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Influence of plant growth regulators on yield and quality parameters of watermelon (*Citrullus lanatus* (Thunb) Mansf.) cv. 'Sugar baby'

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Abstract

The experiment was laid out in randomized block design with three replications and fourteen treatments viz. T₁: Control; T₂: Water spray; T₃: GA₃ 20 ppm; T₄: GA₃ 30 ppm; T₅: GA₃ 40 ppm; T₆: NAA 40 ppm; T₇: NAA 50 ppm; T₈: NAA 60 ppm; T₉: Ethrel 50 ppm; T₁₀: Ethrel 100 ppm; T₁₁: Ethrel 150 ppm; T₁₂: Ca 10 ppm; T₁₃: Ca 20 ppm; T₁₄: Ca 30 ppm. The results revealed that maximum number of fruits per vine (2.27), average fruit weight (2702.33 g), fruit yield per vine (4.02 kg), fruit yield per plot (48.05 kg) and fruit yield per hectare (266.96 q) were recorded with application of Ethrel 150 ppm (T₁₁). Whereas, the quality parameters like; diameter of fruit (cm), Total Soluble Solids (°Brix), reducing sugar (%), non-reducing sugar (%) and total sugar (%) were found not significant. High BCR ratio (3.07) also achieved by treatment T₁₁ Ethrel 150 ppm.

Keywords: Application, hectare, soluble solids

Introduction

Watermelon (*Citrullus lanatus* (Thunb) Mansf.) is believed to be native of Africa (Thompson and Kelly, 1957) [15]. Watermelon has high nutritive value, it is rich in vitamin 'C' which is good for health, low in sugar and calories because of high percent of water (Bose *et al.* 2002) [3]. Approximately 46 per cent of melon is edible and contains 9.47 to 10.21 per cent sugar in the red flesh, which is just above the white flesh rind, while central portion in the flesh and the flesh around the seed contains 2.25 to 12.78 per cent sugar (Mac Gillivray, 1953) [9]. In India, watermelon is grown in about 1.01 lakh hectare areas with the production of 2.52 million MT. (Anon., 2018) [1].

Plant growth regulators other than nutrients usually are organic compounds. They are either natural or synthetic compounds and are applied directly to a plant to alter its life processes or structure in some beneficial ways so as to enhance yield and improve quality (Nickell, 1982) [12]. Foliar spray of growth regulators has been found effective in increasing vegetative growth, early fruiting, total yield and quality of fruits in many vegetables (Das and Swain, 1977; Howthorne and Hopping, 1977 and Bose and Som, 1986) [5, 7, 2]. The influence of GA₃, NAA, Ethrel and MH on growth, yield and quality is known in many vegetable crops, but systematic study in cucurbits, particularly on watermelon is meagre (Nadkarni, 1927) [11]. The present investigation was taken to evaluate the influence of GA₃, NAA, Ethrel and Calcium on yield and quality parameters of watermelon.

Materials and Methods

The present experiment was laid out in randomized block design with three replications. Total fourteen treatments were evaluated in the study viz., T₁: Control; T₂: Water spray; T₃: GA₃ 20 ppm; T₄: GA₃ 30 ppm; T₅: GA₃ 40 ppm; T₆: NAA 40 ppm; T₇: NAA 50 ppm; T₈: NAA 60 ppm; T₉: Ethrel 50 ppm; T₁₀: Ethrel 100 ppm; T₁₁: Ethrel 150 ppm; T₁₂: Ca 10 ppm; T₁₃: Ca 20 ppm; T₁₄: Ca 30 ppm. The experiment was carried out during summer season of 2019 at College Farm, College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Dist. Mehsana, Gujarat. The seeds of watermelon cv. Sugar Baby were used for the experiment.

Two sprays of plant growth regulators were done at 2nd and 4th true leaf stages during morning hours till the both sides of leaves completely wet. The farm yard manure (FYM) at the rate of 20 tons per hectare and recommended dose of fertilizer 100: 50: 50 kg/ha NPK were applied. Half quantity of nitrogen in the form of urea and whole quantity of P₂O₅ and K₂O as basal dose was given in the form of single super phosphate (SSP) and murate of potash (MOP) respectively and remaining half dose of nitrogen was applied at 30 days after sowing. The seeds were sown at spacing of 1.5 m × 1 m on 23rd February. The data were recorded from five randomly tagged plants. All the recorded data statistically analyzed by techniques of Panse and Sukhatme (1985) [13].

