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The Efforts to Increase Vegetative Growth of White Corn (*Zea mays* L) with Vesicle Arbuscular Mycorrhizae (VAM) and Distance Planting Treatment

Upaya Peningkatan Pertumbuhan Vegetatif Jagung Putih (*Zea mays* L) dengan Pemberian Cendawan Mikoriza Arbuskula (CMA) dan Perlakuan Jarak Tanam

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ABSTRACT

The purpose of this study was to see the effect of giving Vesicle Arbuscular Mycorrhizae (VAM) on the vegetative growth of white corn (Zea mays L), distance treatment of plant and interaction both of them on the vegetative growth of white corn. This study used a randomized block design (RBD) on factorial with two-factor and three replications. The first factor is the treatment of giving VAM (A) with various doses consisting of A1 (10 g/plot), A2 (20 g/plot) and A3 (30 g/plot), while the second factor is the treatment of plant spacing (J) with various sizes consisting of J1 (50 cm x 15 cm), J2 (50 cm x 25 cm) and J3 (50 cm x 35 cm). Data collection starts from planting to flowering, namely plant height, number of leaves, flowering time. Data analysis was carried out through analysis of variance and further test of DMRT at 95% confidence level. Based on the results of the study, it was found that the fungal treatment only had a significant effect on plant height and cob length, but did not significantly affect the number of leaves, flowering time. The plant spacing treatment only had a significant effect on plant height but had no significant effect on the number of leaves and flowering time. The interaction of the fungus treatment and plant spacing treatment showed that there was an interaction effect of the two treatments on plant height but did not significantly affect the number of leaves, flowering time. The treatment interaction A3J3 had the highest plant size of 114.55 cm.

Keyword: White corn, VAM, Planting dictance

ABSTRAK

Penelitian ini bertujuan untuk mengetahui pengaruh pemberian Cendawan Mikoriza Arbuskula (CMA), perlakuan jarak tanam serta intraksi antara keduanya terhadap pertumbuhan vegetatif jagung putih. Penelitian ini menggunakan rancangan acak Kelompok (RAK) dalam Faktorial, dua faktor dengan tiga ulangan. Faktor satu adalah perlakuan pemberian CMA (A) dengan berbagai dosis yang terdiri dari A1 (10 gr/plot), A2 (20 gr/plot) dan A3 (30 gr/plot), sedangkan faktor dua yaitu perlakuan jarak tanaman (J) dengan berbagai ukuran yang terdiri dari J1 (50 cm x 15 cm), J2 (50 cm x 25 cm) dan J3 (50 cm x 35 cm). Pengumpulan data dimulai sejak jagung putih ditanam hingga berbunga, yaitu tinggi tanaman, jumlah daun dan waktu berbunga. Analisis data dilakukan melalui analisis ragam dan uji lanjut DMRT pada taraf kepercayaan 95%. Berdasarkan hasil penelitian diperoleh hasil bahwa perlakuan cendawan hanya berpengaruh nyata terhadap tinggi tanaman dan panjang tongkol, namun tidak berpengaruh nyata terhadap jumlah daun, waktu berbunga. Perlakuan jarak tanaman hanya berpengaruh nyata terhadap tinggi tanaman namun tidak berpengaruh nyata terhadap jumlah daun, waktu

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berbunga. Interaksi perlakuan cendawan dan perlakuan jarak tanaman menunjukkan bahwa ada pengaruh interaksi kedua perlakuan tersebut terhadap tinggi tanaman namun tidak berpengaruh nyata terhadap jumlah daun, waktu berbunga. Interaksi perlakuan A3J3 memilki ukuran tanaman tertinggi yaitu sebesar 114,55 cm .

