

ADAPTABILITY AND YIELD PERFORMANCE OF SELECTED EU AND REGIONAL CORN HYBRIDS IN THE AGRO-ECOLOGICAL CONDITIONS OF PEJA, KOSOVO

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ABSTRACT

This study examines the adaptability and yield performance of selected EU and regional corn hybrids under the agro-ecological conditions of the Peja region, Kosovo. Corn (*Zea mays* L.) is a key crop in Kosovo, serving as a major component of both human and animal nutrition. Field trials were conducted using a randomized complete block design with six hybrids originating from France, Croatia, and Serbia. The study assessed agronomic parameters such as plant height, ear placement, biomass production, and grain yield. The results showed significant variation among hybrids, with the Croatian hybrid OS 515 demonstrating the highest yield and protein content, while the French hybrids DKC 5143 and DKC 6574 exhibited strong yield stability. Statistical analysis confirmed a significant correlation between yield, plant height, and biochemical traits, highlighting the role of hybrid selection in optimizing corn production. These findings provide valuable insights for selecting high-performing hybrids suitable for Kosovo's agricultural landscape. Future research should explore multi-environment trials to assess hybrid stability across varying climatic conditions.

Key words: Agro-ecological adaptation, Corn hybrids, Hybrid selection, Kosovo agriculture, Yield performance.

INTRODUCTION

Introduction Corn (*Zea mays* L.) is a crucial crop in Kosovo, playing a significant role in both human consumption and livestock feed. Covering approximately 80,000 hectares annually, it constitutes around 32.27% of the country's agricultural land (Fetahu, 2009). Its adaptability to different environmental conditions, short growing cycle (3–4.5 months), and high yield potential make it a staple in Kosovo's agricultural landscape. Historically, corn has served as a key cereal crop, providing essential nutrients and playing a fundamental role in crop rotation systems. (Bänziger M. 2000; Bruce W, et. al. 2002).

Corn is rich in essential amino acids such as lysine, tryptophan, and methionine, which enhance its nutritional value. It is widely used in various forms, including grain, silage, and fresh consumption during its milky stage. One kilogram of corn grain provides approximately 3864 calories and is equivalent to 1.34 feed units. The energy content

varies depending on the harvest stage, with silage harvested during the milk stage containing 21 feed units per 100 kg, while silage harvested at the wax stage (30–35% grain moisture) contains 26 feed units (Adee E, et. al. 2016). Given its importance in food security and livestock production, evaluating the adaptability and yield performance of different corn hybrids in Kosovo’s agro-ecological conditions is essential. The present study aims to assess selected EU and regional corn hybrids in the Peja region, focusing on agronomic traits such as plant height, ear placement, vegetative growth, and yield. By identifying superior hybrids, the study seeks to provide recommendations for farmers to optimize corn production and improve sustainability in the region. (Chapman S, et. al. 1999).

MATERIALS AND METHODS

Study Area

The field experiment was conducted in the Dukagjin Plain, specifically in Arbesh, on the research farm of the Kosovo Agricultural Institute in Peja. This region is characterized by a continental climate, with moderate annual rainfall and a growing season that provides favorable conditions for maize cultivation. The soil in the experimental plots is classified as silty-clay loam, with good fertility and adequate water retention properties. (Messina C, et. al. 2011)

Experimental Design

A randomized complete block design (RCBD) with three replications was employed to evaluate the agronomic performance of selected corn hybrids. The hybrids included five commercial F1 hybrids from EU and regional breeding programs, along with a standard hybrid used as a control. The tested hybrids included:

- Hybrid Genotypes: DKC 6574, DKC 5143, DKC 6677, OS 515, OS 430, and Standard NS 444;
- Hybrid Origins: France, Croatia, and Serbia;

Each experimental plot measured 3 × 10 m, with a row spacing of 0.75 m and an intra-row plant spacing adjusted according to the FAO maturity group classification of each hybrid. A 1-meter buffer zone was maintained between plots to minimize edge effects (da Silva P, et. al. 2014).

Table 1. The origin and characteristics of researched genotypes.

Nr.	Genotype Hybrid ^a F1	Origin of genotypes ^b	Classification by FAO	The distance of planting and the number of plants per ha
1.	DKC 6574	France	delayed	30 x 70 – 51.300
2.	DKC 5143	France	delayed	30 x 70 – 51.300
3.	DKC 6677	France	delayed	30 x 70 – 51.300
4.	OS 515	Croatia	delayed	30 x 70 – 61.300
5.	OS 430	Croatia	medium	25 x 70 - 57.100
6.	Standard NS 444	Serbia	medium	25 x 70 - 57.100

^a Genotype hybrid; DKC 6574, DKC 5143, DKC 6677, OS 515, OS 430 and Standard NS 444. ^b Origin of genotypes hybrids; France, Croatia and Serbia.

