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Growth Behavior of Kallar Grass (*Leptochloa fusca* L.) In Saudi Arabia

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Abstract: Kellar grass (*Leptochloa fusca*) is widely distributed in salt affected areas of many countries. Being a forage crop with many advantages other than its excellent growth in saline., sodic and waterlogged areas, it is an easily propagated crop and palatable to animals. Such advantages attract us to investigate its suitability to Saudi Arabia. The response of the grass to the climatic conditions of central region of Saudi Arabia and its response to salinity treatments at *in vitro* conditions were investigated. The grass has performed excellent growth through out the year producing seed heads, elongating and producing lateral shoots with slow growth during winter and hot summer, yellowing leafs under shaded greenhouse and short stems in small pots. Plants were affected by salinity levels of *in vitro* treatments as there was high significant difference in their response to different salinity concentrations, this response was increasing with the time.

Key words: Kallar grass, *Leptochloa fusca* L., Salinity treatments

Introduction

Leptochloa belongs to the family *Poaceae* (Graminae) being represented by forty species that are distributed in tropical and sub-tropical regions. Kallar grass (*Leptochloa fusca*) is a high salt tolerant species and grows well on salt affected soils or sandy soils even if irrigated with high sodic water or sea water (Chaudhry and Rafique, 1972; Qadir *et al*., 1996). *Leptochloa fusca* is a C-4 plant which converts 6.0% of radiant energy into chemical energy as compared to the 3.0% used by C-3 plants. Nitrogen fixing bacteria is found in the root system and the species meet 60% of its total nitrogen requirement by converting free nitrogen into soluble nitrates. It can grow on land for years without the addition of nitrogen fertilizers.

Kallar grass is one of the most important crops being used to improve soils in terms of salt reduction, addition of nitrogen and phosphate fertilizers, large amount of bio mass production, nutritive value for cattle and mass for fuel production (Mahmood *et al*., 1995). Its high tolerance to salt-affected soils, palatability to animals and soil reclaiming abilities makes Kallar grass an excellent candidate for a reclamation forage crop (Kumar, 1996).

Saudi Arabia as a hot dry region contains many saline playas (sabkhat), in coastal or inland areas. It also contains many cultivated areas with saline water, 3000-12000 ppm. Such areas usually cultivated with salt tolerant crops. Nowadays. farmers are interested in crops that riot only tolerate salinity, but also can reclaim soils beside being suitable for animals consumption. Kallar grass with such advantages have not been reported as forage crop in Saudi Arabia.

The increasing salinity in the irrigated soils is a serious agricultural problem in many parts of the world and is one of the limiting factors of the utilization of many lands. Tissue culture technique has been used to develop NaCl salt tolerant cell line in oat, rice, tobacco, alfalfa and flax (Nabors *et al*., 1982; Nabors and Dykes, 1985; McCoy, 1987; McHughen, 1987). This technique provide a controlled condition for a faster indications of plant response to factors under study.

Considering the importance of *Leptochloa fusca* as a salt tolerant forage crop, a complex of studies on ears growth behavior were carried out. In the fields we considered evaluating us response to climatic conditions of central region, present investigation was under taken to examine its response to different concentration of salt eontaireng media on germination, mortality, seedling growth, wet and dry weight of *in vitro* cultured seeds. In this paper, partial observations and results of this on going study is presented.

Materials and Methods

Field trial: The seeds of Kallar grass (*Leptochloa fusca* L.) were sorted with thanks from Nuclear Institute for Agriculture and Biology, Faisalabad, Pakistan. The experimental work was carried out at KACST experimental station at Mirzahmiate A primary study on Kallar crass germination and growth under growth rooms conditions was carried out (Al-Khalifah and Al-Tahir, 1999). Seede and stern cuttings were then used from this strew, they were cultured in pots in shaded green house and in the field surrounding newly cultivated Date palm trees, observations on the growth behavior of the grass under such conditions were recorded including shoot length, fresh and dry weight and chlorophyll contents following the method of Moran (1982).

