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YIELD AND NUTRITIONAL QUALITY OF GREENHOUSE LETTUCE (*Lactuca sativa* L.) AS AFFECTED BY GENOTYPE AND PRODUCTION METHODS

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Greenhouse experiments were conducted in winter growing seasons in order to evaluate the effects of genotype and production methods on yield and nutritional quality of lettuce (*Lactuca sativa* L.). A three-year (2009-2011) study was conducted by randomized block system in a greenhouse without additional heating. The trial included three genotypes of lettuce (Archimedes RZ, Santoro RZ, Kibou RZ). Each row with these genotypes was exposed to the following variants of covering: control-planting on bare soil, mulching before sowing with PE-black foil, agro textile-covering plants after planting with agro textile (17 g), a combination of mulching + agro textile. Throughout of all the three years of the trial, it was continuously evidenced that the genotype "Santoro RZ" had the biggest heads and the highest yield (15.33 kg 10 m^{-2}), which leads to conclusion that the yield of lettuce is a genotype characteristics. Moreover, the nutritional value (ascorbic acid concentration) has shown that, depending on the method of production, in average, the combination of mulching + agro textile (26.77 mg 100 g^{-1}) had the highest content while the control variant had significantly lower vitamin C content (21.10 mg 100 g^{-1}). The three-year researches have shown that the production method and genotype significantly affect the nitrate content. An average nitrate content was 2196.33 mg kg^{-1} on the control variant, and 2526.24 mg kg^{-1} on agro textile. Leafy lettuce of genotyp „Kibou RZ" had lower nitrate content (2176.85 mg kg^{-1}) compared to „Archimedes RZ" (2843.05 mg kg^{-1}) and „Santoro RZ" (2221.37 mg kg^{-1}). However,

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nitrate concentration in all treatments remained within the European Union's permissible levels.

Key words: lettuca,genotype, nitrate content, vitamine C.

INTRODUCTION

Lettuce consists one of the most important cultivated vegetable in our region. Lettuce leaves are usually consumed raw and without any restriction to daily intake. However, lettuce is characterized by its great ability to accumulate nitrate in leaves which can be harmful to human health (COMETTI *et al*., 2011). Thus, nitrate concentration in lettuce is considered one of the more important quality parameters. Nitrate accumulation in plants is quite complex since it is influenced by both genetic and environmental factors (NOVO *et al*., 2008). Among environmental factors light intensity is reported to strongly affect nitrate accumulation in plants (NOVO *et al*., 2008). According to researches of (BALALIĆ, 2004; LAZIĆ *et al*., 2001) lettuce is inclined to the accumulation of toxic substances (nitrates). These authors suggest that the accumulation of nitrate largely depends on the fertilizer (especially nitrogen) and climatic conditions (lack of light and low temperature). Winter lettuce production with insufficient lighting and a large amount of nitrogen fertilizers provides ideal conditions that lead to the accumulation of significant amounts of these harmful substances. Environmental factors, lack of water in the soil, also affect the increase in fruit quality, antioxidant activity and increases health-promoting value of vegetables (JOVANOVIC *et al*., 2010).

Besides nitrates, ascorbic acid concentration is also considered as an important quality indicator in lettuces which is also influenced by both abiotic and biotic parameters (COMETTI *et al*., 2011). Vitamin C plays multiple roles in the human organism, this vitamin to increase the organisms resistance to viruses and bacterial infections including allergies. In work (PAVLOVIC *et al*., 2011) emphasize that the role of vitamins and minerals in human health has been clearly established. Apart from this, it has marked antioxidant characteristics and is one of major antioxidant agents (PADAYATTY *et al*., 2003) in removing free radicals along with vitamins E and A, and the minerals selenium and zinc. Also, researches (MLADENOVIC *et al*., 2013) confirmed that lettuce is necessary in human diet as a source of antioxidant components and vitamins, especially since it is used raw so that its nutritive value remains preserved.

