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Effect of plant growth regulators (PGRs) on flowering, fruit-set and yield of cashew var. Jhargram-1

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Abstract

Four commonly used plant growth regulators such as NAA, 2,4-D, ethrel and GA_3 were sprayed (single or double) at panicle initiation and peak flowering stage in cashew var. Jhargram-1. Results showed that spraying of ethrel 50 ppm twice, significantly produced maximum number of panicle per square meter. Spraying PGRs except 2,4-D had beneficial effect for most of the economic traits of the plants. NAA 100 ppm double spray was found to be the most effective to increase number of perfect flowers, fruit retention, nuts per square meter and yield per square meter. The study also revealed that spraying of GA_3 50 ppm (both single and double spray) significantly produced more number of staminate flowers. Duration of flowering more than 60 days was recorded with double spray of GA_3 50 ppm, NAA 100 ppm and GA_3 100 ppm.

Keywords: Cashew, flowering, fruit-set, growth regulators, yield

Introduction

Flowering in cashew is seasonal, producing flower bud in varying phases starting from mid September to February depending upon the cultivars and climatic condition. Though cashew produces innumerable flowers, only 1-2 % of the flowers set fruit and reaches maturity. Production of less number of pistillate flowers and nut drop can be overcome to some extent through use of plant hormones. Growth regulators like 2,4-D (@10 ppm) have shown beneficial effects in producing pistillate flowers and fruit retention (Chattopadhyay, 1993). Fruit-set and their retention are the major limiting factors for low yield in cashew which have not been given due attention. The nuts those develop after pollination start drying and dropping, leaving a very low percentage to maturity. Murthy *et al*. (1975) observed the significant effect of spraying growth regulators in cashew recording highest fruit-set with NAA at 10 ppm twice (107%) followed by 2,4-D at 10 ppm (57%) and IBA at 25 ppm (55%) over control.

Use of growth regulators has wide applications in agriculture, in general, and horticulture, in particular. The present day cashew cultivation is concentrated on intensive cultivation or more specifically, high density plantation (HDP) of cashew. Therefore, a new direction is required to maximize production per unit area. Though the cashew var. Jhargram-1 is recommended for commercial plantation in West Bengal, no attempt has been made so far regarding the use of growth regulators for yield enhancement. Considering the commercial importance of cashew and to boost its productivity, the present investigation was undertaken to study the effect of spraying plant growth regulators on flowering, floral characters, fruit-set and nut yield of cashew var. Jhargram-1.

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Materials and methods

The experiment was conducted at Regional Research Station, Jhargram, Midnapore (West), Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, West Bengal during 2008 and 2009. The altitude of the experimental site is 78.8 m above the MSL (22.5°N latitude and 87°E longitude). The experiment was conducted in 14 year old cashew plantation (var. Jhargram-1). The experimental design was randomized block design (RBD) with 17 treatments and 3 replications. The details of the treatments are T_1 = NAA 50 ppm (single spray), T_2 = NAA 50 ppm (double spray), T_3 = NAA 100 ppm (single spray), T_4 = NAA 100 ppm (double spray), T_5 = 2,4-D 50 ppm (single spray), T_6 = 2,4-D 50 ppm (double spray), T_7 = 2,4-D 100 ppm (single spray), T_8 = 2,4-D 100 ppm (double spray), T_9 = ethrel 50 ppm (single spray), T_{10} = ethrel 50 ppm (double spray), T_{11} = ethrel 100 ppm (single spray), T_{12} = ethrel 100 ppm (double spray), T_{13} = GA_3 50 ppm (single spray), T_{14} = GA_3 50 ppm (double spray), T_{15} = GA_3 100 ppm (single spray), T_{16} = GA_3 100 ppm (double spray) and T_{17} = control (water spray). The plant growth regulators were sprayed during panicle initiation and flowering stage using foot pump paddle sprayer covering the entire canopy. Single spray was given at panicle initiation, while double spray was applied at panicle initiation and peak flowering stage. Observations on flowering, floral characters, fruit-set and yield per square meter were recorded and data were statistically analyzed as per analysis of variance method suggested by Gomez and Gomez (1984).

Results and discussion

Floral characters like panicle length, panicle breadth and number of primary, secondary and tertiary branches per panicle varied significantly among the treatments (Table 1). Pooled data of two years showed that application of ethrel 100 ppm twice at panicle initiation and peak flowering produced maximum size of panicle while, more number of floral branches (primary, secondary and tertiary) was recorded with NAA 100 ppm double spray.

