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# ANTIOXIDANT ACTIVITY IN NINE CORN CULTIVARS (*ZEA MAYS* L.)

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## ABSTRACT

*Grains from nine corn cultivars locally grown in Constanța county were analyzed for antioxidant activity: P 0023, P 0216, P 0710 and P 9415, DKC 4109, DKC 4391, DKC 5810, KWS 4484, and SY Torino.*
*SY Torino (34.33 %) and P 0710 (31.38 %) had the highest average radical scavenging percentage, while DKC 4109 (26.03 %) and KWS 4484 (24.12 %) also showed high values. The lowest antioxidant activity was found in P 0023 and DKC 5810 (below 6 %).*
*Results are comparable to other known corn cultivars. Reported to dry tissue biomass, all hybrids are strongly antioxidant.*

## INTRODUCTION

Corn or maize (*Zea mays* L.) is one of the main cereals cultivated worldwide, also being a major crop in Romania. Corn grains are especially rich in starch and other sugars, being an important part of human diet.

The nutritional value of corn products is not, however, limited to sugars. Various studies have shown that they also host important amounts of other nutrients, including valuable antioxidants, such as various carotenoids and especially phenolic compounds (Popoviciu et al. 2024).

These compounds may bring variate health benefits to consumers, by having antiobesity, antitumoral or neuroprotective properties (Cristianini et al. 2020, Navarro et al. 2018).

The purpose of this paper was to assess the antioxidant activity in extracts from nine corn hybrid cultivars commonly grown in Southeastern Romania.

## MATERIAL AND METHODS

Nine maize hybrids, namely P 0023, P 0216, P 0710 and P 9415 (all developed by Pioneer), DKC 4109, DKC 4391, DKC 5810 (Bayer), KWS 4484 (KWS), and SY Torino (Syngenta), were taken into analysis. Grains were collected in 2024 from local farmers in Constanța county, and taken for laboratory analyses to the „Ovidius" University. Samples were taken from central Cernavodă plateau, on the middle course of the Carasu Valley. Local soil type is carbonaceous chernozem. The average monthly temperatures was 14.8 ºC (the normal average for the area being 11.6 ºC). Annual precipitation was 318.10 mm (normal value being 436 mm). The soils cultivated with the five hybrids were irrigated, with three water aspersion interventions, each of 400 $m^3$ per hectare.

According to the producer, P 0023 is a medium-sized corn variety. With median cob insertion, compact cob and dentate grains. A semi-tardive hybrid (FAO 400 group), it is drought-resistant and easily loses water at mature stage. 1,000-grain weight is 340–395 g.

P 0216 is a semi-tardive (FAO 450) hybrid, also drought-resistant, with a strong root system. Cobs have high insertion and dentate grains. It has high resistance to corn smut. 1,000-grain weight is 365-400 g.

P 0710 is also semi-tardive (FAO 450), with deep roots, and good resistance to drought, eroded soils and fall. 1,000-grain weight is 430-450 g.

P 9415 is a semi-early hybrid (FAO 340), resistant to drought and acidic soils. 1,000-grain weight is 355-395 g (Corteva Agriscience).

Bayer Dekalb DKC 4109 is an average-flowering hybrid, with low to median cob insertion and dentate grains. An early hybrid (FAO 300–340 group), it is drought-resistant, suitable to a wide variety of local climates and high densities.

Bayer Dekalb DKC 4391 is an early hybrid (FAO 300–340), with similar characteristics to the previous, but with a higher drying rate of seeds.

Bayer Dekalb DKC 5810 is a late hybrid (450–490), with higher flowering capacity and good phytosanitary resistance (Corteva Agriscience).

KWS 4484 is an early to medium hybrid (FAO 380), with a tall stem, long cob with an average seed number, tolerant to drought and fall (Popescu et al. 2016).

SY Torino is an early variety (FAO 300–340), adapted to medium-intensive technology conditions, with high productivity and high drying rate (Syngenta).

Analysis of antioxidant activity required grinding corn grains in an electric grinder, until the material was reduced to a fine powder. Extraction was made by mixing the powder with 70 % ethanol solution up to a final concentration of 10 % plant material and filtering.

Antioxidant activity was determined using the DPPH method. Samples were 10-fold diluted and 0.1 mL of each one were incubated for 60 minutes (in the dark) with 2.9 mL 2,2-diphenyl-1-picrylhydrazyl (DPPH). Spectrophotometric absorbance was read at 517 nm using a Cecil 2021 spectrophotometer. A calibration curve was previously made using gallic acid. Results were expressed percentage of DPPH radical scavenging (Brand-Williams et al. 1995). IC50 was derived by linear regression.

