International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Assessment of NaCl Tolerance in Green Gram Cultivars by Observing Morphological Characteristics

B. Sreelakshmi[1], B. Sujatha[1]

[1, 2] Department of Botany, Andhra University, Visakhapatnam, India
[1]Corresponding Author: *sreelakshmibandaru13 [at]gmail.com*

Abstract: ***Soils having high salt content were not useful for cultivation; salinity severely effects the growth and productivity of the crop plants. This problem was covered by cultivating salt tolerant cultivars. The aim of the study is to figure out Nacl tolerant and NaCl sensitive cultivars of Green gram cultivars. In the present study total 7 cultivars of green gram seeds were grown at different NaCl concentrations. Germination percentage, root length, shoot length and dry weight of the seedlings were assessed using different concentrations of NaCl. Based on the growth parameters, T-44 was confirmed as salt tolerant cultivar and PS-07 was confirmed as salt susceptible cultivar.***

Keywords: NaCl tolerance, Green gram, Susceptible and Growth parameters

1. Introduction

Green gram (Vigna radiate L. Wilczek) is an important traditional crop the world over. Legumes/pulses are very important food and feed crops, known for their health benefits (Arnoldi et al., 2014) vital ingredient of Indian and Mediterranean diets and considered staple in other regions (Vaz Patto et al., 2014), have high demand as for age for producing high-quality meat and milk (Boelt et al., 2014). Globally, agriculture productivity is inhibited by abiotic and biotic stresses, but abiotic stresses in particular (Gong et al., 2013) affect spreading of plant species across different environmental zones (Chaves et al., 2003).

Rapidly increasing soil salinity has multifarious effects on plant growth and productivity. Salt-affected land comprises 19% of the 2.8 billion hectares of arable land on earth; and an increase in this menace is posing a serious threat to agriculture globally (Pessarakli and Szabolcs, 1999).

The criteria used to appraise the salt tolerance potential of any plant species are morphological, physiological, and biochemical purely (Rawson et al., 1988; Flowers, 2004; Ashraf and Harris, 2004). The morphological criteria include stunted growth (Srivastava and Jana, 1984; Boyd and Rogers, 2004), leaf scorch (Karakas et al., 2000), chlorosis of green parts (Husain et al., 2003), while biochemical ones include qualitative and quantitative changes in proteins, fats, and carbohydrate patterns (Bassil and Kaffka, 2002). Induced nutrient deficiency is one of the most important aspects of salinity, leading as it does to serious perturbation of normal cellular activities.

Static mung bean yield in last decades is largely accounts for crop susceptibility to various biotic and abiotic stresses at different growth stages of the crop (Sehrawat et al., 2013). Among them, salinity severely limits growth and yield worldwide; ~50mM NaCl can cause >60% yield losses (Abd-Alla et al., 1998). It is expected that increased salinity will have an irresistible global effects, resulting ~50% loss of arable land by mid of the 21st century (Hasanuzzaman et al., 2012). In the present aims at assessment of saline tolerant and saline susceptible green gram cultivars among the selected cultuvars available in the market.

2. Materials and Methods

Evaluation of salt tolerant green gram cultivar among the seven cultivars.

Seven green gram cultivars were collected from Agricultural Research station Vijiayanagaram. For the collected, seven cultivars salt tolerance activity test was conducted with NaCl. For tolerance estimation germination of the seeds, shoot length and root length were calculated. For this assay 10 different salt concentrations were used, i.e. 200, 400, 600, 800, 1000, 1200, 1400, 1600, 1800 and 2000 ppm. Initially 50 seeds from each cultivar were taken and seeded in different pots with mentioned concentration of NaCl. Sufficient waster was supplied to the pots at regular intervals. After 48 hours percent germination was calculated and tabulated in the below. After seven days of germination, root length, shoot length and dry weight was measured and recorded. According to the result resistant and susceptible isolates were characterised.

