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IMPACT OF FERTILIZERS ON CHEMICAL ANALYSIS, AMINO ACID AND FATTY ACID COMPOSITION OF SUDANESE SOYBEAN GENOTYPE

DJELOVANJE UMJETNIH GNOJIVA NA KEMIJSKU ANALIZU I SASTAV AMINOKISELINA I MASNIH KISELINA SUDANSKOG GENOTIPA SOJE

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ABSTRACT

The impact of fertilizer on chemical analysis, amino acid and fatty acid composition of soybean (*Glycine max L merril*) Sudanese local genotype was studied. A field experiment was conducted for two consecutive seasons (2009-2010 and 2010-2011) on the demonstration farm of the College of Agricultural studies, Sudan University of Science and Technology at Shambat. The experiment was laid out in a randomized complete block design with four replicates. The fertilizer treatments consisted of three types: Urea (180 kg/ha), NP (361kg/ha), compost (1904.76 kg/ha) and then control. The results showed that fertilizer treatments had no significant difference in proximate analysis of soybean seeds except in fibber. In fatty acid, control and nitrogen treatments gave the highest percentage of palmitic acid. NP and compost gave highest effect in linoleic acid and compost gave highest effect in polyunsaturated fatty acids. As general compost treatment gave the lowest effect in all amino acids and the highest effect in minerals. Control gave the highest effect in all amino acids. The application of nitrogen, NP and compost fertilizers for soybean significantly increased number of seeds/plant, weight of seeds\plant and seeds yield. The results also showed that urea fertilizer increased protein and ash content, while NP increased oil and carbohydrate contents. Compost increased all the minerals, but there was no effect on fatty and amino acid composition.

Keywords: Amino acid, fatty acid, fertilization, genotype, minerals, soybean.

SAŽETAK

Istraživano je djelovanje umjetnog gnojiva na kemijsku analizu, sastav amino kiselina i masnih kiselina soje (*Glycine max* L.*merril*) lokalnog sudanskog genotipa. Proveden je terenski pokus tijekom dvije uzastopne sezone (2009. – 2010. i 2010. – 2011.) na oglednoj farmi Visoke poljoprivredne škole, Sudanskog Sveučilišta znanosti i tehnologije u Shambatu. Pokus je postavljen u slučajnom potpunom bloku u četiri ponavljanja. Tretmani s umjetnim gnojivom sastojali su se od tri tipa: Urea (180 kg/ha), NP (361 kg/ha) i kompost (1904,76 kg/ha) te kontrola. Rezultati su pokazali da se tretiranje umjetnim gnojivom nije značajno razlikovalo u neposrednoj analizi sjemena soje osim u vlaknu. U masnoj kiselini, kontroli i tretmanu s dušikom dobiven je najviši postotak palminske kiseline. NP i kompost imali su najveći učinak u polunezasićenim masnim kiselinama. Općenito, tretman s kompostom imao je najslabiji učinak u svim aminokiselinama, a najviši učinak u mineralima. Kontrola je pokazala najviši učinak u svim aminokiselinama. Primjena dušika, NP i komposta značajno je povećala broj sjemenki po biljci, težinu sjemenki po biljci i prinos sjemena. Rezultati su također pokazali da je urea kao gnojivo povećala sadržaj dušika i pepela dok je NP povećao sadržaj ulja i ugljikohidrata. Kompost je povećao sve minerale ali nije djelovao na sastav amino i masnih kiselina.

Ključne riječi: Aminokiselina, masna kiselina, umjetno gnojivo, genotip, minerali, soja

