

BIOLOGICAL AND GENETICAL CHARACTERISTICS OF HYBRID MAIZE KNEZA 683A

Ž. Gacovski, G. Cilev

Faculty of Veterinary Science, 7000 Bitola, Macedonia
Corresponding author: zivko.gacovski@uklo.edu.mk
Original scientific paper

Abstract: The basic biological and economic properties of the hybrid maize Kneza 683A, created in Maize Research Institute – Kneza, R. Bulgaria by the method of interline hybridization are briefly described. The hybrid is acknowledged during year 1994 after two years variety-testing in SVTC (State Variety-Testing Commission) with standards American hybrids of maize H 708 and Ivana. During the period of testing, in year 1992 and 1993, in condition without irrigation, the average enlargement of yield on hybrid maize Kneza 683A (8 140 kg/ha), in comparison with hybrid maize H 708 (7 210 kg/ha) was 11, 42% and with hybrid maize Ivana (7610 kg/ha) was 6,51%. In conditions with irrigation, the average enlargement of yield on hybrid maize Kneza 683A (10 610 kg/ha), compared to first standard H 708 (9 890 kg/ha) was 6,78%, and compared to second standard Ivana (10 570 kg/ha) was 0,37%. The hybrid maize Kneza 683A, was examined in year 1994 and 1995 in R. Macedonia in conditions with irrigation and in R. Bulgaria, without irrigation. In comparison with standard american hybrid of maize H 708 (11 233 kg/ha), in our country the average enlargement of yield on the hybrid maize Kneza 683A (11 556 kg/ha) was 2,79%, and in R. Bulgaria was 8,04%. In the examination in year 2006 in R. Macedonia in conditions with irrigation, the average enlargement of yield on the hybrid maize Kneza 683A (11 600 kg/ha) in comparison with standard Kneza 630 (8 830 kg/ha) was 8,04% and hybrid Kneza 621 (11 200 kg/ha) was 3,44%. After examination from SVTC, in year 2007, the University "Goce Delcev" Stip, Institute for Southern Crops in Strumica in our country have registered the hybrid on the sort list. In 2008 was organised seed production on area of 1 ha and there was yield of 2000 kg/ha, which means that although the late sowing there was good yield of seed. In field conditions the hybrid is practically resistant to the economically important disease by the maize. The seed production of the hybrid maize Kneza 683A carry out with simultaneously sowing of the parental components using cytoplasmic male sterility (CMS) and fully restoration of fertility in hybrid generation. The hybrid maize Kneza 683A successfully shift the late Bulgarian and foreign hybrids (group 600 by FAO), since is more drought-resistant and considerably exceeds them by grain yield and silage mass from a unit of area.

Key words: maize, hybrid, biological properties, grain yield, fresh mass

Introduction

The hybrid maize Kneza 683A is from the group of late hybrid maize, group 600 according to classification of UN (FAO). Created in the Maize Research Institute-Kneza, R. Bulgaria, the authorial collective, with hybridization of the original mutant line K 4640 B and American line Mo 17. The aim of our examinations was introduction of Bulgarian maize hybrids in R. Macedonia, which will give higher yields of grain and green mass - silage of the established standards (american, bulgarian and serbian hybrids).

In order to introduce the scientific community and agribusiness with productive properties of the hybrids and the possibilities for exploitation in various conditions of cultivation were organised the trials and shown the biological and genetical characteristics of Hybrid maize Kneza 683A.

Materials and Methods

Hybrid obtained by crossing the mutagenic line ♀ K 4640B with the American line ♂ Mo 17. K4640B line is created by chemical mutagenic action of the Maize Research Institute -Kneza, R. Bulgaria. The material is obtained from the Maize Research Institute-Kneza, R. Bulgaria Prior culture of the maize was wheat.

Monitored are the basic biological and economic characteristics of the hybrid maize Kneza 683A. Assessment is made of the properties of productivity, based on measurements made after the harvest of each repetition of the test hybrid. It is made evaluation of resistance of onslaught of diseases and insects (H. Turcikum, U. maidis, Fusarium spp, O. nubilalis). Evaluation of lying of the plants and broken plants was performed before harvesting. After harvesting is done determining of the moisture in grain and yield in kg/ha with 14 % moisture.

