EFFECT OF CUTTING MATERIAL SELECTION AND INTENSITY OF SUNLIGHT RADIATION ON GROWTH OF *Mucuna bracteata* SEEDLING

Amar Ma'ruf[1*], Retni Mardu Hartati[2], Neny Andayani[2]
*[1]Department of Agriculture, University of Asahan Asahan, Indonesia; [2]Department of Agriculture, Stiper Institute of Agriculture, Indonesia; *Corresponding author: amarmaruf38@gmail.com*

Abstract. The aims of this research is to know the growth of *Mucuna bracteata* seedlings from cuttings material, and its response to the selection of cuttings and the response to the percentage of irradiation (sunlights) intensity. This research was conducted at Alur Dumai Estate Nursery Garden, Lahan Tani Sakti Company, Rokan Hilir District, Riau Province. The experiment was conducted on May - July 2013. This research used experimental method with Split Plot Experiment design with 2 factors, the factors are: First factor, intensity of sunlight as main plot consists of 3 levels: P0 = Intensity of irradiation 100%, P1 = Intensity of irradiation 75%, P3 = Intensity of 50% irradiation. The second factor is the segment of cuttings material as sub plot which consists of 3 levels: T1 = fourth cuttings segment from shoot, T2 = seventh cuttings segment from shoot, T3 = tenth cuttings segment from shoot. The observed data were analyzed by Analysis of Variance. The result of LSD test at the 5% test level showed that the sunlight intensity treatment had a significant effect on the number of seedling leaves. From the average calculation of each parameter, the intensity of 100% sun showed the highest response to the number of seedling leaves. While on the treatment of cutting material gives a significant effect on the fresh weight of seedlings, dry weight of seedlings, the number of leaves, the height of seedlings. The seventh segment cutting material gives the highest effect to the number of seedling leaves that is 6.33 leaves, height of seedlings with the height of seedling 75.00 cm, fresh weight of seedlings which is 14.05 g, and to the to the dry weight of seedlings which is 2.48 g.

Keywords: *Mucuna bracteata*, seedling, cutting, radiation of sunlight

INTRODUCTION

In the management of palm oil plantations, the policy of planting of legume cover crops (LCC) as land cover has long been implemented especially in young cultivation. The cultivation of legume cover crops aims to overcome surface erosion and soil nutrient leaching, enrich organic materials, nitrogen fixation to enrich the soil N nutrients, improve soil structure, and suppress weed growth (Pahan, 2006). Since the last few years there has been the fact that the planting of LCC on plantations has shifted from conventional LCC (a mixture of *Pureria javanica, Colopagonium caeruleum, and Centrosema pubescens*) to LCC *Mucuna bracteata*. Compared to conventional LCC, *Mucuna bracteata's* advantages include fast growth, high biomass production, resistance to drought. At the end of the third year after planting, dry matter production from *Mucuna bracteata* was 8-10 tons ha^{-1}, while in conventional LCC only 4.4 tons ha^{-1}. The added nitrogen nutrient is 220 kg ha^{-1}, which is twice as large as the conventional LCC. Production of litter 3.4 - 7.3 ton ha^{-1} while in conventional LCC only 1.5 ton ha^{-1} (Anonymous, 2005).

The plant breeding of *M. bracteata* is done generatively and vegetatively. In generative planting, *Mucuna bracteata* seed sprouts are not very high, the plants produced are not uniform, and the production period is relatively long. Therefore, the fulfillment of the needs of seeds in the framework of rejuvenation and opening of oil palm plantations, more emphasis on vegetative breeding. Vegetative propagation in *M. bracteata* plant is

generally done by cuttings. The cuttings has some virtues: the absence of the problem of fake shoots (Cramer, 1934, in Sastrowiratmo, 1988), does not require any special skill in its execution, the cost is cheaper (Vasudewa, 1983, in Sastrowiratmo, 1988), the seedlings produced are relatively more uniform and its success is high (Hearer, 1970). However, the main problem in cuttings is the percentage of rooted and sprouting turf is not always high (Kasno and Situmorang, 1973).

Percentage fluctuations of seedlings from cuttings are influenced by factors in cuttings material and external factors (Fiester, 1952). Including factors in cuttings material are the age of the substance and the type of palnts (Prawoto, 1986, in Sastrowiratmo, 1988). Including external factors affecting the percentage of seedling from cuttings are 1) when taking the substance which may be related to carbohydrates, nitrogen compounds, growth regulators and the development stage of the shoots, 2) the pretreatment of the substance, for example the treatment, the use of growth regulators and etiolation, 3) environmental factors consisting of light, temperature and humidity during handling and rooting medium.

The aims of this research is to know the growth of *Mucuna bracteata* seedlings from cuttings material, and its response to the selection of cuttings and the response to the percentage of irradiation (sunlights) intensity.

