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ORGANIC WASTE AS FERTILIZER TO INCREASE THE NUMBER OF PEANUTS (*Arachis hypogaea* L.) FLOWERS

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Abstract. *Peanut has high economic value and a significant role in food needs. the national food supply needs for peanuts to date have not been sufficient. This study aimed to determine the effect of organic waste which in this case is mushroom baglog compost and sheep manure on the flowers and pods of peanuts. The study was conducted on March-July 2018 in Subang district using the simple experimental plot method and group-randomized factorial design with two factors with each treatment done triplicate. The first factor is the baglog compost (soil without baglog compost, 90 g/plants, 120 gr/plants); the second factor is sheep manure dose (without sheep fertilizer, 90 gr/ plants, 120 gr/plants). The results showed that the application of baglog compost and sheep manure fertilizer at concentrations of 90 g and 120 g, respectively increased the number of flowers and potential pods. Moreover, Sheep manure fertilizer at a concentration of 120 g/plant, increased the dry weight of pods, seed, and 100 seeds even though was not significant.*

Keywords: *Arachis hypogaea L., flowers, organic fertilizer, peanuts.*

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INTRODUCTION

Peanut (*Arachis hypogaea* L.) is one of the leading commodities in Indonesia. Peanut has 25-30% protein, 40-50% fat, 12% carbohydrate, and vitamin B1 (Sembiring et al., 2014). About 85% of peanut production is widely used in the food industry such as bread, jam, oil, and peanut flour (Sobari, 2018). Ginting et al. (2015) mentioned that peanut is one of the important requirements in fulfilling the required societies' food nutrition. Thus, it indicated that the quality and quantity of peanut can be considered as one of the important sources of food for everyone.

The national peanut demand has not been fulfilled. Based on Badan Pusat Statistik (BPS), in the last five years, the peanut harvested area in Indonesia has decreased by an average of 4.63% per year. According to ARAM II data in 2016, the productivity of peanuts in Indonesia was 13.21 q/ha or decreased by 0.90% compared to the previous year. In the same period, the average productivity of peanuts in Java reached 12.86 q/ha from a harvest area of 357.028 Ha. During this period the number of national peanut exports averaged 3.39 thousand tons while the number of imports reached 235.81 thousand tons. The development of peanut export volume in the 2011-2015 period experienced an average increase of 18.30% per year, but the tendency for import remained higher than export volumes (Sholihah, 2016). Indonesia through the Indonesian Ministry of Agriculture must import more than 230 million kgs of peanuts in neighboring countries such as Vietnam, China, India, and Australia which reach more than 225 million USD (Dinarto & Astriani, 2012).

Due to the production of peanuts decreased, the existence of harvested areas have decreased as well. Soil fertility factors become a serious problem to the decline of peanut production. Hard soil contour causing hampered root development and resulting in the disability of peanut to grow as the formation of pods cannot penetrate the soil, this is cause of peanut production results are not optimal (Sembiring et al., 2014). Additionally, the efforts to increase the productivity of peanuts can be implemented by fertilizing the soil with organic matter-derived fertilizer that can help change the physical, chemical, and biological properties of the soil. (Hulopi, 2006). Fertilization using organic matter is also an effort in improving soil structure and fertility (Sudarto et al., 2014).

Sheep manure is a livestock waste beneficial to plants as it can be a decomposer and has an organic content that can be used as nutrients for plants such as the N, P and K elements. Sheep manure will be far more optimal if the composting process is carried out first, because the nature of the dense sheep dung reduces pathogenic microorganisms and facilitates absorption by plant roots (Hidayati et al., 2013).

Mushroom baglog is a medium used for the cultivation of oyster or Champignon mushrooms, it was made from sawdust that has been sterilized and compacted in plastic packaging. Mushroom baglogs that have been used previously cannot be used again, and even tend to become unused waste. The use of oyster mushroom baglog waste and sheep dung as an alternative to compost are expected to have good prospects to the higher fertilizers and agricultural needs.

The baglog waste from the mushroom has nutritional contents including 37.241% water content, nitrogen of 0.931%, phosphorus of 2.070%, potassium 8.515%, and C / N ratio of 37.199 (Bellapama et al., 2015). Solid sheep manure has nitrogen levels of 0.60%, phosphorus of 0.30%, potassium 0.17%, and water 60% (Rahmah et al., 2014). This composition has benefits in improving the fertility structure in the soil. This study aimed to assess the potential of organic fertilizer made from mushroom baglog waste and sheep manure as a planting medium to increase the number of flowers as one of the prospective peanut pods and the efforts to improve national peanut productivity.

