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Research Article
Dynamic of Carbon, Nitrogen Content and Biomass Production of *Axonopus compressus* on Modified Shade Conditions of Oil Palm Plantation

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Abstract
Background: Beside as a source of energy for ruminants, grasses have been identified having a capacity as carbon storage. *Axonopus compressus* is a grass species that mostly found under shade condition of palm plantations and are easily adaptable with the ecosystem. As a part of the ecosystem, the grass would always carry on photosynthesis even under shade condition as encountered by *Axonopus compressus*. Thus, it might play an important role in storing carbon. **Methodology:** Therefore, in this study the capability of this grass in storing carbon were investigated including carbon storage dynamics, nitrogen content, C/N ratio and biomass production. In advanced, carbon and nitrogent content of soil were also studied. A completely randomized design was utilized as experimental design with different grass age of 10, 20, 30, 40, 50 and 60 days as the treatments. **Results:** Results indicated that grass age influenced significantly all parameters except carbon and nitrogen content as well as the C/N ratio of soil. Furthermore, it was also revealed that there is a dynamic of carbon storage in leaf, stemp and root of the grass. **Conclusion:** The capacity of the grass in storing carbon increased with increasing plant age.

Key words: Carbon storage, nitrogen, *Axonopus compressus*, age of grass

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INTRODUCTION

Recently, human population has been remarkably increased including in Indonesia. This, as the consequences would affect on increasing demand of animal protein that most commonly relies on beef supply. To fulfil sufficient supply of beef, it in turn, would depend on availability of the forage especially grasses. In essence, forage is the primary energy source for a ruminant to support their activities well. In Indonesia, more than 70% of forage that are consumed by ruminants are sourced from various local tropical grasses[1]. However, nowadays many Indonesian Cattlemen are facing difficulty in fulfilment of forages due to a shortcoming of permanent pastures. Meanwhile, on the other hand, the government is encouraging to expand the palm plantation area. Currently, there are around 12 million palm plantation area existed in Indonesia and this trend reveals progressively increases every year.

Although, the government seems to neglect the problem being faced by Indonesian Cattlemen but indeed this can be harnessed as a potential for expanding pastures. This had been identified by Martaguri *et al.*[2] where many of local tropical grasses were grown under shade of palm plantations in Jambi province and has been becoming part of its ecosystem. For palm plantation, these local tropical grasses are considered as weeds[3] but the existence of some type of grasses such as *Axonopus compressus* can be useful. It can be used for controlling other type of weeds that are more detriment by invading most gap areas in between palm plants so that limiting the spread of other weeds such as *Chromolaena odorata*, *Mikania cordata* and *Mikania micrantha*[4].

The present of tropical grasses in palm plantation would be a potential for pastures. These grasses could grow in the environment that is less light interception but still possible to perform a proper photosynthesis. Some type of grasses has been identified having a specific mechanism that help to adapt well in limited growing conditions[5]. However, shade condition would not affect their productivity[6]. One of this kind is *Axonopus compressus*[2].

Moreover, classifying as C4's plant would enable the grasses including *Axonopus compressus* to have a high photosynthesis rate[7]. During photosynthesis, the grasses would undergo a sequestration of carbon for producing carbohydrate. Carbon sequestration is an absorption of carbon dioxide (CO_2) of atmosphere semi permanently through photosynthesis that will further be converted by plant to be an organic compound. This conversion process is known as carbon fixation[8] that store carbon in the plant.

Carbon storage capacity of every grass species varied depending upon the species, CO_2 concentration in the atmosphere, light intensity, age and condition of the environment[9]. In China, pastures poses 17.5-56.4% of its carbon storage capacity though it is still varied by the type pastures[10]. Ni[11] estimated that the pastures in China have capacity to store carbon by around 9-16% of total absorbable carbon by pastures in the world. Meanwhile, savanna ecosystem has bigger potential of carbon sequestration in tropical region of America[12]. Therefore, introduction of some type of grasses on degraded pastures revealed as an alternative in improving carbon sequestration and increasing financial benefits of Cattlemen in Columbia Amazonia[13].