Much of the current interest in vitamin C is focused on its ability, as a reducing agent, to quench free radicals. The aim of the present study was to examine the effects of different genotypes and growing method on yield, nitrate concentration and nutritional value in lettuce plants.

MATERIALS AND METHODS

During a three-year period (2009–2011) the tests were carried out on the following of genotypes salad (Archimedes RZ, Santoro RZ and Kibou RZ) in a greenhouse without additional heating on the experimental field of the Faculty of Agriculture in East Sarajevo. The land on which they performed experiments is secured medium humus (2.9%). Chemical analysis indicates that this is a favourable soil pH for growing vegetable crops. The content of organic carbon (C) is 1.68%, and the content of total nitrogen content was 0.05%, which indicates that the ratio of C:N unfavourable and is 33,6:1. According to the content of physiologically active phosphorus (96.1 mg 100 g^{-1}) and potassium (56.6 mg 100 g^{-1}), we conclude that it is a land of good provision to these elements. The trial was set in a randomized block system with four replications and an

experimental plot of 2.4 square metres (0.3 × 8 m). There were three rows in the experimental plot, and each row represented a new genotype. Sowing for the production of seedlings was done in containers, without a nosedive on the Klasmann substrate in the first decade of September. The 25 day-old seedlings were seeded at the distance of 20 cm in a row and 30 cm between rows, so that the planting density of about 150 000 plants ha was made. We used the dripping irrigation system, which was set along with the covering of area. The trial included four variants of soil covering: control - planting on bare soil, mulching before planting with PE - black foil, agro textile - covering plants after planting with agro textile (17 g), a combination of mulching + agro textile. Picking of lettuce was carried out in technological maturity. Genotype "Archimedes RZ" is the latest creation of green butter lettuce Salanova for the entire year. Rose is filled with numerous bright green leaves of the same size. It has good tolerance to efflorescence. It can be planted throughout the year. Genotype "Kibou RZ" is the latest genotype in the type of oak leaves, attractive colours, which is effective at high temperature. Heads are uniform weight, open type. Planting time was in the period from February to October. Genotype "Santoro RZ" is a new creation of large, uniform head beautiful green colour. Resistance to efflorescence and can be a long harvest. Due to the structure of the head is suitable for processing (cutting).

Ascorbic acid. Ascorbic acid concentration was determined on leaf discs obtained from randomly selected leaves per treatment. Leaf samples were collected at harvest, wrapped in plastic bags and transferred immediately in the laboratory for Ascorbic acid content. The L-ascorbic acid contents in the leaves were estimated by Tillman's titration method, which was modified by PIJANOWSKI (1973). In short, the leaf material (10 g fresh weight) was homogenised with 30 cm^3 of 2% oxalic acid (***v/v***) and filtrated. The filtrate was filled with 1% oxalic acid (***v/v***) to a total volume of 100 cm^3, then 10 cm^3 of the obtained extract was transferred to an Erlenmeyer flask and then 40 cm^3 of 1% oxalic acid (***v/v***) was added. The solution was quickly titrated using 2,6-dichlorophenolindophenol until the pink colour held for 30 s. The concentrations of the total vitamin C, as the sum of the contents of L-ascorbic acid and dehydroascorbic acid, were expressed as milligrams per 100 g FW.

Nitrates content. Nitrate content in fully mature leaves was determined per treatment. Due to the limited number of plants, nitrate content on blades and midribs were determined in one composite sample obtained by mixing homogeneously each tissue per treatment. Nitrate concentration was determined by a first-derivative spectrophotometric method (spectrophotometer "Unicam UV 2"UK) based on nitrosalicylic acid spectral signals obtained to 388 and 440 nm in basic solution (LASTRA *et al*., 2009).

