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Effect of plant growth substances and antioxidants on growth, flowering, yield and economics of garden pea, *Pisum sativum* L cv Bonneville

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ABSTRACT

A field study was conducted at Horticulture Instructional Farm, CP College of Agriculture, SD Agricultural University, Sardarkrushinagar, Gujarat to find out the effect of plant growth substances and antioxidants on growth, flowering, yield and economics of garden pea, *Pisum sativum* L cv Bonneville. Plants were sprayed with treatments viz control, NAA (25 and 50 ppm), GA_3 (50 and 100 ppm), 2,4-D (5 and 10 ppm), acetyl salicylic acid (100 ppm and 200 ppm), ascorbic acid (100 and 200 ppm) 30 days after sowing. The results revealed that the plant growth substance GA_3 (100 ppm) showed highest growth parameters. Days to first flowering ranged between 48.97 and 52.75. The minimum days (48.97) to first flowering were taken by the treatment GA_3 (100 ppm) and all other treatments were statistically at par for the days taken to first flowering. The data on number of days taken for first and last picking after sowing and number of pickings were found non-significant among different treatments. The maximum yield (114.01 q/ha), net income of Rs 177642/ ha and highest B:C ratio (4.52:1) were obtained in treatment 2,4-D (5 ppm).

Keywords: Garden pea; plant growth regulator; growth; flowering; yield; economics

INTRODUCTION

Pea, *Pisum sativum* L is a popular and highly nutritive pulse crop. A large portion of pea is processed, canned, frozen or dehydrated for consumption in off-season. It is precious for a vegetarian diet. India is the 2nd largest producer of pea in the world. In India crop is primarily grown in the states of Uttar Pradesh, Maharashtra, Jharkhand, Himachal Pradesh and Punjab. In India area under this crop is 4.42 lakh ha with the production of 42.39 lakh MT (Anon 2014).

Increasing the production of pea green pods and dry seeds with high quality could be achieved through using the foliar application of plant growth substances and antioxidants. The present study was conducted to find out the optimum levels of plant growth substances and antioxidants

on growth, flowering, yield and economics of garden pea cv Bonneville.

MATERIAL and METHODS

The investigations were conducted at Horticulture Instructional Farm, CP College of Agriculture, SD Agricultural University, Sardarkrushinagar during the year 2013 with eleven treatments viz NAA (25 and 50 ppm), GA_3 (50 and 100 ppm), 2,4-D (5 and 10 ppm) and antioxidants acetyl salicylic acid (100 and 200 ppm) and ascorbic acid (100 and 200 ppm) along with control (water) sprayed after 30 days after sowing of pea variety Bonneville.

The experiment was laid out in a randomized block design with four replications. To raise the crop recommended package of practices was followed. The crop was sown in November 2013 during Rabi season. The effect of different treatments was studied on growth, flowering, yield and economics of the crop on ten randomly selected plants. Growth attributes were determined by measuring the vine length and length and number of nodes on main vine. Besides days taken to first flowering, days taken to first and last picking after sowing and number of pickings were recorded. The mean data were subjected to statistical analysis following analysis of variance technique (Nigam and Gupta 1979).

RESULTS and DISCUSSION

Growth parameters

In the present investigations the treatment GA_3 (100 ppm) gave significantly higher vine length (58.36 cm) and minimum (45.74 cm) was recorded in control at 45 DAS (Table 1). These results are in conformation with those of Doijode (1975), Mishriky et al (1990), Bora and Sarma (2003), Pandey et al (2004), Brumbaugh and Stewen (2008), Shraiy and Hegazi (2009), Braas (2010), Schroeder (2011), Musmade et al (2013), Emongor (2007), Sharma and Lashkari (2009) and Ngatia et al (2004). The growth substance GA_3 is recognized as a growth promoter which stimulates the rapid cell elongation in meristematic zone of vegetative plant organs.

The treatment GA_3 (100 ppm) maintained significantly higher length of internode (5.54 cm) and it was statistically at par with the treatments GA_3 (50 ppm, 5.51 cm) and ASA (200 ppm, 5.24 cm) while minimum length was recorded in treatment control (4.57 cm) at last picking. These results are in agreement with the findings of Kof et al (1998) and Rai et al (2006). Due to cell elongation and cell division the length of internode increased hence here GA_3 played an important role.

