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# RESPONSE OF WHEAT TO NITROGEN APPLICATION GROWN UNDER SALINE CONDITIONS

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A study was undertaken in solution culture to investigate the performance of two wheat cultivars LU-26S and Pak-81 grown under different salinities (ECe O. 7.5 and 15 dSm$^{-1}$) and varying levels of N (0. 50. 100 and 150 kg ha$^{-1}$). The results showed that LU-26S at ECe 15 dSm$^{-1}$ performed better than Pak-81. Of the different N levels used. application of 100 kg N ha$^{-1}$ proved to be the most suitable one. This was attributed to a significant increase in tillering, spike length. 100-grain weight and grain yield per plant. However. at the highest levels of salinity (15 dSm$^{-1}$) and N application (150 kg ha$^{-1}$) tillering, grain weight and grain yield decreased significantly.

Key words: nitrogen application. response of wheat, saline conditions

## INTRODUCTION

Salinity is a serious constraint to increasing crop yields and is a threat to irrigated agriculture. In Pakistan. of 16.13 x 10$^6$ hectares irrigated land (Economic Survey. 1996-97) about 6.3 x 10$^6$ hectares are in the grip of salinity and sodicity (Khan. 1993). During recent years. wheat on average is grown on 8.m~ x 10$^6$ hectares including marginal lands classified as slightly to moderately salt-affected soils (Economic Survey. 1996-(7). Wheat production potential in Pakistan is not being exploited fully due to many factors. among which salinity and drought are the most important (Vaadia, 1985). In addition to Other soil and crop management practices. fertilizer management has been emphasized by many researchers to be a practical approach in alleviating the effects of salinity on agricultural crops (Bernstein *et al*.. 1974; Peters. 1983 and Feigin, 1985). Increased dry matter production and grain yield were reported in many field crops grown on salt-affected soils due to N application (Masood, 1987 and Yadav, 1988). In contradiction to positive effect of N application. antagonistic effects were also observed by Peters (1983) when excessive N was applied under highly saline situation. The present study was. therefore, conducted to determine a suitable level of N for wheat to be grown under saline conditions.

## MATERIALS AND METHODS

Treatments:

A. Varieties
- $V_1$ = LU-26S
- $V_2$ = Pak-81

B. Salinities
- $S_1$ = Control
- $S_2$ = ECe 7.5 dSm$^{-1}$
- $S_3$ = ECe 15 dSm$^{-1}$

C. N levels
- $N_0$ = Control
- $N_1$ = 50 kg N ha$^{-1}$
- $N_2$ = 100 kg N ha$^{-1}$
- $N_3$ = 150 kg N ha$^{-1}$

| | | |
|---|---|---|
| Design | = | Split-split plot |
| Replications | = | Three |
| Growth medium | = | Solution culture |
| Basal dose of P | = | 75 kg $P_2O_5$ ha$^{-1}$ |
| Source of fertilizer | = | Amm. sulphate (21 % N)<br>Single super phosphate (18% $P_2O_5$) |

Experimental Procedure: Seedlings of two wheat varieties (LU-26S and Pak-81) were raised on sandbed in a nethouse. Ten days old seedlings were transferred to foam-plugged holes in the polystyrene sheets placed on brick and cement made tanks filled with water. There were 32 seedlings i.e. sixteen for LU-26S and sixteen for Pak-81 in each tank arranged in four rows of eight plants each. Then half strength Hoagland medium was added to each tank and the seedlings were kept for seven days in aerated growth medium. An electric pump was used for aeration of the growth medium throughout the crop growth period. Seven days after seedling transfer, the solution was changed and the tanks were refilled with fresh water + half strength Hoagland medium. To these tanks salt solution (NaCl : $CaCl_2$ = 20: 1 on molecular weight basis) with a daily increment of 25 mol m$^{-3}$ was added till the desired salinity levels were achieved in different treatments except control. Then 1/2 of N along with full P were added in the form of Amm. sulphate and single super phosphate in each tank as per treatment. The remaining N was applied 15 days after this application. Later on the solution in the tanks was changed at an interval of about 15 days and with each change full salinity level was created in one single dose (except control). Full strength Hoagland nutrient solution was applied after two weeks interval until harvest of the crop. After 30 days of seedling transfer. fully expanded and disease free penultimate leaves were removed from three randomly selected plants in each treatment for determining foliar ionic composition. At maturity. when the crop was harvested. the data on different growth and yield contributing parameters were recorded. The data were analysed using analysis of variance technique and LSD test at 5% probability was applied to test the significance of the treatment means (Steel and Torrie. 1984).

## RESUL TS AND DISCUSSION

LU-26S produced significantly more fertile tillers per plant than that of Pak-81 (Table I). Salinity x nitrogen rate interactions were significant.. Salinity decreased number of fertile tillers per plant. This effect was more pronounced with no nitrogen (Nu) and when the plants were grown at the highest level of salinity (150 mol m'· NaCI), and nitrogen rate of 150 kg ha ı (N,).

