Journal of Agriculture and Crops
ISSN(e): 2412-6381, ISSN(p): 2413-886X
Vol. 9, Issue. 4, pp: 488-494, 2023
URL: https://arpgweb.com/journal/journal/14
DOI: https://doi.org/10.32861/jac.94.488.494

Academic Research Publishing Group

Original Research Open Access

Mushroom Media Waste and Goat Manure Application on Growth and Yield of Shallots

Rudi Priyadi (Corresponding Author)
Department of Agrotechnology, Faculty of Agriculture, Universitas Siliwangi, Tasikmalaya, West Jawa - Indonesia
Email: rudipriyadi@unsil.ac.id

Yugi R. Ahadiyat
Department of Agrotechnology, Faculty of Agriculture, Universitas Jenderal Soedirman, Purwokerto, Central Jawa - Indonesia

Yaya Sunarya
Department of Agrotechnology, Faculty of Agriculture, Universitas Siliwangi, Tasikmalaya, West Jawa – Indonesia

Ade Hilman Juhaeni
Department of Agrotechnology, Faculty of Agriculture, Universitas Siliwangi, Tasikmalaya, West Jawa - Indonesia

Ahmad Fauzi
Department of Agrotechnology, Faculty of Agriculture, Universitas Jenderal Soedirman, Purwokerto, Central Jawa - Indonesia

Article History
Received: 10 July, 2023
Revised: 24 September, 2023
Accepted: 28 September, 2023
Published: 29 September, 2023

Abstract

The objective of this study was to find out the growth and yield of shallots (*Allium ascalonicum* L.) with the application of mushroom media waste and goat manure. A randomized block design was used with six treatments viz. without mushroom media waste and goat manure, 25 ton/ha mushroom media waste, 20 ton/ha mushroom media waste + 5 ton/ha goat manure, 15 ton/ha mushroom media waste + 10 ton/ha goat manure, 10 ton/ha mushroom media waste + 15 ton/ha goat manure, and 5 ton/ha mushroom media waste + 20 ton/ha goat manure, and repeated four times. The observed variables were plant height per hill, number of leaves per hill, number of bulbs per hill, wet weight of bulbs per hill, wet weight bulbs per plot, dry weight of bulbs per plot, and yield per hectare. The results showed that the application of 10 ton/ha mushroom media wastes organic fertilizer + 15 ton/ha goat manure gained 1.26 kg/plot, equal to 7.7 ton/ha. The application of mushroom media waste and goat manure had the potency to reduce the use of inorganic fertilizers in supporting eco-friendly agriculture.

Keywords: Goat manure; Mushroom media waste; Organic fertilizer; Shallot.

How to Cite: Rudi Priyadi, Yugi R. Ahadiyat, Yaya, Sunarya, *et. al.* 2023. "Mushroom Media Waste and Goat Manure Application on Growth and Yield of Shallots." *Journal of Agriculture and Crops*, vol. 9, pp. 488-494.

1. Introduction

Shallots (*Allium ascalonicum* L.) are one of the horticultural commodities, which is widely used as spice and medicine [1]. The need for shallots increases nationwide with the increase in population. The national household consumption of shallots is 673,230; 731,010; 750,630; 729,820; and 790,630 tons, respectively in 2017, 2018, 2019, 2020, and 2021, whereas the national production of shallots is 1,470,500; 1,503,440; 1,580,240; 1,815,440; and 2,004,590 tons respectively in 2017, 2018, 2019, 2020, and 2021 [2]. The data on shallot production and consumption shows the annual surplus of shallot production over consumption. Nevertheless, the national shallot productivity vis. 8 to 12 ton/ha is lower than the potential yield of national shallot varieties vis. 14 - 17 ton/ha. Shallot productivity can still be increased through better culture techniques such as fertilization improvement [3].

