

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; 8(11): 310-315
www.biochemjournal.com
Received: 22-09-2024
Accepted: 27-10-2024

A Chaitanya Prasad
Department of Plantation,
Spices, Medicinal and Aromatic
Crops, Post Graduate Institute
for Horticultural Sciences,
SKLTGHU, Mulugu, Siddipet,
Telangana, India

G Vijaya Krishna
Scientist (Hort.) and Head,
Horticultural Research
Station, Aswaraopet,
Telangana, India

M Rajasekhara
Professor, Dean of PG Studies
and Dean of Horticulture,
SKLTGHU, Mulugu (M & V),
Siddipet, Telangana, India

K Bhasker
Scientist (GPBR) and Head,
JVR Horticultural Research
Station Malyal, Mahabubabad,
Telangana, India

Effect of plant bio regulators on fruit set and yield of cashew (*Anacardium occidentale* L.) cv. BPP-9

A Chaitanya Prasad, G Vijaya Krishna, M Rajasekhara and K Bhasker

DOI: <https://doi.org/10.33545/26174693.2024.v8.i11d.2848>

Abstract

The present investigation on the effect of plant bioregulators on fruit set and yield of cashew (*Anacardium occidentale* L.) cv. BPP-9 was conducted at the Horticultural Research Station (HRS), Aswaraopet, SKLTGHU, Telangana. The experiment carried out during July 2023 to May 2024 with a factorial concept of three replications per treatment. The parameters recorded were fruits per panicle, percentage of fruit set, number of nuts reached maturity per square meter, nut weight (g), nut count per and nut yield per tree (kg). First factor consist of vegetative bud break and flower induction bioregulators, Ethrel @ 50 ppm was recorded the maximum fruits per panicle (at 715 phenophase) (12.71), fruit set percentage (10.02%), number of nuts reached maturity per square meter (at 815 phenophase) (53.30), nut weight (7.78 g), nut count per tree (1368.63) and nut yield per tree (9.70 kg). The second factor consist fruit set and nut growth-promoting bioregulators, the combination of ZnSO₄ at 0.5% + Borax at 0.15% was recorded the maximum number of fruits per panicle (at 715 phenophase) (12.34), percentage of fruit set (10.10%), number of nuts reached maturity per square meter (at 815 phenophase) (44.29), nut weight (8.00 g), nut count per tree (1339.36) and nut yield per tree (8.89 kg). The interaction effect of factors, Ethrel @ 50 ppm with ZnSO₄ @ 0.5% + Borax @ 0.15% was recorded the maximum the number of fruits per panicle (at 715 phenophase) (16.43), percentage of fruit set (12.97%), number of nuts reached maturity per square meter (at 815 phenophase) (82.60), nut weight (8.25 g), nut count per tree (1640.51) and nut yield per tree (12.64 kg).

Keywords: Plant bioregulators, fruits per panicle, fruit set, nut count, nut yield, cashew

Introduction

The cashew tree is a tropical evergreen that produces an edible nut and apple. Cashew is Native to Brazil, it was introduced in India by Portuguese travellers in the 16th century (Adeigbe *et al.*, 2016) [1]. In India cashew occupied with an area 0.7 million ha with a production of 0.77 million tonnes, India is now a leading global cashew producer (Indian Trade Portal, 2022) [4]. Cashew cultivation is mainly concentrated in the coastal regions across several states of India like Maharashtra, Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Goa, Odisha, West Bengal, Telangana and some parts of North-Eastern region. In Telangana cashew is occupied an area of 5722.48 ha and production of 5221.15 metric tonnes. In Telangana, major cashew-growing districts include Bhadrachari, Khammam, Mancherial and Kumuram Bheem Asifabad (Horticulture Area Production Statistics, 2022-23) [3]. In Telangana state, 90% of total cashew cultivable area is occupied with BPP (BPP-1 to BPP-9) cultivars.

The cashew productivity is largely controlled by climate, which invariably cannot be controlled and hence efforts have to be directed to modulate the cashew phenology to suit unfavourable climatic conditions (Adiga *et al.*, 2019) [2]. Under such circumstances, modulation of bud break, flowering and fruit set by spraying of various plant bio regulators is the best alternative to mitigate or reduce the climate change effect on cashew.

