RESPONSE OF RANGE GRASSES TO SALINITY LEVELS AT GERMINATION AND SEEDLING STAGE

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ABSTRACT

In a pot study conducted in the Department of Forestry, Range Management and Livestock, University of Agriculture, Faisalabad, Pakistan during 2005, three range grasses [blue panic grass (*Panicum antidotale*), bule stem grass (*Dichanthium annulatum*) and buffel grass (*Cenchrus cilliaris*)] were tested against 10,20 and 30 dS/m EC salinty levels at their germination stage. The results revealed that germination percentage, plumule and radicle length, oven-dried weight of root and shoot of all grasses decreased as the salinity level increased. The germination decreased from 93.66 to 78.33, 94.66 to 79.33 and 96.66 to 76.00 percent of blue panic, blue stem and buffel grasses, respectively as the salinity level increased from 0 to 30 dS/m EC. Similarly, all other characters like plumule length (24.66 to 14.66mm), radicle length (44.33 to 24.00mm), root weight per plant (13.66 to 6.00g) and oven- dried shoot weight per plant (11.66 to 5.00g) of blue panic grass decreased as salinity increased. Similar response was observed in case of blue stem grass and buffel grass. Based on the data, there was more reduction in plumule length (64.51%), redicle length (47.61%) and root weight (57.14%) of buffel grass as compared to blue stem grass. Maximum reduction (21.37%) in germination was recorded in buffel grass.

KEYWORDS: ***Panicum antidotale; Dichanthium annulatum; Cenchrus cilliaris*; plumule; radicle; Pakistan.**

INTRODUCTION

Rangelands are very valuable natural resources of Pakistan. These cover two third area and support livestock industry of the country. However, over exploitation of natural range vegetation, drought and salinity are responsible for low range production in Pakistan.

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Salinity is a serious problem all over the world including Pakistan (9, 10, 11). Quraishi and Rana (9) stated that 8.1 percent of total geographical area of the country is suffering from salinity. They further added that salinity covers 15.2, 24.3 and 2.7 percent area of Punjab, Sindh and Baluchistan, respectively. Long ago, Detmann (2) estimated that 40,000 hectare land was lost every year only due to salinity and water logging.

Salinity adversely affects plant growth as reported earlier (4, 5, 6, 16). In addition to drought and salinity, ever- increasing pressure on land use has also limited fodder production for livestock in the country. The livestock population has increased by 30 percent at one hand and area under cultivation of fodder crop declined @ 2 percent per decade on the other due to colonization, urbanization, industrialization and ploughing for food production (13). Over exploitation of range lands through over grazing, excessive lopping and cutting of forage shrubs and trees, desertification and soil erosion have also reduced range forage availability (8).

In view of scarcity of forage and limited land available for fodder cultivation in country, a study was conducted to test three range grasses under different salinity levels for promoting these throughout range lands in the country.

MATERIALS AND METHODS

These studies were conducted in the Department of Forestry, Range Management and Wildlife, University of Agriculture, Faisalabad, Pakistan during 2005. Three range grasses viz. blue panic grass (*Panicum antidotale*), buffel grass (*Cenchrus cilliaris*) and bule stem grass (*Dichanthium annulatum*) were tested against four salinity levels (0, 10, 20 and 30 dS/m ECe) with three replications. Saline solution containing 10,20 and 30 dS/m ECe were prepared and used for determining seed germination. For 0 dS/m ECe level pure distilled water without any salt was applied. Seed germination was recorded after 10 days and length of radicle and plumule of germinated seeds was also measured with transparent ruler.

Thirty six pots were prepared according to treatments and arranged 12 post in three rows. Pots were filled with normal soil which was free of salts. Before applying salinity levels, seedlings of each grass were grown in pots containing pure river sand having no salinity level at all. Then seedlings were transferred to the pots containing normal soil having 0 dS/m ECe salinity.

Three salinity levels viz. 10, 20, 30 dS/m ECe were developed in pots wherever required according to nature of treatments applied. Salinity levels

were maintained throughout the experiment till harvesting (seed maturity stage). Roots and shoots of each plant of each grass i.e. each treatment were measured and then oven-dried till their constant weight. Data were collected, tabulated and analyzed statistically for variance (14).

RESULTS AND DISCUSSION

Salinity affected germination, radicle and plumule length of grasses and their oven- dried weight when changed into root and shoot, respectively. All these parameters decreased with increased salinity level.

1. Effect of salinity on seed germination

The data (Table-1) showed that seed germination of all range grasses was significantly affected by all salinity levels except 10 dS/m. On overall basis of salinity effect, the grasses did not differ with one another significantly, for seed germination.

Table 1. Effect of salinity on seed germination (%) of range grasses.

