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PERFORMANCE OF PEANUT UNDER ORGANIC AND INORGANIC NUTRITION

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ABSTRACT

This study was conducted to determine the response of organic manure and inorganic N source on groundnut. The study involved a 3 x 5 factorial design with three organic manure (0, 5, 10 tons ha^{-1}) levels and five N dose levels (0, 25, 50, 75, 100 kg N ha^{-1}) with three replications. The combination treatment of 10 tons ha^{-1} manure with 100 kg N ha^{-1} had the highest (P<0.05) plant height, chlorophyll content, pod yield, and 100-seed kernel weight among all the treatment combinations applied. Interaction between manure and N, was not significant for leaf area index, nitrate reductase activity, kernel protein and harvest index. The highest nitrate reductase activity was with 5 tons ha^{-1} of manure, and 75 kg N ha^{-1}. The highest harvest index was obtained with 50 kg N ha^{-1}.

Keywords: Peanuts, Manure, N fertilizer, Chlorophyll, Pod yield.

Groundnut is a legume of nutrient abundance and contains a wide variety of chemical constituents such as proteins, carbohydrates, fibers, fats, niacin, folates, thiamine, arachidic acid, flavonoid, magnesium, and phosphorus (Limmongkon *et al*., 2017). Groundnuts (*Arachis hypogaea* L.) in Indonesia is the most important agricultural commodity after soybeans which have a strategic role in national food as a source of protein and vegetable oil (Suresh *et al*., 2016). Badawi *et al.* (2011) states that groundnuts contain 50% fat, 26-28% protein, 20% carbohydrate, and 5% fiber. In Indonesia, most of the new groundnuts are used for household food such as boiled groundnuts, crispy groundnuts, cooking spices, and other snacks (Swastika, 2015).

The provision of organic fertilizer can improve soil structure, increase soil absorption of water, improve living conditions in the soil, and as a source of food for plants. Whereas inorganic fertilizers can stimulate overall growth especially branches, stems, leaves, and play an important role in the formation of green leaves (Haynes, 1986). Nitrogen (N) is essential for the proper growth and development of crops. Although a conservative application of N fertilizer can improve maize production, its overuse may result in serious consequences, including deterioration of the environment and imminent exhaustion of the resources (Ya-wei *et al*., 2019). Nitrogen (N) plays a critical role in plant growth and productivity, as it is required for the synthesis of many essential molecules including nucleic acid (DNA and RNA), amino acid and protein (Fan *et al*., 2014). The combined use of organic and inorganic fertilizers can balance nutrient requirements, optimize soil physical and chemical properties and increase the availability of nutrients (Liu *et al.,*2019).

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Nitrogen can be taken up not only in the form of inorganic N forms, such as nitrate and ammonium but also in the form of organic form, such as amino acids, small peptides or even protein. The use of nitrogen by plants involves several steps, including uptake, assimilation, translocation and, when the plant is aging, recycling, and remobilization (Masclaux-Daubresse *et al*., 2010). Information on the effects of the source of N fertilizers on groundnuts is still required. This study was conducted to determine the effect of source of N on growth, chlorophyll content, nitrate reductase (NR), weight of 100 seeds kernel, pod yield, harvest index and seed protein of groundnut.

MATERIALS AND METHODS

The experiment was conducted at the Field Laboratory, Faculty of Animal Husbandry and Agriculture, Semarang, Indonesia on May 1, 2018, to August, 30, 2018. The soil used for this research was subsoil from Oxisol which has a sandy texture and is very poor in soil fertility (Table 1). The groundnut studied was bunch type(variety Gajah).

