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Impact of Eggshells on Growth and Production of Soybean (Glycine max(L) Merril) in Ultisol

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Abstract— *Soybean (Glycine max (L) Merril) is one of the agricultural commodities to help the food crop of the Indonesian people. Soybeans are one of the commodities that support the implementation of food crop diversification programs and support national food crop security. Increasing soybean productivity in ultisols can be done through liming using eggshell powder. This experiment has been implemented at Jalan Muhammad Hatta, RT 02, RW 08, Pauh, Padang, West Sumatera from October 2020 to March 2021. The purpose is to get the best eggshell powder dose to increase the growth and yield of the soybean on ultisol. The experiment method uses a complete random design (RAL) with 5 levels of eggshell powder treatment 0; 25; 50; 75; 100 g / plant. Data on the observation are analyzed statistically with the F test at a 5% level. If the F count of treatment is greater than the F table, proceed by the test DNMRT at α level of 5% level. The results showed the use of eggshell powder affected the growth and yield of soybean in ultisol to a dose is 25 g /plant.*

Keywords— ***soybean, eggshells powder, ultisol, growth and yield, productivity***

I. INTRODUCTION

Soybean (Glycine max (L.) Merril) is one of the agricultural commodities needed to meet the food needs of the Indonesian people. The main consumption is in the form of tempeh and tofu which are side dishes for Indonesian people. Other forms of soy products can be soy sauce, tauco, and soy milk. Demand for soybeans continues to increase which must be balanced with increased production.

The productivity of soybean in West Sumatra in 2020 is 15.48 ku/ha and in 2021 is 13.93 ku/ha, with soybean harvested areas of 30.10 ha and 4.50 ha respectively. Within these 2 years, the productivity of soybean plants decreased by 5.61% (BPS, 2023). Decreased productivity in soybean cultivation according to Abdurachman, et al. (2013) could be caused by the dry land in West Sumatra Province being dominated by the Inceptisol and Ultisol orders with the main limiting factors for nutrient retention namely acid soil pH, CEC, base saturation, and low soil organic matter.

Soybean plants will grow well in soil that is fertile, loose, and rich in organic matter, namely at a pH of 5.8 – 7.0 (Purwaningsih and Kusumastuti (2019). According to Falagh et al (2018), the optimal pH is 6.0-6.5. In the range The pH is the macro and micro nutrients available to soybean plants. In soils that have an acid reaction (pH less than 5.5), phosphate (P), calcium (Ca), magnesium (Mg), potassium (K), and sulfur (S) are not readily available to soybean plants.

Ultisols are soils that have problems with soil acidity, low organic matter, and low macronutrients and have very low P availability (Fitriatin et al. 2014). In ultisol with a pH of < 5.5, it is necessary to add lime. Economically, the use of chemical-based lime requires a sizable amount of money which is expensive.

One of the livestock wastes is eggshell which is very easy to find in everyday life (Sihotang et al, 2016) which can

pollute the environment and health (Ajala et al, 2018) and can be used as an alternative material to increase soil pH. Eggshell waste containing high calcium can be used to increase soil fertility and plant growth, including soybeans.

The high calcium content of eggshells, which is about 36% of the total weight of eggshells, can be used as a material to improve soil fertility. The composition of the eggshell consists of 97% calcium carbonate, 3% magnesium and 3% phosphorus, sodium, potassium, zinc, manganese, iron, and copper (Saragih, et al. 2016). The eggshell membrane consists of 69.2% protein, 2.7% fat, 1.5% water, and 27.2% ash (Bimasri and Murniati, 2017).

Giving eggshell flour can be used as a substitute for lime because it can increase the pH of alluvial soil. In addition, the element calcium is the nutrient that most determines the level of pod health in soybean plants (Nurjayanti, 2012). According to Bimasri and Murniati (2017), eggshell flour can be used as lime because it contains calcium carbonate compounds (CaCO3), which are useful for reducing soil acidity. Calcium in soybean plants is useful for filling cells, growing root hairs, resistance to disease and increasing the nutritional value of soybeans. Furthermore, Nurjanah et al., (2017) stated that calcium in fertilizers is a macro element besides nitrogen, phosphorus, and potassium, which functions to encourage earlier root formation and growth, improve plant toughness, and increase soil pH.

