Effect of Nitrogen Dosage (N) on Morphology of Soybean Strains (Glycine max (L.) Merr) Hold *Bemisia tabaci*

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Abstract

Nutrients are needed by plants for the growth process and development. One crucial nutrient is nitrogen. Nitrogen triggers the formation and growth of vegetative parts of plants such as roots,stems and leaves. This study aimed to determine the effect of nitrogen dose against Glicine max. L strains UM.4-1, strains UM.7-2, strain UM.2-4, strains UM.7-6, strain UM.6-2, and two varieties namely Gumitir and Wilis resistant Bemisia tabaci. This experimental research was using a completely randomized block design with 4 treatment doses of nitrogen, 0 g, 25 g, 75 g and 100 g/polybag combined with 0,55g of potassium and phosphate 0,917g/polybag. The variables measured were length of petioles, the leaf ratio, leaf length, width and leaf area. Observations was carried out based on soybean lines, dosage, and a combination of both. Data were analyzed using 2-way ANOVA. The results showed that there were significant different in the lenght of petiole, leaf ratio, leaf length, width and leaf area on different strains of Glicine max. L. There was also the effect of different treatments (doses) on the length of petiole, leaf ratio, leaf width and leaf area but no significant effect on leaf length. Combination of treatments showing there were effect on the length of petiole, leaf ratio, leaf length and width and also on leaf area.

Keywords: *Nitrogen, morphologycal character, Glicine max.L.*

1. INTRODUCTION

Nitrogen is an essential nutrient for plants which has a major impact on the growth and development, especially for leaves, stems and roots (Mahmet, 2008; Mul, 1994; Yagoub et al, 2012). Nitrogen works to increase plant growth, improve yellow leaves, increase protein levels. During the process of soybean growth, it requires considerable amounts of nitrogen (Sumarno et al, 1991).

The application of nitrogen in soybean cultivation can increase the growth rate (Astere, 1995). According to Adisarwanto (2010), nitrogen is one of the chlorophyll constituents that are part of the leaves that function in photosynthesis, and nitrogen is a factor affecting the rate of photosynthesis. Limited nitrogen will inhibit chlorophyll formation and decrease the rate of photosynthesis, as well as interfere with the activity of plant metabolism.

Application of nitrogen elements increase the rate of plant photosynthesis in order to trigger vegetative plant growth, with increasing amounts of nitrogen available in the soil will produce large amounts of protein in plants, thereby enhancing the growth of plant tissues (Prawiranata et al., 199). The application of nitrogen fertilizers is also associated with high crops, because the higher the plant the higher chance to produce more branches. Application of nitrogen fertilizer increase plant height and dry weight of plants but no adverse effect on plant freshness (Jenny in Muzammil et al, 2010).

Currently there are resistant soybean strains towards Cowpea Mild Mottle Virus (CpMMV) which have special character (Zubaidah et al, 2009). Efforts to enhance soybean crop quality and disease resistances still need to be improved due to its demand which continue to increase (Adisarwanto, 2011). This increase does not meet with the production (Kurwantoro, 2016). On the contrary, soybean production has been showing decreasing trend (BPS, 2015), one of many causes is due to disease

attack (Kuswantoro, 2015). Cowpea Mild Mottle Virus (CpMMV) is one of the major diseases in soybean plants (Horn, 1991).

Several ways to conduct the efforts are by means of probing plant's genetic potentials, soil and water management, providing additional but controlled nutrients (Orio, 2002; Ahsan et al, 2012). The addition of nutrients to the plant can increase the growth and development of soybean plants (Golparvar et al, 2012). Nitrogen is an important nutrient for plants that have large influence in growth, and plant development (Mahmet, 2008; Aji, 2012; Yagoub et al., 2012; Eutropia et al., 2013).

This study aimed to determine the effect of various combinations of Nitrogen (N) doses on the morphology of *Bemisia tabaci*-resistant soybean. Morphological characters studied were leaf length, leaf width, leaf area, leaf ratio, and length of petiol, leaf shape, flower color, cooked pods, stem fur color, and soybean plant hypocotyl color.

2. RESEARCH METHODS

This experimental research was conducted in May until December 2016 at BALITKABI Malang East Java using randomized block design (RAK). The population studied were all types of soybean and the sample of this study were 5 B tabaci-resistants (UM.4-1, UM.7-2, UM.2-4, UM.7-6, UM.6-2) and 2 other strains (Wilis and Gumitir). There were 4 dose treatments: 0 g, 25 g, 75 g and 100 g each polybag combined with 0.55 g of potassium and 0.917 g of phosphate per polybag.

