

Original Research Article

Effect of Different Chemicals in Enhancing Yield of Cape-Gooseberry

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ABSTRACT

The present study was done in the Department of Horticulture (Fruit) at Bihar Agricultural College, Sabour, Bhagalpur (Bihar) to study the effect of Nitrogen & growth regulators (Gibberellic acid and Ethrel) on the yield of Cape-gooseberry (*Physalis peruviana* Linn.). Nitrogen and Two important plant growth substances viz; Ethelene and Gibberellic acid (GA) in nb different concentrations were utilized for studying their effect on yield. The experimental plot was statistically laid-out in the field adopting randomized block design with 7 treatments replicated thrice. There were altogether 21 plots with treatments as T1- Urea 1.0 %, T2- Urea 1.5%, T3- GA3 20 ppm, T4- GA3 30 ppm, T5- Ethrel 200 ppm, T6- Ethrel 250 ppm and T7- Control (Water spray). The seedlings were transplanted with row to row and plant to plant distance of 60 x 60 cm. Some additional seedlings were also transplanted in each plot for filling the gaps which arouse due to mortality of some seedlings and daily irrigation was provided till establishment. The study revealed that under the treatment T4 (GA3 30 ppm), there was minimum time taken to first flowering (50.17 days), minimum days taken to first picking i.e. 125.73 days, Maximum number of fruit (84.75) was observed, Maximum yield per plant (520.37g) was observed, maximum volume of the fruit (5.97 CC) was also recorded.

Keywords

Nitrogen,
Gibberellic acid,
Ethrel, cape-
gooseberry and
yield

Introduction

The Cape gooseberry (*Physalis peruviana* L.) is a new and endearer herbaceous crop which comes under minor fruit having eighty species originated in new as well as old world starting from temperate and tropical America, East Asia, India and Australia. Out of all species, only three species are well known for their fruit values. The recognized eatable fruit bearing species are comprised of *Physalis peruviana* L; *P. pubescens* L. and *Physalis ixocarpa* Brot. Among these, the *Physalis peruviana* is considered to be the best with respect to

taste, precocity and yield (Gupta and Roy, 1980). It is more commonly known as *Rasbhari* in India which is a small orange berry fruit. It has various names like golden berries, inca berry and ground berries. They are usually grown in warm regions like South Africa, South America, Central America, India and China. It is one of the important minor fruit and is highly nutritious with good source of vitamins and minerals. The Indian name *Rasbhari*, *Makoi* or *Tepari* resembles to the other crops of the same family Solanaceae to tomato, brinjal, chilli

and the potato in its cultural requirements (Khan and Lowder, 1955). In India, Cape gooseberry grown throughout the plains and hills. Recently this crop has assumed much importance and cultivated in large area in South Bihar and in limited area in Chotanagpur. The yield of this crop is very poor in Bihar due to poor soil nutrients, no definite fertilizer and PGR recommendation, poor technical know-how and poor post-harvest technology. Among these, the application of balanced nutrition is most important without which the yield could not be increased. Thus, the application of nitrogen and use of growth regulators are the prime necessities for obtaining higher yield and better performance of the crop.

Information regarding the application of nitrogen and growth regulators on yield of cape-gooseberry fruit is still very meager. Therefore, it became imperative to determine optimum dose of nitrogen and to find out the exact strength of PGR for better yield of Cape-gooseberry.

Materials and Methods

The present study was done in the Department of Horticulture (Fruit) at Bihar Agricultural College, Sabour, Bhagalpur (Bihar) to study the effect of Nitrogen & growth regulators (Gibberellic acid and Ethrel) on the yield of Cape-gooseberry (*Physalis peruviana* Linn.). This area is characterized by hot and desiccating summer, moderate rainfall and cool winter, thus the climate is tropical to subtropical of slightly semi-arid nature. January is usually the coldest month when the temperature normally falls as low as 8.1°C. April and May are the hottest months with an average maximum temperature of 36.0°C. The soil was sandy loam of good fertility and well drained sub-soil. The pH of the soil was 7.0. It clearly shows that prevailing