Table-1. National production and household consumption of shallots

Year	Production (tons)	Consumption (tons)
2017	1,470,500	673,230
2018	1,503.440	731,010
2019	1,580.240	750,630
2020	1,815,440	729,820
2021	2,004,590	790,630

Source: Statistics Indonesia [2]

Farmers of shallots generally use inorganic fertilizers all the time in excessive doses. The excessive use of inorganic fertilizer harms the environment and human health [4]. The continuous use of inorganic fertilizers reduces the soil aggregate stability and causes the soil to become compacted [5], causing soil C-organic degradation and soil acidity [6], and poses serious collateral problems such as environmental pollution, pest resistance development, and food safety decline [7]. One of the efforts to alleviate the worse impact of the continuous use of inorganic fertilizer is the application of organic fertilizer. Furthermore, as reported by Mahfudz, *et al.* [8], the application of biofertilizers (bokashi and mycorrhiza arbuscular) and biopesticides (*Beauveria bassian*a and *Trichoderma sp.*) elevates the shallot production and the farmers' total profit by 29.5% and 79.1%, in addition, to reduce the costs of chemical inputs by around 69.5%.

Inorganic or organic fertilizer has positive and negative impacts if used singly on soil and plant growth. Inorganic fertilizer contains all essential nutrients that are directly available for plants, but continuous use of inorganic fertilizers causes soil organic matter depletion, soil acidity, and environmental pollution. Although organic fertilizer has low nutrient content, in the long range, it improves the physical and biological activities of soil. An integrated nutrient management system by combining inorganic and organic fertilizers is an alternative way for sustainable and cost-effective soil management to increase soil fertility and productivity which is environmentally friendly [6, 9, 10].

National and international market demands for organic agricultural products that are free of chemical residues are currently increasing along with increasing public awareness of health [11]. According to Hartatik, *et al.* [12], organic fertilizers improve the physical, chemical, and biological characteristics of the soil. Lasmini, *et al.* [13], also reported that the application of cow manure and straw mulch could enhance the yield of shallot cultivation in dryland.

As a promising commodity of horticulture, mushroom has increasingly been produced by Indonesian farmers. National production of mushroom in Indonesia reached 31.051.571 kg in 2018 and continue to slightly increase in 2019 (33.163.188 kg) and 33.688.516 kg in 2020 (Statistics Indonesia, 2021). Mushroom cultivation produces a lot of waste. Each kilogram of mushroom production generated about 5-6 kilograms of waste. Mushroom culture waste may contain plant nutrients (P, K, Mg, and Si), and ash from such biomass waste can be used as fertilizer [14]. Organic fertilizer from mushroom media waste contains 0.7% P_2O_5, 0.2 % K_2O, 0.6% N-total, and 49.0% C-organic [15].

Goat manure can also be used as organic fertilizer. Styaningrum [16], states that goat manure can increase soil organic matter, cation exchange capacity, and fertilization efficiency. The application of high-quality goat manure as fertilizer may increase cactus growth performance in terms of racket numbers per plant, number of primary rackets per plant, height, and diameter [17]. The application of goat manure compost with bio-urine and balanced inorganic fertilizers increased red chili productivity by 46% [18]. Goat manure had the potential to increase the nutrient content in *S. alatum* more than in poultry manure [19].

The research on the use of goat manure is found elsewhere. However, combining goat manure with mushroom media waste is necessary to reveal. The objective of this study was to find out the growth and yield of shallots with the application of mushroom media waste and goat manure.

2. Material and Method

2.1. Site Location, Climatic and Soil Conditions

The experiment was conducted from August to October 2022 at the experimental field Faculty of Agriculture Universitas Siliwangi Tasikmalaya at 7°22′39.9" S latitude and 108°15′08.9 E longitude 350 m above sea level. The average daily temperature and relative humidity (RH) were respectively 27.2^{o}C and 82.96%, which was in the optimum range of temperature viz. 20-30^{o}C, but too humid for shallots viz. 50-70% [20]. The monthly average rainfall during the experiment was 267.3-418.7 mm, which was above the optimum monthly average rainfall for shallots viz. 25-208 mm. The soil at the experiment site was slightly acidic (pH 5,8), with very low C-organic (0.80%), high N-total (0,64%), very low C/N ratio (1.25), low content of P_2O_5 (10 mg/100g), and moderate content of K_2O (21 mg/100g). The chemical characteristics of mushroom media waste after being fermented/composted were pH 6.5, C-organic 10%, N-total 2 %, C/N ratio 5, P_2O_5 1%, and K_2O 1%. The chemical characteristics of manure were pH 7.0, C-organic 10%, N-total 2 %, C/N ratio 5, P_2O_5 2%, and K_2O 2.5%.

