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RESEARCH ARTICLE

GERMINATION, GROWTH, YIELD AND YIELD ATTRIBUTES OF MUNGBEAN (*VIGNA RADIATA* L. WILCZEK) EFFECTED BY SALINITY STRESS

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ABSTRACT

An experiment was conducted to evaluate the effect of salinity on germination, growth and yield related parameters of mungbean at deparatment of Ag. Botany, Janta Mahavidyalaya, Ajeetmal (U.P.). Lower salinity (An experiment was conducted 3dsm^{-1}) did not affect the germination, growth and yield attributing parameters. Higher salinity levels reduced germination, growth and yield attributing parameters. Variety K-92-140 showed maximum reduction in all above mentioned of botany, Janta Mahavidyalaya, Ajeetmal U.P..

Key Words **: mungbean, germination, salinity, growth.**

Mungbean (*Vigna radiata* L.) is one of the most important pulse crops grown principally for its rich edible seeds. For developing country like India, pulses constitute the major concentrated source of dietary protein. It contains an important dietary ingredient of the oriental food. It is rich in easily digestible form of protein. It is the best in nutritional value having 59.9 percent carbohydrate, 24.5 proteins and 12.2 percent fat and other mineral elements. It is largely eaten in the form of split pulse as dal, while tender green pod constitute a very favorite vegetable. It is also used as a green manure. Mungbean also have ability to improve the physical, chemical and biological properties of the soil. It can also increase the soil fertility through biological nitrogen fixation from atmosphere. So it may be considered as an inevitable component of sustainable agriculture.

Salinity is a worldwide problem. This problem is particularly serious in arid and semi-arid regions of the world where most of the developing countries happen to fall (Khan *et.al.*, 1999) In India about 7 million hectare land are affected with salinity and alkalinity (Yadav, 1979). Of this nearly 1.295 M ha of land are located in Utter Pradesh (Agrawal *et. al.*, 1979).Salinity causes not only differences between the mean yield and the potential yield but also causes yield reduction from year to year. It affects the plant growth directly through its interaction with metabolic rates and pathways within the plants. It affects plant growth at all stages of development and sensitivity to salinity varies from one growth stage to another. NaCl salinity decreased rate of germination in wheat crop (Hassain *etal.*, 2008 and Kumar *etal.*, 2012). Salinity reduced growth parameters (Khatkar and Kuhad, 2000 and Kumar *et. al.*, 2012). Pulses are generally highly sensitive to salinity (Ashraf and Waheed, 1990), but amount of intra-specific variation for salt tolerance does exist in various pulses crops *e.g.* lentil (Ashraf and Waheed, 1990) & Chickpea (Ashraf and Waheed, 1992). The salt tolerant species possesses a high capacity to resist salt stress through the biosynthesis and accumulation of compatible solute. These substances raise the overall osmotic pressure within the cells, thereby enabling plant cells to maintain both turgor and driving gradient for water uptake (Cha-um *etal.*, 2004).

Therefore, the present study undertaken to ascertain whether there is positive relationship between the degrees of salt tolerance at different growth stage of mungbean.

MATERIALS AND METHODS

A pot experiment was conducted at the pot yard of Department of Agriculture Botany, Janta Mahavidiyalaya Ajeetmal, Auraiya (U.P.)-India during 2008. There are four levels of salt levels and five genotypes of mungbean were taken in consideration are as follows.

Treatments :

S_0: Control
S_1:3 dsm^{-1}
S_2:6 dsm^{-1}
S_3:9 dsm-1
S_4: 12 dsm^{-1}

Varieties :

V_1: K 92-140
V_2: K 92-220
V_3: KM 1284
V_4: T44
V_5: K851

The seeds of mungbean accession were collected from Indian Institute of Pulse Research, Kanpur. 75 earthen pots were selected and lined with polythene to check out side salt and loss of water. The soil of the experimental pot was collected from 0-15 cm depth from rose farm. The collected soil sample were air dried, pulverized under shad, remove stubble and other inert materials. Seeds were sterilized by dipping in 10 percent sodium hypochlorite solution for 10 minutes, and then rinsed with sterilized distilled water and air dried at the ambient temperature of 32^0C in the laboratory. The experiment was laid out as completely Randomized Block Design with three replications.A recommended dose of NPK (20:60:40) were applied. Irrigation was made on the requirement of the crops.

