Comparison of the Diversity of Weed Types in Oil Palm (*Elaeis guineensis* Jacq.) Plantations that have not been Replanted and After Replanting in PTPN II North Sumatera

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ABSTRACT

Comparison of the Diversity of Weed Types in Oil Palm (Elaeis guineensis Jacq.) plantations that have not been replanted and after replanting in PTPN II, North Sumatra.". This study aims to determine the composition, structure of weed vegetation and the comparison of weed diversity in oil palm plantations before and after replanting. This study used a quadratic method with purposive sampling of weeds where the plots were 1 x 1 m in size with a total of 9 plots. The results of this study found that the composition of weeds on oil palm land before replanting was 12 families and 4 species, while on land after replanting there were 10 families and 5 species. The structure of weeds on the land before replanting with dominant weeds was Chrysopogon aciculatus (Retz) trin with an INP value (25,76%). was Ottochloa nodosa Kunth with an INP value (36.14%) while the lowest value was on weeds with an INP value (3.52%). on oil palm land after replanting the diversity value is I<H'<3

Keywords :*Oil Palm, Weed diversity, Plantation, Replanting, and Comparison*

1. INTRODUCTION

Palm oil (*Elais guineensis* Jacq) is the world's largest producer of vegetable oil. According to USDA data in 2014 in Woittiez, et al, 2017. Worldwide palm oil production is estimated at 63 tonnes of crude palm oil per year or 36% of the world's total vegetable oil production. Indonesia is the world's largest producer of palm oil. According to dataDirectorate General of Plantations (2016), The area of oil palm plantatis in the period 1980-2016 has increased 39 times. This increase in area occurred in People's Plantations (PR), State Large Plantations (PBN), and Large Private Plantations (PBS). Based on the concession status, PBN controls 11.67% of the area of oil palm plantations in Indonesia, PBS 50.77% of the area of oil palm plantations in Indonesia, and PR 37.5% of the area of oil palm plantations in Indonesia. Over the past 100 years, the oil palm crop has transformed from an agriforestry and ornamental plant to an important vegetable oil-producing crop in the world.(Woittiez et al., 2017).

Langkat Regency has the third largest oil palm plantation in North Sumatra Province. The area of oil palm plantations in Langkat Regency in 2019 was 47.17 thousand ha. The expansion of this plantation area increased from the previous 46.72 thousand ha in 2017. This increase in area was accompanied by an increase in FFB production as well. FFB production in 2017 which was originally 67.37 thousand tons/ha increased to 758.72 thousand tons/ha in 2019 (Central Bureau of Statistics of North Sumatra Province, 2020).

*Replanting*is the process of rejuvenating oil palm plantations, namely by replacing oil palm trees that are 20-25 years old with new oil palm trees because oil palm trees that are 20-25 years old are no longer productive the results are decreasing every month. This oil palm tree may not be replanted but this old palm tree no longer provides great benefits to the owner because it is not productive and the yield is low. In accordance with the technical age cycle of oil palm cultivation which must begin to be rejuvenated after the age of 20 years and over, the business activities of oil palm plantations in Riau, which were initially developed in the 80s, have now come to be replanted, even past the due time, (Een Saputri, 2018).

Research conducted by Susanti et al. (2014) stated that the alternative underplanting rejuvenation model is able to provide financial benefits compared to the intercropping rejuvenation model (intercropping). Rejuvenation of the underplanting model has been judged to be more effective and efficient. This model cuts down old plants in stages or not entirely so as to allow the company not to lose revenue as long as the replanted plants are not yet mature because there is still income from the remaining old plants.

The purpose of the study was to determine the composition, structure of weed vegetation and the comparison of weed diversity in oil palm plantations before and after replanting.

2. MATERIAL AND METHOD

This research will be carried out in the oil palm plantation of PTPN II, the upstream oil palm plantation unit on plants that have been replanted and the Tanjung gabus fence merbau business unit on plants that have not been replanted. Research Time from May to June 2021.

The tools used in this research are tape measure, scissors, stake, machete, ruler, calculator, stationery, camera, raffia

rope and crank knife. The materials used in this study were spirits, plastic bags, cardboard, cardboard, weed identification books, specimens, field collections and secondary data from PTPN II.

