GENETIC POTENTIAL AND MAIZE PRODUCTION IN SERBIA

Živorad VIDENOVIĆ, Zoran DUMANOVIĆ, Milena SIMIĆ, Jelena SRDIĆ,
Milosav BABIĆ, Vesna DRAGIČEVIĆ

Maize Research Institute, Zemun Polje, Belgrade – Zemun, Serbia

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Genetic potential of maize hybrids grown in Serbia is 10-15 t ha^{-1}, while the average yields are considerably lower. There are many reasons for this. At first, it is well known that drought is present often in some parts of country. Some soils are not suitable in the same degree for intensive maize production, application of mineral fertilizers is insufficient, mechanization is outdated and arable farms are small and fragmented. During the period 1965-2012 high variations in precipitation were present during the maize vegetation. The yearly average precipitation sum was 688.9 mm, with 397.5 mm during vegetation. According to precipitation amount, years were divided into groups: I 200-300 mm 7, (15%); II 301-400 mm 21, (44%) and III 401-500 mm 14, (30%), and IV in 5 years (11%) more than 500 mm of precipitation was present.The highest average yield in Serbia was achieved in 1991 (5.95 t ha^{-1}) and the lowest in 2000 (2.44 t ha^{-1}). The average yield increase was 114 kg ha^{-1} per year from 1965 to 1985, and it was 22 kg ha^{-1} per year from 1986 to 2012. In experiments during the period 1998-2012, when the standard cropping technology (MSY) was applied, the average grain yield was10.46 t ha^{-1} for hybrids of FAO 300-400, 10.39 t ha^{-1} for hybrids from FAO 500 and 11.38 for FAO 600-700. There were no significant differences in yield between hybrids from examined FAO groups. According to this, average maize yield includes only 44.2% for FAO 300-400, 44.5% for FAO 500 and 40.6% for FAO 600-700 utilized maize genetic potential.The significant improvement of maize production demand the strategic long-term program, where it will be elaborated: merging of land properties, increasing of the areas with irrigation and increasing of the technology level in maize cropping.

Key words: maize, yielding genetic potential, cropping technology, drought, yield trend.

Corresponding author: Živorad Videnović, Maize Research Institute „ZemunPolje",S. Bajića 1, 11185 Belgrade, Serbia,e-mail: zvidenovic@mrizp.rs

INTRODUCTION

Maize hybrids with genetic potential of 10-15 t ha^{-1} are grown more than 40 years in Serbia (BABIĆ *et al*, 2002). Meanwhile, average yields are considerably lower and uncertain within years which are affected by several factors. It is fact, that different conditions for maize production are present in Serbia and well known that in some parts of country, particularly in Eastern Serbia, drought is often present during vegetation. The investigation of climate changes effect on yield variability is actual in many parts of Europe (OLESEN *et al*, 2011). The irrigation, which diminishes negative effects of drought, is present only at 1% of the maize production area in Serbia. According to TOLLENAAR and LEE (2002) precipitation deficit and air drought, which was mainly present in Serbia during 2012, were also important stress factors. Even simple adjustments such as cultivars that can be planted earlier to more closely match crop growth to rainfall distribution can increase productivity (TURNER, 2004). Hence, not all of the soils were appropriate for intensive maize production, since the acid, saline, sandy, eroded and soils with unfavourable physic-chemical characteristics are present. It is estimated, that only 1/3 of the total maize production was settled on favourable soils (VIDENOVIĆ *et al*, 2007). Economic power of producers is weak, so the application of mineral fertilizers is insufficient. Mechanization is outdated, what presents significant obstacle in cropping technology. The specificity is also reflecting through fragmentation of arable farms, so the high end economic yield can't be achieved.

