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Effect of growth promoting substances on flowering behaviour of cashew cv. BPP- 8 grown in the coastal region of Odisha

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Abstract

A trail was carried out at All India Coordinated Research Project on Cashew, (OUAT), Ranasinghpur, Bhubaneswar, Odisha during the year 2016-17 to access the effect of growth promoting substances on cashew cultivar BPP- 8. The experiment consisted of eight treatments of growth promoting substances along with control. The treatments are T₁- NAA @ 50 ppm, T₂- GA₃ @ 50 ppm, T₃- Kinetin @ 50 ppm, T₄- ZnSO₄ @ 0.5 %, T₅- Borax @ 0.1 %, T₆- ZnSO₄ @ 0.5 % + Borax @ 0.1 %, T₇- Seaweed extract @ 2 ml. L⁻¹, T₈- Water spray (Control). Growth promoting substances were applied at three stages viz. pre-blooming stage, flowering stage and after fruit set except GA₃ which was sprayed only once at pre-blooming stage. The result revealed significantly positive impact of growth promoting substances on cashew. Foliar application of ZnSO₄ @ 0.5 % recorded significantly higher number of hermaphrodite flowers (66.33) and sex ratio (0.18).

Keywords: cashew, BPP-8, growth promoting substances, flowering

Introduction

Cashew (*Anacardium occidentale* L.) is a tropical evergreen 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, higher percentage of fruit set and low fruit retention (Haribabu, 1982) [6].

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 per cent 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 growth promoting substances. 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 cytokinin and micronutrients like zinc and borax has resulted in improving the vegetative and reproductive parameters which are associated with high yield in many fruit crops (Lakshmipathi *et al.*, 2015; Lafer, 2008; Chacko *et al.*, 1974; Rawash *et al.*, 1983) [9, 8, 3, 12].

Though, the cultivation of cashew is very popular in Odisha, but no attempt has been made so far to study the effect of growth promoting substances on its reproductive growth parameters. Hence, the present investigation was undertaken to study the Influence of growth promoting substances on reproductive growth of cashew var. BPP- 8.

Materials and Methods

The experiment was carried out at Cashew Research Station, All India Coordinated Research Programme on Cashew, Bhubaneswar, Odisha during 2016-17. The experimental site, situated in a cashew growing belt, has red lateritic soil of coastal Odisha, located 25.5 m above the mean sea level with 20° 15' North latitude and 85° 52' East longitude. The study was carried out in a 10 year old cashew plantation (variety BPP- 8) by adopting randomized block design (RBD) with 8 treatments and 3 replications. The treatments are T₁- NAA @ 50 ppm, T₂- GA₃ @ 50 ppm, T₃- Kinetin @ 50 ppm, T₄- ZnSO₄ @ 0.5 %, T₅- Borax @ 0.1 %, T₆- ZnSO₄ @ 0.5 % + Borax @ 0.1 %, T₇- Seaweed extract @ 2 ml. L⁻¹, T₈- Water spray (Control). Growth promoting substances were applied at three stages viz. pre-blooming stage,

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flowering stage and after fruit set except GA₃ which was sprayed only once at pre-blooming stage. Observations on number of flowering laterals per square metre, number of non-flowering laterals per square metre, total number of laterals per square metre, duration of flowering, number of male flowers per panicle, number of hermaphrodite flowers per panicle, total number of flowers, sex ratio were recorded in all the treatments.

The number of flowering laterals and non-flowering laterals were counted from one square metre area of canopy from four directions using a one-metre square iron frame. The duration of flowering was determined by counting the number of days between first flowering and last flowering. Four panicles were selected from the observational trees and tagged for determining the sex ratio. The number of hermaphrodite

flowers and male flowers appearing in each of the four tagged panicles were counted on alternate days and the counted flowers were removed from the panicles. The sex ratio was worked out with mean number of hermaphrodite flowers to total number of flowers per panicle.

Statistical analysis

The data, collected for all the characters involved in the study were subjected to statistical scrutiny for proper interpretation. The standard method of analysis of variance technique as described by Panse and Sukhatme (1967) [11] was employed. Data on flowering parameters of cashew var. BPP-8 as influenced by growth promoting substances are presented in Table- 1.