Interestingly, there have been no evident exposed about potential of carbon sequestration of grasses that are grown in palm plantations ecosystem especially for those that are exist in Jambi province. Therefore, investigation of carbon storage capacity and nutrient content of local tropical grasses that grow under shade of palm plantation are necessary to be investigated. This would be beneficial for strategic planning in stock management that would avoid putting heavy burden on ecology. Thus, in this present study, growth patterns and biomass production as well as dynamics of carbon and nitrogen of *Axonopus compressus* over its growing period under the coverage of palm plantation would be addressed in this observations.

MATERIALS AND METHODS

Experimental plan: Samples were collected from plots containing experimental plants with different age groups of 10, 20, 30, 40, 50 and 60 days as treatment. Each group was replicated 4 times and laid on Completely Randomized Design (CRD). Grasses were planted in with the same condition as being found in palm plantations of Jambi province. All observations were carried out in Field Laboratory of Agrostology, Department of the Nutrient Sciences and Feed Technology of Bogor, Institute of Agriculture and taken around 2 months (60 days). Meanwhile, C and N analysis of soil and grasses were performed at Soil and Land Resources of Agriculture, Faculty of Bogor, Institute of Agriculture.

Experimental procedures

Shade construction: Shade was made by using fishnet with light intensity about 50% or 258 lux/fc which is similar to shade condition in the real palm plantation. Light intensity was measured with Lux meter of Trotec BF50.

Planting media preparation: Planting media were prepared in accordance with modified procedure that was introduced by Dianita and Abdullah[14]. Soil from research garden of Agrostologi Laboratorium of IPB Animal Scince Faculty was excavated from below ground of 20 cm depth. This soil was then naturally dried in a glass house. The dried soil was shifted using a 2.0 mm of sieve. The dried and fine soil particles were weighed up to 5 kg and put down in a container before a 5 g of NPK fertilizer was added.

Cultivation and treatments: Pols of *Axonopus compressus* that were collected from palm plantations at Sarolangun Regency of Jambi province were cultivated in the pots and placed under shade according to experimental design. For 2 weeks, the pols were allowed to grow and replanting was conducted when dying off grasses is found. After the grasses growing up trimming was then conducted to ensure all grasses having the same height. Meanwhile, to maintain all grasses were growing well, watering was conducted twice a day (in the morning and afternoon). However, in rain condition, watering can be ignored. Furthermore, weeding was conducted every week. After 30 days of cultivation, soil structure was improved by tilling the soil.

Measurement and sample preparation: Measurement of grass length, number of leaves and biomass production was taken place after 7 days of grass trimming. This was carried on until being harvested at every 10 days, according to its treatment. Harvesting was performed by taking out all grass parts down to the root. The length of the grass was measured from the root up to the tip of a leaf. Furthermore, length progression was obtained by comparing the length of grass between recent harvest and previous harvest. The weight of fresh matter grass was obtained by weighing the grass that has been taken out from its container and separated from its root. Beforehand, the root was cleaned and drained for removing the retailing soil. Thereafter, dried grass was milled to get fine grass particles for analysis purposes in the laboratory. Meanwhile, soil will be stripped down from the grass root and further be placed in the oven for 48 h at a constant temperature of 70°C before bringing out to laboratory for carbon analysis. Carbon analysis of leaves, stems and root as well as the soil was performed by using the gravimetric method. Meanwhile, N analysis of leaves and stems was conducted using AOAC method[15].

Data analysis: Measured data that gathered from previous stage were analysed using analysis of variance (ANOVA) based on Steel and Torrie[16]. In advance, further tests were also conducted by adapting Duncan multiple range test.

RESULTS AND DISCUSSION

Carbon dynamics: During photosynthesis, plants would produce a carbon organic compound (e.g., carbohydrate) and accumulate them in body biomass such as stems, leaves, roots, tubers and other parts through photosynthesis[17]. This would progress continuously during their growing period. As such, it would affect the C organic content stored in those parts of grass. Thus, observation of C organic content that consists in vegetation is necessary to investigate. The results are shown in Table 1. Data in Table 1 had been analysed statistically and shows that most of them subject to significant difference of $p \leq 0.01$. This is represented by the superscript capital letter near to the value.