3. Result and Discussion

Present study mainly focused on the effect of NaCl stress on morphological characteristics and growth parameters such as percentage of germination, root length, shoot length and dry weight of seedlings in seven different cultivars of green gram were studied. large range of variation was observed in germination percentage under NaCl stress conditions. From the table-1 it is inferred that as the NaCl concentration increased, the germination percentage declined. The highest NaCl concentration used in this experiment was 2000 ppm, only one cultivar i.e. T44 showed 10% seed germination, another one cultivar (ps16) showed germination up to 1200 ppm, Cultivar k851 showed germination up to 1000 ppm, at 800ppm cultivar PDP 71-1 found to be germinated and

remaining two cultivars were showed germination at 600 ppm. Similar results were reported in mungbean (Shakil et al., 2004; Mahajan and Tuteja, 2005; Mahadavi and Sanavy, 2007), rice (Lee et al., 1998), durum wheat (Tekalign Mamo et al., 1996). The effect is more pronounced at higher salinity levels.

Another parameter like root length also responded inverse proportion with increasing NaCl concentration. But at 200 and 400 ppm concentrations different response was observed, at these concentrations root length was enormously increased along with the increasing concentration of NaCl. Because at abiotic stress conditions plant root length was increased to increased the water absorption area. After 400 ppm concentration root length was drastically decreased. In this case also T44 cultivar only showed growth at 200 ppm.

Shoot length was the major parameter as at showed real growth of the plant. In this parameter clear detrimental growth was found with NaCl concentration. Only one cultivar i.e. T44 showed 1.7 cm shoot length at 2000 ppm NaCl concentration, another one cultivar (ps16) showed shoot growth at 1200 ppm, Cultivar k851 showed shoot growth up to 1000 ppm, at 800ppm cultivar PDP 71-1 found to be shoo gowh and remaining two cultivars were showed shoot growth up to 600 ppm NaCl concentration. And plant dry weight also showed significant differences

4. Conclusion

Major and preliminary finding in this study was gradient salt concentration in the soil effect the plant growth parameters inversely. And among the selected cultivars T44 was confirmed as salt tolerant cultivar as it showed germination, root and shoot growth at 2000ppm as it was high in this study. On the other hand PS-7 was confirmed as salt susceptible cultivar.

Table 1: Percentage of germination after gradient salt treatment

Cultivars	Salt concentrations used (PPM)										
	CONTROL	200	400	600	800	1000	1200	1400	1600	1800	2000
PDP 71-1	95.4	83.4	72.0	52.1	21.0	0	0	0	0	0	0
PS 16	98.3	93.2	90.1	75.2	54.0	23.7	9.8	0	0	0	0
ML 131	93.1	78.4	53.0	19.7	0	0	0	0	0	0	0
T 44	97.9	91.9	85.7	75.0	61.9	48.2	40.5	34.7	21.0	15.5	10
CGG 127	96.3	81.0	63.7	34.8	17.2	0	0	0	0	0	0
PS 7	92.5	74.1	32.9	2.8	0	0	0	0	0	0	0
K 851	98.3	75.3	45.9	31.7	19.8	12.0	0	0	0	0	0