Kata kunci: Jagung putih, CMA, Jarak tanam

INTRODUCTION

White corn is one of the corn varieties that has little or no carotene pigment in the endosperm of corn seeds. The calories contained in white corn are higher than yellow corn and the taste is also fluffier (Ratna and Robet, 2009). White corn has seeds that are rich in carbohydrates, most of which are endospremium. The carbohydrate content in white corn reaches 80% of the dry matter of corn kernels. Carbohydrates in the form of starch are generally a mixture of amylose and amylopectin, white corn has amylopectin which is almost all over the starch, and has more protein. White corn as a source of carbohydrates and protein whose nutritional content is starch (72-73%), with amylose and amylopectin (25-30% :70-75%), sugar content 1-3% (Suarni and Firmansyah, 2005).

White corn growth can be increased by VAM treatment (Silitonga and Nasution, 2020). Mycorrhizae life activity depends on the host plant which is quite high, more than 40% of the carbon compounds produced by photosynthesis are allocated to the plant roots and 1/3 of them are given to mycorrhizae arbuscular. The use of VAM does not require large costs because the production technology is cheap, all materials are available in nature, can be produced easily in the field, given once in a lifetime, does not damage the environment, and does not damage the soil structure (Musfal, 2010). VAM can increase corn production that experiences drought during the vegetative and generative phases (Yusnaini et al., 2000).

Spacing is one way to manipulate the physical environment of plants, so that competition between plants can be suppressed, where the increasing or decreasing population greatly affects the growth and production of white corn. This affects the leaf area, dry weight of the plant, the amount of sunlight received by the plant, the root system and the amount of nutrients absorbed from the soil (Indrayanti, 2010).

This study aims to determine the effect of Vesicle Arbuscular Mycorrhizae (VAM), plant spacing treatment and the interacti on between the two on the vegetative growth of white corn.

MATERIALS AND METHODS

This research was carried out at the experimental field of the Faculty of Agriculture, South Tapanuli Muhammadiyah University, Nort Sumatera from March to June 2021

This study used a randomized block design (RBD) with treatments arranged in a factorial manner. The treatments tested consisted of two factors, including:

1. Vesicle Arbuscular Mycorrhizae (VAM) treatment factor (A)
   A1 : 10 gr/plot
   A2 : 20 gr/plot
   A3 : 30 gr/plot

2. Planting distance treatment factor (J)
   J1 : Spacing with a size of 50 cm x 15 cm
   J2 : Spacing with a size of 50 cm x 25 cm
   J3 : Spacing with a size of 50 cm x 35 cm

Thus there are 9 treatment combinations each consist

A1J1	A2J1	A3J1
A1J2	A2J2	A3J2
A1J3	A2J3	A3J3

Observation Parameters

1. Plant Height

Measurement of plant height was carried out after the plants were 2 to 8 weeks old at intervals of every two

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weeks. Plant height was measured from the soil surface to the tip of the highest leaf using a meter.

2. Number of Leaves

The number of leaves was counted on each sample plant by counting the fully opened leaves. Counting the number of leaves starts from 2 weeks to 8 weeks with an interval of every two weeks.

3. Flowering Time

The productive phase of white corn is marked by the appearance of male flowers (Tassel). Flowering time is calculated when 75% of the sample plants have flowered.

Data analysis was carried out through analysis of variance and further test of DMRT at 95% confidence level.

RESULT AND DISCUSSION

1. Plant Height

Based on the results of the analysis of variance, it can be seen that the application of VAM did not have a significant effect on the age of the plant 2 mst, the effect of giving VAM was only seen at the age of 4 to 8 mst. Based on table 1, it can be seen that the tallest plant was found in treatment A3 which was 103.2 cm, while the shortest plant was found in treatment A1 which was 94.44 cm. In the observation of plant spacing treatment, the highest plant was found in treatment J3 which was 105.11 cm while the shortest plant was found in treatment J1 which was 91.25 cm. In observing the interaction between fungal treatment and plant spacing, the highest plant was found in the A3J3 treatment interaction, which was 114.55 cm, while the shortest plant was found in the A1J1 interaction, which was 88.44 cm. From the results of the DMRT further test, it was found that treatment A3 was significantly different from A1 and A2, treatment J1 was significantly different from treatment J2 and J3 and interactions A1J1 and A3J3 were significantly different from other treatments.

