OPEN ACCESS
Pakistan Journal of Agricultural Research

Research Article

Performance Analysis of Shallot Farming Under *Glebagan* System in Central Java, Indonesia

Agus Subhan Prasetyo, Tutik Dalmiyatun, Siwi Gayatri, Kadhung Prayoga, Wulan Sumekar and Joko Mariyono*

Agribusiness Study Program, Faculty of Animal and Agricultural Sciences, Universitas Diponegoro, Jl. Prof. Soedarto, S.H., Tembalang, Semarang, Indonesia

Abstract | This study aimed to analyze the *glebagan* system's effect on shallot farming performance in Central Java, Indonesia. *The glebagan* system is a yearly cropping rotation with plantation crops under the control of state-owned enterprises. This study employed economic production theory as the fundamental analysis. Brebes district was selected as the study site since the region is one of the centers of shallot production at the national level. Samples for the study were obtained from farmers who grew shallot in the *glebagan* and conventional systems, with a sample size of 100 for each group. The sample selection criteria include the farmers adopting *the glebagan* system for two years in technically irrigated lands in the peak season of shallot. The control group was selected based on the same seasons. Production function was employed to analyze the impact of *the glebagan* system. The results show that farmers growing shallots in *the glebagan* system gained many advantages. The production of shallot farming in *the glebagan* system was higher than that of its counterpart, and the system improved the productivity of the land. These findings imply that *the glebagan* system is functional and can be socialized with other farmers. The system can be modified to shallot and other horticultural crops. The study is novel regarding the analytical model that includes control variables to show the attributable impact of the *glebagan* system.

Received | March 12, 2024; **Accepted** | May 21, 2024; **Published** | June 10, 2024
***Correspondence** | Joko Mariyono, Agribusiness Study Program, Faculty of Animal and Agricultural Sciences, Universitas Diponegoro, Jl. Prof. Soedarto, S.H., Tembalang, Semarang, Indonesia; **Email:** jokomariyono@live.undip.ac.id
Citation | Prasetyo, A.S., T. Dalmiyatun, S. Gayatri, K. Prayoga, W. Sumekar, J. Mariyono. 2024. Performance analysis of shallot farming under glebagan system in central Java, Indonesia. *Pakistan Journal of Agricultural Research,* 37(2): 158-164.
DOI | https://dx.doi.org/10.17582/journal.pjar/2024/37.2.158.164
Keywords | Crop rotation, Farm performance, *Glebagan* system, Production, Shallot-based agribusiness

Introduction

The agricultural sector still plays a significant role in the Indonesian economy. The government has designated shallot as one of the national strategic commodities. Shallots have many benefits and high economic value. Shallots are widely produced as a medicinal plant, food, and flavoring (Amiri *et al.*, 2021). As one of the vegetables, shallots provide a significant contribution to providing essential nutritional content that supports food and nutrition security programs (Wijaya *et al.*, 2021a, b). Apart from that, shallots also contain nutrients and compounds that are classified as non-nutritive substances, as well as enzymes that are useful for therapy as improving and maintaining the human body (Amiri *et al*., 2021; Aryaanta, 2019; Mohamad *et al*., 2020; Tabuni, 2017). Shallots are also a raw material for the food industry (Setyadjit and Sukasih, 2015).

Shallots are one of the leading vegetable commodities, and they have important meaning for society in terms of their high economic value (Mariyono, 2018a). This commodity is also a source of income and employment opportunities that make a reasonably high contribution to the economic development of many regions in Indonesia (Astuti et al., 2020; Hidayat *et al*., 2020; Hindarti *et al*., 2023; Parmawati *et al*., 2021; Solichah and Rangga, 2018; Prakoso, 2021), as well as in the regions of other developing countries (Calica and Dulay, 2018; Yang *et al*., 2021; Yao et al., 2017). Importantly, shallot has the potential for export penetration to other countries (Wahyuni *et al*. 2020). Shortly speaking, shallot farming is a backbone commodity in the economy of the regions.

