

THE YIELD OF MAIZE HYBRIDS GROWN ON THE PHOTODEGRADABLE FOLIUM

PRINOS HIBRIDA KUKURUZA NA FOTORAZGRADIVOJ FOLIJI

Predrag JOVIN*, Zivota JOVANOVIĆ*, Ivica ĐALOVIĆ**, Miodrag TOLIMIR*

*Maize Research Institute, Zemun Polje, Serbia and Montenegro

**Faculty of Agronomy, Cacak, Serbia and Montenegro

ABSTRACT In this paper present study was to determine the differences in yields of medium late maturity maize hybrids grown with and without the folium under the equal agroecological conditions. Maize hybrid plants grown with the photodegradable folium were taller by 13.3 cm than the plants of the same hybrids grown without the photodegradable folium. Grain yield of hybrid plants grown with the photodegradable folium was higher on the average for all three years by 8.09% than the yield of hybrid plants grown without the photodegradable folium. Only in a favourable year 2001 with a sufficient amount of precipitation during the growing season there were no differences in yields obtained in hybrid plants grown with and without the photodegradable folium. Due to relatively high costs of the folium and its setting the economic justification in the application of the folium could be found in the production of higher categories of maize seed.

IZVOD: Na prinos kukuruza može se uticati izborom hibrida, raznim agrotehničkim merama, ali i primenom nekih drugih metoda čiji je cilj da se ubrza vegetativni porast, bolje sačuva vlaga u zemljištu, zaštiti usevi od korova i dr.

U radu su prikazani rezultati ispitivanja rodosti srednjekasnih hibrida kukuruza gajenih na fotorazgradivoj foliji u poređenju sa prinosom istih hibrida gajenih bez folije u istim agroekološkim uslovima.

Dobijeni rezultati istraživanja ukazuju da su biljke hibrida kukuruza gajenih na fotorazgradivoj foliji imale viši rast za 13.3 cm u odnosu na biljke istih hibrida gajenih bez folije. Prinos kukuruza na foliji prosečno za tri godine, koliko je trajalo ispitivanje bio je viši od prinosa kukuruza gajenog bez folije za 8.09 % po jedinici površine. U godinama kada je bilo dovoljno padavina u vegetacionom periodu kukuruza, kakva je bila 2001. godina nema značajne razlike u prinosu hibrida gajenih na foliji i bez folije.

Zbog relativno visokih troškova folije i njenog postavljanja opravdanost primene treba tražiti u proizvodnji viših kategorija semena i komercijalnog semena kukuruza

Key words: maize hybrids, photodegradable folium, yield.

Ključne reči: hibidi kukuruza, fotorazgradiva folija, prinos

INTRODUCTION

The maize yield can be affected by the choice of hybrids, different cropping practices, but also by the application of other methods with the aim to accelerate the vegetative growth, better conserve soil moisture, protect the crop from weeds, etc. The application of a photodegradable folium is one of such methods. The invention of this folium has, to a certain extent, rationalised the crop production as subsequent collecting and destroying of the folium is omitted upon the harvest.

The use of photodegradable folium is not a novelty as it has been massively used in the vegetable production. (Bajkin *et al.*, 1995), but it has not been applied so much in the growth of field crops due to high expenses. The possible economic justification in the application of the folium could be found in the growth of early maturity hybrids intended for human

consumption in the immature milk stage or in the production of higher categories of maize seed.

The aim of the present study was to determine the differences in yields of medium late maturity maize hybrids grown with and without the folium under the equal agroecological conditions.

MATERIAL AND METHODS

The three-year studies (2001–2003) were carried out on marshy black soil on Mr. Đorđe Mihajlović's estate in Krnješevci in the vicinity of Belgrade. Four rows at the distance of 70 x 28 cm of the following ZP maize hybrids were sown under rainfed conditions: ZP 633, ZP 677, ZP 680 and ZP 704.