The treatment GA_3 (100 ppm) gave significantly higher number of nodes on main vine (23.10) while minimum was recorded

Table 1. Effect of plant growth substances and antioxidants on growth parameters of garden pea cv Bonneville

Treatment	Vine length 45 DAS (cm)	Length of internode at last picking (cm)	# nodes at last picking
Control	45.74	4.57	20.42
NAA (25 ppm)	48.23	4.72	20.50
NAA (50 ppm)	48.28	4.90	20.67
GA_3 (50 ppm)	55.73	5.51	21.95
GA_3 (100 ppm)	58.36	5.54	23.10
2,4-D (5 ppm)	47.46	4.81	21.05
2,4-D (10 ppm)	46.03	4.61	20.49
Acetyl salicylic acid (100 ppm)	45.89	4.99	21.27
Acetyl salicylic acid (200 ppm)	49.36	5.24	21.67
Ascorbic acid (100 ppm)	45.83	4.77	20.47
Ascorbic acid (200 ppm)	47.42	4.88	20.90
SEm±	0.69	0.13	0.37
$CD_{0.05}$	2.00	0.39	1.08

Table 2. Effect of plant growth substances and antioxidants on pickings and flowering of garden pea cv Bonneville

Treatment	Days to first flowering	First picking (days)	Last picking (days)	# pickings
Control	52.75	105.50	119.00	2.50
NAA (25 ppm)	52.27	101.75	117.75	2.75
NAA (50 ppm)	51.92	100.25	116.75	3.25
GA_3 (50 ppm)	49.62	98.00	117.50	3.00
GA_3 (100 ppm)	48.97	97.00	117.50	3.25
2,4-D (5 ppm)	50.75	95.50	117.50	3.25
2,4-D (10 ppm)	51.62	101.75	117.50	3.00
Acetyl salicylic acid (100 ppm)	51.47	102.75	118.75	2.75
Acetyl salicylic acid (200 ppm)	51.35	100.75	117.50	3.00
Ascorbic acid (100 ppm)	52.42	101.50	116.75	3.25
Ascorbic acid (200 ppm)	51.55	92.00	115.75	3.50
SEm±	1.04	1.90	1.95	0.10
$CD_{0.05}$	3.02	NS	NS	NS

Table 3. Effect of plant growth substances and antioxidants on yield and economics of garden pea cv Bonneville

Treatment	Cost of cultivation (Rs/ha)	Yield/ ha (q)	Gross income (Rs/ha)	Net income (Rs/ha)	B:C ratio
Control	50606	73.29	146580	95974	2.89:1
NAA (25 ppm)	50935	79.27	158540	107605	3.11:1
NAA (50 ppm)	51514	79.70	159400	107886	3.09:1
GA_3 (50 ppm)	62306	86.79	173580	111274	2.78:1
GA_3 (100 ppm)	74256	89.48	178960	104704	2.41:1
2,4-D (5 ppm)	50378	114.01	228020	177642	4.52:1
2,4-D (10 ppm)	50400	82.13	164260	113860	3.25:1
Acetyl salicylic acid (100 ppm)	50595	81.96	163920	113325	3.23:1
Acetyl salicylic acid (200 ppm)	50833	84.23	168460	117627	3.31:1
Ascorbic acid (100 ppm)	50890	84.70	169400	118510	3.32:1
Ascorbic acid (200 ppm)	51423	86.49	172980	121557	3.36:1

in control (20.42) at last picking. Similar results of increase in the mean number of nodes per plant by application of GA_3 were obtained by Pandey et al (2004) and Musmade et al (2013).

Flowering parameters

Days to first flowering ranged between 48.97 and 52.75. The minimum days (48.97) to first flowering were taken by the treatment GA_3 (100 ppm) and all other treatments were statistically at par for the days taken to first flowering. These results are supported by the findings of Chovatia et al (2010), Chatterjee and Choudhuri (2012), Medhi and Borbora (2002) and Uddain et al (2009). Early flowering is due to early completion of vegetative growth and better nourishment of plants. The data on number of days taken for first and last picking after sowing and number of pickings were found non-significant among different treatments (Table 2).

Yield and economics

The maximum yield (114.01 q/ ha), net income of Rs 177642/ha and highest B:C ratio (4.52:1) were obtained in treatment 2,4-D (5 ppm). The minimum net income of Rs 95974/ha was obtained in control while lowest B:C ratio (2.41:1) was obtained in GA_3 (100 ppm) (Table 3)

CONCLUSION

From the investigations it can be concluded that the growth regulator GA_3

(100 ppm) effectively increased the vegetative growth of pea like vine length, length of internodes, number of nodes, days taken for initiation of first flowering whereas 2,4-D (5 ppm) was effective in increasing the yield and highest benefit:cost ratio.

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