EFFECTS OF SOWING DATE ON EMERGENCE AND YIELD OF MAIZE INBRED LINES

UTICAJ VREMENA SETVE NA NICANJE I PRINOS SAMOOPLODNIH LINIJA KUKURUZA

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ABSTRACT

The paper presents the seed production technologies of maize sown on three different sowing dates. Seeds of three maize inbred lines (L1, L2, L3) were used as a seed material in the location of Zemun Polje in 2018. The objectives of the present study was to determine the importance of different sowing dates as a method to overcome stressful conditions caused by unfavourable environmental factors, as well as to point out to a significance of the seed size in sowing. Effects of the following factors were observed in relation to emergence and the maize grain yield: sowing date (SD), seed fraction (LF, SF and PF) and genotype (L). The gained results indicate that the lowest percentage of emergence was determined in the variant L2/SD2/SF (34%), while the highest grain yield was determined in the variant L3/SD1/PF 8.86 t/ha. The standard deviation of the yield is the largest for variants with the highest yield.

Key words: sowing date, maize, yield, germination.

INTRODUCTION

Having information about properties of hybrid maize seed, prior to sowing, is an essential prerequisite for achieving the planned results in seed and commercial production of maize. Considering that there are different maize growing regions, the production technology should be adjusted to the specific conditions of climate, soil and other environmental factors in order to make the most of the potential of habitats and genotypes.

The sowing date is one of the adjustment measures. By the application of this measure, unfavourable conditions of climate, primarily stress caused by drought and extremely low or high temperatures, are avoided.

Variability of agroecological conditions may alter the growth and development of maize (Bergamaschi et al., 2007; Asare et al., 2011; Chen et al., 2011; Rattalino Edreira et al., 2011; Baoyuan et al., 2016).

The temperature is the main climatic factor affecting physiological processes during the grain filling period and therefore the yield itself (Holzkämper and Fuhrer, 2013). Agroecological conditions depend not only on edaphic factors in a certain region, but also on the application of cropping practices in the production of seed crops and on the existing climatic changes that bring restrictions in the established cropping practices (Cicchino et al., 2010; Lobell et al., 2013; Mayer et al., 2014).

The application of the same seed production technologies does not give the same results in different genotypes, therefore the importance of the adjustment of these technologies to the production of a particular genotype is important for the expression of its genetic potential under the given agroecological conditions.

MATERIAL AND METHODS

The three maize inbred lines developed at the Maize Research Institute, Zemun Polje, were used as the seed material in the trial that was set up in the location of Zemun Polje in 2018.

Sowing was performed on three dates: April 1 (SD1), April 10 (SD2) and April 20 (SD3). The seed was divided into three fractions according to its size: small 6.5-8.4 (SF), large 8.5-11 (LF) and primary fraction 6.5-11 (PF). All inbred lines were sown in the density of 71,000 plants ha⁻¹, with the inter-row
distance of 70 cm and the within-row plant distance of 20 cm. Each inbred was sown in tree rows per seed fraction and in four replications.

Seed emergence in the field and grain yield of maize were observed.

Harvest was done manually and then the material was dried and shelled. Drying was done to 14% grain moisture at the temperature of 40 °C. The yield determination was done by harvest of the middle row.

The number of germinated seeds was established after the maize plant emergence in the 1-leaf stage by counting plants in the middle row.

Gained experimental data were processed by mathematical and statistical methods by the application of the statistical package IBM SPSS 19.0 (version free of charge).

Each of obtained parameters was processed by the statistical analysis using descriptive statistics for all parameters at the annual level. Differences between analysed parameters, as well as their interactions were determined by the analysis of variance (ANOVA) for the factorial trial set up according to randomised design as well as by the LSD test at 5% and 1% risk levels.