In the analysed period of 1965-2012, the highest maize yield in Vojvodina was achieved in 1986 (6.99 t ha^{-1}), while the lowest was in 2000 (2.94 t ha^{-1}) http://webrzs.stat.gov.rs/WebSite/. In Central Serbia, the highest yield was obtained in 2004 (5.02 t ha^{-1}) and the lowest in 1965 (1.55 t ha^{-1}). The trend of yield increase in Vojvodina is 129 kg ha^{-1} per year (for period 1965-1985) and 10 kg ha^{-1} per year after 1986. For Central Serbia, yield increase trend was averagely 87 kg ha^{-1} per year (for period 1965-1985) and 30 kg ha^{-1} after 1986. The total maize production had significant trend of increase in period 1965-1985, in Serbia 143,000 t and in Vojvodina for 98,000 t, as well as in Central Serbia for 45,000 t per year. This trend is considerably lower from 1986 to 2012 and it is 5,000 t for Serbia, 4,000 t for Vojvodina and 1,000 t per year for Central Serbia.

Meanwhile, it is indisputably that yields could be higher and less variable from year to year compared to obtain. The high maize yield could be achieved only in cases when proper technology level was applied. This mean that all the present factors must be brought to the optimal level and that plants don't suffer from deficiency of nutrients, water, presence of weeds and pests and other factors.

According to upper mentioned, the aim of this experiment was to determine: (i) the difference between genetic potential and maize yields obtained in Serbia; (ii) extent in yield variation per year; (iii) the main responsible factor and (iiii) what could be done to increase maize production.

MATERIALS AND METHODS

This work is based on official data of maize yields from Statistical Office of the Republic of Serbia for period 1965-2012 (MAY) and experimental results obtained in Maize Research Institute in standard system of maize production (MSY) for period 1998-2012, on the chernozem soil type .

The experiment, established in experimental field in Zemun Polje for analysis of genetic potential of new maize hybrids, was settled in split-plot design with two factors in four replicates. Analyzed hybrids were: FAO 300-400 (ZP 341 and ZP 360): FA0 500 (ZP 505 and ZP 578) and FAO 600-700 (ZP 606 and ZP 684). Sowing was performed in optimal densities for each FAO group: FAO 300-400 - 80,000 plans ha^{-1}; FA0 500 - 70,000 plants ha^{-1} and FAO 600-700 - 60,000 plants ha^{-1}. Preceding crop was winter wheat in every year. Soil cultivation included ploughing of plant residues to 15 cm, primary tillage to 25 cm at the autumn and pre-sowing cultivation in spring (Rau combi: harrow + cultivator + roller). Fertilization included application of 120 kg N ha^{-1}; 80 kg P_2O_5 ha^{-1} and 60 kg K_2O ha^{-1}. The combination of herbicides with atrazine (after 2006 it was terbuthylazine) and acetochlor in amounts of 500 and 1,800 g a.i. ha^{-1} was applied after sowing. One cultivation was applied during vegetation. Data were statistically processed by analysis of the variance (ANOVA) and analysed by the LSD-test (5 %).

Meteorological conditions
High variations in precipitation sums during the maize vegetation period were present in the period 1965-2012 in Serbia (Republic Hydro meteorological Service of Serbia, data for 1965-2012; www.hidmet.gov.rs). Moreover, the significant differences between particular locations were present, too. Because of such complexity, sums of precipitation for Belgrade from April-September were included (Figure 1). Average precipitation sum in vegetative period was 397.5 mm (57.7% of the yearly precipitation sum). According to total sums of precipitation for vegetative period, all years were divided into three categories and for the each of them two typical climate-diagrams by Walter (http://www.zoolex.org/walter.html) were presented: I 200-300 mm (2000 and 2003); II 301-400 mm (2002 and 2007) and III 401-500 mm (2004 and 2006). Precipitation deficit was mainly expressed in years with amount of 200-300 mm (Figure 2), while the favourable conditions were present in years with 400-500 mm of precipitation during vegetation, what showed the highest impact on height of achieved maize yield. Seven years (15%) had 200-300 mm of precipitation, 21 year (44%) with 301-400 mm and 14 years (30%) with 401-500 mm. Only in 5 years (11%), precipitation sum was more than 500 mm.
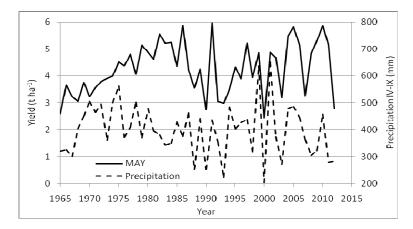