The production of shallot needs to be increased to meet the increasing demand. The *glebagan* system is hypothesized to be an excellent method to improve the performance of shallot farming. Improvement in the shallot performance has a direct effect on production and income. The *glebagan* system comes from Javanese jargon, namely *glebag* or *ngglebag*, which means to reverse or flip. *Glebagan* is essentially a rotation of land use in the agricultural system. In this system, the land in an area is divided into three parts. Every year, one part of the land is submitted to state-owned companies that operate factories in the sugar and tobacco industry to plant sugarcane and tobacco, and two parts are provided for food and horticulture crops (Prabowo, 1994; Mubyarto and Daryanti, 1991). It means a pattern of cultivating on land with commodity crops alternating from season to season to ensure the quality of the land remains fertile. The commodities that are planted in rotation within two years are as follows: 7 months of land had been used by the state-owned companies, and the remaining 17 months of land was managed by farmers for cultivating rice and *palawija* (secondary food crops) such as maize, and soybean (Soepeno and Bindarti, 2017).

Several farmers have tried to use the *glebagan* system for shallot farming in Bebres regions. However, the study related to the *Glebagan* system applicable to shallot farming is still limited, and this is considered a research gap. To fill the research gap, this study aims to analyze the economic performance of shallot farming or shallot-based agribusiness under the *glebagan* system in the Brebes region.

Materials and Methods

This study was conducted in Brebes is known as one of the largest centers for shallot in Indonesia. Brebes district contributes up to 30% of total national production, which accounted for more than 1.4 million tons. Two sub-districts of Kersana and Banjaratma were selected, where several farmers grew shallot in the *glebagan* system, and others in a common or conventional system. This study employed production economic theory as a fundamental analysis (Nicholson and Snyder, 2008; Pindyck and Rubinfeld, 2013). In this case, the *glebagan* system is considered an improved production technology that shifts the production function upward. It can be said that production under the *glebagan* system is higher with the same existing level of input. Some socioeconomic and farm characteristics were incorporated into the analysis. A direct comparison of the costs of production components and economic aspects of shallot farming was conducted to see the gap between *glebagan* and conventional systems. An independent t-test was conducted to analyze the significance. A regression model was constructed to scrutinize the attributable effect of the *glebagan* system by incorporating factors that control the difference. The regression model was derived from the production function based on the optimization of which producers seek profit maximization. In this case, this study postulates how farmers determine, organize, and coordinate the use of the factors of production effectively and as efficiently as possible so that agribusiness provides income as much as possible (Akamine *et al*., 2017). Based on the postulation, the regression model is formulated as follows.

$$Y = \beta_0 + \sum_{i=1}^{10} \beta_i X_i + \varepsilon$$

Where; Y is income; X_i for i=1, 2, …, 11 are land, planting material, fertilizers, pesticides, labor, irrigation, shallot price, age, education, experience, *glebagan* system affecting *Y*; β_i for i=1, 2, …, 11 are regression coefficients to be estimated; ε is error terms representing other factors beyond the study. The definition and unit measurement of variables in this study can be seen in Table 1.

Table 1: *Definition and unit measurement of selected variables.*

No	Variables	Definition	Unit
1	Income	Amount of income earned from one season of shallot farming	IDR
2	Land	Area cultivated to shallots	hectare
3	Planting material (bulb)	Value of shallot bulb as planting material	IDR
4	Fertilizers	Value of all fertilizers applicable to shallot farming	IDR
5	Pesticides	Value of insecticides, fungicides, herbicides and others applicable to shallot farming	IDR
6	Labor	Value or costs of labour consisting of human, animal and machinery devoted to shallot farming	IDR
7	Irrigation	Value of water irrigation, which includes tools.	IDR
8	Shallot price	Farmgate price of shallot at harvesting time	IDR kg^{-1}
9	Age	Age of farmers	year
10	Education	Time spent on formal education	year
11	Experience	Years have been being a shallot farmer	year
12	Glebagan	Farmers operate farming under the *glebagan* system.	1: yes; 0: no

The study's sample size was 200 farmers, where 100 shallot farmers applied *glebagan* system and 100 farmers did not apply as the counterfactual. Data were collected through in-depth interviews conducted in 2021-2022. Data were then compiled and analyzed using STATA ver.13. Hypothesis for this study was formulated as H_0: $\beta_i = 0$, and H1:H_0 is untrue. The hypothesis was tested using significant levels of 0.1, 0.05, and 0.01.