MATERIALS AND METHODS

The study was conducted in Tambakan Village, Jalan Cagak, Subang Regency, West Java, with a height of 518 meters above sea level. from March to July 2018 using a variety of peanut seeds, mushroom baglog, and sheep manure waste. The results of the chemical analysis are as follows Table 1.

The experimental method used was a factorial randomized block design with two factors and three replications. The first factor of treatment is baglog waste composition (K) and the second factor is sheep manure (D), each consisting of; K_0 (soil without baglog waste), K_1 (90 g/plant), K_2 (120 g/plant), and D_0 (soil without sheep fertilizer), D_1 (90 g/plant), and D_2 (120 g/plant).

Table 1. Biomass and ammonium content of 12 cyanobacteria strains

Content	Unit	Mushroom Baglog	Sheep Manure	Soil	Description (*)
pH	-	9.35	7.97	4.24*	Very acid
C-Organik	%	1.79	35.25	7.6*	Very high
N	%	1.20	0.97	0.34*	Normal
C/N Rasio	-	1	36	22*	High
P_2O_5	%	0.81	2.56	-	-
P_2O_5 HCL 25%	mg/100g	-	-	55*	High
K_2O	%	1.97	0.14	-	-
K_2O HCL 25%	mg/100g	-	-	17.5*	Low
Ca	%	1.87	7.49	-	-
Mg	%	0.57	0.40	-	-
Fe	ppm	7485.34	6007.60	-	-
Cu	ppm	38.1	32.0	-	-
Zn	ppm	130.5	116.8	-	-
B	ppm	181.42	9.24	-	-
S	%	0.14	0.00	-	-
Pb	ppm	13.8	20.8	-	-

Source: Personal Data (2018)

Planting used was 27 experimental plots, each 80 cm × 60 cm in size with a distance of 40 cm per bed, 50 cm between the beds the number of 8 plants for every treatment, with a distance of 20 cm × 30 cm or equivalent to 166.666 plant populations. The observed variables included height, number of flowers, number of empty pods, number of filled pods, pod dry weight (g), seed dry weight (g), the weight of 100 seeds (g). The obtained data were analyzed using parametric analysis by first testing the normality using Kolmogorov-Smirnov with SPSS 23.0 of the average distribution of observations value with the provisions of the data having a normal distribution if the Sig. ≥ 0.05 (Santoso, 2016). The data were then analyzed Using the analysis of variance (ANOVA) table F 0.05. If the variables showed a significant effect, then a Duncan's Multiple Range Test (UJBD) at the 5% significant level was then carried out.

RESULTS AND DISCUSSION

The number of environmental parameters was measured during study, including temperature, duration of solar illumination, and wind speed. At the time of the study the average temperature obtained was 27.27°C (Figure 1). According to Faronika et al. (2013) the temperature requirement for peanut growth ranged from 25–35°C, while during the flowering phase need temperature ranged from 24–27°C.

The Number of Flowers.

The emergence of peanut plant flowers occurs at the age of 28 days after planting. The observations were conducted at 5, 6, and 7 WAP (Weeks after planting) which intended to determine the maximum number of flowers that appeared. The number of flowers will affect the number of pods formed. According to Sobari et al. (2018), optimizing pollen from male flowers to the pistil (polli-

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nation) on flowers will be a major factor in the process of fruit formation. As reproduction in nuts by self-pollination (self-pollination), a perfect flower structure (hermaphroditic) helps in the process of pollination to form ovaries (Stalker et al., 2016).