Figure 1. Precipitation and maize yield in Serbia (1965-2012)

RESULTS AND DISCUSSION

Analysis of maize production

Based on the analysed data during observed period (Figure 2), it could be noticed that the highest maize yield in Serbia was achieved in 1991 (5.95 t ha^{-1}) and the lowest in 2000 (2.44 t ha^{-1}).
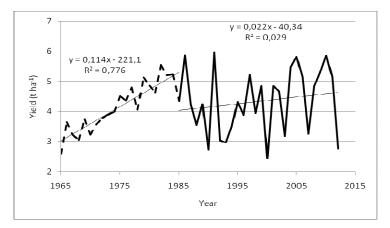

Figure 2. Average maize yelds in Serbia (1965-2012)

Many factors affected level of maize grain yield especially amount and distribution of precipitation (KOVAČEVIĆ *et al*., 2012). It is obvious that level of average maize yield is in accordance with amount of precipitation, Figure 1. Namely, the trend of maize yield has similar variations as trend of amount of precipitation. It is illustrated, to some degree, with maize yield variation from +40% to –43%, what is similar as variation in precipitation sum, from +64% to –49%. Soil moisture deficit and variability of air temperatures, especially in May and August, negatively affect maize grain yield (YAMOAH *et al*., 1998).

The average yield increase for analysed period in Serbia, was 114 kg ha^{-1} per year until 1985, and 22 kg ha^{-1} per year after 1986 with significant yield variations across years. Central Serbia and Vojvodina are two different areas in Serbia according to edaphic and climatic conditions, so, average maize yields are considered separately for these two regions, (Figure 3). The highest yield in analysed period was achieved in Vojvodina in 1986, 6.99 t ha^{-1} and the lowest was in 2000, 2.94 t ha^{-1}. In Central Serbia, the highest yield was obtained in 2004, 5.02 t ha^{-1} and lowest was in 1965, 1.55 t ha^{-1}. In the middle of sixties of XX Century, Serbia was one of the first countries that introduced SC hybrids in maize production, with a consequence of significant yield increase (IVANOVIĆ *et al*, 2002).

In Vojvodina trend of yield increase was averagely 129 kg ha^{-1} per year in 1965-1985 period and 10 kg ha^{-1} per year after 1986. In Central Serbia trend of yield increase was averagely 87 kg ha^{-1} per year in 1965-1985 and 30 kg ha^{-1} per year after 1986. VIDENOVIĆ *et al* (1995), underlined that maize yield increase in Serbia was 107.3 kg ha^{-1} per year in 1957-1965 and 99.9 kg ha^{-1} per year in 1966-1985, while the yield was decreased 225 kg ha^{-1} per year in 1986-1994. According to presented results the degree of realised maize yield potential depended on climatic

