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RESEARCH ARTICLE

Effect of salicylic acid and gibberellic acid on seed germination and growth of pea

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SUMMARY

Significant increase in seed germination and seedling growth of pea due to seed soaking treatment of salicylic acid and gibberellic acid was recorded in the field experiments conducted during *Kharif* 2009. Highest values for plant height, number of leaves, branches, root length, number of nodules and seed yield were recorded with 400 ppm salicylic acid and 100ppm gibberellic acid. Higher concentrations of the growth hormones were found to cause adverse effect.

Key Words : Seed germination, Salicylic acid, Gibberellic acid, Pea

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Pea (*Pisum sativum*) is an important legume crop known for its seeds to meet protein and crude fibre requirements. Efforts are being made to raise its yield by adopting modern agricultural practices. Since the modernization over the last several years depending heavily on chemical fertilizers which are cost intensive and have adverse effect on soil fertility and environment. Many workers had investigated the effect of growth regulators on various crops (Deotale *et al*., 1998; Singh, 2001). Salicylic acid, a secondary metabolite which act as analogue to the growth hormones (Wain and Taylor, 1965) has been found to play paramount role in the improvement of crop yield (Singh, 2001; Reddy *et al*., 2002; Maity and Bera, 2008). In context of the above, the present investigation was under taken to assess the effects of seed soaking in various concentrations of salicylic acid and gibberellic acid on morpho-physiological parameters in pea.

MATERIALS AND METHODS

The locally purchase seeds of *Pisum sativum* var. Azad P-1 were grown in earthenware pots containing sandy clay loam soil and farm yard manure (1:1). The experiments were conducted during Nov – Jan., 2010. The seeds were first washed thoroughly with tap water and soaked for eight hours in different concentrations of salicylic acid (200, 400,600 and 800 ppm) and gibberellic acid (25, 50, 100 and 200 ppm) in Petridishes. The soaked seeds were sown in earthen pots. After germination which took about 7-10 days, five seedlings were retained in each pot for further studies. The spraying treatment of an equal volume of salicylic acid (SA) and gibberellic acid (GA_3) were given separately to the foliage of all pots at an interval of 15 days after germination. The pots were supplied with 500 ml of tap water daily and were kept under normal conditions of light and temperature in the garden.

The experiments were laid out in completely randomized design with five replications. Morpho-physical observations like plant height, number of branches, number of leaves, root length, nodule number and yield were recorded on 10 randomly selected plants in each treatment at 30, 45, 60 DAS. Yield was recorded at physiological maturity.

RESULTS AND DISCUSSION

Data in respect to seed germination are presented in Table 1. Seed germination increased with the increased concentration of growth regulators. Maximum seed germination (90.1 and 98.0%) was recorded on 600 ppm salicylic

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acid and 100 ppm gibbercllic acid after 10 days of sowing. The increased percentage of seed germination as compared to control may be attributed to the increased activities of 1AA oxidase and stimulatory effect of growth crops.

Plant height and root length increased with the higher concentrations of the SA and GA_3. The maximum mean increase in height (35.8 cm and 38.7 cm, repectively) was recorded at 600 ppm SA and 100 ppm GA_3 during 30, 45 and 60 DAS. The rate of increase in plant height had shown gradual decline at higher concentration. The effect of both regulators had less pronounced at initial stage (15 DAS) but it was note worthy during 30, 45 and 60 DAS (Table 1) and thereafter, it gradually decreased in later stages (Date not presented). The increase in plant height may be due to its effect on elongation of internodes (Krishnamoorthy, 1981), whereas the salicylic acid enhances the amino acid biosynthesis (Kefeli and Kutachek, 1977) and this may also be due to stimulation of the activities of nitrogen utilization enzyme such as nitrate reductase, nitrite reductase as reported in *Vigna mungo* (Sarangthem and Singh, 2003).

It is evident from the Table 2, that all the treatment were effective to enhance the number of leaves per plant over control excluding the treatment of 800 ppm SA and 200 ppm GA_3. 100 ppm GA_3 and 600 ppm SA were found significantly superior over all other treatments during 30, 45 and 60 DAS. Higher concentrations were found to decrease the number of leaves. These results are in accordance with the findings of Singh and Dohare (1964) in sugar beet. The numbers of branches were also influenced with the treatment of SA and GA_3 in the same pattern as observed in case of leaves.

