



Influence of Various Mulching Techniques and NAA Application on Flowering and Nut Parameters of Cashew Cv. BPP- 8 under Odisha Condition

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A trial was conducted at All India Coordinated Research Project on Cashew, (OUAT), Ransinghpur, Bhubaneswar, Odisha in the year 2021-22 to access the effect of mulches and NAA application on cashew cultivar BPP- 8. The experiment consisted of nine treatments and three replications in a Randomized Block Design. The treatments were T₁- Only irrigation, T₂- Irrigation + Polythene mulch, T₃- Irrigation+ NAA @ 100 ppm, T₄- Irrigation + Stone mulch, T₅- Irrigation + Residue mulch,

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T₆- Irrigation + Polythene mulch + NAA @ 100 ppm, T₇- Irrigation + Stone mulch + NAA @ 100 ppm, T₈- Irrigation + Residue mulch + NAA @ 100 ppm, T₉- No irrigation (control). Irrigation was applied at the rate of 200 litres per plant after that, the root zone of the plants were covered with different types of mulching materials. NAA @ 100 ppm was sprayed at three stages viz. pre-flowering, flowering stage and after fruit set. The result revealed significantly positive impact of various mulches along with irrigation and NAA application on cashew cultivation. Treatment T₆ (Irrigation + Polythene mulch + NAA @ 100 ppm) most effectively improved total number of flowers per panicle (488.80), maximum male flowers (424.94), maximum hermaphrodite flowers (66.42), highest sex ratio (0.136), number of nuts per panicle (4.08), nut yield per tree (12.07 kg), nut retention (27.50 %), nut weight (8.52 g), nut length (3.33 cm) and nut breadth (2.68 cm).

Keywords: Cashew; mulch; polythene mulch; nut yield.

1. INTRODUCTION

Cashew (*Anacardium occidentale* L.), a native of Brazil, was introduced in Malabar Coast of India during the 16th century for soil conservation purpose. Since its beginning as a crop meant to prevent soil erosion, cashew has grown to become the third-largest earner of foreign exchange after tea and coffee. Cashew nut is one of the essential nuts grown in the world and ranks first. In India cashew is cultivated in an area of 1.18 million hectare with total production 0.75 million metric tons (MT) and productivity 760 kg per hectare [1]. Odisha ranks first in total area under cashew cultivation in country i.e. 223.45 thousand hectare with production of 121.28 thousand MT and productivity 672 kg per hectare during 2021-22 [1].

Water is one of the essential limiting natural resource in crop production [2,3]. Given the global scarcity of water resources, innovative and effective irrigation systems must be implemented to boost water output [4]. Mulching has a beneficial effect on soil moisture conservation, early production, and reducing the incidence of weeds, pests, and diseases. Use of different types of soil covers or mulches like straw, leaves, husk, crop residues, and black plastics conserved moisture, controlled weeds, moderated soil temperature, and increased yield of different vegetables [5]. Naphthalene acetic acid, commonly abbreviated NAA is an organic compound, which is a plant hormone in the auxin family and is an ingredient in many commercial horticultural products; it is also a rooting agent and used for the vegetative propagation of plants from stem and leaf cutting [6]. It has important role in fruit formation, abscission cell elongation, apical dominance, photoperiod and geotropism [7]. Birendra et al. [8] suggested that the highest percentage of flowering shoot, maximum length and breadth of panicle and minimum number of

staminate flowers and maximum number of hermaphrodite flowers per panicle are observed in Amrapali mango when sprayed with NAA. The response of cashew plants to the combined effect of irrigation and plastic mulch and influence on plant growth and development in Odisha conditions have not been established. Hence, an attempt was made to determine the effectiveness of water retention techniques with foliar application of NAA on flowering and fruiting of cashew cultivar BPP-8.