conditions and level of applied production technology (KRESOVIĆ *et al*, 2004; VIDENOVIĆ *et al*, 2005; VIDENOVIĆ *et al*, 2007). BABIĆ *et al.* (2002) realised that maize yield increase per year in Serbia was 71.7 kg ha^{-1} (1947-2001); 114.2 kg ha^{-1} (1965-1986) and 39.5 kg ha^{-1} (1987-2001). The total maize production had noticeable increasing trend in 1965-1985 periods (Figure 4). In Serbia it was increased 143,000 t, 98,000 t in Vojvodina and 45,000 t in Central Serbia per year. After 1986 until 2012, the total maize production in Serbia was pretty lower and it was 5,000 t in Serbia, 4,000 t in Vojvodina and 1,000 t in Central Serbia per year. TOLLENAAR and LEE (2002) ascertained that average yield of commercial maize hybrids in USA was increased from 1 t ha-1 in 1930-ties up to 7 t ha-1 in 1990-ties. Such increase is result of improved genetic potential and cropping technology but they considered that main reason is interaction between genotype and production technology.
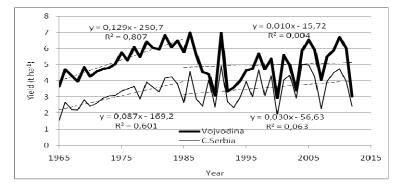

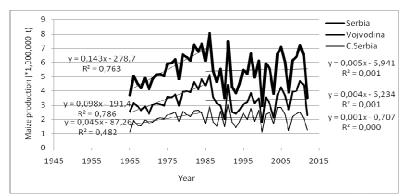Figure 3. Average maize yields in Central Serbia and Vojvodina (1965-2012)

Figure 4. Total maize production in Serbia, Vojvodina and Central Serbia (1965-2012)

The main factors that affect level of maize production

Several factors are affecting maize productivity level and contribute in a lesser or higher extent to reduction of potential yield: size of arable farm, climatic conditions and level of applied cropping technology with special attention given to herbicide application.

Arable farms are small and fragmented which is not suitable for intensive production. On such small farms it is almost impossible to achieve high yields so, the merging of farms could be the only way for improving and economizing of maize production.

Climatic conditions as lack of precipitation together with high air temperatures could significantly decrease maize yield (Figure 5). Figure 6 is illustrate to which extent maize yield could be increased in a case of standard cropping technology application. From that point, the irrigation is important measure in Serbia for noticeable maize yield increase and it could be applied on major percent of production area (KRESOVIĆ *et al*, 2011).
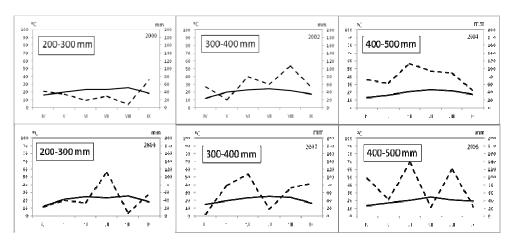

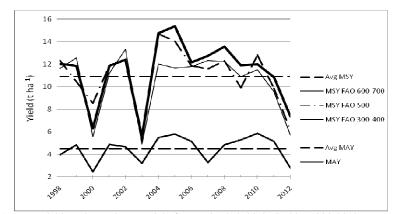Figure 5. Climate-diagrams by Walter

Figure 6. Average yields and genetic potential of ZP maize hybrids in Serbia (1998-2012)

Maize cropping technology requires on time autumn soil ploughing, proper application of mineral fertilizers, pre-sowing cultivation, sowing with high technology equipment that could enable proper crop density and efficient use of herbicides.

The application of observed measures differs and it could be divided into three categories: first, farms with low level of applied technology (1/4 of farms, mostly located in Central Serbia), second category farms with moderate level of technology (1/2 of farms) and third category includes about ¼ of farms mostly situated in Vojvodina, with high level of applied technology. Cropping technology level is mostly influenced by economic potential of producers, mechanization level, age structure and variation in maize price at market, which is together the main reason for lower yields than potential.

Maize technology improving requires deep and long-term strategy (VIDENOVIĆ *et al* 2007), pointed out that contemporary concept of maize production in Serbia could be based on scientific solutions which enable higher, stable and economic maize yields (KOVAČEVIĆ *et al*. 2009), realised that hybrids more tolerant to drought should be used in production on appropriate soil and cropping technology. That is main reason for intensive production of hybrids FAO 400-500 in Serbia in last two decades.

