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MORPHOLOGICAL CHARACTERS, PRODUCTION, AND N-CONTENT OF SOYBEAN LEAVES (GLYCINE MAXL. MERRIL) UNDER WATER STRESS CONDITIONS WITH ORGANIC FERTILIZER MEDIA

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Abstract

This research was carried out in a greenhouse, Faculty of Agriculture, Islamic University of North Sumatra, Gedung Johor Village, Medan Johor District, Medan City, North Sumatra Province with an altitude of 25 meters above sea level and flat topography. The research was carried out from February to April 2021, which aims to determine the morphological characters, production and N content of leaves at intervals of giving water and some organic fertilizers, namely rice husks, roasted rice husks, straw, market vegetable waste on soybeans (Glycine max). The study used a factorial randomized block design (RAK) with two factors, namely: the water supply factor consisted of 3 levels, namely: P1 = watering every day (1000 ml of water), P2 = watering every 3 days (1000 ml of water), P3 = watering every 6 days (1000 ml of water), Factors for Giving Types of Organic Fertilizers Consists of 4 types, namely: O1 = Rice husk (20 tons/ha) = 100 g/polybag, O2 = Roasted rice husk (20 tons/ha) = 100g/polybag, O3 = Straw (20 tons/ha) ha)= 100 g/polybag O4 = Organic fertilizer market vegetable waste (20 tons/ha) = 100 g/polybag, The variables measured were root length (cm), number of root nodules (seeds), volume of plant roots (ml), crop production (g), canopy wet weight (g), canopy dry weight (g), leaf N-element analysis (%). The results showed that the time interval of water application had a significant effect on root length, number of root nodules, root volume, crop production and leaf N content. The type of organic fertilizer has a very significant effect on the parameters of root length, root volume on production and the N-leaf content of soybeans (Glycine max). O1 = Rice husk (20 tons/ha) = 100 g/polybag, O2 = Roasted rice husk (20 tons/ha) = 100g/polybag, O3= Straw (20 tons/ha)= 100 g/polybag O4 = Organic fertilizer market vegetable waste (20 tons/ha) = 100 g/polybag. The variables measured were root length (cm), number of root nodules (seeds), plant root volume (ml), crop production (g), canopy wet weight (g)), canopy dry weight (g), N-leaf elemental analysis (%). The results showed that the time interval of water application had a significant effect on root length, number of root nodules, root volume, crop production and leaf N content. The type of organic fertilizer has a very significant effect on the parameters of root length, root volume on production and the N-leaf content of soybeans (Glycine max). O1 = Rice husk (20 tons/ha) = 100 g/polybag, O2 = Roasted rice husk (20 tons/ha)= 100g/polybag, O3= Straw (20 tons/ha)= 100 g/polybag O4 = Organic fertilizer market vegetable waste (20 tons/ha) = 100 g/polybag. The variables measured were root length (cm), number of root nodules (seeds), plant root volume (ml), crop production (g), canopy wet weight (g)), canopy dry weight (g), N-leaf elemental analysis (%). The results showed that the time interval of water application had a significant effect on root length, number of root nodules, root volume, crop production and leaf N content. The type of organic fertilizer has a very significant effect on the parameters of root length, root volume on production and the N-leaf content of soybeans (Glycine max). O3= Straw (20 tons/ha)= 100 g/polybag O4 = Organic fertilizer market vegetable waste (20 tons/ha) = 100 g/polybag, The variables measured were root length (cm), number of root nodules (seeds), volume of plant roots (ml), crop production (g), canopy wet weight (g), canopy dry weight (g), N-leaf element analysis (%). The results showed that the time interval of water application had a significant effect on root length, number of root nodules, root

The Seybold Report
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Keywords: Soybean, Watering Time Interval, Type of Organic Fertilizer