Based on research conducted by Saragih, et al. (2016), giving eggshell flour at a dose of 0; 25; 50; 75 g/polybag on soybean plants showed a significant effect on the number of productive branches, number of pods, effective root nodule weight, and seed weight per plant at a rate of 75 g/plant polybags. The increase in the weight of nodules was effective because the soil that had been added with eggshell powder increased the pH in the ultisol soil so that the soybean plants could grow better. The increase in seed weight per soybean plant was caused by the element Ca contained in the egg shells helping soybean plants in the growth phase of filling the pods. Lack of calcium nutrients in soybean plants causes many empty pods, while high seed weight production per plant occurs due to the fulfillment of the Ca element needed by plants, especially in the pod formation phase.

The purpose of this study was to obtain the best eggshell flour dosage for the growth and yield of soybean plants on ultisols.

II. RESEARCH METHODS

This research was conducted from October 2020 to March 2021 at Jalan Muhammad Hatta, RT 02, RW 08, Limau Manis Village, Pauh District, Padang City, West Sumatra. The altitude of the research site is ± 1,300 m above sea level.

This study was conducted using a completely randomized design (CRD) with 5 treatments repeated 4 times, so there were 20 experimental units. The treatment in the form of a dose of eggshell flour used is 0, 25, 50, 75 and 100 g/plant. Observational data were analyzed by means of variance. If the F count is greater than F table 5% then continue with Duncan's New Multiple Range Test (DNMRT) at the 5% level.

The research was started by clearing the land used from weeds and garbage, then making experimental plots measuring 200 cm x 200 cm, the distance between plots was 20 cm and the distance between blocks was 40 cm. The soil used is ultisol. The soil is put together with manure with a ratio of 1: 2 into a polybag measuring 35 x 40 cm with a weight of 10 kg of soil.

The eggshells were washed with water, then the shells were separated from the inner membrane and then dried in the sun to dry for 3 days. Furthermore, the shells were crushed with a blender to become eggshell powder (SCT) and sieved through an 80-mesh sieve.

The seeds of the soybean plants used are soaked first in water for selection. The planting medium is soil mixed with manure and stirred evenly. After that, the calcification of CaCO3 is carried out using eggshell flour in each polybag. The manure given was 100 g/plant and for SP36 fertilizer 100 kg/ha (0.5 g/plant), urea fertilizer 75 kg/ha (0.375 g/plant), and KCl 100 kg/ha (0.5 g /plant).. After all the planting media is mixed evenly, put the soil into each polybag as much as 10 kg Then the polybags were labeled and neatly arranged in the field according to the layout of the experimental unit. The prepared planting medium was then incubated for 14 days.

Soybean seed planting is done by making planting holes on the surface of the polybag using a small shovel with a depth of 2.5-5 cm. Furthermore, the seeds are inserted into the planting hole as many as 2 seeds. Soybean seeds begin to grow at the age of 5-6 DAP. Then after 7 days of planting, the soybean plants were thinned by cutting the soybean plants so that only one soybean plant was left

Plant maintenance in the form of watering, weeding, fertilizing, and controlling pests and diseases. Soybean plants are watered every day with fanfare. twice, namely in the morning and in the evening, if the rain is not watered. Weeding is done twice and is done mechanically when the soybean plants are 15-20 DAP, and the second wedding is when the soybean plants have finished flowering, which is 40-45 DAP.

The fertilizers used in the cultivation of soybean plants are manure, SP36 fertilizer, urea, and KCl. Manure is given once at the time of processing the planting media. As for the application of SP36, urea, and KCl fertilizers, it was carried out 2 times, namely when the soybean plants were 7 DAP and 20-30 DAP. Manure fertilization is done by stirring the manure together with the ultsiol soil that has been loosened, and for SP36, urea, and KCl fertilization it is done by placing the fertilizer around the planting hole with a distance of 7-10 cm.

Pest and disease control is carried out mechanically, namely by removing or cutting parts of soybean plants that are attacked by pests and diseases by using hands or tools such as knives, sickles, and machetes. or use insecticides, and fungicides if there is a severe attack. For pest and disease control using insecticides and fungicides, the active ingredient formulas used are Deltamethrin 25g/l with a concentration of 2 ml/liter of water and Mancozeb 80% with a concentration of 1-2 g/liter of water. Insecticide spraying was carried out at 30 HST and fungicide was carried out at 50 DAP

Harvesting was carried out after the soybeans showed the harvest criteria, namely the plants were ripe where 90% of the pods were ripe, brown in color, the leaves had fallen off, the pod skin was easy to peel and the stems were dry. How to harvest is by picking the pods from the plant. Harvesting was done at 11 WIT. Effective root nodule weighing was carried out at 6 WAP. The characteristic of an effective root nodule is that the root nodule is still fresh and filled with a reddish liquid.