INTRODUCTION

Soybean (*Glycine max L Merril*) is a type of legume local to East Asia. The plant is classed as an oilseed rather than legume. It is a yearly plant that has been utilized as a part of China for a long time as a food and medicinal plant. Soybean has occupied third place in oil seed crops of the world. It enriches the soil through symbiotic nitrogen fixation and leaves about 30-40 kg N/hectare for succeeding crops. (http://www.soybean-wikipedia). Its adaptation to subtropical and tropical regions still involves extensive breeding work. Seeds produced dry oil with good quality, used in cooking, and in many industrial applications. The soybean seedcake contributed around 70% of the global exchange of cakes (ITC 1990). The soybean plant is utilized for field, silage, and green manure harvest. The seed has the high dietary esteem and is utilized as a part of assembling numerous human foods. Different parts of the seed, for example, oil is utilized as a part of the assembling of industrial items, and soybean cake is utilized broadly to feed poultry (McNaughton et al., 2007). Soybean contains the three of the full scale supplements required for good nutrition: complete protein, sugar and fat, and additionally vitamins (A, B, C and D) and minerals, including calcium, folic acid and iron. Soybean contains complete protein. Soybean protein gives all the key amino acids in the sums required for human well being. The amino acid profile of soybean protein is almost equal in quality to meat, milk and egg protein (http://www.nsrl.uiuc.edu). Soybean seed contains 42-45% best quality protein and 20-22% dry oil. The carbohydrate amount 38% with 10% total soluble sugars (Asla et al., 1995). After oil extraction, the cake deposit constitutes a variable wellspring of protein for animals feeding.

Many specialists revealed different responses of soybean seed protein and oil contents in in connection to different levels of added NPK fertilizer. Babich and Petrichenko, (1992) observed that, NPK fertilizer increased the seed amino acid content, but showed little impact on the amino acid composition of the protein. Khushwaha and Chandel (1997) recorded that soybean seed protein substance was not altogether influenced by nitrogen, in spite of the fact that it enhanced with added nitrogen fertilizer. However, Sugimoto et al. (1998) expressed that the use of N fertilizer increase the oil content, and decrease in total protein, and some amino acids of developing soybean seeds. Nitrogen (N), Phosphorus (P) and Potassium (K) are considered the most important plant nutrients. Most compound fertilizers will contain these three elements, NPK which stands for nitrogen (promotes leaf growth), phosphorus (root, flower and fruit) and potassium (stem and root growth and protein analysis). N, P, and K affect plant growth and development. Their lack or overdose result in real impacts on crops development and yield.. Manure or compost contains essential nutrients for plant growth and soil organic matter (Eghball and Power 1994). Soybean was cultivated early of 1920 in Sudan. It was grown either as irrigated crop in central and northern parts of the country or rain fed crop in the southern states. It was also grown in 1981 / 82 and 1982 / 83 seasons in Damazine on an area of 5000 and 3000 feddans, respectively (Khidir 1997). Recently, the interest in soybean has been expanded and many researches were done on it. This was because of expanding interest for soybean as a cash crop. This study aims to study: the impact of nutrients, Nitrogen, NP and compost on chemical constituents of soybean local genotype.

MATERIALS AND METHODS

A field experiment was conducted for two consecutive summer seasons (2009-10 and 2010-11) in the Demonstrated Farm, Sudan University of Science and Technology at Shambat, latitude 15 40′ N, longitude 32 32′ E and altitude 386 m above sea level. The soil was montmorillonitic clay soil with a pH in the range of 7.8-8.5.

The climate of the area is a semi-desert and tropical with low relative humidity. The mean annual rainfall is about 160 mm and the mean maximum temperature is more than 40°C in summer and around 20°C in winter. Solar radiation is about 400 - 500 cal cm^{-2} day^{-1}. The land was prepared by disc plow, disc harrowed and leveled ridging up north -south, the spacing between ridges was 70 cm and between holes were 25 cm. The size of the plot was 3x3.5 m^2 consisting of four ridges of 2.5 m length. Sowing was done manually on the shoulder of the ridges, in first season on the 16th July 2009 and in second season on the 8th July 2010. Seeds were sown at a rate of 2-3 seeds per hole and the fertilizer treatments were put immediately after sowing and then immediately irrigated and then subsequently irrigated every seven days. In both seasons, one genotype (1905 E) of soybean was used.

Fertilizer treatments were urea (46% N (180 kg/ha)), NP (23-23 (361kg/ha)), compost (39.6 % Nitrogen, 21.8 ppm Phosphorus and 11.3 meq/l Potassium (1904.76 kg/ha)), and then control (without fertilizing). Randomized complete block design (RCBD) with four replicates was used. Harvest was done in the first season on 21st November 2009 and in the second season on 7th November 2010 The following agronomic traits were studied: number of seeds /plant, weight of seed/plant, and seeds yield (kg/ha).

