

# WayScience



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## THE IMPORTANCE OF MAIZE HYBRIDS PRODUCTION FOR PROVIDING SUSTAINABLE FOOD AND FEED RESOURCES IN MODERN CRISIS CONDITIONS

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**Abstract.** The twenty-first century has brought about numerous challenges and obstacles for humankind, and the modern crisis conditions are continuously escalating. Having in mind the depletion of traditional fuel sources, the geopolitical turmoil, the COVID-19, and other possible future pandemics, basic needs such as sufficient food and feed sources are currently under question. The predominant cereal crops such as wheat, maize, and rice, as well as legumes, such as soybean, represent staple food and feed sources that need to be produced to satisfy the needs for the everyday diet of people and animals. There are numerous issues regarding the agri-food sector that need to be tackled to secure the future food and feed market. The sustainable production of cereals and legumes is among them. Nevertheless, a number of ZP maize hybrids from Serbia, tolerant to drought and pests represent a high-quality starting material for food and feed production.

**Keywords:** maize hybrids; cereals; legumes; agriculture; food; feed; crisis

**Introduction.** Maize (*Zea mays* L.), also known as corn, is currently the most important cereal crop in the world. Besides being mostly used as a staple food, primarily in developing countries, as well as for the production of animal feed, the great importance of this crop as an industrial raw material is incalculable. The range of maize utilization predominantly relies on the chemical composition of the grain. Nevertheless, specific characteristics of the maize ear, husk, corn silk, and the whole plant make these cultivars ideal for a multitude of uses, most importantly including the complete utilization of the by-products. Based on the genetics and environment maize grain, approximately contains 54 - 74% starch, 8 - 14% protein, 3 - 6% oil, and 1.5 - 3% cellulose [1]. Carotenoids and phenolic compounds are the most important maize grain bioactive compounds that act as antioxidants by preventing oxidative stress in the living cells. Maize grain is a valuable source of vitamins E and B, as well as minerals such as potassium, magnesium, zinc, copper, and manganese.

Maize is the most important forage plant due to its high yields, net energy, as well as high dry matter digestibility of the plant biomass. Silage maize is most often used as the main energy source in the ruminant diet, can be easily produced and stored, and consumed on a daily basis the whole year long. The breeding of maize hybrids is key for the production of high-quality silage. It relies on the combination of knowledge from the field of hybrid breeding for grain production with particular demands for silage types of hybrids. The progress regarding the elucidation of the digestion processes, as well as the variations in human and animal nutrient requirements, affected the need for the breeding of new specialty maize hybrids. The development of new hybrids and maize-based food products and feed formulations has long been among the main objectives of the studies within the field of maize breeding, genetics, food, feed technology, and biochemistry. The

focus of these researches is the selection of new hybrids tolerant to pests and drought, and the assessment of physicochemical, functional, and technological properties of different genotypes of maize hybrids, inbred lines, domestic and introduced populations, and varieties. Even though the United States Department of Agriculture has estimated the world maize production for the 2021/2022 marketing year will be 1,210.45 million metric tons, which could mean an increase of 84.57 million tons, or 7.51% in global maize production, the current crisis conditions may affect the overall grain yields, due to the lack of fertilizers, fuel, workforce and other unpredicted factors [2].

**Material and Methods.** A total of 44 hybrids of different FAO maturity groups (200-700) were analyzed. The two-replicate trial was set up according to the randomized complete-block design in the experimental field of the Maize Research Institute. All hybrids were sown in plots of 5 m long rows, with intra and inter-row spacing of 0.20 m and 0.75 m, respectively (i.e. plant density was 66 700 plants ha<sup>-1</sup>), in four rows, using standard cropping practices at the location of Zemun Polje, Serbia (44°52'N, 20°19'E, 81m asl). Maize ears of each replicate were harvested in the full physiological maturity stage from two inner rows. The experiment was sown under rain fed conditions, in 2020. Ten average maize ears per replicate were selected for further laboratory analyses. The physical properties were determined as described previously by Radosavljević et al [3], while chemical composition was determined according to standard AOAC laboratory methods [4]. All analyses were performed in two replicates. Results are presented as means.

### Results and Discussion.

The results of physical traits of the 44 ZP maize hybrids grain are shown in Table 1, and the results of chemical composition in Table 2.

**Table 1. Physical traits of 44 ZP maize hybrids\***

Physical traits	KWt (g)	TWt (kgm-3)	Den (gcm-3)	IF (%)	MRes (s)	HE (%)	WAI	Pericarp (%)	Endosperm (%)	Germ (%)
Min	122.64	673.79	1.21	0.00	6.57	9.57	0.22	3.91	7.89	76.89
Max	386.36	912.22	1.40	95.02	15.53	14.00	0.35	9.08	16.28	85.14
Average	311.77	786.01	1.29	33.53	9.84	11.69	0.27	5.71	11.58	82.72
SD	76.71	47.31	0.05	30.02	2.19	0.95	0.03	1.19	1.47	1.50

\*KWt - 1000-kernel weight (g), TWt - test weight (kgm-3), ADen - absolute density (gcm-3), IF - flotation index (%), MRes - milling response (s), HE - hard endosperm (%), WAI - water absorption index.

**Table 2. Chemical composition of 44 ZP maize hybrids**

Chemical composition	Starch (%)	Protein (%)	Fibre (%)	Ash (%)	Oil(%)
Min	86.80	59.39	7.94	1.74	1.22
Max	90.81	76.03	13.19	2.82	1.84
Average	88.06	72.79	9.65	2.30	1.40
SD	0.88	2.63	1.16	0.27	0.12

The results obtained by analysis of the technological grain quality of the investigated ZP maize hybrids presented in Tables 1 and 2 clearly show that the investigated hybrids varied significantly regarding physical properties and chemical composition of the kernel, which can be suitable for different applications.

**Conclusions.** The maize hybrids selected at the Maize Research Institute, Zemun Polje, according to the investigated quality parameters may be classified as hybrids with high technological and nutritional grain quality. The results obtained in this research are in accordance

with data published earlier by Serbian and foreign authors. According to the obtained results, ZP maize hybrids may be ranked as hybrids of high quality for the production of various food products, as well as animal feed. All the results indicate the overall importance of maize hybrids for providing sustainable food and feed resources in modern crisis conditions.

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**References:**

1. Eckhoff SR, Watson SA (2009): Chapter 9: Corn and sorghum starches: Production, In J.N. BeMiller, R. L. Whistler (ed), Starch: Chemistry and Technology, third edition. Elsevier Inc. 373-439
2. World Agricultural Production.com (2022): World Corn Production 2021/2022, April 2022. On line: <http://www.worldagriculturalproduction.com/crops/corn.aspx>
3. Radosavljević, M., Božović, I., Bekrić, V., Jovanović, R., Žilić, S., Terzić, D. (2001). Savremene metode određivanja kvaliteta i tehnološke vrednosti kukuruza. PTEP- Časopis za procesnu tehniku i energetiku u poljoprivredi, 5 (3), 85-88.
4. AOAC. (2000). Official Methods of Analysis (17th ed.). Gaithersburg, MD: Association of Official Analytical Chemists.