Introduction of post-emergence herbicides for weed suppression is the main characteristic of maize production technology in last few decades. While older generations of maize herbicides are used predominantly as pre-emergent herbicides, today there are modern, post-emergent sulfonylurea products available to the farmer for cost-effective and time-flexible weed control (ORT, 2012). Sulfonylurea herbicides suppress growth of annual and perennial *Poaceae* weeds, showing at the same time good selectivity to maize crop which belongs to the same family (STEFANOVIĆ *et al*, 2002; DRAGIČEVIĆ *et al*, 2012). For maize weed suppression in Serbia products with active ingredients primisulfuron-methyl, rimsulfuron, nicosulfuron, tifensulfuron-methyil, foramsulfuron are registered. The new age in chemical weed control in maize crop is characterised by "specific" herbicides based on new active ingredients: isoxaflutole, mesotrione, tembotrione, topramezone and others, which were aimed for common broad leaf and grass weeds suppression (ELEZOVIĆ *et al*, 2002; MALIDŽA, 2008). They could be pre- and post-emeregence applied with good results independently of soil moisture as well as rain occasion, which will contribute to their wide use. Appropriate and efficient using of these new and good quality herbicides in high degree depends on producer's economic power. The fact is that most farmers in Serbia insufficiently and inappropriately use herbicides, so the real effects of this measure in maize production are missing.

Potential possibilities for maize yield increase

In period 1998-2012, average maize yield in Serbia was 4.62 t ha^{-1} (MAY) and varied in a range of 2.44 t ha^{-1} in 2000 to 5.86 t ha^{-1} in 2010 (Figure 6). In the experiments with standard maize technology (MSY), the average maize yield was 10.46 t ha^{-1} for FAO 300-400; 10.39 t ha^{-1} for FAO 500 and 11.38 t ha^{-1} for FAO 600-700 (Table 1).

According to the presented results in Table 1, there were no statistically significant differences in maize yield between examined FAO groups. Main reason for this is different sowing densities, optimal for each FAO group, according to phenotypic characteristics of modern maize hybrids with upright leaves, used in this experiment. Modern hybrids should have rapid initial growth and lower ear position on stem in order to increase interspecific competition

(SIMIĆ *et al,* 2009). This enables crop growing with higher number of plants per hectare and achieving similar yields between hybrids from early and late maturity groups.

Table 1. Average yield of maize hybrids (t ha^{-1}) in Zemun Polje (1998-2012)

Year	FAO 300-400	FAO 500	FAO 600-700	Average
1998	11.60	12.34	12.03	12.00
1999	12.57	10.44	11.85	11.60
2000	5.57	8.53	6.32	6.80
2001	11.22	11.88	11.87	11.70
2002	13.34	12.34	12.39	12.70
2003	4.89	5.18	5.57	5.20
2004	12.02	14.71	14.76	13.80
2005	11.66	14.05	15.37	13.70
2006	11.80	11.86	12.15	11.90
2007	12.33	11.59	12.73	12.20
2008	12.24	12.30	13.58	12.70
2009	10.89	9.90	11.88	10.90
2010	11.52	12.82	12.00	12.10
2011	9.56	9.86	10.85	10.10
2012	5.70	6.13	7.37	6.40
Average	10.46	10.39	11.38	10.92

Table 2. ANOVA for maize hybrids grain yield (t ha^{-1})

Source of variation	Df	MS	F	P
Genotype	2	11.09	1.38	0.254
Year	14	85.00	55.33	0.000
Genotype x Year	44	29.26	25.32	0.000

LSD_{Year} 0.05 = 1.239 ** (very significant)
LSD_{FAO} 0.05 = 2.834 ns (not significant)
$LSD_{Year \times FAO}$ 0.05 = 1.075 ** (very significant)

Beside this, yield variations in conducted experiment (MSY) follows also yield variation in Serbia (Figure 6). Maize yields were significantly different as a result of interaction between years and FAO groups. The lowest average yield for all FAO groups were obtained in 2003 (5.20 t ha^{-1}) and the highest was in 2004 (13.80 t ha^{-1}). This implicates that average maize yield in Serbia for this period was about 44.2% (FAO 300-400), 44.5% (FAO 500) and 40.6% (FAO 600-700), compared to yield achieved with standard technology from experiments (MSY). This means that genetic yielding potential of maize was used only in observed percents.