Agronomic Data Collection

Agronomic traits were measured throughout the growing season, including:

- Plant Height (cm): Measured from the soil surface to the highest point of the plant
- Ear Height (cm): Distance from the soil to the first cob placement
- Vegetative Growth Duration: Days from planting to tasseling and silking
- Ear Length (cm): Measured from the base to the tip of the ear
- Number of Kernel Rows per Ear: Counted after harvest
- Cob-to-Grain Ratio: Determined as the ratio of cob weight to total ear weight
- Grain Yield (t/ha): Calculated based on harvested grain weight and adjusted to 14% moisture

Statistical Analysis

Data were analyzed using Analysis of Variance (ANOVA) to assess differences between hybrids. Tukey’s HSD test was applied to determine significant differences among means at $p \leq 0.05$. Correlation analyses were also performed to explore relationships between agronomic traits, yield, and quality parameters.

RESULTS AND DISCUSSION

Plant Height and Ear Placement. Plant height is a crucial factor influencing biomass production and adaptability. The results (Table 2) showed significant variation among hybrids, with the Croatian hybrid OS 515 achieving the maximum height (262.3 cm), whereas the French hybrid DKC 6574 recorded the shortest height (225.6 cm). The average plant height across all hybrids was 247.9 cm, with hybrids from Croatia generally exhibiting taller plants compared to those from France.

Table 2. Plant height, corn ear height and number of ears per plant in researched corn hybrids.

No	Hybrid	Plants height, cm	The height of the first corn ear, cm	The number of corn ears in plants	Vegetative period according to FAO
1	DKC 6574	225.6	96.6	1.15	Delayed
2	DKC 5143	246.6	110.0	1.10	Delayed
3	DKC 6677	243.0	103.3	1.15	Delayed
4	OS 515 ^a	262.3	113.3	1.25	Delayed
5	OS 430 ^b	250.0	103.3	1.15	Medium
6	NS 444	257.4	110.0	1.15	Medium

Ear placement height is also an important trait, particularly for mechanized harvesting. The lowest ear placement was observed in DKC 6574 (96.6 cm), while OS 515 exhibited the highest placement (113.5 cm). The standard hybrid NS 444 had an intermediate ear height, making it a reference point for comparison. The findings indicate that hybrids with a higher ear placement tend to have greater biomass accumulation, which can benefit silage production. (Campos H, et. al 2004)

Yield Performance. Yield analysis revealed significant differences among hybrids (Table 3). The Croatian hybrid OS 515 outperformed all others, with the highest recorded grain yield per hectare. The French hybrids DKC 5143 and DKC 6574 also showed competitive performance, while the NS 444 standard hybrid had the lowest yield. The results suggest that hybrids with greater vegetative growth potential do not necessarily translate into higher grain yield, emphasizing the importance of both agronomic and genetic factors in hybrid selection. (Tolleman M and Lee E, 2002)

Cob and Grain Characteristics. Cob length varied among hybrids, with OS 430 and DKC 6574 recording the longest ears (22 cm), while DKC 5143 had the shortest (18 cm). (Sangoi L, et. al. 2002; Hammer G, et al. 2009) The number of kernel rows per cob was highest in OS 515 and DKC 6677, which may have contributed to their higher yield potential. The cob-to-grain ratio indicated that DKC 6677 had superior grain filling, making it a promising hybrid for grain production. (Duvick D., 2005)

Table 3. Some parameters of the corn ear as well as the moisture at harvest time of the researched hybrids.

Hybrid	The height of the ear corn (cm)	Number of circles in corn ear	Number of rows in the corn ear	Moisture at harvest time
DKC 6574	22.1	38	14	17.9
DKC 5143	18	34	16	18.6
DKC 6677 ^a	20	42	16	19.5
OS 515	20	45	14	18.2
OS 430	22	41	14	17.9
NS 444	20	38	14	18.4

Grain Quality: Protein and Fat Content. Protein content is a key factor in assessing the nutritional value of corn for both human and livestock consumption. The OS 515 hybrid had the highest protein content (13.7%), significantly exceeding the standard hybrid NS 444 (12.2%). The lowest protein content was found in DKC 5143 (10.6%), suggesting that this hybrid may be less suitable for feed production.