2.2. Methods

A randomized block design consisting of six treatments was applied and repeated four times. A total number of 24 plots was arranged with each plot size 1 m x 1.3 m, the distance between plots was 40 cm, the distance between replications was 50 cm, and the plot height was 30 cm. The treatments were without mushroom media waste and goat manure, 25 ton/ha mushroom media waste, 20 ton/ha mushroom media waste + 5 ton/ha goat manure, 15 ton/ha mushroom media waste +10 ton/ha goat manure, 10 ton/ha mushroom media waste +15 ton/ha goat manure, and 5 ton/ha mushroom media waste +20 ton/ha goat manure.

2.3. Data Collection

Plant height was measured from the base of the stem to the tip of the highest leaf of the sample plants and then averaged. The number of leaves was counted for all the fully open leaves on the sample plants. Plant height and the number of leaves were observed at 15, 30, and 45 days after planting (DAP) on 6 sample plants. The number of bulbs per hill was counted on each plant sample at harvest time (Figure-1). The weight of fresh bulbs per hill was weighed using a digital balance, then accumulated the total yield per plot. The weight of dry bulbs per plot was weighed per hill after being air-dried for 7 days. The bulb's weight per plot was converted to yield per hectare.

Figure-1. Observations of plant height, number of leaves and bulbs

2.4. Data Collection

The data were analyzed by analysis of variance, and the means were compared by Duncan's Multiple Range Test at P<0.05 [21].

3. Results

Mushroom media waste and goat manure applications did not give a significant effect on the plant height at 15 days after planting (DAP) but gave a significant effect on the plant height at 30 and 45 DAP (Table 1). At 15 DAP all the combination treatments were not significant differences in plant height. However, at 30 and 45 DAP the combination treatments were significantly different in plant height by application of 5-15 ton/ha and goat manure 10-20 ton/ha (Table 2).

Table-2. The effect of mushroom waste media and goat manure on the plant height

Mushroom media waste and goat manure	**Plant height (cm)**		
	15 DAP	**30 DAP**	**45 DAP**
Without	14.05 a	19.68 a	24.36 a
25 ton/ha + 0 ton/ha	15.60 a	20.19 ab	27.69 b
20 ton/ha + 5 ton/ha	14.88 a	20.35 ab	27.15 b
15 ton/ha + 10 ton/ha	15.07 a	20.78 ab	28.52 bc
10 ton/ha + 15 ton/ha	16.00 a	22.94 c	28.96 c
5 ton/ha + 20 ton/ha	14.56 a	21.54 bc	28.72 bc
CV (%)	4.68	5.61	6.21

Note: The numbers followed by the same letter in the same column were not significantly different according to Duncan's test at P≤0.05 0.05

The application of mushroom waste media and goat manure significantly affected the leaf number per hill (Table 3). Table 3 showed that at 15, 30, and 45 DAP application of mushroom waste media and goat manure gave a significant effect on the number of leaves compared to without organic fertilizer. The number of leaves at 15 DAP resulted in less than 17 leaves without organic fertilizer. But, the application of mushroom waste media and goat manure with different dosages resulted in more than 19 leaves. The same results were shown at 30 and 45 DAP that without organic fertilizer, resulted from less than 22 and 28 leaves, respectively. Application of mushroom waste media and goat manure in different doses obtained more than 25 and 30 leaves, respectively.