Grasses	Salinity levels (dS/m ECe)				Mean values
	0	10	20	30	
Panicum antidotale	93.66a	92.67a	89.66b	78.33c	88.58a
Cenchrus cilliaris	94.66a	94.00a	87.66b	79.33c	88.92a
Dichanthium annulatum	96.66a	91.66a	86.00b	76.00c	87.58a
Mean values of salinity levels.	95.00a	92.78a	87.78b	77.89c	

Mean values not sharing similar letter in row or columm, differed significantly with one another at P= 0.05 .

Cenchurs cilliaris and *Dichanthium annulatum* showed maximum (88.92%) and minimum (87.58%) seed germination, respectively while *Panicum antidotale* also gave respective almost similar germination (88.58%).

2. Effect of salinity on plumule and radicle length

Radicle and plumule length of range grasses was significantly affected by different salinity levels (Table 2).

Salt free treatment (0 dS/m Ece) gave higher radicle and plumule length in each grass as compared to saline treatments. Moreover, these values decreased as salinity level increased from dS/m 30 dS/m. This is the reason that higher salinity level (30 dS/m ECe.) gave the lowest value of radicle length (23.67mm) and plumule length (13.00mm).

Table 2. Effect of salinity on radicle and plumule length (mm)of range grasses.

Grasses	Salinity levels (dS/m ECe)				Mean values
	0	10	20	30	
	Radicle length				
Panicum antidotale	44.33a	39.00a	36.00b	24.00c	35.83a
Cenchrus cilliaris	41.33a	38.00a	32.33b	24.33c	34.00a
Dichanthium annulatum	42.00a	35.66a	31.33b	22.67c	32.92a
Mean values of salinity levels.	42.56a	37.56a	33.22b	23.67c	
	Plumule length				
Panicum antidotale	24.66c	21.00d	19.00ef	14.66g	19.83b
Cenchrus cilliaris	29.33a	27.33a	18.66f	13.33g	22.17ba
Dichanthium annulatum	31.00a	29.66a	20.66de	11.00h	23.08
Mean values of salinity levels.	28.33a	26.00b	19.44c	13.00d	

Mean values not sharing similar letter in row or columm, differed significantly with one another (P= 0.05)

3. Effect of salinity on oven- dried weight of root and shoot

Oven-dried weight of range grasses was significantly affected by various salinity levels (Table 3).

Table 3. Effect of salinity on oven-dried root and shoot weight (g) of range grasses.

Grasses	Salinity levels (dS/m ECe)				Mean values of grasses
	0	10	20	30	
Root weight					
Panicum antidotale	13.67a	9.33bc	7.67d	6.00e	9.17b
Cenchrus cilliaris	14.67a	13.33a	13.67a	10.33b	13.00ab
Dichanthium annulatum	14.00a	8.67cd	7.33de	6.00e	9.00ab
Mean values of salinity levels.	14.11a	10.44b	9.56b	7.44c	
Shoot weight					
Panicum antidotale	11.67a	8.00c	6.00fg	5.00h	7.67a
Cenchrus cilliaris	7.00de	5.33gh	4.00b	3.33i	4.92c
Dichanthium annulatum	9.00b	7.33cd	6.33ef	5.33h	6.92b
Mean values of salinity levels.	9.22a	6.89b	5.44c	4.44d	

Means not sharing similar letter in row or columm, differed significantly with one another (P= 0.05).

No significant difference was observed between overall mean values of *Panicum antidotale* and *Dichanthium annulatum* for oven-dried root weight However, oven-dried shoot weight of all grasses differed with another significantly (Table 3). Overall mean differences of treatment means of 10 and 20 dS/m ECe for oven- dried root weight was non-significant whereas all

mean differences of all treatments for oven-dried shoot weight differed significant by (P=0.05). Salt free treatment and high saline treatment (30 dS/m ECe.) gave the highest and lowest oven- dried root and shoot weight of all range grasses, respectively. *Cenchurs cilliaris* and *Panicum antidotale* produced maximum oven-dried weight of root (14.67g) and shoot (11.67g), under salt free (control) treatment whereas *Panicum antidotale* and *Dichanthum annulatum* gave minimum root weight at high level of salinity (30 dS/m ECe.). Against same level of salinity, *Cenchrus cilliaris* gave the lowest shoot weight. Root and shoot oven-dried weight decreased as salinity level increased.

In fact, excessive salt concentration disturbed metabolic and physiological functions of plant cell which resulted in low seed germination and stunted growth of plant (1, 16). Adverse effect of salinity on the germination and growth of cereal crops and grasses was also confirmed by previous workers (1, 5, 6, 7, 15, 16).

CONCLUSION

The study concludes that all three species of range grasses tested can be tried at all salinity levels. However, their germination and growth will reduce with increasing salinity level.

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