Table 4. The content of proteins in the researched corn hybrids.

Hybrid	Protein in %				Average
	I	II	III		
DKC 6574	11.1	12.0	11.2		11.43
DKC 5143	10.3	10.4	11.5		10.6
DKC 6677	13.4	12.5	13.8		13.23
OS 515	14.0	13.5	13.9		13.7
OS 430	13.0	12.5	13.4		12.97
NS 444	12.1	12.0	12.8		12.2

Fat content analysis showed that the DKC 6677 hybrid had the highest fat percentage (5.07%), while the lowest was observed in the NS 444 standard hybrid (3.5%). The correlation analysis (Table 5) revealed a significant relationship between yield and fat content ($r = 0.669^{**}$), indicating that hybrids with higher fat content tend to exhibit better overall performance. (Bolanos J., and Edmeades G., 2002; Aslam M, et al. 2013).

Table 5. Fat content in % of corn hybrids.

Hybrid	Fat				Average
	I	II	III		
DKC 6574	4.5	4.2	4.6		4.43
DKC 5143	5.0	4.9	5.1		5.00
DKC 6677	5.1	5.2	4.9		5.07
OS 515	4.7	4.6	4.6		4.63
OS 430	3.8	3.2	3.9		3.63
NS 444	3.7	3.4	3.5		3.53

Statistical Analysis and Hybrid Selection. ANOVA results confirmed significant differences between hybrids for all measured traits. Tukey’s HSD test further identified that OS 515 and DKC 5143 had statistically higher yields compared to the standard hybrid. Correlation analysis highlighted a strong dependence between plant height and protein content ($r = 0.518^*$), as well as between ear placement and total biomass ($r = 0.854^{**}$).

Table 6. Presentation of correlations between researched parameters.

		Yield	Protein	Fats	Plant-Length	Corn ear length
Yield	Pearson Correlation	1	-,027	0,669(**)	-,171	-,006
	Sig.(2-tailed)		0,916	0,002	0,498	0,981
	N	18	18	18	18	18
Protein	Pearson Correlation	-,027	1	-,111	0,518(*)	0,254
	Sig. (2-tailed)	0,916		0,661	0,028	0,309
	N	18	18	18	18	18
Fats	Pearson Correlation	0,669(**)	-,111	1	-,249	-,200
	Sig. (2-tailed)	0,002	0,661		0,319	0,426
	N	18	18	18	18	18
Plant length	Pearson Correlation	-,171	0,518(*)	-,249	1	0,854(**)
	Sig. (2-tailed)	0,498	0,028	0,319		0,000

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 6 shows a significant dependence ($r = 0.669^{**}$) between yield and fats content and between the plant height and protein content with a correlation coefficient of $r = 0,518^*$. There is also a very significant dependence on the height of plants and the height of the placement of the first corn ear with a correlation coefficient of $r = 0.854^{**}$, but this dependence is normal and visible.

Practical Implications. The findings suggest that the Croatian hybrid OS 515 is the most suitable for cultivation in the Peja region due to its superior performance in plant height, ear placement, grain yield, and protein content. French hybrids DKC 5143 and DKC 6574 also demonstrated strong yield potential and could be considered viable alternatives. These results provide valuable insights for farmers and agricultural policymakers seeking to enhance corn production in Kosovo.

CONCLUSIONS

- This study assessed the adaptability and agronomic performance of selected EU and regional corn hybrids in the Peja region of Kosovo. The findings highlight significant differences among hybrids in terms of plant height, ear placement, grain yield, and nutritional composition.
- Among the tested hybrids, the Croatian hybrid OS 515 demonstrated the highest plant height, ear placement, and grain yield, making it a promising choice for both grain and silage production. French hybrids DKC 5143 and DKC 6574 also exhibited strong yield potential, while the standard hybrid NS 444 had lower yield performance but provided a useful benchmark for comparison.
- Grain quality analysis revealed that OS 515 had the highest protein content, while DKC 6677 exhibited superior fat content. These findings suggest that selecting hybrids based on both yield potential and grain composition is crucial for optimizing production, whether for human consumption or livestock feed.
- The results of this study provide valuable insights for farmers and agricultural policymakers in Kosovo, emphasizing the importance of hybrid selection in improving corn production. Future research should focus on multi-year trials across different agro-ecological zones to further validate these findings and optimize hybrid recommendations for sustainable corn cultivation.

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