

Research Article

Studies on Growth Promoting Substances on Physico-Chemical Parameter of Cashew (*Anacardium occidentale* L.)

Chinmaya Jena*, Promod Kumar Panda, Ajay Kumar Karna, Rajendra Kumar Panda, Kabita Sethi

College of Agriculture, Orissa University of Agriculture and Technology, Bhubaneswar-751003, Odisha, India

Abstract

The present experiment entitled “studies on growth promoting substances on physico-chemical parameter of cashew (*Anacardium occidentale* L.) var. BPP- 8 (H 2/16)” was carried out at All India Coordinated Research Project on Cashew, (OUAT), Ranasinghpur, Bhubaneswar, Odisha during the year 2016-17. The experiment consists of eight treatment *i.e.* 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). The plant treated with ZnSO₄ @ 0.5 % + Borax @ 0.1 % emerged as best treatment in terms of nut length (3.38 cm), nut breadth (2.79 cm), nut weight (8.40 gm), kernel weight (2.60) and number of nuts per kg (121.67). Whereas, ZnSO₄ @ 0.5 % showed highest length (5.33 cm) and weight (65.37 gm) of cashew apple and NAA had significant effect on quality parameters of cashew apple like TSS (13.27), starch (11.01 %) and sugar content (12.24%).

Keywords: Cashew, BPP- 8, growth promoting substances, physico-chemical parameter, ZnSO₄, Borax, NAA.

*Correspondence

Author: Chinmaya Jena

Email: jenachinmaya3@gmail.com

Introduction

Cashew (*Anacardium occidentale* L.) belongs to the family Anacardiaceae and is native to Brazil. Cashew was first introduced in India by the Portuguese missionaries during the 16th century in Goa and Malabar Coast, which later served as the main centre of dispersal to other parts of the country [6]. India was the first country in the world to exploit international trade in cashew kernels in the early part of 20th century [5]. Tree nuts are globally consumed for their desirable sensory and nutritional attributes. Cashew kernel is a food product of the new world and is the third most commonly consumed tree nut in the world. It is largely consumed as a dry fruit or an ingredient in various cuisines of different cultures around the world. Cashew shells contain high quality oil known as cashew nut shell liquid (CNSL) which has several industrial applications. Cashew nuts are good source of proteins (20 %), carbohydrates (23 %) and fats (45 %). Value added products such as juice, fenni, wine, dried cashew apple, syrup and jam can be prepared from cashew apple [19]. India is the second largest producer of raw cashew in the world, next only to Vietnam. India produces about 0.74 million MT of cashew from an area of 1.03 million hectares with a productivity of 0.7 MT/ha [11]. In Odisha, the production of cashew is about 85.80 thousand MT from an area of 180.41 thousand hectares with productivity about 2 tonnes/ha [11]. There is a great scope for improving the fruit set, number of nuts and nut yield per tree through fertilization, foliar spray with nutrients and plant growth regulators as evidenced in many other horticultural crops [1]. Growth promoting substances are perhaps the most powerful tools available for achieving this goal. [20] Foliar application of zinc before anthesis may be most beneficial in terms of fruit yield in citrus and grapes [20]. Foliar application of boron significantly affected yield, fruit weight, soluble solid concentration: titratable acidity ratio, ascorbic acid, total sugars, total phenolic content and total antioxidants in Kinnow mandarin [21].

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 physio-chemical parameters. Hence, the present investigation was undertaken to study the influence of growth promoting substances on yield parameter as well as quality of cashew var. BPP- 8.