2. MATERIALS AND METHODS

The field experiment was conducted at AICRP on Cashew, OUAT, Aiginia, Bhubaneswar, Odisha during month of November, 2021 to May, 2022 in 2021-22 with the cashew cultivar BPP-8. The weather condition of the location recorded presented in Fig. 1. Experiment was outlined in Randomized Block Design of total 9 treatments and 3 replications. The treatments were T₁- Only irrigation, T₂- Irrigation + Polythene mulch, T₃- Irrigation+ NAA @ 100 ppm, T₄- Irrigation + Stone mulch, T₅- Irrigation + Residue mulch, T₆- Irrigation + Polythene mulch + NAA @ 100 ppm, T₇- Irrigation + Stone mulch + NAA @ 100 ppm, T₈- Irrigation + Residue mulch + NAA @ 100 ppm, T₉- No irrigation (control). Irrigation was applied at the rate of 200 litres per plant after that, the root zone of the plants were covered with different types of mulching materias. Mulch materials were locally collected and laid manually around the plant trunk of 2meter diameter. NAA @ 100 ppm was sprayed at three stages viz. pre-blooming stage, flowering stage and after fruit set. Four flowering panicles per tree, one in each direction, were tagged at random before flowering. The panicles were tagged as and when emerged, depending on the time of flowering in each selected tree. The tagged panicles were used for recording the date of emergence of the first flowering panicle to the

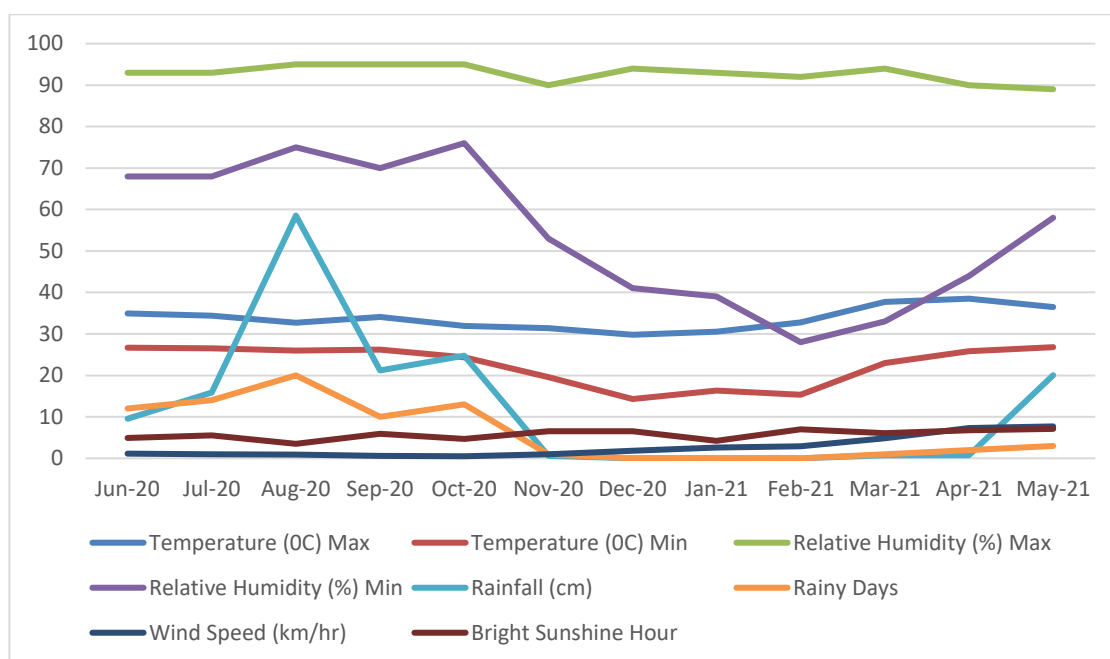


Fig. 1. Metrological data from June 2020 to May 2021

day of drying of the last flowering panicle. Staminate flowers were counted from four panicles, one in each direction, selected randomly. The mean number of staminate and perfect flowers produced per panicle was calculated for each selected tree. Sex ratio was calculated by dividing total number of perfect flowers by staminate flowers for the tagged panicles and was averaged. Nuts per panicle and nut retention percentage was calculated for tagged the panicles. Nut length and breadth were measured with a digital calliper. For nut weight fifty nuts were weighed and for kernel weight one kilogram well dried nuts were sampled followed by shelling. Yield was recorded as total weight of nuts per tree. The data, collected for all the characters involved in the study were subjected to statistical analysis for proper interpretation. The standard method of analysis of variance technique as described by Panse and Sukhatme [9] was employed. The data set were analysed by using online software OPSTAT 9.1 Version.

