GREEN ROOM SESSIONS 2018

Book of Proceedings

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FOREWORD

Green Room Sessions International Conference aims to be platform for international scientific discussion on agriculture in general as well as agriculture in conjunction with economics and ecology, food and nutrition science and technology, rural development, environment and forestry. Green Room Sessions brings together and is connecting research, industry, social concepts and practices. The scientific core is based on applying Eco-Eco (ecological-economical) concepts and principles to optimize interactions between natural, social and built components of the rural environments: plants, animals, soil, water, air, humans and man-made structures. In addition, Green Room Sessions placed social issues at the centre of solutions for a sustainable and fair food system. Green Room Sessions are targeting to multiple benefits to society and the environment, by bringing people together and providing them the opportunity to sit together and exchange ideas and connect the business.

In November 2018, the 1st Green Room Sessions International Conference provided an opportunity for sharing experiences and builds the evidence base on agriculture, forestry, human interactions and built environment, as well as reaching a consensus on the priorities for achieving more sustainable food systems. It also endorsed Institutional roles of National services, Regional and International organisations in supporting further implementation and promotion of Eco-Eco (ecological-economical) concepts and principles.

Dialogue between the participants targeted:

- Enhancing smallholder and family farmers' adaptation and resilience to the impacts of climate change;
- Improving nutrition including through more diversified diets;
- Protecting and enhancing agro-biodiversity in support of ecosystem services;
- Improving livelihoods in rural areas;
- National Food Wealth, the holy trinity: agriculture, economics and ecology (a x e^2);
- Mutual interconnections and how to deal with them and how this mix influence National Food Wealth and National Health.

achieving a transformative change in agricultural practices towards sustainable development.

The Green Room Sessions International Conference synthesized and build on the outcomes of the regional meetings, and provided an opportunity to share and discussed policies that can help scale-up and scale-out agriculture, rural development, agroecology, nutrition in order to achieve the Sustainable Development Goals.

The Symposium also moved the topic of agriculture and rural development from dialogue to activities at the regional and country level by complementing on-going initiatives to integrate biodiversity and ecosystem services in agriculture, identifying opportunities for synergies with National Strategic Programmes and Regional Initiatives, and facilitating regional and International cooperation between the scientists and business.

Green Room Sessions International Conference as a final goal is looking forward to assist people from the rural areas, related business, agriculture and allied sectors to take the advantage of:

- Natural resources, secure access to land and water, and improved natural resource management and conservation practices;
- Improved agricultural technologies and effective production services;
- Linking the interested parties with financial services;
- Transparent and competitive markets for agricultural inputs;
- Opportunities for rural off-farm employment and enterprise development;
- Local and national policy and programming.

We launch this with the aim of unlocking innovative, integrated, multidisciplinary science and technology with activation of all dimensions of sustainable development goals for all the participants.

In this Book of Proceedings we published part of the original scientific full papers presented at the Conference. The other part is provided for publication at the journal Agriculture and Forestry (ISSN 0554-5579, Printed; ISSN 1800-9492, Online), all based on the requests of the authors who participated at the Conference.

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PREDGOVOR

Međunarodna konferencija Green Room Sessions imala je za cilj da bude platforma međunarodne naučne diskusije o poljoprivredi uopšte, poljoprivredi vezano sa pitanjima ekonomije i ekologije, nauci o tehnologiji hrane i prehrane, ruralnim razvojem, životnom sredinom i šumarstvom. Green Room Sessions okupila je i povezivala nauku, istraživanje, industriju, društvene koncepte i prakse.

Naučni principi zasnovani su na primjeni Eko-Eko (ekološko-ekonomskih) koncepata za optimizaciju interakcije između prirodnih, socijalnih i komponenti ruralnih sredina: biljka, životinja, zemljište, voda, vazduh, kao i strukture koje su nastale kao plod rada ljudi. Pored toga, Green Room Sessions je težila da postavi društvena pitanja u centar rješenja održivog i fer sistema proizvodnje hrane. Brojni sastanci održani su tokom Konferencije sa ciljem da imaju višestruke koristi za društvo i sredinu koja nas okružuje, približavajući tokom ovih komunikacija ljude jedne drugima, pružajući im priliku da međusobno komuniciraju na jednom mjestu, razmenjuju ideje i povezuju poslovanja.