Various studies in cashew have been standardized for profuse flowering and yield improvement by mitigating the adverse effects of climatic conditions. Among various vegetative bud breaking and flower promoting plant bio regulators, GA₃ is a plant hormone that regulate various developmental processes, including flower induction and flower development (Srivastava *et al.*, 2002) [21]. GA₃ at 50 ppm effectively induces flowering in cashew by vegetative bud breaking (Jena *et al.*, 2018) [10]. Ethrel at 50 ppm improves the fruit set per square meter, number of nuts per panicle, high flowering and sex ratio (Ghadage

Corresponding Author:
A Chaitanya Prasad
Department of Plantation,
Spices, Medicinal and Aromatic
Crops, Post Graduate Institute
for Horticultural Sciences,
SKLTGHU, Mulugu, Siddipet,
Telangana, India

et al., 2016) [8]. Humic acids are organic molecules, which increased crop growth by increasing plant growth promoting hormones such as auxin and cytokinin (Billingham, 2012) [5]. Humic acid at 0.4% as foliar spray has effectively increased the number of panicles per unit area in cashew (Pandiyan *et al.*, 2014) [15]. Among various fruit set and nut growth improving plant bio regulators NAA at 50 ppm double spray proved most effective for increasing number of perfect flowers, fruit retention, nuts per square meter and yield per square meter (Singh and Pariari 2012) [19].

Materials and Methods

The experiment was conducted in an orchard at the Horticulture Research Station, Aswaraopet, SKLTGHU, Telangana. The experimental site was situated at an altitude of 166 m above mean sea level on 81° 13' East longitude and 17° 25' North latitude. It falls under a semi-arid tropical climate zone. The soil of the orchard selected is well drained deep sandy loamy with a pH of 6.7 and EC of 0.15 dsm⁻¹. Six-year-old cashew trees of the BPP-9 variety, which were well-grown and uniform, were selected for the experiment. The trees were planted in a square system with a spacing of 7 meters between them. In the experimental trees all cultural practices, including fertilizer, insecticide, fungicide application and irrigation were consistently applied. The trees for the treatment were chosen randomly and a randomized block design with a factorial concept was used for the layout of the experiment (Oliver, 1965) [14]. Factor 1: Vegetative bud-breaking and flower induction Plant Bio-Regulators (PBR's) (V) - Spraying was done at 20 days before bud break (319 phenophase). V₁: GA₃ @ 50 ppm, V₂: Humic acid @ 0.5%, V₃: Ethrel @ 50 ppm, V₀: Control (Water spray) Factor 2 (Fruit set and nut growth promoting PBR's) (F) - 1st spray was done at full bloom stage (617 phenophase) and 2nd spray at fruit set (713 phenophase). F₁: NAA @ 50 ppm, F₂: ZnSO₄ @ 0.5% + Borax @ 0.15%, F₀: Control (Water spray). The detail of the treatments were T₁ - Spraying of GA₃ @ 50 ppm with NAA @ 50 ppm (V₁F₁), T₂ - Spraying of GA₃ @ 50 ppm with ZnSO₄ @ 0.5% + Borax @ 0.15% (V₁F₂), T₃ - Spraying of GA₃ @ 50 ppm with Control (Water spray) (V₁F₀), T₄ - Spraying of Humic acid @ 0.5% with NAA @ 50 ppm (V₂F₁), T₅ - Spraying of Humic acid @ 0.5% with ZnSO₄ @ 0.5% + Borax @ 0.15% (V₂F₂), T₆ - Spraying of Humic acid @ 0.5% with Control (Water spray) (V₂F₀), T₇ - Spraying of Ethrel @ 50 ppm with NAA @ 50 ppm (V₃F₁), T₈ - Spraying of Ethrel @ 50 ppm with ZnSO₄ @ 0.5% + Borax @ 0.15% (V₃F₂), T₉ - Spraying of Ethrel @ 50 ppm with Control (Water spray) (V₃F₀), T₁₀ - Spraying of Control (Water spray) with NAA @ 50 ppm (V₀F₁), T₁₁ - Spraying of control (Water spray) with ZnSO₄ @ 0.5% + Borax @ 0.15% (V₀F₂), T₁₂ Absolute spray (V₀F₀).

Results and Discussion

1. Fruits per panicle (at 715 stage)

The results on number of fruits per panicle of cashew cv. BPP-9 was influenced by plant bio-regulators showed in (Table 1) and (Fig 1). Among the vegetative bud-breaking and flower induction bio-regulators, the maximum number of fruits per panicle was produced in Ethrel @ 50 ppm (V₃) (12.71) followed by GA₃ @ 50 ppm (V₁) (11.52) and Humic acid @ 0.5% (V₂) (8.12). However, the minimum number of fruits per panicle was produced in Control (V₀) (6.69). Ethylene lead to the maximum number of fruits per panicle