Soil analysis

Ten samples of soil were taken randomly from every plot (30 cm depth) before starting first season to represent the area it is taken from. A soil samples were taken at the right time and in the right way. A soil-sampling probe, an auger, and spade tools were used; the samples were packed in medium zip-lock bags.

Yield component

Five plants in each plot and each treatment were randomly selected and harvested separated to determine the number and weight of seeds per plant. All seeds were collected, dried normally by the sun for a week and cleaned, then counted and weighed in sensitive balance and the average number and weight of seeds was taken. A meter length from the middle ridge of each plot was harvested and seeds were collected and dried normally in the sun for a week, then cleaned and weighed in a sensitive balance to determine seeds yield and transferred to kg/ha.

Chemical composition analysis

At harvest dried seeds of soybean from the first season were taken from the field experiment which was treated by the fertilizer, and the following data were determined.

Proximate composition

Proximate analysis was carried out on the dried seeds to determine the percentage moisture, crude fiber, ash, protein, oil and carbohydrate following the AOAC (1990) method. The organic nitrogen was determined using Kjeldahl method and the content of nitrogen was measured by multiplying by a factor of 6.25 (Lorenz et al., 2002). The analysis was carried out in triplicate. Total carbohydrate content was calculated by difference, using the formula: 100% - (% protein + % oil + % ash + % fiber).

Oil extraction and determination

The seeds were ground, delicately in a blender (Braun Multimix System 200, with Multimix deluxe grinder, MXK4 Germany), and oil was extracted by Soxhlet assembly utilizing petroleum ether 40–60°C and oil content was determined following AOCS (1993) method. The samples were investigated in triplicate, and then mean and standard deviation were calculated. The extracted oil was stored in a cold room (4°C) in a dark glass bottle under nitrogen blanket for further analysis.

Fatty acid composition

Gas liquid chromatography (GLC) was used to determine the fatty acid compositions of the extracted oils. The oils were converted to their relating methyl esters (FAME) following AOCS (1993) method. Hewlett-Packard HP-5890 Series II GC coupled to a FID detector equipped with a capillary column, a split injector (split ratio 88:1) was used. The column temperature program was 5 min at 150°C, 10°C/min to 275°C, and 10 min at 275°C. The injector temperature was 250°C. The carrier gas was hydrogen at a flow rate of 1.6 mL/min. The detector temperature was 280°C with air and hydrogen flow rates of 460 and 33 mL/min, respectively. The fatty acid peaks were identified by comparing the retention times with those of a mixture of standard FAMEs (Sigma Chemicals, Deisenhofen, Germany). Each FAME sample was investigated in duplicate.

Amino acid composition by amino acid analyzer

Preparation of Hydrolysate Sample

AOAC (1990) was followed to measure the content of dry matter and total N. The content of amino acids was determined utilizing Amino Acid Analyzer (L-8900 Hitachi-Hitech, Japan) under the test conditions prescribed for protein hydrolysates. Samples containing 5.0 mg of protein were acid hydrolyzed with 1.0 mL of 6 N HCl in vacuum-sealed hydrolysis vials at 110°C for 22 h. The ninhydrine was added to the HCl as an internal standard. The tubes were cooled after hydrolysis, opened, and set in a desiccator containing NaOH pellets under vacuum until dry (5–6 days). The residue was then dissolved in a suitable volume of a sample dilution Na–S buffer, pH 2.2 (Beckman Instr.), filtered through a Millipore membrane (0.22-lm pore size) and analyzed for amino acids by ion-exchange chromatography in a Beckman (model 7300) instrument, equipped with an automatic integrator. Nitrogen in amino acids was determined by multiplying the concentration of individual amino acids by corresponding factors calculated from the percentage N of each amino acid. The ammonia content was included in the calculation of protein nitrogen retrieval, as it comes from the degradation of some amino acids during acid hydrolysis. The ammonia nitrogen content was calculated by multiplying the ammonia content by 0.824 (N = 82.4 % NH3).