environmental amplitudes was quite congenial for optimal growth and development under the existing soil for raising cape-gooseberry based cropping system. Seeds were procured from Horticultural garden, Sabour. Raised nursery beds (2 m x 1 m) were prepared. The soil was pulverized well and supplied with sufficient quantities of well rotten compost. Seeds were sown. After sowing, seeds were covered with a fine mixture of soil and leaf mould, lightly pressed and the beds were covered with straw for ensuring maximum germination. The straw was removed after sprouting of seeds. Raised nursery beds (2 m x 1 m) were prepared. The soil was pulverized well and supplied with sufficient quantities of well rotten compost. Seeds were sown. After sowing, seeds were covered with a fine mixture of soil and leaf mould, lightly pressed and the beds were covered with straw for ensuring maximum germination. The straw was removed after sprouting of seeds. Two important plant growth substances viz; Ethelene and Gibberellic acid (GA) in different concentrations were utilized for studying their effect on yield. A few drops of alcohol were used for dissolving these chemicals in the process of preparing their solutions for spraying.

The experimental plot was statistically laid-out in the field adopting randomized block design with 7 treatments replicated thrice. There were altogether 21 plots with treatments as T1 Urea 1.0 %, T2 Urea 1.5%, T3 GA3 20 ppm, T4 GA3 30 ppm, T5 Ethrel 200 ppm, T6 Ethrel 250 ppm and T7 Control (Water spray). The seedlings were transplanted with row to row and plant to plant distance of 60 x 60 cm. Some additional seedlings were also transplanted in each plot for filling the gaps which arose due to mortality of some seedlings and daily irrigation was provided till establishment.

Preparation of plant growth regulators

Aqueous solution of plant growth substances and urea was prepared with required quantity of chemicals in order to apply their different concentrations each time prior to spraying. For GA3 solutions, 20 mg & 30 mg of the chemical was carefully weighed with the help of a sensitive chemical balance. It was dissolved in a small quantity of alcohol and diluted to 1000 ml by adding distilled water with constant stirring in a measuring flask. This gave the stock solution of 20 ppm and 30 ppm GA3. Similarly, the stock solution 200 and 250 ppm of ethrel. Desired concentrations for all the plant growth substances were prepared by further addition of water at the time of spraying.

Methods and time of application

Aqueous solution of plant growth substances and urea were sprayed with the help of Ganesh Hand Sprayer. First spraying was done on after 30 days of planting. The second and third spraying was done at an interval of 15 days after first and second spraying respectively. The spraying of plant growth substances was done in the afternoon (3 pm) having low light intensity and medium temperature which was free from prolonged effect of days light.

Results and Discussion

Number of fruits per plant

The number of fruits per plant were counted for each harvesting and their optimum number was calculated and presented in Table-1

The perusal of the table revealed that there was a marked difference in the number of fruits in different treatments. Maximum

number of fruit (84.75) was observed under the treatment T4 (GA3 30 ppm) which was at par with T3 (GA3 20 ppm), T6 (Ethrel 250 ppm), T5 (Ethrel 200 ppm) and T2 (Urea 1.5 %). However, the minimum number of fruit (62.73) was observed in case of T7 (Water spray). It was observed from the analysis of variance table that treatment differences were highly significant.

Yield per plant (g)

The fruits were harvested at maturity, which was indicated by change of colour from whitish green to yellowish orange. The fruits were usually harvested at the interval of 3-4 days.

Data presented in table-2 clearly indicates that the weight of fruits per plant was affected by different concentrations of urea, GA3 and ethrel. Maximum yield per plant (520.37g) was observed in T4 (GA3 30 ppm) which was at par with T3 (GA3 20 ppm) treatment. However, minimum yield per plant (227.02 g) was observed under the treatment T7 (Water spray) followed by T1 (Urea 1.0%), T2 (Urea 1.5%), T5 (Ethrel 200 ppm) and T6 (Ethrel 200 ppm). It was observed from the analysis of variance table that treatment differences were highly significant. Fambuena, M. *et al.*, (2012) reported that GA3 applied at the floral bud induction period significantly increased fruit yield per tree of Washington navel orange.

