Response of Maize to N Fertilization and Rotational Crop Sequences

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ABSTRACT

Six crop sequences, differing in legume/ nonlegume ratio and terminal crop, were sown in 2005 and 2006 seasons, followed by maize (*Zea mays* L.) fertilized with three N levels (N_1= 10, N_2 = 120 and N_3 = 135 kg /fed). Maize agronomic and grain yield characters were evaluated in 2007 and 2008 summer seasons. A split-plot design, with three replicates, was used, where the main plots and subplots were assigned to crop sequences and N levels, respectively.

Plant height, ear-leaf area, 100-grain weight and grain yield increased with the increase of legume percent in crop sequence and proximity of legume crop to maize. The 100% legume sequence gave the significantly highest values for these traits. A similar trend was found for these characters with increasing N application level from 105 to 135 kg /fed. However, plant height and 100-grain weight showed insignificant increase when applied N level increased from 120 to 135 kg /fed. The interaction effect of both crop sequences and N application level was significant for plant height and ear-leaf area in 2007 season, and for ear-grain weight and grain yield/fed in 2008 season. The highest values for these characters were obtained with 100% legume crop sequence and application of 135 kg N/fed.

Stepwise regression analysis indicated that ear grain weight was the main component that described the greatest portion of variations in grain yield/fed. (R^2 values of 0.956 and 0.899 in the two seasons, respectively). In addition, data showed highly and positive correlation between grain yield/fed and both of ear-grain weight and 100-grain weight.

Key Words: Crop sequence, Zea mays L., Nitrogen fertilizer level, Grain yield

INTRODUCTION

Suitable land areas for food production almost remain fixed or are diminishing, yet agronomists and farmers are faced with the task of increasing productivity. Raising land productivity, through a more effective use of land natural resources and resources added to land, is possible by wise management and choice of suitable crops in crop rotation. Crop rotation, an ordered succession of crops on the same field for a certain period, is not enough to optimize yield, but also, choice of rotation crops, growth habit of preceding crop and legume to non-legume planting ratios are agricultural decisions that should be considered to reach the maximum yield of the following crop (Copeland *et al.*, 1993 and Khalil *et al.* 2004).

Residues amount and quality (C/N ratio) of a preceding crop affect the performance of the subsequent one. Narrow C/N ratio (below 20:1) increases N mobilization by microbial organisms and the reverse is true with wide (above 20:1) C/N ratio (Jones, 1987).

The value of legumes inclusion in a sequential cropping system would be attributed to the contribution they may make to the following crop; e.g., soil supply with organic matter and available organic N and reduction of its reliance on chemical N fertilizers (Echeverria *et al.*, 1992). Holland and Herridge (1992) reported that legumes, grown in rotation with cereals, could slow the depletion of organic N rate, compared with only a cereal system, provided that the net amount of soil N, used by the legume; i.e., the difference between the amount of N removed as harvested product and the amount fixed, was less than the amount used by cereal crop.

The effects of crop growth habit and crop allocation into the crop sequence, that precedes the subsequent crop, were reported by several investigators. Khalil *et al.* (1999 and 2000) and Nawar (2004) showed that residues, left after clover, gradually decayed to establish a continuous supply of nitrogen to the subsequent crop. Khalil *et al.* (2004) studied the effect of different crop sequences on sunflower growth traits and found that such traits were proportionally increased to increase in legumes planting ratio in crop sequence and legume proximity to sunflower.

Maize, as one of the most important cereals in the world's agricultural economy, is greatly affected by rotational cropping sequence (Crookston *et al.*, 1991). Nichel *et al.* (1995) attributed the positive effect of rotation on maize to the improvement of maize growth vigor. Meanwhile, Paul *et al.* (1997) attributed the beneficial effect of rotation on maize to the establishment of high yielding conditions for maize by rotation.

Several studies were conducted to study the effect of different preceding crops on maize traits, including plant height (Khalil *et al.*, 2000), number