Due to having low value, the C organic found in the soil was not considered in this discussion. From Table 1, in general, the maximum percentage of C organic found in leaf, stem and root were comparable. The maximum percentage of C organic in leaf, stem and root were around 50, 47 and 49%, respectively. Nevertheless, they can still be distinguished by different patterns of their percentage of C organic stored at every growth period. By using curve fitting of quadratic of polynomial approach as presented in Eq. 1-3, it shows that the percentage of C organic pattern in root was likely to have the highest amplitude in comparison to that in the leaf. Meanwhile, the percentage of C organic pattern in stem tended to steadily decrease at the beginning of the observation (e.g., at 10 days) before slightly increase to maximum at age of 60 days. Thus, it is conceivable that either in the leaf or in the root, there is a dynamic carbon storage capacity over the observation age. This might be due to a dynamic of C sequestration in leaf and root over their growing period.

The dynamic of C sequestration in the leaf is considered as effect of photosynthesis. In photosynthesis, by use of triphosphopyridine nucleotide (TPNH) and adenosine triphosphate (ATP)[18], a chemical reaction would occur by transforming and reducing carbon from CO_2 into a C organic

Table 1: Percentage of C organic in *Axonopus compressus* and its soil obtained during the observation

	Percentage of C organic (%)			
Age (days)	Leaf	Stem	Root	Soil
10	44.75 ± 0.30^{B}	47.08 ± 0.23^{A}	48.18 ± 0.36^{B}	0.71 ± 0.02^{B}
20	42.71 ± 0.42^{C}	45.75 ± 0.59^{B}	42.78 ± 0.52^{C}	0.76 ± 0.05^{B}
30	43.02 ± 0.22^{C}	43.84 ± 0.45^{D}	41.88 ± 0.39^{D}	0.84 ± 0.03^{A}
40	42.53 ± 0.21^{C}	43.67 ± 0.23^{DE}	41.30 ± 0.35^{D}	0.54 ± 0.01^{C}
50	40.52 ± 0.31^{D}	42.97 ± 0.23^{E}	49.32 ± 0.44^{A}	0.72 ± 0.02^{B}
60	49.89 ± 0.23^{A}	44.80 ± 0.47^{C}	47.69 ± 0.50^{B}	0.74 ± 0.03^{B}

Value with superscript in capital letter indicates a significant difference ($p \leq 0.01$)

compound that is known as a carbon reduction cycle. This cycle is assumed to be varied over the growing period and dependency of photosynthesis rate[9]. The rate of photosynthesis is incorporated positively with chlorophyll that is an essential part of the chloroplast[19]. Synthesis of chlorophyll occurs in leaf and is influenced by the light, glucose, carbohydrate, water, temperature, genetic factors and nutrient quality[20]. As the leaf experiencing degradation and begun to fall, the synthesis would become slower. Thus the carbon reduction process might be stopped and accumulating the C organic in the leaf. Accordingly, it is plausible that the percentage of C organic in the leaf is the highest at the end growing period:

$$\text{C leaf (\%)} = 0.0085\text{Age}^2\text{-}0.5439\text{Age}+50.001 \text{ with } R^2 = 0.6168 \quad (1)$$

$$\text{C stem (\%)} = 0.0037\text{Age}^2\text{-}0.3149\text{Age}+50.116 \text{ with } R^2 = 0.9279 \quad (2)$$

$$\text{C root (\%)} = 0.0097\text{Age}^2\text{-}0.6342\text{Age}+52621 \text{ with } R^2 = 0.6132 \quad (3)$$

$$\text{C soil (\%)} = 0.00002\text{Age}^2\text{-}0.0015\text{Age}^2+0.0439\text{Age}+ \\ \text{-}0.4067 \text{ with } R^2 = 0.3385 \quad (4)$$

Furthermore, the capability of the leaf in storing much C organic at the end of its growing period is prior to the ability of *Axonopus compressus* to perform photosynthesis although in limiting light intensity. This is attributable to adaptation characteristics of *Axonopus compressus* that correspond to anatomy, morphology, physiology and biochemistry due to photosynthesis[21].

