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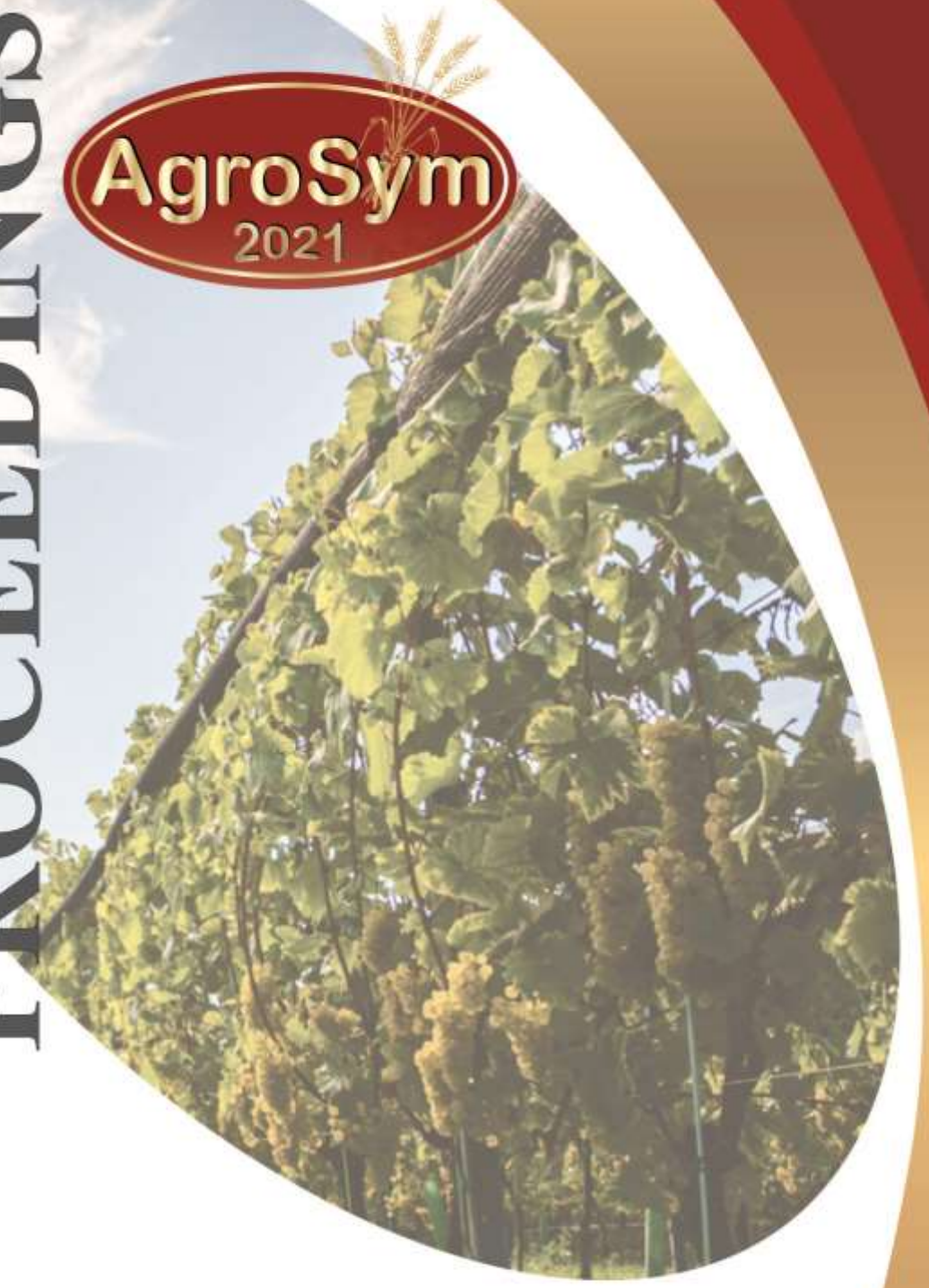

XII International Scientific Agriculture Symposium "AGROSYM 2021" October 7-10, 2021

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EFFECT OF DRYING TEMPERATURE ON ANTIOXIDANT ACTIVITY OF WHITE AND RED MAIZE (*ZEA MAYS* L.) SEEDS