***In vitro* study**

Surface sterilization: Due to heavy contamination associated with the use of apical and lateral buds as explants, seeds were used as a source of expiants. Seeds were soaked in distilled water for 12 hours and then surface sterilized with 1.0% Sodium hypochor for 20 minutes followed by 4 to 5 times rinsing with sterilizerd distilled water. Seeds were then allowed to germinate on Murashige and Skoog (1962) basal media without growth regulators. The media pH was adjusted to 5.6. Cultures were incubated at 25°C ± 1 under light intensity of 45 µmol m_1^{12} s_1^{11} (12 hours photoperiod) provided by warm white florescent tubes. Plants were raised *in vitro* were used as source Jr explants. The expiants were then used without sterilization for salinity study.

Nutrient Media: Media includes micro arid rniiucro elements or (Murashige and Skoog, 1962). Vitamins (Nitsch and Nitsch, 1969) glycine, Adenine sulfate. NA.A., gibbereitic acid BAP activated and charcoal and sugar. The pH of the media was adjusted to 5.6 and solidified with 0.7% agar.

Cuttings two stem case having menstern were cultured in ineorum to proclucie multiple shoots and roots.

For the salinity study, the media was additionally supplemented with sodium chloride salt (NaCl) at a concentration of 30 mM, 60 mM and 90 mM. The effect of different concentrations of NaCl was compared with that of control (0.0 mM, NaCl).

Twelve replicates (jars) were arranged in CRD design and used for each treatment. Approximately 120 seeds were used for each treatment. Parameters of the *in vitro* observations were; germination percentage, seedling growth as seedling height on 7,14 and 21 days period after initial culture, and fresh and dry weight were estimated. To estimate the fresh and dry weight, the plants were washed with tap water followed by distilled water to remove agar. All the samples were dried with blotting sheets and weighed separately. The samples were dried in dry oven at 80°C for 24 hours and weighed separately.

Results and Discussion

Field trial: In both the green house and the field, the stem cuttings of Kallar grass performed good growth. In the green house, however, plants in small pots seems to be inhibited, and appeared to be short with maximum 50 cm shoot length, where in large pots plants reached 120 cm shoot length (Fig. 1) and were able to produce lateral shoots and seed heads. Due to low light intensity in the green house, maximum (370 Lux), plants seemed to be stressed, turning yellow, but when transferred to the open field, they were able to regenerate from lateral buds. On the other hand, plants cultivated in the open field, maximum (950 Lux) showed excellent growth with shoot length of up to 150 cm and many seed heads (Fig. 2) with dark green color, which appears from" the chlorophyll quantity for grasses in the field and green house (Table 1). Plants continued to be green all round the year with extensive lateral shoot production. Fresh and dry weight of fully expanded shoots and shoot length was recorded (Table 1).

Table 1: Growth behavior of *Leptochloa fusca* L. growing in the open field and in greenhouse. (n= 10)

Parameter	Shoot length cm	Fresh weight g/stem	Dry weight g/stem	Chlorophyll contents mg/g
Field plants	121.8	7.91	3.00	163.2
Greenhouse plants	97.6	5.44	2.41	84.4
LSD	19.6**	0.13**	0.06**	0.34**

The growth of Kallar grass in the open field conditions of the central region of Saudi Arabia show that such conditions are significantly suitable and optimum for its growth. This performance makes planting Kellar grass surrounding newly cultivated date palm trees beneficial in utilizing the irrigation water applied to date palm trees and in mean time a mean of protection of the trees against extremes of the environmental conditions besides its benefit as a forage crop as described by Mahmood *et al*. (1995).