U novembru 2018. godine, Green Room Sessions International Conference pružila je mogućnost razmjene iskustava potvrđenih praksi u poljoprivredi, šumarstvu, interakcijama čovjeka i njegovog okruženja, struktura koje su nastale kao plod rada ljudi. Ovo je postignuto organizovanjem susreta naučnika i stručnjaka iz ove oblasti, te razmjenom iskustava, doprinoseći unapređenju održivijeg sistema proizvodnje i prerade. Iskustva drugih koji su gostovali istakli su značaj institucionalne uloge nacionalnih službi, regionalnih i međunarodnih organizacija u podršci i daljoj promociji eko-eko (ekološko-ekonomskih) koncepata i principa.

Dijalog između učesnika bio je usmjeren na:

- Prilagođavanje malih proizvođača i porodičnih farmera i jačanje njihove otpornosti na uticaj klimatskih promjena;
- Zaštitu i unapređenje agro-biodiverziteta, podrške održivosti ekosistema;
- Poboljšanje životnih uslova, životnog standarda u ruralnim područjima;
- „Sveto trojstvo": poljoprivreda, ekonomija i ekologija ($a \times e^2$), njihove međusobne veze i kako se baviti njima, te kako ovaj miks međusobnih relacija utiče na proizvodnju domaće hrane i zdravlje nacije;

- Postizanje tranzicionih promjena u poljoprivrednim praksama u skladu sa principima održivog razvoja.

Konferencija je dijelom uradila sintezu i nadograđivala rezultate regionalnih sastanaka i pružiti priliku da podijeli svoja iskustva sa učesnicima, diskutuje o politikama koje mogu pomoći u povećanju poljoprivredne proizvodnje, ruralnog razvoja, agroekologije, ishrane kako bi se postigli ciljevi održivog razvoja.

Konferencija je takođe inicirala pomjeranje teme poljoprivrede i ruralnog razvoja od dijaloga ka konkretnim aktivnostima na lokalnom i regionalnom nivou, tražeći rješenja očuvanja biodiverziteta u poljoprivredi, identifikujući mogućnosti za sinergiju sa nacionalnim strateškim programima i regionalnim inicijativama, pospješujući regionalnu i međunarodnu saradnju između naučnika i biznisa.

Učesnici na Konferenciji tražili su načine da se pruži pomoć ljudima iz ruralnih područja, njihovim malim biznisima, poljoprivredi i srodnim sektorima da iskoriste prednosti:

- Prirodnih resursa, bezbjednog pristupa zemljištu i vodama, poboljšavajući prakse upravljanja prirodnim resursima i pristupe konzervacije;
- Poboljšane poljoprivredne tehnologije i efikasnijih proizvodnih usluga;
- Povezivanje zainteresovanih strana sa finansijskim servisima;
- Mogućnosti za zapošljavanje i razvoj preduzeća u ruralnim područjima;
- Lokalnih i nacionalnih politika i programiranja.

Ovo inicijativa je pokrenuta sa ciljem otvaranja i susreta sa inovativnom, integrisanom, multidisciplinarnom naukom i tehnologijom uz aktiviranje svih dimenzija ciljeva održivog razvoja za sve učesnike.

U ovom Zborniku radova objavili smo dio originalnih naučnih radova (*Full papers*) predstavljenih na Konferenciji. Drugi dio je proslijeđen za objavljivanje časopisu Poljoprivreda i šumarstvo (ISSN 0554-5579, print; ISSN 1800-9492, online), sve na osnovu zahtjeva autora koji su učestvovali na Konferenciji.