The examination of the hybrid was conducted in the competition sort trials (CST) in the period from year 1989 to 1997, in the Maize Research Institute-Kneza in 1993 - 1994 and in 1993 – 1994 in SVTC (State Variety-Testing Commission) in R. Bulgaria. Experiments are placed after the block method and the method of latin rectangle in 3 and 4 repetitions with the size of the experience parcel 10 m². Schemes for field trials are used according to *Shanin (1977)* and *Barov (1982)*. Dispersion analysis of the results of the trials was done after *Shanin (1977)*.

The examinations of the hybrid maize 683A in R.Macedonia are made in year 1994 and 1995 on area of ZK "Pelagonia" – R. Macedonia in conditions with irrigation and on area at the Maize Research Institute-Kneza, R. Bulgaria without irrigation. Then in year 2006, they are made on area at the Institute of Southern Crops – Strumica, R. Macedonia in conditions with irrigation. The experiments are performed after the method of random block system, in 5 repetitions with the size of the experience parcel of 10 m². After examination from SVTC (State Variety-Testing Commission) in R. Bulgaria, in year 2007, the University "Goce Delcev" Stip, Institute for Southern Crops in Strumica in our country have registered the hybrid on the sort list. In 2008 was organised seed production on area of 1 ha.

Results and Discussion

The hybrid maize Kneza 683A is a simple cross-line hybrid, created in the Maize Research Institute-Kneza, R. Bulgaria, in year 1989 by hybridization on the mutant line K4640B and the american line Mo 17. Hybrid maize Kneza 683A is a late hybrid, according to the FAO classification belongs to the group of maturity (600-699), which is evident from the results obtained during the test. The period from sprouting to silking is 72 days without irrigation in R. Bulgaria and 74 days with irrigation in R. Macedonia.

Period from sprouting to physiological maturity is 133 days without irrigation in R. Bulgaria and 138 days with irrigation in R. Macedonia.

The hybrid has a high, healthy stem, without anthocyanins coloration at the beginning of the leaves. Silk is light - pink. Cob is like a cone, 16-18 rows of grain and with a medium length from 24-27 cm. Spindle is with anthocyanins color, the shape of the grain is like a tooth, the color of the grain of the forehead is yellow and with very dark color in the basis. The mass of 1000 grains is 360-380 grams, and randeman during the crumbling of the cobs is 85-86%.

Table 1 – Biological characteristics of hybrid maize Kneza 683A

Simple hybrid	M.L. K 4640B x USA Mo 17	
FAO	600 – 699	
	With irrigation	Without irrigation
Sprouting – silking	72 days	74 days
Sprouting - physiological maturity	133 days	138 days
Stalk	High	
Colour of the silk	light – pink	
Form of the cob	like a cone	
Length of the cob in sm	24-27	
Type of grain	like a tooth	
Mass on 1000 grains in g	360 – 380	
Randeman on the grain in cob (%)	85-86	

The hybrid is acknowledged during year 1994 after two years variety-testing in SVTC (State Variety-Testing Commission) with standards American hybrids of maize H 708 and Ivana.

During the period of testing from SVTC (State Variety-Testing Commission) in R. Bulgaria 1992 and 1993 in conditions without irrigation, the average enlargement of yield on hybrid maize Kneza 683A (8 140 kg/ha), in comparison with american hybrid maize H 708 is 11,42% or 7 210 kg/ha and with Ivana is (6,51% or 7 610 kg/ha). In conditions with irrigation, the average enlargement of yield on hybrid maize Kneza 683A (10 610 kg/ha), compared to first standard H 708 is 6,78% or 9 890 kg/ha and compared to the second standard Ivana is 0,37% or 10 570 kg/ha (*Genov. and Genova, 2005*).

Table 2. Average results for yield of grain on hybrid maize K-683A, in comparison with standards H 708 St (1) and Ivana St (2) in production year 1992-1993, in the period of examination in SVTC in R. Bulgaria (without irrigation).