Statistical analysis. The results achieved were processed by variance analysis method of a two-factorial trial (ANOVA) using SPSS 4.5 software. We carried out the testing of significance of differences between the means by the method of the variance analysis of two-factorial trial covering x variety (4 ×3). The significance of differences of individual means was tested by LSD test for the general means and interaction. We conducted a statistical analysis of experimental data according to the year of research.

RESULTS AND DISCUSSION

The air temperature in the greenhouse during the experiment. The graph daily flow temperature (Fig.1) notes that the first two years of experiments 2009. and 2010. have approximately the same and climatic conditions in relation to the year 2011, which stands as a

cold. Maximum daily temperatures are reaching over 2009. and 2010. and more than 25°C, which resulted in the rapid flow of vital processes in the lettuce. In the first two years of experiments have been no frosts. Daily maximum temperature during the 2011th year, reaching up to 22°C, while the minimum Temperature went up to 2°C, which resulted in a reduction of lettuce yield. Temperatures in the greenhouse were directly dependent on temperature in the open field after the greenhouse is not warmed up. On the other hand, the use of different modes coverage affected the temperature disparity between the studied treatments in the experimental facility.

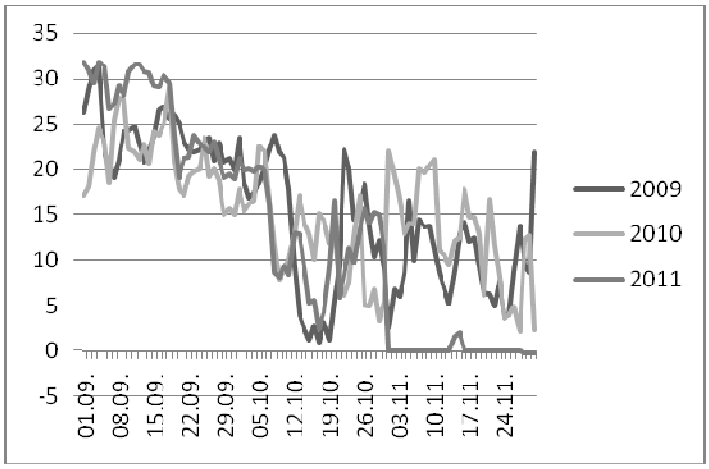

Figure1. The mean daily temperatures (in the greenhouse) for the experimental production of lettuce

Yield. In the first year, comparing the average yield per genotypes, yields ranged from genotype "Santoro RZ" (13,35 kg per experimental plot) to genotype "Archimedes RZ" (7,30 kg per experimental plot). Genotypes behaved similarly and in the second year of experiment. Variations in the value of the average yield of the "Santoro RZ" genotype (19.32 kg) compared to the genotype "Archimedes RZ" (11.24 kg) and the genotype "Kibou RZ" (14.08 kg) were evaluated at the threshold of significance of $P < 0.01$. NGUYEN (2006) achieved the similar results in their trial. In the final year reflected the generally observed lower values of yield over the previous two years. Reduced yield due to low temperatures and occasional temperature falls below 0°C (Fig.1) which affected the growth of lettuce.

When comparing the average yield per variant of covering in first year of experiment, the combination mulching + agro textile distinguishes itself as the best option, on which the maximum average yield of 13.33 kg per experimental plot, i.e. 55.5 kg 10 m^2 is achieved. The yield on this variant was by 58.50% higher compared to the control. Statistically, differences in the values of this variant of covering compared to the first, second and third are rated at the level of significance of $P < 0.01$. During 2010, we recorded higher average yields compared to the previous year. The variants of covering applied significantly affected the increasing of the yield of lettuce. The plants on agro textile had a maximal productivity (19.27 kg), i.e. 80.2 kg 10 m^2. The yield on this variant was by 71.13% higher compared to the control variant.