## RESULTS AND DISCUSSIONS

The percentual radical scavenging activity of corn grain extracts is shown in Figure 1. Table 1 shows the average half maximal inhibitory concentrations (IC50) of studied corn extracts against free radicals.

Results show that antioxidant activity is a highly variable parameter, even among related cultivars. SY Torino (34.33 %) and P 0710 (31.38 %) had the highest average radical scavenging percentage, while high rates were also found in DKC 4109 (26.03 %) and KWS 4484 (24.12 %). At the lower end were P 0023 and DKC 5810 (below 6 %).

Antioxidant activities are often related to the concentrations of specific types of chemicals, especially phenols and, to a lesser extent ascorbic acid and carotenoids. The four selected Pioneer hybrids were previously studied from this point of view (Popoviciu et al. 2024). However, chemical parameters are not correlated with actual radical scavenging, since P 9415 is the richest in total phenols, phenolic acids and carotenoids, while P 0023 has the highest ascorbic acid amounts.

The only parameter that could be correlated is a higher concentration of flavonoids and stilbenes.

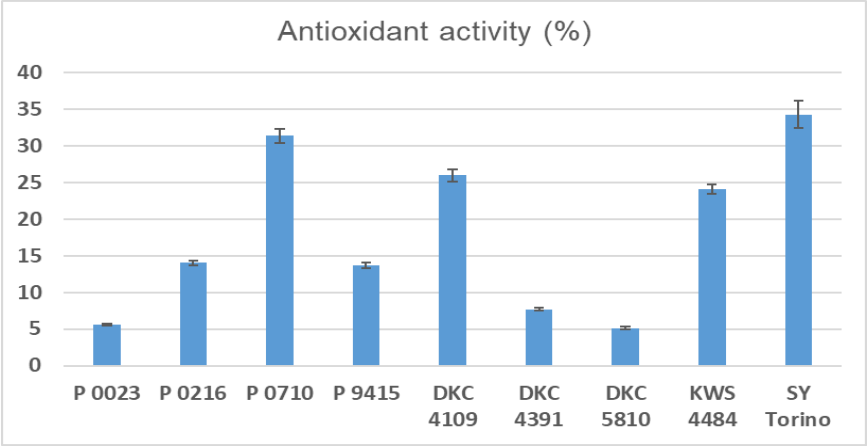


Figure 1. Radical scavenging activity in 10 % ethanolic extracts of selected corn hybrids (%).

Table 1

Average IC50 in 10% ethanolic extracts of selected corn hybrids against free radicals (mg/L)

| Hybrid | P 0023 | P 0216 | P 0710 | P 9415 | DKC 4109 |
|---|---|---|---|---|---|
| IC50 (mg/mL) | 103.57 | 92.14 | 68.58 | 92.14 | 75.85 |
| Hybrid | DKC 4391 | DKC 5810 | KWS 4484 | SY Torino | |
| IC50 (mg/mL) | 100.72 | 104.23 | 78.44 | 64.58 | |

The same was true for the other five hybrids (unpublished data), since DKC 4109 and SY Torino have low phenolic inventories (including flavonoids).

For comparison literature data is also extremely variate. Results cited in a review paper (Nawaz et al. 2018) give antioxidant activities in seed extracts ranging from 22.95 to 61.75 %. A study on seven cultivars found IC50 values of 5.56–16.96 mg/L, equating to 55.6–16.96 mg/L in 10 % extracts. The authors classified all cultivars with IC50 < 50 mg/L as very strongly antioxidant (Sinay et al. 2022). This is the case with most of the extracts in our study. P 0023, DKC 4391 and DKC 5810, extracts on the other hand, could be classified as strongly antioxidant (values below 100 mg/L). Crude corn tissue can be considered as strongly antioxidant in all hybrids.

It is also known that among factors influencing antioxidant activity is the ratio between different components of the grain, since corn seed bran can have double radical scavenging rate than the germ (Smuda et al. 2018). Climatic factors and harvest season and date also influence this parameter, with variations up to 66% (Ledenčan et al. 2022).

## CONCLUSIONS

Among the nine hybrid cultivars, SY Torino (34.33 %) and P 0710 (31.38 %) had the highest average radical scavenging percentage, while DKC 4109 (26.03 %)

and KWS 4484 (24.12 %) also showed high values. The lowest antioxidant activity was found in P 0023 and DKC 5810 (below 6 %).

Results are comparable to other known corn cultivars, although they show little correlation to the actual chemical composition of the grains, i.e. the total phenolic content and concentrations of other known antioxidants.

P 0023, DKC 4391 and DKC 5810, extracts could be classified as strongly antioxidant according to scales found in literature (IC50 < 50 mg/L), while the other six hybrids are very strongly antioxidant. Crude tissue is strongly antioxidant in all studied hybrids.

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