Table1. Plant Height

Treatment		Plant Height (cm)			
		2 wap	4 wap	6 wap	8 wap
VMA Treatment (A)	A1	29.89 a	46.44 a	66.78 a	94.44 a
	A2	31.22 a	49.03 b	70.66 b	99.25 b
	A3	30.85 a	50.63 b	72.29 b	103.26 c
distance Treatment (J)	J1	28.37 a	44.30 a	64.55 a	91.25 a
	J2	31.18 b	49.03 b	70.18 b	100.58 b
	J3	32.40 b	51.89 b	75.00 b	105.11 c
Treatment Interaction (A*J)	A1J1	29.22 a	43.11 a	63.78 a	88.44 a
	A1J2	29.55 a	48.11 ab	67.44 ab	97.11 b
	A1J3	30.89 a	48.11 ab	69.11 ab	97.77 b
	A2J1	28.33 a	44.55 ab	65.33 ab	92.11 c
	A2J2	33.22 a	52.00 b	71.78 b	102.63 c
	A2J3	32.11 a	50.55 b	74.88 b	103.00 d
	A3J1	27.55 a	45.22 ab	64.55 b	93.22 d
	A3J2	30.77 a	49.66 b	71.33 b	102.00 d
	A3J3	34.22 a	57.00 b	81 b	114.55 e

Note: The numbers followed by the same letter notation in the same column show that there is no significant difference between treatments based on the DMRT follow-up test at a significance level of 5%

Based on the results of the analysis of variance on the observation of plant height on plant spacing treatment, it shows that there is an effect of plant distance on plant height. The J3 treatment had the

highest size, meaning that the 5x35 cm (J3) distance treatment was more effective in increasing plant height. This is because corn is a C4 plant that is adaptive to sunlight, so a larger spacing of 5 cm x 35 cm provides plants with full sunlight and sufficient nutrients to carry out the assimilation process better. Barri (2003) stated that the spacing system affects the nutrients and growing space obtained by plants which in turn has an effect on plant growth and production. Spacing system affects light, CO2, wind and nutrients obtained by plants so that it will affect the process of photosynthesis which in turn gives different effects on the parameters of growth and corn production.

2. Number of Leaves

Based on the results of variety analysis, it can be seen that the treatment of VAM and plant distance treatment and the interaction of the two did not give a significant effect on the number of leaves (Table 2). In the last observation (8 mst) it can be seen that in VAM treatment, the most number of leaves is found in A1 treatment which is 8.57 pieces while the least number of leaves is found in A3 treatment which is 8.92 pieces.

In the observation of plant distance treatment, the most number of leaves is found in J1 treatment which is 8.39 pieces while the least number of leaves is found in J3 treatment which is 8.92 pieces. In the observation of the interaction between mushroom treatment with plant distance treatment, the most number of leaves are found in the interaction of A1J1 which is 9.05 pieces while the least number of leaves are found in the interaction of A3J3 which is 9.66 pieces.

Table 2. Number of Leaves

Treatment		Number of Leaves (piece)			
		2 wap	4 wap	6 wap	8 wap
VAM Treatment (A)	A1	5.48	7.51	8.04	8.57
	A2	5.55	7.66	8.29	8.63
	A3	5.85	7.74	8.40	8.92
Distance Treatment (J)	J1	5.59	7.62	7.92	8.39
	J2	5.66	7.66	8.37	8.81
	J3	5.63	7.62	8.44	8.92
Treatment Interaction (A*J)	A1J1	5.66	7.55	7.78	9.05
	A1J2	5.66	7.44	8.22	8.44
	A1J3	5.11	7.55	8.11	8.22
	A2J1	5.55	7.66	8.00	8.00
	A2J2	5.78	7.78	8.33	9.00
	A2J3	5.33	7.55	8.55	8.89
	A3J1	5.55	7.66	7.99	8.11
	A3J2	5.55	7.77	8.55	9.00
	A3J3	6.44	7.77	8.66	9.66

