.19g), kernel weight (1.87g) and apple weight (44.98g) and shelling percentage (36.02) as compared to control.**

***Keywords* – Cashew, *Anacardiumoccidentale* L., Nutrients, Growth Regulators.**

INTRODUCTION

Cashew (*Anacardiumocidentale*) is one of the most important foreign exchange earners of our country. However, the yield of cashew per hectare is very low in India. Among several constraints to cashew yield, fertilizer application plays a vital role in increasing yield of cashew nut. The method of fertilizer application in cashew is an important as the dose of fertilizer. Unless the recommended dose of fertilizer is applied in a correct root zone the genetic yield potential of a tree cannot be exploited. Not much detailed studies seem to have been made in red soils on the efficiency of different levels of fertilizers application now recommended. It has become pertinent there for, to find out a suitable method of fertilizer application for cashew in red soils.

Sex expression, fruit set, fruit retention and nut yield are known to be influenced by exogenous application of plant growth substances in several fruit crops (singh and phogat, 1984). Preliminary studies carried out on the improvement of sex ratio, fruit set, fruit retention and yield by the use of plant growth substances have indicated certain beneficial effects on cashew (Veeraragavathatham and palanisamy, 1983).

Nutrition is also known to play an important role in the improvement of yield in cashew (Gosh, 1990). As cashew tree is a regular bearer, hence, considerable amount of nutrients are removed every years from the soil. A thirty year old cashew tree, yielding 24 kg of nuts and 155 kg of apples, removes 2.840 kg of N, 0.752 kg of P_2O_5 and 1.265 kg of K_2O per year. In the past, several studies have been conducted to understand the nutrient requirements of cashew. These have undoubtedly brought into light the necessity of major nutrients such as nitrogen, phosphorus and potassium for its sustained productivity.

II. MATERIALS AND METHOD

The experiment was carried out at state Horticultural farm, Neyveli, 4th block during 2004 – 05. This experiment was designed to find out the influence of different levels of nutrient and growth regulators on yield of cashew. Principles of split plot design were followed in laying out the experiment and each experiment was replicated thrice. The main treatments included 100 percent recommended dose of fertilizers + 50 kg of FYM, 75 percent recommended dose of fertilizers + 100 kg of FYM + cowpea as aninter crop and 75 per cent recommended dose of fertilizers +100 kg of FYM + cowpea as an intercrop + 1.0 kg of humic acid as soil application.

The sub treatments included foliar spray of water, 0.4 per cent humic acid, urea 3 percent, 2, 4 – D – 25 mg l^{-1}, panchakavya (3%),ethrel 50 ppm during new flushing, flower initiationand fruit setting stages.

III. EXPERIMENTAL DESIGN AND DETAILS

The various treatments included for the study were as follows:

Main treatment:

1. M_1 - NPK 100% + 50 kg FYM
2. M_2 - NPK 75% + 100 kg FYM + cowpea (as inter crop)
3. M_3 - NPK 75% + 100 kg FYM + cowpea (as inter crop) + 1.0 kg Humic acid as soil application.

Sub treatments:

1. S_1 - Water spray
2. S_2 - 0.4% humic acid as foliar spray.
3. S_3 - Urea 3%
4. S_4 – 2.4 D – 25 mg l^{-1}
5. S_5 – Panchakavya (3% conc.)
6. S_6 – Ethrel 50 mg l^{-1}

Total number of treatments

T_1	M_1S_2	NPK 100% + 50 kg FYM + Water spray
T_2	M_1S_2	NPK 100% + 50 kg FYM + 0.4% HA as foliar spray
T_3	M_1S_3	NPK 100% + 50 kg FYM + Urea 3%
T_4	M_1S_4	NPK 100% + 50 kg FYM + 2, 4-D 25 mgl^{-1}
T_5	M_1S_5	NPK 100% + 50 kg FYM + Panchakavya

