

Effect of Excessive Moisture and Heat on Seedling Establishment of Vegetable Pea

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ABSTRACT Vegetable pea is sensitive to excessive moisture for both germination and vigour index, therefore resulted in poor field emergence under inundation. To cover larger area under timely sown condition by flood irrigation, farmers may select varieties like AP 3, AP 1 or VRP 8. Arkel and PM 3 are sensitive to excessive moisture stress therefore pre-sowing irrigation should be adopted to obtain optimum plant population. Apart from excessive moisture, the crop also faces high temperature stress (28-35°C) when sown early in September. Varieties like Arka Sampurna, E6 and VRP 8 are more heat tolerant as compared to Arkel therefore can be recommended for early sown conditions.

Key words: Inundation, vegetable pea, seedling establishment

To get optimum field emergence and plant population, the vegetable pea (*Pisum sativum* L.) is sown with pre-sowing irrigation (in local language *jamna marke*), but to fetch higher price early-timely sowing in large area with pre-sowing irrigation is a difficult target. Sowing with flood irrigation results in poor field emergence due to low germination, and length and dry weight of seedling [1, 2, 3], rate of germination, seedling growth rate [4] and seed vigour [5, 6]. Drastic reduction in oxygen [7, 8] is the primary plant stress under excessive moisture responsible for a considerable loss. Respiration and electron transport are inhibited and ATP formation and root injury is caused when oxygen is less due to excessive moisture stress [9, 10]. The crop is sown earlier in September for early picking that faced high temperature stress along with excessive moisture at seedling stage. Therefore, the genotypes have to be evaluated for excessive moisture alongwith heat tolerance at seedling establishment.

MATERIALS AND METHODS

The investigation was carried out at the Seed

Technology Research Unit, Department of Plant Breeding and Genetics, JNKVV, Jabalpur on sixteen genotypes (AP 1, AP 3, Arka Ajit, Arka Kartik, Arka Sampurna, Arkel, E 6, JM 6, PM 3, Pusa Pragati, VRP 2, VRP 5, VRP 6, VRP 7, VRP 8 and VRP 16) collected from IIVR, Varanasi in two consecutive years.

Randomly selected three hundred (100 per replication) surface sterilized (70% ethanol for 30 seconds) seeds were tested for germination [11] and vigour index [12] after inundation for 8, 16, 24, 32 and 40h [13] in distilled water before germination test at 20,25,30 and 35°C during *rabi* 2006-07 and 2007-08.

RESULTS AND DISCUSSION

Genotypic variability for seed germination and vigour index exists, which is related to the ability of different genotypes to utilize the stored assimilate in the cotyledon through anaerobic metabolism for germination and radicle/plumule development. High genotypic and phenotypic coefficient of variation was observed for vigour index, whereas low for germination percentage

(Table 1). Efforts are needed to widen variability for effective selection to improve germination percentage under excessive moisture stress *i.e.*, flood irrigation after sowing.

Initial germination per cent of all the genotypes at the start of the screening for tolerance against excessive moisture stress during germination was 90 per cent. It remained above 80 per cent up to 16h under excessive moisture stress in all the genotypes without any significant difference but after that it reduced very fast and reached zero per cent after 40h inundation (Fig. 1) at temperature above 25°C. Among the genotypes, minimum reduction in germination after 32h of inundation was in AP 3, AP 1 and VRP 8 whereas maximum deterioration in terms of per cent germination was in Arkel, VRP 22 and PM 3 (Fig. 1). In sensitive varieties, germination reached below seed certification standard after 24h of inundation at 25°C.

Initial high vigour index of all the genotypes deteriorated consistently up to 16h and then it reduced drastically after 32h of soaking and sharply with increase in temperatures (20-35°C). Among the genotypes minimum reduction in vigour index after 32h of excessive moisture was in AP 3, AP 1 and VRP 8, whereas maximum deterioration was in Arkel, VRP 22 and PM 3 (Figs. 2 and 3). In sensitive varieties, germination reaches below seed certification standard after 24h of stress.

Present finding reveals that vegetable pea is sensitive to excessive moisture for both germination and vigour index, therefore resulted in poor field emergence under inundation. To cover larger area under early sown condition with flood irrigation, farmers may select varieties like AP 3, AP 1 or VRP 8. Varieties like Arkel and PM 3 are sensitive to excessive moisture stress therefore sowing should be done with pre-sowing irrigation. Apart from excessive moisture, the crop also faces high temperature stress (28-35°C) when sown early in September. Varieties like Arka Sampurna, E6 and VRP 8 were more tolerant genotypes against heat based on stress indices as compared to Arkel.