Velibor SPALEVIĆ
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Plant production, Plant protection and food safety, Genetic resources

Environment protection, natural resources management, Rural development and Forestry

Original Scientific paper

Effects of quantity of nitrogen on maize yield

Ljubica ŠARČEVIĆ-TODOSIJEVIĆ[1*], Ljubiša ŽIVANOVIĆ[2], Vera POPOVIĆ[3*], Dragutin ĐUKIĆ[4], Sanja MIKIĆ[3], Velibor SPALEVIC[5], Ksenija MAČKIĆ[6]

[1] High Medical - sanitary School of Professional Studies "Visan", Tošin b.,7a, Zemun, Serbia
[2] University of Belgrade, Faculty of Agriculture, Nemanjina, 6, Zemun, Belgrade, Serbia
[3] Institute of Field and Vegetable Crops, Maksim Gorky 30, Novi Sad, Serbia
[4] University of Kragujevac, Faculty of Agronomy Čačak, Cara Dušana, 34, Čačak, Serbia
[5] University of Montenegro, Geografy Department of the Faculty of Philosophy, Nikšić, Montenegro
[6] University of Novi Sad, Faculty of Agriculture, Novi Sad, Serbia;
***** Correspondence: ljsarcevic@gmail.com; Tel.: +381 64 4122174

Abstract
Maize is one of the leading farm cultures in the world. The primary aim of maize production is to gain high and steady incomes. Varying of the incomes of the grown plants is seen in a great measure both as a consequence of weather conditions and applied quantities of nitrogen fertilizer. In this work, in a two-year period, it is examined how the increasing quantities of nitrogen fertilizer influence the parameters of productivity, that is, morphological features and components of the incomes of Serbian maize hybrid. The examinations were conducted on the locality of Eastern Srem (88 m.s.l.). The examinations covered the following systems of maize fertilization: control (without fertilizer), P_{90} K_{60} N_{30} kg ha^{-1} (basic, phon), P_{90} K_{60} N_{60} kg ha^{-1}, P_{90} K_{60} N_{120} kg ha^{-1}, P_{90} K_{60} N_{180} kg ha^{-1}. Within the morphological features of maize, it is examined the influence of the nitrogen fertilizer on the growth of a plant and the number of leaves on a corncob, and within the components of the income, its influence on the length of a cob, the number of grain rows and the number of grains on a cob. The results of our research have shown that, on the average for the examined factors, the height of a plant was 276.1 cm. On the average for the years, along with the increasing quantities of nitrogen up to 120 kg ha^{-1}, the height of a plant increased, and then it declined. The differences in the height of a plant between treatments were statistically significant and very significant. The number of leaves on a stalk, on the two-year average was 14.0. On the average for the years, along with the increase of nitrogen quantities up to 120 kg ha^{-1}, the number of leaves increased, and then it declined. Statistically significant differences were got between controls and quantities of 60 and 120 kg ha^{-1} N, as well as of phon and 120 kg ha^{-1} of nitrogen. Approximately for the examined factors, the length of the corncob was 20.0 cm. On the average for the years, while the quantities of nitrogen up to 120 kg ha^{-1} increased, the length of a cob grew, and then it stagnated. The shortest length of a cob (18.8 cm) belonged to the controlled plants, and the longest ones (20.6 cm) were those of the plants with the applied of 120 kg/ha^{-1} N. The differences between treatments were statistically very significant. On the average, for the covered factors, the number of grain rows on the cob was 15.2. Between the years of the examinations, some significant difference in the number of grain rows on the cob was not noticed. On the other hand, nitrogen manifested a completely specific influence on this parameter of maize fertility. On the average, within one-year period, with the increase of nitrogen quantity up to 120 kg ha^{-1}, the number of the grain rows increased, and then it stagnated. The differences between treatments were significant and very significant.
Keywords: fertilizer, maize productivity, climate conditions.