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Abstract

Maize is the most commonly consumed cereal in the world. Its various compounds are associated with nutraceutical properties and health-promoting benefits. Therefore, maize seeds are considered to be functional food with high antioxidant activities. The drying conditions have a huge impact on maintaining the seed quality. This study aimed to evaluate the effect of temperature on the antioxidant activities of white and red maize (*Zea mays* L.) cultivars. A drying time of 1 h at a temperature of 45 °C was tested. The antioxidant activity expressed in percentages was evaluated as radical scavenging activity using the DPPH (2,2-diphenyl-1-picrylhydrazyl) reagent. The results revealed that the antioxidant activity of the dried white seeds (74.08 %) was not significantly different ($p>0.005$) with respect to the un-dried seeds used as control (72.6 %). Contrary, drying at 45 °C caused a significant ($p<0.005$) rise of antioxidant activity in the red-coloured seeds' being 85.95 % and 92.25 % before and after the treatment, respectively. The obtained results show that the antioxidant activity may be a reliable indicator for the estimation of the cereal seeds' quality, which is useful in the food industry and agriculture.

Keywords: *maize seeds, 2,2-diphenyl-1-picrylhydrazyl radical scavenging activity, oven-drying, quality.*

Introduction

Maize (*Zea Mays* L.) is a principal cereal crop cultivated worldwide and one of the major food sources. High diversity exhibited in cultivated maize is recognized phenotypically by different seed colours, shapes, and sizes, as well as differences in the cob and plant characteristics (Martínez-Martínez et al., 2019). The quality of pigmented grain could be correlated to the antioxidant activity (AA%). Secondary metabolites, phenolics, and carotenoids found in pigmented maize are attributed to the high antioxidant properties of their seeds. The most commonly present phenolic compounds in the seeds are flavonoids, which are responsible for the different coloration of plants, and phenolic acids (Žilić et al., 2012). The color of purple corn is due to anthocyanin which has been using for coloring beverages, jellies, candies (Vilcacundo et al., 2020).

Health promotion benefits of edible plants are correlated to biologically active compounds, called antioxidants, that protect the cells from the harmful effect caused by active oxygen species and prevent the development of various diseases (Harakotr et al., 2014; Zargoosh et al., 2019). Beneficial health effects of nutrients that feature high antioxidant capacity are considered to be functional food ingredients.

Drying cereal seeds is a method of preservation common in the food industry used also to produce food with desired characteristics. During this process, retained moisture is evaporating up to a certain level, while the storage period of dried products is increased (Hihat et al., 2017).

Effects of drying of seeds were investigated experimentally in several separate research studies and the obtained conclusion was that increasing drying temperature reduces nutraceutical properties. Other studies reported the effects of different drying techniques on the antioxidative activity of seeds (López-Vidaña et al., 2017).

In the present work, the effect of drying temperature on antioxidant activity of different coloured maize seeds (white and red) was investigated. The impact of drying was evaluated using DPPH assay. The difference in antioxidant activity between treated (dried at 45 °C) and untreated (control) seeds of two different coloured maize variants was detected.

Material and Methods

Sample preparation

The seed material was supplied by the Maize Research Institute (Zemun Polje, Serbia). Experimetns were carried out at the Institute for Multidisciplinary Research, University of Belgrade. Half of the maize seeds (both white and red coloured) were dried for 1 h at 45 °C in an oven (Daihan Scientific, South Korea) while the other half was stored at room temperature (25 °C) to be used as control. After the heat treatment, maize seeds were homogenized. The seeds were grinded in a mill, followed by further powdering with liquid nitrogen in a mortar with pestle, and used for detection of antioxidant activity with DPPH assay.

DPPH Assay

Antioxidant activity (AA) of different coloured maize seeds, before and after drying, was measured by employing a 2,2-diphenyl-1-picrylhydrazyl (DPPH, Sigma-Aldrich, St. Louis, MO, USA) assay. DPPH was dissolved in 96 % ethanol to a final concentration of 0.4 mM. Freshly prepared DPPH solution was stored in the dark at 4 °C until use. The samples of powdered maize seeds were immersed in 3 ml of ethanol (70 % v/v) and shaken on a vortex mixer for a few seconds. After extraction, 1 ml of 0.4 mM DPPH solution was added to each sample to a final concentration of 0.1 mM. The reaction was carried out while the mixture was constantly shaken and incubated for 30 minutes in the dark. Absorbance was measured at 517 nm on a UV-VIS microplate reader (Tecan Infinite M Nano+, Switzerland). Pure deionized water was considered as a blank while the control consisted of 0.1 mM DPPH in 96 % ethanol solution. Antioxidant activity was calculated as a percentage of depleted reagent and the results were presented as a mean value of four replicates (n=4) and the standard error. The Mann-Whitney U nonparametric test has been used for tested the means values.