Table 1. The average yield at the experimental plots (kg) fresh weight

Coverin land	G_1			G_2			G_3			Average
	2009	2010	2011.	2009.	2010	2011.	2009.	2010.	2011.	
C_0	7.30	8.77	2.52	8.95	15.34	2.85	9.00	9.66	2.73	7.45
C_1	7.60	12.14	2.77	14.20	18.35	3.71	12.39	11.21	3.09	9.49
C_2	6.90	13.72	3.51	11.25	24.95	5.25	11.30	19.14	4.09	11.12
C_3	7.40	10.33	3.78	19.00	18.66	4.88	13.60	16.29	5.02	10.99
Avera. G	7.30	11.24	3.14	13.35	19.32	4.17	11.57	14.08	3.73	9.78
LSD	2009.year			2010. year			2011 .year			
	A	B	A × B	A	B	A × B	A	B	A ×B	
0.05	0.98	0.86	1.73	3.25	2.82	5.65	0.48	0.41	0.83	
0.01	1.32	1.16	2.32	4.34	3.78	7.56	0.64	0.55	1.11	

G-genotypes(G_1- Archimedes RZ, G_2- Santoro RZ, G_3- Kibou RZ); C-covering land (C_0-control, C_1- black -PE foil, C_2- agrotextile,C_3- black-PE foil + agrotextile)

Over a three-year trial, it was continuously confirmed that the genotype "Santoro RZ" had the biggest heads and the highest yield (table 1). The results obtained in our trial are consistent with the research of a number of authors which show that the yield of lettuce depends primarily on the genotype, the conditions of production, nutrition, dates of seeding and picking (SANTAMARIA *et al*., 2001; CONVERSE *et al*., 2004).

The vitamin C content. Except nitrates, ascorbic acid concentration is considered as one of the most important nutritional quality factors in many vegetable crops (LEE and KADER, 2000).Lettuce cultivars with higher content of vitamin C and anthocyanins may be a good source of antioxidants, especially in winter, when there is a deficit in the consumption of fresh vegetables.

Vitamin C ranged from 10.06 mg 100 g^{-1} to 42.30 mg 100 g^{-1} (Table 2).

We could say that the amount of the other antioxidant compounds (L-ascorbic acid) remains within the boundaries recorded in other lettuce types (LLORACH *et al*., 2008).Our results from the study about vitamin C content in lettuce show that the genotype "Santoro RZ" had the lowest content (22.73 mg 100 g^{-1}) and the genotype "Kibou RZ" the highest content of vitamin C (25.29 mg 100 g^{-1}). The presented data on the effect of the genotype on the content of vitamin C are consistent with the research (SIOMONS *et al*., 2002) where the content of vitamin C, depending on the genotype , ranged from 31.50 mg 100 g^{-1} to 37.25 mg 100 g^{-1}. Also, in the researches of (PETRIKOVA and POKLUDA, 2003) and (LLORACH *et al*., 2008) it can be concluded that the content of vitamin C is affected by a number of factors, among which the genotype is in the first place. In results of (KOSMA *et al*., 2013) the higher levels of shading and cover material seemed to negatively affect ascorbic acid concentration. Furthermore, the ascorbic acid content was significantly lower in lettuces grown during winter compared to those grown during spring. Values of vitamin C content depended on the method of production i.e. on the covering variant applied. In average, a combination of mulching + agro textile (26.77 mg 100 g^{-1}) had the highest content, while the control variant had a significantly lower content of C vitamin. The results of our researches are contrary to the data of BALALIĆ (2004), who states, in his experiment, that the variant without mulching had the highest average content of vitamin C (8.07 mg 100 g^{-1}), and the variant of mulching with black foil had the lowest (7.8 mg 100 g^{-1}).