INTRODUCTION

Soybean in Indonesia is an important food crop after rice and corn. Soybean is one of the foodstuffs that have high nutritional value. Among the types of beans, soybeans are the best source of protein, fat, vitamins, minerals and fiber. Soybean in Indonesia is an important food crop after rice and corn. Soybean is one of the foodstuffs that have high nutritional value. Among the types of beans, soybeans are the best source of protein, fat, vitamins, minerals and fiber (Cahyadi, 2008). The need for soybeans inIndonesia is increasing every year this is in line with increasing population growth and the development of animal feed factories. The current per capita consumption of soybeans is approximately 8 kg/capita/year. Every year the need for soybean seeds is approximately 1.8 million tons and soybean meal is approximately 1.1 million tons (Central Bureau of Statistics, 2005). Data from the Central Statistics Agency (2014) shows that in 2012 the national soybean harvested area was 567,624 ha, productivity was 1.85 tons/ha and production was 843,153 tons. Data in 2013 decreased soybean harvested area to 550,797 ha with productivity of 1.46 tons/ha and soybean production of 780,163 tons. Soybean consumption in Indonesia reaches 2.5 million tons per year and of that amount around 1.7 million tons (about 70%) must be imported.

The amount of water available in the soil is sufficient and then it is well absorbed by the plant so that it adds weight to the plant. It is known that 90% of plant cells are composed of water. Then fromTherefore, the water content in the soil has a significant effect on the wet weight of the plant and if the water needs of the plant are met, there is a balance between the availability and use of water. This results in the plant's metabolic activities running smoothly Mapegau, (2006). The development of soybean plants requires land for cultivation, which can be in the form of dry land, intercropping with plantation crops, intercropping plants after rice harvest, and other cropping patterns. that the land for soybean cultivation can be in the form of irrigated land, non-irrigated land, dry land/garden, field/huma land and temporarily uncultivated land. If all types of land are planted with soybeans, even through improved plant and land

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management, it is hoped that the achievement of the soybean self-sufficiency target in North Sumatra will easily be achieved (Rachmanet al, 2013). The water factor in plant physiology is a very important main factor. Plants will not be able to live without water, because water is the matrix of life, even other creatures will become extinct without water. Kramer explains how important water is for plants; namely water is part of the protoplasm (85-90% of the total weight of the green part of plants (growing tissue) is water. Furthermore, it is said that water is a reagentimportant in photosynthesis and hydraulic processes. Besides, it is also a solvent of salts, gases and materials that move into plants, through cell walls and essential tissues to ensure turgidity, cell growth, leaf shape stability, the process of opening and closing stomata, continuity of movement. plant structure (Haryati, 2003). Fertilizer is a material that is added to the planting medium or plants to meet the nutrient needs needed by plants so that they are able to produce well. Fertilizer material can be in the form of organic or non-organic (mineral) materials. Fertilizers differ from supplementary supplements in that they contain the raw materials for plant growth and development, while supplements such as plant hormones help to smooth metabolic processes. Artificial fertilizers can be added with a number of mineral supplements (Anonimus, 2012).

METHOD APPROACH

This research was conducted at the Greenhouse of the Faculty of Agriculture, Islamic University of North Sumatra, Jln. Karya Wisata, Medan Johor District, Medan Municipality. The altitude of the place is ±25 meters above sea level, with a flat topography. This research will start from February to April 2021.This study used a factorial Randomized Block Design (RAK) with two factors, namely: the water supply factor consisted of three levels, namely: P1 = daily watering (1000 ml ai); P2 = every 3 days (1000 ml of water); P3 = watering every 6 days The factor of giving organic fertilizer consists of 4 types, namely: O1 = rice husk (20 tons/ha) = 100 g/polybag; O2= roasted rice husk (20ton/ha)= 100g/polybag; O3= straw (20 tons/ha)= 100 g/polybag; O4= organic fertilizer from market vegetable waste (20 tons/ha)= 100 g/polybag. The variables observed were root length, number of root nodules, volume of plant roots, weight of crop production, wet weight of crown, dry weight of canopy, N-total leaf analysis.

