Original Research Article

Effect of Various Water Retention Techniques and NAA Application on Flowering and Nut Parameters of Cashew Cv. BPP- 8 under Odisha Condition

Abstract

A trail was carried out at All India Coordinated Research Project on Cashew, (OUAT), Ransinghpur, Bhubaneswar, Odisha during the year 2021-22 to access the effect of various water retention techniques on cashew cultivar BPP- 8. The experiment consisted of nine treatments and three replication and experiment was designed on Randomized Block Design. The treatments were T_1- Only irrigation, T_2- Irrigation + Polythene mulch, T_3- Irrigation+ NAA @ 100 ppm, T_4- Irrigation + Stone mulch, T_5- Irrigation + Residue mulch, T_6- Irrigation+ Polythene mulch + NAA @ 100 ppm, T_7- Irrigation + Stone mulch + NAA @ 100 ppm, T_8- Irrigation + Residue mulch + NAA @ 100 ppm, T_9- 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 water retention techniques on cashew cultivation. Treatment T_6 (Irrigation + Polythene mulch + NAA @ 100 ppm) expressed significant results on 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, water retention technique, polythene mulch, nut yield.

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 MT and productivity 760 kg per hectare (Hubballi, 2023). 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 (Hubballi, 2023).

Water is one of the essential limiting natural resource in crop production (Zaman *et al*. 2017; Singh *et al*. 2021). Given the global scarcity of water resources, innovative and effective irrigation systems must be implemented to boost water output (Maitra and Pine, 2020). 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 have been found to conserve moisture, control weeds, moderate soil temperature, and increase in yield of different vegetables (Santosh and Maitra, 2021). 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.

Materials and methods:

The experiment was conducted at AICRP on Cashew, OUAT, Aiginia, Bhubaneswar, Odisha during 2021-22. Cashew cultivar BPP-8 was considered for research program. Experiment was outlined in Randomized Block Design of total 9 treatments and 3 replications. The treatments were T_1- Only irrigation, T_2- Irrigation + Polythene mulch, T_3- Irrigation+ NAA @ 100 ppm, T_4- Irrigation + Stone mulch, T_5- Irrigation + Residue mulch, T_6- Irrigation + Polythene mulch + NAA @ 100 ppm, T_7- Irrigation + Stone mulch + NAA @ 100 ppm, T_8- Irrigation + Residue mulch + NAA @ 100 ppm, T_9- 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-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 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 flowers produced per panicle was worked out for each selected tree. The mean number of perfect flowers produced per panicle was computed in the same way as the number of staminate flowers per panicle. Sex ratio was calculated by dividing total number of perfect flowers to staminate flowers for the tagged panicles and average was carried out. Nuts per panicle, nut retention percentage were calculated by tagging the panicle in all four directions. Nut length and breadth were measured by help of digital calliper. For nut weight fifty nuts were weighed and for kernel weight one kilogram well dried nuts were taken followed by shelling. Total weight of nuts picked during fruiting season of a tree was measured and represented as nut yield 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 (1967) was employed.

Results and Discussion:

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 T_6 (Irrigation + Polythene mulch + NAA @ 100 ppm) i.e. 488.80 which was statistically at par with treatment T_8 (Irrigation + Residue mulch + NAA @ 100 ppm) i.e. 487.13 andlowest number of total flowers was obtained in T_9 (control) i.e. 395.94. Lowest number of total flowers was obtained in T_9 (control) i.e. 395.94. Maximum number of male flowers per panicle (424.94) were recorded in T_6 (Irrigation + Polythene mulch + NAA @ 100 ppm) which is statistically at *par* with T_8 (Irrigation + Residue mulch + NAA @ 100 ppm) i.e. 420.70. Lowest male flowers per panicle (346.58) were recorded in case of T_9 (control). The highest values (66.42) for number of perfect flowers were recorded under treatment T_6 (Irrigation + Polythene mulch + NAA @ 100 ppm) which was at par with T_8 (Irrigation + Residue mulch + NAA @ 100 ppm) and minimum number of hermaphrodite flowers were observed in T_9 (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.* (2018) and Olawale *et al.* (2011) in cashew.

Maximum sex ratio of cashew cv. BPP-8 was recorded in treatment T_6 (Irrigation +Polythene mulch + NAA @ 100 ppm) i.e. 0.136and at par with T_2, T_3, T_4, T_7 and T_8. 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.* (1994) in cashew.

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 T_6 (Irrigation + Polythene mulch + NAA @ 100 ppm) followed by T_7 (3.25), T_5 (3.16), T_3 (3.08) and T_8 (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.* (1975) in cashew and Samant *et al.* (2017) 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 (Kumar *et al*., 1994). Similar findings were reported by Lakshmipathi *et al.* (2014) in cashew and Samant *et al*. (2017) in mango.

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 T_6 (Irrigation + Polythene mulch + NAA @ 100 ppm) was found to be best on higher nut weight (8.52 g) which was at par with T_5 (8.42 g), T_3 (8.35 g), T_2 (8.35 g), T_8 (8.31 g) and T_7 (8.25 g). Lowest nut weight was recorded in T_9 (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 kernels by the spraying of NAA. The result was supported by Ghadage*et al.* (2016) and Olawale *et al.* (2011) 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 T_9 (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.* (2016) in cashew cv. Vengurla- 4 and Tiwari *et al*. (2014) in sapota.

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.* (2011) 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 T_6 (Irrigation + Polythene mulch + NAA @ 100 ppm) which was statistically at par with T_8 (10.89 kg) and T_7 (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.* (2018), Panda *et al.* (2018) and Mishra *et al.* (2008) in cashew and Samant *et al.* (2017) in mango.

Conclusion:

From the above study it can be concluded that adaptation water retention technique of irrigation along with 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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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

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