



Screening of Salinity (NaCl %) Tolerance Potential of Some Short Duration Pulses

KEYWORDS

Pulses crops, salinity, Physiological study

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ABSTRACT

Pulses are as poor man's meat. They also provide energy, essential minerals, vitamins and several compounds considered beneficial for good health. Salinity is major problem limiting plant growth and production by affecting its many phases viz, seed germination, growth, flowering and fruting ,metabolite content. The salinity effects on pulses cultivars like mung bean, cluster bean and cowpea were investigated. all the cultivars Seeds treated with 0.5 %,0.75%,1.0 % and 1.5 % NaCl along with control (DW) were kept for germination at room temperature up to 168 hr. Physiological parameters viz. germination percentage, shoot length, root+hypocotyls length, Fresh weight ,Dry weight and seed vigor index were measured. Salinity tolerant cultivars were identified.

Introduction

Different types of pulses / legumes are producing in India from last several years in both the rabi and kharif season. Pulses are essential food crops as it contains large amount of protein as well as free amino acids, carbohydrates, several vitamins and minerals. Its protein content is generally double the amounts of wheat and three times of the rice (Jayalath *et al.*, 2014). Short duration legumes crops also help in crop rotation for adding nitrogen content in the soil. Pulses do not contain cholesterol, little fat or sodium in their seed component. Pulses also provide iron, magnesium, phosphorus, zinc and other minerals, which play a variety of roles in maintaining good health. Plant growth and yields in pulses are highly affected by abiotic stresses such as drought, salinity, extreme temperatures, high light intensity, and mechanical wounding and often a combination of stresses under field and pot conditions so, per acre production is very low in them. The environmental stress conditions often activate different signaling cascades and cellular pathways leading to the production of proteins, molecular chaperones, ROS scavenging systems, accumulation of compatible solutes in response to stress (Wang *et al.*, 2005). Salt stress has adverse effects on legume plant growth, symbiotic association of nodules and soil rhizobia and finally the nitrogen fixation capacity. However; the intensity of adverse and injurious effects of salinity stress depends upon the nature of plant species, concentration and duration of salt stress, plant developmental stage, and mode of salt application to the crop.(Wang *et al.*, 2005) a .The objectives of the present study was to evaluate the

changes in physiological parameters of some short duration pulses under salinity stress.

Materials and methods

The laboratory experiment was conducted on four short duration legume varieties viz. Mungbean(cv. Mehlul -44 and cv. Anuradha), cluster bean (cv. Vasundhara) and cowpea (cv. Minaxi) obtained from seed agency (Mangalam seed) Patan ,Gujarat. These treatments constituted different concentrations of NaCl solution (viz. 0.50%, 0.75% , 1% and 1.5 %) as salinity dosages and distilled water as control. 10 seeds of each cultivars were kept for germination in Petri plates containing whatman filter paper No. 1 in each treatments and three replicated were maintained for germination study after surface sterilization with 0.2% HgCl₂ for 15 seconds at room temperature (Rukam singh *et al.*, 2007). As the germination begins from 24 hrs in all the cultivars, the data on germination percentage was recorded in all the salinity treatments along with control from 24 hrs to 168 hrs. 1 to 2 ml of appropriate treatment solution was applied depending on necessity; Physiological parameters viz. germination percentage, shoot length, root+hypocotyl length, fresh weight and dry weight of seedling were recorded up to 168 hr of germination (ISTA, 1999).

Seed Vigor Index (S.V.I.) = [Germination percentage x Root Length (cm)] + shoot length)

(Abdul Baki and Anderson, 1973).

Table 1: Effects of NaCl stress on germination percentage, root+ hypocotyls length, and Seed Vigour index of four legume cultivars.

No.	Cultivars	NaCl (%)	Germination percentage	Root length (cm)	Shoot length (cm)	Fresh weight (gm)	Dry weight (gm)	SVI
1	Mehul -44	control	100	6.8	4	6.8	4	1080
		0.5%	80	4.9(-38.77)	3.2(-25)	4.9(-38.77)	3.2(-25)	648
		0.75%	70	4.2(-61.90)	2.7(-48.14)	4.2(-61.90)	2.7(-48.14)	483
		1.00%	60	3.8(-78.94)	2.0(-50)	3.8(-78.94)	2.0(-50)	348
		1.5%	00	0.00	0.00	0.00	0.00	0.00