Introduction

Maize is one of the leading farm cultures in the world. The primary aim of maize production is to gain high and steady incomes. In order to achieve high incomes of growing plants, it is necessary to

apply agricultural measures in a right way. In that point, in a tecnology of maize production, the choice of hybrids and a proper mineral apply of nitrogen fertilizer has a special importance. (Stojaković et al. 1996; Popović, 2010; 2015; Živanović, 2005; Živanović et al. 2018; Stevanović et al. 2018). Mineral nitrogen nutrition is one of the most significant factors with its influence on productivity and features of plants. Optimal nitrogen nutrition has an influence on a development of the root system and overground biomass as well as on nutritive value of fruits (Glamočlija, 2004; Glamočlija et al. 2015; 2017; Đekić et al. 2014; 2015; Terzić et al. 2018; Božović et al. 2018). Numerous researches here and in the world confirmed that nitrogen mineral fertilizers in a great measure increases the income of maize grains (Brković, 1985; Hojka, 2004; Binder et al. 2000; Šarčević - Todosijević at al. 2016).

On the other hand, increased and uncontroled apply of nitrogen mineral fertilizers, leads to a plenty of phenomena as its consequence which are harmful for plants and the living environment. They include a lengthened vegetation period, a harvest period decrease, an increased sensitivity of plants to patogenic microorganisms and flattening. The apply of nitrogen in the quantities that surpass the needs of plants, leads to the increase of the level of nitrates in soil and their washing off into underground waters. (Schepers at al. 1991; Villar – Mir et al. 2002; Đukić et al. 2007; Glamočlija et al. 2015, 2017).

In this work, in a two-year period, on the locality of Eastern Srem, it is examined how the increasing quantities of nitrogen fertilizer influence of the productivity parameters, that is, morphological features and components of the incomes of Serbian maize hybrid.

Materials and Methods

A microfield testing station was set in Zemun Polje, on the locality of Eastern Srem, on 88 meters altitude. Varying of the incomes of the grown plants is seen in a great measure both as a consequence of weather conditions and applied quantities of nitrogen fertilizer. For undisturbed growth and development of maize, there is a requirement for convenient meteorological conditions, average air temperatures and good regime of rainfall during a vegetation period (Penney et al.; 1996; Schmidt et al., 2002). Eastern Srem is settled in the area of medium continental climate, between two big rivers, the Danube and the Sava. This area is specified by average annual temperature of 11.9^{0}C and the quantity of rainfall is to be 638.3 mm. Winters are with approximate temperatures of 1.6^{0}C and rainfall of 113.4 mm. Springs can be slightly colder (12.1^{0}C) than autumns (12.4^{0}C), but with a higher quantity of rainfall (159.0 mm in relation to 152.1 mm). Average summer temperatures are 21.4^{0}C and rainfall of 213.8 mm. During the research, field micro tests are used, conducted by the split plots method in four goes. The applied technological practices on the examinations was standard, as for regular maize production (Šarčević-Todosijević et al., 2016). The examinations covered the following systems of maize fertilization:

B_1 – Control (without fertilizer),
B_2 – P_{90} K_{60} N_{30} kg ha^{-1} (basis, phon),
B_3 – P_{90} K_{60} N_{60} kg ha^{-1},
B_4 – P_{90} K_{60} N_{120} kg ha^{-1},
B_5 – P_{90} K_{60} N_{180} kg ha^{-1}.

Within the parameters of productivity, it is examined how the increasing quantities of nitrogen fertilizer influence on morphological features and components of the incomes of Serbian maize hybrid. Within the morphological features of maize, it is examined the influence of the nitrogen fertilizer on the growth of a plant and the number of leaves on a maizecob, and within the components of the income, its influence on the length of a cob, the number of grain rows and the number of grains on a cob.

Statistical Analysis

On the basis of achieved research results the usual variation all statistical indicators were calculated: average values. Experimental data were analyzed by descriptive and analytical statistics using the program STATISTICA, 2012. All evaluations of significance were made on the basis of the ANOVA test at 5% and 1% significance levels.