Wheat was a preceding crop during the first two experiment years, while sugar beet was used in the third year. After wheat was harvested, stubble was fallowed and deep ploughing (28–30 cm) was carried out in autumn. The same procedure was applied to sugar beet. During the all three years only Urea of mineral fertilisers was applied in the amount of 250 kg during the seedbed preparation and 40 t manure ha⁻¹ in autumn of 2000.

Simultaneous maize sowing and folium setting was done on April 20, 14 and 19 in 2001, 2002 and 2003, respectively. After sowing the following herbicides were applied over the whole trial area: Alachlor 5 l/ha⁻¹ + Atrazine 1.5 l/ha⁻¹ + Prometrin 1 kg/ha⁻¹. The plant height was measured at the end of July (10 successive plants in each row, i.e. replication). Harvest and yield measuring was done on October 6, 2001, september 22 and 19 in 2002 and 2003, respectively. Ear samples were drawn from each replication and were analysed in the Seed Testing Laboratory of the Maize Research Institute, Zemun Polje.

The elementary plot size amounted to 20 m².

The analysis of variance was used for statistical processing of data, while the evaluation of significance was done by the LSD-test.

Meteorological conditions

Meteorological data are presented for the meteorological station at Zemun Polje as it is the closest station to the place of trial performance. Table 1. shows that mean air temperatures during investigation years were at the level of the long-term mean. Mean monthly air temperatures in May, June, July and August were higher than the long-term mean. The only exception were mean temperatures in June of 2001, which were lower than the long-term mean.

Table 1
Mean monthly air temperatures (°C) and precipitation sum (mm) at Zemun Polje

	Year	Months						Mean/ Sum
		April	May	June	July	August	September	
Temperatures (°C)	2001	11.0	17.6	18.1	22.4	23.3	15.9	18.0
	2002	11.6	19.2	22.0	23.4	21.6	16.5	19.0
	2003	11.2	20.4	24.0	22.5	24.3	17.1	19.9
	1961–90	11.6	16.8	19.7	21.4	20.9	17.0	17.9
Precipitation (mm)	2001	148.8	46.2	168.0	41.8	35.0	70.8	510.6
	2002	54.8	29.4	65.0	34.8	105.1	55.4	344.6
	2003	14.6	23.4	19.0	105.4	26.4	41.2	230.0
	1961–90	49.5	58.7	77.5	60.6	50.8	45.1	343.2

The precipitation sum of the growing period in 2001 (510.6 mm) was higher than the long-term mean (342.2 mm). In 2002 this sum (344.6 mm) was at the level of the long-term mean, while in 2003 it (230.0 mm) was lower than the long-term mean. A great amount of rain in April (148.8 mm) and June (168.0 mm) favourably affected maize yield in 2001. In 2002, there was a great sum of precipitation in August (105.2 mm), which also affected maize yield. Low amounts of rain in 2003, especially in April, May, June and August (14.6, 23.4, 19.0 and 26.0 mm, respectively) adversely affected yield so obtained yield in that year was lower than in remaining two years.

RESULTS AND DISCUSSION

The average plant height (Table 2) was significantly higher in hybrids grown on the degradable folium (237.1 cm vs. 223.8 cm). All observed hybrids grown on the folium and individually studied had greater plant height than the same hybrids grown without the folium: ZP 633 (229.3, 213.7 cm), ZP 677 (238.2, 227.1 cm), ZP 680 (239.2, 225.0 cm) and ZP 704 (241.8, 229.6 cm).

Furthermore, the plant height was also greater over years in hybrids grown on the folium than in the same hybrids grown without the folium: 2001 (256.1, 244.2 cm), 2002 (237.7, 223.5 cm) and 2003 (217.4, 203.8 cm).