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T_6	M_1S_6	NPK 100% + 50 kg FYM + Ethrel 50 mg l^{-1}
T_7	M_2S_1	NPK 75% + 100 kg FYM + cowpea + Water spray.
T_8	M_2S_2	NPK 75% + 100 kg FYM + cowpea + 0.4% Humic acid as foliar spray
T_9	M_2S_3	NPK 75% + 100 kg FYM + cowpea + Urea 3%
T_{10}	M_2S_4	NPK 75% + 100 kg FYM + cowpea + 2.4 – D – 25 mg 1^{-1}
T_{11}	M_2S_5	NPK 75% + 100 kg FYM + cowpea + Panchakavya
T_{12}	M_2S_6	NPK 75% + 100 kg FYM + cowpea + Ethrel 50 mg 1^{-1}
T_{13}	M_3S_1	NPK 75% + 100 kg FYM + cowpea + 1.0 kg HA as soil application + Water spray.
T_{14}	M_3S_2	NPK 75% + 100 kg FYM + cowpea + 1.0 kg HA as soil application + 0.4% HA as foliar spray.
T_{15}	M_3S_3	NPK 75% + 100 kg FYM + cowpea + 1.0 kg HA as soil application +Urea 3%
T_{16}	M_3S_4	NPK 75% + 100 kg FYM + cowpea + 1.0 kg HA as soil application + 2, 4 – D – 25 $mg1^{-1}$
T_{17}	M_3S_5	NPK 75% + 100 kg FYM + cowpea + 1.0 kg HA as soil application + panchakavya
T_{18}	M_3S_6	NPK 75% + 100 kg FYM + cowpea + 1.0 kg HA as soil application +Ethrel 50 mg 1^{-1}

Design : Split – Plot
Replications : 3
Number of trees/replication : 4

IV. Results and Discussion

In the present study, three main treatments viz., NPK 75% + 100 kg FYM + cowpea as an inter crop + 1.0 kg humic acid as soil application, and NPK 75% + 100 kg FYM + cowpea as an inter cropand NPK 100% + 50 kg FYM and six sub treatments (Water spray, 0.4% humic acid as foliar spray, Urea 3%, 2, 4-D 25ppm, panchakavya 3% and Ethrel 50 ppm) were imposed. The application of NPK 75% + 100 kg FYM + cowpea as an inter crop + 1.0 kg humic acid as soil application performed better than the other two treatments (Table. 1, 2, 3, 4, 5, 6, 7, 8, 9). The regions for the yield improvement due to application of NPK, humic acid and inter crop pulse are discussed sufficiently. Among the six sub treatments, the traditional practices of spraying Panchakavya excelled over the growth regulating substances. However, foliar application of the other growth regulators like humic acid, ethrel, 2, 4-D and Urea also improved growth and yield of cashew as compared to the control. Panchakavya is the fermented product of the mixture of ghee, milk, curd, dung and urine.The fermented product contains essential nutrients, vitamins, growth regulating substances, etc. When suitably mixed and used those substances should a positive influence on living organisms.Cosmic energy, when made to pass through a living system, removes the imbalances in terms of physical, Chemical, Biological and Physiological and harmonizes the basic elements, which revitalize the growth process (Sundararaman et al., 2001).

In the present study, the other growth regulating substances viz., Ethrel, 2, 4-D and humic acid also improved the floral characteristics and yield of cashew. Ethrel showed better performance than 2, 4-D. The increased yield of cashew due to the application of Ethrel and 2, 4-D were reported by several workers from the various cashew growing regions (murthy et al., 1975; Pappaiah et al., 1979; Pappaiah et al., 1980; Ramakrishna, 1980; Ashok and Thimmaraju, 1981; Panda and Pal, 1981; Haribabu, 1982; Mohan, 1983 and Konhar and Arun mech,1988 and Mohan et al.(1995).The Increased fruit set due to different growth regulators could be attributed to the increased number of bisexual flowers and reduced Premature fruit drop. Further, exogenous application of 2, 4-D and Ethrel is known to increase the endogenous auxin levels and thus help in minimizing the abscission of flowers and favour the fertilization and growth of post fertilized fruit (Salisbury and Rose, 1986).

Application of Urea through foliage @ 3 percent also showed a positive influence on the growth and yield of cashew. Nitrogen is a constituent of chlorophyll and plant cell itself. Nitrogen promotes early growth and development of young cashew Plantation by producing more levels and shoots facilitates early flowering and produces more female flowers reflecting in an increase yield, as reported by Nandhakumar et al. (1997).