Table 2.The vitamin C content in lettuce (mg 100^{-1} g) fresh weight

Coverin land	G_1			G_2			G_3			Average
	2009	2010	2011.	2009.	2010	2011.	2009.	2010.	2011.	
C_0	10.06	28.30	26.23	10.13	22.50	23.34	10,23	38.70	20.49	21.10
C_1	11.40	34.40	26.05	10.09	21.40	23.87	13.16	36,80	30.65	23.06
C_2	12.72	35.30	29.67	10.89	41,00	29.22	13.20	31.20	29.79	25.88
C_3	13.33	35.80	32.19	11.63	41.10	27.64	13.27	42,30	23.75	26.77
Avera. G	11.81	33.45	28.53	10.68	31.50	26.01	12.46	37.25	26.17	24.21

LSD	2009.year			2010. year			2011 .year		
	A	B	A × B	A	B	A × B	A	B	A ×B
0.05	0.61	0.53	1.06	0.75	0.64	1.29	0.27	0.23	0.47
0.01	0.82	0.71	1.42	1.00	0.86	1.73	0.36	0.31	0.63

G-genotypes (G_1- Archimedes RZ, G_2- Santoro RZ, G_3- Kibou RZ); C-covering land (C_0-control, C_1- black -PE foil, C_2- agrotextile,C_3- black-PE foil + agrotextile)

Nitrate content.

Depending on the choice of genotypes, in first year experiment nitrate content ranged from 2606.12 mg kg^{-1} to 3464.56 mg kg^{-1}. The effect of the genotype indicates to the existence of significant differences in nitrate content of the genotype "Archimedes RZ" in relation to "Santoro RZ" and "Kibou RZ". Also in the second year of experiment the genotype "Archimedes RZ" had the highest average value of nitrate (2842.9 mg kg^{-1}), and the genotype "Kibou RZ" had the lowest (2162.87 mg kg^{-1}). Variations in the values of nitrate content of the genotype "Archimedes RZ" compared to the other two tested genotypes were evaluated at the significance level of $P < 0.01$. Statistical analysis of the mean values of nitrate content showed a significant difference between the genotype "Archimedes RZ" and all other varieties. In the final year of the experiment, we have recorded generally lower average values of nitrate content compared to the previous two years (Table 3). If we look at the temperatures in the years of trial (Fig.1) it can be seen that the temperatures during October and November in 2009 and 2010 were higher than they were in 2011, when the lowest nitrate content was recorded. Nitrate content in lettuce depends on many factors. There is more nitrate in vegetables cultivated with higher doses of nitrogen and organic fertilizers at low relative air humidity, under drought conditions, low light intensity, during the short day, temperatures above 25°C degrees. According to research (KASTORI and PETROVIĆ, 2003) for the accumulation of nitrate is very significant interaction of temperature and light intensity. Cited authors point out that the accumulation of nitrate favours high substrate temperature and low light intensity.

The accumulation of nitrates in the leaf tissues was significantly higher in lower irradiance intensity and low temperature treatments compared to the control (KOSMA *et al*., 2013.). Nitrate accumulation in plants is affected greatly by environmental factors. In warm and wet years, increased accumulation of nitrate is possible, regardless of whether the nitrogen originates from organic or mineral sources (CUSTIC *et al*., 2003). Plant nitrate levels were influenced by weather conditions more significantly than by the form and application rates of fertilizers (CUSTIC *et al*., 2003). It is accepted that plants in winter are not able to use all the nitrogen available in the soil due to less favorable light and temperature conditions. GRUDA (2005) has extensively reviewed the effect of different environmental factors on the nitrate content of greenhouse

vegetables. Winter-sown crops have generally higher nitrate concentration than summer crops in the same environment and Northern European crops have higher nitrate levels compared to Southern European crops (WEIGHTMAN *et al.,* 2006). These differences can be explained by both, higher irradiance in summer which tends to reduce nitrate, and also to higher growth rates which coincide with periods of high irradiance and warmer temperatures. Furthermore, nitrate concentration was significantly higher in plants grew during the winter period compared to those in spring. These higher values of nitrate concentration during the winter season could be attributed to differences in microclimatic parameters in greenhouse. According to the results (KASTORI and PETROVIĆ, 2003), there is more nitrate is the peduncle than in the leaves. Survey results indicate that all four types of coverage differentiated in nitrate content (Table 3). In the first year of experiment the highest content of nitrate (3192.25 mg kg^{-1}) was recorded in agro textile and the lowest (2597.83 mg kg^{-1}) on the control. The differences in nitrate content among the black -PE foil, agrotextile and black-PE foil + agrotextile variants of covering were evaluated at the significance level of $P < 0.01$ in comparison to the control variant.