Table 1. Initial soil nutrient analysis

Parameter	Nutrient (%)	Score
Nitrogen (N)(Kjeldahl method)	0.13	low
P_2O_5 (HCl 25% method)	0.08	Very low
K_2O (HCl 25% method)	0.07	Very low
C-organic(Walkey and Black method)	9.18	High

Source: Soil Research Center, Indonesia (2009)

The design was a 3 x 5 factorial with three replications, with a total number of 45 plots with a size of 2 x 2 m each and the spacing of 20 x 20 cms (100 plants plot^{-1}). Manure treatment involved K1 = 0 t ha^{-1}, K2 = 5 t ha^{-1}, K3 = 10 t ha^{-1} where for each treatment

0,25,50,75, 100 kg N ha^{-1} (21.75; 43.5; 65.25 and 87 g urea $plot^{-1}.fed^{-1}$) doses were used. Plants were given phosphate fertilizer @ 100 kg SP36 ha^{-1} (36 % P_2O_5) and 50 kg KCl ha^{-1}(50 % K). Micronutrients (Fe, Mn, B, Mo, Cu, Zn, Cl, Co) were added @ 10 grams for each plot. Plants that did not grow or die were replaced with the new one. Parameters measured were plant height, chlorophyll content, NR, LAI, productivity, the100 seeds-kernel weight, harvest index and seed protein.

Plant height was measured from the base of the stem to the growing point of the plant. Chlorophyll was determined according to method given by Purbajanti *et al.* (2016) and analysis of NR activity was performed according to the methods used by Hartiko (1987). The N content of the seed was assayed by Kjeldahl method and the protein content was determined by: N content x 6.25.

The chlorophyll content of the fifth leaf from the tip of the plant, NR activity, grain yield, and peanut straw stover yield were also determined. Chlorophyll content was measured in fresh leaf samples. Leaf samples (0.5 g) were homogenized with acetone (90% v/v), filtered, and made up to a final volume of 50 ml. Chlorophyll concentration was calculated based on the absorbance of the extract measured by a spectrophotometer 645 UV/Vis and 666 UV/Vis (Purbajanti *et al.*, 2016). Chlorophyll content was observed at 4 week old plants. Leaf area index calculations were made by dividing leaf area by plot area. LAI was observed at 12 week old stage. Yield was measured at physiological harvest (90 days after planting). The weight of 100 seed-kernels was recorded at 90 days after planting. Harvest index was also worked out.

Analysis of NR activity was performed according to the methods used by Hartiko (1987). The third leaves of peanut plant shoots were harvested between 9 and 10 a.m. and used for further observation. The leaves were washed with distilled water and finely sliced, and 200 mg of the leaf sample was added to 5 ml NaH_2PO_4 and $NaHPO_4$ buffer solutions at pH 7.5 in dark tubes that were covered and maintained for 24 h, after which the buffer solution was replaced with 5 ml of fresh buffer solution. Next, 0.1 ml of 5 M $NaNO_3$ was added to every dark tube. The time of addition of $NaNO_3$ was designated the 0 incubation point, and samples were incubated for 2 h. Meanwhile, another test tube was filled with 0.2 ml 1% sulfanilamide reagent, which was dissolved in 3N HCl and 0.2 ml 0.02% naphthyl ethylene diamide. Then 0.1 ml of the filtrate was incubated for 2 h and was placed in a test tube containing the sulfanilamide reagent, HCl, and a naphthyl ethylene diamide solution. The test tubes were agitated to mix the filtrate and accelerate the reaction, and allowed to stand for 15 min; this resulted in the reduction of NO_2 with dye reagents to bring up the pink color. Next, 2.5 ml of distilled water was added to the test tube as a color diluent. The absorbance of this solution was measured at a wavelength of 540 nm. NR was observed at 4 weeks old plants.

The collected data were then analyzed using the analysis of variance (ANOVA, Steel and Torrie, 1965) using Duncan's multiple range test.