Though application of increased level of NPK, along with FYM increased the yield of cashew, the supplementation of growth promoting substances through foliar spray showed a additive effect in the yield improvement. Application of 75 per cent recommended dose of NPK along with 100 kg FYM and 1.0 kg of humic acid tree-1 as basal treatment, growing of cowpea as an intercrop and foliar application of Panchakavya (3%) was found to be the best treatment combination to improve the productivity of cashew and sustain the soil health.

V. Conclusion

To study the influence of different levels of nutrients and growth regulators on nut yield of cashew var.VRI-2 was conducted at the state Horticultural farm, Neyveli, 4th block. The results revealed that among the various treatments on application of 75 per cent of the recommended dose of fertilizers + 100 kg FFM + cowpea as aninter crop + 1.0 kg humic acid as soil application + 3 percent Panchakavya recorded the maximum total number of flowers $Panicle^{-1}$, number of hermaphrodite flowers $panicle^{-1}$, number of fruits $panicle^{-1}$ percentage of fruit set $panicle^{-1}$, nut yield $tree^{-1}$, nut,kernel, apple weight and shelling percentage. This was followed by the tree, which received 75 percent of the recommended dose of fertilizers +100kg FYM + Cow pea as an inter crops + 1.0kg Humic acid as soil application + 0.4 percent humic acid as foliar spray. The least values for the above saidcharacters were recorded in the treatment which received 100 percent recommendeddoseof fertilizer + 50 kg FYM + Water spray.

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Table 1: Influence of different levels of nutrients and intercrops on total number of flowers, Hermaphrodite flowers and fruits panicle^{-1}

Main / Sub	No. of flowers panicle^{-1}				Hermaphrodite flowers panicle^{-1}				No. of fruits panicle^{-1}			
	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean
S_1	696.11	698.22	900.74	765.02	38.07	39.68	68.01	48.58	3.84	4.98	13.52	7.44
S_2	899.33	900.15	907.45	902.31	65.20	66.31	70.01	67.17	12.00	12.73	15.25	13.33
S_3	897.44	899.53	901.55	899.51	65.79	65.89	68.17	66.61	11.53	12.31	13.61	12.48
S_4	897.95	899.27	901.67	899.80	65.81	65.91	68.20	66.64	11.81	12.53	13.70	12.68
S_5	899.41	900.59	910.25	903.42	65.87	66.44	71.68	67.99	12.96	12.98	16.67	14.20
S_6	898.90	900.01	903.71	900.87	65.84	65.99	68.39	66.74	11.96	12.68	13.80	12.81
Mean	894.85	866.38	904.23	878.48	61.09	61.70	69.08	63.95	10.68	11.67	14.42	12.25

M1-NPK 100% + 50 kg FYM tree^{-1},M2-NPK 75% + 100kg FYM + Cow pea as an inter crop, M3- NPK 75% +100kg FYM + Cow pea as an inter crop + 1.0kg Humic acid as soil application,S1-Water spray, S2- 0.4% humic acid as foliar spray, S3-Urea 3%, S4-2.4-D-25mg l$^{-1,}$ S5-Panchakavya (3% conc.), S6-Ethrel 50mg l^{-1}

	No. of flowers panicle^{-1}		Hermaphrodite flowers panicle^{-1}		No. of fruits panicle^{-1}	
	SEd	CD (P=0.05)	SEd	CD (P=0.05)	SEd	CD (P=0.05)
Main	0.20	0.55	0.17	0.34	0.23	0.47
Sub	0.47	0.97	0.50	0.31	0.25	0.51
Sub at same main	0.82	1.69	0.88	1.79	0.55	1.12
Main at same/diff. sub	0.95	1.90	0.77	1.54	0.56	1.12

Table 2: Influence of different levels of nutrients and intercrops on fruit set panicle^{-1}(%), nut yield^{-1}(Kg) and nut weight (g)