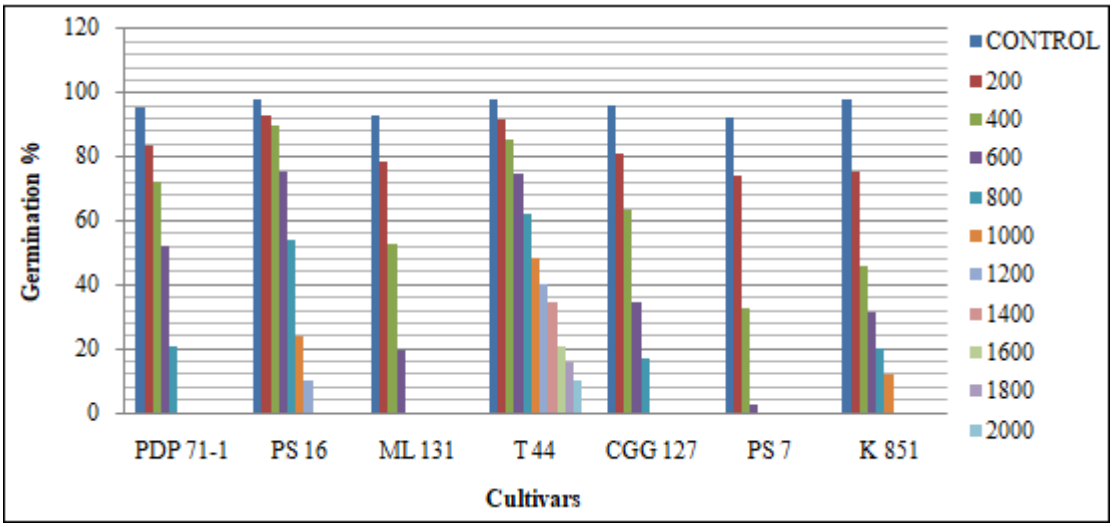


Table 2: Root length of green gram plants after gradient salt treatment

Cultivars	Salt concentrations used (PPM)										
	CONTROL	200	400	600	800	1000	1200	1400	1600	1800	2000
PDP 71-1	3.9	4.6	5.3	2.5	1.7	0	0	0	0	0	0
PS 16	4.3	4.9	4.9	3.2	2.7	1.7	0.9	0	0	0	0
ML 131	4.3	4.3	2.8	1.3	0	0	0	0	0	0	0
T 44	4.8	5.9	5.9	4.6	3.3	3.1	2.7	2.5	1.4	1.4	0.9
CGG 127	2.7	3.8	4.2	2.1	1.4	0	0	0	0	0	0
PS 7	3.1	3.4	2.1	1.5	0	0	0	0	0	0	0
K 851	2.9	3.7	3.8	2.4	1.2	0.8	0	0	0	0	0