RESULTS AND DISCUSSION

Plant height

Groundnut plant height data are presented in Table 2. Organic fertilizer and inorganic fertilizer doses showed significant interaction, also their individual effects were significant. Manure @ 10 t ha^{-1} and 100 kg ha^{-1} N fertilizer had the highest plant height compared to all other treatments. The plant height at 100 kg ha^{-1} N fertilizer and 10 t ha^{-1} organic fertilizer increased by 209.5 % compared to without organic fertilizer. Nitrogen (N) is one of the most important nutrient that affects the growth, development, yield and quality of crops. An increasing supply of nitrogen fertilizer stimulates plant growth and productivity as well as the photosynthetic capacity of the leaves through an increase in the number of stromal and thylakoid protein leaves (Purbajanti *et al*., 2019).

Leaf Area Index

Interaction between organic fertilizer and inorganic fertilizer did not affect leaf area index. Both organic and inorganic sources showed a significant effect on leaf area index. Organic fertilizer,however, did not show consistent effect. Highest leaf area index was achieved under manure treatment 100 t ha^{-1}.

Leaf area index parameter is an accurate indicator of processes such as the balance of the global carbon exchange and energy cycle in photosynthesis, evapotranspiration mechanisms, precipitation interception, and the water/nutrient cycling. Besides, LAI is a good biophysical indicator of the above-ground biomass. Various direct and indirect techniques have been proposed for data collection and the calculation of LAI. Direct invasive methods involve manual clipping of the leaves and measuring their size (LeilaTaheriazada *et al.,* 2019). Sustainable crop production depends on the sustainable renewal of soil fertility through a balance between the demand and supply of the planting system. Nitrogen is the most important of all fertilizers for plant growth, productivity and grain quality (Liu *et al*., 2019). A definite increase in plant dry matter can result from increased absorption of nitrogen, phosphorus, and potassium (Liu *et al*., 2017).

Chlorophyll

The amount of chlorophyll is primarily related to the rate of photosynthesis. Chlorophyll is a photosynthetic apparatus that helps plants absorb energy from sunlight. (Purbajanti *et al.*, 2017). The chlorophyll content is related to plant N nutrition and can be used as an indicator to detect precisely and promptly on time, the crop N nutrient conditions. N stress damages intracellular chloroplast structure and decreases chlorophyll content, making plants vulnerable to light injury. (Ya-wei *et al.*, 2019).

Both organic and inorganic sources showed significant effect on chlorophyll content. Organic fertilizer @ 10 t ha^{-1} and 100 $kg.ha^{-1}$ N fertilizer had the highest total chlorophyll compared to all other treatments.

Nitrate reductase

Interaction between organic fertilizer and inorganic fertilizer did not affect nitrate reductase. Both organic and inorganic sources showed a significant effect on nitrate reductase (Table 4). Organic fertilizer, however, did not show consistent effect. Highest nitrate reductase was achieved under treatment 75 kg ha^{-1} N fertilizer.

The potential of NRA as a reliable indicator of diferences in BNI was verified by strong correlations

Table 3. Effect of manure and nitrogen on plant height, leaf area index, chlorophyll, and nitrate reductase, 100-seed weight, harvest index and seed protein of *Arachis hypogaea* cv Gajah.