The research procedure was started from 1) Preparation and cultivation, 10 kg/polybag of soil as growth media were prepared two weeks before planting. Fertilizer consist of Nitrogen (N), Posphar (P) and Potassium (K) were added according to treatment given. 2). Nurture, ie watering the plant 2 times a week and weeding weeds. 3). Observation, plant observation was performed on all plants in each polybag, parameters observed including: leaf length, leaf width, leaf area, leaf ratio, and length of petiol, flower color, leaf shape, hypocotyl color, cooking pod color and color stem hair. Data collection was done by measuring the length of the petiol, leaf ratio, leaf length, width and leaf area. flower color. Qualitative observation included leaf shape, hypocotyl color, cooking pod color, and color of stem hair. Observation was carried out based on the strains, doses and combination of both. The collected data was analyzed using 2-way anova followed by a 5% LSD.

3. RESULTS AND DISCUSSION

The results of two-way Anova showed that there were differences in strains on the length of petiole, leaf ratio, leaf length, leaf width, and leaf area. There were significant differences in the length of petiole, the leaf ratio, the leaf width, leaf area, but no effect on leaf length. As for the combination treatment, there were significant effect of the combination treatments on the length of petiole, leaf ratio, leaf width and leaf area. The summary of Anava result presented in Table 1.

Table 1. Summary of F Test of Each Morphological Character

Morphological character	F		
	Soybean strains	Treatment of nitrogen fertilizer	The combination of strains and fertilizer
long Leaf	0.001 *	0.063 *	0,000 *
Lebar Daun	0,000 *	0,000 *	0,000 *
Leaf Size	0.001 *	0.010 *	0,000 *
Leaf ratio	0,039 *	0.018 *	0,000 *
long petiole	0.021 *	0,000 *	0,000 *

Note: * = p Value <0, 05.

LSD test on the strain treatments showed that the Gumitir strain has significantly longer, wider and broader leaves than other strains. whereas the other six strains had leaf lengths that did not differ significantly from each other. Strain

UM 2-4 significantly had a higher leaf ratio than the UM 6-2, UM 7-6, UM 4-1, Wilis, and UM 7-2. The gumitir strain had smaller leaf ratio but it did not significant difference with UM 2-4 strain. The petiole of UM 7-2, UM 7-6, Wilis, and Gumitir had no significant differences with each other, but significantly difference with UM 6-2, UM 2-4, and UM 4-1. The complete result of LSD presented in Table 2.

Table 2. Summary of 5% LSD Test Results for Treatment of Strains in Each Morphological Character

The strain	Leaf Length	Wide Leaf	Large Leaf	Ratio Leaf	Petiol Length
UM 6-2	6,518 a	3.773 a	25.3a	0.537 a	9,356a
UM-24	6, 536a	3.87 4a	26,94 8a	0.57 9a	9,484ab
Wilis	6.656a	4.01 2a	27,61 8a	0.59 2a	9,672ab c
UM 7-6	6.752a	4.08 4a	27,88 1a	0.62 8a	10,211b cd
UM 4-1	6.881a	4.13 5a	28.87 3a	0.66 8a	10.22bc d
UM 7-2	7,083a	4.15 4a	30.79 9a	0.79 8a	10,304c d
Gumitir	11.31 6b	8.64 3b	233,2 68	0.91 b	10,441d

LSD test on the N-fertilizer treatments showed that the dose of 25 g had significantly larger and wider leaf, more leaf ratio. Table 3 presents the complete result of LSD test.

Table 3. Summary of 5% LSD Test Result for Treatment of Nitrogen Fertilizer Dosage In Each Morphological Character.