Soybean plants are harvested in two ways. First, for observing root nodules, soybean plants are harvested by dismantling polybags, and then the roots are separated from the soil. Soybean plants whose samples were taken for observation of root nodules were 40 samples of soybean plants per polybag. Second, for plants outside the destructive sample, it is harvested by cutting the main stem of the soybean plant just above the soil surface. The stover and the pods that were still attached were removed to be dried for 3 days. Harvesting soybean plant pods was carried out by cutting the planting pods and separating them based on predetermined treatments and repetitions. Meanwhile, the harvesting of soybean plant seeds is done after the stover is dry enough or the pods are opened a lot or the water content is 14-16%, the dry seeds are separated from the pods and the seeds are put in separately.

The observed variables were plant height, number of productive branches, number of fruitful pods, number of empty pods, the total number of pods, weight of fruitful pods, and weight of seeds planted. weight of 100 seeds planted, effective root nodule weight, power of hydrogen (pH).

III. RESULT AND DISCUSSION

Planting Media Analysis

Analysis of the planting media was carried out at the beginning of the study with the aim of knowing the nutrient content of the media. In Table 1 it can be seen that the soil pH, Available-P, K-dd, Ca-dd, and CEC values are below normal, and soil Al-dd is classified as high. In Table 1, soil pH analysis shows that the planting medium has a pH of 5.61 with slightly acidic criteria. According to Falagh et al (2018), soybean plants grow well on slightly acidic to nearly neutral soils with an optimal pH of 6.0 - 6.5. Soil acidity can be caused by several factors, including soil parent material, organic matter, aluminum hydrolysis, oxidation reactions to certain minerals, and alkaline leaching. This is in accordance with what was stated by Damanik, et al (2011), that increased soil acidity is caused by the leaching of cations which are replaced by H+ and Al3+.

In the analysis of the planting media, the soil Al-dd is 5.68 me/100 g with high criteria. Based on the soil analysis results, it can be seen that the Al-dd value has a relationship with aluminum saturation. The high Al-dd value of the soil causes the aluminum saturation to increase, thus causing low exchangeable bases. With the low exchangeable bases, the saturation value of Al shows that the cation exchange complex is dominated by Al.

According to Syahputra, et al. (2015), the lack of phosphate in ultisol can be caused by the phosphate content of the soil parent material which is definitely low, or the phosphate content is actually high but not available to plants because it is absorbed by other elements such as Al and Fe. The low CEC value of the soil is due to the low organic matter of the soil. As stated by Mukhlis, et al (2011) that the amount of CEC in the soil is determined by the following factors, namely the soil texture, soil with a clay texture will have a greater CEC value than soil with a sandy texture. This is because clay is a soil colloid; second, the amount of organic matter, because some of the organic matter is humus that acts as a soil colloid, the more organic matter, the greater the CEC of the soil; and the third type of clay mineral contained in the soil, the type of clay mineral greatly determines the size of the CEC of the soil.

Power Of Hydrogen (pH)

The pH analysis of the P3IN Laboratory of the Faculty of Agriculture of Andalas University shows the influence of several treatments of eggshell flour on the pH of ultisol as

a medium for soybean plants. The results can be seen in Table 2.

Table 2 shows that the administration of several doses of eggshell flour can increase the pH of ultisol. The increase in the ultisol pH of the soybean plant media is caused by the eggshell containing calcium carbonate (CaCo3) or lime which functions to reduce soil Al-dd levels so that soil pH increases. Alibasyah, R. M. (2016) stated that the general reaction of lime carbonate produces hydroxyl ions that bind to acidic cations (H and Al) so as to increase soil pH.