Hybrids	FAO (group)	Average Yield of grain kg/ha	Comparison with St in %
H-708 St (1)	700	7210	100
Ivana St (2)	700	7610	100
K-683A	600-699	8140	112, 9 (1), 106, 96 (2)

In Table 2 are given the average results for yield of grain on hybrid maize K-683A, in comparison with standards H 708 St (1) and Ivana St (2) in production year 1992-1993, in the period of examination in SVTC in R. Bulgaria (without irrigation).

Table 3. Average results for yield of grain on hybrid maize K-683A, in comparison with standards H 708 St (1) and Ivana St (2) in production year 1992-1993, in the period of examination in SVTC in R. Bulgaria (with irrigation).

Hybrids	FAO (group)	Average Yield of grain kg/ha	Comparison with St in %
H-708 St (1)	700	9890	100
Ivana St (2)	700	10570	100
K-683A	600-699	10610	107, 28 (1), 100, 38 (2)

In Table 3 are given the average results for yield of grain on hybrid maize K-683A, in comparison with standards H 708 St (1) and Ivana St (2) in production year 1992-1993, in the period of examination in SVTC in R. Bulgaria (with irrigation).

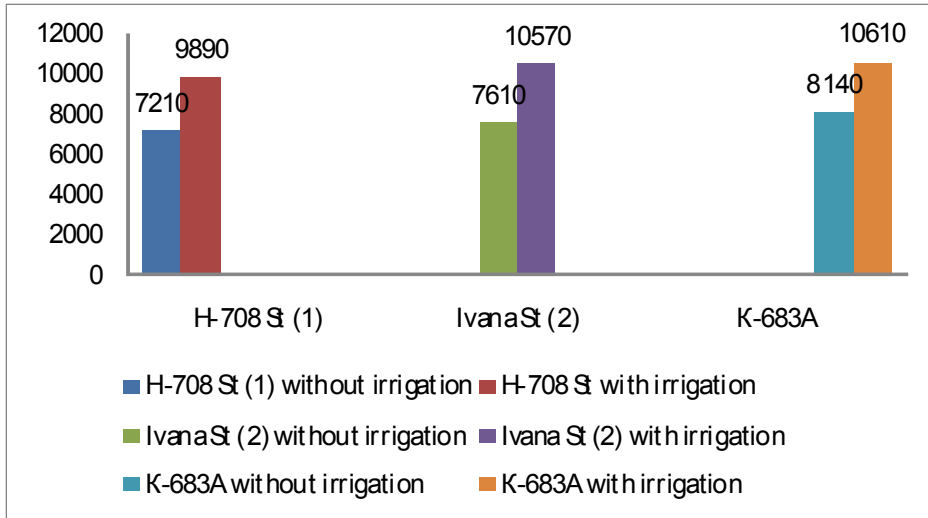


Figure 1. The results from table 2 and 3 are shown, for yield of grain on hybrid maize K-683A, in comparison with standards H 708 St (1) and Ivana St (2) in production year 1992-1993, in the period of examination in SVTC in R.Bulgaria (without and with irrigation).

The hybrid maize 683A, was examined in year 1994 and 1995, on area of ZK "Pelagonia" R. Macedonia in conditions with irrigation and on area at the Maize Research Institute-Kneza, R. Bulgaria, without irrigation. In comparison with standard american hybrid maize H 708 (11 233 kg/ha), in our country the average enlargement of yield on hybrid maize Kneza 683A is for 2,79% or 11 556 kg/ha, while in R. Bulgaria in comparison with the standard H-708 (8120 kg/ha), average enlargement on the yield of hybrid maize Kneza 683A is for 8,04% or 8830 kg/ha (*Gacovski, 1998*).

Table 4. Average results for yield of grain on hybrid maize K-683A, in comparison with the standard H 708 St (1) in production year 1994-1995, in the period of examination in ZK "Pelagonia" R. Macedonia (with irrigation).

Hybrids	FAO (group)	Average Yield of grain kg/ha	Comparison with St in %
H-708 St (1)	700	11233	100
K-683A	600-699	11556	102, 87(1)

In Table 4 are given the average results for yield of grain on hybrid maize K-683A, in comparison with the standard H 708 St (1) in production year 1994-1995, in the period of examination in ZK "Pelagonia" R. Macedonia (with irrigation).

