Evaluation of different levels of nitrogen fertilizer on maize (*zea mays l.*) Under balkh province climate

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Abstract: - In order to study the effects of nitrogen levels on yield and yield components in maize, a split plot experiment based on randomized complete block design with three replications was conducted in 2019 at the Agricultural Research Farm of Agriculture Faculty, Balkh University. Treatments were arranged in a split plot design with three replicates. Nitrogen levels (0, 80, 160 and 240 kg ha-1). Results indicated that nitrogen levels had significant effects on yield and yield components in maize hybrids. The highest grain yield was obtained from the highest levels of nitrogen fertilizer. The highest number of kernel per ear, the number of grains per ear row, ear diameter, cob length, grain per plant and plant height were recorded at the highest levels of nitrogen fertilizer. Maximum grain yield (7.76 ton/ha) was obtained in the plots with 240 kg ha^{-1} amount of Nitrogen and minimum of it (5.12 ton/ha) was obtained in the plots with 0 kg nitrogen ha-1. It can be suggested that 240 kg ha-1 amount of Nitrogen should be applied.

Key-Words: - Nitrogen, Fertilizer, Urea, *Zea mays*, Yield & Yield components.

1 Introduction:

Zea mays L. is one of the most important cereals in Afghanistan after wheat and rice. Its grain is used for human consumption and poultry nutrition. This crop is used in many agricultural industries. This plant has more protein than rice. Based on the amount of production and area under cultivation, maize is one of the three most important cereals (wheat, rice and maize) among the producing countries. Maize yield in Afghanistan is lower than in other producing countries. One of the effective factors is mismatch of the appropriate amount of nitrogen fertilizer [1].

Nitrogen is a key ingredient in crop growth and is one of the essential nutrients for plant growth, including chlorophyll and many enzymes. Nitrogen is effective in absorbing many important nutrients such as potassium and phosphorus, which the proper amount of these elements cannot be effectively used in plant nitrogen deficiency conditions [6]. Therefore, nitrogen deficiency reduces Maize yield. Nitrogen requirement for crops is from 150 to 200 kg ha^{-1} [11]. Nitrogen requirement of Maize depends on factors such as irrigation, varieties used and soil fertility. It is reported that use of nitrogen fertilizer is efficient to increase the quantitative and qualitative yield of
Maize [13].

Hardas reported that yield of Maize increases while 180 kg ha^{-1} nitrogen fertilizer is used [5]. Also use of 200 kg ha-1 nitrogen fertilizer is reported efficiently for have proper yield of Maize [10]. In 1998 and 2001 it was concluded that increase in rate of nitrogen fertilizer absolutely will increase yield of Maize [8 & 12]. In Egypt 160 kg ha^{-1} nitrogen fertilizer is reported efficient for Maize [3]. So, the current experiment was conducted to determine the proper rate of nitrogen fertilizer to be used to increasing yield of Maize under Balkh province climate.

2 Materials and Methods

The experiment was conducted in research farm of agriculture faculty at Balkh University

in 2019 spring, applying the randomized complete block design (RCBD). Balkh province has a warm and dry climate which is very hot in Summer and very cold in winter. Average of precipitation in Balkh province is 300 mm per year. Soil of area was tested in Soil Laboratory of Agriculture Faculty which its characteristics are described in Table 1. First of all the area prepared as well and divided into 12 plots. In this experiment; four treatments by 3 replications were applied [Table 2]. Potential Seed (A hybrid variety of Maize) was used. Distance between rows was 75cm and between plants was 20cm and plots size was 5m x 4m = $20m^2$. There were 5 rows in each plot. Distance between plots was 0.5m and Total size of experiment area was $292m^2$.

In this experiment, nitrogenous fertilizer (urea) was applied in three growth stages (3 leaf stage; one month after germination, flowering and one month after flowering) while after plots were well irrigated. All agronomic operations in every plot were same except applying fertilizer. In this experiment height of 10 randomize plants were measured and other parameters such as number of grain in 10 cobs in every plot, number of cobs per plant, length of cobs, diameter of cobs and number of grain rows per cob were measured. Data analyze was done by SAS 2016 and effect of treatments was tested by LSD (Least Significant Differences).

Table 1: Shows soil characteristics of research farm.

No	Soil Characteristics	Measures
1	Soil Type	Silty Loam
2	Soil Density	1.21 gr/cm^3
3	pH	8.1
4	Electroconductivity	0.6ms/cm
5	Nitrogen amount	14.0 ppm
6	Phosphorus amount	47.1 ppm
7	Potassium amount	152 ppm
8	Organic Matter (%)	0.5

Table 2: Shows treatments of experiment.