Organic manure level (t ha^{-1})	Nitrogen (kg ha^{-1})				
	0	**25**	**50**	**75**	**100**
Plant height (cm)					
0	5.5m	6.3 m	7.2 l	8.4 k	10.5 j
5	12.5 i	14.5 h	17.5 g	20.3 f	21.00 f
10	25.00 e	26.8 d	28.5 c	31.0 b	32.5 a
Leaf area index					
0	0.69	0.79	0.76	0.76	0.79
5	0.67	0.77	0.70	0.87	0.83
10	0.78	0.76	0.81	0.85	0.96
Chlorophyll (mg g^{-1})					
0	0.41 b	0.34 b	0.32 b	0.34 b	0.35 b
5	0.41 b	0.22 d	0.25 c	0.29 bc	0.27 bc
10	0.30 bc	0.31 b	0.34 b	0.35 b	0.54 a
Nitrate reductase (μmol NO_2 g^{-1} per hour)					
0	2.72	2.96	1.85	2.79	2.25
5	4.58	4.41	4.38	4.38	3.93
10	2.91	3.75	3.59	4.54	3.08
100 seed kernels weight(g)					
0	17.00 h	22.25 h	30.00 g	34.00 efg	41.00 bcd
5	33.25 fg	37.25 def	40.50 bcd	41.00 bcd	45.50 ab
10	43.50 abc	39.00 cde	39.75 cd	41.25 bcd	46.75 a
Pod yield (ton)					
0	0.741f	1.100 bc	1.253 b	1.265b	1.293 b
5	1.078 ef	1.159 cde	1.269 b	1.330 ab	1.320 ab
10	1.144 de	1.240 bcd	1.268 b	1.315 ab	1.391 aa
Harvest index					
0	0.17	0.16	0.22	0.19	0.19
5	0.18	0.18	0.23	0.20	0.21
10	0.19	0.19	0.21	0.21	0.22
Protein (%)					
0	31.10	31.29	31.84	32.72	32.73
5	31.71	31.65	32.27	31.36	31.68
10	32.78	32.55	32.12	31.88	31.95

[abc] *Means within rows without common letter are different (P<0.05)*

with NO_3^- in soil solution, either through enhanced soil nitrification activity or direct NO_3^- supply via fertilization. However, no significant correlation was detected for leaf NRA and soil NO_3^- measured at the same date, indicating a delay between re-supplied NO_3^-, its uptake by roots and transfer into xylem for transportation to the cytoplasm, where it was finally reduced via NR (Karwat *et al*., 2019)

Weight of 100 seed-kernels

Interaction between dosage organic fertilizer and inorganic fertilizer showed a significant difference (Table 3). Dosage organic fertilizer showed a significant difference. Dosage inorganic fertilizer also showed a significant difference. Highest weight of 100 achieved treatment 10 t ha^{-1} - 100 kg ha^{-1} N fertilizer. Same effect with organic 5 t ha^{-1} – 75 kg ha^{-1} N fertilizer , and organic 5 t ha^{-1} -100 kg ha^{-1} N fertilizer so organic 10 t ha^{-1} - 75 kg ha^{-1} N fertilizer.

Pod Yield

Interaction between dosage organic fertilizer and inorganic fertilizer showed a significant difference. Dosage organic fertilizer showed a significant difference. Dosage inorganic fertilizer also showed a significant difference. Organic fertilizer 10 t ha^{-1} and 100 kg ha^{-1} N fertilizer has the highest yield. Same effect with organic 5 t ha^{-1} – 75 kg ha^{-1} N fertilizer , and organic 5 t ha^{-1} -100 kg ha^{-1} N fertilizer so organic 10 t ha^{-1} - 75 kg ha^{-1} N fertilizer.

Climate factors (e.g., temperature, precipitation, sunshine) had a significant effect on growth, distribution, productivity, seed yield and oil content of plants (Wen *et al*., 2012). Fertilization, in general particularly with nitrogen, is considered as one of the major factors that greatly affect seed yield and oil. However, reported that 80 kg N ha^{-1} was sufficient for sunflower fertilization (El-Satar *et al*., 2017)

The application of 40 kg N ha^{-1} (N40) recorded a maximum number of leaves of 29.2 plants^{-1} which was significantly superior to remaining nitrogen level (Parry *et al*., 2018). Fruit yields and NPK uptake increase with increasing initial soil fertility and with increased levels of N, P_2O_5 and K_2O, and FYM fertilizers (Dhinesh and Santhi, 2016). Nitrogen increases quality, yields and increases photosynthetic activity, leaf area, leaf area duration and net assimilation rate (Kaur and Sharma, 2018). The application of 100% N to French peas with 100% N is statistically equivalent to under 50% N and significantly higher than 0 or 25% (Dua *et al*., 2017).

