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Grain yield and yield components at maize under different preceding crops and nitrogen fertilization conditions

Adrian Gheorghe BĂŞA*, Viorel ION, Marin DUMBRAVĂ, Georgeta TEMOCICO, Lenuţa Iuliana EPURE, Dumitru ŞTEFAN

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, 011464, District 1, Bucharest, Romania

Abstract

The yield components and the grain yield are influenced by several factors, either they are environmental or technological. Among the environmental factors there is counting as one of the most important the water supply, while among the technological factors there are counting the preceding crop and fertilization strategy. In this respect, the aim of this paper is to present the results regarding the yield components and the grain yields obtained at two maize hybrids studied under the drought specific conditions of 2015 in South Romanian and under different preceding crops and fertilization conditions. In this respect, a field experiment was performed in 2015 on a reddish preluvosoil in South Romania under rainfed conditions. Two maize hybrids were studied under three preceding crops (triticale, sorghum and maize) and three fertilization conditions ($N_{40+0}P_{40}$, $N_{40+40}P_{40}$, $N_{40+80}P_{40}$). In the fully ripe stage of the maize plants, the cobs from one square meter and from each experimental variant were collected and analyzed in laboratory. The yield components of the cob were determined and the grain yield was calculated in tons.ha^{-1} and reported at moisture content of 14%. The obtained data were statistically processed by analysis of variance. In our study, the highest values of the yield components (cob length, number of kernels per cob, cob weight, and kernel weight on cob, except thousand grain weight) were registered in the case of maize as preceding crop and fertilization conditions of $N_{40+80}P_{40}$, which leaded to the highest values of the grain yield. Nitrogen application in the growth stage of five leaves increased the values of the yield component (except thousand grain weight) and of the grain yield, but according to the preceding crop.

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Keywords: maize, grain yield, yield components, preceding crop, nitrogen fertilization, drought.

* Corresponding author. Tel.: +4031-433-4250; Fax: +4021-318-0466.
E-mail address: adibasa@agro-bucuresti.ro

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1. Introduction

The yield components and the grain yield are influenced by several factors, either they are environmental or technological. Among the environmental factors are counting as one of the most important the water supply. Drought is a major constraint factor affecting crop production (Beheshti and Behboodi, 2010; Aslam et al., 2013). This is influencing the growth, development and production of plants, with a significant impact on the yield components and the yield level. Water shortage is a critical problem limiting maize growth through impact on anatomical, morphological, physiological and biochemical processes (Khalili et al., 2013). So, the plant response to drought is a complex process (Spitkó et al, 2014). A better knowing of this complex response of plants to drought stress will give us more possibilities to limit the negative effects of the drought.

Among the technological factors with a significant influence upon the yield components and the grain yield at maize there are counting the preceding crop and fertilization strategy. The preceding crop is an important crop technology measure with a significant influence upon the yield, respectively upon the yield components which represent those elements participating to the yield formation (Ion et al., 2015). Crop rotation and nitrogen application are among the management methods that can increase maize grain yields (Stanger and Lauer, 2008). In non-fertilized maize and maize fertilized with N_{100}, the highest yields were achieved in the three-year rotation (Ciontu et al., 2012), the preceding crop having an important impact on the level of grain yields. In fact, the effect of crop rotation on maize yield is inversely proportional to the ratio of the maize in the crop rotation (Šeremešić et al., 2013). Maize is known to be a heavy feeder of nitrogen (N) fertilizer (Muhamman et al., 2014). Relatively low production of the maize plants may determine a higher yield per unit area at a higher plant density (Ionescu, 2015), if the maize plants have enough resources.

Farmers growing maize must consider crop technology as a tool for a maximum use of resources and for diminishing the effects of limitative environmental factors (Dumbrava et al., 2015). From this perspective, the aim of this paper is to present the results regarding the yield components and the grain yields obtained at two maize hybrids studied under the drought specific conditions of 2015 in South Romanian and under different preceding crops and fertilization conditions.

2. Materials and Methods

2.1. Experimental design

Researches were performed in 2015 in a field experiment, which was located on reddish preluvosoil within the Experimental Farm Moara Domneasca (44°29' N latitude and 26°15' E longitude) belonging to University of Agronomic Sciences and Veterinary Medicine of Bucharest. There were studied two maize hybrids (Cera 410 and Cera 450) under three preceding crops (sorghum, triticale, and maize) and three fertilization conditions ($N_{40+0}P_{40}$, $N_{40+40}P_{40}$, $N_{40+80}P_{40}$). First fertilization was performed before seedbed preparation with 200 kg.ha^{-1} of complex fertilizer of type 20:20:0, which means 40 kg.ha^{-1} of nitrogen and 40 kg.ha^{-1} of phosphorous. Second fertilization was performed in the growth stage of maize plants of five leaves with 0, 40, and respectively 80 kg.ha^{-1} of nitrogen (the used fertilizer was ammonium nitrate). So, on a background of 40 kg.ha^{-1} of nitrogen and 40 kg.ha^{-1} of phosphorous, there were the following variants with nitrogen application in the growth stage of five leaves: 0 kg.ha^{-1} of nitrogen; 40 kg.ha^{-1} of nitrogen; 80 kg.ha^{-1} of nitrogen.

2.2. Crop management

The plowing was performed in 2014, on 10th of November. One harrowing was performed on 14th of April 2015. The seedbed preparation was performed on 21st of April 2015. The sowing was performed on 25st of April 2015 at 70 cm between rows. The plant density was of 80,000 plants.ha^{-1}. The weed control was performed by the help of herbicides, respectively Dual Gold 960 EC (based on the active substance S-metolaclor 960 g/l) applied at a dose of 1.2 l.ha^{-1} one day after sowing. The weed control was completed by one manual hoeing.