**RESULTS AND DISCUSSION**

The lowest (34%), i.e. highest (90%) emergence in the trial was determined in the genotype L2 for the variant SD2/LF, i.e. genotype L3 for the variant SD1/SF, respectively (Table 1). The highest (8.86 t/ha), i.e. lowest (5.07 t/ha) grain yields were established in the genotype L3 for the variant SD1/PP, and SD1/LF, respectively. The greatest variability in emergence (sd 21.8) was recorded in the variant SD1/SF/L2. The yield, in relation to the given parameters, was the highest (8.86 t/ha) in the variant SD1/PF/L3, while it was the lowest (5.07 t/ha) in the variant SD1/LF/L3. The differences in emergence and yields among variants SD/F/L were a consequence of high temperatures and unfavorable precipitation distribution. In 2018, the highest air temperature since the beginning of meteorological data measurements recorded in April was on average higher by 2°C than the warmest April ever (18.20°C) (RHMZ Bulletin). High temperatures were recorded during the entire growing season, which mostly affected stages of emergence and emergence, and even later stages of pollination and grain filling. Regarding precipitation in the growing season, there was only 336.6 mm, which was lower by 130 mm than precipitation during the reference period (1981-2010) and the water requirements of the crop. The greatest water deficiency was in April, May and July (Table 1).

By applying technology of seed processing according to physical properties a greater quantity of a high-quality seed material for sowing is obtained (Đokić et al., 2020). The rank of emergence of all variants was 70 % and the grain yield was 6.65 t/ha. The total variation in the degree of plant emergence was 16.3 and of the yield was 1.2%.

The sowing dates also significantly affected the differences between SD1 and SD2 (12.8 %) and SD1 and SD3 (13.9%). There were no significant differences between SD2 and SD3. Significant differences in yields were recorded between SD1 and SD3 (0.552 t/ha).
The second observed factor, the fraction, did not significantly affect emergence. However, the differences were significant in yields when various seed fractions were used: between LF and SF: 3.6747% (for emergence) and -0.5144 t/ha (for yield) (Table 3). Regarding the genotype, emergence significantly differed between L1 and L2 (16.5%) and L1 and L3 (3%). Differences in grain yields depending on the used genotype (L) were significant if adequate growing practices (first of all sowing dates) were applied. The greatest differences of 0.5156 t/ha and 0.6933 t/ha were recorded between L3 and L1, respectively (Table 2).

The effects of factors on seed emergence under production conditions and maize grain yield were of different significance. Sowing date as a technological measure in the seed maize production, but also in commercial seed production is very significant in yields when various seed fractions were used: 3.6747% (for emergence) and -0.5144 t/ha (Table 3). The greatest differences of 0.5156 t/ha and 0.6933 t/ha were recorded between L3 and L1, respectively (Table 2).

| Source of variation | Emergence F-test | Grain yield F-test |
|---------------------|------------------|-------------------|
| S                   | 19.136**         | 2.857 ns          |
| F                   | 1.240 ns         | 2.201 ns          |
| L                   | 24.902**         | 4.310*            |
| S * F               | 5.201*           | 1.732 ns          |
| S * L               | 5.294*           | 0.754             |
| F * L               | 2.099 ns         | 4.151*            |
| S * F * L           | 3.737*           | 4.049             |

* Significant at p≤0.05; ** Significant at p≤0.01; ns-non significant

a. R Squared = .678 (Adjusted R Squared = 0.575)
b. R Squared = .490 (Adjusted R Squared = 0.326)

CONCLUSION

During the expression of the effects of the factor of seed properties, agroecological conditions also change, due to which they act differently. Agroecological conditions depend as much on meteorological and edaphic conditions in a certain region as on the application of agro-technological procedures in the production of seed crops. According to the stated, traits of the produced maize hybrid seed depend on the procedures completely controlled by man, on the ecological conditions that are under certain anthropogenic effects, on the properties of the parental inbreds and on all interactions among mentioned factors.

With climate change, the average daily air temperature increased with the insufficient precipitation, especially at the beginning of the growing season. The highest percentage of emergence (90%) and the highest grain yield (8.86 t/ha) in the variant SD1/PF/L3 confirm the importance of different sowing dates as a technological procedure in reducing poor effects of environmental factors. By earlier sowing the extreme April temperatures were avoided and soil moisture from the previous winter period was used for seed emergence and emergence and normal development in remaining pheno-phases.

Differences in yield and emergence of various genotypes with the application of different variants of seed production confirm that the same results cannot be expected with the application of the same technology.

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