Table 5. Average results for yield of grain on hybrid maize K-683A, in comparison with the standard H 708 St (1) in production year 1994-1995, in the period of examination in ZK "Pelagonia" R. Macedonia (without irrigation).

Hybrids	FAO (group)	Average Yield of grain kg/ha	Comparison with St in %
H-708 St (1)	700	8120	100
K-683A	600-699	8830	108, 74 (1)

In Table 5 are given the average results for yield of grain on hybrid maize K-683A, in comparison with the standard H 708 St (1) in production year 1994-1995, in the period of examination in ZK "Pelagonia" R. Macedonia (without irrigation).

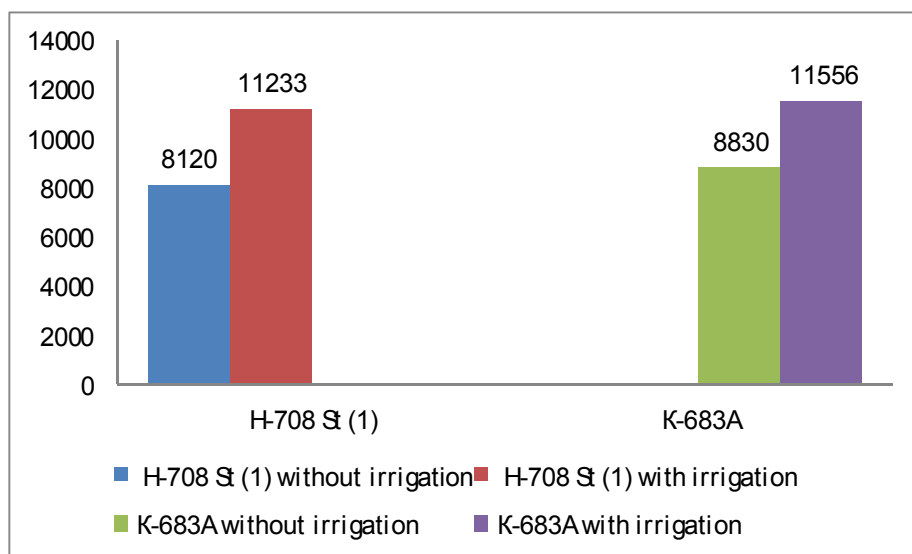


Figure 2. The data from table 4 and 5 are shown, for yield of grain on hybrid maize K-683A, in comparison with standard H 708 St (1), in production year 1994-1995, in the period of examination on area of ZK "Pelagonia" R. Macedonia (without and with irrigation).

In the examination in year 2006 in R. Macedonia, on area at the Institute for southern crops- Strumica, R. Macedonia, in conditions with irrigation, the average enlargement of yield on the hybrid maize Kneza 683A (11 600 kg/ha) in comparison with standard Kneza 630 is for 8,62% or 10 600 kg/ha and hybrid Kneza 621 for 3,44% or 11 200 kg/ha (Gacovski, 2006).

Table 6. Average results for yield of grain on hybrid maize K-683A, in comparison with the standard Kneza 630 (1) and Kneza 621 in production year 2006, on area at the Institute for Southern Crops in Strumica, R.Macedonia (with irrigation).

Hybrids	FAO (group)	Average Yield of grain kg/ha	Comparison with St in %
Kneza 630 (1)	650	8830	100
Kneza - 683A	600-699	11600	131, 37
Kneza 621	650	11200	126, 84

In Table 6 are given the average results for yield of grain on hybrid maize K-683A, in comparison with the standard Kneza 630 (1) and Kneza 621 in production year 2006, on area at the Institute for Southern Crops in Strumica, R. Macedonia (with irrigation).

