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THE SUITABILITY OF THE WATER NEEDED BY SOYBEAN PLANT COMBINED WITH CANE PULP (BAGAS) IN ALFISOL DRY SOIL

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ABSTRACT

The aimed of research to find was treatment organic matter (sugar cane bagas) and non non organic matter to water capacity of soil to soybean, to find the optimal soil moisture of the alfisol soil with organic matter (sugar cane bagas) and non-organic matter (sugar cane bagas) what are available to crop growth and yield. The results show that there is a significant interaction between the treatment of organic material and the water volume on the dry weight of the total of plant (the age is 2 weeks after planting), the ratio of wide leaf (the age is 2 and 4 weeks after planting), and the number of seeds. On the other hand, there is no interaction with other components. The treatment of water volume has real influence and it is really seen on all growth components and products except for the relative rapid growth of plant which has the weight of 100 seeds and harvest index. The best treatment of water volume is seen on the giving of water volume on field capacity and 500 ml. On the other hand, the treatments of organic matter tend to show a good result rather than without giving organic matter even though most of them are not real.

1. INTRODUCTION

Soybean is one of the important legume plants in Indonesia. His position is in first place then peanuts and green beans. Dry land has strategic potential for soybean development because the largest area is in agricultural cultivation areas, even though the area is poor and the constraints are very complex. One type of dry land with a large area is alfisol dry land. Alfisol is one of the potential areas for planting legumes, but most of its area has a low fertility level, which is reflected by the low content of organic matter and some nutrients, 90% of 57 dry land locations in East Java and Central Java contained organic matter below 2%, the low content of organic matter resulted in low soil moisture holding and only lost soil organic matter content. can be replaced with the addition of organic matter [1]. Utilization of organic matter in agricultural land is centered on assessing the potential of organic matter in providing nutrients through decomposition and mineralization processes. So that for plants, generally organic matter that is easily weathered means that it is easy to decompose because it has the nature of a low C / N ratio, low polyphenol and lignin content.

However, this high quality organic matter does not contribute to the soil organic matter content as a result, the ability of the soil to hold more rainwater does not increase. In fact, organic matter is hard to rot, has high C/N ratio properties, high polyphenol and lignin content, generally provides a slow element for plants, but contributes significantly to the soil organic matter content, which in turn can increase the ability of the soil to hold the water [2]. Soil organic matter plays a key role in maintaining fertility and soil productivity. The effects of organic matter can be direct or indirect. Organic material that plays a direct role as a source of plant nutrients and directly affects physical and chemical properties [3]. The results of [4], that the application of conservation tillage with better nutrient management from organic matter is a viable option to achieve higher productivity. In Entisol soil in KP Mojosari, husk compost provides higher air holding, which is 10.22% of the control. Meanwhile, on Alfisol soil in Muneng KP, the best bagasse compost increased the air holding capacity by 13.5% from the control. The purpose of this study was to obtain the treatment of bagasse on the ability of the soil to lose air in green bean plants as well as to obtain optimum soil moisture in Alfisol soil with bagasse or without bagasse which soybean plants can tolerate for growth. and the results have not decreased.

2. RESEARCH METHOD

The research was conducted in the greenhouse of the Cereals Research Institute K. The soil used was Alfisol soil, a type of soil with a structure from clay to clay originating from Lamongan district. Altitude 450 meters above sea level, the average daily temperature is 25 - 27o C. Experimental materials include: soybean varieties Wilis. The organic material given is sugarcane waste (bagasse) at a dose of 60 gr / pot, urea fertilizer, Sp-36, KCl and pesticides. The tools used in the experiment were, a greenhouse, a wooden box, an analytical scale, an oven, a ruler, an oven, a chlorophilmeter, and a measuring cup.

The experiment was carried out in a greenhouse, consisting of two factors that were arranged factorially using a separate plot design, and repeated 5 times.