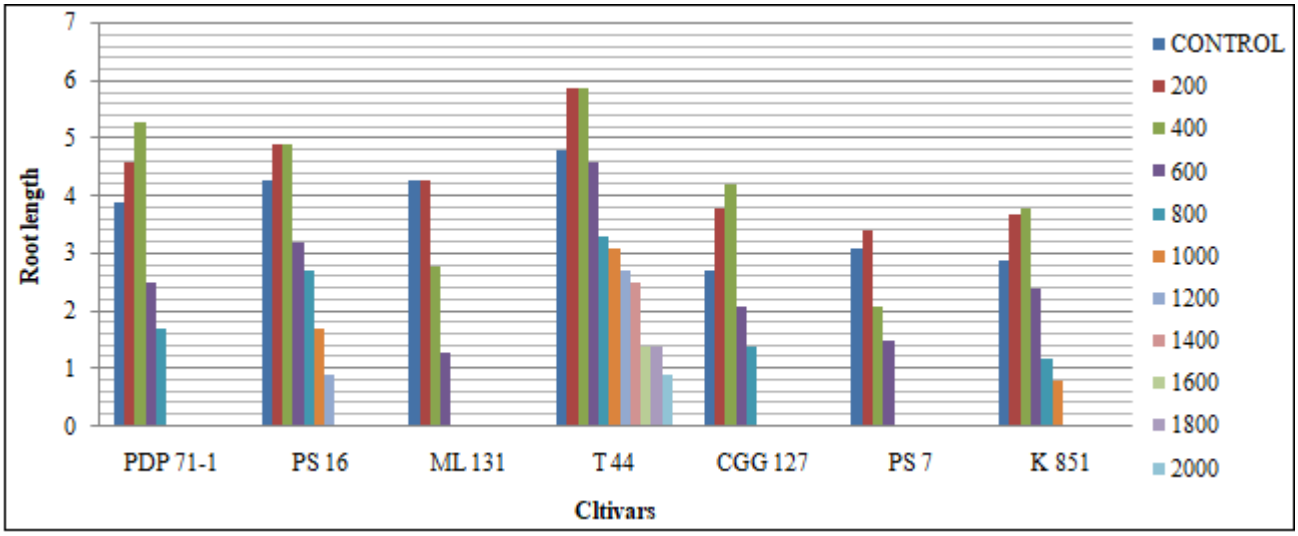


Table 2: Shoot length of green gram plants after gradient salt treatment

Cultivars	Salt concentrations used (PPM)										
	CONTROL	200	400	600	800	1000	1200	1400	1600	1800	2000
PDP 71-1	7.5	5.4	3.1	2.6	1.9	0	0	0	0	0	0
PS 16	6.3	4.3	4.0	3.1	2.6	1.9	1.5	0	0	0	0
ML 131	8.2	4.2	2.8	1.7	0	0	0	0	0	0	0
T 44	8.6	7.4	6.9	6.1	5.3	4.6	4.1	3.2	2.6	2.2	1.7
CGG 127	7.4	4.2	2.8	2.1	1.5	0	0	0	0	0	0
PS 7	8.8	5.3	2.9	2.1	0	0	0	0	0	0	0
K 851	6.1	5.0	3.7	2.5	2.1	1.3	0	0	0	0	0

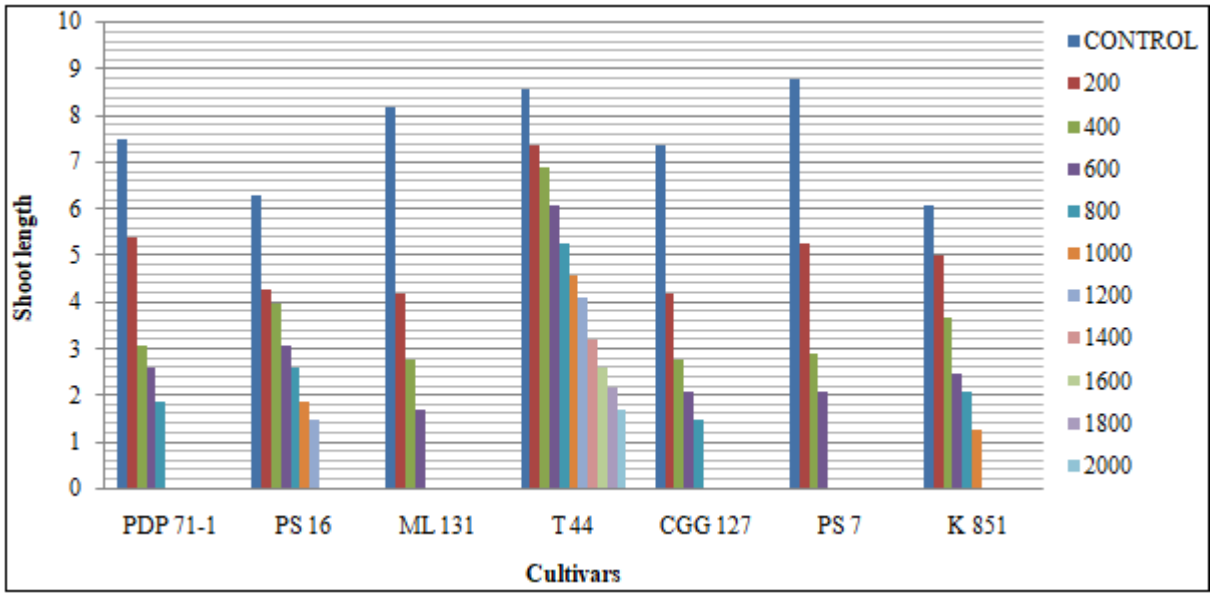
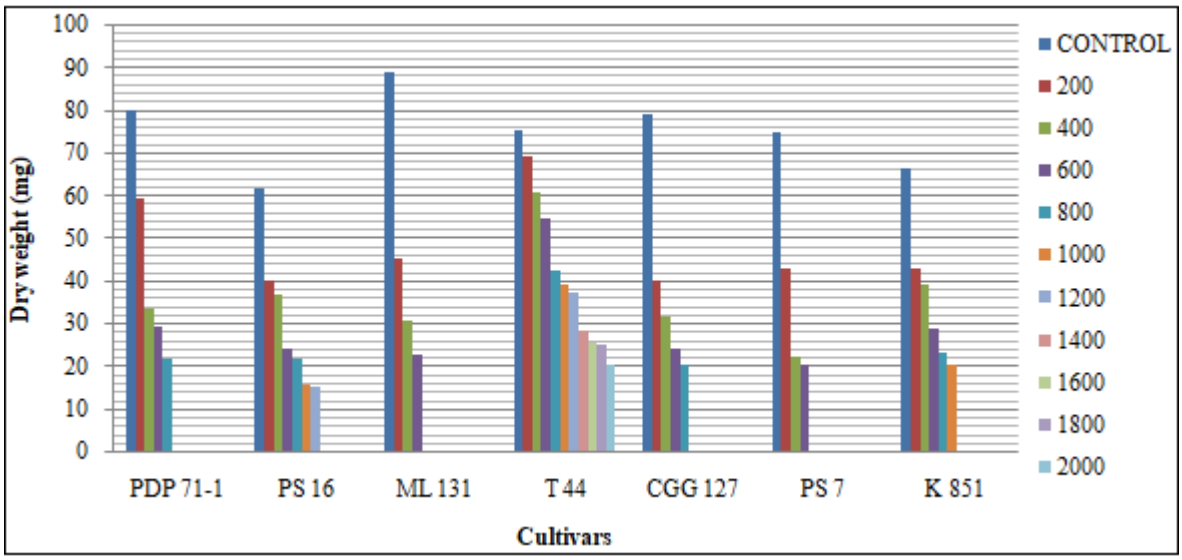


