

## Effect of Fertilizers on Photosynthetic Productivity of Barley Varieties under Irrigated Condition

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**Abstract:** Field experiment was carried out to study the effects of fertilizers on photosynthetic potential of barley varieties under irrigated condition. Barley varieties were grown in three test conditions: controlled, with complex mineral ( $N_{120}P_{80}K_{80}$ ) and organic (manure  $20 t ha^{-1}$ ) fertilizers. Photosynthetic productivity indicator such as photosynthetic potential (Pp) was calculated by using leaf area index and growth rate of the each varieties. The correlation among photosynthetic potential of interest, yield was also analyzed. Results indicated that the photosynthetic potential of fertilized barley varieties had higher values than those of the varieties under the controlled (without fertilizer) condition. There was a significant correlation between photosynthetic productivity and yield of barley varieties.

**Keywords:** fertilizer, manure, photosynthetic potential, yield, irrigation.

### 1. INTRODUCTION

Mongolia features an extreme continental, semi-arid to arid climate with short, hot summers and long, cold winters. The effects of climate change are expected to worsen, bringing more droughts, heat waves, unreliable rainfall distribution and extreme weather events, all of which threaten food security and make agricultural production unpredictable. Water and nutrient (especially, nitrogen) deficiency are the main constraint for crop production in country because of the low precipitation (about 150-300 mm per year) and low level (no more  $10 kg ha^{-1}$ ) of fertilizer used. Irrigation and nutrient supply are considered to be the two environmental inputs that contribute most to crop productivity (lenka, et al., 2009; Wang et al., 2011). Enhancing food security and climate change adaptation requires an integrated water-nutrient management approach to improve the productivity and efficiency of food and feed crops. Photosynthesis is the primary physiological process that is affected by changes in growing conditions. Barley (*Hordeum vulgare L.*) is the second important cereal crop after wheat in Mongolia. To increase production it will be necessary to improve light conversion efficiency by increasing photosynthetic activities. The influence of fertilizers on barley under irrigated condition has attracted considerable interest. Therefore, the study was conducted to screen the high potential barley varieties with increasing photosynthetic productivity under integrated activities of agricultural technology.

### 2. MATERIALS AND METHODS

The experiment was conducted in the research field of the Division of Selection, Plant Science Research and Training Institute, Darkhan, Mongolia in 2011. The soil of the experimental field was silt loam with pH of 7.12. The organic matter 1.34%, available nutrients such as nitrate nitrogen ( $NO_3-N$ ) 2.67 ppm, phosphorus ( $P_2O_5$ ) 2.6 mg/100g, potassium ( $K_2O$ ) 9.6 mg/100g. The experiment was conducted in a randomized block design with 3 replications.

Ten varieties of barley were grown under 3 fertilized treatments (control,  $N_{120}P_{80}K_{80}$  and manure  $20 kg ha^{-1}$ ). Fertilizers were applied before sowing. Irrigation rate was  $350 m^3 ha^{-1}$  and irrigation frequency 10-15 days depending on rainfall. Each plot square  $9 m^2$ . Every replication plot was 7.5 m long and 1.2 m wide. 10 plants were selected from middle rows of each plot to measure the leaf area at each growing stage from germination to maturity. The photosynthetic potential of barley varieties was calculated from the leaf area values, by Nichiporovich A.A. The statistical analysis of the data was performed with Dospekhov.

### 3. RESULTS AND DISCUSSION

Photosynthesis convert light energy into chemical energy and has a major impact on crop productivity. The responses of photosynthetic potential (Pp) to fertilizers were studied under irrigated conditions in spring barley varieties leaves.

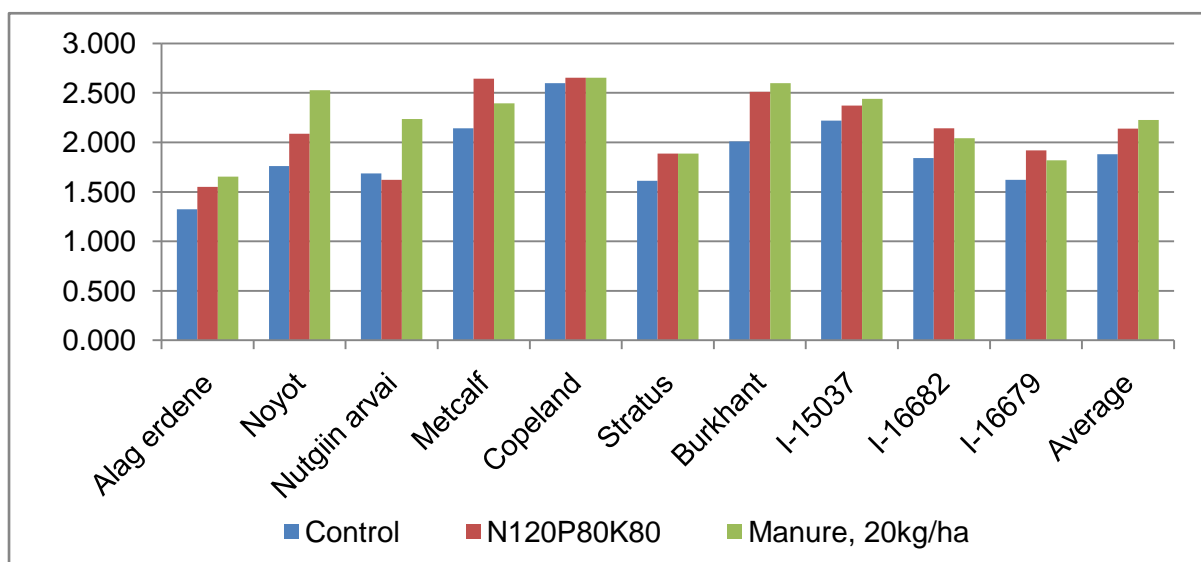


Figure1. The effect of fertilizers on photosynthetic potential of barley varieties

In 2011 the average value of photosynthetic potential (Pp) of barley in control 1.882 million m<sup>2</sup> ha<sup>-1</sup>, with mineral fertilizer 2.138 million m<sup>2</sup> ha<sup>-1</sup> and manure 2.226 million m<sup>2</sup> ha<sup>-2</sup>. The result showed, that the under irrigated condition the photosynthetic activities of barley increased by fertilizer application. Pp of barley varieties was increased 13% from complex mineral fertilizer and 18% from manure compared to unfertilized control. The highest value of Pp was obtained the Copeland variety at treatments with both fertilizers. Metcalf was more sensitive to mineral fertilizers, in the contrary Noyot to manure. Throughout the growing season in barley the positive correlations between leaf area index and photosynthetic potential (r=0.47). Photosynthesis is the foundation of crop yield production. A positive correlation (r=0.70) between grain yield and photosynthetic potential was observed in barley varieties.

#### 4. CONCLUSION

In general, complex mineral and organic fertilizers had positive effect on photosynthetic potential of barley varieties under irrigated condition. In 2011 the effect of manure was higher than mineral fertilizer on photosynthetic activities of barley. In addition, there was a positive correlation between Pp and grain yield of barley.

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