Moreover, the dynamic of C organic found in the root of *Axonopus compressus* might be as effect of photosynthesis where root has to function as transporter for product of photosynthesis in the leaf. Therefore, the percentage of C organic in the root also fluctuates over its growing period as in leaf. In addition, the highest percentage of C organic found in root may be an accumulation of C organic taken from the soil and stem[22].

In advanced, though the percentage of C organic found in soil was remarkably lower in comparison to that were identified in leaves, stems and roots however, the difference over the growing period was analysed significant. Besides, the dynamic of C organic over growing period was fitted to three-order polynomial approach as presented in Eq. 4.

Dynamics of nitrogen: Nitrogen is a substantial compound that can be found in chloroplast of plants. It plays a significant role for the chloroplast biogenesis. Chloroplast supplies the energy and reduces carbon necessary for the plant growth. Thus, it implies that by increasing nitrogen would in turn decrease the need of carbon for the plant growth. In this study, an analysis to examine the nitrogen content in *Axonopus compressus* had been performed.

Table 2 shows that distribution of nitrogen content in *Axonopus compressus* was somewhat different to that of distribution of C organic. The age only predominantly affected the percentage of N content of leaf and stem. Meanwhile, the age variation was considered insignificant in affecting the percentage of nitrogen content in the root due to have a tendency to be constant at all age levels. Whereas, as in percentage of carbon organic, percentage of nitrogen content in soil were only 15% that those N in root, leaf and stem, respectively.

Interestingly, it was shown that the highest percentage of N content; either for leaf or stem reveals at the age of 10 days. This is due to the addition of NPK fertilizer at the early age of growing period of *Axonopus compressus*. Thus, it is sequestered well by the plant. However, as age increases the content of N that can be sequestered is also reduced. So, accumulation of N content in the plant is also decreased.

Sirait[23] found that the addition of NPK would significantly increase the percentage of N content of Benggala grass at shading condition of 38 and 56%. Besides, age is also assumed to have an influence on the plant. Purnomo[24] stated that age would affect chlorophyll of the leaf. Meanwhile, N is known as one of composition of chlorophyll. Therefore, it implies that age would influence the percentage of N.

Furthermore, from this study, it appeared that N content found in the root of *Axonopus compressus* and its soil was insignificant. This indicates that there is a transfer of N content from the soil to the root, stem and leaf orderly. Therefore, the percentage of N content in the soil remains low. The ability of each part of the plant in absorption of nutrient is influenced by rooting system and nutrient concentration available in the root area[9].

In general, the percentage of N content in *Axonopus compressus* in this study was relatively low that was below

Table 2: Percentage of nitrogen (N) content of *Axonopus compressus* and its soil obtained during the observation

	Nitrogen (%)			
Age (days)	Leaf	Stem	Root	Soil
10	0.92 ± 0.05^{A}	0.66 ± 0.03^{A}	0.45 ± 0.02	0.07 ± 0.01
20	0.61 ± 0.03^{C}	0.64 ± 0.03^{A}	0.55 ± 0.04	0.07 ± 0.01
30	0.78 ± 0.02^{B}	0.47 ± 0.04^{BC}	0.49 ± 0.02	0.08 ± 0.01
40	0.67 ± 0.08^{C}	0.45 ± 0.03^{C}	0.48 ± 0.04	0.06 ± 0.01
50	0.62 ± 0.04^{C}	0.51 ± 0.02^{B}	0.50 ± 0.04	0.07 ± 0.01
60	0.79 ± 0.04^{B}	0.47 ± 0.02^{BC}	0.50 ± 0.06	0.07 ± 0.00

Value with superscript in capital letter indicates a significant difference ($p\leq0.01$)

1%. Meanwhile, Dianita and Abdullah[14] found that percentage of N content in *Axonopus compressus* under shading condition was around 2.9%. In addition, percentage of N content in some of grasses species observed by Sirait *et al.*[6] was around 2.16%. This difference might be subjected to variation in nutrient concentration of the soil that were used as growing media.