The data in Table I showed that both varieties produced almost similar plant height.. However. a significant interaction between salinity and nitrogen showed that the application of 50 and 100 kg N ha I increased plant height over no nitrogen at all the salinity levels. The plant height. however. decreased at higher nitrogen level (150 kg N ha') which in turn was at par with $S,N_0$ where plants were grown at ISO mol m' NaCl without nitrogen.

The variety Pak-81 required significantly more time (100. I days) to caring than LU-26S (94.6 days). Various salinity x nitrogen rate combinations differed significantly from one another.. Increased salinity induced early earing at all rates of N. Minimum number of days (94.0) for earing were taken in treatment S,N", whereas maximum period (99.8 days) for caring was recorded in SuN", where plants were grown at no salinity but treated with the highest level of N (150 kg N ha'). In general, nitrogen application significantly delayed earing over control.

The data in Table I further showed that LU-26S produced significantly larger spikes (9.4 cm) than Pak-81 (8.0 cm). Salinity level of 150 mol m' NaCl significantly decreased spike length and 100 kg N ha' produced significantly longer spikes than control.. The variety LU-26S produced significantly higher weight per 100 grains than Pak-81. Salinity caused a progressive decrease in lOO-grain weight but N application increased it progressively. Maximum lOO-grain weight (4.6 g) was recorded in SoN, treatment, whereas the minimum (1.2 g) was noticed in $S,N_0$ treatment where the plants were grown at 150 mol m' NaCl without nitrogen.

The data in Table I also indicated that LU-26S gave significantly more grain yield per plant (2.5 g) than Pak-81 (1.7 g). Increasing salinity caused a significant decrease in grain yield per plant but N application improved the situation. The application of 50 kg N ha' at So produced the maximum grain yield per plant (4.9 g) but at salinity levels SI and S", 100 kg N ha ı produced significantly higher grain yield per plant than that with other treatments.

Pak-81 had significantly higher level of Na+ (111.8 m mol kg ı) than that of LU-26S (68.6 m mol kg'). Leaf Na' contents increased with increasing salinity. However, increasing N in the growth medium caused a decrease in leaf Na' contents'. The application of 100 kg N ha ı decreased $Na^T$ contents in leaves both at SI and S, levels of salinity. Maximum leaf Na" content (234.3 m mol kg') was recorded in $S,N_0$ treatment, whereas minimum Na+ contents (9.6 m mol kg') were found in SoNı when plants were grown without salinity and treated with 50 kg N ha"'.

Pak-81 showed significantly higher leaf KT contents than LU-26S. Higher salinity (S,) decreased K+ contents hut N application significantly increased leaf K' contents. Plants grown at no salinity in combination WIth 50 or 100 kg N ha ı produced significantly higher KT in leaves.

Keeping in view overall performance of varieties, LU-26S was found to be more salt tolerant. Similar trend was also established by Qureshi and Rashid (1988) through screening of about 700 varieties of wheat grown in a saline medium. Increasing salinity in the growth medium affected most of the plant parameters adversely. Suppression of these parameters at higher salinity was also observed earlier (Jodav *et al.,* 1976; Qureshi *et al.,* 1980 and Rawson, 1986).

Salinity-fertility relationships are of great economic importance which have been the subject of many greenhouse and field studies (Kafkafi, 1984). It was observed that in addition to other agronomic practices, successful crop production on salt- affected soils demanded for judicious use of nutrients particularly nitrogen (Patel *et al.,* 1986 and Aslam *et al.,* 1989). The application of higher dose of N i.e. 150 kg ha' seemed to be less effective in improving crop salt tolerance; it rather showed antagonistic effects on different plant parameters when applied to the medium containing a higher level of salinity (ISO mol m'· NaCI). Suppression of growth due to interactive effect of higher salinity and high N was also reported by Peters (1983).

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Table 1. [illegible]

| Treatments | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
|---|---|---|---|---|---|---|---|---|
| Varieties | | | | | | | | |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| LSD | [illegible] | [illegible] | [illegible] | 1.1 | [illegible] | [illegible] | [illegible] | [illegible] |
| Salinity × N rate | | | | | | | | |
| $S_0$ $N_0$ | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| $N_1$ | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| $N_2$ | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| $N_3$ | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| $S_1$ $N_0$ | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 10 | [illegible] | [illegible] |
| $N_1$ | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| $N_2$ | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| $N_3$ | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| $S_2$ $N_0$ | [illegible] | [illegible] | [illegible] | [illegible] | 1.12 | [illegible] | [illegible] | [illegible] |
| $N_1$ | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | 1.1 | [illegible] | [illegible] |
| $N_2$ | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| $N_3$ | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| LSD | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

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