This study used a quadratic method with purposive sampling of weeds where the plots were 1 x 1 m in size with a total of 9 plots. Determining the number of plot determination methods using a mathematical equation approach according to Zaidan et al., 2017 where:

Observation plot = 10% of the total area of observation (1 plot represents 1 Ha of the observation area).

So that :

Observation plot = 10% x 220 Ha, 9 plots represent 9 Ha.

The data obtained were then processed using the formulation of the square plot method (Handayani, 2006, Indriyanto, 2006). The calculation parameters and the formula used are vegetation analysis with the formula (Odum, 1993):

➢ Density (K)

Density is the number of individuals of a type of weed in a certain location, formulated:

$$Ki = \frac{\varepsilon\ individu\ jenis\ gulma}{luas\ letak\ sampel}$$

➢ Relative Density (KR)

Relative density is the percentage of the density of a type of weed to the density of all types of weeds, formulated as:

$$KR = \frac{K\ jenis\ gulma - i}{k\ total\ seluruh\ jenis\ gulma} x100\%$$

➢ Frequency of each Weed Type (F)

Frequency is the ratio of the number of weed types found in sample plots to all sample plots made, the calculation of the frequency of each type of weed is calculated by the formula:

$$F = \frac{\varepsilon\ sub\ sampel\ ditemukan\ jenis\ gulma - i}{\varepsilon\ seluruh\ petak\ sampel}$$

➢ Relative Frequency (FR)

The relative frequency is the percentage of the frequency of a type of weed to the frequency of all types of weeds, formulated as:

$$FR = \frac{F\ jenis\ gulma - i}{F\ total\ seluruh\ jenis\ gulma} x100\%$$

➢ Important Value Index (INP)

The important value index is the result of the sum of the relative values of the two parameters (density and frequency) that have been previously measured, so that their values also vary, formulated as:

INP = relative density + relative frequency

➢ Summed Dominance Ratio (SDR)

Comparison of important values is formulated:

$$SDR = \frac{INP}{2}$$

➢ Weed diversity of the Shonnon – Winner index was calculated using the formula:

$$H' = Pi \ In \ Pi$$

Information :

H'= Species Diversity Index

Pi= Probability of interest for each species

= in/N

Ni= Number of individuals per one species

N= Total number of individuals

Classification of diversity level categories as follows:

H'<1 : Low Diversity Category

1<H'<3: Medium Diversity Category

H'>3 : High Diversity Category

3. RESULTS AND DISCUSSION
Analysis of Weed Composition in Oil Palm Plantations

Comparison of weed composition in oil palm plantations before replanting and post replanting can be seen in Table 1

Table 1. Comparison of weed composition in oil palm plantations before replanting and after replanting

No	Family	Species	Comparison of Weed Composition	
			Before Replanting	After Replanting
	broadleaf weed			
1	Asteraceae	*Ageratum Conyzoides L*	-	14
2	Asteraceae	*Borreria Alata (Aubi) Rubia Cede*	25	-
3	Araceae	*Syngonium Podophyllum*	-	16
4	Acanthaceae	*Asystasia Intusa (Bi)*	23	-
5	Fabaceae	*Mimosa Invisal*	43	-
6	Melastomatacea	*Chidemia Hirta (1)*	-	39
7	Verbenaceae	*Stachytarpeta Indical (1) Vach*	7	-
	Narrow-leaved weed			
1	Cyperaceae	*Cyperus Brevifouus (Rootb) Cyperaceace*	45	35
2	Cyperaceae	*Cyperus Rotundus*	-	2
3	Poaceae	*Saccharum Spontaneum L (GRAMINEDE)*	39	-
4	Poaceae	*Paspalum Scrobiculatum L*	33	10
5	Poaceae	*Chrysopogon Aciculatus (Retz) Trin*	53	25
6	Poaceae	*Ottochloa Nodosa (Kunth) Dandy Graminae*	29	49
7	Poaceae	*Paspalum Conjugatum Berg.*	-	35
	fern weed			
1	Lomariopsidaacea	*Nephrolepis Biserrata (Sw) Schoot*	29	-
2	Ophioglossaceae	*Ophioglossum Resi Culatum Linn*	29	-
3	Polypodiacea	*Cyclosorus Aridus (Don). Ching*	13	-
	woody weed			
1	Melastomataceae	*Melastoma Malabathrium*	-	21
	Total		368	246

The most dominant weeds found before replanting in oil palm plantations were Chrysopogonn aciculatus (retz) trin which is a flowering plant weed and in post-replanting oil palm the most dominant weeds were Ottochloa nodosa (kunth) dandy graminae, a flowering plant weed.

