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EFFECT OF SALINISATION AND DESALINISATION ON GROWTH AND DEVELOPMENT OF PEA (*PISUM SATIVUM* L.)

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SUMMARY

Germination was delayed and not reduced by salinity. Growth of the plant decreased progressively with increase in salinity level. On desalinisation, the recovery in case of roots was more than the stem whereas, the leaves showed least recovery. Flowering was delayed and the intensity of flowering and pod setting was reduced under saline conditions. However, time taken to develop pod, was not affected. Salinity reduced the number of pods more than the seeds and partitioning of the dry matter was differently affected by different levels of salinity. The recovery in the number of pods and seeds was incomplete with complete desalinisation,

INTRODUCTION

Salinity affects the growth and development of plants (Strogonov *et al*, 1970). A comprehensive programme was undertaken to study the effect of salinisation and desalinisation on the growth and development of pea.

MATERIALS AND METHODS

Pea (*Pisun sativum* L.) cv. Bonneville was grown in sand culture supplied with Wilson and Reisenauer (1963) nitrogen free nutrient solution. To create salinity pods were flushed with nutrient solution supplemented with 40, 80 and 120 (meq.) salts mixture. Salt mixture used had Na: Ca : Mg in 5 : 1.5 : 3.5 and Cl : SO_4 in 8 : 2 on meq basis. A standard rhizobial culture solution of strain PS-1 was added to the nutrient solution, at the time of first irrigation. Ten seeds were sown in each pot and only, three plants of comparable growth were left in each pot after recording germination. After 45 days of sowing, some of the plants growing in 80 meq/l were desalinised partially (40meq/l) and completely (0 meq/l). Six plants were sampled at 45, 70 and 95 days after sowing under each treatment which represent vegetative, flowering and pod filling stages respectively. Four uniform plants were chosen for determining the dry weight of various plant organs. At the time of flowering, ten plants under each treatment were marked for recording the number of flowers and pods produced over

a period of two days regularly. At harvest ten plants (marked earlier) were used for recording dry weight of stem, leaves, pods, seeds and the number of pods and seeds per plant.

RESULTS AND DISCUSSION

Increasing salinity of the media progressively delayed the germination of pea seeds, but the final germination percentage was not affected, (Table I).

Table I : Effect of salinity on germination percentage in pea

Days after sowing	Salts meq/l				
	0	40	80	120	C.D. at 5%
5.	4.4	3.3	0.0	0.2	0.99
5.	29.9	31.1	0.0	0.0	N.S.
6.	37.7	33.3	0.0	0.0	3.55
7.	47.7	42.2	4.4	0.0	4.44
8.	74.3	62.2	43.3	0.0	6.54
9.	77.7	75.5	68.8	17.7	9.54
10.	87.7	86.6	83.2	45.5	7.88
11.	97.7	98.7	94.3	68.8	8.88
12.	99.9	99.9	98.8	85.4	7.32
13.	100.0	100.0	99.9	93.2	2 99
14.	100.0	100.0	100.0	100.0	N.S.

However, a contradictory report has been mentioned in the literature (Babu and Kumar, 1979, Bishnoi and Pancholy, 1980 ; Joshi and Iyenger, 1982). None of the plants could survive salinity level of 120 meq/1 beyond 7 weeks of sowing. Eighty percent plant could survive upto maturity at 80 meq/1.

Dry weights of roots, stem, leaves and reproductive organs decreased progressively with increasing salinity (Table II). The stem dry weight continued to increase upto harvest under all conditions but leaf dry weight decreased after 95 days of sowing. The dry weight of the roots also increased with the age, but after flowering there was slight increase with 40 meq/1 and a decrease with 80 meq/1 salinity. Desalinisation of the media increased in the dry weight of the various plant organs in partially or completely desalinised plants. The recovery in dry weight of the roots was more than the stem. Leaves showed least recovery.

Table II : Effect of salinity and desalinisation on the dry weight (mg/plant) of various plant organs of pea

Days after sowing	Salts meq/l						
	0	40	80	120	40*	0*	C.D. at 5%
			Roots				
45	343	243	131	77	—	—	20.1
70	617	433	187	×	232	343	17.4
95	1204	478	166	×	422	717	21.1
			Steam				
45	290	154	200	47	—	—	28.3
70	690	307	130	×	185	367	39.7
95	2020	885	303	×	615	668	22.2
Harvested	3343	1266	602	×	1419	1467	35.7
			Leaves				
45	679	429	228	157	—	—	21.8
70	1738	635	329	×	388	595	41.2
95	3507	1682	661	×	1308	1498	37.1
Harvested	2222	1185	509	×	824	896	21.9
			Reproductive organs				
95	1900	849	243	×	271	333	31.3
Harvested	6708	2582	2236	×	4499	5707	1107.2