Table-3. The effect of mushroom waste media and goat manure on the leaves' number

Mushroom media waste organic fertilizer + goat manure	**Leaves number per hill**		
	15 DAP	**30 DAP**	**45 DAP**
Without	16.62 a	21.32 a	27.69 a
25 ton/ha + 0 ton/ha	19.56 b	25.87 b	31.14 b
20 ton/ha + 5 ton/ha	20.12 b	26.91 bc	31.36 b
15 ton/ha + 10 ton/ha	19.85 b	26.49 b	31.19 b
10 ton/ha + 15 ton/ha	20.94 b	28.67 c	33.49 b
5 ton/ha + 20 ton/ha	20.92 b	27.58 bc	31.55 b
CV (%)	8.11	9.75	6.04

Note: The numbers followed by the same letter in the same column were not significantly different according to Duncan's test at P<0.05

Table 4 showed that all treatment combinations have more bulbs per hill, heavier bulbs per hill, and per plot than that without organic fertilizer and among the treatment combination. However, the treatment combinations 10 ton/ha mushroom media waste organic fertilizer +15 ton/ha goat manure has more bulbs per hill, heavier bulbs per hill and plot; the treatment has, respectively, 2.04 more bulbs per hill, 12.21 g heavier bulbs per hill.

Table-4. The effect of mushroom media waste and goat manure on the number of the bulb per hill, bulbs weight per hill, and plot

Mushroom media waste organic fertilizer + goat manure	Bulbs number per hill	Bulbs weight per hill (g)	Bulbs weight per plot (kg)
Without	6.62 a	29.41 a	1.01 a
25 ton/ha + 0 ton/ha	7.33 b	35.46 b	1.19 b
20 ton/ha + 5 ton/ha	7.71 bc	39.17 bc	1.33 bc
15 ton/ha + 10 ton/ha	8.25 cd	37.83 bc	1.35 bc
10 ton/ha + 15 ton/ha	8.66 d	41.62 c	1.48 c
5 ton/ha + 20 ton/ha	7.62 b	37.25 bc	1.21 b
CV (%)	9.25	11.31	12.84

Note: The numbers followed by the same letter in the same column were not significantly different according to Duncan's test at $P<0.05$

The statistical analysis revealed that the mushroom media waste organic fertilizers and goat manure significantly affected bulb dry weight per plot and yield per hectare (Table 5). Table 5 showed that all the treatment combinations, except for the treatment 10 ton/ha mushroom media waste +15 ton/ha goat manure, have the same weight as without mushroom media waste and goat manure. The yield of shallots per hectare in this experiment ranges between 5.1 and 7.7 tons, which is below the national average of shallot productivity vis. 8 to 12 tons. The treatment of 10 ton/ha mushroom media waste +15 ton/ha goat manure increased yield per hectare by 2.6 tons compared with the treatment of without organic fertilizer.

Table-5. The effect of mushroom media waste organic fertilizers and goat manure on the dry bulb weight per plot and yield per hectare

Mushroom media waste organic fertilizer + goat manure	Dry bulb weight per plot (kg)	Yield per hectare (ton/ha)
Without	0.84 a	5.1 a
25 ton/ha + 0 ton/ha	1.05 ab	6.4 ab
20 ton/ha + 5 ton/ha	1.12 ab	6.6 ab
15 ton/ha + 10 ton/ha	1.11 ab	6.8 ab
10 ton/ha + 15 ton/ha	1.26 b	7.7 b
5 ton/ha + 20 ton/ha	1.02 ab	6.2 ab
CV (%)	12.99	13.11

Note: The numbers followed by the same letter in the same column were not significantly different according to Duncan's test at $P<0.05$.

4. Discussion

The application of 10 ton/ha mushroom media waste + 15 ton/ha goat manure gave better growth characteristics, yield components, and yield of shallots. This study shows that a good combination or composition between mushroom media waste and goat manure, which is nearly balanced in weight, gives a better effect on the growth and yield of shallots.