in this study, due to the increased production of bisexual flowers per panicle induced by Ethrel (Konhar and Mech 1988) [11]. A similar increase in fruits per panicle with Ethrel was earlier confirmed by Lakshmipathi *et al.* (2017) [13] in cashew. In fruit set and nut growth-promoting bio-regulators, the maximum number of fruits per panicle was produced in ZnSO₄ @ 0.5%+ Borax @ 0.15% (F₂) (12.34), followed by NAA @ 50 ppm (F₁) (11.20). However, the minimum number of fruits per panicle was produced in control (F₀) (5.75). Zinc plays a crucial role in carbohydrate synthesis and auxin biosynthesis, while boron strengthens cell walls and aids in flower and fruit development as distinguished by Senthivel and Kaleeswaran (2019) [18]. The interaction between factors was significant. The maximum number of fruits per panicle was recorded in the combination of Ethrel @ 50 ppm + ZnSO₄ @ 0.5%+ Borax @ 0.15% (V₃F₂) (16.43) followed by Ethrel @ 50 ppm + NAA @ 50 ppm (V₃F₁) (14.39), which was on par with GA₃ @ 50 ppm + ZnSO₄ + Borax (V₁F₂) (14.24) fruits per panicle. However, the minimum number of fruits per panicle was recorded in Absolute control (V₀F₀) (4.39). This synergistic effect of Ethrel, zinc, and boron enhanced fruit set and development, which was also earlier reported by Ghadage *et al.* (2016) [8] and Rajamanickam *et al.* (2023) [16] in cashew.

2. Percentage of fruit set

The results on fruit set percentage of cashew cv. BPP-9 was influenced by plant bio-regulators showed in (Table 1) and (Fig 1). Among the vegetative bud-breaking and flower induction bio-regulators, the maximum percentage of fruits set was recorded in Ethrel @ 50 ppm (V₃) (10.02) followed by GA₃ @ 50 ppm (V₁) (9.28), Humic acid @ 0.5% (V₂) (6.88). However, the minimum percentage of fruit set was recorded in Control (V₀) (5.77). Might be due to the higher fruits per panicle. In fruit set and nut growth promoting plant bio-regulators, the maximum percentage of fruit set was recorded in ZnSO₄ @ 0.5%+ Borax @ 0.15% (F₂) (10.10), followed by NAA @ 50 ppm (F₁) (9.16). However, the minimum percentage of fruit set was recorded in Control (F₀) (4.69). The interaction between the factors was significant. The maximum percentage of fruit set per panicle was recorded in V₃F₂ (Ethrel @ 50 ppm + ZnSO₄ @ 0.5%+ Borax @ 0.15%) (12.97), followed by GA₃ @ 50 ppm + ZnSO₄ @ 0.5%+ Borax @ 0.15% (V₁F₂) (11.51). which is on par with Ethrel @ 50 ppm + NAA @ 50 PPM (V₃F₁) (11.33). However, the minimum percentage of fruit set per panicle was recorded in Absolute control (V₀F₀) (3.69). These results align with previous findings by Lakshmipathi *et al.* (2015) [13] and Gopikrishna *et al.* (2021) [9] confirming the positive effect of Ethrel, zinc and boron on increasing fruit set in cashew.

3. Number of nuts reached maturity per square meter (at 815 stage)

The results on number of nuts reached maturity per square meter of cashew (*Anacardium occidentale* L.) cv. BPP-9 as influenced by plant bio-regulators showed in (Table 1) and (Fig 1). Among the vegetative bud-breaking and flower induction bio-regulators, the maximum number of nuts reached maturity per square meter was recorded in Ethrel @ 50 ppm (V₃) (53.30), followed by GA₃ @ 50 ppm (V₁) (38.20) and Humic acid @ 0.5% (V₂) (19.00). However, the minimum number of nuts reached maturity per square meter

was recorded in Control (V_0) (11.14). Ethrel increased hermaphrodite flowers, fruits per panicle, and fruit set percentage likely due to more nuts reaching maturity per square meter. Similar findings were reported by Lakshmipathi *et al.* (2015) ^[13] in cashew cv. Bhaskara. In fruit set and nut growth promoting plant bio-regulators, the maximum number of nuts reached maturity per square meter was recorded in $ZnSO_4$ @ 0.5%+ Borax @ 0.15% (F_2) (44.29) followed by NAA @ 50 ppm (F_1) (34.79). However, the minimum number of nuts reached maturity per square meter in Control (F_0) (12.15). Zinc enhances fruit retention by increasing auxin production, reducing abscission and improving nutrient mobilization, preventing premature fruit drop (Swietlik, 1999) ^[22]. Boron supports nut growth through sugar translocation, pollination and calcium mobilization (Rao *et al.*, 2017) ^[17]. A similar increase in mature nuts per square meter was reported by Jena *et al.* (2018) ^[10] in cashew. The interaction effects of factors were found significant. The maximum number of nuts reached maturity per square meter was recorded in Ethrel @ 50 ppm + $ZnSO_4$ @ 0.5%+ Borax @ 0.15% (V_3F_2) (82.60) followed by Ethrel @ 50ppm + NAA @ 50 ppm (V_3F_1) (60.59) which is on par with GA_3 @ 50 ppm + $ZnSO_4$ @ 0.5%+ Borax @ 0.15% (V_1F_2) (57.94). However, the minimum number of nuts reached maturity per square meter was recorded in Absolute control (V_0F_0) (9.12). Might be due to Ethrel's enhancement of hermaphrodite flowers and fruit set combined with $ZnSO_4$ and Borax's role in boosting fruit retention and development.

