

1.2. SPRAYER SETUP AND FOLIAR APPLICATION EFFECT ON MAIZE GROWTH CHARACTERISTICS USING DIFFERENT UREA CONCENTRATIONS

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ABSTRACT

The experiment was carried out in a plastic pot using maize crop. The objective was to study the influence of the sprayer setting on the crop growth characteristics. The trials are including two different nozzle heights 25 and 50 cm and four different concentrations of the urea fertilizer 0, 5, 10 and 15gm/l. The foliar spraying was carried out once a week for two months, after 4-6 leaves appeared. Plant height, number of leaves, leaf chlorophyll content, and leaf area were measured in this study. The preliminary results showed significant differences in foliar fertilization depending on the urea concentration, nozzle height, and the interaction between them. The combination of the urea concentration of 15 gm/l and nozzle height of 25cm was revealed the best growth characteristics compared to the control and other treatments.

INTRODUCTION

Maize crop (*Zea mays L.*) is one of the most economically important crops in the world and comes in the third category after wheat and rice crop in cultivated area (Imran *et al.*, 2014). Despite the expansion in crop cultivation, the qualitative and quantitative crop production decreases due to various factors as type of cultivated variety, climatic conditions, and method of fertilization. There are also factors related to the abundance of nutrients necessary for its growth and the quality of its grains as nitrogen (Ombuki, 2018; Braimoh and Velk, 2006; Urassa, 2015; and Chen *et al.*, 2018). One of the methods to improve maize yield is adding urea fertilizer which contains a high percentage of nitrogen (46% N). Maize considers one of the crops that are highly responsive to nitrogen fertilization (Sapkota *et al.*, 2017; Selassie, 2015; Leghari *et al.*, 2016). Nitrogen deficiency reduces the ability of the crop to absorb nitrogen from the soil depending on the growth stage that resulting in the growth cessation, yellowing leaves, and decreasing in the leaves chlorophyll content (Kandil, 2013; and Moraditochae *et al.*, 2012). The previous studies have shown that the amount of soil fertilizer applied on the plant is lost because of the factors mentioned above (Roy *et al.*, 2006). To reduce the losses and to increase the benefit, the researchers applied a new method to adding fertilizer with a foliar application for absorption increasing up to 90% compared to the traditional method (Fageria *et al.*, 2009). By this method, it is a possible to spray different types of crops at different growth periods (Roy *et al.*, 2006; and Barranco *et al.*, 2010). Therefore, the main objective of this study was to investigate different urea concentrations and nozzle heights on the characteristics of maize growth using the foliar application.

METHODS AND MATERIALS

A field experiment was carried out in the plastic pots in the PVC of Soil and Water Science Department, College of Agriculture, University of Basrah for the growing season 2019 using hybrid maize 34N84. The seeds were planted in pots weighing of 10 kg in silty clay soil. Samples of the soil were taken at a depth from 0 to 30 cm to measure the physical and chemical properties of soil that were mentioned in the Table 1.

Table 1. Some properties of physical and chemical Soil characteristics

Character	Measuring unit	Average value
Electrical Conductivity (ECe)	Dc/m	18.52
Soil PH	-	7.42
Total available nitrogen	%	42.93
Organic Matter (OM)	gm/kg	9.12
Soil structure(sand, clay, silt)	gm/kg	295.2, 312.3, 392.5

Foliar application spraying was done once a week at the evening when the crop has an average of 4-6 leaves. Four urea concentrations 0 (control, water only), 5, 10, and 15 g/l were used in this study. Knapsack sprayer was used in the experiments for applying foliar fertilization. Two heights 25 and 50 cm above the crop of the Flat fan nozzle 110 03 at 2 bar operating pressure were selected. The general description of this sprayer was shown in the Table 2.

Table 2: Knapsack sprayer description

Knapsack sprayer model	Total tank capacity (litter)	Number of a nozzle mounted	Power source	Piston pump	Sprayer color
XF-16B	16	1	Manual	Internal	Blue

Maize growth characteristics

Plant height: plant height was measured from the surface of the ground to the tip of the fully opened leaf

Leaves numbers: The total number of the leaves on the plant was measured by counting it manually.

