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# YIELD RESPONSE OF ELEVEN VARIETIES OF WHEAT TO IRRIGATION REGIMES

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**Abstract.** The yield response of 11 varieties of wheat (6 varieties imported from Mexico, *viz.*, Cajema, Jupateco, Nuri, Potam, Torim, Yeccora ; and 5 local varieties, *viz.*, Barani-70, Maintenance 157, Mexi-Pak-65, Pak-70, T-J. 75,) to four irrigation regimes (0, 7.5, 15.0, 22.5 cm water) was studied in the field. Among the newly introduced varieties Nuri and Jupateco gave the highest yields. Nuri yielded best under low and Jupateco under high irrigation.

Wheat is not a heavy user of water and is therefore grown extensively in semi-arid and arid regions of the world.[1] Nevertheless, it responds well to irrigation water when moisture deficiency occurs. As the water supply in many regions of the country is limited, the economic use of water is of vital importance to wheat growers. The problem of water shortage is becoming more serious as the area under cultivation is increasing throughout the world. This problem can be solved partly by growing varieties that requireless water.

The objective of this experiment was to determine the relative adaptation of eleven varieties of wheat to various moisture regimes.

## Materials and Methods

Eleven varieties of wheat were grown in the field under four irrigation regimes. Six newly introduced varieties, namely, Cajeme, Jupateco, Nuri, Potam, Torim and Yeocora, that were evolved at CIMMYT, Mexico ; and five varieties, namely, Barani-70, Maintenance-157, Mexi-Pak-65, Pak-70 and T. J. 75, that already exist in Pakistan, were included in this study.

The irrigation treatments were : (1) no irrigation after germination, (2) one irrigation applied at tillering stage, (3) two irrigations applied at tillering and boot stage and (4) three irrigations applied at the tillering, boot and dough stage. One irrigation was applied to all treatments for seed bed preparation. In each irrigation 7.5 cm water was applied.

The treatments were arranged in a split plot design with irrigation as the main plots and varieties as sub-plots. Each treatment was replicated five times. The individual sub-plot was $2 \times 10$ m with 10 rows of wheat plants. The crop received 150 kg N/ha and 40 kg P/ha. The crop was flood irrigated with canal water. Observations on yield components, e.g. the number of tillers per metre length, the number of filled heads, the number of kernels per spike, etc. were recorded. An area of $\times 1.5$ m was harvested for grain yield.

Soil samples were taken before irrigating the crop to determine the moisture content gravimetrically every 15 cm down to a depth of 90 cm (Table 1).

TABLE 1. WATER CONTENT (% BY VOLUME) IN SOIL AT DIFFERENT STAGES OF WHEAT UNDER VARIOUS IRRIGATION REGIMES (SOIL SAMPLES TAKEN BEFORE EACH IRRIGATION)

| Depth (cm) | Irrigation treatments (cm water applied) | | | |
|---|---|---|---|---|
| | 0 | 7.5 | 15.0 | 22.5 |
| | Seeding | | | |
| 0-15 | 11.5 | 12.0 | 11.4 | 11.1 |
| 15-30 | 25.4 | 26.0 | 25.5 | 25.2 |
| 30-45 | 25.6 | 25.4 | 24.9 | 24.5 |
| 45-60 | 24.6 | 24.2 | 24.4 | 24.3 |
| 60-75 | 24.0 | 24.4 | 23.9 | 24.6 |
| 75-90 | 24.0 | 24.5 | 24.3 | 24.1 |
| | Tillering stage | | | |
| 0-15 | 8.2 | 8.5 | 8.0 | 8.0 |
| 15-30 | 20.4 | 20.0 | 20.4 | 20.5 |
| 30-45 | 21.4 | 21.6 | 21.3 | 21.7 |
| 45-60 | 22.2 | 22.2 | 22.0 | 22.6 |
| 60-75 | 21.9 | 21.9 | 22.0 | 22.0 |
| 75-90 | 23.3 | 23.0 | 22.9 | 23.2 |
| | Boot stage | | | |
| 0-15 | 6.0 | 7.8 | 8.0 | 8.1 |
| 15-30 | 9.2 | 15.0 | 14.8 | 15.4 |
| 30-45 | 14.6 | 18.0 | 17.9 | 18.2 |
| 45-60 | 16.0 | 21.8 | 21.0 | 22.6 |
| 60-75 | 17.9 | 23.8 | 22.9 | 23.2 |
| 75-90 | 19.2 | 23.4 | 23.4 | 23.5 |
| | Dough stage | | | |
| 0-15 | 4.9 | 5.4 | 6.9 | 6.8 |
| 15-30 | 6.9 | 7.6 | 12.0 | 12.5 |
| 30-45 | 9.0 | 11.5 | 13.0 | 13.9 |
| 45-60 | 11.5 | 14.8 | 17.0 | 17.5 |
| 60-75 | 16.7 | 18.0 | 18.9 | 19.0 |
| 75-90 | 18.0 | 20.0 | 21.5 | 22.0 |