RESEACRH METHODS

This research was conducted at Alur Dumai Estate Nursery Garden, Lahan Tani Sakti Company - Minamas Plantation located in Pondok Kresek Village, Pujud Subdistrict, Rokan Hilir District, Riau Province. The experiment was conducted in May - July 2013. This research used experimental method with Split Plot Experiment design with 2 factors, the factors are: First factor, intensity of sunlight as main plot consists of 3 levels: P0 = Intensity of irradiation 100%, P1 = Intensity of irradiation 75%, P3 = Intensity of 50% irradiation. The second factor is the segment of cuttings material as sub plot which consists of 3 levels: T1 = fourth cuttings segment from shoot, T2 = seventh cuttings segment from shoot, T3 = tenth cuttings segment from shoot. Observation parameters in this research were: number of seedlings, height of seedlings (cm), fresh weight of seedlings (g), dry weight of seedlings (g). The observed data were analyzed by Analysis of Variance. To know the difference of treatment done Least Significant Difference (LSD) test with real level 5%.

The cuttings material taken from plants in the field that has been aged 8-12 months, derived from the shoot, the middle of the vine plants, so that the length of the cuttings is made 3 segments.

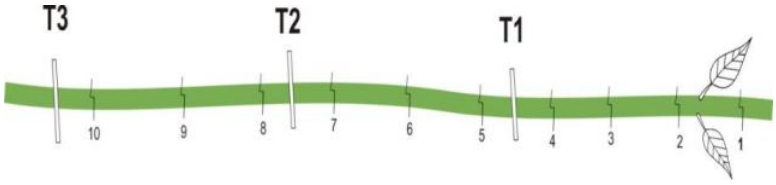

Fig. 1. Introduction of Cutting Materials

RESULTS AND DISCUSSION

Number of Seedling Leaves

Table 1 shown that the intensity of sunlight 100% (5.83) showed the highest effect on the number of seedling leaves, followed by the intensity of sunlight 75% (4.59) and 50%

(4.50). The seventh segment cutting material (6.33) showed the highest effect on the number of seedlings leaves, followed by the tenth segment cutting material (4.50) and the fourth segment cutting material (4.09).

Table 1

Effect of sunlight intensity and cutting material on the number of seedling leaves

Sunlight Intensity (% of Irradiation)	Cutting Material			Average
	4th Segment	7th Segment	10th Segment	
100%	5.17	6.17	6.17	5.83
75%	3.78	6.67	3.33	4.59
50%	3.33	6.17	4.00	4.50
Average	4.09	6.33	4.50	

Height of Seedlings

Table 2

Effect of sunlight intensity and cutting material on height of seedling (cm)

Sunlight Intensity (% of Irradiation)	Cutting Material			Average
	4th Segment	7th Segment	10th Segment	
100%	39.00	61.17	53.67	51.28
75%	35.94	98.17	33.00	55.70
50%	28.33	65.67	31.33	41.78
Average	34.43	75.00	39.33	

Table 2 shown that between the intensity of sunlight 100% (51.28 cm), the intensity of sunlight 75% (55.70 cm), and the intensity of sunlight 50% (41,78 cm) did not give significant effect on height of seedlings. The seventh segment cutting material (75,00 cm) gave the highest effect on height of the seedlings, followed by tenth segment cutting material (39.33 cm) and the fourth segment cutting material (34.43 cm).

Fresh Weight of Seedling (g)

Table 3

Effect of sunlight intensity and cutting material on fresh weight of seedling (g)

Sunlight Intensity (% of Irradiation)	Cutting Material			Average
	4th Segment	7th Segment	10thSegment	
100%	6.32	12.83	12.59	10.58
75%	5.82	15.36	4.01	8.40
50%	9.30	13.96	3.78	9.01
Rerata	7.15	14.05	6.79	

Table 3 shown that between the intensity of sunlight 100% (10.58 g), the intensity of sunlight 75% (8.40 g), and the intensity of sunlight 50% (9.01 g) did not give a significant effect on the fresh weight of seedlings. The seventh segment cutting material (14.05 g) showed the highest effect on the fresh weight of seedlings.

Dry Weight of Seedling (g)

Table 3

Effect of sunlight intensity and cutting material on dry weight of seedling (g)

Sunlight Intensity (% of Irradiation)	Cutting Material			Average
	4th Segment	7th Segment	10thSegment	
100%	1.56	2.50	2.66	2.24
75%	1.06	2.25	0.65	1.32
50%	1.86	2.69	0.76	1.77
Average	1.49	2.48	1.35	

Table 4 shown that between the intensity of sunlight 100% (2.24 g), the intensity of sunlight 75% (1.32 g), and the intensity of sunlight 50% (1.77 g) has no significant effect on the dry weight of seedlings. The seventh segment cutting material (2.48 g) showed the highest effect on the dry weight of seedlings.

Effect of Sunlight Intensity on Growth of *Mucuna Bracteata*

The result of LSD test at the 5% test level showed that the sunlight intensity treatment had a significant effect on the number of seedling leaves. From the average calculation of each parameter, the intensity of 100% sun showed the highest response to the number of seedling leaves. The growth of seedling leaves of *Mucuna bracteata* is affected by the intensity of sunlight. The high intensity of sunlight, in line with the number seedleng leaves of *Mucuna bracteata*. Therefore, the activity of plant metabolism in full instensity of sunlight more leverage than the shaded plants. Boysen-Jensen and Muller (1929) in Fitter and Hay (1981) claim that a similar physiological state difference can be found between each leaf in a single plant. The shaded and shaded leaves differ in their morphological state, and show parallel differences in their response to the intensity of light.