Results and Discussions

Influence of GA₃, NAA, Ethrel and Calcium on Yield Parameters:

A perusal of data presented in Table 1 showed significant differences among the treatments for number of fruits per vine, average fruit weight (g), yield per vine (kg), yield per plot (kg) and yield per hectare (q). The application of treatment

T₁₁ (Ethrel 150 ppm) recorded maximum number of fruits per vine *i.e.* 2.27, which was statistically at par with treatment T₁₀ (Ethrel 100 ppm), T₉ (Ethrel 50 ppm), T₅ (GA₃ 40 ppm), T₈ (NAA 60 ppm) and T₄ (GA₃ 30 ppm) *i.e.* 2.13, 2.07, 2.07, 1.87 and 1.87, respectively. Similar results were observed by Prasad *et al.* (2008) [14] in pumpkin, Mahala *et al.* (2014) [10] in bottle gourd and Chaurasiya *et al.* (2016) [4] in muskmelon. The maximum fruit weight *i.e.* 2702.33 g was recorded with application of (Ethrel 150 ppm) T₁₁, which was statistically at par with treatment T₁₀ (Ethrel 100 ppm), T₉ (Ethrel 50 ppm) and T₅ (GA₃ 40 ppm) *i.e.* 2646.33 g, 2588.33 g and 2541.20 g, respectively. Treatment T₁₁ (Ethrel 150 ppm) found better for maximum fruit yield per vine *i.e.* 4.02 kg, which was statistically at par with treatment T₁₀ (Ethrel 100 ppm), T₉ (Ethrel 50 ppm) and T₅ (GA₃ 40 ppm) *i.e.* 3.93 kg, 3.77 kg and 3.40 kg, respectively. The probable reason for increased fruit yield by ethrel treatment, may be due to ethrel suppressed the number of male flowers and promoted number of female flowers thereby increased number of fruits and ultimately produced the highest yield (Gopalkrishnan and Chaudhary, 1978) [6].

Table 1: Influence of GA₃, NAA, Ethrel and Calcium on yield parameters

Treatment No.	Treatments	Number of fruits per vine	Average fruit weight (g)	Yield per vine (kg)	Yield per plot (kg)	Yield per hectare (q)
T ₁	Control	1.53	1671.33	2.97	35.75	198.59
T ₂	Water Spray	1.60	1637.20	3.00	36.16	200.87
T ₃	GA ₃ 20 ppm	1.80	2117.80	3.19	37.66	209.24
T ₄	GA ₃ 30 ppm	1.87	2260.53	3.27	38.20	212.22
T ₅	GA ₃ 40 ppm	2.07	2541.20	3.40	40.00	222.22
T ₆	NAA 40 ppm	1.67	1909.80	3.05	36.79	204.37
T ₇	NAA 50 ppm	1.73	2147.07	3.14	37.00	205.57
T ₈	NAA 60 ppm	1.87	2068.80	3.30	38.97	216.48
T ₉	Ethrel 50 ppm	2.07	2588.33	3.77	44.44	246.87
T ₁₀	Ethrel 100 ppm	2.13	2646.33	3.93	46.31	257.28
T ₁₁	Ethrel 150 ppm	2.27	2702.33	4.02	48.05	266.96
T ₁₂	Ca 10 ppm	1.60	1964.80	3.18	36.17	200.93
T ₁₃	Ca 20 ppm	1.60	1745.80	3.27	36.46	202.54
T ₁₄	Ca 30 ppm	1.67	1848.00	3.35	37.54	208.56
S.Em. ±		0.15	114.28	0.22	2.39	13.29
C.D. at 5%		0.44	332.16	0.64	6.95	38.63
C.V. %		14.45	9.28	11.47	10.56	10.56

The highest fruit yield per plot (48.05 kg) and fruit yield per hectare (266.96 q) was recorded with treatment T₁₁ (Ethrel 150 ppm) followed by treatment T₁₀ (Ethrel 100 ppm) *i.e.* 46.31 kg and 257.28 q, respectively, and treatment T₉ (Ethrel 50 ppm) *i.e.* 44.44 kg and 246.87 q, respectively. These results agree with the finding of Chaurasiya *et al.* (2016) [4] in muskmelon, Mahala *et al.* (2014) [10] in bottle gourd.