RESULTS AND DISCUSSION

The results of the analysis showed that the factor of water supply had a significant effect on production. Likewise, the factor of giving organic fertilizer had a significant effect on soybean production. The interaction of the two factors significantly affected the root length of soybean plants at harvest. In Table 1 it can be seen that the water supply factor significantly affected the length of soybean roots. The longest root length was obtained in treatment P1 (watering every day as much as 1000 ml) which was 77.25 cm, which was significantly different from treatment P2 (watering every 3 days as much as 1000 ml of water) which was 66.25 cm, and significantly different from treatment P3 (watering every 6 days as much as 1000 ml of water) is 65.13cm. The P2 treatment was 66.25cm not significantly different from the P3 treatment at

The Seybold Report
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65.13cm.The interaction between the water supply factor (P) and the organic fertilizer application factor (O) significantly affected the root length of soybean plants at harvest. The longest root length was obtained in the P1O1 treatment (daily watering of 1000 ml combined with 20 tons/ha of rice husk) which was 108.33 which was significantly different from all treatments.

Table 1: Average Root Length of Soybean Plants (cm) Due to Giving Factors Water (P) and Organic Fertilizer (O)

O treatment	P treatment			Average
	P1	P2	P3	
O1	108.33 a	76.83 b	79.33 b	88.17 a
O2	69.83 cb	65.50 cd	65.17 cd	66.83 b
O3	73.50 cb	65.17 cd	64.17 cd	67.61 b
O4	57.33 ed	57.50 ed	51.83 e	55.56 c
Average	77.25a	66.25 b	65.13 b	

Information: Figures followed by unequal letters in the same treatment group were significantly different at the 5% level based on the DMRT test.

Table 2: Average Number of Root Nodules of Soybean Plants (seeds) Due to Giving Factors Water (P) and Application of Organic Fertilizer (O) at Harvest

O treatment	P treatment			Average
	P1	P2	P3	
O1	73.00	66.17	59.67	66.28
O2	73.50	62.67	58.67	64.94
O3	69.50	58.00	53.33	60.28
O4	70.33	59,50	64.33	64.72
Average	71.58 a	61.58 b	59.00 b	

Information : Figures followed by unequal letters in the same treatment group were significantly different at the 5% level based on the DMRT test and unnotated data showed no significant effect.

Table 3: Average Root Volume of Soybean Plants (ml) Due to Giving FactorWater (P) And Organic Fertilizer (O) At Harvest

O treatment	P treatment			Average
	P1	P2	P3	
O1	29.17	16.67	15.00	20.28 a
O2	23.33	16.67	11.67	17.22 ab
O3	22.50	15.00	10.00	15.83 bc
O4	15.83	13.33	10.83	13.33 c
Average	22.71 a	15.42 b	11.88 c	

Information : Figures followed by unequal letters in the same treatment group were significantly different at the 5% level based on the DMRT test and unnotated data showed no significant effect.

In Table 2 it can be seen that the water supply factor significantly affected the number of root nodules of soybean plants at harvest. The highest number of root nodules was obtained in treatment P1 (watering every day as much as 1000 ml) namely 71.58 seeds, which was