Soil that has high organic matter content can be ascertained to have fair physical, chemical, and biological soil properties. According to [22], organic matter plays an important role in improving soil structure. Budianto, *et al.* [23], state that the number of leaves is related to vegetative growth, which is influenced by the rate of photosynthesis and respiration, whereas leaves with fast photosynthesis and respiration rates will affect the amount of sugar in higher leaves and increase the growth of mesophyll cells. Despite its slow natural decomposition, organic fertilizers contain macro and micronutrients that are needed by plants [24]. As stated by Budianto, *et al.* [23] that the appropriate fertilizer doses will produce optimal growth. Nitrogen affects the number of tillers which will develop into bulbs. In the process of forming these tillers, nitrogen is needed for the formation of plant cells so that optimal N administration can increase the rate of plant growth. Mushroom media waste, which is rich in organic matter, is highly potential to be used as organic fertilizer. The protein content which is quite high in the mushroom media waste is a source of nitrogen. Shallot bulbs are formed from enlarged and fused layers of leaves. This formation process is inseparable from the mechanism of action of N nutrients. Elemental N is the basic ingredient for the formation of nucleic acids that play a role in the cell nucleus for the cell division process to form leaf layers which then develop into bulbs [25].

According to Sumiati and Gunawan [26], the yield of shallot will decrease if the plant is deficient in nitrogen. The number of bulbs is not only influenced by soil nutrient content but also by genetic factors. The yield of shallot bulbs is significantly affected by the variety [27]. The addition of organic fertilizers increases C-organic in the soil and nutrient absorption by plants and increases yields, especially bulbs. According to Smith, *et al.* [28], C-organic can maintain soil quality to support plant growth. According to Azmi, *et al.* [29], the process of forming shallots requires a longer period of days. The shallot's bulbs will continue growing and emerging new tillers when the minimum day length limit is reached. In line with the statement of Ramadhan and Sumarni [30], that wet bulb weight is related to P (Phosphorus) content in the soil because the role of the P element helps in fruit formation and bulb maturity. The high P_2O_5 content in the soil causes the P elements needed by plants for bulb formation to be available due to the application of organic fertilizers from oyster mushroom media waste and organic goat manure, which can increase the P content in the soil. This effect is in line with the previous study that the application of mushroom waste substrate vermicompost can increase the amount of P-total and P-available in soil [31]. Wet bulbs weight is one indicator to determine bulbs quality. According to Laude and Tambing [32], fertilization must be done properly to produce maximum growth and yields.

According to Priyadi, *et al.* [33], the essential nutrients for plant growth consist of macronutrients and micronutrients, and the nutrients are available in organic fertilizers. Elemental K plays a role in protein and carbohydrate synthesis, photosynthetic translocation to all parts of the plant, increases plant resistance to disease and improves yield and quality of crop yields.

In addition to increasing the availability of nutrients in the soil, organic fertilizer also functions as a granulator, namely improving soil structure so that it can increase the ability to hold water and increase the Cation Exchange Capacity (CEC) of the soil to be higher. Soil with a high CEC can absorb and provide nutrients better than soil with a low CEC. Organic fertilizers, when given into the soil, will be able to increase the diversity and activity of soil microorganisms so that the overhaul of organic matter will take place more quickly. According to Priyadi, *et al.* [34], the increased activity of microorganisms will boost the decomposition of organic matter so that the nutrients contained in the soil become available. The availability of these nutrients allows the rate of photosynthesis to increase so that a higher dry bulb weight of shallots per plot is obtained.

According to Nurshanti [35], the increase in plant dry weight is strongly influenced by overall plant growth. This is closely related to the photosynthate produced from the photosynthesis process which is used to build tissues and organ systems in plants. The increase in the number of leaves and plant fresh weight is positively correlated with dry weight. Nitrogen functions in producing amino acids (proteins), nucleic acids, nucleotides, and chlorophyll in plants, thus supporting vegetative growth. Potassium acts as an activator of various enzymes that are essential in photosynthesis and respiration reactions and for enzymes involved in protein and starch synthesis. Plant dry weight is the accumulation of carbohydrates available for growth during the life of the plant [36]. Dry weight can become an indicator of how much organic fertilizer is absorbed by plants in the form of minerals.

