Growth, Herbage Yield and Chemical Composition of *Talinum Paniculatum* (Jacq.)

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**ABSTRACT**

Java Ginseng (*Talinum paniculatum* Gaertn.) is a succulent plant from the family Portulacaceae which can be consumed as vegetable. There were three main objectives for the research. Firstly, to evaluate the growth of plants *Talinum paniculatum* (Jacq.) with the different levels of nitrogen and harvesting times. Secondly, to understand the level of nitrogen fertilizer on the largest biomass production. Thirdly, to study the harvesting weeks for the largest biomass production with the best quality. The combination treatment between the harvesting times of 8 wk and the manure 150 kg N ha−1 has effects on the plant height, the numbers of branches and leaves. The highest protein content was reached at 4 wks harvesting age with fertilization of 150 kg N ha−1 with significant difference in all treatments.

**Key words:** Growth, Harvesting weeks, Nitrogen fertilizer, Quality, *Talinum paniculatum* Gaertn., Yield.

**INTRODUCTION**

*Talinum paniculatum* Gaertn. or Som Java is recognized as having various medicinal properties (Manuhara et al., 2015). Plants Som Java (*Talinum* spp.) is known as a source, of traditional herbal medicine in Asia as a tonic for fertility (Thanamool et al., 2013). Its leaves and plant canopy can be consumed as vegetable that contains high nutrition. Ginseng is easily propagated by using plant materials such as seeds or stem cuttings (Susanti et al., 2008). *Talinum paniculatum* (Jacq.) Wild. (Portulacaceae) is a caulescent, perennial herb growing to a height of 80-100 cm. It is popularly known as Waterleaf because of its high moisture content of almost 90.8% edible leaf (Swarna and Ravindhran, 2013).

Growth is influenced by root uptake and accumulation of nitrogen allocation. Although long roots can only absorb a small amount of nitrogen, nitrogen allocation to older leaves is higher in plants with long roots. Nitrogen is needed to support the growth of leaves. When root growth rate is low, nitrogen supplied from other parts of the plant, such as old leaves was almost yellowing (Schoene and Yeager, 2007). This study was conducted to determine the agronomic ability of *Talinum paniculatum* (Jacq.) as a vegetable crop to evaluate the growth, biomass production and the quality of vegetables production of *Talinum paniculatum* (Jacq.) at different levels of nitrogen and harvesting ages (cutting intervals).

**MATERIALS AND METHODS**

The experiment was conducted at the editorial Village, Getasan sub-district, Semarang regency, Indonesia, in March, 2016 to September, 2016. The soil was classified as a type of Oxisol with loam texture. The soil pH was 5.6, organic matter was of 1.4% and a bulk density was 1.1. The soil nitrogen (N), phosphorus (P) and potassium (K) content were 0:28%, 16 ppm and 18 ppm, respectively.

The experimental design was a 3 x 3 Factorial RBD (Randomized Complete Block Design) with three replications. The spacing 50 x 25 cms (40 plants.plot−1). Treatments were harvesting intervals of 4, 6, 8 weeks after sowing and fertilizer application of 50,100,150 kg N ha−1. Plants were given phosphate fertilizer as much as 70 kg SP36 and 50 kg KCl ha−1. Micronutrients (Fe, Mn, B, Mo, Cu, Zn, Cl, Co) were added as much as 10 grams per plot. Gap filling was done on 5 day after sowing. Parameters measured were plant height, number of branches, number of leaves and crop growth rate. Harvesting was done by taking the entire header and leaving the stem with the height of 10 cms from the ground. Plant height is measured from the base of the stem to the growing point of the plant. The number of branches and leaves were calculated on the entire plant canopy. Biomass yield was calculated in each plot. Dry matter content, mineral content, fat, fiber and protein were analyzed.

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based on the AOAC method. The collected data were then analyzed using the analysis of variance (ANOVA), referring to Steel and Torrie (1960) and it was followed by the Duncan’s multiple range test.