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significantly different from treatment P2 (watering every 3 days as much as 1000 ml) which was 61.58 seeds, and significantly different from treatment P3 (watering every 6 days as much as 1000 ml) which is 59.00 seeds. The P2 treatment, which was 61.58 seeds, was not significantly different from the P3 treatment, which was 59.00 seeds. The factor of giving organic fertilizer did not significantly affect the number of root nodules of soybean plants at harvest time, however, the highest number of root nodules of soybeans was obtained in the O1 treatment (rice husk 20 tons/ha), which was 66.28 seeds. The results of the analysis showed that the factor of providing water had a significant effect on the number of root nodules at harvest and the factor of application of organic fertilizer had no significant effect on the number of root nodules of soybean plants at harvest. In Table 3 it can be seen that the time interval factor for giving water has a significant effect on the volume of soybean roots at harvest. The highest root volume was obtained in treatment P1 (watering every day as much as 1000 ml) which was 22.71 ml, which was significantly different from treatment P2 (watering every 3 days as much as 1000 ml) which was 15.42 ml, and significantly different from treatment P3 (watering every 6 days as much as 1000 ml) which is 11.88 ml. The P2 treatment, which was 15.42 ml, was significantly different from the P3 treatment, which was 11.88 ml. The factor of giving the type of organic fertilizer has a significant effect on the root volume of soybean plants. The highest volume of plant roots was obtained in the O1 treatment (rice husk 20 tons/ha) which was 20.28 ml, which was not significantly different from the O2 treatment (20 tons/ha) which was 17.22 ml, and significantly different from the O3 treatment (straw 20 tons/ha) was 15.83 ml and significantly different from the O4 treatment (organic fertilizer for market vegetable waste 20 tons/ha) which was 13.33 ml. O2 treatment was not significantly different from O3 treatment and significantly different from O4 treatment. O3 treatment was not significantly different from O4 treatment. The results of the analysis showed that the water supply factor had a significant effect on the volume of plant roots at harvest and the organic fertilizer application had a significant effect on the root volume of soybean plants at harvest. The interaction of the two factors did not significantly affect the volume of soybean roots at harvest.

Table 4: Average Production Weight Per Soybean Plant (g)Due to Factors Giving Water (P) And Organic Fertilizer (O)

O treatment	P treatment			Average
	P1	P2	P3	
O1	148.33	138.33	138.33	141.67
O2	143.33	138.33	136.67	139.44
O3	146.67	151.67	136.67	145.00
O4	155.00	150.00	133.33	146.11
Average	148.33 a	144.58 ab	136.25 b	

Information : Numbers followed by unequal letters in the same treatment group were significantly different at the 5% level based on the DMRT test and unnotated data showed no significant effect.

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Table 5: Average Wet Weight of Soybean Plants (grams) Due to Giving FactorsWater (P) And Organic Fertilizer (O)

O treatment	P treatment			Average
	P1	P2	P3	
O1	225.00	164.17	202.50	197.22
O2	190.83	202.50	179.17	190.83
O3	221.67	185.00	181.67	196.11
O4	205.83	176.67	202.50	195.00
Average	210.83	182.08	191.46	

Information : Numbers followed by unequal letters in the same treatment group were significantly different at the 5% level based on the DMRT test and unnotated data showed no significant effect.

In Table 4 it can be seen that the water supply factor has a significant effect on the weight of production per soybean plant at harvest. The heaviest production weight was obtained in treatment P1 (watering every day as much as 1000 ml) which was 148.33 grams, which was not significantly different from treatment P2 (watering every 3 days as much as 1000 ml) which was 144.58 grams, and significantly different from treatment P3 (watering every 6 days as much as 1000 ml) is 136.25 grams. The P2 treatment, which was 144.58 grams, was not significantly different from the P3 treatment, which was 136.25 grams. The factor of giving organic fertilizer did not significantly affect the weight of production per soybean plant at harvest, however, the weight of production per soybean plant at the time of the heaviest harvest was obtained in the O4 treatment (organic fertilizer for market vegetable waste 20 tons/ha), which was 146.11 grams. The results of the analysis showed that the water supply factor had a significant effect on the weight of production per soybean plant at harvest and the organic fertilizer application had no significant effect on the production weight per soybean plant at harvest. The interaction of the two factors did not significantly affect the volume of soybean roots at harvest. In Table 5, it can be seen that the water supply factor did not significantly affect the wet weight of the soybean canopy at harvest, however, the heaviest canopy wet weight was obtained in treatment P1 (watering 1000 ml daily) which was 210.83 grams. The results of the analysis showed that the water supply factor had no significant effect on the wet weight of the soybean canopy at harvest and the organic fertilizer application had no significant effect on the wet weight of the soybean canopy at harvest. The interaction of the two factors did not significantly affect the wet weight of soybean canopy at harvest. The factor of giving organic fertilizer did not significantly affect the wet weight of the soybean crown at harvest, however, the heaviest wet weight of the crown was obtained in the O1 treatment (rice husk 20 tons/ha) which was 197.22 grams.