Table 1. Mean performance and genetic variability for excessive moisture tolerance at different intervals of stress

Period of inundation hours	Germination	Vigour index	
		Vigour index I (Seedling length)	Vigour index II (Seedling dry wt.)
20°C			
0	90.00	1554.300	39.600
8	89.82	1425.443	35.029
16	89.71	1314.252	22.427
24	84.36	1139.704	19.402
32	48.91	606.97	09.29
GCV (%)	78.46	023.18	25.78
PCV (%)	79.45	023.19	26.71
25°C			
0	90.00	1528.26	38.700
8	88.76	1367.71	33.728
16	88.41	1269.56	22.986
24	83.61	1113.84	20.902
32	39.92	506.58	07.98
GCV (%)	77.45	22.19	24.65
PCV (%)	78.81	22.98	25.39
30°C			
0	90.00	1378.80	36.00
8	83.45	1200.84	30.87
16	79.38	1056.54	16.66
24	66.45	844.579	12.62
32	38.32	445.278	5.748
GCV (%)	66.84	25.43	20.47
PCV (%)	69.32	26.45	21.36
35°C			
0	76.45	983.911	24.464
8	66.87	801.102	20.729
16	54.32	536.138	13.036
24	44.19	392.407	09.279
32	32.16	246.024	06.110
GCV (%)	58.45	19.45	19.88
PCV (%)	59.45	20.76	19.98

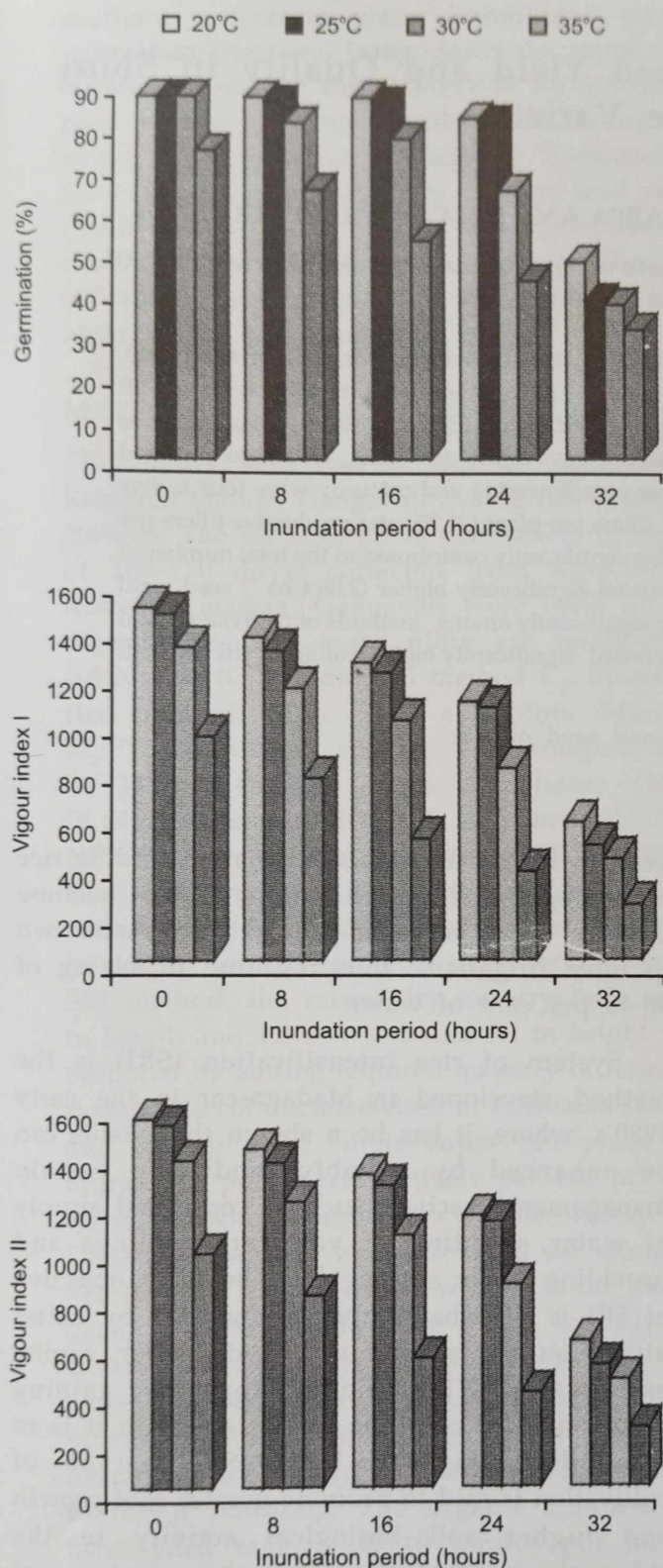


Fig. 1. Effect of water logging and temperature stress on germination and vigour index of vegetable pea

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