Dose of Fertilizer / polybag	Leaf width	Leaf area	Leaf ratio	The length of the petiol
50g	3.972a	26,1 77a	0.776a	10,206b c
0g	4.001a	28,6 81a	0.579a	9.694ab
75g	4.133a	31,4 71a	0.572a	10.59c
25g	6,565b	142. 635b	0.787 b	9,331a

LSD test on the combination treatments showed that the Gumitir strain combined 25 g of N-fertilizer had significantly longer, wider and broader leaf than other soybean. While other strains did not have differences in leaf length, leaf width, nor leaf area. Gumitir strain with treatment of Nitrogen at dose 25 g and UM 2-4 strain with treatment of Nitrogen at dose 50 g has leaf ratio which is significantly greater than other combination treatment. Table 3 presents the complete result of LSD test

Table 4. Summary of 55% BNT test results for Combination treatment on each morphological character

Combination	Long Leaf	Leaf Width	Leaf Area	Leaf ratio	Petiol Length
UM 6-2 Nitrogen 0 g	5.958 a	3.292a	19.668 a	0.55 2a	7,817a
UM 2-4 Nitrogen 0 g	7.274 a	4.097a	31.467 a	0.57 6a	8.867ab cde
Wilis	8.13a	5.192a	40,407 a	0.67 4a	13,144j
UM 7-6 Nitrogen 0 g	7,123 a	4,014	30.295 a	0.56 4a	10,198d efghi
UM 4-1 Nitrogen 0 g	6.208 a	3.358a	20,883 a	0.55 4a	8.492ab c
UM 7-2 Nitrogen 0 g	6.825 a	3.792a	26,573 a	0.55 3a	9,158ab cdef
Gumitir	7.275 a	4.217a	31,473 a	0.58 7a	10,183d efghi
UM 2-4 * Nitrogen 25 g	6.25a	3.983a	25,068 a	0.63 8a	8.767ab cd
UM 7-6 Nitrogen 25 g	6.75a	3.8a	26,181 a	0.56 5a	9,175ab cdef
UM 4-1 Nitrogen 25 g	6.025 a	3,642a	21.419 a	0.64 3a	8.3ab
UM 7-2 Nitrogen 25 g	6.45a	3.882a	27,474 a	0.92 4a	10,153d efghi
Willis * Nitrogen 25 g	6a	3.65a	21.9a	0.60 9a	10,483f ghi
Gumitir Nitrogen 25 g	24.32 5b	3.917a	850.06 b	1.54 8b	9,925cd efgh
UM 6-2 Nitrogen 50 g	6.157 a	3.457a	19,549 a	0.56 6a	9,799bc defg
Nitrogen 2-4 UM 50 g	4.567 a	4,042a	16.925 a	1.90 8b	10,025d efghi
Willis * Nitrogen 50 g	6.383 a	4.217a	27,163 a	0.65 8a	9,358bc def
UM 7-6 Nitrogen 50 g	5.825 a	3.292a	19,029 a	0.58 2a	10,208d efghi
UM 4-1	8,096	4.882a	41.211	0.60	11,481i

Nitrogen 50 g	a		a	1a	
Nitrogen 7-2 UM 50 g	7.15a	4a	29.961 a	0.568a	10,317efghi
Gumitir Nitrogen 50 g	7,367a	23,142a	29,403 a	0.546a	10,258defghi
UM 6-2 Nitrogen 75 g	7.4a	4.483a	35.638 a	0.594a	11.292ghi
UM 2-4 Nitrogen 75 g	8,053a	4.214a	37.012 a	0.516a	10,278defghi
Willis * Nitrogen 75 g	6.11a	3.479a	22.056 a	0.576a	8,231ab
UM 7-6 Nitrogen 75 g	7.308a	4.392a	32,286 a	0.607a	11.3ghi
UM 4-1 Nitrogen 75 g	7.196a	4.164a	31.978 a	0.581a	10,416efghi
UM 7-2 Nitrogen 75 g	7.908a	4.492a	39,191 a	0.627a	11.217ghi
Gumitir Nitrogen 75 g	6.296a	3.225a	22,135 a	0.512a	11.398hi

Qualitative results of the morphological character of soybean crops were showed that all soybean strains have oval leaves, purple flowers, brown pod color, brown fur color, and purple hypocotyl color. The observations can be seen in Table.5

Table 5. Summary of Qualitative Observation Results Morphological Character of Soybean Crops

The strain	Leaf shape	Color Flower	Cooked Color Pod	Color of Stem Fur	Hypocothyl color
UM 6-2	Oval	Purple	Chocolate	Chocolate	Purple
UM-24	Oval	Purple	Chocolate	Chocolate	Purple
Wilis	Oval	Purple	Chocolate	Chocolate	Purple
UM 7-6	Oval	Purple	Chocolate	Chocolate	Purple
UM 4-1	Oval	Purple	Chocolate	Chocolate	Purple
UM 7-2	Oval	Purple	Chocolate	Chocolate	Purple
Gumitir	Oval	Purple	Chocolate	Chocolate	Purple

