ABSTRACT

The productive efficiency of an improved barley cultivar against local variety was studied with different levels of NP fertilizer including 0-0, 30-20, 60-40 and 90-60 kg ha⁻¹ during 2004 - 05 at Arid Zone Research Institute, D.I. Khan. The data showed that an improved variety ‘Zarghoon’ performed better than the local variety. Different levels of fertilizers also increased the yield and yield components of barley compared to control condition. The data revealed that highest grain yield of 3100 kg ha⁻¹ was obtained from Zarghoon variety with fertilizer level of 90-60 kg NP ha⁻¹ showing non-significant difference with 3093 kg ha⁻¹ yield obtained from the same variety with 60-40 kg ha⁻¹. Maximum grain yield (1187 kg ha⁻¹) was obtained from local variety without fertilizer application. Results suggested that newly introducing variety ‘Zarghoon’ was more responsive to fertilizer application than the local. Thus, it can be recommended that improved variety with optimum level of fertilizer (60-40 kg ha⁻¹) can be grown by the farmers to increase their yield by 160% in climatic condition of D.I. Khan, Pakistan.

Key Words: Barley (Hordeum vulgare L.); Varieties; Fertilizer levels; Grain yield; Pakistan

INTRODUCTION

Barley (Hordeum vulgare L.) is multipurpose winter crop grown on an area of 89.9 thousand hectares with a production of 87.5 thousand tones in Pakistan during 2005-06 (Anonymous, 2006). Its grain is consumed as food by poor masses as well cattle feed. In irrigated areas, barley is also used as a companion crop with Lucerne for fodder (Arnon, 1972). The introduction of a superior variety may accomplish the same objectives as the evaluation of a superior variety through breeding programs. Newly introduced variety may excel the out dated local variety in terms of increased yield per unit area. Similarly, fertilizer plays an important role among the environmental influences on crop production. Research workers have reported differential responses of different genotypes to fertilizers application. Aslam et al. (2000) found maximum grain yield of barley 2995 kg ha⁻¹ was harvested from 69.69 N P₂O₅ kg ha⁻¹ treatment and the lowest grain yield of 507 kg ha⁻¹, was obtained from control treatment. Turk et al. (2003) obtained the highest grain yield of barley under 120 kg N ha⁻¹ among N rates owing to the highest numbers of spikes m⁻² (537.5), spike length (7.5 cm) and number of grains per spike (56.3), though it had the lowest 1000 seed weight. Dogar (1983) reported that the yield and yield components of wheat genotypes significantly increased by the application of fertilizer. He further observed that different wheat genotypes showed differential response to nitrogen-grain and cost benefit ratio. Similarly, many other studies indicated that the application of NP fertilizer significantly increased the yield of different crops compared to control condition (Gill et al., 2001; Ahmad et al., 2003).

Several factors responsible for low yield are poor soil, out dated varieties and lack of modern technologies used for cropping. The use of suitable fertilizers in appropriate doses is considered one of the most important factors for increased yield of crop per unit area. Zia et al. (1991) indicated that the use of correct fertilizer can increase yield up to 50% in Pakistan. Ahmad and Rashid (2004) reported that the application of recommended level of NPK significantly increased the yield of wheat by 224% over control (1302 kg ha⁻¹). Similarly, Imran et al. (2005) found that NPK fertilizer dose of 160-80-50 kg ha⁻¹ gave the maximum grain wheat yield but increased fertilizer more than this level decreased yield as well as its contributing characters like plant height, tillers plant⁻¹, spikes plant⁻¹ and spike length.

In light of importance of the high yielding crop varieties and fertilizer use, this study was undertaken to determine the comparative effect of different varieties and fertilizer levels on the yield of barley.

MATERIALS AND METHODS

In this study two different varieties of barley viz; Zarghoon (VI) and Local (V2) were grown with four different levels of NP fertilizer at the Arid Zone Research Institute, D.I. Khan during 2004 - 05. The fertilizer levels T₁ (0), T₂ (30-20), T₃ (60-40) and T₄ (90-60) NP kg ha⁻¹ were applied at the time of land preparation before sowing. The trial was laid out in a split plot design with three replications. Varieties were kept in main plot and fertilizer levels in sub-plots. A plot size of 5 x 1.8 m keeping six (6) rows 30 cm apart was maintained. Physico-chemical properties of composite soil taken from the experimental...
The results of analysis indicated the pH value of (8.2), electrical conductivity (1.9 dS m⁻¹), organic matter (0.40%), extractable P (7.2 mg kg⁻¹), extractable K (101.0 mg kg⁻¹) with clayey textural class. During the growing season the minimum air temperature ranged from 4 to 19°C and maximum temperature ranged from 19 to 30°C from October 2004 to April 2005, respectively. The total rainfall of (182 mm) was recorded during the season but the maximum (68 & 54 mm) rainfall occurred during the months of January and February, respectively. Common cultural practices like weeding etc were carried out uniformly throughout the growing season. At physiological maturity of the crop, yield components data on plant height, tillers plant⁻¹, days to maturity and spike length were recorded. The samples harvested for grain yield were sun dried and threshed. The data were subjected to ANOVA and the treatments means were compared by LSD at 5% level of probability (Steel & Torrie, 1984).