No	Treatment	Dose of Urea
1	Treatment 1	0 kg ha^{-1}
2	Treatment 2	80 kg ha^{-1}
3	Treatment 3	160 kg ha^{-1}
4	Treatment 4	240 kg ha^{-1}

3 Results

After analyzing data, the results showed that; there was just significant difference between replications in plant height but the remain parameters had no significant difference in replications. In this experiment as treatments were in focused so, there were significant difference between treatments in all parameters [Table 3]. Comparing mean of parameters showed that in plant height and grain per row, weight of grain per plant, grain per cob, cob length, and cob diameter treatment 4 (240 kg ha^{-1} Urea) was efficient, while in number of rows per cob there was less difference between treatments 1, 2 and 3 [Table 4]. Finally, there was significant difference between treatments in plant yield that was significantly increased by increasing dose of urea [Table 3 & Fig. 1].

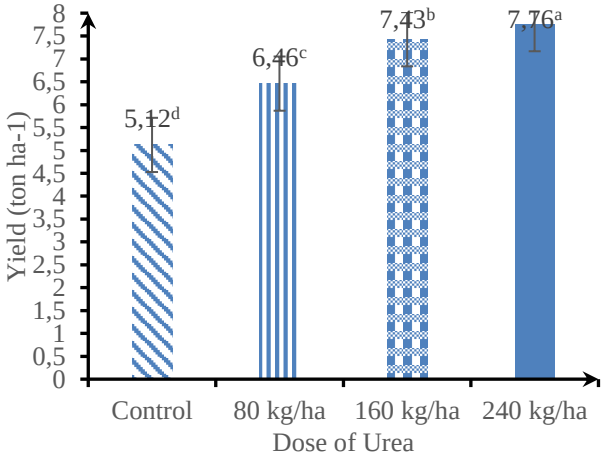

Fig. 1. Yield of maize in all treatments.

4 Discussion

The increasing population of our country requires to produce more food, there the main food for our people is cereals and among them maize is the third crop. Therefore, one option to achieve this goal is to increase yield of this plant and one way is using N-fertilizer [8]. As maize plant produces more dry matter so, for producing dry matter more nutrients are needed.

5 Conclusion

In this experiment, nitrogen fertilizer application had a positive effect on yield and yield components of corn, as it increased with increasing amount of nitrogen fertilizer and yield components of corn and decreased with decreasing amount of nitrogen fertilizer and yield components of maize. The highest grain yield of maize seed was in the highest amount of nitrogen fertilizer (240 kg ha^{-1}) and the lowest seed yield of observed where no nitrogen fertilizer was applied (Treatment 1).

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Table 3: Represents the analyzed data of plant parameters.

Source of Variance	Df	Plant yield	Plant height	grain/row	Number of rows	grain/plant	grain/cob	Cob/plant	Cob length	Cob diameter
Replication	2	1.254^{ns}	1093.12**	7.38^{ns}	0.702^{ns}	1115.32^{ns}	191.68^{ns}	0.082^{ns}	9.26^{ns}	0.0071^{ns}
Treatment	3	125**	876.4^{ns}	194.97*	2.9^{ns}	853.63*	7129.15*	0.38^{ns}	32.5*	0.52*
Error	6	20.63	981.03	95.43	3.154	156.63	21770.23	0.64	11.7	0.47

** Shows significance at 1% level and * at 5% level by Fisher's LSD, but ns shows non-significant level.

Table 4: Shows grading of plant parameters.

Treatments	Plant yield (Ton/ha)	Plant height (cm)	grain/row	Number of rows	weight of grain/plant	grain/cob	Cob/plant	Cob length	Cob diameter
0	5.12^{c}	181.0^{c}	26.89^{c}	16.0^{c}	76.0^{d}	430.2^{d}	2.00^{d}	147.0^{d}	38.0^{c}
80	6.46^{b}	196.0^{c}	196.0^{c}	16.2^{c}	95.0^{c}	3175.2^{c}	3.30^{c}	153.0^{c}	40.0^{b}
160	7.43^{a}	199.8^{b}	199.8^{b}	16.5^{b}	105.2^{b}	3296.7^{b}	4.55^{b}	160.1^{b}	42.2^{ab}
240	7.76^{a}	204.6^{a}	204.6^{a}	18.6^{a}	107.0^{a}	3805.5^{a}	6.70^{a}	167.2^{a}	44.5^{a}

$^{a, b, c, d}$ Represents the degrees of parameters.