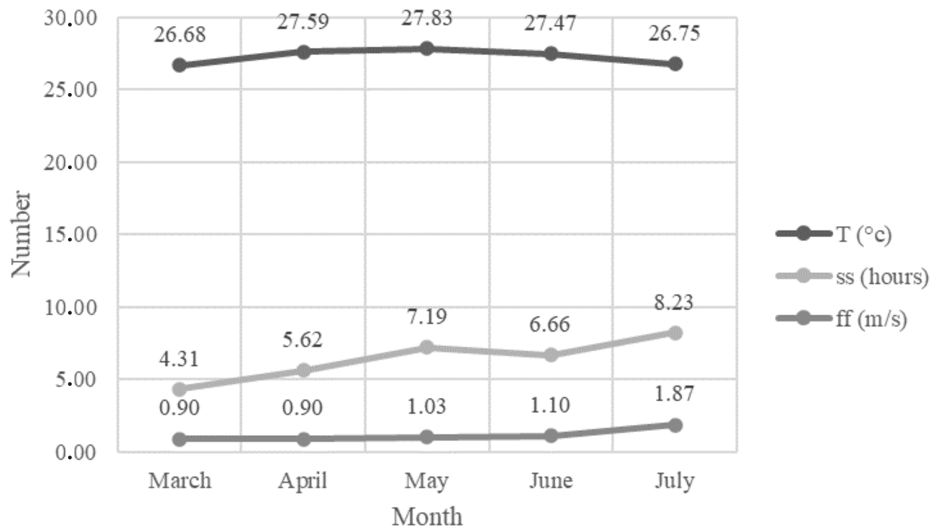

Figure 1. Climate data during the study (T: Average temperature (°C); ss: Duration of solar illumination (hours); ff: Average wind speed (m/s))

Figure 2. Flower growth of *Arachis hypogaea* L. (a). Flower forming Phase (b). Forming Pods Phase (c). Development phase of seed on pods

Table 2. Number of Peanut Flowers at 5 WAP, and 7 WAP

Treatment	Number of flowers	
	5 WAP	7 WAP
Mushroom Baglog Compost		
K_0	12.94 ± 2.25 a	4.08 ± 0.32 a
K_1	13.99 ± 1.59 a	4.50 ± 1.05 a
K_2	12.43 ± 0.24 a	3.15 ± 0.75 a
Sheep Manure Compost		
D_0	12.40 ± 0.34 a	3.97 ± 0.13 a
D_1	12.50 ± 1.30 a	3.60 ± 0.42 a
D_2	14.46 ± 1.92 b	4.17 ± 1.66 a

Description: WAP (Weeks after planting); Values are mean ± standard error. Values marked with the same letter are not significantly different according to Duncan's Multiple Range Test at the 0.05 level.

The result of this study showed that treatment of sheep fertilizer D_2 (120 g/plant) significantly increased the number of flowers that appear in peanut plants with an average value of 14.46 per hectare compared to treatments of D_0 and D_1 (Table 2). Flower formation starts from the formation of primordia or generative buds to anthesis flowers (blooms), the process of flower blooming occurs gradually (Putri & Pramono, 2013). The changes of flowers in plants with autogamy are most difficult to observe, thus it is very important in determining the right time of maturation for circulation and pollination so the fertilization can run well. This is the basis that the number of flowers can be influenced by the age of flower maturity (Onwubiko et al., 2013).

The provision of available sheep fertilizer at the beginning of flowering can improve flower formation and development. This due to the phosphorus content derived from the sheep fertilizer of 2.56% (Table 1) that mixed with soil that already has relatively high phosphorus content. This is in line with what Setiawati et al. (2010) stated, the content of phosphorus absorbed will help the process of plant metabolism and accelerate flowering in the generative phase. Moreover, phosphorus plays a role in cell nucleus formation, cell division, increasing the growth of root, flowers, fruits, and seeds (Sawara et al., 2012).

The Number of Empty Pods

This value was obtained by counting all the pods formed, both those that have not yet fully formed seeds and those that have already formed seeds.

As presented in Figure 3, shows there is a relationship between the number of flowers that appear with the formation of pods. It can be assumed that the potency of peanut pod formation is influenced by the amount of flowers and the success of flower development into a gynophore that reaches the soil (Sobari et al., 2018). The previous research by Zharare et al. (2010) explained that the gynophore carries the results of pollination in the form of an ovary, at the end, it bends and extends downward then penetrates the ground. After the ovary buried as deep as 5-10 cm, then, the embryo begins to expand and fruit enlargement occurs. The development of gynophore is influenced by the structure and fertility of the soil where the provision of organic matter has an important role in improving the physical, chemical, and biological properties of the soil. By increasing soil aggregation, improve aeration and percolation, will make soil structure crumb, and increase soil fertility, so that the development of gynophore into the soil takes place optimally (Sawara et al., 2012). The spacing also determines the successin the number of pods formed. Reducing plant density per hectare will result in changes in the microclimate around the plant which can affect growth and yield. (Marliah et al., 2012). The higher the plant density, the higher the competition among plants affecting plant growth and yield, and decrease the number of pods per plant produced (Tamura et al., 2017).