Table 6: Average Dry Weight of Soybean Plants (grams) Due to Giving Factors Water (P) And Organic Fertilizer (O) At Harvest

O treatment	P treatment			Average
	P1	P2	P3	
O1	40,12	38.29	40.09	39,50
O2	40.02	41.32	39.38	40.24
O3	39.76	38.87	38.77	39.13

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O4	40,19	39.02	40,80	40.00
Average	40.02	39.37	39.76	

Information : Numbers followed by unequal letters in the same treatment group were significantly different at the 5% level based on the DMRT test and unnotated data showed no significant effect.

Table 7: Average Leaf Analysis of Total N Element of Soybean Plants (%) Due to Factors Giving Water (P) And Organic Fertilizer (O) At Harvest

O treatment	P treatment			Average
	P1	P2	P3	
O1	3.59	4.24	4.03	3.95
O2	3.76	3.92	3.88	3.85
O3	3.88	3.75	4.08	3.90
O4	3.79	4.01	3.83	3.88
Average	3.75 a	3.98 b	3.95 b	

Information : Numbers followed by unequal letters in the same treatment group were significantly different at the 5% level based on the DMRT test and unnotated data showed no significant effect. In Table 6 it can be seen that the water supply factor did not significantly affect the dry weight of the soybean crown, however the heaviest canopy dry weight was obtained in treatment P1 (watering every day as much as 1000 ml) which was 40.02 grams.

The factor of giving organic fertilizer did not significantly affect the dry weight of the soybean crown at harvest, however, the heaviest crown dry weight was obtained in the O2 treatment (burned rice husk 20 tons/ha) which was 40.24 grams. The results of the analysis showed that the water supply factor had no significant effect on the dry weight of the soybean canopy at harvest and the organic fertilizer application had no significant effect on the dry weight of the soybean canopy at harvest. The interaction of the two factors did not significantly affect the dry weight of the soybean canopy at harvest. In Table 7 it can be seen that the water supply factor had a significant effect on the analysis of the total N element leaf of soybean plants at harvest. Leaf analysis of the largest total N element was obtained in treatment P2 (watering every 3 days as much as 1000 ml) which was 3.98 percent, which was significantly different from treatment P1 (watering every day as much as 1000 ml) which was 3.75 percent, and not significantly different. with P3 treatment (watering every 6 days as much as 1000 ml) which is 3.95 percent. The P1 treatment was 3.75 percent significantly different from the P3 treatment, which was 3.95 percent. The application of organic fertilizer had no significant effect on the analysis of the total N element of soybean leaves, however the analysis of the leaves of the total N element of soybean plants at the time of the largest harvest was obtained in the O1 treatment (rice husk 20 tons/ha) which was 3.95 percent. The results of the analysis showed that the water supply had a significant effect on the N-total leaf analysis of soybean plants at harvest and the organic fertilizer application had no significant effect on the N-total leaf analysis of soybean plants at harvest. The interaction of the two factors did not significantly affect the analysis of the total N element of soybean leaves at harvest.

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CONCLUSION

Interaction of the time interval of giving water and the type of organic fertilizer gave a significant effect on root length, number of root nodules, root volume, production per plant and leaf N element. Treatment P1 (watering every day as much as 1000 ml) gave the highest yield. The type of organic fertilizer has a significant effect on the parameters of root length and root volume. O1 treatment (rice husk 20 tons/ha) gave the highest yield. There was a significant interaction in root length parameters, where the combination of P1 treatment (daily watering of 1000 ml) with O1 treatment (rice husk 20 tons/ha) gave the longest results compared to other combinations.

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