Table 4: Dry weight of green gram plants after gradient salt treatment

Cultivars	Salt concentrations used (PPM)										
	CONTROL	200	400	600	800	1000	1200	1400	1600	1800	2000
PDP 71-1	80	59.3	33.5	29.1	21.5	0	0	0	0	0	0
PS 16	61.6	40.2	36.9	24.1	21.9	15.6	15.1	0	0	0	0
ML 131	89.3	45.3	30.7	22.5	0	0	0	0	0	0	0
T 44	75.4	69.3	61.0	54.8	42.6	39.2	37.4	28.5	25.5	24.9	20.5
CGG 127	79.3	40.2	31.8	24.1	20.4	0	0	0	0	0	0
PS 7	75.2	43.1	22.0	20.1	0	0	0	0	0	0	0
K 851	66.3	42.9	39.3	29.0	22.9	20.1	0	0	0	0	0



References

[1] Abd-Alla, M. H., Vuong, T. D., and Harper, J. E. (1998). Genotypic differences in nitrogen fixation response to NaCl stress in intact and grafted soybean. *Crop Sci.* 38: 72.

[2] Arnoldi, A., Zanoni, C., Lammi, C., and Boschin, G. (2014). The role of grain legumes in the prevention of hyper cholesterolemia and hypertension. *Crit. Rev. Plant Sci.* 33, 1-3.

[3] Ashraf, M and P. J. C. Harris. 2004. Potential biochemical indicators of salinity tolerance in plants. PlantSci.1**66:** 3-16.

[4] Bassil, E. S. and S. R. Kuffka. 2002. Response of safflower (*Carthamustinctorius*L.) to saline soils and irrigation: II. Crop response to salinity. Agri. Water. Managmnt.5**4:** 81-92.