CONCLUSION

Regarding to present multiyear results of maize yields, it could be concluded:

* In the period 1965-2012 high variations in precipitation amounts were present. The average sum of precipitation per year in Belgrade was 688.9 mm and 397.5 mm during

vegetation season. Number of extremely unfavourable seasons for maize production with 200-300 mm of precipitation was 7 (15%), moderate with 301-400 mm was 21 (44%) and favourable with 401-500 mm was 14 (30%). Only in 5 years (11%) more than 500 mm was present.

* The highest maize yield in Serbia was achieved in 1991 (5.95 t ha^{-1}) and the lowest in 2000 (2.44 t ha^{-1}). The average yield increase was 114 kg ha^{-1} per year until 1985 and 22 kg ha^{-1} per year after 1986. In this period the highest yield in Vojvodina was 6.99 t ha^{-1} in 1986 and the lowest 2.94 t ha^{-1} in 2000. In Central Serbia the highest yield was 5.02 t ha^{-1} in 2004 and the lowest 1.55 t ha^{-1} in 1965.

* The trend of yield increase was averagely in Vojvodina 129 kg ha^{-1} per year in 1965-1985 and 10 kg ha^{-1} per year after 1986. In Central Serbia it was 87 kg ha^{-1} per year in 1965-1985 and only 30 kg ha^{-1} per year after 1986.

* Total maize production had increasing trend from 1965 to 1985 in Serbia for 143,000 t, in Vojvodina for 98,000 t and in Central Serbia for 45,000 t per year. Since 1986 until 2012 this trend was decreased and it was 5,000 t in Serbia, 4,000 t in Vojvodina and 1,000 t in Central Serbia per year.

* In experiments were the standard cropping technology (MSY) was applied, the average yield was 10.46 t ha^{-1} (FAO 300-400), 10.39 t ha^{-1} (FAO 500) and 11.38 t ha^{-1} (FAO 600-700). There were no statistically significant differences in maize yields between examined FAO groups. The average maize yield in Serbia was about 44.2% (FAO 300-400), 44.5% (FAO 500) and 40.6% (FAO 600-700), compared to yield achieved with standard technology from experiments (MSY), i.e. genetic yielding potential of maize was used only in observed percents.

Based on these results it could be concluded that genetic potential of maize was not used enough and that cropping technology must be enhanced together with resolving of some other problems in order to increase maize yield in Serbia. Precipitation deficiency is the main limiting factor in maize production in Serbia so the irrigation is one of the most important measures which could contribute to significant maize production improving.

ACKNOWLEDGEMENT

REFERENCES

BABIĆ, M., N. DELIĆ and G. STANKOVIĆ (2002): ZP hybrids – precaution of high and stable yields. III Symposium „Science, practice and commerce in agro industry", Agroinovations, January, 10-14, Soko Banja, Serbia, 39-46. (*in Serbian*)

DRAGIČEVIĆ, V., M. SIMIĆ, M. SEČANSKI, G. CVIJANOVIĆ and A. NIŠAVČIĆ (2012): Study of the susceptibility of maize lines to some sulfonilurea herbicides. Genetika-Belgrade, Vol. 44, No 2, 355-366.