3. RESULTS AND DISCUSSION

3.1 Effect on Total Number of Flowers Per Panicle, Number of Male Flowers Per Panicle, Number of Hermaphrodite Flowers Per Panicle and Sex Ratio

It is evident from the data given in the Table-1 that the flowering parameters like total number of flowers per panicle, number of male flowers per

panicle, number of hermaphrodite flowers per panicle and sex ratio are significantly influenced by different water retention techniques and NAA application. Highest number of total flower was recorded in treatment T₆ (Irrigation + Polythene mulch + NAA @ 100 ppm) i.e. 488.80 which was statistically at par with treatment T₈ (Irrigation + Residue mulch + NAA @ 100 ppm) i.e. 487.13 and lowest number of total flowers was obtained in T₉ (control) i.e. 395.94. Lowest number of total flowers was obtained in T₉ (control) i.e. 395.94. Maximum number of male flowers per panicle (424.94) were recorded in T₆ (Irrigation + Polythene mulch + NAA @ 100 ppm) which is statistically at par with T₈ (Irrigation + Residue mulch + NAA @ 100 ppm) i.e. 420.70. Lowest male flowers per panicle (346.58) were recorded in case of T₉ (control). The highest values (66.42) for number of perfect flowers were recorded under treatment T₆ (Irrigation + Polythene mulch + NAA @ 100 ppm) which was at par with T₈ (Irrigation + Residue mulch + NAA @ 100 ppm) and minimum number of hermaphrodite flowers were observed in T₉ (control) i.e. 48.05. This may be due to inorganic mulch having the potential of moisture conservation during the peak period of flowering and combined with NAA helps in prevention of flower drop leading to retention of more number of hermaphrodite flowers per panicle. These findings are similar with the findings of Lakshmana et al. [10] and Olawale et al. [11] in cashew.

Table 1. Effect of different water retention techniques with foliar application of NAA on total number of flowers per panicle, number of male flowers per panicle, number of hermaphrodite flowers per panicle and sex ratio

Treatments	Total number of flowers/panicle	Number of male flowers/panicle	No. of hermaphrodite flowers/panicle	Sex ratio
T ₁ - Only irrigation	399.78	347.89	50.25	0.126
T ₂ - Irrigation + Polythene mulch	420.73	366.93	55.26	0.131
T ₃ - Irrigation + NAA @ 100 ppm	427.35	370.44	56.91	0.133
T ₄ - Irrigation + Stone mulch	400.50	349.52	51.92	0.130
T ₅ - Irrigation + Residue mulch	418.86	361.99	53.92	0.129
T ₆ - Irrigation + Polythene mulch + NAA @ 100 ppm	488.80	424.94	66.42	0.136
T ₇ - Irrigation + Stone mulch + NAA @ 100 ppm	440.57	385.30	58.74	0.133
T ₈ - Irrigation + Residue mulch + NAA @ 100 ppm	487.13	420.70	63.86	0.131
T ₉ - No irrigation (control)	395.94	346.58	48.05	0.121
SE(m) ±	11.43	9.91	2.65	0.01
CD at 5 %	34.58	29.98	8.03	0.03

Maximum sex ratio of cashew cv. BPP-8 was recorded in treatment T₆ (Irrigation +Polythene mulch + NAA @ 100 ppm) i.e. 0.136 and at par with T₂, T₃, T₄, T₇ and T₈. Improvement in the sex ratio with the application of inorganic mulch and NAA was mainly due to increased number of hermaphrodite flowers and it may be due to the effect of auxin on production of hermaphrodite flowers by reducing the number of male flowers. Similar findings were reported by Kumar et al. [12] in cashew.

3.2 Effect on Nuts Per Panicle and Nut Retention

Treatments were significantly influenced nuts per panicle in cashew cultivar BPP-8 (Table 2). Maximum nuts per panicle (4.08) was recorded in treatment T₆ (Irrigation + Polythene mulch + NAA @ 100 ppm) followed by T₇ (3.25), T₅ (3.16), T₃ (3.08) and T₈ (2.91). This may be due to the increased in number of hermaphrodite flowers and improved sex ratio and more percentage of fruit retention. Similar results has also been observed by Murthy et al. [13] in cashew and Samant et al. [14] in mango.

Water retention techniques and foliar application of NAA had significantly influenced the nut

retention in cashew. The results revealed that maximum nut retention (27.50 %) was recorded by Irrigation + Polythene mulch + NAA @ 100 ppm and minimum in control (18.30 %). 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 fruits in cashew [12]. Similar findings were reported by Lakshmipathi et al. [15] in cashew and Samant et al. [14] in mango.