The composition of amino acids was communicated as milligrams per gram of N to estimate the quality of the protein in soybean defatted seeds utilizing the amino acid score pattern where amino acid ratio = (mg of an essential amino acid in 1.0 g of test protein/mg of the same amino acid in 1.0 g of the reference protein X 100). Nine essential amino acids were calculated following FAO/WHO (1991) method where egg protein was utilized as reference protein.

Mineral analysis

Five hundred milligrams of each dried, powdered seed samples were weighed, then wet-ashed by refluxing overnight with 15 mL of concentrated HNO_3 and 2.0 mL of 70% $HClO_4$ at 150°C. The samples were dried at 120°C, and the residues were dissolved in 10 mL of 4.0 N HNO_3-1% $HClO_4$ solution. The mineral content of each sample solution was determined by the mineral contents of the samples were quantified against standard solutions of known concentrations, which were analyzed simultaneously.

Statistical analysis

Statistical analysis (mean values, standard deviation and proportions) was performed using Excel 2003. T-tests were applied after variability correlation by F tests.

RESULTS AND DISCUSSION

Effect of fertilizer on yield component

The impact of fertilizer on yield component of Soybean is presented in Table (1). Analysis of variance ANOVA showed no significant difference ($p \geq 0.05$) between treatments in both seasons. The highest mean number of seeds per plant in the first season was 156.8 given by control, in the second season was 138.5 given by NP treatment. The highest mean weight of seeds per plant in the first season was 12.72 (g) given by control, in the second season was 8.34 (g) given by NP treatment. In seeds yield ANOVA indicated significant differences ($p < 0.05$) between treatments in the first season and no significant difference ($p \geq 0.05$) in the second season. The highest mean seeds yield in the first season was 2150.40 (kg/ha) given by control, in the second season was 1193.63 (kg/ha) given by nitrogen treatment. Bünyamin et al., (2008) investigated the impact of maxicrop leaf fertilizer on yield of soybean, seeds yield was found to be between 933.3 and 1376.8 kg/ha. Bangoo and Albotton (1972) reported that soybean growth and yield showed positive correlation with nitrogen and potassium fertilization.

Table 1 Effect of fertilizer on number of seeds\plant, weight of seeds\plant and seeds yield (g) of soybean genotype[A]

Tablica 1. Djelovanje umjetnog gnojiva na broj sjemenki/biljci, težinu sjemenki/biljci i prinos sjemena (g)

	2009/2010			2010/2011		
Treatments	No of seeds/plant	Weight of seeds/plant (g)	Seeds yield(g)	No of seeds/plant	Weight of seeds/plant (g)	Seeds yield(g)
Nitrogen	139.10	10.81	1929.33	114.20	6.82	1193.63
Compost	150.75	11.42	2118.61	123.70	7.46	1049.13
NP	124.65	9.68	1227.17	138.50	8.34	1153.74
Control	156.80	12.72	2150.40	118.80	6.90	819.80
LSD	58.36 ns	5.45 ns	563.50*	42.24 ns	2.94 ns	418.80 ns
CV%	25.54	30.52	18.98	21.33	24.93	24.84
SE ±	36.48	3.41	352.28	26.41	1.84	261.82

[A]Mean ±SD, *= significant **= highly significant ns= non significant LSD= Least Significant Difference CV % = Coefficient of Variation SE± = Standard Error