4. Nut weight (g)

The results on nut weight (g) of cashew cv. BPP-9, influenced by plant bio-regulators showed in (Table 1) and (Fig 2). Among the vegetative bud-breaking and flower induction bio-regulators, the maximum nut weight was recorded in Ethrel @ 50 ppm (V_3) (7.78) followed by GA_3 @ 50 ppm (V_1) (7.69), Humic acid @ 0.5% (V_2) (7.60) and the minimum nut weight (g) was recorded in Control (V_0) (7.40). Ethylene likely increased nut weight by improving nutrient mobilization and sugar translocation (Ghadage *et al.*, 2016) ^[18]. In fruit set and nut growth treatments, the maximum nut weight was recorded in $ZnSO_4$ @ 0.5% + Borax @ 0.15% (F_2) (8.00 g) followed by NAA @ 50 ppm (F_1) (7.77 g), whereas, the minimum nut weight was recorded in Control (F_0) (7.08 g). Zinc enhances protein synthesis, carbohydrate translocation and auxin levels, promoting fruit growth and weight (Gopikrishna *et al.*, 2021 in cashew) ^[9]. Boron stimulates hormonal metabolism, cell division and expansion, aiding water and sugar movement within fruits which boosts fruit weight (Singh *et al.*, 2012 in aonla, Lakshmipathi *et al.*, 2015 ^[20, 13] in cashew). The interaction between factors was found significant. The maximum nut weight was recorded in Ethrel @ 50 ppm + $ZnSO_4$ @ 0.5%+ Borax @ 0.15% (V_3F_2) (8.25) followed by GA_3 @ 50 ppm + $ZnSO_4$ +borax (V_1F_2) (8.10). However, the minimum nut weight (g) was recorded in Absolute control (V_0F_0) (7.01). This might be due to the synergistic effects of Ethrel's role in enhancing flowering and fruit set, combined with the nutritional benefits of zinc and boron, which optimize physiological and hormonal processes, resulting in heavier nuts.

5. Nut count per tree

The results on nut count per tree of cashew cv. BPP-9 influenced by plant bio-regulators showed in (Table 1) and

(Fig 2). Among vegetative bud-breaking and flower induction plant bio-regulators, the maximum the maximum nut count per tree was recorded in Ethrel @ 50 ppm (V_3) (1221.22), followed by GA_3 @ 50 ppm (V_1) (1047.44), and Humic acid @ 0.5% (V_2) (971.03). Whereas, the minimum nut count per tree was recorded in control (V_0) (768.15). Ethrel increased the number of panicles, hermaphrodite flowers and extended flowering, leading to more fruits and nuts per tree (Gawankar *et al.*, 2010) ^[7]. In fruit set and nut growth promoting plant bio-regulators, the maximum nut count per tree was recorded in $ZnSO_4$ @ 0.5%+ Borax @ 0.15% (F_2) (1339.36), followed by NAA @ 50 ppm (F_1) (1042.98). However, the minimum nut count per tree was recorded in Control (F_0) (623.54). The interaction between factors was found significant, the maximum nut count per tree was recorded in (1640.51), followed by Ethrel @ 50ppm + NAA @ 50 ppm (V_3F_1) (1437.48). However, the minimum nut count per tree was recorded in Absolute control (V_0F_0) (497.94). The combined effect of Ethrel and $ZnSO_4$ + Borax synergistically improved panicle numbers, fruit set, and nut maturity, leading to the maximum nut count was earlier confirmed by Lakshmipathi *et al.* (2015) ^[13] and Rajamanickam *et al.* (2023) ^[16] in cashew.