Fitter and Hay (1981) suggest that the shaded leaves problem is to maintain a positive carbon balance, and the drainage density in which this state is achieved, is a compensation point. Under low light pressure there are three options: 1) reduction of respiration rate, to decrease the point of compensation; 2) Increased leaf area, to obtain a larger surface for light absorption; and 3) Increased the speed of photosynthesis of each unit of light energy and leaf area.

Seedling height of *Mucuna bracteata* not too affected by intensity of sunlight. Harahap *et al.* (2008) suggest that *Mucuna bracteata* is a shade tolerant plant. According to Fitter and Hay (1981) normally most of the weeds show symptoms of etiolation in the dark. Normal etiolation is not observed in adaptable and resistant species of confinement (Fitter and Ashmore, 1977 *in* Fitter and Hay (1981). Then the plants that are at the intensity of radiation 100% or without shade is also not as good as in plants with shade. In accordance with opinion (Morgan and Smith, 1979 *in* Fitter and Hay, 1981), that the rate of stem extension, leaf weight ratio and petiole extension are all more labile in plants adapting to open state than found to grow in shading.

Effect of Cutting Material Selections on Growth of *Mucuna Bracteata*

The result of LSD test at the 5% test level showed that cutting material selection treatment had a significant effect on fresh weight of seedlings, dry weight of seedlings, number of leaves, height of seedling. Growth of cutting material from juvenile stage is better than cutting material from reproductive segment and end segment that is still too young. This is related to factors that is cause plant still too young, presence of inhibitors, endogenous auxin content and co-factor content. Ingredients of juvenile stage origin have not formed growth inhibitors, endogenous auksin content and co-growth factors are better than

reproductive stem-origin material (Hartmann and Kester, 1975). The most influential co-factor content of leaf growth is Nitrogen. Franklin *et al.* (1991) states that N deficiency leads to a reduction in the growth and aging of the leaves. Other minerals seem to have less effect than N on growth and leaf aging.

CONCLUSION

The result of LSD test at the 5% test level showed that the sunlight intensity treatment had a significant effect on the number of seedling leaves. From the average calculation of each parameter, the intensity of 100% sun showed the highest response to the number of seedling leaves. While on the treatment of cutting material gives a significant effect on the fresh weight of seedlings, dry weight of seedlings, the number of leaves, the height of seedlings. The seventh segment cutting material gives highest effect to the number of seedling leaves that is 6.33 leaves. The seventh segment cutting material gives the highest effect to the height seedlings with the height of seedling 75.00 cm. The seventh segment cutting material gives the highest effect to the fresh weight of seedlings, which is 14.05 g. The seventh segment cutting material gives the highest effect to the dry weight of seedlings which is 2.48 g.

REFERENCES

1. Anonim, 2005. Laporan Tim Scientific Exchange Pusat Penelitian dan Pengembangan Perkebunan.
2. Fiester D.R. 1952. Some Aspects of the asexsual propagation of cortex by cutting. Inter American Institute Agriculture, Turrieble, Costarica. 92 p.
3. Fitter, A.H. and R.K.M Hay (1981). Fisiologi Lingkungan Tanaman. Gadjah Mada University Press.
4. Franklin, P. Gardener, R. Brent, R.L. Mitchel. 1991. Fisiologi Of Crop Plant. Penerbit The Lowa State University.
5. Hearer, A.E. 1970. Coffe growing. Oxford Universitas Press. Ely House, London. 127 p.
6. Hartman, H.T and D.E. Kester. 1975. Plant Propagation principles and practices. Third Ed.Prentice-Hall, Inc., Englewood Cliffs, New Jersey.
7. Kasno E. P. and Situmorang. 1973. Usaha-usaha mempercepat pembentukan akar pada stek coklat. KTP IV Naskah Karya no. 9 Budidaya Kopi dan Coklat. Tretes 3-6 Desember 1973.
8. Kramer, P.J and T.T. Kozlowski. 1961. Physiology of Tress. MC Graw-Hill. Co. Inc, New York. Toronto. London
9. Pahan, I. 2006. Panduan Lengkap Kelapa Sawit. Manajemen Agribisnis dari Hulu hingga Hilir. Penebar Swadaya, Jakarta.
10. Sastrowiratmo, S. 1988. Kajian Penurusan Kopi Arabika dengan Tingkat Perkembangan Turus Berbeda dan Perlakuan IBA. Fakultas Pasca Sarjana. Universitas Gadjah Mada. Vol (-) : p-p
11. Vissoh P, VM Manyong, JR Carsky, P Osei Bonzu and M Galiba. 1998. Experience with Mucuna in West Afrika. IDRC, Ottawa.