[5] Boelt, B., Julier, B., Karagic, D., and Hampton, J. (2014). Legume seed production meeting market requirements and economic impacts. *Crit. Rev. PlantSci.* 33, 116-122.

[6] Boyd, D. C. and M. E. Rogers. 2004. Effect of salinity on the growth of chicory (*Cicoriumintybus*cv. Puna)_ a potential dairy forage species for irrigation areas. Aust. J. Expt. Agri.4**4:** 189-192.

[7] Chaves, M. M., Maroco, J. P., and Pereira, J. S. (2003). Understanding plant responses to drought-from genes to the whole plant. *Funct. Plant Biol.* 30, 239-264.

[8] Flowers, T. J. 2004. Improving cropsalt tolerance. J. Exp. Bot. **55:** 307-319.

[9] Gong, Y., Rao, L., and Yu, D. (2013). "Abiotic stress in plants, "in *Agricultural Chemistry*, ed. M. Stoytcheva (Rijeka: InTech).

[10] Hasanuzzaman, M., Hossain, M. A., daSilva, J. A. T., and Fujita, M. (2012). "Plant responses and tolerance to abiotic oxidative stress: antioxidant defenses is a key factor, "in *Crop Stress and Its Management: Perspectives and Strategies*, eds V. Bandi, A. K. Shanker, C. Shanker, and M. Mandapaka (Berlin: Springer), 261-316.

[11] Husain, S., R. Munns, and A. G. Codon. 2003. Effect of sodium exclusion trait on chlorophyll retention and growth of durum wheat in saline soil. Aust. J. Agric. Res. **54:** 589-597.

[12] Karakas, B., R. L. Bianco, and M. Reiger. 2000. Association of marginal leaf scorch with sodium accumulation in salt stressed peach. Hort Sci. **35:** 83-84.

[13] Lee, K. S., Choi, Y. S. and Choi, Y. W. (1998): Varietal difference in salinity tolerance during germination stage of rice. Korean J. Crop Science., 43 (1): 11-14.

[14] Mahadevi, B. and Sanavy, S. A. (2007): Pakistan Journal of Biological Sciences., 10 (2): 273-279.

[15] Pessarakli, M. and I. Szabolcs.1999. Soil salinity and sodicity as particular plant/crop stress factor. *In*M. Pessarakli (ed.), Handbook ofPlant and Crop Stress. MarcelDekker Press Inc. New York, pp. 1-16.

[16] Rawson, H. M., R. A. Richards, and R. Munns. 1988. An examination of selection criteria for salt tolerance in wheat, barley and triticale genotypes. Aust. J. Agric. Res. **39:** 759-772.

[17] Sehrawat, N., Jaiwal, P. K., Yadav, M., Bhat, K. V., and Sairam, R. K. (2013a). Salinity stress restraining mungbean (*Vignaradiata*L. Wilczek) production: gateway for genetic improvement. *Int. J. Agric. Crop Sci.* 6, 505-509.

[18] Shakil Ahmad, Abdul Wahid, EjazRasulAnd Abdul Wahid. 2004. Comparative morphological and physiological responses of green gramgenotypes to salinity applied at different growth stages. Bot. Bull. Acad. Sin. (2005) **46:** 135-142.

[19] Srivastava, J. P. and S. Jana. 1984. Screening wheat and barley germ plasm for salt tolerance. *In* R. C. Staples and G. H. Toeniessen (eds.), Salinity Tolerance in Plants: Strategies for Crop Improvement. John-Wiley New York, pp. 223-284.

[20] Tekalign, M., Richter, C. and Heiligatag, B. (1996): Response of some varieties of durum wheat and tef to salt stress. J. African Crop Sci., 4 (4): 423-432.

[21] VazPatto, M. C., Amarowicz, R., Aryee, A. N. A., Boye, J. I, Chung, H. J., Martín-Cabrejas, M. A., et al. (2014). Achievements and challenges in improving the nutritional quality of food legumes. *Crit. Rev. PlantSci.* 33, 188-193.