The application of organic fertilizers can activate various species of soil organisms that can release phytohormones and promote plant growth [37]. Tränkner, *et al.* [38], state that potassium plays a role in helping the process of photosynthesis, namely the formation of organic compounds that are stored in storage organs. The bulbs weight increases with the proper dosage of organic fertilizers [39].

In this study, the application of mushroom media waste and goat manure increased plant height by 4.6 cm, the number of leaves per hill by 5.8 at the age of 45 DAP, the number of bulbs per hill by 2.04, the weight of wet bulbs per hill by 12.21 g compared to that of without organic mushroom media waste and goat manure. The application of 10 ton/ha mushroom media waste + 15 ton/ha goat manure yielded 1.26 kg/plot which is equivalent to 7.7 ton/ha and with the increment of 2.6 ton/ha compared to that of without mushroom media waste and goat manure.

5. Conclusion

The applications of mushroom media waste and goat manure increased the growth and yield of shallot. The applications of best combination was 10 ton/ha mushroom media wastes organic fertilizer and 15 ton/ha goat manure, which gained an optimum level in plant height (28.96 cm), leaves number (33.49), and yield of shallot (1.26 kg/plot equal to 7.7 ton/ha). Further study is required to achieve the potential yield of shallot by combining organic and inorganic fertilizers at the most efficient level.

References

[1] Kourosh, C., Abdolrazagh, M., Behrouz, E., and Kobra, M. V. H. N., 2019. "The role of onion (*allium cepa*) in controlling parasitic diseases: A mini review." *Herbal Medicines Journal*, vol. 4, pp. 175–180.

[2] Statistics Indonesia, 2021. "Statistics of horticulture 2021. Bps-statistics Indonesia." Available: https://www.bps.go.id/publication/2022/06/08/44e935e8c141bcb37569aed3/statistik-hortikultura-2021.html

[3] Herwanda, R., Murdiono, W. E., and Koesriharti, 2019. "The application of nitrogen and foliar fertilizer to growth and yield of leeks (*allium fistulosum* l.)." *Journal of Crop Production,* vol. 5, pp. 46–53.

[4] Cabral-Pinto, M. M. S., Inácio, M., Neves, O., Almeida, A. A., Pinto, E., Oliveiros, B., and Ferreira, d. S. E. A., 2020. "Human health risk assessment due to agricultural activities and crop consumption in the surroundings of an industrial area." *Exposure and Health,* vol. 12, pp. 629–640.

[5] Blanco-Canqui, H. and Schlegel, A. J., 2013. "Implications of inorganic fertilization of irrigated corn on soil properties: Lessons learned after 50 years." *Journal of Environmental Quality,* vol. 42, pp. 861–871.

[6] Roba, T. B., 2018. "The effect of mixing organic and inorganic fertilizers on productivity and soil fertility." *(Journal Review). Scientific Research,* vol. 5, pp. 1-11.

[7] Lin, Y., Xia, Z., Encai, B., Jianshe, L., Zhirong, Z., and Kai, C., 2020. "Bio-organic fertilizer with reduced rates of chemical fertilization improves soil fertility and enhances tomato yield and quality." *Scientific Reports,* vol. 10, p. 177.

[8] Mahfudz, M., Saleh, S., Antara, M., A., A., Bachri, S., Made, U., Hasanah, U., and Rauf, R. A., 2019. "Adoption and advantages of eco-friendly technology application at the Shallot farming system in Indonesia." *Agronomy Research,* vol. 17, pp. 1679-1687.

[9] Balaguravaiah, D., Adinarayana, G., Prathap, S., Reddy, and Yellamanda, T., 2005. "Influence of long-term use of inorganic and organic manures on soil fertility and sustainable productivity of rainfed groundnut in alfisols." *Journal of the Indian Society of Soil Science,* vol. 53, pp. 608-611.