Highest number of panicles per square meter (24.04) was observed with the foliar spray of ethrel 50 ppm (double spray) followed by double spray of

Table 1. Effect of plant growth regulators on floral characters of cashew var. Jhargram-1

Treatments		No. of sprays	No. of panicle/m²	Panicle length (cm)	Panicle breadth (cm)	Primary branch (no.)	Secondary branch (no.)	Tertiary branch (no.)
T_1	NAA 50 ppm	Single	17.54	19.64	23.18	8.09	15.70	48.69
T_2	NAA 50 ppm	Double	22.03	18.02	22.19	8.31	18.40	52.04
T_3	NAA 100 ppm	Single	20.63	16.96	20.30	8.27	18.69	55.80
T_4	NAA 100 ppm	Double	21.27	15.48	18.01	8.50	19.06	63.21
T_5	2, 4-D 50 ppm	Single	14.97	16.48	20.26	7.64	16.54	45.50
T_6	2, 4-D 50 ppm	Double	19.42	17.60	20.99	8.19	16.41	51.59
T_7	2, 4-D 100 ppm	Single	16.98	15.32	17.38	7.96	16.46	42.96
T_8	2, 4-D 100 ppm	Double	16.70	15.33	18.04	7.23	14.88	34.65
T_9	Ethrel 50 ppm	Single	19.95	17.26	20.78	7.66	16.11	39.23
T_{10}	Ethrel 50 ppm	Double	24.04	18.84	22.23	8.21	17.70	44.13
T_{11}	Ethrel 100 ppm	Single	18.95	19.09	23.07	8.38	18.98	57.44
T_{12}	Ethrel 100 ppm	Double	22.91	20.73	25.11	7.40	15.18	39.88
T_{13}	GA_3 50 ppm	Single	15.95	16.84	19.80	8.34	16.86	49.89
T_{14}	GA_3 50 ppm	Double	14.62	16.89	20.29	8.28	18.66	51.63
T_{15}	GA_3 100 ppm	Single	19.08	16.54	18.20	8.16	18.73	49.69
T_{16}	GA_3 100 ppm	Double	14.78	14.33	16.50	7.64	15.58	43.81
T_{17}	Control	-	16.83	16.45	19.24	7.71	15.66	38.54
S. E. (±)		-	1.00	0.71	0.92	0.33	0.77	4.45
C.D. (P= 0.05)		-	2.90	2.06	2.67	0.93	2.22	12.83

ethrel 100 ppm (22.91), NAA 50 ppm (22.03) and NAA 100 ppm (21.27) and the treatments were statistically found to be at par with each other. A significant increase in number of panicles per square meter with double spray of ethrel (50 and 100 ppm) over control might be due to increase activity of peroxidase and α-amylase releasing more sugar for induction of flowering (Yamdagni and Khangia, 1989). Staminate flower production was significantly influenced by GA_3 treatments (Table 2). Maximum number of staminate flowers (386.31) were obtained with the plant sprayed with GA_3 50 ppm (single spray) followed by GA_3 50 ppm double spray (362.63) which were statistically at par with NAA 100 ppm double spray (347.01) and GA_3 100 ppm single spray (339.15). On the other hand, maximum number of perfect flowers (125.77), total flowers per panicle (472.78) and sex ratio (0.36) was recorded with double spray of NAA 100 ppm. In cashew, similar findings were also reported by Panda and Pal (1982) and Ashok and Thimmaraju (1981). Duration of flowering was highly influenced with double spray of GA_3 50 ppm (68.03) followed by NAA 100 ppm (64.28) and GA_3 100 ppm (61.62).

The effect of growth regulators on fruit-set at various stages and its retention in cashew var. Jhargram-1 has been presented in Table 3. Double spray of NAA 100 ppm increased the fruit-set at pea stage and marble stage and fruit retention. Probably, exogenous application of this hormone at panicle initiation and flowering stage might prevent migration of metabolites like minerals, amino acids, RNA and other substances from developing fruits to other plant parts. Application of NAA 100 ppm might also reduce the activity of cellulose and pectinase which are the two most important enzymes which hastens abscission. Krishnamoorthy (1981) reported abscission of immature apple fruit due to lower auxin content and can be prevented through exogenous supply of NAA. Studies also indicated that double spray was found to be more effective than single spray except 2,4-D 100 ppm and GA_3 100 ppm (double spray) for the number of nuts per square meter. Maximum yield per square meter was recorded with NAA 100 ppm (double spray). More number of perfect flowers, proper pollination, less premature flowers and fruit drop, low physiological stress are some of the factors responsible for increase in yield. Yield increment in cashew due to hormone spray like NAA and ethrel were also reported by earlier workers (Kumar *et al*., 1995; Veeraragavathatham and Palaniswamy, 1983).