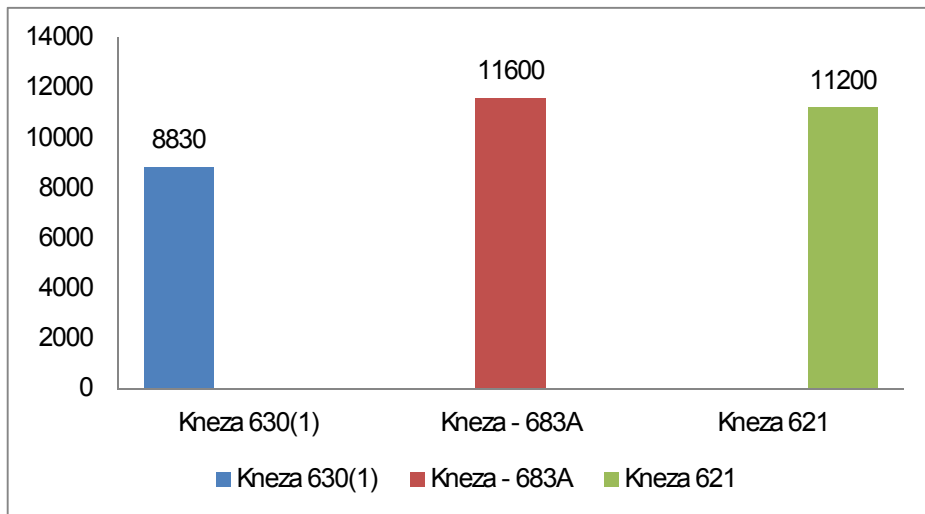


Figure 3. The data from table 6 are shown, for yield of grain on hybrid maize K-683A, in comparison with standard Kneza 630 (1) and Kneza 621, in production year 2006, on area at the Institute for Southern Crops in Strumica, R.Macedonia) (with irrigation).

After examination from SVTC (State Variety-Testing Commission) in R. Bulgaria in year 2007, the University "Goce Delcev" Stip, Institute for Southern Crops in Strumica in our country have introduced and registered the hybrid on the sort list. In 2008 was organised seed production on area of 1 ha and there was yield of 2000 kg/ha, which means that although the late sowing there was good yield of seed.

The optimal sowing period is from 15 to 30 April. Fertilization N - 160 kg/ha, P - 90 kg/ha и K - 90 kg/ha, then on time proper protection from weeds and

pests is needed and 400 mm rainfalls with uniform disposition during year for obtaining normal progress and maturity.

Optimal solidity on the hybrid maize Kneza 683A during production in condition with irrigation is 60 000 plants/ha, while without irrigation is 40 000 plants/ha.

From the hybrid maize Kneza 683A, in conditions with irrigation is obtained 15 000 – 20 000 kg/ha grain, while without irrigation with normal disposition of rainfalls during vegetation is obtained 13 000 – 15 000 kg/ha.

Because of the strong vegetative develop this hybrid is suitable for production of forage. Harvest during the use of forage is suitable to be made in waxed maturity.

In field conditions the hybrid is practically resistant to the economically important disease by the maize: leaves carp or withering, simple glanica, decomposing of stalk, fusarioza of the cobs and simple mosaic.

Technology of seed production of hybrid maize Kneza 683A is carry out with simultaneously sowing of the parental components. Hybrid is using cytoplasmic male sterility (CMS) with fully restoration of fertility and after desire of the producers, seed production may be carry out with or without removing on taseles of motherly rows.

The big breed coefficient of the mother give a possibility for obtaining yield from 4 000 – 6 000 kg/ha standard hybrid seed.

Scheme of sowing on the hybrid lot is 6:2 or 4:2. Restoration of seed production on the hybrid is made in the Maize Research Institute-Kneza.

The hybrid maize Kneza 683A successfully shift the late maize hybrids, especially the American hybrids, since is more drought-resistant and considerably exceeds them by grain yield and silage mass from a unit of area.

Conclusion

1. Hybrid maize Kneza 683 A, after the property yield of grain in (kg/ha), considerably exceeds the hybrids from the late maternity group (FAO 600), used as standards during the period of examination, after which define the hybrid suitable for seed production.

2. Examination of yield from the whole plant shows that hybrid maize Kneza 683 A is among the best hybrids for silage production.

3. Hybrid maize Kneza 683A, is resistant to the most important diseases by the maize in our country.

4. Seed production is suitable because of the high breed coefficient, simultaneously sowing of the parental components and removing of the tasele at female -♀ mother component.