Table 3. Mean values of nitrate (mg kg^{-1}) in the lettuce

Covering land	*2009 year*			*2010 year*			*2011 year*		
	G_1	G_2	G_3	G_1	G_2	G_3	G_1	G_2	G_3
C_0	*3313.00*	*2290.00*	*2190.50*	*2727.25*	*2001.5*	*1863.00*	*2142.25*	*1713.25*	*1536.25*
C_1	*3491.50*	*2403.00*	*2523.00*	*2831.75*	*2211.00*	*2136.50*	*2172.50*	*2019.75*	*1926.50*
C_2	*3642.50*	*3253.00*	*2681.00*	*2889.70*	*2524.00*	*2165.00*	*2137.00*	*1795.00*	*1649.00*
C_3	*3411.25*	*2782.25*	*3029.75*	*2923.00*	*2148.50*	*2487.00*	*2435.00*	*1515.25*	*1944.75*
Avera. G	*3464.56*	*2682.06*	*2606.12*	*2842.90*	*2221.25*	*2162.87*	*2221.68*	*1761.00*	*1764.18*

LSD	*2009 year*			*2010 year*			*2010 year*		
	A	*B*	*A ×B*	*A*	*B*	*A ×B*	*A*	*B*	*A ×B*
0.05	*97.04*	*84.03*	*168.08*	*61.61*	*53.34*	*213.47*	*30.62*	*26.52*	*53.04*
0.01	*129.70*	*112.32*	*224.66*	*82.35*	*71.30*	*285.33*	*40.93*	*34.45*	*70.90*

G-genotypes (G_1- Archimedes RZ, G_2- Santoro RZ, G_3- Kibou RZ); C-covering land (C_0-control, C_1- black -PE foil, C_2- agrotextile,C_3- black-PE foil + agrotextile)

During 2010, the study has determined that the control variant had the lowest nitrate accumulation (2197.25 mg kg^{-1}), while the highest nitrate accumulation was recorded in agrotextile (2356,83 mg kg^{-1}).The differences were also spotted in the content of nitrate per genotype. The highest accumulation of nitrate was recorded in the genotype "Archimedes RZ" (2842.90 mg kg^{-1}), while the lowest content was recorded in the genotype "Kibou RZ" (2162.87 mg kg^{-1}). The differences among genotypes were highly significant, indicating that the varieties have an impact on nitrate content in lettuce leaves. That nitrate accumulation depends on the type, variety and climatic conditions has been shown in the researches of SORENSEN (1994). The significant role of light intensity in nitrate concentration has also been reported for a variety of vegetables (PROIETTI *et al*., 2004). Similar results are found in the works of LAZIĆ *et al*., (2002). According to their research, the nitrate content is a varietal characteristics and the leaf lettuce has the highest level of it (350.30 mg kg $^{-1}$fresh weight), and the Roman lettuce has the lowest level (310, 90 mg kg^{-1} fresh weight). in the nutrient solution, as expected (ALBERICI *et al*., 2008). It

seems that genes encoding for nitrate transporters are differentially expressed at different nitrate levels in the growing medium,regulating nitrate uptake (OKAMOTO *et al*., 2006). In fact, leaf nitrate content increased with macronutrient concentration of culture solutions and was paralleled by the increase in the content of sucrose.