Furthermore, it was identified the dynamic of N content found in *Axonopus compressus* as in C organic. Using four-order polynomial approach, the dynamic pattern of N content were following Eq. 5-7. Interestingly, the pattern of dynamic of N content in *Axonopus compressus* is almost the same except its magnitude. This indicates that accumulation of C organic is an N-limitation[25]:

$$\text{N leaf (\%)} = 2\times10^{-6}\text{Age}^4\text{-}0.0003\text{Age}^3\text{+}0.0133\text{Age}^2\text{-}0.267\text{Age+}2.5033 \text{ with } R^2 = 0.9101 \quad (5)$$

$$\text{N stem (\%)} = \text{-}1\times10^{-6}\text{Age}^4\text{+}0.0001\text{Age}^3\text{-}0.0066\text{Age}^2\text{+}0.111\text{Age+}0.0767 \text{ with } R^2 = 0.9938 \quad (6)$$

$$\text{N root (\%)} = \text{-}5\times10^{-7}\text{Age}^4\text{+8E-05Age}^3\text{-}0.0043\text{Age}^2\text{+}0.0885\text{Age-}0.0833 \text{ with } R^2 = 0.9703 \quad (7)$$

C/N ratio: The C/N ratio is a ratio of C organic to nitrogen content. This ratio can be used to identify the limitation of nitrogen content of a plant. In addition, it is also useful in Paleo climate research as in this study. The C/N ratio of different harvesting age of *Axonopus compressus* which were grown under shade of palm plantation is depicted in Table 3. In general, a C/N ratio of *Axonopus compressus* for all harvesting age was of significant difference. This indicates that the age of the observed grass had a predominant contribution in varying the C/N ratio value. Meanwhile, the harvesting age was insignificant in influencing the C/N ratio of soil where *Axonopus compressus* was grown.

Moreover, from Table 3, it is shown that the maximum C/N ratio of each part of *Axonopus compressus* was achieved at different harvesting age. The maximum C/N ratio achieved by leaf and root occured at age of 20 and 10 days, respectively. Meanwhile, stem achieved the maximum C/N ratio at age of 40 days. Variation in achieving a maximum C/N ratio of the part of *Axonopus compressus* might be due to difference in generative and vegetative phase. The part that had a higher C/N ratio indicated that generative phase was undergone earlier and hinder the vegetative phase. In addition, the higher C/N ratio is the earlier flower coming up[26]. Therefore, the plant gets fall earlier. Furthermore, the vegetative phase occurs at a condition in which C/N ratio is low[27].

In contrast to *Axonopus compressus*, the soil taken from the field where it was grown had a quite low C/N ratio. The low ratio of C/N of the soil causes decomposition of soil microbe becoming slower so that soil fertility is affected. For long term, it can also affect the growing rate of the plant.

Biomass production: Biomass can be determined from total weight or organism volume grown in an area or in a certain volume[28]. Biomass production of *Axonopus compressus* resulted in this study is depicted in Table 4. The method that was utilized in the measurement of plant biomass was by weighing wet and dry matters of plant[29]. Weight of wet matters can be determined without having to deface of the plant and the value can be varied depending upon water content of a plant. In this case, weight of dry matter is more acceptable in estimating the growth of a plant because it reflects accumulation of organic matters that are synthesized from inorganic substances. In this study, plant parts that were considered as biomass were stem and leaf.

Products of photosynthesis that is photosyntate was exist in buds. Therefore, by weighing of fresh and dry matters, it can be considered as an indicator of plant growth. From Table 4,

Table 3: Carbon to nitrogent ratios (C/N) of *Axonopus compresus* during the observations