Results and Discussion

The results of our research have shown that the applied quantity of nitrogen had significant impact on maize yield. The differences between treatments were statistically significant and very significant. On the average for the examined factors, the height of a plant was 276.1 cm (table 1).

Table 1. The influence of the nitrogen fertilizer on the growth of a plant, cm

Quantity of nitrogen (B)	Year (A)		Average	Index (%)
	First	Second		
1	273.1	265.1	269.1	100.0
2	279.3	267.8	273.6	101.7
3	280.8	271.1	276.0	102.5
4	285.8	278.3	282.1	104.8
5	287.0	272.4	279.7	103.9
Average	281.2	270.9	276.1	-
Index (%)	100.0	96.3	-	-

LSD	A	B	BxA	AxB
0.05	2.28	2.69	3.80	4.26
0.01	4.19	3.64	5.15	6.53

In the first year of the research, the measured height of a plant was 10.3 cm longer than in the second year of the research. The difference was statistically very significant. On the average for the years, along with the increasing quantities of nitrogen up to 120 kg ha^{-1}, the height of a plant increased, and then it declined. The shortest height (269.1 cm) was measured among the plants on controled variations, while the longest one (282.1 cm) belonged to the plants treated by 120 kg ha^{-1} N. The differences in the height of a plant between treatments were statistically significant and very significant. Observing the years separately, it can be noticed that in the first year of the resreach, with a higher quantity of rainfall, the height of a plant increased to the highest dose of nitrogen (180 kg ha^{-1}), although the interaction was not statistically significant (table 1).

The number of leaves on a stalk, on the two-year average was 14.0 (table 2).

Table 2. The influence of the nitrogen fertilizer on the number of leaves

Quantity of nitrogen (B)	Year (A)		Average	Index (%)
	First	Second		
1	14.1	13.6	13.9	100.0
2	14.2	13.7	14.0	100.7
3	14.3	13.8	14.1	101.4
4	14.5	13.8	14.2	102.2
5	14.3	13.7	14.0	101.1
Average	14.3	13.7	14.0	-
Index (%)	100.0	96.1	-	-

LSD	A	B	BxA	AxB
0.05	0.15	0.11	0.15	0.21
0.01	0.27	0.14	0.20	0.34

Table 3. The influence of the nitrogen fertilizer on the length of a corn cob, cm

Quantity of nitrogen (B)	Year (A)		Average	Index (%)
	First	Second		
1	19.6	18.0	18.8	100.0
2	20.0	18.8	19.4	103.2
3	20.8	19.6	20.2	107.4
4	21.4	20.6	21.0	111.7
5	21.2	19.9	20.6	109.3
Average	20.6	19.4	20.0	-
Index (%)	100.0	94.2	-	-

LSD	A	B	BxA	AxB
0,05	0.89	0.45	0.64	1.11
0,01	1.64	0.61	0.87	1.91

In the first year of the research, with a higher quantity of rainfall and lower temperature, a higher number of leaves for 0.6 was recorded in comparison to the second year of the research, which was drier and warmer. The difference was statistically very significant. On the average for the years, along with the increase of nitrogen quantities up to 120 kg ha^{-1}, the number of leaves increased, and then it declined. The least number of leaves (13.9) was recorded on a variation without fertilizer and the most one (14.2) was recorded at a dose of 120 kg ha^{-1} N. Statistically significant differences were got between controls and quantities of 60 and 120 kg ha^{-1} N, as well as of phon and 120 kg ha^{-1} of nitrogen. In the average as well as per years of the research, a similar tendency of nitrogen influence on the leaves of a stalk was manifested, but without a significant interaction.

Within the components of the maize income, it is examined the influence of the nitrogen fertilizer on the length of a cob, the number of grain rows and the number of grains on a cob.

Approximately for the examined factors, the length of the corn cob was 20.0 cm (table 3).