Strains, N-fertilizer dosage, and the combination of both had significant effect on each morphological character. Strains have an influence on the morphological character of a plant. Among many factors that affect the growth of a plant one of which is the nutrient. The results showed that the dosage of n-fertilizer influenced the length of petiole, leaf ratio, leaf width, and leaf area, but no effect on the length of soybean leaf. Nitrogen is a very important nutrient needed by plants (Pambudi, 2015). This nutrients are inseparable from chlorophyll molecules and hence the sufficient nitrogen supply will increase vegetative growth of plants (Novriani, 2011). Nitrogen is one of the most important nutrients for plants that have a major impact on plant growth and development, which has an important role for soybean crops (Mahmet, 2008;Yagoub et al., 2012).

Application of fertilizer at a dose of 25 g/polybag significantly affects the morphological character of the soybean crops compared with control or without the application of nitrogen. The Gumitir strain with treatment of Nitrogen at dose 25 g has significantly longer, wider, broader leaf, while other strains do not have significant differences in leaf length, leaf width, leaf area. Plants that do not get sufficient nitrogen will tend to be hampered growth. Plants with nitrogen deficiency will appear thin, dwarfed and brown, nitrogen deficiency will limit the production of proteins, enzymes, and nucleotids and other ingredients such as lignin in the formation of new cells (Meliala, 2009).

Application of N-fertilizer at dose of 25 grams/polybag on soybean has produce significantly larger and wider leaves, more leaf ratio, and has shorter petioles. Nitrogen is the main nutrient for plant growth, which is generally necessary for the formation or growth of vegetative parts of plants such as leaves, stems, roots (Mul, 1994). The research conducted by Muzammil et al (2010) showed that the application of nitrogen fertilizer is also associated with the increase of plant height, because with the higher the plant the bigger opportunity to produce more branches. On the other hand, the application of nitrogen fertilizer which can increase the height and dry weight of the plant is not adversely affects plant

freshness. Nitrogen will rapidly increase the growth of stems and leaves (Zainal et al, 2014). The combination treatment showed that soybean from Gumitir strain with treatment of Nitrogen at dose 25 g had significantly longer, wider and broader leaf. Gumitir strain with treatment of Nitrogen at dose 25 g and UM 2-4 strain with treatment of Nitrogen at dose 50 g has leaf ratio which is significantly greater than other combination treatment.

According to The Beans and Tuber Plant Research Institute (2008), recommendation of Nitrogen fertilization on 25-50 kg urea / ha soybean or equivalent to 25 -50 g / polybag as a starter to achieve optimal growth. Excessive fertilization is also not good for soybean, the doses of 250 kg N / ha decreases stomatal opening and affects vegetative growth of plants (Budiman, 2013).

Qualitative observation on the morphological character showed all soybean strains having the shape of oval leaves, purple flowers, brown pod color, brown fur color, and purple hypocotyl color. Soybean crops given the treatment of various doses of nitrogen fertilizer were significantly influenced its grown especially on hypocotyl, leaf, and flower.

The plant morphologically grows normally. Soybean has compound leaves, the main leaves are unifoliate, opposite and ovoid, the secondary leaves are trifoliolate, have purple flowers (Biology document, 1996; AAK, 1989). The color is generally light green and yellowish green, leaf shape ranging from oval to triangular depends on the strains, soybean flowers are called purple butterfly flowers, pods on soy depending on the type (AAK, 1989).

4. CONCLUSION

The conclusion of this research is: 1) difference strains effect the length of petiole, leaf ratio, leaf length, leaf width, and leaf area, 2) treatment of nitrogen fertilizer effect on the length of petiole, leaf ratio, leaf width, leaf area, but no effect on the leaf length, 3) the combination treatment influenced the length of petiole, leaf ratio, leaf width. Strain Gumitir has the best morphological character compared to other soybean strain. 4) the application of n-fertilizer at a dose of 25 grams / polybag significantly gave the best influence on morphological characters compared to other doses. 5) different doses of nitrogen fertilizer has no effect on leaf shape, flower color, cooking pod color, stem color, and soybean plant hypocotil color.

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