**RESULTS AND DISCUSSION**

**Growth of Talinum paniculatum (Jacq.):** The plant height, the number of branches and the number of leaves are a growth parameter which is highly influenced by the growth phase and age of the plant (Table 1). Eight weeks were the oldest age and these resulted in the increase in the plant height, the number of branches and leaves and in the the highest amount of nitrogen fertilizer. The treatment of 8 wks harvest age combined with manure 150 kg N ha⁻¹ affected the plant height, the number of branches and a number of leaves, this effect was the highest among all combinations of the treatment applied. The plant height at the harvest age of 4 wks increased when an increasing nitrogen fertilizer was applied, this was also the case of the harvesting ages of 6 wks and 8 wks. The plant height at the harvest ages of 4 wks and of 6 wks and with the application of 100 kg N ha⁻¹ increased from 28.8% to 51.9% and from 12.6% to 26.4%., respectively. The average plant height of the study was 17.3 cm to 52.3 cm. This result is lower than previous studies that the mean of plant height was 34.25 cm to 58.08 cm (Nya and Eka, 2015). The number of branches at the harvesting age of 4 wks increased with increasing application of nitrogens 25% to 50%, of 6 wks, 12.5% to 28.75% and of 8 wks, 19.16% to 46.66%. The number of leaves also increased with the increase in nitrogen fertilizer application, namely the harvesting age of 4 wks, 55.39% to 83.67%, of 6 wks, 13.95% to 21.85% and of 8 wks, 30.27% to 61.53%. Application of 40 kg N ha⁻¹ (N40) recorded maximum average number of leaves 29.2 plant⁻¹ which was significantly superior to rest of the nitrogens levels (Parry et al., 2018). The results showed that the fertilizer doses increased the plant height, stem diameter, number of leaves per plant and dry matter yield of leaf. It could be concluded that nitrogen fertilization was effective in stimulating growth, production yet higher nitrogen doses (200 Kg N/ha) are ineffective and have inhibitory effects of growth and production (Nohong et al., 2019). Crop growth rate (CGR) was not affected by treatment combination of the harvesting age and the fertilizer dosage of nitrogen. The dose of nitrogen fertilizer did not affect the CGR. The influence of each factor is the growing crop age (8wks) where the improvement of the improving CGR was significantly different from the harvesting ages of 6 wks and of 4 wks. Crop Growth rate (CGR) is not affected by different levels of nitrogen application. The increase in plant growth and development and accumulation of biomass is greater in the fertilized plants and it is also correlated with the decrease in the allocation of resources and DM production. CGR is slow at early growth stages because the plant cover is incomplete and the plants absorb just a part of the solar radiation. As the plants develop, their growth rate is quickly increased because of the expansion of leaf area and the penetration of less radiation through plant cover to the soil surface. Maximum CGR (the steepest slope in total biomass variations graph) is realized when the plants are tall and dense enough to be able to maximally utilize all environmental parameters (Ahmadi, et al., 2014).

**Herbage Yield:** The results of herbage yield showed an increase in line with increasing nitrogen supply and harvesting age, with the increase of 8.94% to 23.64% at the 4 wk- harvesting age, 22.22% to 39.48% at the 6wk- harvesting age and 14.22% to 54.07% at the age 8 wk harvesting age. The higher yield was 23.62 t.ha⁻¹. These results are higher than previous studies that shoot mean yield per plant varied between the ranges of 39.88 g to 113.13 g in the parental cultivars and between 35.5 g and 86.8 g in the F1 hybrids (Nya and Eka, 2015). Plant nutrition is one of the most important factors that increase crop production. Nitrogen (N) is one of the most important nutrients that affect the growth, development, yield and quality of crops. An increasing supply of nitrogen fertilizer stimulates plant