Material and methods

The above research problem was conducted on twelve year old trees cashew cultivar BPP-8 at Cashew Research Station, AICRP on Cashew, Ranasinghpur, Bhubaneswar, under Orissa University of Agriculture and Technology in the year 2016-17 and it was carried out in Randomized Block Design having three replication (RBD). The cashew

plants were planted with a recommended spacing of 7m x 7m. There are eight treatments comprising as 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) and T₈ (Water spray *i.e.* Control). Foliar spray of growth promoting substances was done. GA₃ was applied at before flowering whereas, NAA, Kinetin, ZnSO₄, Borax and Seaweed extract were applied at three stages viz. pre-blooming stage, flowering stage and after fruit set. The treatments were applied after preparing ppm solutions of each plant growth regulators. The foliar spray was done in the morning hours between 8.00 to 11.00 a.m. with the help of foot pump paddle sprayer. On the trees selected for experimentation, one panicle from each direction (North, South, East and West) was tagged for recording observations related to physico-chemical parameter of cashew nut and cashew apple.

Result and discussion

The data indicated (Table-1) that spraying of growth promoting substances have a significant effect on nut length of cashew cultivar BPP-8. The maximum nut length (3.38 cm) was observed when ZnSO₄ @ 0.5 % + Borax @ 0.1 % (T₆) sprayed followed by treatments T₃ (Kinetin @ 50 ppm), T₂ (GA₃ @ 50 ppm), T₄ (ZnSO₄ @ 0.5 %), T₅ (Borax @ 0.1 %) and T₇ (Seaweed extract @ 2 ml/lit) *i.e.* 3.34 cm, 3.33 cm, 3.32 cm, 3.27 cm and 3.20 cm respectively which was statistically at par and minimum (2.85 cm) in control (T₈) treatment. T₆ was significantly different from T₁ (NAA @ 50 ppm) and T₈ (control) *i.e.* 3.07 cm and 2.85 cm respectively. Significant effects were observed (Table-1) among the treatments on nut breadth of cashew variety BPP-8. Maximum nut breadth (2.79 cm) was found in T₆ (ZnSO₄ @ 0.5 % + Borax @ 0.1 %) which was at par with T₂ (2.75 cm), T₃ (2.61 cm), T₁ (2.60 cm) and T₄ (2.59 cm) and significantly different to T₅ (2.49 cm), T₇ (2.45 cm) and T₈ (2.34 cm). The minimum nut breadth (2.34 cm) was observed in control treatment (T₈). This may be due to the effect of zinc and boron on cell development, cell elongation which may influence nut size. Higher nut length and breadth by application of ZnSO₄ @ 0.5 % + Borax 0.1 % was earlier reported in cashew cv. Bhaskar [10].

Table 1 Effect of growth promoting substances on nut length, nut breadth, nut weight, number of nuts per kg and kernel weight of cashew

Treatment	Nut length (cm)	Nut breadth (cm)	Nut weight (gm)	Number of nut per kg	Kernel weight (gm)
T ₁ - NAA @ 50 ppm	3.07	2.60	7.37	128.67	2.29
T ₂ - GA ₃ @ 50 ppm	3.33	2.75	8.30	124.00	2.34
T ₃ - Kinetin @ 50 ppm	3.34	2.61	8.00	122.33	2.39
T ₄ - ZnSO ₄ @ 0.5 %	3.32	2.59	8.27	122.00	2.31
T ₅ - Borax @ 0.1 %	3.27	2.49	8.17	123.67	2.37
T ₆ - ZnSO ₄ @ 0.5 % + Borax @ 0.1 %	3.38	2.79	8.40	121.67	2.60
T ₇ - Seaweed extract @ 2 ml/lit	3.20	2.45	8.20	124.00	2.32
T ₈ - Water spray (Control)	2.85	2.34	7.30	136.00	2.16
Mean	3.22	2.58	8.00	125.29	2.35
SE(m) ±	0.08	0.09	0.13	2.04	0.07
CD at 5 %	0.24	0.26	0.40	6.19	0.22
CV %	4.18	5.87	2.87	2.82	5.32

Significant difference was found among the treatments for nut weight of cashew cv. BPP-8 (Table- 1). In case of T₆ (ZnSO₄ @ 0.5 % + Borax @ 0.1 %) highest nut weight (8.40 g) was recorded and in T₈ (control), lowest nut weight (7.30 g) was observed. T₆ is *statistically at par* with T₂ (GA₃ @ 50 ppm), T₄ (ZnSO₄ @ 0.5 %), T₇ (Seaweed extract @ 2 ml/lit), T₅ (Borax @ 0.1%) and T₃ (Kinetin @ 50 ppm) with values 8.30g, 8.27g, 8.20g, 8.17g and 8.00g respectively and significantly different from T₁ (7.37g) and T₈ (7.30g).