Note: There is no significant difference between treatments based on the DMRT follow-up test at a significance level of 5%

Table 2 shows that the spacing did not affect the number of leaves. This is presumably because the distance treatment given is too small so that the effect has not been seen to have a significant effect on the number of leaves. According to Kartika (2018), variations in spacing have no significant effect on leaf growth, while according to Mayadewi (2007), it is stated that maximum production is achieved when using the appropriate spacing. The higher the density level of a plant, the higher the level of competition between plants in terms of getting nutrients and light.

From table 2 it can also be seen that the interaction of treatment between the application of VAM and spacing (A3J3) at 8 mst showed the highest mean number of

leaves. This indicates that when the dose of VAM is higher and the distance is less, the maize growth is more optimal. If the distance between plants is closer with a high dose of VAM, there will be competition between corn plants and fungi for nutrients or photosynthesis such as carbohydrates, thereby inhibiting the growth of colonized corn (Delvian, 2005). Fuady, 2013 Explains that the development of mycorrhizal life takes place in the root tissue of the host plant, after being preceded by a root infection process. This fungus receives about 12-27% carbon from its host plant in the form of simple sugars.

3. Flowering Time

Based on the results of the analysis of variance, it can be seen that the treatment with CVAM and plant spacing treatment and the interaction of the two did not have a significant effect on flowering time (Table 3). The fastest flowering time was found in A3 treatment, which was 41.52 DAP, while the longest flowering time was found in A1 treatment, which was 42.03 DAP. In the observation of plant spacing treatment, the fastest flowering time was found in treatment J3 which was 41.40 DAP and the slowest flowering time was found in treatment J1 which was 42.18 DAP. In observing interactions between fungal treatments and plant spacing treatments, the fastest flowering time was found in the A3J3 interaction (41 DAP) while the slowest flowering time was found in the A1J1 and A1J2 interactions, which were 42.33 DAP respectively.

Table 3. Flowering time

Treatment		Flowering Time (DAP)
VAM Treatment (A)	A1	42.03
	A2	42.00
	A3	41.52
Distance Treatment (J)	J1	42.18
	J2	41.96
	J3	41.40
Treatment Interaction (A*J)	A1J1	42.22
	A1J2	42.33
	A1J3	41.55
	A2J1	42.44
	A2J2	41.89
	A2J3	41.66
	A3J1	41.89
	A3J2	41.66
	A3J3	41.00

Note: There is no significant difference between treatments based on the DMRT follow-up test at a significance level of 5%

Setting the spacing and nutritional adequacy is an alternative that needs to be considered in an effort to increase the growth of white corn, so it is necessary to know for sure the role of each factor in influencing the growth component. From table 3, it can be concluded that the wider the spacing and the higher dose of VAM given, the shorter the flowering period of maize. In Table 3, it can be seen that the A3J3 treatment showed that at a wider spacing and higher doses of VAM, flowering appeared more quickly.

CONCLUSION

Based on the results of the study, it can be concluded as follows:

1. The VAM treatment and plant distance treatment only had a significant effect on plant height, but had no significant effect on the number of leaves and flowering

time. In the observation of VAM treatment on plants, the highest plant was found in A3 treatment, which was 103.26 cm. The J3 treatment was more effective in increasing plant height with the highest size of 105.11 cm

2. The interaction of the VAM treatment and plant spacing treatment showed that there was an interaction effect of the two treatments on plant height but did not significantly affect the number of leaves, flowering time. The interaction of A3J3 treatment was more effective in increasing plant height with the highest plant size of 114.55 cm.

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