In the first year of the research, a length of a corn cob was for 1.2 cm longer in comparison to a corn cob in the second year. The difference was statistically significant. On the average for the years, while the quantities of nitrogen up to 120 kg ha^{-1} increased, the length of a cob grew, and then it stagnated. The shortest length of a cob (18.8 cm) belonged to the controlled plants, and the longest ones (20.6 cm) were those of the plants with the applied of 120 kg ha^{-1} N. The differences between treatments were statistically very significant (table 3).

On the average, for the covered factors, the number of grain rows on the cob was 15.2 (table 4).

Table 4. The influence of nitrogen fertilizer on the number of grain rows

Quantity of nitrogen (B)	Year (A)		Average	Index (%)
	First	Second		
1	14.4	14.9	14.7	100.0
2	14.7	15.0	14.9	101.4
3	15.1	15.3	15.2	103.8
4	15.7	15.7	15.7	107.2
5	15.6	15.5	15.6	106.1
Average	15.1	15.2	15.2	-
Index (%)	100.0	100.1	-	-

LSD	A	B	BxA	AxB
0,05	0.29	0.20	0.28	0.41
0,01	0.54	0.27	0.38	0.68

Between the years of the examinations, some significant difference in the number of grain rows on the cob was not noticed. On the other hand, nitrogen manifested a completely specific influence on this parameter of maize fertility. On the average, within one-year period, with the increase of nitrogen quantity up to 120 kg ha^{-1}, the number of the grain rows increased, and then it stagnated. The differences between treatments were significant and very significant.

The number of grains was, on the average for the examined factors, 636.6 (table 5).

Table 5. The influence of nitrogen fertilizer on the number of grains on a cob

Quantity of nitrogen (B)	Year (A)		Average	Index (%)
	First	Second		
1	583.1	585.7	584.4	100.0
2	620.0	622.2	621.1	106.3
3	650.4	654.1	652.3	111.6
4	678.7	659.2	669.0	114.5
5	659.0	653.1	656.1	112.3
Average	638.2	634.8	636.6	-
Index (%)	100.0	99.5	-	-

LSD	A	B	BxA	AxB
0,05	20.68	27.32	38.63	41.71
0,01	37.95	37.02	52.35	62.88

In the first year of the research, the number of grains on a cob was slightly higher than in its second year, but that difference was not justified. Opposite to that, additional nutrition with nitrogen manifested its influence on this component of the income. On the average for the years, along with the increase of nitrogen quantity up to 120 kg ha^{-1}, the number of grains on a cob also increased, and then it mildly stagnated. The least number of grains on a corn cob (584.4) was registered on control, while the highest number (669.0) was registered due to fertilization with 120 kg ha^{-1} N. However, a statistically justified difference was proved only with the use of 60 kg ha^{-1} N. The interaction between the factors, considering the number of grains on a corn cob, was not determined (table 5).

The numerous researchers claim that the effect of the applied mineral fertilizers on the income and the quality of maize grains decreases with the increase of their quantity (Starčević et al, 1994; Blažić, 2006; Šarčević - Todosijević et al. 2016; Janković et al. 2018; Ikanović et al. 2018; Maksimović et al. 2018; Živanović et al. 2018). This noticed pattern was confirmed by the results of our research.

Conclusions

According to the results, there can be drawn the following conclusions.

Applied quantity of nitrogen had significant impact on maize yield. The differences between treatments were statistically significant and very significant.

On the average for the years, along with the increasing quantities of nitrogen up to 120 kg ha^{-1}, the height of a plant, the number of leaves, the length of a cob, the number of the grain rows and the number of grains on a cob increased, and then declined.

According to the conducted research, it can be concluded that on the soil of "černozem" type and in the climate conditions of Eastern Srem, a proper nitrogen nutrition applied on the examined hybrid, implies the use of 120 kg ha^{-1} N, on a phon 90 kg ha^{-1} of phosphorus and 60 kg ha^{-1} of potassium.

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Conflicts of Interest: The authors declare no conflict of interest.

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