Table 2. Effect of plant growth regulators on flowering behavior in cashew var. Jhargram-1

Treatments		No. of sprays	Total flowers (no.)	Staminate flower (no.)	Perfect flower (no.)	Sex ratio	Duration of flowering (days)
T_1	NAA 50 ppm	Single	318.12	246.99	71.13	0.29	48.27
T_2	NAA 50 ppm	Double	398.17	301.57	96.60	0.31	59.85
T_3	NAA 100 ppm	Single	391.60	293.63	97.96	0.33	51.18
T_4	NAA 100 ppm	Double	472.78	347.01	125.77	0.36	64.28
T_5	2, 4-D 50 ppm	Single	206.58	159.41	47.17	0.29	40.17
T_6	2, 4-D 50 ppm	Double	258.93	198.95	59.98	0.30	47.44
T_7	2, 4-D 100 ppm	Single	278.76	220.96	57.80	0.25	39.73
T_8	2, 4-D 100 ppm	Double	206.78	162.16	44.62	0.27	38.96
T_9	Ethrel 50 ppm	Single	281.12	215.23	65.90	0.30	45.71
T_{10}	Ethrel 50 ppm	Double	415.63	317.34	98.29	0.30	52.48
T_{11}	Ethrel 100 ppm	Single	288.20	216.47	71.73	0.32	48.58
T_{12}	Ethrel 100 ppm	Double	430.19	317.98	112.21	0.35	57.77
T_{13}	GA_3 50 ppm	Single	460.98	386.31	74.67	0.22	57.80
T_{14}	GA_3 50 ppm	Double	456.58	362.63	93.95	0.26	68.03
T_{15}	GA_3 100 ppm	Single	447.32	339.15	108.17	0.31	59.13
T_{16}	GA_3 100 ppm	Double	272.51	216.23	56.28	0.26	61.62
T_{17}	Control	-	298.03	234.88	63.15	0.26	49.19
S. E. (±)		-	22.51	18.86	6.59	0.01	4.71
C.D. (P= 0.05)		-	64.95	54.41	19.01	0.05	13.60

Table 3. Effect of plant growth regulators on fruit-set and yield in cashew var. Jhargram-1

Treatments		No. of sprays	Fruit-set/ panicle at peanut stage (no.)	Fruit-set/ panicle at marble stage (no.)	Fruit retained / panicle (no.)	Nuts/m^2 (No.)	Yield/m^2 (g)
T_1	NAA 50 ppm	Single	15.22	5.70	4.77	20.50	98.12
T_2	NAA 50 ppm	Double	21.36	8.16	7.69	29.56	161.66
T_3	NAA 100 ppm	Single	21.16	7.12	6.48	26.61	128.68
T_4	NAA 100 ppm	Double	27.06	10.36	10.00	37.54	207.10
T_5	2, 4-D 50 ppm	Single	14.73	4.56	2.34	14.01	64.82
T_6	2, 4-D 50 ppm	Double	18.07	5.28	3.35	17.51	82.05
T_7	2, 4-D 100 ppm	Single	20.74	4.70	1.70	12.10	52.16
T_8	2, 4-D 100 ppm	Double	16.50	4.16	1.02	9.73	41.52
T_9	Ethrel 50 ppm	Single	14.09	5.26	3.91	20.42	94.71
T_{10}	Ethrel 50 ppm	Double	23.20	7.81	7.38	32.34	182.73
T_{11}	Ethrel 100 ppm	Single	17.48	5.80	5.07	24.00	105.12
T_{12}	Ethrel 100 ppm	Double	24.67	9.95	9.58	35.03	196.84
T_{13}	GA_3 50 ppm	Single	18.81	5.60	4.78	18.31	86.21
T_{14}	GA_3 50 ppm	Double	20.80	6.29	5.63	23.05	125.89
T_{15}	GA_3 100 ppm	Single	22.85	8.86	8.33	24.50	134.65
T_{16}	GA_3 100 ppm	Double	16.13	5.18	4.22	19.67	96.79
T_{17}	Control	-	15.60	4.90	3.76	18.13	90.23
S. E. (±)		-	0.71	0.67	0.57	1.47	9.27
C.D. (P= 0.05)		-	2.06	1.94	1.66	4.25	26.76

Application of plant growth regulators had positive effect in increasing or decreasing various yield and yield attributing parameters. In the present study, application of NAA 100 ppm and ethrel 100 ppm (double spray) were beneficial for increasing the fruit-set and nut yield in cashew var. Jhargram-1.

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