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NITROGEN USE EFFICIENCY OF THREE MAIZE (*ZEA MAYS* L.) CULTIVARS

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ABSTRACT

Nitrogen use efficiency is one of the key issues in farming and fertilization, it is defined as the amount of product produced per unit of resource used. A split plot arrangement in randomized complete block design with four replications was used to compare the yield, nitrogen use efficiency and some quality characters of three maize (*Zea mays* L.) cultivars. The analysis of variance revealed that both nitrogen and maize cultivars were significantly differences in yield, nitrogen use efficiency, crude protein and crude fibre content in both seasons. This study revealed that improving nitrogen use efficiency can help in optimizing nitrogen use in maize.

KEYWORDS

Maize cultivars, Nitrogen use efficiency, *Zea mays*, Crude protein, Crude fibre.

1. INTRODUCTION

Maize also known as Corn (*Zea mays* L.) is a grain crop that belongs to the family Poaceae. The origin of this crop remains unknown; however, many historians believe that maize was first domesticated in Mexico's Tehuacan valley, then introduced to Africa by the Portuguese in the sixteenth century and has become Africa's most important staple food crop [1]. Maize is the most important cereal crop in the world after wheat and rice. It has great yield potential and attained the leading position among cereals based on production as well as productivity and that is why it is called "queen of cereals" [2]. Nitrogen use efficiency parameters are high under low nitrogen levels and decrease with increasing nitrogen level. Decreased nitrogen use efficiency at high nitrogen is attributed to higher losses because the plant is unable to absorb all of nitrogen applied [3]. Maize is nitro positive and needs ample quantity of nitrogen to attain high yield. Nitrogen deficiency is a key factor for limiting maize yield [4]. Low yield of maize can be attributed to many constraints but NPK fertilizer application is one of the major factors [5].

2. MATERIALS AND METHODS

A pot experiment was carried out during two consecutive summer seasons 2013/2014 and 2014/2015 at the Demonstration Farm of the Faculty of Agricultural Sciences –University of Dongola-Sudan (Latitude 19° 11' N and Longitude 30° 29' E). The Northern State occupies the distant northern part of the Sudan and is within the desert region of the Sudan which has extremely high temperature and radiation in summer and low temperature in winter. In general, in Dongola rainfall is scarce and wind prevails from the north. A Split plot arrangement in randomized complete block design with four replications was used to execute the experiment where the three cultivars assigned to the main plots and the four nitrogen levels to the sub plots. Nitrogen levels (0, 43, 86 and 129 kg/ha) used for the treatment were notified as N0, N1, N2 and N3, respectively. Three to four seeds were sown per hole and then thinned to one plant per hole three weeks after sowing in both seasons. The total grain yield was calculated according to the following formula: Total grain yield (tons/ha) = grain weight(g)/m² / 100 [6]. Nitrogen use efficiency calculated as follows: NUE = grain yield/ actual amount of nitrogen added [7]. Seeds crude protein and crude fibre contents were determined following the standard methods of the Association of Official American Analytical Chemists [8]. The organic nitrogen content was determined using the micro-Kjeldahl method, and an estimate of the crude protein content was estimated by multiplying the organic nitrogen content by a factor of 6.25% [9]. Two different samples were analyzed in triplicate. The data were

submitted to standard procedure of analysis of variance, means were separated using Duncan Multiple Range Test (DMRT) as described by [10].

3. RESULTS AND DISCUSSION

3.1 Effect of Nitrogen on the Yield, Nitrogen Use Efficiency and Quality

Results in table-1 and table-2 showed that nitrogen caused highly significant differences in the yield and yield efficiency in both seasons. Maize yield is high when responsive to nitrogen fertilizer [11]. Also, this result was similar to those reported by a group researcher who all found the same result [12-18]. Similarly, the result of this study indicated a highly significant effect of nitrogen on nitrogen use efficiency (NUE) in both seasons. Nitrogen use efficiency decreased significantly with the increase of nitrogen rate. This could probably be attributed to the inability of plants to assimilate all of nitrogen taken up. Similar result was reported by a researcher who indicated that nitrogen use efficiency decreased with the increase of nitrogen rate because the plants were unable to assimilate all of nitrogen taken up [3]. Furthermore, nitrogen caused highly significant differences in crude protein and crude fiber content in both seasons. Similar results were obtained by some scientist who all found the same result [19-22]. The increase in crude protein due to nitrogen can be attributed to the fact that nitrogen often plays a great role in the synthesis of protein.

Table 1: F-values for the yield, nitrogen use efficiency and quality of maize cultivars during the summer season 2013/2014 and 2014/2015

Characters	Nitrogen		Cultivars		Interaction	
	1st Season	2nd season	1st season	2nd season	1st Season	2nd season
Crude protein	42.78**	27.03**	7.45*	15.56*	0.63 ns	5.90*
Crude fibre	46.53**	34.67**	3.14 *	9.11*	1.63 ns	3.14 *
Yield	18.27**	14.23**	39.94**	31.11**	1.26 ns	1.12 ns
Nitrogen use efficiency	31.16**	29.76**	24.37**	20.12**	5.94*	5.00*

*significant at 5% level, ** significant at 1% level, ns: non-significant at 5% level

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