3.3 Effect on Nut Parameters Viz. NUT Weight, Nut Length and Nut Breadth

Significant effect of treatments was found on nut weight of cashew cultivar BPP-8. Treatment T₆ (Irrigation + Polythene mulch + NAA @ 100 ppm) was found to be best on higher nut weight (8.52 g) which was at par with T₅ (8.42 g), T₃ (8.35 g), T₂ (8.35 g), T₈ (8.31 g) and T₇ (8.25 g). Lowest nut weight was recorded in T₉ (7.68 g). This may be due to very good response of cashew to inorganic mulch, which further help in increasing moisture content in soil, photosynthates and increase dry matter contents. Higher nut weight can be attributed due to well filled and plumpy

Table 2. Effect of different water retention techniques with foliar application of NAA on number of nuts per panicle, nut yield per tree (kg), nut retention (%), nut weight (g), nut length (cm) and nut breadth (cm)

Treatments	Number of nuts/panicle	Nut yield/tree (kg)	Nut retention (%)	Nut weight (g)	Nut length (cm)	Nut breadth (cm)
T ₁ - Only irrigation	2.16	9.13	24.07	8.11	3.25	2.64
T ₂ - Irrigation + Polythene mulch	2.50	9.68	21.66	8.35	3.07	2.60
T ₃ - Irrigation + NAA @ 100 ppm	3.08	10.19	24.51	8.35	3.01	2.53
T ₄ - Irrigation + Stone mulch	2.66	9.18	22.95	8.18	3.28	2.54
T ₅ - Irrigation + Residue mulch	3.16	9.42	25.74	8.42	3.32	2.60
T ₆ - Irrigation + Polythene mulch + NAA @ 100 ppm	4.08	12.07	27.50	8.52	3.33	2.68
T ₇ - Irrigation + Stone mulch + NAA @ 100 ppm	3.25	10.39	26.43	8.25	3.26	2.65
T ₈ - Irrigation + Residue mulch + NAA @ 100 ppm	2.91	10.89	22.56	8.31	3.08	2.53
T ₉ - No irrigation (control)	2.08	6.10	18.30	7.68	2.65	2.31
SE(m) ±	0.11	0.59	1.38	0.11	0.06	0.05
CD at 5 %	0.35	1.80	4.18	0.34	0.20	0.17

kernels by the spraying of NAA. The result was supported by Ghadage et al. [16] and Olawale et al. [11] in cashew.

Water retention techniques and foliar application of NAA had a significant impact on nut length and breadth. Maximum nut length (3.33 cm) and nut breadth (2.68 cm) was observed by application of Irrigation + Polythene mulch + NAA @ 100 ppm whereas, minimum nut length (2.65 cm) and nut breadth (2.31 cm) were observed in T₉ (Control). This may be due to the effect of inorganic mulch in moisture conservation which may influence the nut size. This was earlier reported by Gajbhiye et al. [17] in cashew cv. Vengurla- 4 and Tiwari et al. [18] in sapota.

3.4 Effect on Kernel Weight and Nut Yield Per Tree

The result indicated that highest kernel weight (2.42 g) was recorded by the application of Irrigation + Polythene mulch + NAA @ 100 ppm followed by Irrigation + Residue mulch + NAA @ 100 ppm (2.41 g). This may be due to the optimum filling of kernels due to the availability adequate moisture and very good response of cashew to inorganic mulching. These findings are in line with Olawale et al. [11] in cashew.

Water retention techniques with foliar application of NAA had a significant effect on nut yield per

tree. Highest nut yield per tree (12.07 kg) was found in T₆ (Irrigation + Polythene mulch + NAA @ 100 ppm) which was statistically at par with T₈ (10.89 kg) and T₇ (10.39 kg). The increase in yield might be due to the dual role of inorganic mulch and spraying of NAA which helps in retention of more number of nuts per panicle, increased sex ratio and hermaphrodite flowers. But in organic mulching, due to less moisture conservation as compared to inorganic mulching yield is little bit less. The above results are in conformity with the findings of Lakshmana et al. [10], Panda et al. [19] and Mishra et al. [20] in cashew and Samant et al. [14] in mango.

4. CONCLUSION

From the above study it can be concluded that adoption of polythene mulch and foliar application of NAA@ 100 ppm can increase the nut yield in cashew by increasing flowering and yield attributing characters.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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