6. Nut yield per tree (kg)

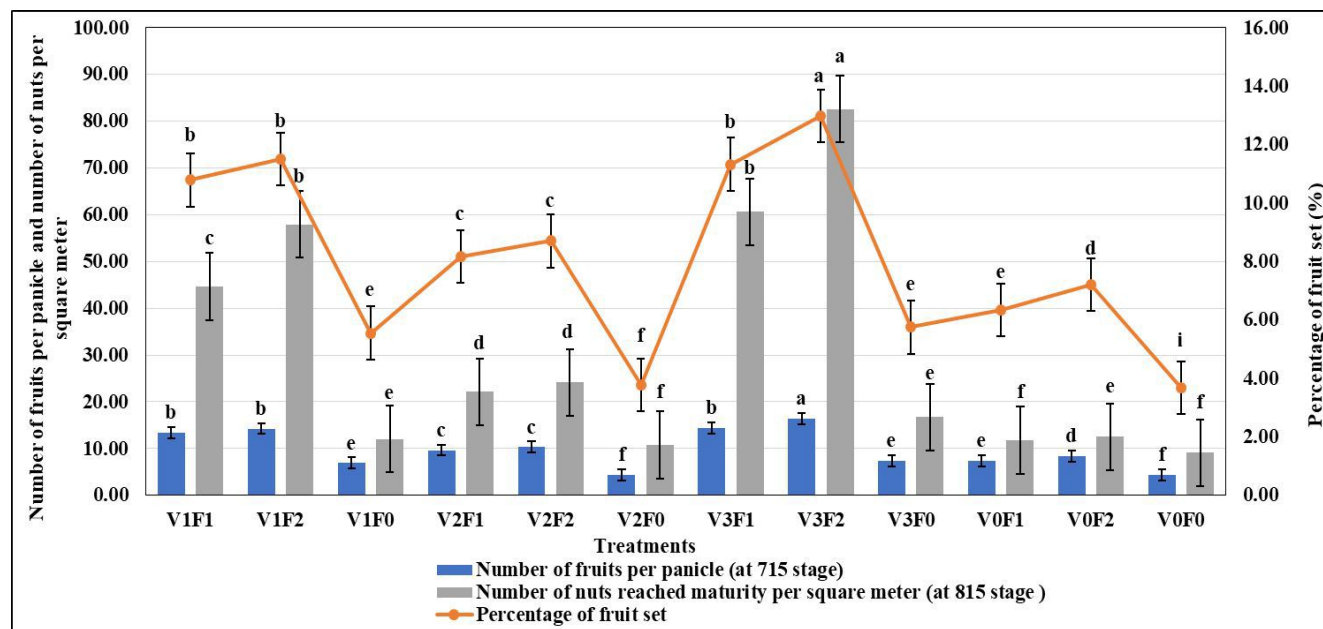
The results on nut yield per tree (kg) of cashew cv. BPP-9 as influenced by plant bio-regulators showed in (Table 1) and (Fig 2). Among vegetative bud-breaking and flower induction plant bio-regulators. The maximum nut yield per tree was recorded in Ethrel @ 50 ppm (V_3) (9.70) followed by GA_3 @ 50 ppm (V_1) (7.80), Humic acid @ 0.5% (V_2) (5.98) and the minimum nut yield per tree was recorded in Control (V_0) (4.75). Ethrel likely increased nut yield by enhancing fruit set and nut weight as noted by Gajbiye *et al.* (2007) ^[6], Gawankar *et al.* (2010) ^[7] and Lakshmipathi *et al.* (2015) ^[13] in cashew. In fruit set and nut growth promoting plant bio-regulators, the maximum nut yield per tree was recorded in $ZnSO_4$ @ 0.5% + Borax @ 0.15% (F_2) (8.89), followed by NAA @ 50 ppm (F_1) (8.11). However, the minimum nut yield per tree was recorded in Control (F_0) (4.18). The treatment $ZnSO_4$ @ 0.5%+ Borax @ 0.15% (F_2) significantly improved nut development, increasing the number of fruits per panicle, improving fruit set percentage and resulting in a greater number of mature nuts per square meter and per tree. These factors, along with increased nut weight, led to the highest overall nut yield per tree by Jena *et al.* (2018) ^[10]. The interaction between factors was found significant. The maximum nut yield per tree was recorded in Ethrel @ 50 ppm + $ZnSO_4$ @ 0.5%+ Borax @ 0.15% (V_3F_2) (12.64) followed by Ethrel @ 50ppm + NAA @ 50 ppm (V_3F_1) (10.65) which is on par with GA_3 @ 50 ppm + $ZnSO_4$ +borax (V_1F_2) (9.60). However, the minimum nut yield per tree was recorded in Absolute (V_0F_0) (2.73). The best results with the combination of Ethrel @ 50 ppm + $ZnSO_4$ @ 0.5% + Borax @ 0.15% (V_3F_2) for nut yield per tree (12.64) can be attributed to Ethrel's effectiveness in increasing the number of fruits per tree and nut weight, combined with $ZnSO_4$ + Borax's role in enhancing fruit set and development. This synergistic effect resulted in the maximum number of fruits per panicle, improved fruit set percentage, increased mature nuts per square meter and greater nut weight leading to the optimal overall nut yield per tree.

