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POPULATION STRUCTURE AND DIVERSITY IN FORMER ZP MAIZE BREEDING PROGRAM ASSESSED WITH SNP MARKERS

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Maize breeding in Maize research institute "Zemun Polje" was conducted for more than 75 years resulting in the creations of numerous maize hybrids with superior traits and performance. The source breeding material used in the breeding programs was very diverse and varied from the domestic landraces to the introduced inbred lines. This resulted in a very diverse and complex structure of the breeding pools used in commercial maize breeding in "Zemun Polje" Institute. As genetic material in this study, 24 maize inbred lines of different origin, heterotic and maturity goups were selected were selected from the 3rd and 4th cycle of breeding in Maize research institute "Zemun Polje". These are inbreds that were commonly used in breeding programs during the 1980s and were parental components of most important commercial maize hybrids. The genotyping was performed using a Maize 25k Infinium array. The neighbor-joining cladogram, PcoA and Structure were used to analyze the genetic structure and diversity of the panel. Population structure analysis of the panel initially showed a clear divide between Lancaster and Non-Lancaster inbred lines, revealing the dominant heterotic pattern in the breeding program. Further analysis with an increased number of population (k) showed a more complex structure of the non-Lancaster group of inbred lines with best number of ancestral population being k=5. The average genetic distance in the panel was 0,385, ranging from 0,039 to 0,544, with paternal inbreds in most of commercial hybrids being the most distant ones. The genotyping results of the Zemun Polje maize panel were further merged with DROPS European panel of 247 dent maize inbred lines in order to view the results of the diversity analysis of the Zemun Polje panel from a broader perspective.

Keywords: *maize breeding, inbred lines, genotyping, population structure, diversity*

RECIPROCAL EFFECT ON GRAIN YIELD AND YIELD COMPONENTS IN SINGLE-CROSS MAIZE HYBRIDS

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Reciprocal effect in maize refers to the phenotypic difference between reciprocal F1 hybrids. The aim of this study was to estimate influence of reciprocal crosses on grain yield and eight yield components. Five single-cross hybrids, their reciprocal crosses and six parental inbred lines were selected and all hybrids belong to late maturity group (FAO 500-600) with Lancaster ZPL-7 line as mutual parent. The experiment was set up in two replications using a completely-randomized block design in 2016 and 2017, at a total of seven environments. Reciprocal effect significantly influenced only grain yield and ear length, while factors hybrid and location were significant for all the examined traits. All hybrids individually displayed significant reciprocal effect for grain yield, ear length, number of kernels per row and 100 kernel weight, two hybrids for kernel length and thickness, while three hybrids showed reciprocal effect on kernel width. The effects were both positive and negative depending on the genotype itself. Furthermore, there were no significant differences for ear row number and ear width between normal and reciprocal variants. The highest difference for grain yield was between ZP 606 reciprocal (12.06 t/ha) and ZP 606 normal (11.28 t/ha). Pearson correlations were calculated between examined traits. All correlations between grain yield and other yield components were found significant and positive, except for the number of rows per ear (no correlation) and kernel width (negative correlation). Reciprocal effect has strong influence on the measured yield traits, but it is genotype specific. Therefore, in the future we should examine normal and reciprocal variants of all commercial maize hybrids.

Keywords: *grain yield, reciprocal effect, single cross, Zea mays L.*

ESTIMATION OF PHENOLIC CONTENT IN YELLOW, RED, BLUE AND RED-BLUE MAIZE BY NEAR-INFRARED REFLECTANCE SPECTROSCOPY

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Red and blue colors in maize kernel are the consequence of anthocyanin pigments, responsible for the increased phenolic content and antioxidant activity in maize. Therefore, interest in pigmented maize as a novel functional food due to its possible health benefits and unique taste has grown. The red color in maize kernel originates from pericarp and is maternally inherited while the blue color originates from aleurone, which is triploid in nature and its mode of inheritance is more complicated. Red and blue maize are usually low-yielding populations, and at the Maize Research Institute Zemun Polje (MRIZP), commercial inbred lines have been converted to red and blue colors to produce high-yielding red and blue maize hybrids.
Maize extractable phenolic content (EPC) can be directly determined through wet chemistry and measures phenolic amides, glycerides, free phenolic acids, and some flavonoids. In this study, however, Fourier-transformed near-infrared reflectance spectroscopy (FT-NIRS), as a non-destructive, inexpensive, and rapid technique has been used to scan EPC profiles of 56 MRIZP maize samples (14 genotypes in two replications and two environments) differing in kernel color: yellow, red pericarp, blue aleurone and red pericarp with blue aleurone. Twenty samples with outlying EPC values have been directly analyzed for total phenolics and these values have been used to adjust and improve NIRS calibration.
EPC values ranged from 1.69 to 6.82 mg g^{-1} across genotypes and environments. Two red inbred lines had the highest EPC content in 2017, 6.82 and 5.11 mg g^{-1}, and, overall samples from 2017 had a higher content of EPC compared to the same genotypes grown in 2018. Red genotypes on average had the highest EPC content, followed by red-blue, while yellow and blue kernels had similar and the lowest content within the samples.

Key words: *colored maize, near-infrared spectroscopy, phenolics*