Table 1: Effect of growth promoting substances on flowering behaviour of cashew cultivar BPP- 8

Treatments	NFL	NNFL	TNL	DF	NSF	NPF	TNF	SR
T1 - NAA @ 50 ppm	18.75	1.83	20.58	82.33	332.67	52.67	385.33	0.13
T2 - GA ₃ @ 50 ppm	20.47	1.70	22.17	83.33	353.03	60.58	413.62	0.15
T3 -Kinetin @ 50 ppm	19.50	2.90	22.28	83.33	365.50	60.25	425.50	0.16
T4 - ZnSO ₄ @ 0.5 %	19.85	1.82	21.67	79.33	403.50	66.33	469.83	0.18
T5 -Borax @ 0.1 %	19.05	4.10	23.33	83.67	399.03	57.17	456.20	0.12
T6 - ZnSO ₄ @ 0.5 % + Borax @ 0.1 %	19.20	3.30	25.50	85.00	357.14	54.64	411.55	0.11
T7 - Seaweed extract @ 2 ml/lit	18.75	3.77	22.52	83.00	406.33	56.42	462.75	0.10
T8- Water spray (Control)	16.00	5.58	21.58	85.67	421.17	49.17	470.33	0.11
Mean	18.95	3.13	22.08	83.21	397.80	57.15	436.89	0.13
SE(m) ±	0.76	0.61	0.48	1.15	18.84	2.45	18.95	0.01
CD at 5 %	2.32	1.85	1.47	NS	57.15	7.44	57.47	0.04
CV %	6.98	33.72	3.80	2.39	8.59	7.43	7.51	15.19

NFL- Number of flowering laterals per square meter, NNFL- Number of non-flowering laterals per square meter, TNL- Total number of laterals per square meter, DF- Duration of flowering, NSF- Number of staminate flowers per panicle, NPF-Number of perfect flowers per panicle, TNF- Total number of flowers, SR- Sex ratio.

Research findings

The results obtained from the present investigations are summarized below:

Effect on number of flowering laterals per meter square

The number of flowering laterals per meter square was showed significant effect by the application of growth promoting substances. Highest flowering laterals per square meter was found in T₂ i.e. GA₃ @ 50ppm sprayed trees and statistically at par with other treatments except T₈ (control) which showed lowest result of number of panicles per square meter i.e. 16.00.

Effect on number of non-flowering laterals per meter square

The data pertained from the above tables reveals that the growth promoting substances had significant effect on number of non-flowering laterals per square meter and best result was found in case of GA₃ @ 50 ppm treated trees (1.70) and highest non-flowering laterals was recorded in water sprayed trees (5.58). T₂ is statistically at par with T₁, T₃, T₄ and T₆.

Effect on total number of laterals per meter square

Application of growth promoting substances had a significant effect on number of laterals per square meter presented in the table- 4.1. Highest result (23.33) was recorded in case of treatment T₅ (Borax @ 0.1 %) which is at par with treatment T₂, T₃, T₆ and T₇. Lowest number (20.58) was found in case of treatment T₁. %. This may be due to the application of Borax through foliar spray which supplies maximum Boron to plants for better growth and development. Boron is vital to plant

health, due to its role in forming and strengthening cell (Broadley *et al.*, 2012) [2]. Boron has a significant effect on cell wall formation, cell development and cell elongation (Fageria, 2008) [5].

Effect on duration of flowering

Data pertaining to duration of flowering were presented in the table- 4.1 and was found non-significant among the treatments. The duration of flowering was extended (85.67 days) in case of treatment T₈ (control) followed by T₆ (ZnSO₄ @ 0.5 % + Borax @ 0.1 %) i.e. 85.00 days and found shorter (79.33 days) in case of treatment T₄ (ZnSO₄ @ 0.5 %). All the treatments are statistically at par except T₄.

Effect on number of staminate flowers

The number of staminate flowers per panicle was found significant among the treatments. The highest staminate flowers per panicle (421.17) were recorded in control (T₈) followed by 406.33 in spraying of seaweed extract. Lowest male flowers per panicle (332.61) were recorded in case of application of NAA @ 50 ppm (T₁). T₈ is at par with T₇ (406.33), T₄ (403.50), T₅ (399.03) and T₃ (365.50) and statistically superior over T₆ (357.14), T₂ (353.03), T₁ (332.67).

Effect of growth promoting substances on number hermaphrodite flowers per panicle

Foliar sprays of growth promoting substances had a positive and significant effect on total number of perfect flowers as reflected in the table. The highest values (66.33) for number of perfect flowers were recorded under treatment T₄ (ZnSO₄). It was statistically at par with treatment T₂ (GA₃ @ 50 ppm)

and T₃ (Kinetin 50 ppm) i.e. 60.58 and 60.25 respectively. The lowest number of perfect flowers was observed in treatment T₈ (control) i.e. 49.17. The treatment T₄ is found significantly different from T₅, T₇, T₆, T₁ and T₈ i.e. 57.17, 56.42, 54.64, 52.67 and 49.17 respectively.