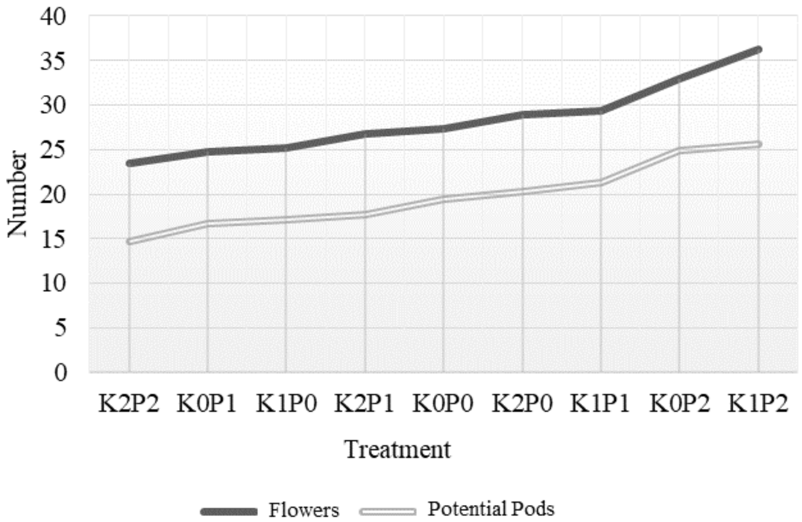

Figure 3. The number of peanut flowers *Arachis hypogaea* L. and empty pods after treatment of organic waste mixtures

The Number of Fully Formed Pods

These numbers obtained by counting fully formed pods that have clear, dense, seed-filled pods (Sobari, 2016). Experimental data show (Table 3), that the treatments of baglog compost and sheep fertilizer did not significantly affect the number of fully formed pods.

The treatments showed no significant effect on the number of fully formed pods in peanut. It may be influenced by environmental factors that are more dominant compared to genetic factors. The genetic factors cause differences such as diversity in the appearance of plant phenotypes by displaying special characteristics that differ from each other (Mahdiannoor et al., 2017). As for the environmental factors basically change characteristics in plants themselves (Sobari & Wicaksana, 2017).

Table 3. The Number of fully formed pods/plant

Treatment	Number of fully formed pods/plant
Mushroom Baglog Compost	
K_0	13.53 ± 2.97 a
K_1	15.47 ± 4.59 a
K_2	13.03 ± 2.60 a
Sheep Manure Compost	
D_0	13.60 ± 1.81 a
D_1	12.71 ± 1.97 a
D_2	15.72 ± 5.22 a

Description: WAP (Weeks after planting); Values are mean ± standard error. Values marked with the same letter are not significantly different according to Duncan's Test at the 0.05 level.

Dry Weight of Pods, Seed, and 100 Seeds

The treatments of baglog compost and sheep fertilizer did not provide a significant effect on the dry weight of pods, seed, and 100 seed (Table 4). However, The dry weight of 100 seeds increased along with the increase of sheep manure fertilizer application. The largest value of each observation variable shows that the treatments K_1 and D_2 (Table 4) have a higher value than other treatments (K_0K_2 and D_0D_1). As has been reported by Barus et al. (2014), the haviest weight of 100 mung bean seeds obtained from TSP fertilizer was at a dose of 30 g/plant compared to control treatment and 15 g plant.

Table 4. The Dry Weight of Pods, Seeds, and 100 Seeds.

Treatment	Dry Weight of Pods (g)	Dry Weight of Seeds (g)	Dry Weight 100 Seeds (g)
Mushroom Baglog Compost			
K_0	16.62 ± 5.02 a	9.87 ± 2.05 a	30.61 ± 1.90 a
K_1	20.57±7.32 a	13.94 ± 4.43 a	32.53 ± 0.75 a
K_2	15.69 ± 3.25a	9.96 ± 2.56 a	29.73 ± 1.97 a
Sheep Manure Compost			
D_0	16.28 ± 2.02 a	10.55 ± 1.66 a	30.03 ± 1.58 a
D_1	15.55 ± 2.90 a	10.47 ± 2.38 a	30.59 ± 2.72 a
D_2	21.06 ± 8.38 a	12.75 ± 5.76 a	32.24 ± 0.58 a

Description: WAP (Weeks after planting); Values are mean ± standard error. Values marked with the same letter are not significantly different according to Duncan's Test at the 0.05 level.