Yield per hectare (q)

The fruit yield per hectare showed significant variation as affected by urea and application of PGR which has been depicted in Table-3

A critical evaluation of the table- 3 revealed that the different treatments had different effects on yield.

Table.1

Treatments	Replications			Total	Mean
	I	II	III		
T1	65.00	68.25	61.75	195.00	65.00
T2	74.00	78.35	82.65	235.00	78.33
T3	87.40	77.50	82.45	247.35	82.45
T4	84.75	89.85	79.65	254.25	84.75
T5	74.17	78.50	82.80	235.47	78.49
T6	82.40	74.60	78.50	235.50	78.50
T7	62.75	66.20	59.25	188.20	62.73
Mean	530.47	533.25	527.05	1590.77	
C.D at 5% 8.1019 C.V.%= 6.01					

Table.2

Treatments	Replications			Total	Mean
	I	II	III		
T1	303.55	326.30	280.80	910.65	303.55
T2	355.60	378.35	401.05	1135.00	378.33
T3	509.35	442.80	476.05	1428.20	476.07
T4	520.35	561.95	478.80	1561.10	520.37
T5	354.65	381.40	408.10	1144.15	381.38
T6	409.80	359.85	384.80	1154.45	384.81
T7	227.00	245.15	208.90	681.05	227.02
Mean	2680.30	2695.8	2638.5	8014.6	
C.D at 5% 7.8272 C.V.%= 7.87					

Table.3

Treatments	Replications			Total	Mean
	I	II	III		
T1	48.10	47.95	46.45	142.50	47.50
T2	45.22	48.15	51.05	144.42	48.14
T3	53.05	47.55	50.30	150.90	50.30
T4	53.25	56.45	50.05	159.75	53.25
T5	45.23	48.20	51.35	144.78	48.26
T6	53.00	47.50	50.25	150.75	50.25
T7	38.76	40.10	37.12	115.98	38.66
Mean	335.90	338.65	334.53	1009.08	
C.D at 5% 5.3074 C.V.%= 6.21					

Table.4

Treatments	Replications			Total	Mean
	I	II	III		
T1	4.65	4.95	4.41	14.01	4.67
T2	4.39	4.85	5.25	14.49	4.83
T3	6.15	5.41	5.75	17.31	5.77
T4	6.15	6.55	5.72	18.42	6.14
T5	4.63	4.85	5.10	14.58	4.86
T6	5.20	4.60	4.90	14.70	4.90
T7	3.60	3.80	3.46	10.86	3.62
Mean	34.77	35.01	34.59	104.37	
C.D at 5% 0.6234 C.V.%= 0.6234					

Table.5

Treatments	Replications			Total	Mean
	I	II	III		
T1	2.055	2.190	1.932	6.177	2.059
T2	1.996	2.130	2.258	6.384	2.128
T3	2.470	2.173	2.320	6.963	2.321
T4	2.468	2.640	2.296	7.404	2.468
T5	2.009	2.175	2.338	6.522	2.174
T6	2.305	2.022	2.165	6.492	2.164
T7	1.990	2.140	1.843	5.973	1.991
Mean	15.293	15.47	15.152	45.915	
C.D at 5% 0.2823 C.V.%= 0.2823					

Table.6

Treatments	Replications			Total	Mean
	I	II	III		
T1	1.965	2.112	1.824	5.901	1.967
T2	1.877	2.035	2.187	6.099	2.033
T3	2.285	2.161	2.220	6.666	2.222
T4	2.410	2.590	2.236	7.236	2.412
T5	1.914	2.085	2.250	6.249	2.083
T6	2.230	1.983	2.105	6.318	2.106
T7	1.855	1.985	1.725	5.565	1.855
Mean	14.536	14.951	14.547	44.034	
C.D at 5% 0.2643 C.V.%= 7.08					