Table 1: Effect of plant bio regulators on number of fruits per panicle, percentage of fruit set, number of nuts reached maturity per square meter, nut count per tree, nut yield per tree, nut weight in cashew cv. BPP-9.

Treatment Details						
Factor 1 (V): Vegetative bud-breaking and flower induction plant bio- regulators						
4 levels	NFS/P	PFS	NNRM/S.qm	NC	NY	NW
V ₁	11.52 ^b	9.28 ^b	38.20 ^b	1047.44 ^b	7.80 ^b	7.69 ^b
V ₂	8.12 ^c	6.88 ^c	19.00 ^c	971.03 ^c	5.98 ^c	7.60 ^c
V ₃	12.71 ^a	10.02 ^a	53.30 ^a	1221.22 ^a	9.70 ^a	7.78 ^a
V ₀	6.69 ^d	5.77 ^d	11.14 ^d	768.15 ^d	4.75 ^d	7.40 ^d
SE (m) ±	0.20	0.16	0.94	8.19	0.21	0.01
C.D at 5 %	0.58	0.46	2.75	24.01	0.62	0.02
Factor 2 (F): Fruit set and nut growth promoting plant bio regulators						
3 levels	NFS/P	PFS	NNRM/S.qm	NC	NY	NW
F ₁	11.20 ^b	9.16 ^b	34.79 ^b	1042.98 ^b	8.11 ^b	7.77 ^b
F ₂	12.34 ^a	10.10 ^a	44.29 ^a	1339.36 ^a	8.89 ^a	8.00 ^a
F ₀	5.75 ^c	4.69 ^c	12.15 ^c	623.54 ^c	4.18 ^c	7.08 ^c
SE (m) ±	0.17	0.14	0.81	7.09	0.18	0.01
C.D at 5 %	0.51	0.40	2.38	20.79	0.54	0.02
Interactions	NFS/P	PFS	NNRM/S.qm	NC	NY	NW
V ₁ F ₁	13.41 ^b	10.79 ^b	44.63 ^c	1027.91 ^e	9.02 ^c	7.85 ^d
V ₁ F ₂	14.24 ^b	11.51 ^b	57.94 ^b	1437.48 ^b	9.60 ^b	8.10 ^b
V ₁ F ₀	6.90 ^e	5.55 ^e	12.03 ^e	676.94 ^h	4.77 ^e	7.11 ^h
V ₂ F ₁	9.65 ^c	8.18 ^c	22.15 ^d	992.42 ^e	7.03 ^d	7.71 ^e
V ₂ F ₂	10.32 ^c	8.70 ^c	24.10 ^d	1356.17 ^c	7.54 ^d	8.01 ^c
V ₂ F ₀	4.40 ^f	3.77 ^f	10.76 ^f	564.50 ⁱ	3.38 ^f	7.09 ^h
V ₃ F ₁	14.39 ^b	11.33 ^b	60.59 ^b	1268.37 ^d	10.65 ^b	7.97 ^c
V ₃ F ₂	16.43 ^a	12.97 ^a	82.60 ^a	1640.51 ^a	12.64 ^a	8.25 ^a
V ₃ F ₀	7.32 ^e	5.75 ^e	16.70 ^e	754.7 ^g	5.82 ^e	7.12 ^h
V ₀ F ₁	7.33 ^e	6.34 ^e	11.77 ^f	883.23 ^f	5.72 ^e	7.56 ^g
V ₀ F ₂	8.35 ^d	7.20 ^d	12.52 ^e	923.27 ^f	5.78 ^e	7.63 ^f
V ₀ F ₀	4.39 ^f	3.69 ⁱ	9.12 ^f	497.94 ^j	2.73 ^f	7.01 ⁱ
S.Em±	0.34	0.27	1.63	14.18	0.37	0.01
CD at (5%)	1.01	0.80	4.77	41.59	1.08	0.04

Figures with same alphabets did not differ significantly. ** Significant at (p= 0.01 LOS), *Significant at (p= 0.05 LOS), Values were compared with respective C.D values.

NFS/P- Number of fruits per panicle (at 715 stage); PFS- Percentage of fruit set; NNRM/S.qm- Number of nuts reached maturity per square meter (at 815 stage); NC- Nut count per tree; NY- Nut yield per tree (kg); NW- Nut weight (g)

**Fig 1:** Interaction effect of vegetative bud breaking and flower induction plant bio regulators (V) and fruit set and nut growth promoting plant bio regulators (F) on fruits per panicle, number of nuts reached maturity per square meter and percentage of fruit set in cashew (*Anacardium occidentale* L.) cv. BPP-9.