Factor I: Provision of organic material, which consists of two levels:
1 = No organic matter (no bagasse)
2 = With organic material (with bagasse)

Factor II: The amount of water given consists of six levels:
A = field capacity during growth
B = 500 ml
C = 400 ml
D = 300 ml
E = 200 ml
F = 100 ml

The first factor consists of 2 (two) levels and the second factor consists of 6 (six) levels so that there are 12 treatment combinations, each repeated 5 times so that there are 60 experimental pots, overall 240 pots used and tested by Duncan's Multiple Range Test at the 5% level for the treatment that had interactions, while for treatments that did not occur interactions were tested with the smallest significant difference at the 5% level. Implementation includes media preparation, planting, fertilization and observation.

2.1 Observation

2.1.1 Observations During Growth

Observations were made at the age of 2, 4, 6, 8 weeks after planting. The observed growth variables were

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plant height, leaf area per plant, leaf chlorophyll content, total dry weight per plant, flowering age and specific leaf area.

2.1.2 Observation of Results

Yield observations and yield components were observed at harvest time by taking 2 sample plants. The yield components observed included: seed weight / plant, seed weight / pot number of pods / plant, weight of 100 seeds, weight of pods / plant.

3. Results and Discussion

3.1 Results

Table 1. Average Soybean Plant Height (cm) in Material Treatment Organic and Water Volume

Treatment	Plant Height (cm)			
	2 Week after planting	4 Week after planting	6 Week after planting	8 Week after planting
Organic material				
Without bagas	30.63 a	41.00 a	54,03 a	58,61 a
With bagas	30.91 a	43.19 a	53,89 a	58,65 a
HSD 0,05	ns	ns	ns	ns
Volume Air				
A (KL)	36.33 a	47.17 ab	57,67 ab	66,87 ab
B (500 ml)	36.75 a	51.30 a	59,60 a	69,40 a
C (400 ml)	30.90 b	42.72 bc	54,30 b	64,00 b
D (300 ml)	27.58 bc	38.10 cd	49,30 c	58,95 c
E (200 ml)	27.30 bc	37.80 cd	48,92 c	58,93 c
F (100 ml)	25.77 c	35.48 d	-	-
HSD 0,05	5.684	4.205	7.306	4,291

Description: Column numbers accompanied by the same letter are not significantly different based on HSD test at the 0.05 level. HSD = Honestly significant difference,

Table 2. Average Leaf Area on Organic Material Treatment and Water Volume

Treatmen	Leaf are (cm^2)		
	2 WAP	4 WAP	6 WAP
Organic material			
Without bagas	29.16 b	90.49 a	148.68 a
With bagas	45.67 a	81.66 a	189.75 a
HSD 0,05	15,42	ns	ns
Water volume			
A (KL)	63.94 a	134.63 ab	264.81 a
B (500 ml)	44.95 b	165.45 a	336.71 a
C (400 ml)	36.74 bc	84.94 bc	156.80 b
D (300 ml)	31.24 c	65.71 cd	137.93 bc
E (200 ml)	17.16 d	41.70 cd	70.38 cd
F (100 ml)	16.68 d	24.03 d	48.66 d
HSD = 0,05	12.53	56,58	78,72

Description: Column numbers accompanied by the same letter are not significantly different based on HSD test at the 5% level. HSD = Honestly significant difference WAP = Week after planting, ns = not significant

Table 3. Interaction Between Provision of organic matter with water volume Against Total Plant Dry

Weight (g) at harvest	
Treatment	Total Plant Dry Weight (gr)
Without bagas+Field Capacity	60,49 ab
Without bagas +500ml	59,34 cde
Without bagas +400ml	55,32 de
Without bagas +300	54,19 fg
Without bagas +200ml	45,14 g
Without bagas +100ml	42,11 g
with bagas+ Field Capacity	66,55 a
with bagas +500ml	61,43 bc
with bagas +400ml	58,34cde
with bagas +300ml	56,36 cd
with bagas +200ml	46,26 ef
with bagas +100ml	44,26 ef