***In vitro* study:** Germination of seeds started on third day of the initial culture in control, 30 mM and 60 mM NaCl. Treatments and forth day in 90 mM NaCl treatment. Germination % of the was clearly low and differ among the treatments (Table 2). The difference in germination % at *in vitro* conditions between the control

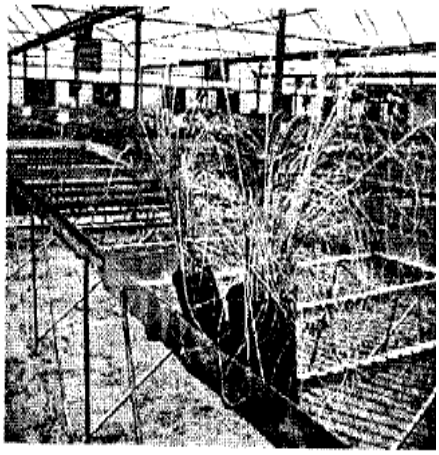

Fig. 1: Kallar grass growth performance under green house shaded conditions

Fig. 2: Kallar grass in the open field, performing excellent growth

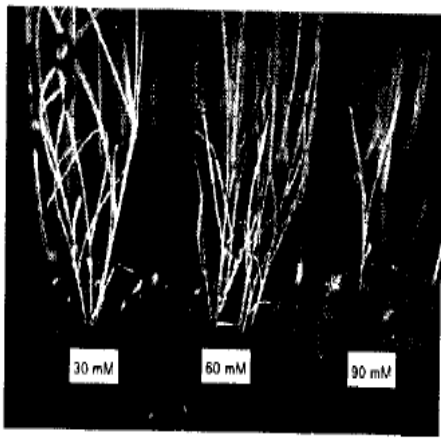

Fig. 3: Kellar grass performance at in *vitro* conditions as affected by different NaCl concentrations

Table 2: Germination trend of *Leptochloa fusca* L. treated with different salinity concentrations

Treatment	Cultured seeds	Germinated seeds	Gerrnination%
Control	138	46	33.33
30 mM	119	25	21.00
60 mM	137	32	23.36
90 mM	129	14	10.85

and 90 mM is limited to the effect of the increase of salinity, this indicate that even being salt tolerance, Kallar grass seeds germination is limited by salinity.

The effect of different concentration of NaCl on mean seedling height is given in Table 3. There was a corresponding decrease in the mean seedling heights with the increase in concentration of NaCl (Fig. 3). This effect became clear with the time, but it did not come to the full inhibition of the growth. This response of salt tolerance of Kallar grass to *in vitro* salinity of 90 mM indicate that the plant can tolerate to be irrigated with saline irrigation water in some areas of the central region which reach up to 5000 mg/L.

Table 3: Effect of salinity on shoot elongation of *Leptochloa fusca* L. at different stages of growth. (n = 12)

Treatment	Seedling height on 7tn day of culture (cm)	Seedling height on 14th day of culture (cm)	Seedling height on 14th day of culture (cm)
Control	3.50	5. 52	8.30
30 mM	1.87	3. 94	6.38
60 mM	2.68	2. 47	3.48
90 mM	0.74	1. 39	2.20

LSD for salinity treatments = 0.97** at P = 0.05
LSD for time factor = 0.31** at P = 0.05

The *in vitro* mass production of Kallar grass was significantly decreased with the increase of the salt concentration (Table 4).

Table 4: Fresh ana dry weight of *Leptochloa fusca* L. plants developed *in vitro* using different concentrations of NaCl. (n = 12)

Treatment	Fresh weight (mg/jar)	Dry weight (mg/jar)	Dry weight %
Control	1721 a	244.8 a	14.2
30 mM	1000b	182.0b	18.2
60 mM	560 c	90.2 c	16.1
90 mM	65d	16.2d	28.9
LSD P =0.05	2.03**	4.38**	

This performance of the grass may indicate that Kallar grass is may be tolerating the salty conditions by escaping but not resisting as at *in vitro* conditions the plant dose not have the mechanism that allow it to resist the salts as it do when cultivated in soil by the mechanism of establishing deep roots as reported by Qadir *et al.* (1996).

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