V1: GA3 @ 50 ppm	F1: NAA @ 50 ppm
V2: Humic acid @ 0.5%	F2: ZnSO ₄ @ 0.5% + Borax @ 0.15%
V3: Ethrel @ 50 ppm	F0: Control (Water spray)
V0: Control (Water spray)	

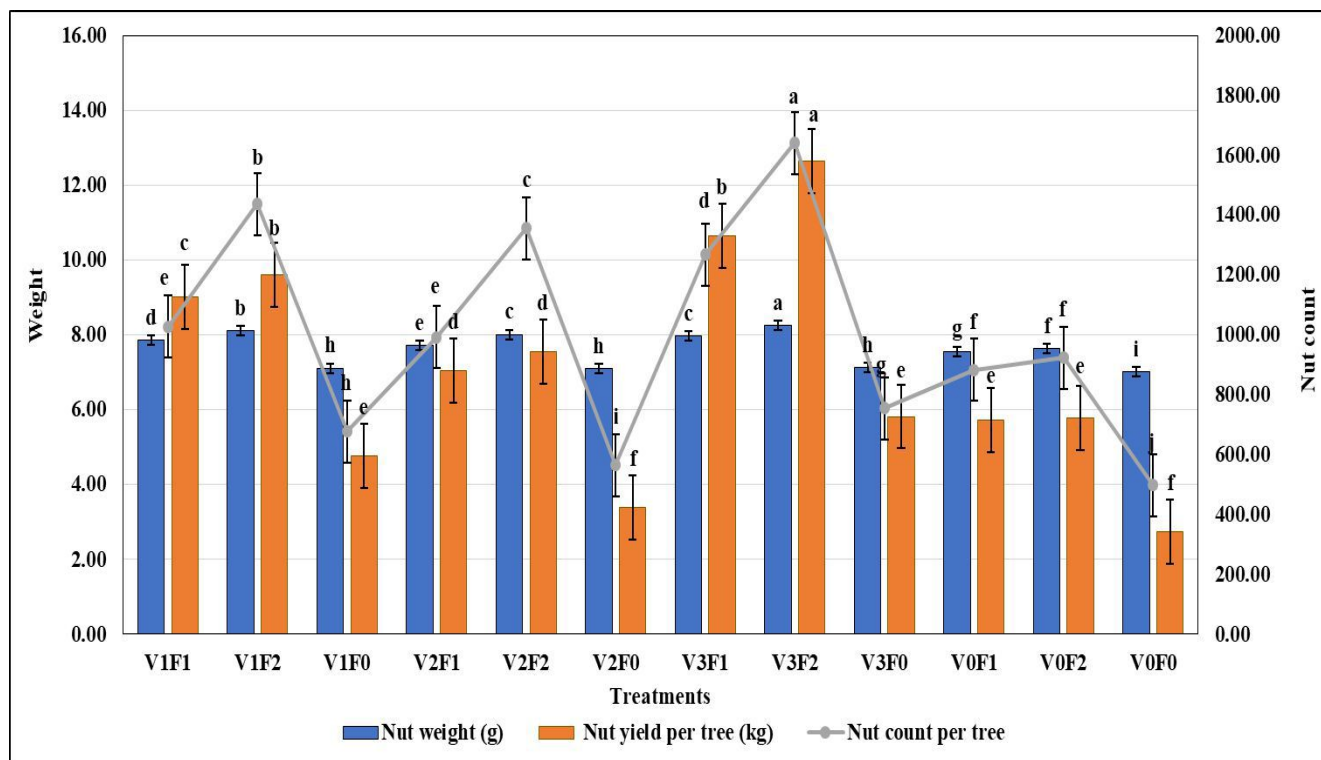


Fig 2: Interaction effect of vegetative bud breaking and flower induction plant bio regulators (V) and fruit set and nut growth promoting plant bio regulators (F) on nut yield per tree (kg), nut weight (g) and nut count per tree in cashew (*Anacardium occidentale* L.) cv. BPP-9.

V ₁ : GA ₃ @ 50 ppm	F ₁ : NAA @ 50 ppm
V ₂ : Humic acid @ 0.5%	F ₂ : ZnSO ₄ @ 0.5% + Borax @ 0.15%
V ₃ : Ethrel @ 50 ppm	F ₀ : Control (Water spray)
V ₀ : Control (Water spray)	

Conclusion

Among the different plant bio regulators, Ethrel @ 50 ppm + ZnSO₄ @ 0.5% + Borax @ 0.15% (V₃F₂) significantly improved the fruits per panicle, percentage of fruit set, number of nuts reached maturity per square meter, nut weight, nut count per tree and overall nut yield per tree in cashew.