Influence of GA₃, NAA, Ethrel and Calcium on Quality Parameters:

The pertaining of data related to quality parameters are presented in Table 2. The diameter of fruit (cm), Total Soluble Solids (°Brix), reducing sugar (%), non-reducing sugar (%) and total sugar (%) content in fruit influenced by different treatments was found to be non-significant results.

Table 2: Influence of GA₃, NAA, Ethrel and Calcium on Quality Parameters

Treatment No.	Treatments	Diameter of fruit (cm)	TSS (°Brix)	Reducing sugar (%)	Non reducing sugar (%)	Total sugar (%)
T ₁	Control	17.98	10.06	3.42	4.44	7.95
T ₂	Water Spray	18.43	10.13	3.45	4.44	7.98
T ₃	GA ₃ 20 ppm	18.27	10.34	3.54	4.51	8.00
T ₄	GA ₃ 30 ppm	18.83	10.37	3.59	4.54	8.09
T ₅	GA ₃ 40 ppm	19.65	10.37	3.60	4.60	8.18
T ₆	NAA 40 ppm	19.03	10.23	3.51	4.53	8.15
T ₇	NAA 50 ppm	19.29	10.54	3.51	4.56	8.04
T ₈	NAA 60 ppm	19.59	10.67	3.54	4.56	8.06
T ₉	Ethrel 50 ppm	20.50	10.90	3.67	4.74	8.17
T ₁₀	Ethrel 100 ppm	20.93	11.09	3.86	4.87	8.24
T ₁₁	Ethrel 150 ppm	21.43	11.67	3.92	4.91	8.25
T ₁₂	Ca 10 ppm	17.80	10.16	3.37	4.43	8.03
T ₁₃	Ca 20 ppm	18.27	10.21	3.39	4.49	8.01
T ₁₄	Ca 30 ppm	18.63	10.73	3.44	4.52	7.98

S.Em. \pm	0.91	0.31	0.11	0.11	0.07
C.D. at 5%	NS	NS	NS	NS	NS
C.V. %	8.20	5.06	5.48	4.27	1.53

Economics

Influence of plant growth regulators on net return and benefit cost ratio in watermelon are presented in Table 3, Maximum net return (3,59,881 ₹/ha) and BCR (3.07) was found under treatment Ethrel 150 ppm (T₁₁), whereas the

minimum net return (2,23,542 ₹/ha) and BCR (2.29) was found in control (T₁).

After close evaluation of treatments, it was found that treatment (T₁₁) emerged as most remunerative for watermelon cultivation.

Table 3: Effect of plant growth regulators on economics and benefit cost ratio

Treatments	Yield per hectare (q)	Gross realization (₹/ha)	Total cost of cultivation (₹/ha)	Net returns (₹/ha)	Benefit Cost Ratio
T ₁	198.59	397180	173638	223542	2.29
T ₂	200.87	401740	173638	228102	2.31
T ₃	209.24	418480	174226	244254	2.40
T ₄	212.22	424440	174460	249980	2.43
T ₅	222.22	444440	174813	269627	2.54
T ₆	204.37	408000	173745	234255	2.35
T ₇	205.57	411140	173772	237368	2.37
T ₈	216.48	432960	173798	259162	2.49
T ₉	246.87	493740	173772	319968	2.84
T ₁₀	257.28	514560	173905	340655	2.96
T ₁₁	266.96	533920	174039	359881	3.07
T ₁₂	200.93	401860	173639	228221	2.31
T ₁₃	202.54	405080	173640	231440	2.33
T ₁₄	208.56	417120	173641	243479	2.40

Selling price of watermelon: 20 ₹ / kg.

Rate of sources	
FYM @ ₹ 1000 per tone	MOP @ ₹ 590 per 50 kg bag
Urea @ ₹ 295 per 45 kg bag	GA ₃ @ ₹ 110 per 1 g
SSP @ ₹ 400 per 50 kg bag	NAA @ ₹ 250 per 25 g
Ethrel @ ₹ 1000 per 100 ml	Calcium Nitrate @ ₹ 50 per kg

Conclusion

From present investigation it could be concluded that highest fruit yield, better quality and better BCR ratio could be achieved by foliar application of Ethrel 150 ppm twice at 2nd and 4th true leaf stages in watermelon cv. 'Sugar Baby' under the North Gujarat Agro Climatic Condition.

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