Description: Column numbers accompanied by the same letter are not significantly different based on Duncan's Multiple Distance Test at the 5% level

Table 4. Average Amount of Chlorophyll, Flowering Age and Specific Leaf Area Green Bean Plants on Treatment of Organic Materials and Water Volume

Treatment	Observation		
	Amount of Chlorophyll	Flowering Age (days)	Specific Leaf Area
Organic Material			
With bagas	45.71 a	43.07 a	207.6 a
Without bagas	43.49 a	41.37 a	272.4 a
HSD 0,05	ns	ns	ns
Water Volume			
A Field Capacity	50.45 a	36,50 c	270.5 ab
B (500 ml)	47.76 ab	36,40 c	359.7 a
C (400 ml)	45.63 bc	39,50 bc	213.2 ab
D (300 ml)	42.79 cd	45,10 ab	240.1 ab
E (200 ml)	40.95 d	48,60 a	232.9 ab
F (100 ml)	40.03 d	47,20 a	123.7 b
HSD 0,05	4,35	7,01	181,8

Description: Column numbers accompanied by the same letter are not significantly different based on the HSD test at the 0.05 level. HSD = Honestly significant difference ns = not significant

Table 5. Average Weight seed /Plant (g), Weight seed / Pot (g), Weight 100 Seeds (g) Weight pod / Plant (g) and Number of Pods / Plant at Treatment of Organic Materials and Water Volume.

Treatment	Result Component				
	Weight seed/ plat (g),	Weight seed/pot	Weight 100 Seeds (g)	Weight pod/ plant	Number of Pods / Plant
Organic Material					
Without bagas	12.22 a	22.51 a	10.44 a	21.74 a	40.16 a
With bagas	12.37 a	22.74 a	10.87 a	21.74 a	30.72 a
HSD 0,05	ns	ns	ns	ns	ns

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Water Volume					
A Field Capacity	12.64 ab	23.48 a	10.94 a	22.69 a	60,60 a
B (500 ml)	13.11 a	24.22 a	11.05 a	22.60 a	60,00 a
C (400 ml)	12.16 bc	22.42 b	10.90 a	21.44 b	30.60 b
D (300ml)	10.93 c	21.75 bc	10.26 a	21.27 b	20.60c
E (200 ml)	10.63 c	21.26 c	9.13 a	20.70 b	10,00 c
F (100 ml)	-	-	-	-	-
HSD 0,05	0.58	1.05	ns	0,99	1.54

Description: Column numbers accompanied by the same letter are not significantly different based on the HSD test at the 0.05 level. HSD = Honestly significant difference.

3.2 Discussion

The results showed that the response to growth and soybean production due to the treatment of organic matter and water volume was different. Treatment of water volume has a very real effect on almost all components of growth and yield. The interaction between organic matter treatment and water volume only affected the total dry weight of the plant. Treatment of water volume on plant growth, namely plant height to produce the highest plant height until the end of the observation was the provision of water with field capacity (A) and 500 ml (B). This means that the provision of water at such a concentration is sufficient for plant needs, according to the opinion of [5] which states that plant height is influenced by cell division and enlargement that occurs in the tip meristem tissue, which is influenced by availability of water, lack of water only a few bars in plant life can slow or even stop the division and enlargement of organs. The results of [6] research show that plants experiencing water deficit will reduce all growth and yield characteristics of maize, but if gibberellic acid spraying is carried out, it will help plant growth and development. Although the effect of organic matter (bagasse) treatment on plant height components was not significant, the increase was still better than without the use of bagasse, this meant that there had been a shift towards increasing water-binding ability. The problem is not different from the bagasse treatment, maybe the high lignin and cellulose content in sugarcane bagasse (27.2% and 27.96%) has an indirect effect on the ability of water binding through the slow weathering of the material, it needs to be further investigated under controlled conditions. Seeing the high lignin content in sugarcane [7] bagasse, it is categorized as low quality organic material, because it is difficult to decompose.