The effect of treatments on number of nut per kilogram was found statistically significant (Table-1). Best result (121.67) was found in case of T₆ (ZnSO₄ 0.5% + Borax 0.1%) and least (136.00) in control treatment (T₈). Treatments T₆ was statistically at par with T₄ (ZnSO₄ @ 0.5 %), T₃ (Kinetin), T₅ (Borax @ 0.1 %), T₂ (GA₃ @ 50 ppm) and T₇ (Seaweed extract @ 2 ml/lit) with values 122.00, 122.33, 123.67, 124.00 and 124.00 respectively. T₆ is significantly different to T₁ (128.67) and T₈ (136.00).

The data related to kernel weight in cashew cv. BPP-8 as influenced by various treatments. Data furnished in table-1 revealed a significant effect of growth promoting substances. ZnSO₄ @ 0.5 % + Borax @ 0.1 % spray showed maximum (2.60 g) kernel weight and was statistically at par with T₃ (2.39 g) and significantly different from T₅ (2.37 g), T₂ (2.34 g), T₇ (2.32 g), T₄ (2.31 g), T₁ (2.29 g) and T₈ (2.16 g). Treatment T₈ (2.16 g) showed minimum kernel weight as compared to other treatments.

Table 2 Effect of growth promoting substances on physico-chemical parameter of cashew apple

Treatment	cashew apple		TSS (° Brix)	Total sugar (%)	Starch (%)	Ascorb ic acid (mg/10 0gm)
	Length (cm)	Weight (gm)				
T ₁ - NAA @ 50 ppm	4.74	54.67	13.27	12.24	11.01	3.56
T ₂ - GA ₃ @ 50 ppm	5.26	62.63	12.32	11.13	10.01	4.26
T ₃ . Kinetin @ 50 ppm	4.65	53.43	12.35	10.12	9.10	5.23
T ₄ - ZnSO ₄ @ 0.5 %	5.33	65.37	12.75	11.96	10.76	3.55
T ₅ - Borax @ 0.1 %	4.69	54.73	12.37	11.04	9.90	4.06
T ₆ - ZnSO ₄ @ 0.5 % + Borax @ 0.1 %	4.73	57.03	12.84	11.25	10.12	4.08
T ₇ - Seaweed extract @ 2 ml/lit	4.91	59.57	12.67	11.55	10.39	3.62
T ₈ - Water spray (Control)	4.43	48.07	11.92	9.95	8.95	5.18
Mean	4.84	56.94	12.56	11.15	10.03	4.19
SE(m) ±	0.17	1.57	0.23	0.40	0.37	0.02
CD at 5 %	0.51	4.77	0.71	1.23	1.11	0.07
CV %	6.06	4.78	3.21	6.27	6.31	1.01

The data (Table-2) related to length of the cashew apple of cashew cv. BPP-8 was significantly influenced by various growth promoting substances. Treatments applied have a significant influence on length of the cashew apple. Maximum cashew apple length (5.33 cm) was observed in ZnSO₄ @ 0.5 % (T₄) and found significantly at par with T₂ (5.26 cm) and T₇ (4.91 cm) but statistically different to other treatments like T₁ (4.74 cm), T₆ (4.73 cm), T₅ (4.69 cm), T₂ (4.65 cm) and T₈ (4.43 cm) respectively. The data regarding weight of the cashew apple (Table-2) of cashew cv. BPP-8 as affected by growth promoting substances treatment and showed a significant impact of growth promoting substances on weight of the cashew apple. It was found that the highest apple weight (65.37 g) was recorded in ZnSO₄ @ 0.5 % (T₄) and was significantly superior to T₈ (48.07 g) but statistically at par with T₂ (62.63 g) and significantly different from T₇ (59.57 g), T₆ (57.03 g), T₅ (54.73 g), T₁ (54.67 g) and T₃ (53.43 g). The data related to length of the cashew apple of cashew cv. BPP-8 was significantly influenced by various growth promoting substances. This may be due to the rapid synthesis of protein and translocation of carbohydrate which ultimately lead to increase fruit weight as well as fruit size. These results are supported with the work [3] in mango; [8] in mandarin; [15] in sweet orange; [17] in aonla and [2] in litchi.