[10] Yunlong, Z., Caihua, L., Yanwei, W., Yimin, H., Peter, C., Junling, Z., and Xiaolin, L., 2016. "Maize yield and soil fertility with the combined use of compost and inorganic fertilizers on a calcareous soil on the North China plain." *Soil and Tillage Research,* vol. 155, pp. 85-94.

[11] Corozo, Q. L., Arteaga, A. F. J., Cuenca, C. E. W., Salas, M. C. A., Delgado, D. M. M., Montes, E. K., Monteros, A. Á., and Macías, P. F. C., 2020. "Effect of organic and chemical fertilization on the onion crop (*Allium cepa* L.)." *Journal of Central European Agriculture,* vol. 21, pp. 522–530.

[12] Hartatik, W., Husnain, and Widowati, L. R., 2015. "The Role of Organic Fertilizers in Increasing Soil and Plant Productivity." *Jurnal Sumberdaya Lahan,* vol. 9, pp. 107–120.

[13] Lasmini, S. A., Wahyudi, I., Rosmini, R., Nasir, B., and Edy, N., 2019. "Combined application of mulches and organic fertilizers enhance shallot production in dryland." *Agronomy Research,* vol. 17, pp. 165-175.

[14] Antunes, F., Marçal, S., Taofiq, O., Morais, A. M. M. B., Freitas, A. C., Ferreira, I. C. F. R., and Pintado, M., 2020. "Valorization of mushroom by-products as a source of value-added compounds and potential applications." *Molecules,* vol. 25, p. 2672.

[15] Sulaeman, Y., Maswar, and Erfandi, D., 2017. "The effect of a combination of organic and inorganic fertilizers on soil chemical properties and maize yields in an acid-dry land." *Journal of Agricultural Technology Research and Development,* vol. 20, pp. 1–12.

[16] Styaningrum, L., 2013. "Response of common bean (*phaseolus vulgaris* l.) at the various dosage of manure and foliar fertilizer." *Journal of Crop Production,* vol. 1, pp. 54–60.

[17] Sanista, E. M., Safalaoh, A. C. L., Chigwa, F., Jere, W. L., and Gherman, G. A., 2019. "The effect of goat manure on performance of vegetative growth of cactus (nopalea cochenillifera salm-dyck)." *International Journal of Animal Health and Livestock Production Research,* vol. 3, pp. 15-25.

[18] Batubara, S. F., Santoso, A. B., and Ramija, K. E. L., 2021. *Potential of goat manure as organic fertilizer in north Sumatera*. BIO Web of Conferences 33, 05001 The 1st International Conference of Advanced Veterinary Science and Technologies for Sustainable Development (ICAVESS 2021). (bio-conferences.org).

[19] Mbatha, K. C., Mchunu, C. N., Mavengahama, S., and Ntuli, N. R., 2021. "Effect of poultry and goat manures on the nutrient content of sesamum alatum leafy vegetables." *Appl. Sci.,* vol. 11, p. 11933.

[20] Sumarni, N. and Hidayat, A., 2005. *Shallot cultivation, technical guide for shallots cultivation*. Bandung: Indonesian Vegetables Research Institute.

[21] Gomez, K. A. and Gomez, A. A., 2010. *Statistical procedures for agricultural research*. Universitas Indonesia.

[22] Widawati, S., Suliasih, and Syaifudin, 2002. "Effect of compost plus introduction on dry weight production of cat's whiskers (orthosiphon aristatus) leaves on three kinds of soil media." *J. Biol. Indon.,* vol. 3, pp. 245–253.

[23] Budianto, A., Sahiri, N., and Madauna, I. S., 2015. "Giving effect of different doses of fertilizer on chicken coop plant growth and results of onion (*allium ascalonicum* l.) variety palu valley." *E-Journal Agrotekbis,* vol. 3, pp. 440–447.

[24] Asngad, A., 2013. "The innovation of organic fertilizer from chicken manure and water hyacinth combined with granule mycorrhizae." *Indonesian Journal of Mathematics and Natural Sciences,* vol. 36, pp. 1–7.

