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Research Article

EFFECT OF DIFFERENT LEVELS OF NUTRIENTS AND GROWTH REGULATORS ON FLOWERING BEHAVIOUR OF CASHEW (*Anacardium occidentale L.*) variety VRI -2

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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 (*Anacardium occidentale* 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 percent Panchakavya as foliar spray had increased the productivity *viz*., maximum total number of flowers panicle^{-1} (910.25), number of hermaphrodite flowers panicle^{-1} (71.68) as compared to control. respondents.

Keywords: Cashew Var-VRI-2, Different levels of nutrients and growth regulators

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Introduction

Cashew (*Anacardium occidentale* L.) is a polygamous tree and produces male and hermaphrodite flowers in different phases during flowering. Some of the factors for low yield of cashew are the production of low percentage of hermaphrodite flowers, poor fruit set, immature fruit drop and low fruit retention [1]. Flowering in cashew is seasonal, producing flower bud in varying phases starting from September to March depending upon the cultivars and climatic conditions. Though, cashew produces innumerable flowers, only 1-2 percent of the flowers set fruit and reach maturity. Production of more number of pistillate flowers and reduction in nut drop can be accomplished by the use of plant hormones. Fruit set and their retention are the major limiting factors for low yield in cashew which needs due attention. The nuts those develop after pollination start drying followed by dropping, leading to very low percentage of matured nuts. Use of growth regulators like auxins, gibberellins, and ethylene has resulted in improving the vegetative and reproductive parameters which are associated with high yield in many fruit crops [2]. Cashew (*Anacardium ocidentale*) 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 [3]. 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 [4]. Nutrition is also known to play an important role in the improvement of yield in cashew [5]. As cashew tree is a regular bearer, hence, considerable amount of nutrients is removed every year 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.

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 an inter crop and 75 percent 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 percent Humic acid, urea 3 percent, 2, 4 – D – 25 mg 1^{-1}, panchakavya (3%), Ethrel 50 ppm during new flushing, flower initiation and fruit setting stages.

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 1^{-1}
5. S_5 - Panchakavya (3% conc.)
6. S_6 - Ethrel 50 mg 1^{-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 M1S_4 NPK 100% + 50 kg FYM + 2, 4-D 25 mg 1^{-1}

T_5 M_1S_5 NPK 100% + 50 kg FYM + Panchakavya

T_6 M_1S_6 NPK 100% + 50 kg FYM + Ethrel 50 mg 1^{-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}

T13 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

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 intercrop and 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]. 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. 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 [6-14].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 [15]. 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. 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 an additive effect in the yield improvement. Application of 75 percent 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. Application of 50 ppm Ethrel had positive effect in increasing number of hermaphrodite flowers (306) and male flowers (434) followed by 25 ppm NAA (278 and 397 hermaphrodite and male flowers, respectively). The least number of hermaphrodite flowers and male flowers were recorded with control and 10 ppm 2,4-D. The total number of hermaphrodite and male flowers was significantly higher for 50 ppm Ethrel than rest of the treatments which improved the sex ratio also. Improvement in sex ratio with application of growth regulators was mainly due to increased number of bisexual flowers. Both auxin and ethrel had stimulating effect and caused the physiological changes in the tissues influencing the flowering characters. The increase in length and number of secondary branches per panicle are important attributes for the production of more number of flowers which increases the yield. The flowering in other fruit crop as influenced by ethrel and auxin was also reported5 in mango. The author reported that the spray of 15 ppm NAA and 100 ppm Ethrel had marked influence on increasing the total number of flowers, hermaphrodite flowers and sex ratio male:hermaphrodite) in cashew [16]. The researcher in his study revealed that clones having broader sex ratio were high yielders. Spraying of 50 ppm Ethrel increased the number of fruits set, number of fruits retained per panicle, nut weight (g), nut yield (kg) per tree and reduced fruit drop per panicle over other treatments. However, the maximum fruit drop per panicle was recorded with control. Increased fruit set and fruit retention due to application of ethrel and other growth regulators could be attributed to the increased number of bisexual flowers and reduced pre mature fruit drop [17]. Similar findings were identified in mango [18]. Reduced fruit drop due to exogenous applications of growth regulators may be attributed to increased endogenous auxins which helps in overcoming the formation of abscission layer in the abscission zone, thereby reducing the immature fruit drop and increasing mobilization of nutrients to the developing fruit [19]. Reduced fruit drop in cashew due to application of growth regulators was also reported 13. Increased nut yield with application of growth regulators could be attributed to increased number of bisexual flowers, fruit set, fruit retention and total number of nuts per tree 4. Nut yield (kg) per tree was found to be most significantly and positively correlated with number of flowering laterals per square metre (0.84), total number of laterals per square metre (0.83), duration of male flowers (0.89), duration of hermaphrodite flowers (0.76), number of male flowers per panicle (0.85), number of hermaphrodite flowers per panicle (0.89), total number of flowers (0.90), number of fruits set per panicle (0.94), number of fruits retention per panicle (0.92) and nut weight (0.87). However, the correlation of number of non-flowering laterals per square metre (-0.64) with nut yield was significant and negative. It was observed that number of perfect flowers per panicle was positively correlated with yield in cashew [20,21]. In the present study, it was concluded that the application of 50 ppm Ethrel and 25 ppm NAA were found to be beneficial for increasing the nut yield through improvement in sex ratio, fruit set and fruit retention in cashew *var*. Bhaskara.

Summary

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 percent of the recommended dose of fertilizers + 100 kg FFM + cowpea as an inter 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}. 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 said characters were recorded in the treatment which received 100 percent recommended dose of fertilizer + 50 kg FYM + Water spray.

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

Main	No. of flowers panicle^{-1}				Hermaphrodite flowers panicle^{-1}			
Sub	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
S_2	899.33	900.15	907.45	902.31	65.20	66.31	70.01	67.17
S_3	897.44	899.53	901.55	899.51	65.79	65.89	68.17	66.61
S_4	897.95	899.27	901.67	899.80	65.81	65.91	68.20	66.64
S_5	899.41	900.59	910.25	903.42	65.87	66.44	71.68	67.99
S_6	898.90	900.01	903.71	900.87	65.84	65.99	68.39	66.74
Mean	894.85	866.38	904.23	878.48	61.09	61.70	69.08	63.95

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 1^{-1}, S5-Panchakavya (3% conc.), S6-Ethrel 50mg 1^{-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

Application of research: Application of 75 percent of the recommended dose of fertilizers + 100 kg FFM + cowpea as an inter 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}. It will be increased the yield of cashew

Research Category: Vegetable science

Abbreviations:
1. FYM –Farmyard manure
2. NPK –Nitrogen,Phosphorus and Potash
3.2-4 D – Dichloro Indophenol Acidic Acid
4. NAA –Naphthalene Acitic Acid
5. PPM –Parts per million
6. HA-Humic Acid
7. GA3- Gibberellic acid
8. MT – Metric Tonnnes
9. CNSL- Cashew nut shell liquid

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