Weed Vegetation Structure in Oil Palm Plantations Comparison of the structure of weed vegetation on oil palm plantations before replanting and post replanting was obtained by knowing the structure of the vegetation density value (K), relative density (KR), frequency (F), relative frequency (FR), important value index (INP) and comparison Summed dominance ratio (SDR) of each weed found in oil palm observation plots before replanting and after replanting can be seen in Tables 2 and 3.

Table 2. Structure of weed vegetation before replanting in oil palm tanaman

No	Species name	K	KR (%)	F	FR (%)	INP (%)	SDR (%)
	Broadleaf Weed						
1	*Asystasia Intusa (Bi)*	2.56	6.25	0.44	9.09	15.34	7.67
2	*Borreria Alata (Aubi) Rubia Cede*	2.78	6.79	0.44	9.09	15.88	7.94
3	*Mimosa Invisal*	4.78	11.68	0.44	9.09	20.77	10.39
4	*Stachytarpeta Indical (1) Vach*	0.78	1.90	0.22	4.54	6.45	3.22
	Narrow Leaf Weed						
1	*Cyperus Brevifouus (Rootb) Cyperaceace*	5.00	12.23	0.56	11.36	23.59	11.79
2	*Saccharum Spontaneum L (GRAMINEDE)*	4.33	10.60	0.56	11.36	21.96	10.98
3	*Paspalum Scrobiculatum L*	3.67	8.97	0.44	9.09	18.06	9.03
4	*Chrysopogon Aciculatus (Retz) Trin*	5.89	14.40	0.56	11.36	25.76	12.88
5	*Ottochloa Nodosa (Kunth) Dandy Graminae*	3.22	7.88	0.44	9.09	16.97	8.48
	Fern Weed						
1	*Cyclosorus Aridus (Don). Ching*	1.44	3.53	0.11	2.27	5.80	2.90
2	*Nephrolepis Biserrata (Sw) Schoot*	3.22	7.88	0.33	6.82	14.70	7.35
3	*Ophioglossum Resi Culatum Linn*	3.22	7.88	0.33	6.82	14.70	7.35
	Total	40.89	100	4.89	100		100

Note: density (K), relative density (KR), frequency (F), relative frequency (FR), important value index (INP) and summed dominance ratio (SDR)

Table 2 can be seen that the highest IINP (25.76%) and SDR (12.88%) values are found in weeds*Chrysopogon Aiculatus*(Retz) Trin is a flowering plant weed and the lowest values of INP (5.80%) and SDR (2.90%) were found in Cyclosorus Aridus (Don). Ching is a weed of the ferns. According to Irwanto, 2007 Vegetation is a collection of plants, usually consisting of several types that live together in one place. There is a close interaction between the individual constituents of the vegetation itself and with other organisms so that it is a system that lives and grows and is dynamic.

Table 3. Weed vegetation structure after replanting in oil palm plantations

No	Species name	K	KR	F	FR	INP	SDR
	Broadleaf Weed						
1	*Ageratum Conyzoides L*	1.56	5.69%	0.33	8.11%	13.80%	6.90%
2	*Chidemia Hirta (1)*	4.33	15.86%	0.56	13.52%	29.37%	14.69%
3	*Syngonium Podophyllum*	1.78	6.50%	0.44	10.81%	17.32%	8.66%
	Narrow Leaf Weed						
1	*Cyperus Brevifolius (Rottb)*	3.89	14.23%	0.33	8.11%	22.34%	11.17%
2	*Chrysopogon Aiculatus*	2.78	10.16%	0.44	10.81%	20.98%	10.49%
3	*Cyperus Rotundus*	0.22	0.81%	0.11	2.70%	3.52%	1.76%
4	*Paspalum Conjugatum Berg.*	3.89	14.23%	0.33	8.11%	22.34%	11.17%
5	*Paspalum Scrobiculatum L*	1.11	4.07%	0.33	8.11%	12.18%	6.09%
6	*Ottochloa Nodosa (Kunnth) Dandy*	5.44	19.92%	0.67	16.22%	36.14%	18.07%
	Woody Weed						
1	*Melastoma Malabathrium*	2.33	8.54%	0.56	13.52%	22.05%	11.03%
	Total	27.33	100%	4.11	100%		100%