ELEZOVIĆ ,I., M. STEVIĆ and K. JOVANOVIĆ-RADOVANOV (2002): Mesotrione – new herbicide for maize weed suppression. Book of Abstracts XII Symposium of Plant Protection and Pesticide Use, Zlatibor, 141. (*in Serbian*)

IVANOVĆ ,M., N. VASIĆ, V. TRIFUNOVIĆ, M. VUKOVIĆ, L. JAKOVLJEVIĆ and N. JOVANDIĆ (2002): Inbreed lines that pointed maize breeding in Yugoslavia. Proceeding of Scientific Institute for field and vegetable crops Novi Sad, Book *36*: 301-310. (*in Serbian*)

KOVAČEVIĆ, V., J. ŠOŠTARIĆ, M. JOSIPOVIĆ, D. ILJKIĆ and M. MARKOVIĆ (2009): Precipitation and temperature regime impacts on maize yields in eastern Croatia. Res. J. of Agric. Sci., *41* (1), 49-43.

KOVAČEVIĆ, D., S. OLJAČA, Ž. DOLIJANOVIĆ and V. MILIĆ (2012): Climate changes: ecological and agronomic options for mitigating the consequences of drought in Serbia. 3rd International Scientific Symposium "Agrosym Jahorina 2012", Novemebr, 15-17, Pale, Republic of Srpska, 17-35.

KRESOVIĆ, B., Ž. VIDENOVIĆ and M. TOLIMIR (2004): Genotype and environment interaction effect on heterosis expression in maize. Genetika, *36* (2), 171-180.

KRESOVIĆ, B., V. DRAGIČEVIĆ., M. SIMIĆ and A. TAPANAROVA (2011): The responses of maize genotypes to growth conditions. Genetika-Belgrade, 43 (3): 331-342.

MALIDŽA, G. (2008): Efficience and selectivity of new herbicides tembotrione and topramezone. Book of Abstracts, IX Symposium of Plant Protection, Zlatibor, 62-63. (*in Serbian*)

MARKOVIĆ, M., L. STEFANOVIĆ and B. ŠINŽAR (2002): Maize weeds and their suppression. *In*: Maize deseases, pests and weeds and their suppression. Maize Research Institute Zemun Polje, Belgrade, DOO Školska knjiga, Novi Sad, 496-617.

OLESEN, E.J., M. TRNKA, K.C. KERSEBAUM, A.O. SKJELVÅG, B. SEGUIN, P. PELTONEN-SAINIO, F. ROSSI, J. KOZYR and F. MICAELE (2011): Impacts and adaption of European crop production systems to climate change. European Journal of Agronomy, *34*: 96-112.

ORT, O. (2012): Newer sulfonylureas. *In*: Modern Crop Protection Compounds- Herbicides. (Ed.) Kramer, W., Schirmer U., Jeschke P., Witschel M. Wiley-VCH Verlag, GmbH&Co. KgaA, Weinheim, Germany. 534 p.

SIMIĆ, M., Ž. DOLIJANOVIĆ, R. MALETIĆ, M. FILIPOVIĆ and N. GRČIĆ (2009): The genotype role in maize competitive ability. Genitika, 41 (1): 57-

STEFANOVIĆ, L., M. SIMIĆ and Z. PAJIĆ (2002): Effects of nicosulfuron application dates on popcorn and weeds. Proceedings of 12th EWRS Symposium, June 24-27, Wageningen, The Netherlands, 220-221

TOLLENAAR, M. and E.A. LEE (2002): Yield potential, yield stability and stress tolerance in maize. Field Crops Res., *75* (2-3), 161-169.

TURNER, N.C. (2004): Sustainable production of crops and pastures under drought in a Mediterranean environment. Annals of Applied Biology, 144: 139-174.

VIDENOVIĆ, Ž., M. VESKOVIĆ, L. STEFANOVIĆ, Ž. JOVANOVIĆ and Z. DUMANOVIĆ (1995): Maize growing technology development in Serbia. Maize breeding, production and utilisation - 50 years of Maize Research Institute Zemun Polje, September, 28-29., Belgrade, Serbia, 163-175. (*in Serbian*)

VIDENOVIĆ, Ž., L. STEFANOVIĆ, M. SIMIĆ and B. KRESOVIĆ (2005): Tendencies in maize growing practices in Serbia. International Maize Conference: Accomplishments and Perspectives, Book of Abstracts, 19-20.