Each observation variable in this study is closely related to each other. During the seed filling period in this study, the increase in accumulation of dry matter and nutrient deficiencies resulted in disruption of seed development. This occurs due to the availability of water as a solvent in the soil is limited, so that the need for nutrients absorbed by plants is insufficient. The water is a universal solvent, and can dissolve various types of chemical compounds (Putri et al., 2017).

Another thing is the rainfall during the experiment was relatively low with an average of 134.32 mm/month causing nutrients in the soil difficult to dissolve. Elements such as phosphorus and potassium are essential for plants to develop seeds and roots. Potassium also serves to form flowers, fruit and helps fight disease (Sondakh et al., 2012). As explained by (Widarti et al., 2015), that to compile 0.1-0.4% of the dry matter of plants, the element of phosphorus is needed, this element is important especially in the photosynthesis and other physiology activities of plants such as cell division, tissue development, and plant growth. The weight yield of seeds is a factor that determines the high productivity of yields per hectare. The factor is influenced by the complex inheritance and can also involve other factors (Boer, 2011). Harvesting time can also affect the weight of seed yield, as expressed by (Butar & Lubis, 2018).

Taken together, it can be concluded that the application of baglog compost and sheep manure fertilizer increased the number of flowers and empty pods. Sheep manure treatment at concentration of 120 g/plant at 5 Weeks after planting significantly increased number of flowers. Moreover, Sheep manure fertilizer at a concentration of 120 g/plant, increased the dry weight of pods, seed, and 100 seeds even though was not significant.

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REFERENCES

Bellapama, I. A., Hendarto, K. & Widyastuti, R. A. D. (2015). Pengaruh Pemupukan Organik Limbah Baglog Jamur dan Pemupukan Takaran NPK Terhadap Pertumbuhan dan Produksi Pakchoy (*Brassica chinensis* L.). *J. Agrotek Tropika*, 3(3), 327–331.

Boer, D. (2011). Genetic Variability and Path Coefficient Analysis for Some Agronomic and Physiology Characters of Seed Yield on Genetic Diversity of 54 Accessions of Maize from East Indonesia. *Agroteknos*, 1(1), 35–43.

Butar, D. V. B. & Lubis, I. (2018). Response of Soybean Genotypes (*Glycine max* L. Merrill) from Various Countries to Environmental Condition at The Experimental Field IPB Sawah Baru. *Buletin Agrohorti*, 6(2), 258–269.

Dinarto, W. & Astriani, D. (2012). Produktivitas Kacang Tanah di Lahan Kering Pada Berbagai Intensitas Penyiangan. *Agrisains*, 3(4), 33–43.

Faronika, M., Siregar, L. A. M. & Hasyim, H. (2013). Evaluasi Produktifitas dan Kualitas Beberapa Varietas Kacang Tanah (*Arachis hypogaea* L.) Di Tanah Bertekstur Liat. *Agroekoteknologi*, 1(2), 201–213.

Ginting, E., Yulifianti, R. & Utomo, J. S. (2015). Standar Mutu Kacang Tanah. *Monograf Balai Penelitian Tanaman Aneka Kacang dan Umbi*, 13, 394–406.

Hidayati, Y. A., A. K., Tb. B. & Harlia, E. (2013). Analysis of Total Bacteria and Identification of Bacteria in Liquid Fertilizer with the Addition of Sheep Feces *Saccharomyces cereivisiae*. *Jurnal Ilmu Ternak Universitas Padjadjaran*, 13(2), 1–3.

Hulopi, F. (2006). Pengaruh Penggunaan Pupuk Kandang dan NPK Terhadap Pertumbuhan dan Hasil Tanaman Kacang Tanah. *Buana Sains*, 6(2), 165–170.

Mahdiannoor, Istiqomah, N. & Syahbudin. (2017). Growth and Yield Two Soybean Varieties (*Glycine max* L.) with Biofertilzer Application. *Zaraa'ah*, 42(3), 257–266.

Marliah, A., Hidayat, T. & Husna, N. (2012). The Effect of Some Varieties and Spacing on Growth of Soybean (*Glycine max* (L.) Merrill). *Agrista*, 16(1), 22–23.