Chlorophyll content: Leaf chlorophyll content was measured by chlorophyll meter SPAD-502.

Leaf area (LA): leaf area was calculated depending on the following formula (Mananze *et al.*, 2018):

$$LA = Length * width * 0.75 \quad (1)$$

Statistical analysis

Based on the results from this study, analysis statistical was performed using ANOVA table. The test of L.S.D_{0.05} was used to compare the differences between the studied parameters.

RESULTS AND DISCUSSION

Effect of foliar urea concentration and nozzle height on plant height

As shown in Fig.1, significant differences were observed in plant height by increasing the number of spraying periods, urea concentrations, and nozzle height. Higher plant height 27.25cm showed a significant difference at the third spraying period compared to the other treatments and the control.

The same figure also showed the urea concentration significantly affects the plant height. Higher plant height value of 27.25 cm revealed with a relative increase of 58.78% in comparison to the control when the foliar fertilization was used with urea concentration of 15gm/l. Minimum plant height of 11.23 cm was recorded where no fertilizer (control) was used. Contrary, decreasing in the nozzle height led to significant increasing in the plant height. Higher plant height value 27.25 cm was observed with nozzle height 25 cm compared to nozzle height 50 cm and the control.

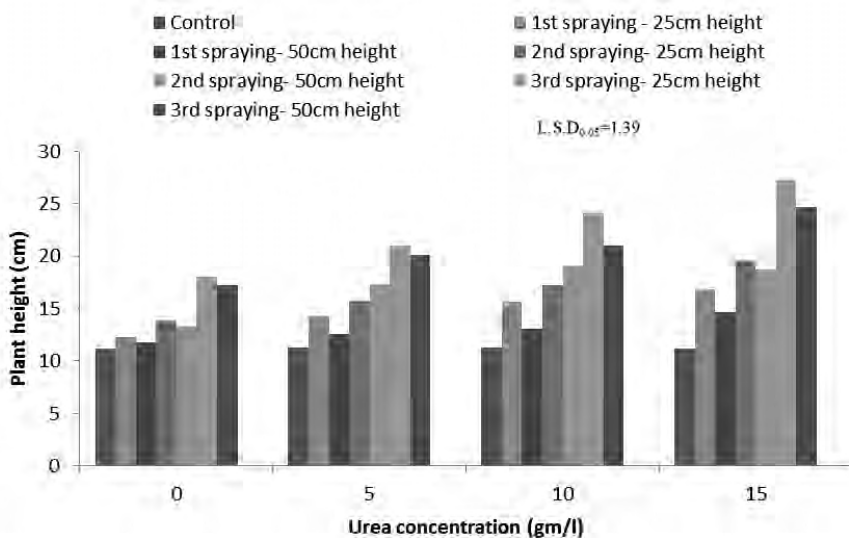


Fig.1. Effect of nozzle height and urea concentration on the plant height

Effect of foliar urea concentration and nozzle height on plant leaves number

The results indicated that there were significant differences between the urea concentration and the nozzle height in average of the leaves number. The third spraying (15 gm/l) significantly affected average of the leaves number (12.34-leaf) with an increase of 27.07 % compared to the control which recorded the lowest average of leaves number (9-leaf). The results also revealed significant effect of the nozzle height on leaves number. Higher average leaves number (12.34- leaf) was observed with nozzle height 25 cm compared to the nozzle height 50 cm and the control.