[25] Przygocka-Cyna, K., Barłóg, P., Grzebisz, W., and Spizewski, T., 2020. "Onion (Allium cepa L.) yield and growth dynamics response to in-season patterns of nitrogen and sulfur uptake." *Agronomy,* vol. 10, pp. 1-17.

[26] Sumiati, E. and Gunawan, O. S., 2006. "Application of mycorrhizal biological fertilizer to increase the efficiency of npk nutrient uptake and its effect on yield and quality of shallot bulbs." *Journal of Horticulture,* vol. 17, pp. 34–42.

[27] Gebretsadkan, G., Gebremicael, Y., Asgele, K., Abebe, E., Gebrelibanos, W., and Tsehaye, Y., 2018. "Enhancing productivity and production of onion (*allium cepa* l.) through the use of improved varieties at north western zoze of tigray , Ethiopia." *International Journal of Environment, Agriculture and Biotechnology (IJEB),,* vol. 3, pp. 756–762.

[28] Smith, P., Haberl, H., Popp, A., Erb, K. H., Lauk, C., Harper, R., Tubiello, F. N., De Siqueira, P. A., Jafari, M., *et al.,* 2013. "How much land-based greenhouse gas mitigation can be achieved without compromising food security and environmental goals?" *Global Change Biology,* vol. 19, pp. 2285–2302.

[29] Azmi, Hidayat, I. M., and Wiguna, G., 2011. "The effect of varieties and size of bulbs on shallot productivity." *Jurnal Hortikultura,* vol. 21, pp. 206–213.

[30] Ramadhan, A. F. N. and Sumarni, T., 2018. "The response of onion crop (*Allium ascalonicum* L.) to organic and inorganic fertilizers." *Journal of Crop Production,* vol. 6, pp. 815–822.

[31] Purnawanto, A. M. and Ahadiyat, Y. R., 2022. "Maize growth and yield characteristics with application of mushroom waste substrate vermicompost in ultisol." *Agronomy Research,* vol. 20, pp. 1090-1103.

[32] Laude, S. and Tambing, Y., 2010. "The growth and yield of spring onion (*allium fistulosum* l.) at various application of chicken manure doses." *Journal Agroland,* vol. 17, pp. 144–148.

[33] Priyadi, R., Juhaeni, A. H., and Haryadi, F. I., 2021. "The effect of fermentation organic fertilizer measures (poracy) aren with chicken fertilizer on red pepper's growth and production." *Agricoula Journal,* vol. 11, pp. 49–57.

[34] Priyadi, R., Juhaeni, A. H., and H., T., 2020. "The effect of a combination of organic manure fermented (porasi) and biological fertilizer (m-bio) on chili pepper's growth and production." *Agricoula Journal,* vol. 10, pp. 74–84.

[35] Nurshanti, D. F., 2009. "The effect of organic fertilizers and yields of caisim mustard greens (brassica juncea l.)." *AgronobiS,* vol. 1, pp. 329–332.

[36] Desiana, C., Banuwa, I. S., Evizal, R., and Yusnaini, S., 2013. "Effect of liquid organic fertilizer cow urine and tofu waste on the growth of cocoa seeds (theobroma cacao l.)." *Journal Agrotek Tropika,* vol. 1, pp. 113–119.

[37] Yoldas, F., Ceylan, S., Mordogan, N., and Esetlili, B. C., 2011. "Effect of organic and inorganic fertilizers on yield and mineral content of onion (*Allium cepa* .)." *African Journal of Biotechnology,* vol. 10, pp. 11488–11492.

[38] Tränkner, M., Tavakol, E., and Jákli, B., 2018. "Functioning of potassium and magnesium in photosynthesis, photosynthate translocation and photoprotection." *Physiologia Plantarum,* vol. 163, pp. 414–431.

[39] Diaz-Perez, J. C., Bautista, J., Gunawan, G., Bateman, A., and Riner, C. M., 2018. "Sweet onion (*allium cepa* l.) as influenced by organic fertilization rate : 2 . Bulb yield and quality before and after storage." *Hort Science,* vol. 53, pp. 459–464.