Leaf area resulted from water volume treatment was significantly affected by this treatment. In Table 3, it can be seen that the water volume treatment of 500 ml (B) aged 4 and 6 weeks after planting shows the highest leaf area compared to other treatments, but not different from the field capacity treatment (A). In the 400 ml water volume treatment, it was seen that there was a decrease in leaf area, where by giving water to this limit there was a decrease in leaf area by 40% of the field capacity, while for the E (200 ml) and F (100 ml) treatments showed the most leaf area. small. The results showed that there was a close relationship between leaf area and plant dry weight, which resulted in a correlation of 0.9117 **. This means that leaf area has a very significant positive correlation with the increase in plant dry weight, which means that an increase in the value of leaf area will be followed by an increase in the dry weight of soybean plants. The results showed that there was a significant interaction between the treatment of organic matter and water volume at the age of 15 DAS to dry weight, where the 2A treatment combination showed a greater increase in dry weight but was not significantly different from the treatment combination 1A (without bagasse + KL). This means that the provision of bagasse can support the vegetative growth of the plant for the better because with the addition of bagasse, the stored water becomes higher before watering. Soil organic matter is essential importance for maintaining soil quality by improving biological, physical and chemical soil conditions; it consists of a variety of simple and complex carbon compounds [8]. The role of the organic materials in the soil is very important that as the primary granules soil into a binder in the formation of stable aggregates. The results of statistical analysis of chlorophyll content showed that the volume of water significantly affected the amount of chlorophyll from green bean plants, where treatment with sufficient water (field capacity and 500 ml) showed that the amount of chlorophyll was more than the treatment with less water volume. From Table 4, it can be seen that when giving 200 ml of water, there was a decrease in the amount of chlorophyll by 9.5% of the field capacity. The decrease in chlorophyll content when plants are water deficient is related to the activity of photosynthetic devices and to reduce the rate of plant photosynthesis. Lack of water will affect the content and organization of chlorophyll in the chloroplasts in the tissue [9].

The results of the analysis showed that the volume of water treatment significantly affected the time of release of the green beans plant flower, where the treatment with sufficient amount of water was the fastest in terms of the appearance of the first flower compared to the treatment with less water. this means that a sufficient amount of water is needed by plants to accelerate the discharge of flowers. In the table, it can be seen that a decrease in water supply to 400 ml from the field capacity will slow the discharge of flowers for up to 6 days. Water stress would slow down the appearance of flowers which consequently shortened the seed filling period [10]. The greater the number of flowers that come out, the more flowers that become pods so that it is expected that the number of pods, pod weight and seed / plant weight will also increase. Sugarcane bagasse has been able to increase the ability of the soil to hold water, because the organic C content in sugarcane baggage is high enough to 43.68% resulting in a greater water binding ability. Organic substances, contain the element carbon and it comprises about half of the mass of soil organic matter. Organic matter in the world's soil profiles contains four to six times as much C as is found in all the world's vegetation. Soil Organic matter plays a critical role in the global C-organik matter balance that largely controls global climate change being serving as both source and sink for C. The increase in C- organic matter in the soil will add more water-binding ability. This ever-changing soil component exerts huge influence on many soil physical, chemical, and biological properties and ecosystem functions of soils such as improving soil aggregation, increases nutrient exchange, retains soil moisture, reduces compaction and surface crusting, and increases water infiltration into the soil [11]. This is consistent with research conducted by [12] that the highest digest plant available moisture content 14.3% was recorded in the biochar applied with the combination of sugarcane bagasse. Overall biochar application with crop residues is effective in improving the carbon fractions and its combination with sugarcane bagasse improves polysaccharides and soil moisture content in the arid soil. Based on the results of statistical analysis, the treatment of water volume significantly affected the specific leaf area, where plants with a water volume treatment of 100 ml (F) had thicker leaves than plants with adequate water supply. A thin leaf can be likened to a transparent sheet, so that when the leaves receive solar radiation it will be transmitted to the lower layer more than thick leaves, so that it is advantageous in the distribution of solar radiation throughout the plant. On the other hand, thick leaves are more efficient than thin leaves, this thickening of the leaves is intended so that the sun's radiation that falls on the surface of the leaves is not lost because it is passed downward, a mechanism that is unique to plants in relation to environmental factors. At the level of general morphology, it is observed that leaves in the shade are wider and thinner (in particular the palisade layer appears less developed than that of leaves in the sun) and often have a greater concentration of chlorophyll in the upper surface. Added to this are a series of characteristic effects of the lack of radiation, i.e., yellowing and abscission of the lower leaves, a lack of branching, excessive elongation of stems and shoots and low or no fertility [13].