Results and Discussion

Obtained results of the antioxidant activity of the two analyzed maize seeds dried at 45 °C compared to the control (untreated) seeds are presented in Figure 1. Drying treatment (1h at 45 °C) of red coloured seeds significantly ($P<0.05$) increased their AA to 92 % as compared to AA of 86 % recorded in control samples. Contrary to the red pigmented seeds, there is no significant difference ($P>0.05$) in AA between treated (74.08 %) and control (73 %) seeds of white coloured maize seeds.

Red pigment of the maize seed is attributed to a high content of a class of flavonoids called anthocyanins, with high antioxidant and antiradical activities, located in aleurone layer or pericarp (Žilić et al., 2012). These compounds may contribute to an increase in antioxidant

activity in red pigmented seed after exposure to temperature treatment at 45 °C. These red pigmented seeds might be used for producing of the sprouts which have attracted the interest of the food industry for the nutritional value of their components and their biological properties such as the antioxidant activity.

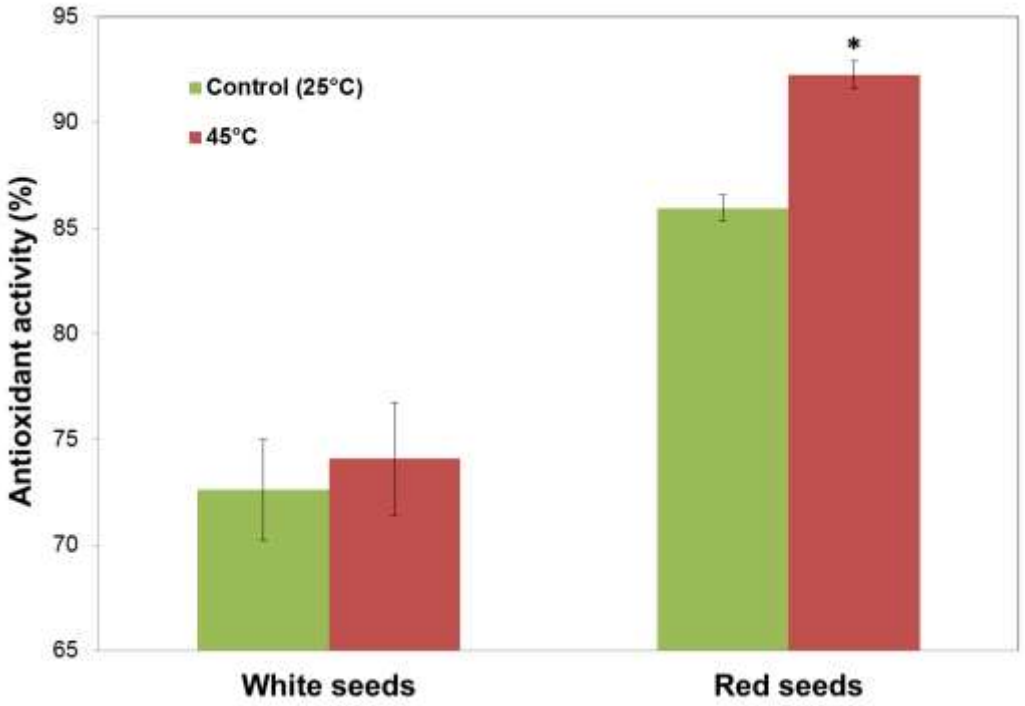

Figure 1. Antioxidant activity of white and red maize seeds after 1 h drying at 45 °C compared to the control (seeds stored at room temperature, 25 °C). Values are given as the mean percentage ± SD (n=4). Asterisk (*) indicates a significant difference at $p<0.05$.

Conclusions

Our results indicate that the heat treatment of the maize seeds (1 h-drying at 45 °C) increased antioxidant activity compared to the control samples. The difference is statistically significant ($p<0.005$) only for red pigmented maize. The two different coloured maize types have different phytochemical profiles, therefore corresponding antioxidant activity differs significantly between the two seed types.

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