Number of days from sowing to starting of germination was recorded in different genotypes sowing to completion of germination at alternate days and finally germination percent was calculated on the basis of number of seed germination out of the number seed sown per pot. Plant height was measured in centimeter with the help of meter scale from the soil level to the aerial top leaf of the stem. Numbers of branches, number of leaves were counted. Dry weight per plant was calculated on oven dry weight basis. Number of pod, number of grain per pod, grain yield, straw yield, biological yield, and test weight was recorded at harvesting stage. Harvest index percent can be calculated by formula suggested by Donald (1962) as follow :

$$\text{Harvest index (\%)} = \frac{\text{Economic yield}}{\text{Biological yield}} \times 100$$

RESULTS AND DISCUSSION

Application of salt to mungbean genotypes at 3 dsm^{-1} had no adverse effect rather it proved better among all the levels of salinity. Germination percent (Table 1) of mungbean genotypes was not affected by salinity at EC 3 dsm^{-1}. Further, increased salinity levels reduced 6.77% germination at 10 DAS variety K-851, T-44, KM 1284, K-92-220 exhibited better tolerance against higher levels of salinity. Variety K-92-140 showed poor performance. Delayed and reduced germination percent seem to be due to less absorption of water from soil which resulting in increasing osmotic pressure of soil water due to higher amount of salt present in the soil solution. Similar finding were also

Table 1 : Effect of salinity on germination, plant height, leaf area, numbers of branches and dry weight of different genotypes of Mungbean

Genotypes/ Salinity levels (EC dsm-1)	Germination (%) DAS	Plant height (Cm) DAS		Leaf area (Cm^2) DAS	Number of branches DAS		Dry weight (g) DAS	
	10	15	45	30	15	45	15	45
K92-140								
control	71.00	7.96	33.88	23.00	2.10	4.47	1.61	6.23
3	73.00	8.01	34.80	25.00	2.75	5.12	1.71	7.03
6	70.00	7.93	33.38	22.00	1.95	4.25	1.60	6.18
9	69.00	7.91	32.17	21.00	1.90	4.00	1.55	6.10
12	68.00	7.89	31.11	20.00	1.85	3.90	1.50	6.00
Mean	70.20	7.94	33.06	22.20	2.11	4.34	1.594	6.308
K92-220								
Control	72.00	8.00	35.03	23.30	2.65	5.00	1.66	7.18
3	73.00	8.09	35.92	25.30	2.70	5.80	1.70	8.23
6	71.00	8.03	33.50	22.50	2.65	4.85	1.55	7.10
9	70.00	8.00	31.21	20.00	2.55	4.70	1.50	7.00
12	69.00	7.98	30.22	20.00	2.52	4.62	1.50	6.93
Mean	71.00	8.02	33.17	22.22	2.61	4.99	1.582	7.28
KM-1284								
Control	72.00	8.00	34.18	22.00	1.95	4.55	1.60	6.35
3	73.00	8.04	35.97	24.30	2.04	5.25	1.63	7.25
6	71.00	7.95	32.90	22.00	1.85	4.35	1.52	6.42
9	70.00	7.93	31.01	18.00	1.80	4.20	1.50	6.15
12	69.00	7.93	29.87	18.00	1.75	4.10	1.44	6.10
Mean	71.00	9.97	32.78	20.86	1.90	4.49	1.54	6.45
T 44								
Control	73.00	8.10	35.53	24.00	2.75	5.10	1.68	7.30
3	74.00	8.12	36.60	25.00	2.80	5.85	1.75	8.35
6	72.00	8.07	33.93	23.00	2.64	4.92	1.70	7.15
9	71.00	8.01	31.71	22.00	2.62	4.70	1.65	7.10
12	69.00	8.00	30.73	21.00	2.60	4.65	1.63	7.04
Mean	71.80	8.06	33.70	23.00	2.69	5.04	1.682	7.38
K-851								
Control	75.00	8.14	35.74	25.00	2.80	5.45	1.75	7.35
3	76.00	8.18	36.96	26.00	2.85	6.25	1.80	8.45
6	73.00	8.10	34.08	24.00	2.68	5.10	1.75	7.28
9	71.00	8.01	32.09	23.00	2.65	4.90	1.65	7.24
12	69.00	7.99	34.78	22.00	2.53	4.71	1.65	7.14
Mean	72.88	8.08	34.13	24.00	2.70	5.28	1.720	7.49
S	0.735	0.726	0.441	0.634	0.093	0.177	0.045	0.206
V	0.735	0.726	0.441	0.634	0.92	0.177	0.045	0.206
CD at 5 % (S x V)	NS	NS	NS	NS	0.209	NS	NS	NS