	C/N Ratio			
Age (days)	Leaf	Stem	Root	Soil
10	48.76 ± 3.00^{C}	71.41 ± 3.15^{C}	107.19 ± 4.32^{A}	10.74 ± 0.66
20	70.46 ± 2.27^{A}	71.19 ± 2.50^{C}	78.49 ± 4.80^{C}	10.38 ± 0.30
30	55.42 ± 1.59^{C}	93.06 ± 7.80^{A}	86.14 ± 3.07^{BC}	11.02 ± 1.24
40	63.71 ± 7.27^{AB}	97.28 ± 5.92^{A}	85.82 ± 6.45^{BC}	9.59 ± 0.88
50	65.83 ± 3.30^{AB}	84.35 ± 3.48^{B}	99.16 ± 8.90^{AB}	10.82 ± 1.18
60	62.96 ± 2.50^{B}	96.06 ± 2.37^{A}	97.03 ± 12.32^{AB}	10.52 ± 0.36

Value with superscript in capital letter indicates a significant difference ($p\leq0.01$)

Table 4: Weight of fresh and dry matters of *Axonopus compressus* during the observation

Age (days)	Leaf	Stem	Total
Fresh matters (g pot^{-1})			
10	15.00 ± 2.94	17.25 ± 1.71^{B}	32.25 ± 2.87^{B}
20	24.00 ± 2.45	31.00 ± 4.69^{A}	55.00 ± 3.16^{A}
30	21.75 ± 8.02	33.00 ± 5.42^{A}	54.75 ± 12.97^{A}
40	21.00 ± 6.32	33.50 ± 5.26^{A}	54.50 ± 10.88^{A}
50	21.75 ± 7.80	35.50 ± 5.45^{A}	57.25 ± 11.62^{A}
60	13.00 ± 5.77	17.75 ± 6.18^{B}	30.75 ± 11.32^{B}
Dry matters (g pot^{-1})			
10	10.25 ± 2.01^{bc}	12.00 ± 1.19^{B}	22.25 ± 1.97^{B}
20	16.75 ± 1.71^{a}	21.75 ± 3.29^{A}	38.50 ± 2.22^{A}
30	14.75 ± 5.44^{ab}	23.61 ± 3.87^{A}	38.36 ± 8.99^{A}
40	13.75 ± 4.14^{abc}	23.60 ± 3.71^{A}	37.35 ± 7.37^{A}
50	13.96 ± 5.01^{abc}	24.00 ± 3.68^{A}	37.96 ± 7.61^{A}
60	7.75 ± 3.44^{c}	9.75 ± 3.40^{B}	17.50 ± 6.48^{B}

Value with a capital letter superscript indicates a significant difference at $p\leq0.01$, while value with small letter superscript indicates as significant different at $p\leq0.05$

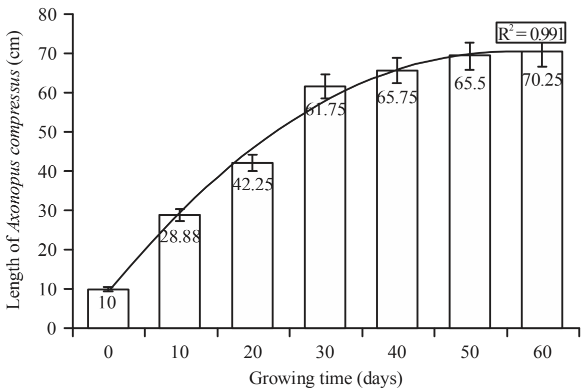

Fig. 1: Average length of *Axonopus compressus* observed during the observations and its progression

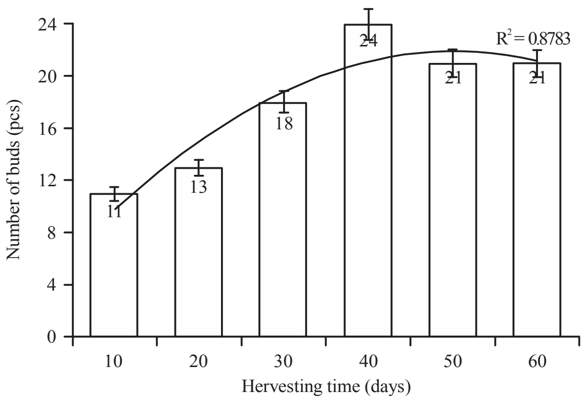

Fig. 2: Number of shoots observed when harvesting *Axonopus compressus* at different age

it was shown that plant age significantly influenced the production of fresh weight of *Axonopus compressus* stems and whole grass. In contrast, it was insignificant for the leaf. Meanwhile, for dry matters, age also significantly affect the weight of leaves and signifies significantly difference with whole plant.