Proximate chemical analysis

The results showed that fertilizer treatments had increased the proximate composition of soybean as presented in table (2) but had no significant differences ($p < 0.05$) in all the analyzed components of the proximate composition with the exception of crude-fiber content, the highest level of fiber given by control at 17.35%, also the results showed that addition of nitrogen gave the most high amount and ash content of 42.6% and 5.62%, and NP treatment gave the highest level of oil and carbohydrates content at 15.78% and 22.05%, and respectively. These results are in good agreement with Khushwaha and Chandel (1997), and Sugimoto et al. (1998) results. They stated that the protein substance of seeds was increased by the addition of N2 fertilizer, but this increase was not significant. Farhad et al., (2010) found similar results statistically insignificant variation was observed in oil content in seed of soybean with different doses of potassium. Arslan and Arioglu (1991) studied the proximate analysis of different cultivars of the soybean crop. The moisture content was found to be 4-7.5%, crude protein 39.2-40.4%, oil 18.4-22.3%, ash 4-5%, crude fibre 3.0-6.5% and carbohydrate was 28-38%. Also Hamad (1986) studied the chemical composition of five varieties of soybean. The moisture content was found to range from 4.5-4.7%, protein 32.8 -37.9%, fat 18.4-21.5%, fiber 6.7-8%, ash 4.3-5.0% and carbohydrate 25.8-29.3%. Furthermore Mohamed and Mustafa (1994) found that the moisture content of soybean seed was 5.9-10.0%, ash 5.0-5.8% and protein 44.8-51.3%.

Table 2 Effect of fertilizer on approximate analysis of soybean seed[A]

Tablica 2 Djelovanje umjetnog gnojiva na približnu analizu sjemena soje

Treatments	Fiber %	Ash %	Protein %	Fat %	Moisture%	CHO %
Nitrogen	12.66	5.62	42.60	14.78	4.60	19.76
Compost	13.51	5.38	39.53	14.95	4.83	21.81
NP	13.09	4.86	39.38	15.78	4.88	22.05
Control	17.35	4.57	40.13	14.98	4.88	18.10
LSD	3.698 *	1.116 ns	6.552 ns	2.001 ns	0.547 ns	7.51ns
CV%	16.34	13.67	10.14	8.27	7.13	22.98
SE $\pm$	2.312	0.698	4.096	1.251	0.342	4.695

[A]Mean ±SD, *= significant, **= highly significant, ns= non significant, LSD= Least Significant Difference, CV % = Coefficient of Variation, SE$\pm$ = Standard Error

Mineral composition

The effect of fertilizer applications on mineral composition of seed samples is given in table (3) the results showed that calcium was gave the highest level by compost at (239.15 ppm). Potassium assumes an imperative part in human physiology, and adequate measures of it in food secure against coronary, hypoglycemia, diabetes and kidneydiseases, results showed that compost treatment gave the highest level at (928.72 ppm). Compost treatment also gave the highest level of iron, magnesium, manganese, copper and cobalt in (4.66, 121.89, 3826.18, 1102.34, and 22.71 ppm, respectively). Hamad (1986) studied the mineral content of soybean seeds and the results were as follows: calcium content range 203 mg/100 g, copper 1.2-1.4 mg/100g, iron 9.04-13.32 mg/100g, magnesium 261-296 mg/100g, manganese 3.38-4.94 mg/100g, phosphorus 339-409 mg/100g, potassium 1500-1935 mg/100g, sodium 11.9-15.11 mg/100g and zinc 3.75-4.02 mg/100g and FAO (1982) determined the mineral content of soybean. They reported that, calcium content was found to be 240 mg/100g, magnesium 270 mg/100g, potassium 1917 mg/100g, sodium 5 mg/100g, iron 5.6 mg/100g, copper 2 mg/100g, manganese 3.8 mg/100g and zinc 6.3mg/100g.

Table 3 Effect of fertilizer on element composition of soybean seed meal (ppm wet basis) [A]

Tablica 3. Djelovanje umjetnog gnojiva na na sastav elemeata brašna sojinog zrna (ppm mokre baze)

Minerals (ppm)	Control	Nitrogen	NP	Compost
Aluminium(Al)	3.379	2.127	2.022	2.305*
Calcium(Ca)	180.59	175.79	140.46	239.15*
Cadmium(Cd)	0.086	0.098	0.118	0.06 ^{NS}
Cobalt (Co)	0.017	0.017	0.013	0.023 ^{NS}
Chromium (Cr)	0.014	0.011	0.009	0.013^{NS}
Copper (Cu)	0.954	0.801	0.508	1.102*
Iron (Fe)	4.05	3.58	2.39	4.66*
Potassium (K)	593.62	619.52	455.71	928.72**
Magnesium (Mg)	94.45	88.92	67.72	121.89**
Manganese (Mn)	2.631	2.831	1.784	3.826
Sodium (Na)	0.06	0.049	0.039	0.04 ^{NS}
Nickel (Ni)	0.348	0.29	0.204	0.396 ^{NS}
Lead (Pb)	0.073	0.617	0.032	0.028*
Zinc (Zn)	2.462	2.191	1.634	3.159*

[A]Mean ±SD, *= significant, **= highly significant, ns= non significant.