5. Seed production is profitable because of the high breed coefficient, simultaneously sowing of the parental components and removal of the tasseling at mother component.

Biološke i genetske karakteristike hibrida kukuruza Kneža 683a

Ž. Gacovski, G. Cilev

Rezime

U radu su opisane osnovne biološke i ekonomske karakteristike hibrida kukuruza Kneža 683a stvorenog u Institutu za kukuruz – Kneža u R. Bugarskoj.

Hibrid je priznat u toku 1994. godine, nakon dve godine testiranja, od strane državne službe za testiranje sorata, sa standardima, američkim hibridom H 708 i Ivanom.

U toku perioda testiranja u 1992. i 1993. godini u uslovima bez navodnjavanja hibrid Kneža 683A (8 140 kg/ha), u odnosu na hibrid H 708 (7 210 kg/ha) postigao je veći prinos za 11,42%, a u odnosu na hibrid Ivana (7610 kg/ha) za 6,51%. U uslovima navodnjavanja prosečni prinosi hibrida Kneža 683A (10 610 kg/ha), u poređenju sa prvim standardom H 708 (9 890 kg/ha) bili su veći za 6,78%, a u poređenju sa drugim Ivanom (10 570 kg/ha) za 0,37%.

Hibrid kukuruza Kneža 683A, istraživan je u 1994. i 1995. godini u R. Makedoniji u uslovima navodnjavanja i u R. Bugarskoj u uslovima bez navodnjavanja. U poređenju sa standardom, američkim hibridom H 708 (11 233 kg/ha), u našoj zemlji, Kneža 683A (11 556 kg/ha) je ostvario prinos veći za 2,79%, a u R. Bugarskoj za 8,04%. U ispitivanjima u 2006. godini u R. Makedoniji u uslovima navodnjavanja prosečno povećanje prinosa Kneža 683A (11 600 kg/ha) bilo je za 8,04% veće od standarda, hibrida Kneza 630 (8 830 kg/ha) i za 3,44% od Kneža 621 (11 200 kg/ha).

Nakon istraživanja od strane SVTC u 2007. godini, Univerzitet "Goce Delcev", Institut za južne useve u Strumici je registrovalo hibrid na sortnoj listi. U 2008. godini organizovana je semenska produkcija i dobijen je prinos od 2000 kg/ha, što znači da i pored kasne setve postoji dobar prinos semena.

U poljskim uslovima hibrid je otporan na sve ekonomski važne bolesti kukuruza. Proizvodnja semena hibrida Kneža 683A zasniva se na simultanoj setvi roditelja korišćenjem citoplazmatične muške sterilnosti – CMS, i potpunom obnavljanju plodnosti generacije hibrida.

Hibrid Knežza 683A uspešno je zamenio kasno bugarske i druge strane hibride (iz grupe FAO 600), pošto je više otporan na sušu, daje veći prinos zrna i više silažne mase sa jedinice površine.

References

- BAROV V. (1982): Analysis and schemes of field examinations. Sofia.
- STATE VARIETY TESTING COMMISSION (1994): Cultural sort plants proposed for recognition and for registration in the sort list of the country. Material for 49th conference of DSK, Sofia, June.
- GACOVSKI Z. (1998): Екологогенетична оценка на късни и средно късни хибриди царевица и ЦМС аналози. Селскостопанска академия. Институт по царевицата-Кнежа. Докторска дисертация, София.
- GACOVSKI Z. (2006): Examination of the length of vegetation period, genetic potential for production and possibilities for introduction of genotypes hybrid maize, created in the Institute of Maize, Knezha, R. Bulgaria, in production in the region of Strumica in R.Macedonia. Year Code. University of Goce Delcev Stip, Agriculture Faculty. V6, 101-110.
- GENOV M., GENOVA I. (2005): Hybrid Kneza 683A – New achievements in the modern Bulgarian selection at the corn, Institut for Maize, Knezha, R. Bulgaria
- SANIN I. (1974): Metodics of field examinations, BAS. Издателство на БАН, София.

Received 30 June 2011; accepted for publication 15 August 2011