References

- Adeigbe OO, Adewale BD, Muiyiwa AA, Olasupo FO, Olaniyi OO, Adenuga OO, *et al.* Quantitative descriptors of cashew nut categories in Nigeria: providing indices for superior nut selection. *ARNP Journal of Agricultural and Biological Science*. 2016;11(4):142-148.
- Adiga JD, Muralidhara BM, Preethi P, Savadi S. Phenological growth stages of the cashew tree (*Anacardium occidentale* L.) according to the extended BBCH scale. *Annals of Applied Biology*. 2019;175(2):246-252.
- Anonymous. Horticulture Area Production Statistics; 2022.
- Anonymous. Indian Trade Portal; 2022.
- Billingham KL. Humic products-potential or presumption for agriculture, can humic products improve my soil? In: 27th Annual Conference; 2012.
- Gajbiye RC, Jalgaonkar VN, Gawankar MS. Effect of growth regulator to improve fruit set and yield in cashew. In: Souvenir and extended summaries of national seminar on research, development and marketing of cashew. ICAR Research Complex; 2007. p. 136-137.
- Gawankar MS, Sawale RD, Pawar SN, Chavan SA. Effect of Ethrel® on flowering, sex-expression and yield in cashew. *Journal of Horticultural Sciences*. 2010;5(1):68-70.
- Ghadage VR, Ahlawat TR, Chawla SL, Shah NI, Ghadage N. Effect of plant growth regulators on flowering behavior of cashew cv. Vengurla-4 grown in the hilly tracts of South Gujarat. *Journal of Applied and Natural Science*. 2016;8(1):23-27.
- Gopikrishna K, Panda PK, Nayak RK, Sethi K. Effect of nutrients on yield and yield attributing characters in cashew (*Anacardium occidentale* L.). *The Pharma Innovation Journal*. 2021;10(1):117-119.
- Jena C, Panda PK, Karna AK. Effect of growth promoting substances on flowering behaviour of cashew cv. BPP-8 grown in the coastal region of Odisha. *International Journal of Chemical Studies*. 2018;6(6):908-911.
- Konhar T, Mech A. Effect of growth regulators on flowering, fruit set and fruit retention in cashew (*Anacardium occidentale* L.). *Indian Cashew Journal*. 1988;18(4):17-19.
- Lakshmipathi JD, Kalaivanan D, Halesh GK. Effect of plant growth regulators on leaf area, chlorophyll content, carotenoids, stomatal count and yield of cashew (*Anacardium occidentale* L.) var. Bhaskara. *Journal of Plantation Crops*. 2017;45(2):141-146.
- Lakshmipathi J, Adiga D, Kalaivanan D, Mohana GS, Meena RK. Effect of growth regulators on leaf area and yield of cashew (*Anacardium occidentale* L.) var. Bhaskara. *Ecology Environment and Conservation*. 2015;20:9-11.

14. Oliver LL. Statistical methods in experimentation. 1st ed. 1965. p. 11-30.
15. Pandiyan R. Influence of different levels of regulators on nut yield. International Journal of Research in Agricultural Sciences. 2014;1(4):2348-3997.
16. Rajamanickam C, Baskaran A, Muralidharan B. Studies on the effect of foliar application of micronutrients for growth, yield, economic traits and leaf nutrient content in cashew (*Anacardium occidentale* L.) var. VRI 3. International Journal of Plant and Soil Science. 2023;35(22):46-56.
17. Rao VG, Ramana PV. Effect of critical micronutrients foliar application on yield of cashew (*Anacardium occidentale* L.) under agency tracts of Rampachodavaram (Andhra Pradesh). Plant Archives. 2017;17(2):1201-1203.
18. Senthivel T, Kaleeswaran M. Studies on the effect of micronutrients on the yield, quality of mango varieties under UHDP (Ultra High-Density Planting). International Journal of Microbiology and Applied Sciences. 2019;8(12):2074-2080.
19. Singh LS, Pariari A. Effect of plant growth regulators (PGRs) on flowering, fruit-set and yield of cashew var. Jhargram-1. Journal of Plantation Crops. 2012;40(2):101-104.
20. Singh PC, Gangwar RS, Singh VK. Effect of micronutrients spray on fruit drop, fruit quality and yield of aonla cv. Banarasi. Horti Flora Research Spectrum. 2012;1(1):73-76.
21. Srivastava LM. Plant growth and development: Hormones and Environment. 1st ed. Elsevier; 2002. p. 171-190.
22. Swietlik D. Zinc nutrition in horticultural crops. Horticultural Reviews. 1999;23:109-180.