Fatty acid composition

Table (4) showed the impact of fertilizer on fatty acid composition of soybean. From these results the control and nitrogen treatments gave higher effect in palmitic (16:0) and saturated at 13.3-13.2 and 18.0. NP and compost gave higher effect in linoleic acid (18:2) at 49.4 - 49.9 and compost gave higher effect in polyunsaturated at 56.5. Akbari et al., (2011) investigated the impact of nitrogen fertilizer and farmyard manure on sunflower seed. He found that oleic acid (37.28 - 40.65), linoleic acid (48.06 - 53.28), palmitic acid (5.7 - 6.2), stearic acid (3.2 - 4.5). John et al. (2003), found that palmitic acid (11.5), stearic acid (4.5) and linolenic acid (9.5), respectively. In many oil crops, oleic (18:1) and linoleic (18:2) acids always represent more than 70% of the fatty acid composition.

Table 4 Effect of fertilizer on fatty acid composition (%) of soybean oil[A]

Tablica 4. Djelovanje umjetnog gnojiva na sastav aminokiselina (%) sojinog ulja

Fatty acid %	Control	Nitrogen	NP	Compost
14:0	0.1±0.1	0.1±±0.1	0.1±±0.1	0.1±±0.1
16:0	13.2±0.3	13.3±0.4	12.3±0.3	12.2±0.3
16:1	0.1±0.1	0.1±0.1	0.1±0.1	0.1±0.1
17:0	0.1±0.1	0.1±0.1	ND	0.1±0.0
18:0	3.6±0.2	3.5±0.3	3.8±0.3	3.7±0.3
18:1	26.5±0.3	26.4±0.5	26.6±0.5	26.1±0.5
18:2	48.9±0.8	48.9±0.8	49.4±0.7	49.9±0.8
18:3	6.3±0.3	6.4±0.2	6.5±0.2	6.6±0.3
20:0	0.4±0.2	0.4±0.1	0.4±0.1	0.4±0.1
20:1	0.2±0.1	0.2±0.1	0.2±0.1	0.2±0.1
22:0	0.4±0.1	0.4±0.2	0.4±0.2	0.4±0.1
24:0	0.2±0.1	0.2±0.1	0.2±0.1	0.2±0.1
SFA	18.0±0.4	18.0±0.4	17.2±0.4	17.1±0.4
MUFA	26.8±0.5	26.7±0.5	26.9±0.5	26.4±0.5
PUFA	55.2±0.7	55.3±0.6	55.9±0.6	56.5±0.7

[A]Mean ±SD, *SFA= Saturated Fatty Acids, MUFA= Monounsaturated, PUFA= Polyunsaturated

Amino acid composition

Table (5) indicates the impact of fertilizer treatment on amino acid composition of soybean. These results, reported that, as general, compost treatment gave the lowest effect in all amino acids and control gave the highest effect. Achakzai et al. (2003), reported that fertilizer increased the amount of free amino acid, but however, this amount was decreased together with different amounts of added urea fertilizer and they found that the maximum level of free amino acids was in the range of 0.207 - 0.223 mg/g. In corn Rendig and Broadbent (1979), found that addition of nitrogen fertilizer decreased the levels of lysine, arginine, tryptophan, glycine, and threonine in protein, while levels of phenylalanine, alanine, glutamic acid, tyrosine, and leucine were increased.