NS=Non-significant

Table 2 : Effect of salinity on number of pod, pod weight, seed number, grain yield, straw yield, biological yield, harvest index and test weight of different genotypes of Mungbean

Genotypes/ Salinity level (dsm-1)	Number of pod	Pod weight (g)	Seed Number/Pod	Grain yield/plant	Straw yield/Plant	Biological yield/Plant	Harvest index	Test weight
K 92-140								
control	15.75	4.45	9.25	3.44	6.13	9.57	39.10	35.94
	16.90	4.80	11.02	3.92	7.01	10.93	40.50	35.86
6	14.09	4.00	8.42	3.31	5.90	9.21	38.05	3593
9	12.10	3.42	7.12	3.21	5.71	8.92	37.04	35.98
12	10.60	3.02	6.41	3.12	5.60	8.72	35.12	35.77
Mean	13.88	3.93	8.44	3.40	6.07	9.47	37.96	35.89
K92-220								
Control	17.05	4.85	10.21	3.92	7.00	10.92	33.45	35.89
3	19.10	5.35	11.40	4.25	7.55	11.80	33.13	36.01
6	14.45	4.10	8.69	3.78	6.73	10.51	31.45	35.96
9	10.75	3.07	6.40	3.45	6.15	9.60	28.60	35.93
12	9.85	2.80	5.85	3.30	5.85	9.15	26.15	36.06
Mean	14.24	4.03	8.51	3.74	6.65	10.39	30.55	35.97
KM 1284								
Control	16.85	4.81	10.12	3.54	6.30	9.48	38.45	35.97
3	18.40	5.20	11.02	4.10	7.27	11.37	40.12	36.05
6	15.00	4.21	9.00	3.38	6.02	9.40	39.90	35.95
9	11.90	3.35	7.13	3.30	5.83	9.13	34.15	36.14
12	10.04	2.84	666.1	3.18	5.65	8.75	33.10	36.34
Mean	14.43	4.08	8.65	3.50	6.21	9.69	37.14	36.09
T 44								
Control	23.05	6.55	13.79	4.10	7.25	11.35	37.45	36.12
3	24.50	6.98	14.31	4.45	8.00	12.45	39.72	35.74
6	18.80	5.35	11.25	3.89	6.91	9.80	36.50	33.96
9	17.05	4.85	10.20	3.55	6.35	9.90	34.25	35.85
12	14.50	4.15	8.75	3.35	6.00	9.35	33.13	35.29
Mean	19.58	5.57	11.66	3.86	6.90	10.57	36.21	35.39
K 851								
Control	23.85	6.82	14.31	4.22	7.50	11.72	42.45	36.00
3	25.50	7.33	14.41	4.60	8.25	12.85	44.10	35.79
6	20.15	5.75	12.05	4.00	7.10	11.10	40.20	36.03
9	18.45	5.25	11.10	3.65	6.56	10.21	38.15	35.74
12	15.90	4.50	9.51	3.55	6.21	9.76	36.65	33.63
Mean	20.77	5.93	12.27	4.00	7.12	11.12	40.31	35.43
S	0.577	0.159	0.322	0.080	0.137	0.224	0.557	0.210
V	0.577	0.159	0.322	0.080	0.137	0.224	0.557	0.471
CD at 5% (S x V)	1.291	0.356	0.721	N S	N S	0.502	1.24	N S

NS=Non-significant

reported by earlier by Bera *et. al., (*2006) in chickpea and Kumar *et .al.,* 2012 in wheat. In case of tolerant genotypes accumulation of osmotically active substances such as sugar, organic acid, proline, glycine, K^+, and Cl^- which provide nutrient acquition, ion selectivity and osmotic adjustment to salinity.