Note: density (K), relative density (KR), frequency (F), relative frequency (FR), important value index (INP) and summed dominance ratio (SDR)

Table 3 can be seen that the INP value (36.14%)and SDR (18.07%) is highest in weeds*Ottochloa nodosa*(kunnth) dandy is a flowering plant weed and the lowest values of INP (3.52%) and SDR (1.76%) are found in Cyperus rotundus which is a flowering weed.

Weed Diversity in Oil Palm Plantations

From this study, the results of the diversity of weeds in oil palm plants before replanting and post replanting were obtained. Weed diversity can be seen in tables 4 and 5 below:

Table 4. Weed Diversity Index in Oil Palm Plantations before replanting.

No	Species	Number of Individuals (Eng)	Pi	La Pi	Pi*In Pi
	Broadleaf Weed				
1	*Asystasia Intusa (Bi)*	23	0.06	-2.77	-0.17
2	*Borreria Alata (Aubi)*				
	Rubia Cede	25	0.07	-2.69	-0.18
3	*Stachytarpeta Indical (1)*				
	Vach	7	0.02	-3.96	-0.08
4	*Mimosa Invisal*	43	0.12	-2.15	-0.25
	Narrow Leaf Weed				
1	*Cyperus Brevifouus*				
	(Rootb) Cyperaceace	45	0.12	-2.10	-0.26
2	*Chrysopogon Aciculatus*				
	(Retz) Trin	53	0.14	-1.94	-0.28
3	*Saccharum*				
	Spontaneum L				
	(Graminede)	39	0.11	-2.24	-0.24
4	*Paspalum*				
	Scrobiculatum L	33	0.09	-2.41	-0.22
5	*Ottochloa Nodosa*				
	(Kunth) Dandy				
	Graminae	29	0.08	-2.54	-0.20
	Fern Weed				
1	*Cyclosorus Aridus*				
	(Don). Ching	13	0.04	-3.34	-0.12
2	*Nephrolepis Biserrata*				
	(Sw) Schoot	29	0.08	-2.54	-0.20
3	*Ophioglossum Resi*				
	Culatum Linn	29	0.08	-2.54	-0.20
	Amount	368	1.00	-31.23	-2.39
				H'	2.39
	Category Diversity		1= 1>H'>3		

Note: H' = index of species diversity, Pi = probability of interest for each species (obtained from Ni/N where Ni = number of individuals of each species and N = total number of individuals) and Ln Pi = anti-log value of Pi.

Table 4 can be seen that the highest Pi Lon Pi values are found in weeds*Chrysopogon Aiculatus*(Retz) Trin is a flowering weed and the lowest valuePi Lon Pi is found in weeds*Stachytarpeta Indical*(1) Vach is a flowering weed. The overall value of weed diversity in oil palm plantations is H' = 2.39 which is in the medium diversity category with the range of the Shonnon Winner index value is= 1>H'>3 = medium category.

Table 5. Weed Diversity Index in post-replanting oil palm plantations.

No	Species	Number of Individuals (Eng)	Pi	La Pi	Pi*ln Pi
	Broadleaf Weed				
1	*Ageratum Conyzoides L*	14	0.06	-2.87	-0.16
2	*Chidemia Hirta (1)*	39	0.16	-1.84	-0.29
3	*Syngonium Podophyllum*	16	0.07	-2.73	-0.18
	Narrow Leaf Weed				
1	*Cyperus Brevifolius (Rottb)*	35	0.14	-1.95	-0.28
2	*Cyperus Rotundus*	2	0.01	-4.81	-0.04
3	*Chrysopogon Aiculatus*	25	0.10	-2.29	-0.23
4	*Paspalum Conjugatum Berg.*	35	0.14	-1.95	-0.28
5	*Paspalum Scrobiculatum L*	10	0.04	-3.20	-0.13
6	*Ottochloa Nodosa (Kunnth) Dandy*	49	0.20	-1.61	-0.32
	Woody Weed				
1	*Melastoma Malabathrium*	21	0.09	-2.46	-0.21
	Amount	246	1.00	-25.72	-2.12
				H'	2.12

Diversity Category	1= 1>H'>3

Note: H' = index of species diversity, Pi = probability of interest for each species (obtained from Ni/N where Ni = number of individuals of each species and N = total number of individuals) and Ln Pi = anti-log value of Pi.