An increase in soil pH indicates that eggshell fertilizer has the opportunity to reduce the limiting factor of soils that have high acidity. Taufiq and Sundari (2012) explained that soybean plants can grow well at a soil pH of 5.8-7.0. In this pH range, macro and micronutrients are available to soybean plants. In soils with an acid reaction (pH less than 5.5), phosphate (P), calcium (Ca), magnesium (Mg), potassium (K), and sulfur (S) nutrients are not easily available to soybean plants. In acid soils, the minerals Mn, Al, and Fe are available in excess, so they can be toxic to soybean plants.

Acidic soils containing high Al, levels of more than 20% cause poisoning of the roots of soybean plants, so that the roots do not develop, the plants grow stunted, the leaves are brownish yellow, and are unable to form pods. The development of Rhizobium bacteria is also hampered in acidic soil, caused by a lack of photosynthesis from the leaves (Sumarno and Manshuri, 2013). The increased pH value causes the availability of macro-nutrients to increase and are needed by soybean plants for growth. Optimal pH and the availability of soil nutrients improve soil fertility status, so that plants can respond to the application of nutrients in the form of fertilizer. The higher the increase in the pH value which is close to the pH value needed by plants, the better the growth rate and amount of production produced by plants.

Plan Heigh, Number of Productive Branches, Number of Fill Pods, and the Total Number of Pods

Plant height, number of productive branches, number of fruity pods, and total number of pods of soybean plants were affected by the dose of eggshell flour (Table 3). In Table 3 it can be seen that the application of eggshells at a rate of 25 g/plant gave the best results for plant height, number of productive branches, number of fruitful pods, and the total number of pods. The results of the study by Bachtiar et al. (2013) showed that the Anjasmoro variety had a positive response to the administration of eggshell flour during the early stages of growth. This is because Rhizobium bacteria are already capable of forming root nodules, which are around 4-5 days after planting and root nodules can bind nitrogen (N) from the air at the age of 10-12 days after planting so they can support plant growth.

Eggshells contain essential nutrients in the form of macronutrients, namely calcium, magnesium, phosphorus, and carbonate-free macronutrients, while for micronutrients, namely manganese, sodium, potassium, zinc, and copper (Noviansyah and Chalimah, 2015). According to Saragih, et al. (2016), egg shells consist of 97% calcium carbonate (CaCO3). In addition, according to him, the average eggshell contains 3% magnesium, phosphorus and manganese, sodium, potassium, zinc, manganese and copper. These nutrients have an impact on the growth of plant height and the number of productive branches, the number of fruitful pods and the number of soybean plant pods.

The element phosphorus (P) plays a role in accelerating the growth and development of the root tips and growing points of soybean plants. The role of phosphorus (P) for soybean plants according to Taufiq (2014), among others, is as a component of the compound ATP (Adenosine Triphosphate) which serves as a source of energy for the growth of soybean plants, a constituent of DNA (Deosiribonucleic Acid), RNA (Ribonucleic Acid) which are important in the fission of soybeans. cells and reproduction, and as a constituent of cell membranes. According to Anwar. (2019), excessive calcification can cause the availability of phosphate elements to decrease again due to the formation of insoluble calcium phosphate, absorption or uptake of phosphorus by plants is very difficult, causing plant metabolism to be disrupted

According to Fitri, et al (2014), stated that magnesium (Mg) is an activator of photosynthetic enzymes needed to produce photosynthate for plant development and plants also need the nutrient potassium (K) to accelerate the growth of soybean plants. In the vegetative growth phase of plants, photosynthetic results are translocated to the roots, stems and leaves. The distribution of photosynthetic results during the vegetative phase of the plant determines the branching development of soybean plants. It is necessary to apply the fertilizer that contains all three macronutrients like N, P and K (Warnita *et al*, 2017)

The element calcium (Ca) is one of the most important elements in determining the health of the pods. Eggshell flour contains calcium (Ca) which is needed by legumes during the pod filling phase. Soybean plants that lack Ca result in an increase in empty pods. The increase in the number of rice pods occurred due to the fulfillment of the element Ca needed by soybean plants, especially in the formation of pods. This is in accordance with the opinion of Nurjayanti (2012), which states that egg shells contain a high element of Ca up to 98%. The element Ca is the

nutrient that most determines the level of fruitiness of the pods.