Plant height (Table 1) increased by salinity up to the level of 3 dsm^{-1}, beyond that a significant reduction was noted by 12.74 % at 15 DAS, and 14.72 % at 45 DAS. Among varieties lesser reduction was noted in K-851 over other varieties. Minimum plant height was recorded in variety K-92-140. Variety K-851 produced maximum leaf area, while lowest leaf area was noticed in variety K-92-140. Dry weight (Table 1) was minimum at 15DAS and maximum at 45 DAS. The total dry weight increased about four times from 15 to 45 DAS. Increase in the level of salinity > 3 dsm^{-1} showed a drastic reduction at 15DAS (9.94 %)and at 45 DAS (7.22 %).Variety K-851, T-44, KM-1284 accumulated maximum dry weight, while variety K-92-140showed poor performance. Adverse effect of salinity on the above parameters might be due to fewer uptakes of water and nutrients from the growing media due to higher concentration of salts present in the root zone, which may causes imbalances in osmotic pressure. Reduced growth under salt stress might be due to reduced transport of essential nutrient to the shoot (Dager *etal,* 2004 and Kumar *et.al.,* 2012). Cherian and Reddy (2000) reported that ECe level 7.5 dsm^{-1} quit detrimental causing about 60 percent decline in dry matter in *Suaeda nudiflora.* Reduction in dry matter accumulation in plant seems to be increasing levels of salinity (Sharma, 2003).Under condition of salinity tolerance vigorous growth and continual replacement of lost leaves results in dilution of salt concentration in plant system. Tolerant genotypes can be minimized salt uptake, potential salt load per unit of new growth and provide better water use efficiency (Flower *et al*., 1988)

Salinity level >3dsm-1 showed a reduction about 41.71 % in number of pod (Table 2). Variety K-851 produced maximum pods. Pod weight (g) and seed number per pod was maximum noticed at 3dsm-1, beyond that a reduction was noticed by 41.65 % and 42.27 %. Variety K-851 showed better performance in this regard. However variety K-92-140 produced lowest pod weight and seed number per pods. Grain yield and straw yield per plant significantly reduced by 22.53 % and 23 % due to salinity > 3 dsm^{-1}. Genotypes K-851, T-44, KM 1284 and K-92-220 showed better tolerance against higher levels of salinity. Biological yield, harvest index and test weight were significantly reduced by salinity. Genotype K -851 produced maximum value and genotype K-92-220 showed minimum value (Table 2)

Salinity may directly or indirectly inhibit cell division, cell enlargement, which results in reduction of shoot length, number of leaves, dry matter accumulation, leaf size, mobilization of food material from source to sink and increased root shoot ratio (Mass and Poss, 1989) found similar result. Yield and yield attributes decreased markedly with increasing levels of sodicity. Salt stress of EC 6 dsm^{-1} and 12 dsm^{-1} decreased grains, straw yield and harvest index (Kumar *et. al.*, 2012). Tolerant genotypes had a capability to better nutrient and water absorption which provide maximum leaf area that resulting in better accumulation of photo-assimilate in plant.

Conclusion

The assessment of the effect of salinity on the germination, growth and yield attributes in mungbean genotypes lead to conclude that all the considered parameters were significantly affected by salt stress .The results of this study are in accordance with earlier reports which show that proline act as protective compound and higher potassium sodium ratio provide safety during salt stress. These organic solutes and ionic balances could be used as physiological markers for assessing salt tolerance in wheat. However, these results are from only one year experiment.

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