Table 2

Plant height (cm)

Treatment	Year	ZP 633	ZP 677	ZP 680	ZP 704	Average
Without folium	2001	232.4	245.1	243.7	255.6	244.2
	2002	215.1	227.0	225.8	226.1	223.5
	2003	193.6	209.3	205.4	207.1	203.8
	Average	213.7	227.1	225.0	229.6	223.8
With folium	2001	245.3	355.5	258.8	265.0	256.1
	2002	230.0	240.7	238.2	242.1	237.7
	2003	212.5	218.3	220.6	218.3	217.4
	Average	229.3	238.2	239.2	241.8	237.1

LSD	Year	Year x Folium	Year x Hybrid
0.05	5.6	7.3	9.4
0.01	8.8	10.7	12.8

Table 3

Average yield of dry grain (t ha⁻¹)

Treatment	Year	ZP 633	ZP 677	ZP 680	ZP 704	Average
Without folium	2001	9.97	10.70	10.50	11.06	10.56
	2002	8.45	10.31	9.00	8.12	8.97
	2003	6.12	6.49	6.50	6.62	6.43
	Average	8.18	9.17	8.67	8.60	8.65
With folium	2001	11.43	10.59	9.37	11.32	10.68
	2002	10.31	11.21	10.42	10.21	10.54
	2003	6.58	7.17	7.01	6.65	6.85
	Average	9.44	9.66	8.93	9.39	9.35

LSD	Year	Year x Folium	Year x Hybrid
0.05	0.42	0.60	0.84
0.01	0.57	0.81	1.15

Water, air and heat properties of the soil are more favourable under the folium (Molnar, 1995). This is especially important for the growth and development and it is mostly manifested on the accelerated initial growth of field and vegetable crops. (Kovačević, 2003).

The average yield of dry grain (table 3) was statistically significantly higher in maize hybrids grown on the folium ($9.35 \text{ t} \cdot \text{ha}^{-1}$) than in the same hybrids grown without the folium ($8.65 \text{ t} \cdot \text{ha}^{-1}$). Yields of all individual hybrids grown with the folium was higher than yields of the same hybrids grown without the folium: ZP 633 ($9.44, 8.18 \text{ t} \cdot \text{ha}^{-1}$), ZP 677 ($9.66, 9.17 \text{ t} \cdot \text{ha}^{-1}$), ZP 680 ($8.93, 8.67 \text{ t} \cdot \text{ha}^{-1}$), ZP 704 ($9.39, 8.60 \text{ t} \cdot \text{ha}^{-1}$). Furthermore, average yield of hybrids grown on the folium was higher over years than the yield of the same hybrids grown without the folium. In 2001, a favourable year for maize cultivation, the yield obtained in hybrids grown with the folium was insignificantly higher than of the same hybrids grown without the folium ($10.68, 10.56 \text{ t} \cdot \text{ha}^{-1}$). In, 2002, the difference in obtained yields was statistically very significant ($10.54, 8.97 \text{ t} \cdot \text{ha}^{-1}$), while this difference in 2003 was just significant ($6.85, 6.43 \text{ t} \cdot \text{ha}^{-1}$).

The essential role of the photodegradable folium is maintenance of moisture in the stage of seed germination and emergence, as well as, in the stage of plant growth, then, faster warming of a sowing soil layer by which emergence is accelerated, protection against weeds is provided, etc. (Group of authors, 1996; Nielsen, 1997). Nielsen (1997), increased the yield by 7.4–9.8% by growing maize with the photodegradable folium under Louisianan agroecological conditions.

CONCLUSIONS

According to obtained results the following conclusions can be drawn:

- Maize hybrid plants grown with the photodegradable folium were taller by 13.3 cm than the plants of the same hybrids grown without the photodegradable folium.
- Grain yield of hybrid plants grown with the photodegradable folium was higher on the average for all three years by 8.09% than the yield of hybrid plants grown without the photodegradable folium. Only in a favourable year 2001 with a sufficient amount of precipitation during the growing season there were no differences in yields obtained in hybrid plants grown with and without the photodegradable folium.
- Due to relatively high costs of the folium and its setting the economic justification in the application of the folium could be found in the production of higher categories of maize seed.

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