VIDENOVIĆ Ž., L. STEFANOVIĆ, M. SIMIĆ and B. KRESOVIĆ (2007): Trends in maize growing practices in Serbia. Herbologia, *8* (2), 85-94.

VIDENOVIĆ Ž., Ž. JOVANOVIĆ, G. CVIJANOVIĆ, L. STEFANOVIĆ and M. SIMIĆ (2007): The contribution of science to the development of contemporary maize growing practices in Serbia. Science the basis sustainable development, October, 15, Maize Research Institute Zemun Polje, 267-283.

YAMOAH F.C., A.C. FRANCIS, E.G. VARVEL and J.W. WALTMAN (1998): Weather and Management Impact on Crop Yield Variability in Rotations. Journal of Production Agriculture, 11 (2): 219-225.

http://webrzs.stat.gov.rs/WebSite/
http://www.zoolex.org/walter.html
www.hidmet.gov.rs

GENETIČKI POTENCIJAL I PROIZVODNJA KUKURUZA U SRBIJI

Živorad VIDENOVIĆ, Zoran DUMANOVIĆ, Milena SIMIĆ, Jelena SRDIĆ,
Milosav BABIĆ, Vesna DRAGIČEVIĆ

Institut za kukuruz „Zemun Polje", Beograd, Srbija

Izvod

Genetički potencijal hibrida kukuruza koji se gaje u Srbiji iznosi 10-15 t ha⁻¹, ali su prosečni prinosi znatno niži od toga. Ima više razloga za to. Najpre, poznato je da se u nekim delovima zemlje često javlja suša. Zatim, nisu sva zemljišta u jednakoj meri pogodna za visoku proizvodnju kukuruza, mineralna đubriva se nedovoljno koriste, mehanizacija je zastarela, posed je veoma usitnjen. U periodu od 1965 do 2012 godine bilo je velikih variranja količina padavina u toku vegetacije kukuruza. Tokom ovog perioda prosečna godišnja suma padavina je iznosila 688,9 mm, a u vegetacionom periodu 397,5 mm. Po količini padavina, godine su podeljene u grupe: I. 200-300 mm 7, (15%); II. 301-400 mm 21, (44%), III. 401-500 mm 14, (30%) i IV u 5 godina (11%) je bilo više od 500 mm padavina. Najviši prosečan prinos u Srbiji je ostvaren 1991. godine (5,95 t ha⁻¹) a najniži 2000 godine (2,44 t ha⁻¹). Prosečno povećanje prinosa iznosilo je 114 t ha⁻¹ godišnje od 1965. do 1985. godine, a 22 t ha⁻¹ godišnje od 1986. do 2012. godine. U periodu 1998-2012, u ogledima sa standarnim agrotehničkim merama (MSY) ostvaren je prosečan prinos zrna od 10,46 u t ha⁻¹ za hibride grupa zrenja FAO 300-400, 10,39 t ha⁻¹ za hibride grupe zrenja FAO 500 i 11,38 t ha⁻¹ za hibride grupa zrenja FAO 600-700. Nije bilo statistički značajnih razlika u prinosima između ispitivanih FAO grupa zrenja. U odnosu na genetički potencijal, prosečan prinos kukuruza iznosi svega 44,2% kod FAO grupa zrenja 300-400, 44,5% kod grupe zrenja FAO-500 a 40,6% kod grupa zrenja FAO 600-700. Za značajna poboljšanja proizvodnje kukuruza neophodan je strateški dugoročni program gde će detaljno biti razrađeno: ukrupnjavanje zemljišnog poseda, izgradnja sistema za navodnjavanje na što većim površinama i povećanje nivoa tehnologije gajenja kukuruza.