INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
ISSN Print: 1560–8530; ISSN Online: 1814–9596
07-108/AWB/2008/10–1–124–126
http://www.fspublishers.org

***Short Communication***

# Comparative Effect of Varieties and Fertilizer Levels on Barley (*Hordeum vulgare*)

ABDUR RASHID[1] AND RAHMAT ULLAH KHAN
*Arid Zone Research Institute (AZRI), Ratta Kulachi D.I. Khan, Pakistan*
[1]Corresponding author's e-mail: drrukhan@yahoo.com

## 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 messes 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 $P_2O_5$ 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 $T_1$ (0), $T_2$ (30-20), $T_3$ (60-40) and $T_4$ (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

**To cite this paper:** Rashid, A. and R.U. Khan, 2008. Comparative Effect of Varieties and Fertilizer Levels on Barley (*Hordeum vulgare* L.). *Int. J. Agri. Biol*., 10: 124–126

**Table I. Yield components data on barley as influenced by fertilizer**

| Fertilizer levels NP kg ha$^{-1}$ | Plant height (cm) | | | Days to heading | | | Spike length (cm) | | | Tillers plant$^{-1}$ | | | Days to maturity | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | V1 | V2 | Mean | V1 | V2 | Mean | V1 | V2 | Mean | V1 | V2 | Mean | V1 | V2 | Mean |
| 0-0 | 74.07 f | 87.07 e | 80.57 d | 112 d | 116 e | 114 c | 6.60 d | 6.33 d | 6.46 c | 2.40 e | 2.07 f | 2.23 c | 150 c | 159.2 e | 154.7 c |
| 30-20 | 86.20 e | 99.41 c | 92.80 c | 113 d | 118 b | 115 b | 7.37 c | 7.33 c | 7.35 b | 3.20 e | 2.77 d | 2.98 b | 150 e | 160.0 bc | 155.0 c |
| 60-40 | 95.33 d | 107.0 b | 101.2 b | 115 e | 120 a | 117 a | 7.90 ab | 7.60 bc | 7.75 a | 4.13 a | 3.63 b | 3.88 a | 151 de | 160.7 ab | 155.47 b |
| 90-60 | 105.9 b | 115.9 a | 110.9 a | 116 e | 121 a | 118 a | 8.17 a | 7.70 b | 7.93 a | 4.30 a | 3.67 b | 3.98 a | 152 d | 16.6 a | 156.7 a |
| Mean | 90.37 b | 102.3 a | - | 114 b | 119 a | - | 7.51 a | 7.24 b | - | 3.51 a | 3.03 b | | 150.8 b | 160.3 a | - |
| LSD | 7.145 | | 2.280 | 1.898 | | 1.027 | 0.2605 | | 0.2142 | 0.3239 | | 0.1949 | 5.282 | | 0.715 |
| LSD value inter action | 3.225 | | | 1.453 | | | 0.3030 | | | 0.2756 | | | 1.005 | | |

Means followed by same letters do not differ significantly at $P \leq 0.05$ . V1 = Zarghoon variety; V2 = Local variety

**Table II. Grain yield of barley varieties as influenced by fertilizer application**

| Fertilizer levels NP kg ha$^{-1}$ | Grain Yield (kg ha$^{-1}$) | | Mean |
|---|---|---|---|
| | V1 | V2 | |
| 0-0 | 2039 cd | 1187 e | 1613 e |
| 30-20 | 2557 b | 1842 d | 2200 b |
| 60-40 | 3093 a | 2269 bc | 2681 a |
| 90-60 | 3100 a | 2284 bc | 2692 a |
| Mean | 2697 a | 1895 | - |
| LSD | 106.8 | | 265.1 |
| LSD value interaction | 374.9 | | |