Different effects of age to weight of fresh and dry matters of leaf might be caused by variation of water content found in leaves and stems. The increase of the weight of fresh and dry matters was of significant at age of 20 days and remained up to the age of 50 days before it decreases at age of 60 days. This might be affected by growth as indicated by length of plant and the number of buds. *Axonopus compressus* encountered a significant growth at age of 20 days and experienced declining at age of 50 days (Fig. 1, 2). This has been indicated by Lingga and Marsono[30]. At vegetative phase, height of plant would keep increasing up to a certain age before it is stopped. Meanwhile, decrease in weight found at the age of 60 days may associate with a derogation of the number of buds because of getting fall. Swamy *et al.*[31] indicated that grass biomass can be varied significantly due to variation in age and its growing environments.

Moreover, biomass of *Axonopus compressus* are also affected by dynamic of carbon and nitrogen content during the growing period. Higher C and nitrogen content at early growing phase and fluctuation during the growing period would indicate fluctuation in biomass formation. Luttge[32] stated that during photosynthesis most of the plants would store carbon in a form of carbohydrate. This carbohydrate would be used by the plant to form its body that incorporates with plant biomass[24].

Furthermore, N content would be of importance in synthesizing chlorophyll[20]. However, in this study, it was observed that N content was considerably low. Therefore, it would significantly reduce the Leaf Area (LA) and chlorophyll thus lowering down biomass production[33]. Complex protein found in chlorophyll suggests as an important component of photosynthesis[34]. Meanwhile, chlorophyll is considered as a primary component of chloroplast and positively correlated with the rate of photosynthesis[19]. In addition, chlorophyll poses three main functions in photosynthesis that are to utilize the solar energy, to initiate fixation of CO_2 in production of carbohydrate and to reserve the energy for the whole ecosystems.

Furthermore, biomass formation cannot be ignored from the plant growth at vegetative phase. According to Harjadi[35] at vegetative phase, roots, stems and leaves would experience growth. This phase associates with three important processes that are cell fission, cell elongation and differentiation stage of the cell. Increasing in number and size of the cell would trigger the formation of tissue and in advanced plant's organs. Vegetative growth constitutes with increasing of volume, number, shape and size of vegetative organs such as leaf, stem and root that is initiated by the formation of leaf at germination until the generative organ is formed[36]. Munawar[37] stated that N metabolism is an important factor in vegetative growth of stem and leaf. Plants have tendency to grow at vegetative growth due to having a low C/N ratio[27]. Furthermore, Rai *et al.*[26] concluded that higher C and lower N content would increase the ratio of C/N thus promoting flowers. In this study, C/N ratio calculated higher so that the plant would enter generative phase quickly and lower down biomass production. If N content is higher, *Axonopus compressus* might acquire better biomass quality because of having higher carbon storage capacity.

CONCLUSION

From this study, some conclusion can be drawn as follows:

- Carbon storage capacity of *Axonopus compressus* accumulated at the end of its growing phase (e.g., 60 days) with a capacity around 40-45%. In all parts of *Axonopus compressus*, there was dynamic of C organic over its growing period. However, although the percentage of C organic found in *Axonopus compressus* was high, but there were no sufficient evidences that can correspond it with percentage of C organic of soil
- As C organic, the trend of nitrogen content found over the growing period of *Axonopus compressus* can also be characterized as dynamics. However, its percentage was quite low compared with percentage of C organic. Thus, it causes C/N ratio of *Axonopus compressus* becoming high
- Evident from this study reveals that growth progression of *Axonopus compressus* was remarkably high from 10 days of its growing age up to 40 days. Meanwhile, from age of 50 days to the end of its growin g period (e.g., 60 days), a slight decrease of growth period was experienced
- Capability for biomass production of leaf and stem of *Axonopus compressus* were varied. Leaf had the capability to produce more biomass at the age of 20 days, whereas stem required a longer time before it would have a high accumulation of biomass

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