Table.7

Treatments	Replications			Total	Mean
	I	II	III		
T1	5.15	5.40	4.96	15.51	5.17
T2	5.46	5.70	6.00	17.16	5.72
T3	6.25	5.61	5.90	17.76	5.92
T4	5.95	6.30	5.66	17.91	5.97
T5	5.40	5.75	6.10	17.25	5.75
T6	6.05	5.38	5.70	17.13	5.71
T7	4.67	4.95	4.39	14.01	4.67
Mean	38.93	39.09	38.71	116.73	
C.D at 5% 0.5792 C.V.%= 5.85					

Maximum yield per hectare (53.25 q) was obtained with T4 (GA3 30 ppm) which was statistically at par with T3 (GA3 20 ppm), T6 (Ethrel 250 ppm), T5 (Ethrel 200 ppm) and T2 (Urea 1.5%). However, minimum yield per hectare (38.66 q) was obtained with T7 (Water spray) followed by T1 (Urea 1.0%). It was observed from the analysis of variance that treatment differences were highly significant. Hegde and Srinivas (1990) in a field experiment in Arka Saurabh variety of tomato found that nitrogen fertilization increased the yield. Imran, S. (2015) found that application of 150 kg N ha⁻¹ produced maximum grain yield and plant population of 80000 plants ha⁻¹ produced higher grain yield.

Fruit weight (g)

Average weight of the fruit harvested in different treatments was taken. Average weight of fruit varied with different treatments has been shown in Table-4.

Data presented in table clearly indicates that maximum average fruit weight (6.14 g) was observed with T4 (GA3 30 ppm) which was statistically at par with T3 (GA3 20 ppm) followed by T6 (Ethrel 250 pp) and T5 (Ethrel 200 ppm). However, the minimum average

Fruit weight (3.62 g) was observed with T7 (Water spray) followed by T1 (Urea 1.0%) and T2 (Urea 1.5 %). It was observed from the analysis of variance that treatment differences were highly significant.

Length of fruit (cm)

Ultimate length of fruit was evaluated by taking the measurement longitudinally. Measurement of its length was made with the help of slide calipers.

From the perusal of table-5, it appears that the application of nitrogen, GA3 and ethrel on an average was effective in enhancing the length of fruit over control. Among the different treatments, GA3 30 ppm proved to be the best treatment in increasing the fruit length. The maximum length of the fruit was observed under treatment T4 (GA3 30 ppm) and the value was 2.46 cm.

However, the lowest value was found under control. It was observed from the analysis of variance table that treatment differences were statistically significant. Wang *et al.*, (2013) also found that foliar spray of ‘cara cara’ navel orange with GA3 at concentration of at concentration of 10, 20 and 30 ppm during early period of fruit growth increased significantly.

Diameter of fruit (cm)

The berry diameter was also measured along with the length of the fruit. The diameter of the fruit also varied with different treatments. Data with respect to the diameter of fruit influenced by different treatments have been presented in Table-6.

Among the different treatments, GA3 30 ppm proved itself to be the best treatment among the lot for increasing the diameter of fruits. The maximum diameter (2.41 cm) was observed under treatment T4 (GA3 30 ppm) which was at par with T3 (GA3 20 ppm) which was 2.22 cm. However, the minimum diameter i.e. 1.85 cm was recorded under control. It was observed from the analysis of variance table that treatment differences were highly significant.

Volume of fruit (CC)

Volume of the fruit was calculated by water displacements method. The average volume of fruit was also found different with different treatments. The average volume of fruit is being presented in Table-7.

From table number-7, it was apparent that maximum volume of the fruit (5.97 CC) was found with T4 (GA3 30 ppm) which was at par with T3 (GA3 20 ppm), T5 (Ethrel 200 ppm), T2 (Urea 1.5%) and T6 (Ethrel 250 ppm). However, minimum fruit volume (4.67 CC) was observed with T7 (Water spray). It was observed from the analysis of

variance table that treatment differences were highly significant.

From the above facts could be concluded that the application of optimum dose of nitrogen and two PGRs i.e gibberellic acid and Ethrel may be regarded as the best chemicals for taking minimum days to first flowering, minimum days to first picking, maximum number of fruits per plant, maximum yield per plant, maximum yield per hectare, maximum fruit weight and maximum size of the fruit, hence, increasing the income of the farmers.

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