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These data showed that water stress under no irrigations was 15 atm. or more during the growth of wheat.

## Results and Discussion

Irrigation levels showed profound effect on yield potential of wheat varieties. The Nuri variety produced the highest yield under complete moisture stress (Table 2, P=0.05). Irrigation increased yield

TABLE 2. EFFECT OF IRRIGATION REGIMES OF GRAIN YIELD (KG/HA) OF DIFFERENT VARIETIES OF WHEAT

| Varieties | Irrigation regimes (cm) water applied | | | | Mean |
|---|---|---|---|---|---|
| | 0 | 7.5 | 15.0 | 22.5 | |
| Barani-70 | 1058 | 1518 | 1918 | 2458 | 1738 |
| Cajeme | 1062 | 1714 | 2146 | 2882 | 1950 |
| Jupateco | 1432 | 1700 | 2498 | 3506 | 2284 |
| Maintenance-157 | 1268 | 1824 | 2514 | 3046 | 2162 |
| Mexi-Pak-65 | 1286 | 2110 | 2454 | 3060 | 2216 |
| Nuri | 1852 | 2106 | 2526 | 3186 | 2418 |
| Pak-70 | 1428 | 1864 | 2366 | 3142 | 2200 |
| Potam | 1172 | 1764 | 2096 | 2856 | 1972 |
| T. J. 75 | 1264 | 2160 | 2666 | 3170 | 2314 |
| Torim | 1180 | 1588 | 2344 | 2892 | 2000 |
| Yeccora | 1168 | 1814 | 2404 | 2964 | 2086 |
| Mean | 1288 | 1832 | 2356 | 3010 | |

| | | |
|---|---|---|
| (1) LSD for two irrigation means | (.05) = | 144.30 |
| | (.01) = | 218.60 |
| (2) LSD for two variety means | (.05) = | 141.24 |
| | (.01) = | 185.64 |
| (3) LSD for two variety means in the same irrigation | (.05) = | 282.50 |
| | (.01) = | 371.28 |

of all varieties, each irrigation raising 500-600 kg grain/ha in various varieties. Jupateco gave the highest yield with three and T. J. 75 with two irrigations (P=0.05). The highest mean yield over the irrigations was obtained from the Nuri (P=0.05).

The results of this study indicated that wheat plants could produce grain even when subjected to moisture stress greater than 15 atm.[2] The magnitude of the stress to which wheat may be subjected was also shown by Haise *et al.*[3] in their study where the moisture content of the soil in which roots were well disseminated was greater than 26 atm, The grain yield was, however, adversely affected because the moisture stress apparently resulted in fewer tillers, fewer heads, fewer spikelets per spike and fewer kernels per spikelet.[4,5] The varieties tested in this study differed in their adaptability to moisture stress. Nuri proved to be adaptable to high moisture stress and Barani-70 (the variety grown in Barani area) appeared to be the least adaptable to high moisture stress. The ability of Nuri to withstand high stress could be due to its root system which enables it to absorb moisture from deeper soil layers. The varietal differences that are responsible for their ability to withstand moisture stress need be investigated before any definite conclusion is drawn.

The results showed that among the newly introduced varieties, Nuri is promising with respect to grain yield in areas with short water supply and Jupateco for areas with adequate water supply. These preliminary results suggest that there is a great scope for the economic use of limited water supply for higher wheat grain production. Further studies involving the effect of soil, moisture, stress and microclimate on the growth of, and nutrient uptake by wheat are needed for final evaluation.

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