No.	Cultivars	NaCl (%)	Germination percentage	Root length (cm)	Shoot length (cm)	Fresh weight (gm)	Dry weight (gm)	SVI
2	Anuradha	control	100	4.5	3.0	4.5	3.0	750
		0.5%	80	3.8(-18.42)	2.7(-11.11)	3.8(-18.42)	2.7(-11.11)	520
		0.75%	70	3.4(+32.35)	2.3(-30.43)	3.4(+32.35)	2.3(-30.43)	342
		1.00%	60	3.0(-50)	2.0(-50)	3.0(-50)	2.0(-50)	300
		1.5%	00	0.00	0.00	0.00	0.00	000
3	Minaxi	control	100	4.5	2.4	4.5	2.4	690
		0.5%	80	3.9(-15.38)	2.1(-14.28)	3.9(-15.38)	2.1(-14.28)	480
		0.75%	80	3.0(-50)	1.0(-60)	3.0(-50)	1.0(-60)	360
		1.00%	70	2.7(-66.66)	1.0(-60)	2.7(-66.66)	1.0(-60)	175
		1.5%	00	0.00	0.00	0.00	0.00	000
4	Vasundhara	control	100	2.9	3.6	2.9	3.6	650
		0.5%	80	2.7(-7.40)	3.0(-20)	2.7(-7.40)	3.0(-20)	456
		0.75%	80	2.4(-20.83)	3.4(+5.88)	2.4(-20.83)	3.4(+5.88)	464
		1.00%	70	1.6(-81.25)	2.8(-28.57)	1.6(-81.25)	2.8(-28.57)	308
		1.5%	00	0.00	0.00	0.00	0.00	000

Results and discussion

Results of seed Germination

Seeds germinated in 0.5 % NaCl shows 80 % germination after 7th days while in control condition was 100 % germination after 7th days in all four cultivars (Table -1). This show 20 % decreased germination even at lowest salinity level 0.5 % NaCl. Result of seed germination of Mungbean (cv. Mehul - 45 and Anuradha), Cowpea (cv. Minaxi), Cluster bean (cv. Vasundhara) under salinity NaCl 0.5%, 0.75%, 1.0%, 1.5% were shows in (Table-1). Germination decreases as the salinity increases in all the four cultivars. It was decreases with sequences as 0.5% < 0.75% < 1.0% over control. Germination stops at 1.5 % NaCl salinity in all cultivars. Similar results were obtain regarding germination percentage in different concentration of salinity level in *Archis hypogea* L. (Shrimali et al., 2015), Mung beans (Jeanette et al. (2002), sorghum (Francois, 1985). Decreased seed germination in all the four legumes was found which shows their highly sensitiveness to NaCl salinity during early phases of growth and establishment which ultimately affect crop production in legumes.

Results of seedling growth

(Table-1) shows that Decrease in shoot length, root length, fresh weight and Dry weight in seedling of all the cultivars treated with lowest 1 % NaCl salinity.

In Mung bean (cv. Mehul -44) 78.94 % decrease in root length, 50 % decrease in shoot length ,70% decrease in fresh weight and 42.85 % decrease in dry weight were observed in 1 % NaCl salinity. It shows seedling length and

dry weight accumulation is low under salinity. In Mung bean (cv. Anuradha) 50 % decrease in root length, 50 % decrease in shoot length, 86.66% decrease in fresh weight and 100% decrease in dry weight observed in 1% NaCl. It show seedling length and dry weight accumulation is low under salinity. In Cowpea (Cv. Minaxi) 66.66% decrease in root length and 60 % decrease shoot length observed in 1% NaCl salinity. 80% decrease in fresh weight and 75% decrease in dry weight observed in 1% NaCl. Cluster bean (cv. Vasundhara)

81.25% decrease in root length, 28.57 % decrease in shoot length, 81.25% decrease in fresh weight and 28.57 % decrease in dry weight observed in 1% NaCl. Similar result of decrease seedling growth were periodically reported in many crops like in peanut crop (Taffouo et al., 2010) reported that different concentration of salinity decrease the fresh weight, dry weight, shoot length and root length. The present observations are in line with earlier reports in wheat (Hurd, 1974), goat weed (Singh and Jain, 1989) sorghum (Sullivan and Ross, 1979) and chickpea (Al-Mutawa, 2003) where increased salinity also led to decreased radical lengths. Thus, here all the four legume seedling shows lower seedling length and dry weight accumulation under salinity even the lowest lower dose (0.5 % NaCl) are also decreasing seedling physiology and 1.5 % NaCl completely stop the germination by damaging the seed.

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