Onwubiko, N. C., Uguru, M. I., Ngwuta, A. A., Inyang, E. T. & Nnajiemere, O. J. (2013). Floral biology of Bambara groundnut [*Vigna subterranea* (L.) Verdc]. *African Journal of Dairy Farming and Milk Production*, 1(3), 57–58.

Putri, K. P. & Pramono, A. A. (2013). (Stage of Flower, Fruit and Reproductive Success of *Adenanthera pavonina* L.). *Penelitian Hutan Tanaman*, 10(3), 147–154.

Putri, L. M. A., Prihandono, T. & Supriadi, B. (2017). Pengaruh Konsentrasi Larutan Terhadap Laju Kenaikan Suhu Larutan. *Pembelajaran Fisika*, 6(2), 147–153.

Rahmah, N. L., Anggarini, S., Pulungan, M. H., Hidayat, N. & Wignyanto. (2014). The Making of Oyster Mushroom Log Waste Cpmpost: Study on Goat Manure, EM4 Concentration and Reversal Time. *Teknologi Pertanian*, 15(14), 59–66.

Santoso, S. (2016). *Buku panduan SPSS 23*.

Jakarta: Elex Media Komputindo.

Sawara, Nurmas, A. & A. J., M. D. (2012). Growth and Yield of Soybean (*Glycine max* L.) All Guano Fertilizer and Tall Grass Mulsch. *Agroteknos*, 2(2), 97–105.

Sembiring, M., Sipayung, R. & Sitepu, F. E. (2014). Growth and Peanut Production With Provision of Empty Palm Bunches at different Pile Up Frequency. *Jurnal Online Agroekoteknologi*, 2(2), 598–606.

Sholihah, S. (2016). *Kacang tanah. In Outlook Komoditas Pertanian Sub Sektor Tanaman Pangan*. Jakara: Pusat Data dan Sistem Informasi Pertanian Kementerian Pertanian.

Sobari, E. (2016). *Panduan Teknik Pengolahan dan Pengawetan Pangan*. Yogyakarta: Deepublish.

Sobari, E. (2018). *Teknologi Pengolahan Pangan*. Yogyakarta: Andi Publisher.

Sobari, E. & Wicaksana, N. (2017). Genetic Diversity and Relationship of Bambara Groundnut (*Vigna subteranea* L.) Genotype Landraces of West Java. *Jurnal Agro*, 4(2), 90–96.

Sobari, E., Fathurohman, F. & Hadi, M. A. (2018). The Character Growth of Peanut (*Arachis hypogaea* L.) with Compost Mushroom Baglog and Manure of Lamb. *Agrin*, 22(2), 116–122.

Sondakh, T. D., Joroh, D. N., Tulungen, A. G., Sumampow, D. M. F., Kapugu, L. B. & Mamarimbing, R. (2012). Peanut (*Arachis hypogaea* L.) Yield on Some types of Organic Fertilizer. *Eugenia*, 18(1), 64–72.

Stalker, H. T., Tallury, S. P., Seijo, G. & Leal-Bertioli, S. C. M. (2016). *Biology, Speciation, and Utilization of Peanut Species. In Peanuts: Genetics, Processing, and Utilization*. USA: Academic Press and AOCS Press

Sudarto, Hipi, A. & Herawati, N. (2014). Pengaruh Teknologi Pemupukan Terhadap Hasil Kacang Tanah Di Lahan Kering Lombok Timur. *Prosiding Seminar Hasil Penelitian Tanaman Aneka Kacang dan Umbi, 4 (Oldeman 1980), 687–690.*

Tamura, P., Soelistyono, R. & Guritno, B. (2017). Effect of Plant Spacing and Dose Giving Chicken Manure on Growth and Yield of Soybean (*Glycine max* L.). *Produksi Tanaman*, 5(8), 1329–1337.

Widarti, B. N., Wardhini, W. K. & Sarwono, E. (2015). Pengaruh Rasio C/N Bahan Baku Pada Pembuatan Kompos dari Kubis dan Kulit Pisang. *Integrasi Proses*, 5(2), 75–80.

Zharare, E. G., Blamey, F. C. P. & Asher, L. C. (2010). Some Observations on The Culture of Attached Groundnut (*Arachis hypogaea* L .) Gynophores in Simplified Nutrient Solutions. *African Journal of Plant Science*, 4(8), 296–299.