Plants that receive phosphorus (P) nutrients grow taller so that the number of pods formed is greater. Fitri et al. (2014), suggested that phosphorus (P) in soybean plants functions in cell division, albumin formation, fruit formation and maturation, root development, disease resistance. The nutrient element potassium (K) can increase the efficiency of photosynthesis. In addition, potassium also plays a role in strengthening the plant body so that it does not collapse easily and flowers and fruit do not fall easily. The higher the nutrient calcium (K) absorbed by soybean plants, the pod filling process runs smoothly and the number of pithy pods increases.

Soybean plants that lack calcium result in an increase in empty pods. Nurjayanti (2012). In addition, the nutrient that affects the number of soybean plant pods is the nutrient phosphorus (P). Deficiency of phosphorus in soybean plants can inhibit the formation of root nodules, root development, pod and seed formation so that the pods are few and the seeds are smaller. Phosphorus deficiency generally occurs in acid soils and acid soils generally contain high iron (Fe) and aluminum (Al) (Taufiq, 2014). Therefore, the addition of eggshell flour to the planting medium can reduce the acidity of the soil and the availability of nutrients needed by soybean plants.

In soybean plants, the pods formed will enlarge and increase with age and the number of flowers. The number of pods formed varies from leaf axil, while the number of pods that can be harvested depends on the soybean variety planted and the growing environmental conditions. The Anjasmoro variety has soybean plant pods that are resistant to pod bursting

The formation of soybean pods depends on the condition of the plants in the flowering phase. In the flowering phase, plants need a lot of photosynthetic which is necessary for the development of flowers and preparation for the formation of pods. According to Wiyono (2017), the availability of sufficient water determines the efficiency of photosynthesis. Water stress can cause a decrease in photosynthetic efficiency which can be seen from the reduced net assimilation rate, this decreased photosynthetic rate causes a reduction in plant yield components both in quantity (seed dry weight) and quality (number of pods and seeds).

In addition, the formation of plant pods is influenced by the conditions and content of the planting medium used, the element phosphorus (P) contained in the egg shells is needed by soybean plants because element P can activate pod formation and fill empty pods, and accelerate fruit ripening. The greatest period of P use begins during pod formation until approximately 10 days before the seeds are fully developed (Irwan and Nurmala, 2018). The role of phosphorus absorbed by plants is important for cell growth, formation of fine roots and root hairs, strengthening plants so they don't fall over easily, improving plant quality, forming flowers, fruits and seeds as well as strengthening resistance to disease attacks, so that the number of filled pods is getting stronger. (Kurniawan, et al. 2014).

The weight of filled pods and the weight of seeds per plant, the weight of 100 seeds, and the weight of effective root nodules

The weight of filled pods and the weight of seeds per plant, the weight of 100 seeds, and the weight of root nodules of soybean plants were affected by the dose of egg shells given (Table 4). Nurjayanti (2012) stated that calcium is the nutrient that most determines the level of pod health. Eggshell flour contains calcium which is needed by legumes during the pod-filling phase. According to Saragih, et al. (2016), egg shells contain a very high element of calcium, up to 98%. Soybean plants that lack calcium result in an increase in empty pods.

The increase in rice pod weight occurred due to the fulfillment of the elements needed by soybean plants, especially in the formation of pods. In addition, phosphorus also has a role in the process of increasing fruit and seed formation, as well as accelerating plant maturation. The nutrient element phosphorus also plays an important role in increasing the weight of seeds per plant. Fitri, et al. (2014), stated that phosphorus can increase root development which can then increase the element of phosphorus in plants so that photosynthesis also increases, resulting in greater seed weight produced.

Kurniawan, et al. (2014) stated that the elements contained in the eggshell are components that are absorbed rapidly during vegetative growth and are translocated from vegetative tissues to seeds after flowering. The increased yield of soybean varieties is due to an increase in the rate of transport of dry matter to the seeds due to the nutrients contained in it. Availability of sufficient assimilate in plants increases seed weight. The large seed size gives a high total dry seed yield.

According to Irwan and Nurmala (2018), seed filling comes from photosynthates produced after flowering and translocation of stored photosynthates. Therefore, during filling of newly formed or stored photosynthate seeds can be used to increase seed weight. In soybean plants that are given additional eggshell flour will give 100 more seed weight per plant

Treatment of egg shell flour in accordance with the needs of plants can increase the weight of effective root nodules

in soybean plants. The increase in effective root nodule weight is because the soil that has been added eggshell flour can increase the soil pH, so that soybean plants grow better in soil that has a suitable pH for growth between 5.8 – 7.0.