Significantly increase in the number of nodules during 30, 45 and 60 DAS in SA whereas on various conc. of GA_3 no significant results were found. Nodules play an important role in atmospheric N_2 fixation by leguminous crops. Exogenous application of 1AA was found to promote nodulation in alfa–alfa (Gwodien and Zvironaile, 1971). Salicylic acid not only increased nodulation of this crop but also helped to restore longevity of the nodules till harvest as evident by slow degeneration in number and fresh weight of the nodules in the SA treated plants as compared to control. Thus helping the crop to tend higher yield by supplying nitrogen during seed development stage.

Significant increases in seed yield was obvious in various treatment of SA. Maximum yield was recorded at 600 ppm SA,

Table 1 : Effect of salicylic acid and gibberellic acid on seed germination in *Pisum satiuum* var. Azad P-I

DAS	Control	Salicylic acid(ppm)				Gibberellic acid(ppm)			
		200	400	600	800				
2	-	-	-	-	-	-	-	-	-
4	12+2.3	18± 2.3	22± 2.2	30± 2.1	16± 1.3	20±2.4	26±2.1	30±2.4	10±1.9
8	42± 3.4	58± 3.2	62± 2.4	68 ±2.2	26± 2.6	74±2.3	78±2.0	82±2.0	38±2.6
10	69± 4.5	72± 3.4	82± 2.3	90± 2.1	66± 2.3	86±2.6	96±2.2	98±2.8	64±2.1

Table 2: Effect of growth regulators on morpho-physiological parameters of pea

Growth regulators (mgl^{-1})	Plant height (mean± s.d.) (cm)			No. of branches (mean ± s.d.)			No. of leaves (mean ± s.d.)			Root length (mean ± s.d.) (cm)			No. of nodules (mean± s.d.)			No. of seed /plant (mean ± s.d.)
	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS	30 DAS	45 DAS	60 DAS	90 DAS
Control	18.1	37.5	40.1	4.0	5.2	6.3	14.2	31.0	39.5	18.6	28.1	32.4	6.1	17.3	19.1	55.7
SA																
200	21.2	28.8	33.6	3.2	5.5	7.4	15.2	24.3	38.2	18.9	25.4	28.9	6.8	20.4	24.0	55.3
400	23.4	32.5	40.6	3.2	6.7	7.8	16.4	28.2	40.4	20.4	26.3	36.3	8.9	22.8	28.4	56.4
600	27.2	34.4	43.4	3.3	7.1	8.4	18.3	34.3	42.9	22.4	28.9	32.4	8.1	20.1	26.4	60.2
800	26.4	32.2	39.4	2.3	6.2	7.8	15.2	28.1	35.4	20.2	28.3	31.8	7.1	19.8	25.2	48.4
GA_3																
25	19.0	38.4	42.5	4.3	6.5	8.5	15.4	32.1	40.8	19.8	28.2	30.8	6.1	18.2	20.1	48.8
50	20.3	40.6	48.4	4.0	6.2	10.5	16.5	34.3	48.8	20.8	30.2	32.1	8.3	20.2	22.1	47.4
100	22.2	43.4	50.8	4.8	6.9	10.5	12.4	36.4	40.8	20.2	32.3	38.4	8.1	18.9	21.2	40.4
200	21.2	40.1	47.3	4.6	6.8	9.7	12.2	34.4	40.7	18.1	30.4	38.4	7.3	18.1	21.2	40.3
S.E.±	0.342	0.422	0.212	0.204	0.249	0.442	0.349	0.441	0.331	0.421	0.349	0.442	0.342	0.442	0.342	0.542
C.D. (P=0.05)	0.923	0.828	0.839	1.232	1.021	1.342	0.623	0.826	0.833	0.729	0.78	0.623	0.644	0.398	0.364	1.034

exhibiting 10 per cent higher seed yield over control. This can be attributed to the superior values of morpho-physical components like the plant height, number of leaves and nodules in plants growth treated with growth regulators which might have contributed to enhance the source sink relationship. Cheema *et al.* (1987) emphasized that growth regulators are effective in balancing the source – sink for increasing the yield of crop. Similar results have also reported in groundnut (Rao, 1975). Application of growth regulators might have increased assimilation rate and growth rate of the plants which is evident from increased plant height, leaf number, branches and number of nodules.

To conclude, application of salicylic acid (600ppm) at early stage of crop plants (30, 45 and 60 DAS) increased pea yield significantly.

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