Harvest Index

Interaction between dosage organic fertilizer and inorganic fertilizer showed did not a significant difference to harvest index. Dosage organic fertilizer showed a significant difference in harvest index. Dosage inorganic fertilizer did not show a significant difference in harvest index. Fertilizer N 50 kg ha^{-1} have same effect with 75 kg ha^{-1} N, and 100 kg ha^{-1} N.

Al-haidary (2018) considered nitrogen is a key of functions for each amino acids, cellulose, chlorophyll, proteins, quinines, toxins, and organizing of enzymes actions which in turn are transformed as products of photosynthesis activity as starch contents in leave's cell wall and then are converted to the seed. In other legumes, there is a need to make morphological and agronomic

Table 4. Main effect of plant height, leaf area index, chlorophyll, NR, 100-seed kernels weight, pod yield, harvest index and seed protein of groundnut (Arachis hypogaea cv gajah)

Treatments	Plant height (cm)	Leaf Area Index	Chlorophyll (mg g^{-1})	Nitrate reductase (µmol NO_2 g^{-1} per hour)	100-seed kernels weight (g)	Pod Yield (ton)	Harvest index	Protein (%)
Dose of organic manure (t ha^{-1})								
0	5.9 c	0.74 a	0.37 a	2.84 c	19.63 c	1.130 c	0.16c	31.25
5	13.5 b	0.72 b	0.32 b	4.50 a	35.25 b	1.231 b	0.18ab	31.68
10	25.9 a	0.77 a	0.31 c	3.33 b	41.25 a	1.272 A	0.19 a	32.67
Dose of nitrogen (kg ha^{-1})								
0	14.3 e	0.71 c	0.37 ab	3.40 c	31.25 e	0.988 e	0.18 b	31.90
25	15.9 d	0.77 bc	0.29 c	3.71 b	32.83 d	1.166 d	0.18 b	31.83
50	17.7 c	0.76 b	0.30 c	3.27 d	37.00 c	1.263 c	0.22 a	32.08
75	19.9 b	0.83 ab	0.32 bc	3.90 a	38.75 b	1.303 b	0.20 ab	31.98
100	21.3 a	0.86 a	0.39 a	3.09 e	44.42 a	1.453 a	0.21 ab	32.12

Description:

[abc] *Means within rows without common superscript are different (P<0.05)*

comparisons between wild and cultivar populations. This comparison must cover the total biomass of all leaves produced during the complete plant life cycle so that HI is not overestimated. Increased photo sharing is assimilated into the reproductive structure concerning the vegetative structure, reflected in a higher crop index (HI) and has been associated with an increase in crop yield potential. The differences in the genetic makeup of different genotypes may also be responsible for the differences in yield components, yield and HI. Grain yield in cereals is related to biomass yield and HI. An increase in DM accumulation and partitioning is important because it is significantly associated with grain yield and HI (Amanullah and Inamullah, 2016). Berrocal-Ibarra *et al*. (2002) states that HI has played an important role in increasing bean yield, but total biomass production, flowering days, and seed growth rates also contribute in relevant ways. Macronutrient like N is needed to improve the stimulate the green growth production of the plant, P as an important phosphate source for nucleic acid and K provides a vital role in photosynthesis activity (Azman *et al.,* 2018).

Seed protein

Interaction between dosage organic fertilizer and inorganic fertilizer showed did not a significant difference to seed protein. Dosage organic fertilizer did not show a significant difference in seed protein. Dosage inorganic fertilizer did not show a significant difference in seed protein.

From the results of this study, it can be concluded that the combination treatment of 10 t ha^{-1} manure with nitrogen 100 kg N ha^{-1} has the highest ($P<0.05$) plant height, chlorophyll content, pod yield, and 100-seed kernel weight among all treatment combinations applied. Interaction between manure and nitrogen, not significant difference LAI, NR, seed protein and harvest index. The leaf area between no manure is equal to 10 t ha^{-1} of manure while the highest leaf area is 100 kg ha^{-1} nitrogen treatment. The highest NR in the treatment of 5 tons of manure, while for nitrogen is 75 kg N ha^{-1}. The highest harvest index was at 50 kg N ha^{-1}.