In the final year of the study, the average value of nitrate content ranged from 1797.25 mg kg^{-1} (control) to 2039.58 mg kg^{-1} (black PE foil) (Table 3). The differences achieved in the average values of nitrate content at different variants of mulching are rated on the threshold of significance of 1%, only these differences were not statistically significantly justified between the third and fourth variants of mulching. In the final year of the study, the order of the studied genotypes, in terms of this trait, was identical to the one from the previous years.

CONCLUSIONS

Throughout the three years of the trial, it was continuously confirmed that the genotype Santoro had the biggest heads, as well as the highest yield.

The three-year studies have shown that the coverage variants applied significantly affected the yield of lettuce (*Lactuca sativa* L.). The highest yield was recorded in the variant of agro textile and the lowest in controls. Plants grown in different variants of mulching (PE- foil, agro textile, agro textile + PE foil) achieved significant or highly significant differences in the parameters tested compared to plants grown on bare soil.

The combined applying of mulching + agro textile had the highest yield in the trial in the first and the third year. In the second year, the maximum yield was determined in the agro textile variant. The lowest values of all of the observed parameters were determined in the control variant.

The nutritional value (ascorbic acid concentration) has shown that, depending on the method of production, in average, the combination of mulching + agro textile had the highest content while the control variant had significantly lower vitamin C content.

A significant influence of genetic factors has been determined and the highest nitrate content was recorded in the genotype “Archimedes RZ” which is by 22% more than in the genotype “Kibou RZ” and “Santoro RZ”. The trend of increasing of nitrate is emphasized depending on the variant of covering. The minimum content of nitrate was found in the control variant which is by 13% less than the in the agro textile variant, where the highest content of nitrate was found. The values of maximal nitrate content in our trial were below the acceptable standard (4500 mg kg^{-1} for lettuce grown in the protected area) as provided by the European Commission EC.

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UTICAJ GENOTIPA I NAČINA PROIZVODNJE NA PRINOS I KVALITET SALATE (*Lactuca sativa* L.) GAJENE U PLASTENIKU

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Izvod

Ogled u plasteniku je postavljen u zimskom periodu sa ciljem praćenja uticaja genotipa i načina proizvodnje na prinos i kvalitet salate.Trogodišnji ogled (2009-2011) je postavljen po randomiziranom blok sistemu u plasteniku bez dodatnog zagrijavanja. Ispitivane su tri genotipa salate (Arhimed RZ, RZ Santoro i Kibo RZ). Svaki red sa navedenim genotipovima bio je izložen sljedećim varijantama pokrivanja: kontrola – sadnja u obično zemljište**,** malčiranje prije sjetve sa PE - crnom folijom, agrotekstil za pokrivanje biljaka nakon sadnje (17g) i kombinacija malčiranje + agrotekstil. U toku trogodišnjeg ogleda bilo je evidentno da je genotip Santoro imao najveće glavice i najveći prinos (15.33kg10m^{-2}) što dovodi do zaključka da je prinos kod salate karakteristika genotipa . Osim toga, ispitivanja kvaliteta salate (sadržaj askorbinske kiseline) su pokazala da je kombinacija malč + agrotekstil (26,77mg100g^{-1}) je imao najveći sadržaj dok je imao najveći sadržaj dok je kontrola imala značajno niži sadržaj vitamina C (21.10mg100g^{-1}).Trogodišnja istraživanja su pokazala da su način proizvodnje i genotip, značajno uticali na sadržaj nitrata. U prosjeku sadržaj nitrata je bio 2196.33mgkg^{-1} u kontroli i 2526.24mgkg^{-1} na agrotekstilu. Lisnata salata genotipa Kibo je imala niži sadržaj nirata (2176.85mgkg^{-1}) u poređenju sa Arhimed genotipom 2843.05mgkg-1 i Santoro 221.37mgkg^{-1}. U svakom slučaju, saržaj nitrata kod svih primjenjenih tretmana je u skladu sa dozvoljenim vrijednostima propisanim od Evropske unije.

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