Table 5. it can be seen that the highest Pi Lon Pi values are found in weeds*Ottochloa nodosa*(kunnth) dandy is a flowering weed and the lowest value*Pi Lon Pi* is found in weeds*cyperus rotundus*is a flowering weed. The overall value of weed diversity in oil palm plantations is H' = 2.12, which is in the medium diversity category with a range of values for the Shonnon Winner index is= 1>H'>3 = medium category.

(Chrysopogon Aciculatus Weed Documentation(Retz) Trin. Observation result)

4. CONCLUSION

Analysis of weed composition in oil palm plantations. The most dominant weed found before replanting was chrysopogonn aciculatus (retz) trin. Comparison of the structure of weed vegetation in oil palm plantations before replanting and after replanting the highest is found in weeds*Chrysopogon Aiculatus*(Retz) Trin.Weed diversity in oil palm before replanting and after replanting Niali Pi Lon Pi is highest in weeds*Chrysopogon Aiculatus*(Retz) TrinThe highest post-replanting diversity of Pi Lon Pi values is found in weeds*Ottochloa nodosa*(kunnth) dandy is a flowering weed and the lowest value*Pi Lon Pi* is found in weeds*cyperus rotundus*is a flowering weed.

REFERENCE

Ardana, IK, & Kariyasa, K. (2016). Influence of Technological Innovation and Use of Production Input on Productivity of Oil Palm in West Kalimantan Province. Journal

of Industrial Plant Research, 22(3), 125–134.

Central Bureau of Statistics of North Sumatra Province, 2020

Makassar Forestry Education and Training Center. 2011. Herbarium as a Planting Reference

Trees. http://www.badikhut.com. Retrieved 14 June 2012.

Een Saputri. 2018. Readiness of Oil Palm Farmers in Facing Replanting in Delima Jaya Village, Kerinci Kanan District, Siak Regency.

Ditjenbun. (2016). Palm Oil Outlook. Ministry of Agriculture.

Handayani, DM 2006. Analysis of Profitability and Income of Paddy Rice Farming by Area and Land Ownership Status in Karacak Village, Leuwilang District, Bogor Regency, West Java. Bogor. [Thesis] Bogor Agricultural University. 85 p.

HastutiP.W.2012, Herbarium, Yogyakarta State University, Yogyakarta.

Hutasoit, F., Hutabarat, S., Muwadi, D. 2015. Analysis of perceptions of RSPO certified independent oil palm smallholders in facing oil palm rejuvenation activities in Ukui District, Pelalawan Regency

Indriyanto. 2006. Forest Ecology. Earth Literature. Jakarta.

Irwanto. 2007. Vegetation Analysis for Management of Protected Forest Areas on Marsegu Island, West Seram Regency, Maluku Province. [Thesis]. Yogyakarta: Graduate School, Gadjah Mad University

Odum, EP 1993. Fundamental Ecology 3rd. WR Sauders Co. Philadelphia.

Setyamidjaja, D. 2006. Oil Palm Cultivation Series. Yogyakarta(ID): Kanisius.

Sembodo, DRJ 2010. Weeds and their Management. Yogyakarta: Graha Ilmu.

Susanti, E., Hutabarat, S., Muwardi, D. 2014. Comparative analysis of alternative conventional oil palm replanting models with underplanting of the People's Core Plantation (PIR) pattern in Sei Lambu Makmur Village, Tapung District, Kampar Regency. Journal of Faperta Vol 1 No 2. Riau University.

Woittiez, LS, Wijk, MT Van, Slingerland, M., Noordwijk, M. Van, & Giller, KE (2017). Yield gaps in oil palm : A quantitative review of contributing factors. European Journal of Agronomy, 83, 57–77.