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Authors' contribution

Conceptualization of research work and designing of experiments (EDP, EF,BAK); Execution of field/ lab experiments and data collection (EDP, EF,BAK); Analysis of data and interpretation (EDP, EF,BAK); Preparation of manuscript (EDP, EF,BAK)

LITERATURE CITED

Al-haidary, H K M A 2018. Splitting of nitrogen application through growth stages in various sunflower cultivars to improve their vegetative growth and seed yield. *Asian J Agri & Biol*. **6**(3):357-66.

Amanullah and Inamullah 2016. Dry Matter Partitioning and Harvest Index Differ in Rice Genotypes with Variable Rates of Phosphorus and Zinc Nutrition. *Rice Science*, **23**(2): 78-87.

Azman, N A N, Malek, N A N N , Noor, N S M and Javed, M 2018. Improving the growth of Centella asiatica using surfactant modified natural zeolite loaded with NPK nutrients. *Asian J Agri & Biol*. **6**(1):55-65.

Badawi F Sh F, Biomy, A M M and Desoky A H 2011. Peanut plant growth and yield as influenced by co-inoculation with *Bradyrhizobium* and some rhizo-microorganisms under sandy loam soil condition. *Annals of Agriculture Science* **56**:17-25.

Berrocal-Ibarra, S, Ortiz-Cereceres J and Peña-Valdivia C B 2002. Yield components, harvest index and leaf area efficiency of a sample of a wild population and a domesticated variant of the common bean Phaseolus vulgaris. *South African Journal of Botany* **68**: 205–11.

Dhinesh V and Santhi R 2016. Effect of initial soil fertility and integrated plant nutrition system (IPNS) on yield and NPK uptake by brinjal on an Alfisol. *Indian J Agric Res*, **50**(2) : 131-134. DOI:10.18805/ijare.v0iOF.7101

Dua V K, Kumar S and Jatav M K 2017. Effect of nitrogen application to intercrops onyield, co mpetition, nutrient use efficiency and economics in potato (Solanum Tuberosum L.) + French bean (Phaseolus Vulgaris L.) system in north-western hills of India. *Legume Research*. **40**: 698-703. **DOI:** 10.18805/lr.v0i0.7841

El-Satar M A A, Ahmed A A, and Hasan T H A 2017. Response of seed yield and fatty acid compositions for some sunflower genotypes to plant spacing and nitrogen fertilization. *Information Processing in Agriculture* **4**: 241-252.

Fan Z, Xie D, Chen J, Lu H, Xu Y, Ma C and Xu G 2014. Over- expression of os*ptr6* in rice increased plant growth at different supplies but decreased nitrogen use efficiency at high ammonium supply. *Plant Science*, **227**: 1-11.

Hartiko H 1987. *Plant Enzyme Analysis*. Biochemistry Laboratorium, Biology Faculty, Gadjah Mada University, Yogyakarta.

Haynes R J. 1986. *Mineral Nitrogen in the Plant – Soil System*. Academic Press, Inc. New York.483 p.

Karwat H, Sparke M, Ras F, Arango J, Nuñez J, Rao I, Moreta D and Cadisch G 2019. Nitrate reductase activity in leaves as a plant physiological indicator of in vivo biological nitrification inhibition by Brachiaria humidicola. *Plant Physiology and Biochemistry* **137**: 113-20.

Kaur G and Sharma M 2018. Effect of nitrogen doses and inter crops on growth and yield of broccoli (Brassica oleracea L. var. italica). *Indian J Agric Res*, **52**(5) : 566-570. DOI: 10.18805/IJARe.A-5058

Limmongkon A, Janhom P, Amthong A, Kawpanuk M, Nopprang P, Poohadsuan J, Somboon T, Soijeen S, Surangkul D, Srikummool M and Boonsong T 2017. Antioxidant activity, total phenolic, and resveratrol content in five cultivars of peanut sprouts. *Asian Pac J Tropical Biomed* **7**(4): 332-38.