Means followed by same letters do not differ significantly at $P \leq 0.05$
V1 = Zarghoon variety
V2 = Local variety

site were determined as prescribed by Jackson (1962). The results of analysis indicated the pH value of (8.2), electrical conductivity (1.9 dSm$^{-1}$), 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$^0$C and maximum temperature ranged from 19 to 30$^0$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 he cultivars. Zarghoon variety of barley produced significantly ($P \leq 0.05$) 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 correlationship 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

Ahmad, S., F. Ahmad, Faridullah and M. Hussain, 2003. Effect of different NPK levels on the growth and yield of Kohlrabi (*Brassica canlorapa* L.) at Northern Areas of Pakistan. *Asian J. Pl. Sci*., 2: 336–8

Ali, L., A.R. Chaudry and A.H. Shah, 1984. Correlation between yield and yield component in wheat. *J. Agric. Res.*, 22: 279–83

Ali, J., J. Bakht, M. Shafi, S. Khan and W.A. Shah, 2002. Uptake of nitrogen as affected by various combinations of nitrogen and phosphorus. *Asian J. Pl. Sci*., 1: 367–9

Anonymous, 2006. *Agricultural Statistics of Pakistan*. Ministry of Food, Agriculture and Livestock, Government of Pakistan, Islamabad

Arnon, I., 1972. Barley crop management cropping sequences. *In*: *Crop Production in Dry Regions*, Vol. II, p: 81. Publisher: Leonard Hill, London

Aslam, K., M. Azam and M. Khan, 2000. Grain yield and economic effect of NP fertilizers application on dry land barley. *Pakistan J. Bio. Sci*., 3: 816–8

Bashir, A., M. Yaqoob and M. Rahim, 2006. Karak-2, a new high yielding variety of chickpea for rainfed ecologies of NWFP. *Indus J. Pl. Sci*., 5: 639–41

Chaudhary, A.K. and S.P. Majumdar, 2002. Effect of N and Zn application on uptake of P and K by barley in loamy sand soil. *Curr. Agric*., 26: 113–5

Dogar, A.A., 1983. Performance of some new wheat genotypes at various levels of nitrogen. *M.Sc. (Hons) Thesis.* University of Agriculture, Faisalabad

Food and Agriculture Organization, 1998. *Guide to Efficient Plant Nutrition Management*. Land and Water Development Division. FAO- Rome, Italy

Gill, K.H., S.J.A. Sherazi, J. Iqbal, A.A. Sheikh, M. Ramzan and M.K. Shaheen, 2001. Evaluation of different NP rates in maize in central and barani zone of the Punjab. *Pakistan J. Soil Sci*., 20: 81–5

Imran, M., Z.A. Somroo, M. Qamar and Z.A Gurmani, 2005. Effect of nitrogen and phosphorus on yield and yield contributing characteristics of wheat. *Sarhad J. Agric.*, 21: 651–3

Jackson, M.L., 1962. *Soil Chemical Analysis*, p: 497. Prentice Hall Inc. Englewood Clifts, New Jersy

Singh, S., G.S. Deol and S.K. Mann, 2003. Successful Cultivation of Barley. *Progressive Farming*, pp: 22–4

Steel, R.G.D. and J.H. Torrie, 1984. *Principles and Procedure of Statistics: A Biomaterical Approach*, 2nd edition. McGraw Hill Book company Inc., New York

Turk, M.A., A.M. Tawala, N. Samarah and Allataifeh, 2003. The response of awnless six row barley (*Hordeum vulgare* L.) to nitrogen fertilizer application and weed control methods in the absence of misture stress. *Pakistan J. Agron*., 2: 101–8

Yaqoob, M., M. Mansoor, Najibullah and Nasirudin, 2005. A high yielding lentil cultivar for rainfed ecologies of NWFP. *Indus J. Pl. Sci*., 4: 314–8

Zia, M.S., M.A. Gill, M. Aslam and M.F. Hussain, 1991. Fertilizer use efficiency in Pakistan. *Progressive Farming*, 11: 35–8


**(Received 31 May 2007; Accepted 03 September 2007)**