*Plants from 80 meq/l desalinised after 45 days of sowing
×All the plants under this treatment died by this time
—Treatment was not present at that time

Flowering in pea was delayed by 12 days with the salinity of 80 meq/l (Table III). The flower production (indicated by the number of flowers produced

Table III : Effect of salinity on the intensity of flower production and on the total number of pods per plant in pea

Days after sowing	Salts meq/l			
	0	40	80	C.D. at 5%
55	0.3	0.0	0.0	—
57	*1.3	0.2	0.0	0.24
59	2.1	*1.1	0.0	0.72
61	3.1	1.8	0.0	0.81
63	4.1	2.4	0.1	1.21
65	4.6 (0.1)	3.2 (0.1)	0.3	1.10
67	4.8 (0.5)	3.6 (0.2)	0.5	0.94
69	4.6 (2.1)	3.0 (0.9)	*1.1	0.78
71	4.5 (3.2)	3.1 (1.4)	1.6	0.99
73	3.2 (4.4)	2.8 (2.8)	2.8 (0.5)	N.S.
75	2.8 (6.7)	2.6 (4.3)	2.1 (0.9)	N.S.
79	2.1 (9.1)	2.0 (5.1)	1.9 (2.0)	N.S.
85	0.9 (11.4)	1.6 (5.0)	1.7 (4.8)	N.S.
89	0.4 (11.3)	0.2 (4.6)	0.3 (2.8)	N.S.
91	0.0 (11.1)	0.0 (4.2)	0.1 (2.6)	N.S.

*Time when 50% of the plants flowered.

Figures in parenthes represent the total number of pods present on a plant that day.

over a period of every two days) was reduced by salinity. The time taken by a flower to develop into a pod was almost the same (12 days) under saline as well as non saline conditions, however, relatively lesser number of flowers turned into pods under saline conditions. In pigeonpea genotypes the period of intensive flower production was delayed and more flowers got converted into pods under saline condition (Promila and Kumar, 1982).

An analysis of the various yield characters indicate that salinity reduced the number of pods more than the number of seeds (Table IV). Weight of seeds as percent of total pod weight indicates that more dry matter was partitioned into the seeds at higher level of salinity (80 meq/1) followed by non saline (contorl) (0 meq/1) and the least at lower level of salinity (40 meq/1). Weight of seed and pod as percent of shoot weight, shows that 40 meq/1 reduce these parameters whereas, salinity of 80 meql1 increases over control. These results thus indicate

Table IV : Effect of salinity and desalinisation on yield characters (per plant basis) and partitioning of shoot dry matter into the reproductive organs of pea

Plant characters	Salt meq/1					C.D. at 5%
	0	40	80	40*	0*	
Total number of pods	11.2	4.0	2.6	5.2	6.3	1.33
Weight of pods(g)	6.7	2.6	2.2	4.5	5.7	1.11
Total number of seeds	29.7	13.4	11 2	17.3	19.1	1.01
Weight of seeds(g)	4.9	1.7	1.8	3.6	4.4	0.79
$\frac{\text{Seed weight} \times 100}{\text{shoot weight}}$	40.3	34.5	53.5	52.9	54.7	—
$\frac{\text{Pod weight} \times 100}{\text{shoot weight}}$	54.6	51.3	66.5	66.7	70.9	—
$\frac{\text{Seed weight} \times 100}{\text{pod weight}}$	73.7	66.9	80.2	79.3	77.1	—

*80 meq/1 plants desalinised to 40 and 0 meq/1 after 45 days of sowing.

that effect of salinity differs at defferent levels however reports in the literature, indicate a general and progressive reduction in the number and size of the seeds with increase in the level of salinity (Uprety and Sarin, 1975 ; Malik *et al.*, 1977 ; Lauter and Munns, 1981). Desalinisation of the media led to a rceovery in the yield parameters, and the magnitude increased with the extent of desalinisation. The recovery in the number of pods and seeds was incomplete with complete desalinisation, whereas, it was found complete in partial desalinisation. The recalculations given in Table IV indicate that there was more partitioning of the shoot dry matter into the pods and seeds than in the rest of the shoot in desalinised plants as compared to their respective controls (growing under that salinity conditions from the date of sowing). Further, the dry matter of the pods was partitioned more into the seeds than the pod wall under desalinised conditions. Thus, even when the total dry matter of the plants could not be recoverd-completely, the partitioning of the shoot dry matter into the seeds increased over their respective controls.

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