In the research conducted by [14] the overall effect of water deficiency occurred in shorter plants with the same leaf biomass, thus increasing the leaf mass ratio and the denser the leaf tissue, which gave an advantage in extreme conditions, such as heavy rain, wind. and prolonged drought, as they prevent damage to plant tissues and habitat, while high levels of photosynthetic and protective pigments can enhance their function. Water level and implementation of immersion determined the greenness of the leaves which is an indicator of the chlorophyll content of leaves [15]. Based on the research results, the provision of organic matter did not significantly affect the yield components of soybean crops. However, even so the treatment using bagasse is still better than the treatment without bagasse. The difference between these treatments may be due to the fact that bagasse has a high lignin content (27.2%) so it is slow to rot, as stated by [16] that sugarcane bagasse is a rich source of cellulose (32–45%), hemicellulose (20–32%) and lignin (17–32%), 1.0–9.0% ash and some extractivesWater volume treatment significantly affected the yield components of soybean except the weight of 100 seeds. The results showed that treatment with 500 ml water volume showed the highest seed / plant weight, seed / pot weight, 100 seed weight, number of pods / plant, and pod weight compared to other treatments but not significantly different from the field capacity treatment (A). This means that in such water conditions the plants are able to utilize the available water for various growth and development activities. Treatment with water volume 200 ml (E) gave the lowest yield component, while treatment with water volume 100 ml) F) was not able to survive until production. This is closely related to the translocation of photosynthetic results (photosynthate), where with the availability of sufficient amounts of water, the translocation of photosynthate to the sink will be better. The translocation of photosynthate and nutrients to the sink is largely determined by the availability of water, lack of water will inhibit translocation [17]. Furthermore, the results research on alfisol soil found that It is revealed that the mixture of 75% sugar cane bagasse compost and 25% fertilizer N from urea is the most appropriate composition for the 8.76 ton/ha greean bean yield [18]. This means that given bagasse has been able to increase the ability to hold water which will then be used by plants for seed production / yields compared to plants not given bagasse. The number of pods is one of the determining components of the green bean crop yield. Soybean yields will increase if the plant is able to produce a larger number of pods and seeds / pods. The results of this study with research conducted by [19] that drought stress had significant effect on plant height, stem diameter, lateral shoot number, biological yield, flowering duration, days to maturity, pod per plant, seed per pod, 1000 seed weight, seed yield and harvest index of Brassica napus. Seed yield average reduced from 3955.1 to 2800.96 kg/ha (29.18%) caused by drought stress. Meanwhile pod per plant reduced more (32.54%).

4. CONCLUSION

- Provision of water to the treatment limit of 400 ml at an air temperature of 38.33 0C can reduce seed / plant weight, seed / pot weight, number of pods, amount of chlorophyll and leaf area respectively by 30%, 46%, 45%, 9, 5% and 40%, and can delay flowering for 6 days.
- Giving 500 ml of water to several observed parameters such as plant dry weight shows an interaction with other treatments where the provision of bagasse can save water consumption by 20%.
- The results of regression analysis show that there is a positive linear correlation with water volume treatment for almost all growth and yield variables except for flowering age
- The potential yield that can be achieved from this experiment is 0.7 tonnes h-1 (for 500 ml treatment) and

0.55 tonnes ha-1 (400 ml treatment).

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