It is observed that starch value of the cashew apple was found significantly different among the treatments (Table-2). Maximum starch content (11.01 %) of cashew apple was found in foliar spray of NAA @ 50 ppm and was superior to

T₃ (9.10 %) and T₈ (8.95 %). The treatment T₁ was statistically at par with T₄ (10.76 %), T₇ (10.39 %), T₆ (10.12 %), T₂ (10.01 %) and T₅ (9.90 %). Minimum starch content was recorded in T₈ (control). The total sugar percentage of various treatments varied significantly during the course of investigation (Table- 2). Maximum total sugar content (12.40 %) was recorded in T₄ (ZnSO₄ @ 0.5 %) followed by T₂ (12.10 %), T₁ (11.95 %), T₇ (11.86 %) and T₆ (11.20 %) which were statistically at par with T₄. Treatment T₄ was found significantly superior over T₃ (10.00 %), T₇ (10.83 %) and T₈ (10.86 %). Lowest total sugar content (10.00 %) was observed in T₃. The data pertaining to TSS of cashew apple cv. BPP- 8 as influenced by growth promoting substances (Table-2). It can be seen from table that application of growth promoting substances had a significant effect on TSS of cashew apple. Highest TSS (13.27 ° Brix) was found in T₁ (NAA 50ppm) which was statistically at par with T₆ (12.84 ° Brix), T₄ (12.75 ° Brix) and T₇ (12.67 ° Brix) and significantly different from T₂, T₃, T₄ and T₈. Lowest TSS (11.92 ° Brix) was recorded in control (T₈). Trees sprayed with NAA @ 50 ppm showed best results in qualitative aspects of cashew cv. BPP- 8 like TSS, total sugar and starch content of cashew apple. These findings are also reported by [9], [4], [16], [22], [12] and [13] in mango and [14] in ber.

Ascorbic acid content of cashew apple was significantly affected by various treatments (Table-2). Highest ascorbic acid (5.23 mg/ 100g) of cashew apple was observed in T₃ (kinetin @ 50 ppm) which was at par with T₈ (5.18 mg/ 100gm) and significantly different from other treatments like T₁, T₂, T₄, T₅, T₆ and T₇. Lowest ascorbic acid content (3.55 mg/ 100gm) was observed in treatment T₄ (ZnSO₄ 0.5%). Highest ascorbic acid (5.23 mg/ 100 g) content of cashew apple was found in kinetin @ 50 ppm treated plant. Increase in ascorbic content due to spraying of growth regulators may be due to their catalytic influence on the bio- synthesis of ascorbic acid, or through inhibition of the activities of oxidative enzymes such as oxidases and dehydrogenase [18]. This observation agreed with the finding of [7] in litchi.

Conclusion

From the above investigation carried out on cashew concluded that spraying of ZnSO₄ @ 0.5 % + Borax @ 0.1 % emerged as best treatment in terms of length, breadth and nut weight, kernel weight and number of nuts per kg. Whereas, ZnSO₄ @ 0.5 % showed highest length and weight of cashew apple and NAA had significant effect on quality parameters of cashew apple like TSS, starch and sugar content.

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Publication History

Received	27 th Oct 2018
Revised	15 th Nov 2018
Accepted	20 th Nov 2018
Online	30 th Nov 2018

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