Main / Sub	Fruit set panicle^{-1} (%)				Nut yield^{-1}(Kg)				Nut weight (g)			
	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean
S_1	12.46	12.55	19.88	14.96	6.01	7.01	11.77	8.26	4.49	4.53	5.00	4.67
S_2	18.13	19.20	21.78	19.70	11.46	11.68	13.02	12.05	4.84	4.98	5.14	4.99
S_3	17.52	18.68	19.96	18.72	10.95	11.56	11.81	11.44	4.80	4.88	5.01	4.89
S_4	17.94	19.04	20.09	19.02	11.39	11.59	11.84	11.60	4.82	4.89	5.04	4.91
S_5	19.67	19.54	23.26	20.82	11.49	11.71	14.19	12.46	4.86	4.99	5.19	5.02
S_6	18.16	19.21	20.18	19.18	11.44	11.62	11.95	11.67	4.83	4.97	5.09	4.96
Mean	17.31	18.04	20.86	18.73	10.45	10.86	12.43	11.24	4.77	4.87	5.08	4.90

M1-NPK 100% + 50 kg FYM tree^{-1},M2-NPK 75% + 100kg FYM + Cow pea as an inter crop, M3- NPK 75% +100kg FYM + Cow pea as an inter crop + 1.0kg Humic acid as soil application,S1-Water spray, S2- 0.4% humic acid as foliar spray, S3-Urea 3%, S4-2.4-D-25mg l$^{-1,}$ S5-Panchakavya (3% conc.), S6-Ethrel 50mg l^{-1}

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	Fruit set panicle^{-1}(%)		Nut yield^{-1}(Kg)		Nut weight (g)	
	SEd	CD (P=0.05)	SEd	CD (P=0.05)	SEd	CD (P=0.05)
Main	0.34	0.68	0.08	0.16	0.10	0.80
Sub	0.20	0.41	0.15	0.31	0.005	0.01
Sub at same main	0.89	1.82	0.53	1.02	0.02	0.03
Main at same/diff. sub	0.03	0.07	0.49	0.98	0.02	0.03

Table 3: Influence of different levels of nutrients and intercrops on shelling percentage, kernel weight (g) and apple weight (g)

Main / Sub	Shelling percentage				Kernel weight (g)				Apple weight (g)			
	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean
S_1	32.6 (34.82)	32.29 (34.93)	34.56 (36.00)	33.32 (35.26)	1.45	1.49	1.72	1.55	27.51	27.74	40.14	31.79
S_2	33.87 (35.59)	34.13 (35.75)	35.44 (36.53)	34.48 (35.96)	1.65	1.70	1.82	1.72	36.0	38.82	42.69	39.17
S_3	33.37 (35.29)	34.26 (35.83)	34.53 (35.99)	34.05 (35.69)	1.60	1.67	1.73	1.66	35.61	37.22	40.24	37.58
S_4	33.71 (35.49)	34.36 (35.89)	34.64 (36.05)	34.23 (35.81)	1.62	1.68	1.74	1.68	34.72	37.86	40.30	37.62
S_5	33.96 (35.64)	34.40 (35.91)	36.02 (36.88)	34.79 (36.14)	1.65	1.71	1.87	1.75	36.09	38.94	44.98	40.00
S_6	33.77 (35.53)	33.98 (35.66)	34.81 (36.16)	34.48 (35.78)	1.63	1.68	1.77	1.69	35.77	38.71	40.32	38.26
Mean	33.55 (35.39)	33.99 (35.66)	35.00 (36.27)	34.17 (35.77)	1.59	1.65	1.78	1.67	34.28	36.55	41.45	37.42

Figures in parenthesis indicate arc sine transformed value
M1-NPK 100% + 50 kg FYM tree^{-1},M2-NPK 75% + 100kg FYM + Cow pea as an inter crop, M3- NPK 75% +100kg FYM + Cow pea as an inter crop + 1.0kg Humic acid as soil application,S1-Water spray, S2- 0.4% humic acid as foliar spray, S3-Urea 3%, S4-2.4-D-25mg $l^{-1,}$ S5-Panchakavya (3% conc.), S6-Ethrel 50mg l^{-1}

	Shelling percentage		Kernel weight (g)		Apple weight (g)	
	SEd	CD (P=0.05)	SEd	CD (P=0.05)	SEd	CD (P=0.05)
Main	0.15	0.31	0.06	0.05	0.04	0.09
Sub	0.10	0.20	0.011	0.02	0.064	0.12
Sub at same main	0.28	0.52	0.01	0.03	0.11	0.22
Main at same/diff. sub	0.28	0.48	0.01	0.03	0.11	0.22

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