Effect on total number of flowers per panicle

The total number of flowers per panicle was found significant among the treatments. The highest number of flowers was found in T₈ (469.83) and statistically at par with. Lowest flower number per panicle recorded in T₁.

Effect of growth promoting substances on sex ratio (%) of cashew

The data related to sex ratio of cashew cv. BPP-8 as influenced by growth promoting substances is presented in above table and was found significant among the treatments. The sex ratio of cashew variety BPP-8 was significantly influenced by application of growth promoting substances. The highest sex ratio (0.18) was recorded by application of ZnSO₄ @ 0.5 % (T₄) followed by 0.16 and 0.15 in case of application of Kinetin @ 50 ppm (T₃) and GA₃ @ 50 ppm (T₂) which are statistically at par. Lowest sex ratio (0.10) was observed in case of spraying of Seaweed extract @ 2 ml/lit (T₇). T₄ is significantly different from T₁ (NAA @ 50 ppm), T₅ (Borax 0.1%), T₆ (ZnSO₄ @ 0.5 % + Borax @ 0.1 %), T₈ (control) and T₇ (seaweed extract 2 ml/lit) i.e. 0.13, 0.12, 0.11, 0.11 and 0.10 respectively.

Discussion

Effect on number of laterals per meter square

The effect of different growth promoting substances on highest number of panicles per square meter (20.13) was observed in treatment T₂ (GA₃ @ 50 ppm). It may be due to an increase in the activity of peroxidase and α -amylase which ultimately released more sugar for induction of flowering. This view was supported by Yamdagni and Khangia (1989) in mango. Flower initiation depends on the presence of an unknown flower promoting factor or factors synthesised in the leaves and at the same time, there are other factors in the shoots which work against the flowering factors. (Kulkarni *et al.*, 2006) [6].

Highest number of laterals per square meter (23.00) was recorded in trees sprayed with Borax @ 0.1 %. This may be due to the application of Borax through foliar spray which supplies maximum Boron to plants for better growth and development. Boron is vital to plant health, due to its role in forming and strengthening cell (Broadley *et al.*, 2012) [2]. Boron has a significant effect on cell wall formation, cell development and cell elongation (Fageria, 2008) [5]. Maximum plant height, leaf number and leaf area were observed by application of boric acid @ 50ppm in egg plant (Abd El-Gawad and Osman, 2014) [1].

Effect on flowering traits

Duration of flowering

The data pertaining to duration of flowering was found non-significant among the treatments.

Number of staminate and perfect flowers

Growth promoting substances had substantial effect on number of staminate and perfect flowers. Maximum number of staminate flowers per panicle (421.17) were recorded in control (T₈) followed by 406.33 in spraying of seaweed extract. Lowest male flowers per panicle (332.61) were

recorded in case of application of NAA @ 50 ppm (T₁). The highest values (66.33) for number of perfect flowers were recorded under treatment T₄ (ZnSO₄ @ 0.5 %) which was at par with T₂ (GA₃ @ 50 ppm) and T₃ (Kinetin 50 ppm) and minimum number of perfect flowers were observed in T₈ (control) i.e. 49.17. Foliar spray of ZnSO₄ showed best result on flowering characters. It may be due to the diversion of reserve food material to the vegetative part to reproductive part and it also promotes the photosynthesis, nucleic acid metabolism and protein biosynthesis in Washington Naval Orange (Dawood *et al.*, 2001) [4]. ZnSO₄ had stimulating effect and caused the physiological changes in the tissues influencing the flowering characters. Zinc influences flowering and fruit set through its role in auxin biosynthesis as auxins play a major role in flowering and fruit set, so it is better to give a foliar spray at pre-bloom for pome fruits and a pre-bloom and post-bloom spray for other fruits. This observation agreed with the finding of Lakshmi pathi *et al.* (2015) [9] in cashew and Swietlik (1999) in citrus.

Sex ratio

Data revealed that sex ratio of cashew was significantly influenced by foliar spray of growth promoting substances and highest sex ratio (0.18) was recorded in T₄ (ZnSO₄ @ 0.5 %) which was statistically at par with T₂ and T₃. Lowest sex ratio (0.10) was observed in seaweed extract treated trees. Improvement in the sex ratio with the application of ZnSO₄ was mainly due to increased number of hermaphrodite flowers. It may be due to the effect of auxin on production of hermaphrodite flowers by reducing the number of male flowers and by foliar application of zinc, endogenous auxin level was increased which results in production of more hermaphrodite flowers as reported by Mariappan *et al.* (1995) [10] in cashew.

Conclusion

In the present study, it was concluded that farmers growing cashew cultivar BPP-8 under coastal Odisha condition may spray ZnSO₄ @ 0.5 % to get more number of perfect flowers and higher sex ratio.

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