RESULTS

Data recorded on the yield components showed that the response of both the barley varieties to different levels of fertilizer was highly significant (Table I). Plant height data showed significant variation between the treatment means of different varieties. The plants of local variety were significantly taller than Zarghoon. The plant height was linearly increased with increasing level of fertilizer. Maximum plant height of 110.9 cm was recorded in the treatment of 90-60 NP kg ha⁻¹ as against 80.57 cm in control condition. The interaction between varieties and fertilizer levels was present wherein the plants of local variety were significantly taller (115.9 cm) with NP fertilizer of 90-60 kg ha⁻¹ as compared to all other treatments of combination under study. The data on days to maturity also varied statistically. Local variety took more days (160.3) than Zarghoon matured in 150.8 days. This late maturity of local variety might be due to the genetic characteristics of local variety. Application of NP fertilizer also improved the maturity period of crop. Plants received 90-60- kg NP ha⁻¹ fertilizer took more days to maturity significantly as compared to control and other level of fertilizer. This might be due to fertilizer effect on the vegetative growth of barley, which ultimately delayed maturity of the crop. The interacting effect of varieties and fertilizer levels was significant for this attribute. Local variety receiving 90-60 NP kg ha⁻¹ took more days (161.3) to maturity closely followed by the same variety (local) with 60-40 NP kg ha⁻¹ showing no difference to each other. All other treatments took significantly less days to maturity of the crop.

Number of tillers plant⁻¹ of both the varieties was significantly increased by the application of fertilizer (Table I), whilst Zarghoon produced greater number of tillers plant⁻¹ than the local variety. This might be due to an improved tillering capacity of Zarghoon. NP fertilizer levels also significantly improved the tillering of crop. Number of tillers plant⁻¹ linearly increased with increasing level of fertilizer. The difference between the treatment means of tillers plant⁻¹ produced by 60-40 and 90-60 kg ha⁻¹ was not much different between the varieties to each other and showed 74 and 78% increase over control treatment having 2.23 tillers plant⁻¹. The interaction between varieties and fertilizer levels was however significant. Zarghoon variety received 60-40 and 90-60 kg ha⁻¹ fertilizer produced significantly more number of tillers plant⁻¹ than the rest of treatments combination. Local variety without fertilizer produced minimum number of tillers plant i.e., 2.07. The spike length of both the varieties was also significantly improved by the application of fertilizer. Spike length (7.51 cm) of Zarghoon variety was significantly greater than the spike length of local variety. The spike length was linearly increased with increasing level of fertilizer. Maximum spike length of 7.93 cm was recorded in the treatment received 90-60 NP kg ha⁻¹ showing non-significant difference with 7.75 cm spike length in the treatment of 60-40 NP kg ha⁻¹. Minimum spike length of 6.46 cm was recorded in the
treatment received zero fertilizer (Table I). The data on grain yield of barley showed that by increasing the fertilizer levels, grain yield of both the varieties increased significantly (Table II). Zarghoon variety producing 2697 kg ha\(^{-1}\) grain yield surpassed the local variety by 42%. This increase might be attributed to the maximum tillering capacity and increased spike length of Zarghoon variety compared to local variety. The grain yield data as influenced by fertilizer levels ranged from 1613 kg ha\(^{-1}\) to 2692 kg ha\(^{-1}\). The difference between the grain yield by the application of 60-40 and 90-60 NP kg ha\(^{-1}\) was non-significant. Therefore, 60-40 NP kg ha\(^{-1}\) might be the optimum level for producing potential yield of barley, because the higher fertilizer dose, showed lodging leading to loss of grain yield. Highest grain yield of 3100 kg ha\(^{-1}\) was produced by Zarghoon variety with 90-60 kg ha\(^{-1}\) NP closely followed by 3093 kg ha\(^{-1}\) obtained from the same variety with 60-40 kg ha\(^{-1}\) NP fertilizer. This showed that the newly introduced variety ‘Zarghoon’ responded efficiently to the NP fertilizer compared to local variety. Minimum grain yield of 1187 kg ha\(^{-1}\) was recorded by local variety without fertilizer.

**DISCUSSION**

Barley lower cost of cultivation and low inputs demand helps in its preference by the farmers of arid and semi-arid regions (Singh et al., 2003). The major constraints limiting barley production is poor fertility status of coarse textured sandy soils coupled with imbalanced nutrition. The easiest way to boost the productivity is through balanced fertilization to the undernourished crop (Chaudhary et al., 2002). The results of this investigation revealed that comparison of an improved variety “Zarghoon” with local variety under varying levels of fertilizers indicated significant effect of fertilizer on the yield components and grain yield of both the cultivars. Zarghoon variety of barley produced significantly (P ≤ 0.05) more grain yield than local variety, wherein this increase in grain yield might be attributed to the tillering capacity and spike length of Zarghoon variety. These results are in harmony with Ali et al. (1984) who reported positive correlation of tillers plant\(^{-1}\) with grain yield of wheat. Thus, the local variety can be replaced by Zarghoon variety to increase barley production in climatic conditions of D.I. Khan. These results are in agreement with the findings of Yaqoob et al. (2005) and Bashir et al. (2006) who developed lentil and chickpea varieties through selection.

Improvement in barley yield with fertilizer application can be attributed to the stimulating effects of nutrients on plant growth that provides ideal condition for crop as the fertilizer N supply mineral N to plants they need (FAO, 1998), which ultimately increased the grain yield of crop. These results are in line accordance with the achievements of Ahmad et al. (2003), Ahmad and Rashid (2004) and Imran et al. (2005). Results suggested that an introduction of high yielding crop variety with balanced application of NP fertilizer can be recommended to the end users.

**CONCLUSION**

Both the varieties differed significantly for their growth and nutrients utilization at different levels of fertilizer application. An improved variety “Zarghoon” responded more efficiently to fertilizer than local variety. Thus, it can be concluded that the farmers can adopt improved varieties of barley with appropriate dose of fertilizer (60-40 kg ha\(^{-1}\)) application to increase their yield by 160% in prevailing condition of D.I. Khan, Pakistan.

**REFERENCES**

Ahmad, N. and M. Rashid, 2004. *Fertilizer use in Pakistan*, p: 74. NFDC, Planning and Development Division, Islamabad


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