Liu D, Yang Q, Ge K, Hu X, Qi G, Du B, L.iu K and Ding Y 2017. Promotion of iron nutrition and growth on peanut by *Paenibacillus illinoisensis* and *Bacillus sp.* Strain in calcareous soil. *Brazilian Journal of Microbilogy* **48**: 656-70.

Liu Z, Gao F, Liu Y, Yang J, Zhen X, Li X, Li Y, Zhao J, Li J, Qian B, Yang D and Li X 2019. Timing and Splitting of nitrogen fertilizer supply to increase crop yield and efficiency of nitrogen utilization in wheat-peanut relay intercropping in China. *The Crop Journal* **7**: 101-12.

Masclaux-Daubresse C, Daniel-Vedele F, Dechorgnat J, Chardon F, Gaufichon L and Suzuki A 2010. Nitrogen uptake, assimilation and remobilization in plants: challenges for sustainable and productive agriculture. *Ann Bot.* **105**(7): 1141–57. DOI: 10.1093/aob/mcq028

Parry S A, Jaiswal P C, Parry F A, Ganie S A and Masood A 2018. Effect of different levels of nitrogen and sulphur on growth, nodulation and yield of green gram (*Vigna radiate* L.). *Legume Research* **41**(5) : 767-770. DOI: 10.18805/LR-3428

Purbajanti E D, Kusmiyati F, Slamet W and Adinurani P G 2016. Chlorophyll, crop growth rate and forage yield of Brachiaria (Brachiaria brizantha Stapf) as the result of goat manure in various nitrogen dosage. AIP Conference Proceedings 1755, 130013 doi: 10.1063/1.4958557

Purbajanti E D, Kusmiyati F and Fuskhah E 2017. Growth, Yield and Physiological Characters of Three Types of Indonesian Rice Under Limited Water Supply. *Asian J Plant Scie* **16**(2): 101-108. DOI: 10.3923/ajps.2017.101.108.

Purbajanti E D, Fuskhah E and Kristanto B A 2019. Growth, Herbage Yield and Chemical Composition of Talinum Paniculatum (Jacq.). *Indian J Agric Res* **53**(6): 741-744.

Soil Research Center 2009. *Chemical Analysis of Soil, Plant, Water,and Fertilizer*. Soil Research Center, Bogor. 220 p.

Suresh S, Kathikejan S and Jayamoorty K 2016. Efect of bulk and nano-Fe2O3 particle on peanut plant leaves studied by Fourier transform infrared spectral studies. *J Adv Res* **7**: 739-47.

Steel R G and Torrie J H. 1965. *Principles of Statistics*. Wiley and Sons, New York.

Swastika D K S 2015. Peanut Economy in Indonesia. Bean and Tubers Research Agency Monograph No 13.

Taheriazada L, Moghadasb H and Sanchez-Azofeifaa A 2019. Calculation of leaf area index in a Canadian boreal forest using adaptive voxelization and terrestrial LiDAR. *Int J Appl Earth Obs Geoinformation* 8: 101923.

Wen Y, Tang M, Sun D, Zhu H, Wei J, Chen F and Tang L 2012. Influence of Climatic Factors and Soil Types on Seed Weight and Oil Content of Jatropha Curcas in Guangxi, China. *Procedia Environmental Sciences* **12**: 439 – 44.

Ya-wei W, Qiang L, Rong J, Wei C, Xiao-lin L, Fan-lei K, Yong-pei K, Haichun S and Ji-chao Y.2019. Effect of low-nitrogen stress on photosynthesis and chlorophyll fluorescence characteristics of maize cultivars with different low nitrogen tolerances. *J Integ Agri* **18**(6): 1246–56.