Nurjayanti (2012) also stated that, adding eggshell flour can be used as a substitute for lime, by adding eggshell flour the pH of acidic soil can be neutralized. With the presence of calcification on acid soils, elements such as P, K, and Mg needed by soybean plants are simultaneously available in the soil. With increasing soil pH, soybean plants can properly fix nitrogen (N), so that root nodules develop properly. The element nitrogen (N) in the soil is used by legume plants to form root nodules. The presence of nitrogen (N) in the soil determines the number of nodules formed on legume plants.

The formation of root nodules in soybean plants is influenced by nitrogen (N) fixation. Root nodules are formed starting from the entry of Rhizobium bacteria into the young and tender root hairs, once inside the roots the bacteria then infect plant roots and form root nodules. Zhang et al (2020) Up to 81.5%–87.1% of the N absorbed by the soybean roots and fixed by the root nodules was supplied for shoot growth, leaving 12.9%–18.5% for root and nodule growth. Soybeans preferentially used fertilizer N in the presence of the NO− 3 or NH+ 4 supply. After the absorbed fertilizer N and nodule-fixed N was transported to the shoot, a portion of it was redistributed to the roots and nodules

The role of calcium (Ca) in soybean plants is very important at the root growing point. Because it has a direct effect on the growing point, a deficiency of this element causes stunted flower production.

IV. FIGURES AND TABLES

Table 1. Planting media analysis

Soil Chemical properties	Value	Criteria
pH H_2O	5,61	slightly sour
N-Total	0,31%	medium
P-Available	1,37 ppm	very low
K-dd	0,30 me/100 g	low
Ca-dd	1,13 me/100 g	very low
Al-dd	5,68 me/100 g	height
CEC	12,40 me/100 g	low

Note: Means with different letters, in the same column differ significantly (p≤0.05, according to Duncan's New Multiple Range test

Table 2. pH of planting media when giving several amounts of eggshell powder

Dosage eggshell Powder	pH H_2O			
	Early	Criteria	After	Criteria
0 g/plant	5,61	SC	5,61	SC
25 g/ plant	5,61	SC	6,63	N
50 g/ plant	5,61	SC	6,78	N
75 g/ plant	5,61	SC	6,93	N
100 g/ plant	5,61	SC	7,15	N

Note: Means with different letters, in the same column differ significantly (p≤0.05, according to Duncan's New Multiple Range test

SC: slightly sour, N: neutral

Table 3. Plant height, number of productive branches, number of fill pods, and total pods of soybean plants at various doses of eggshell powder

Dosage of eggshell powder	Plant height (cm)	Number of branches (piece)	Number of fill pod (fruit)	Total number of pod (fruit)
0 g/plant	56,25 a	5,00 a	54,38 a	57,75 a
25 g/ plant	67,50 b	6,00 c	101,38 b	111,63 b
50 g/ plant	61,25 ab	5,88 bc	66,00 a	69,88 a
75 g/ plant	60,00 ab	5,25 ab	59,38 a	64,63 a
100 g/ plant	52,50 a	4,75 a	45,50 a	49,00 a
CV =	9,58 %	8,52 %	26,06 %	29,12 %

Note: Means with different letters, in the same column differ significantly (p≤0.05, according to Duncan's New Multiple Range test

Table 4. The weight of filled pods, the weight of seeds per plant, the weight of 100 seeds, and the weight of effective root nodule

Dosage of eggshell	The weight of filled pods (g)	The weight of seeds per plant (g)	The weight of 100 seeds (g)	The weight of effective root nodule (g)
0 g/plant	25,57 a	17,69 a	13,15 a	3,31 ab
25 g/plant	42,16 b	26,34 b	16,11 b	6,60 c
50 g/plant	29,82 a	19,32 a	15,16 ab	5,05 bc
75 g/plant	27,14 a	18,04 a	14,23 ab	4,48 abc
100 g/plant	19,50 a	12,98 a	12,53 a	2,23 a
CV=	25,09 %	23,67%	11,39%	15,22%

Note: Means with different letters, in the same column differ significantly ($p \leq 0.05$, according to Duncan's New Multiple Range test.

V. CONCLUSION

Based on the results of the research that has been done, it can be concluded that the administration of various doses of eggshell flour affected the growth and yield of soybean plants in ultisols with the best yield of 25 g/plant.

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