Table 5 Effect of fertilizer on amino acid (mg/g N) composition of soybean[A]

Tablica 5. Djelovanje umjetnog gnojiva na sastav aminokiselina (mg/g N) soje

Amino acid (mg\g N)	Control	Nitrogen	NP	Compost
Aspartic acid	30.47±0.5	28.25±0.2	28.80±0.2	21.75±0.1*
Threonine	11.83±0.2	11.15±0.2	11.27±0.2	8.56±0.1*
Serine	5.75±0.2	6.70±0.3	6.79±0.3	5.04±0.2*
Glutamic acid	49.40±1.1	50.91±1.2	51.03±1.2	37.72±0.6**
Glycine	12.37±0.1	11.56±0.1	11.44±0.1	8.76±0.1*
Alanine	19.10±0.3	16.69±0.2	16.46±0.2	13.98±0.2*
Cystine	44.61±0.7	3.99±0.2	4.11±0.2	2.80±0.2*
Valine	23.12±0.4	20.30±0.3	19.95±0.3	15.40±0.4*
Methionine	2.58±0.1	2.74±0.1	2.36±0.1	1.68±0.1*
Isolucine	20.94±0.5	18.62±0.4	18.53±0.4	14.20±0.3*
Leucine	27.25±0.3	25.37±0.2	25.20±0.3	20.06±0.3*
Tyrosine	7.50±0.2	7.85±0.2	7.61±0.2	5.19±0.2*
Phenylalanine	18.77±0.4	19.56±0.4	19.83±0.4	14.87±0.3*
Histidine	9.43±0.2	9.42±0.2	9.57±0.2	7.26±0.2*
Lysine	20.65±0.3	20.49±0.3	19.25±0.3	15.64±0.3*
Ammonia	18.30±0.3	17.10±0.3	16.75±0.3	14.25±0.2*
Arginine	27.66±0.3	30.61±0.4	30.75±0.4	23.15±0.5*
Proline	20.79±0.3	23.64±0.3	24.62±0.4	17.97±0.3*

[A]Mean ±SD, *= significant, **= highly significant, ns= non significant

Table 6 Approximate analysis of soil in depth of 30 cm after harvesting of soybean

Tablica 6. Približna analiza tla na dubini od 30 cm nakon berbe soje

Seasons	2010/2011													
Treatments	pH	Ece	Na meq/l	Ca+Mg meq/l	K meq/l	Co_2 meq/l	Hco_3 meq/l	Cl meq/l	P ppm	$CaCo_3$	N %	Sand %	Clay %	Silt %
Nitrogen	7.66	2.07	15.50	8.93	0.01	0.30	3.97	15.35	6.00	2.09	0.06	18	60.33	21.67
Compost	7.74	1.94	14.20	8.30	0.03	0.30	4.83	14.23	5.05	2.09	0.07	18	61.50	20.50
NP	7.79	1.68	11.78	7.98	0.02	0.20	3.98	11.90	5.53	2.32	0.06	17	62.00	21.00
Control	7.74	2.05	14.90	9.10	0.02	0.35	5.35	14.78	4.58	2.31	0.06	17	62.25	20.75
LSD	0.26	0.62	7.38	2.52	0.01	0.28	2.41	6.47	1.94	0.98	0.01	1.92	4.09	2.82
CV%	2.10	19.93	32.74	18.34	42.36	60.98	33.19	28.75	22.89	27.91	14.11	6.87	4.15	8.39
SE ±	0.16	0.39	4.61	1.57	0	0.17	1.50	4.04	1.21	0.61	0	1.20	2.55	1.76
Mean before sowing	7.91	1.29	10.88	4.62	0.01	0.02	0.8	10.61	2.4	1.64	0.05	18.3	61.8	19.9

*= significant, **=highly significant, ns=non significant, LSD=Least Significant Difference
CV % = Coefficient of Variation, SE± = Standard Error

CONCLUSIONS

This study evaluates the impact of fertilizer (Urea, NP and compost) on growth, yield and quality of soybean (*Glycine max L*). The fertilizer treatments were urea (46% N (180 kg/ha)), NP (23-23 (361kg/ha)) and compost (39.6% Nitrogen, 21.8 ppm Phosphorus and 11.3 meq/l Potassium (1904.76 kg/ha)). The findings showed that fertilizer had increased numbers of seeds/plant, weight of seeds/plant and seeds yield. Moreover, the results also showed that urea fertilizer increased protein and ash content, while NP increased oil and carbohydrate contents. Compost increased all the minerals, but there was no effect on fatty and amino acid composition.

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