| Treatment (week) | N kg/ha | Plant height (cm) | Stem (No) | Leaves (No) | CGR (g/day) | Biomass (t/ha) |
|------------------|---------|------------------|-----------|-------------|-------------|---------------|
| 4                | 50      | 17.3³           | 4.0       | 34.3³       | 1.09        | 3.13³         |
|                  | 100     | 22.3³           | 5.0³      | 53.3³       | 1.01        | 3.41³         |
|                  | 150     | 26.3³           | 6.0³      | 63.0³       | 1.18        | 3.87³         |
| 6                | 50      | 29.00³          | 8.0³      | 81.0³       | 2.40        | 9.37³         |
|                  | 100     | 32.66³          | 9.0³      | 92.3³       | 2.56        | 11.43³        |
|                  | 150     | 36.66³          | 10.3³     | 97.7³       | 2.20        | 13.07³        |
| 8                | 50      | 41.00³          | 12.0³     | 111.0³      | 2.86        | 15.33³        |
|                  | 100     | 48.3³           | 14.3³     | 144.6³      | 2.93        | 17.51³        |
|                  | 150     | 52.3³           | 17.6³     | 179.3³      | 3.64        | 23.62³        |

Description: *=significant, ns =non significant

abMeans within rows without common superscript are different (P<0.05).
growth and productivity as well as the photosynthetic capacity of the leaves through an increase in the number of stromal and thylakoid protein leaves (Hedari and Mohammad, 2012). Nitrogen is a macronutrient that is much required a lot of plants that often limit plant growth. The application of nitrogen fertilizer on agricultural land is to encourage greater production of biomass canopy potential photosynthesis and higher productivity (Hawkesford, 2014). The fruit yield as well as NPK uptake by brinjal had increased with increase in initial soil fertility and with increase in the levels of fertilizer N, P O \textsubscript{4} and K O and FYM (Dhinesh and Santhi, 2016). Nitrogen improves quality, the yield and increases the photosynthetic activity, leaf area, leaf area duration and net assimilation rate (Kaur and Sharma, 2018).

Chemical ingredients of Talinum paniculatum (Jacq.): Nitrogen fertilizer dose influences the content of crude protein and crude fiber content (Table 2). Harvest age significantly increased the DM content of 1.69% at intervals of 6 wk harvest age compared with 4 wk harvest age, whereas 6.94% at 8 wk harvest age compared with 4 wk harvest age. The harvest age at 8 weeks had lowered the ash content. The increasing age of 8 wks resulted in smaller ash content, which was significantly different from the 6 wk and 4 wk harvesting ages. Fiber content increased with age but decreased when the week-harvest age weeks increased. The highest fiber content was achieved by the 8 wk harvest age with 50 kg N ha\textsuperscript{-1} showing the most significant difference from all treatments. The highest protein content at 4 wk harvest age with the fertilization of 150 kg N ha\textsuperscript{-1} was significantly different from all treatments. The Average protein content of Talinum paniculatum (Jacq.) is 17.85% to 21.72% (100% DM), meaning that these vegetables have good quality. The nitrogen content of the plant is a key factor in photosynthesis, growth and light utilization efficiency. Photosynthesis decreases with decreasing concentration of leaf nitrogen. For this reason, the nitrogen content of leaves is considered as an indicator of environmental adaptation of plants and can be used to calculate the effect of the level of nitrogen fertilization on yield and quality. Enough of nitrogen supply to the leaves can sustain crop yields. Plants absorb nitrogen from the soil. The nitrogen content of the soil is reasonably necessary to maintain high leaf nitrogen. Yield and quality of fiber depend on the distribution of nitrogen in plants (Chen et al, 2016). In conventional vegetable production, excessive nitrogen fertilizer used has led to low nitrogen fertilizer efficiently used in most intensive vegetable production regions (Xia et al, 2016).

CONCLUSION
From the results of this study, it can be concluded that the combination treatment of 8 wk harvest age with nitrogen 150 kg N ha\textsuperscript{-1} has the highest (P<0.05) plant height, number of branches and number of leaves among all treatment combinations applied. The dry matter of yield from plots in the 8 wk harvest age and the nitrogen fertilizer (150 kg N ha\textsuperscript{-1}) is higher than the other plots interaction in terms of the harvesting age and the nitrogen fertilizer. The contents of minerals and of fat are not significant. Fiber content increases with age but decreases with an increasing cutting interval. The highest fiber content is achieved by 8 wk harvest age with 50 kg N ha\textsuperscript{-1} which are significantly different from all treatments. The highest protein content at 4 wk harvest age with the fertilization.

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