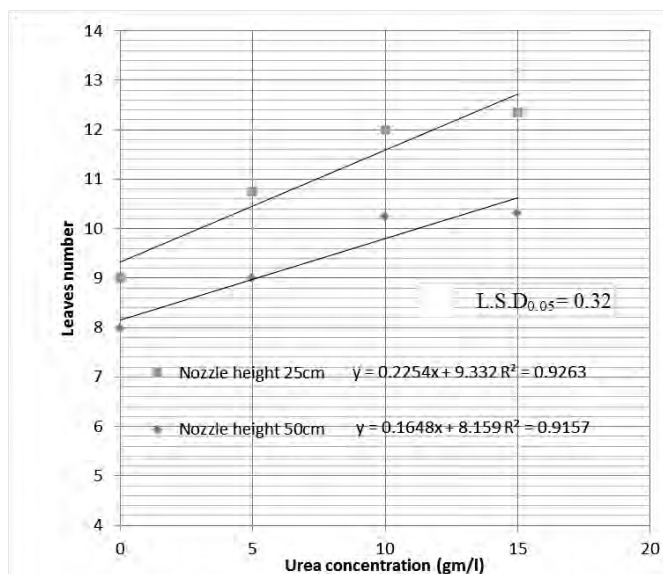


Fig. 2. Leaf number correlated to nozzle height and urea concentration

Effect of urea concentration and nozzle height on leaf area

The results introduced significant differences between urea concentration and nozzle height in leaf area. Increasing of the foliar urea concentration led to significant increase in leaf area. Higher urea concentration (15gm/l) showed the highest average of leaf area (243.37cm²) compared to the lowest average 207.5cm² of the control. The same figure also showed significant differences in the leaf area between nozzle heights (25 and 50cm). Higher leaf area (235.04 cm²) was observed with nozzle height 25cm compared to the control and nozzle height of 50cm.

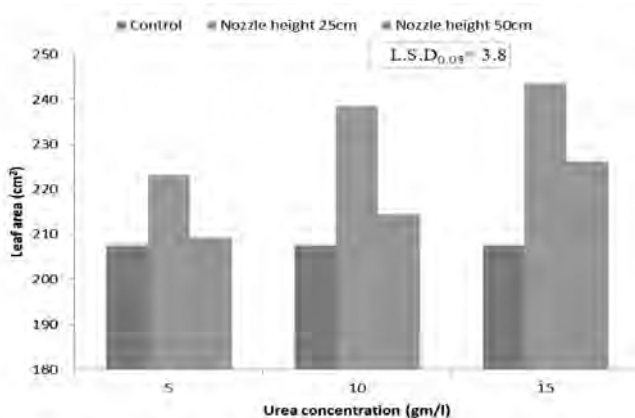


Fig. 3. Leaf area related to urea concentrations and nozzle heights

Effect of foliar urea concentration and nozzle height and their interaction on leaves chlorophyll content

The results as shown in the Fig.4 illustrated significant differences between urea concentrations and nozzle heights on the leaves chlorophyll content.

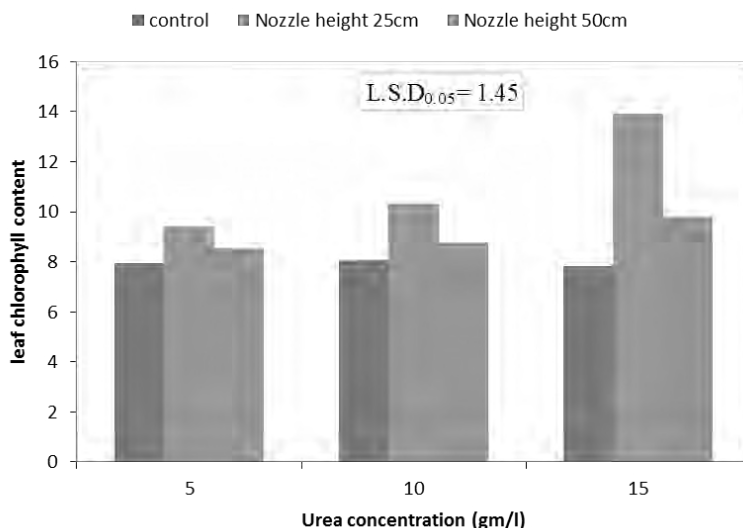


Fig. 4. Leaf chlorophyll content at different urea concentrations and nozzle heights combination

Leaves chlorophyll content reached to high average value (13.9 Spad) with urea concentration of 15gm/l and nozzle height of 25cm compared to the nozzle height 50cm and the lowest average value (7.95 Spad) of control.

CONCLUSIONS

The outcomes of this present study demonstrated that it was a possible to improve plant growth characteristics by selecting suitable urea concentration and nozzle height. Higher values of the plant height, leaf area, and leaves chlorophyll content were observed in urea concentration of 15gm/l and nozzle height of 25cm compared to the control (spraying water only) and the nozzle height of 50cm.

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