Results and Discussion

First, let us describe the selected farmers' socioeconomic aspects in Table 2. Farmers in the study sites, on average, were about 44 years old and had experience in shallot cultivation for about 24 years. Their education level was mostly below senior high schools. These characteristics represent the human capital of farmers that potentially affect agribusiness management. Both groups have pretty similar characteristics; thus, comparing both groups in terms of agribusiness performance is pretty good.

Table 3 compares production cost components for *glebagan* and conventional systems. In the *glebagan* system, planting material (shallot bulb) and irrigation costs were higher than conventional ones. In the *glebagan* system, farmers tended to increase the planting density because they expected that the plant would respond to the new soil conditions. The high density of planting and new soil conditions required enough water, and this is why the cost of irrigation was higher in the *glebagan* system.

Table 2: *Socioeconomic characteristics of shallot farmers.*

No	Description	Glebagan	Conventional
1	Age (years)	46	43
2	Experiences (year)	23	25
3	Education level (%)		
	Tertiary school	5	7
	Senior high school	22	19
	Junior high school	33	27
	Elementary school	48	47

Source: *primary data analysis.*

Table 3: *Components of production costs (IDR ha^{-1}).*

No	Description	Glebagan	Conven-tional	Gap
1	Planting material	45,680,000	37,691,000	7,989,000*
2	Fertilizers	4,904,000	6,612,000	-1,708,000*
3	Pesticides	3,315,000	6,408,000	-3,093,000*
4	Labor	18,041,000	25,213,000	-7,172,000*
5	Irrigation	5,640,000	4,013,000	1,627,000*

Note: *IDR is the Indonesian currency, US$ 1 ≅ IDR 15,000; * indicates a t-test significant difference at 0.01.*
Source: *Primary data analysis.*

Fertilizers and pesticides in the *glebagan* system were lower than those in the conventional one. Farmers expected that land in the *glebagan* system would be considered fresh from the sugarcane rotation. The soil condition is considered suitable for shallots, and the pests and diseases have been cut with such rotation. Thus, there is no need for high levels of pesticides and fertilizers. The lower level of such agrochemicals reduced the labor costs devoted to agrochemical application. Other aspects of low labor costs in the *glebagan* system were fewer crop maintenance.

Table 4: *Economic aspects of shallot farming (IDR ha^{-1}).*

No	Description	Glebagan	Conven-tional	Gap
1	Revenue	373,714,000	199,667,000	174,047,000*
2	Production cost	77,580,000	79,937,000	-2,357,000*
3	Income	296,134,000	119,730,000	176,404,000*

Note: *IDR is the Indonesian currency, US$ 1 ≅ IDR 15,000; * indicates a t-test significant difference at 0.01*
Source: *Primary data analysis.*

Table 4 compares the economic aspects of shallot farming in *glebagan* and conventional systems. Revenue or sales of shallot generated in *the glebagan* system was almost double that of the conventional one. This phenomenon is understandable since the density of shallot plants in the *glebagan* system is higher than that of its counterpart. As per farmers expectations, shallot in the *glebagan* system grew better than in the conventional one. Assuming the shallot price is the same, the shallot production in the *glebagan* system should be higher than that in the conventional system. However, the price of shallot in the *glebagan* system could be higher because of the higher quality of shallot than in the conventional one. The production costs of shallot farming in the *glebagan* system were lower than those of the counterpart. It is sensible since the conventional system's crop maintenance costs were very high. The result of high revenue and low production costs was the high income generated from *the glebagan* system, which was more than double the conventional system.

The direct comparison might be biased since other factors control the differences. Using the regression model shown in Table 5, we can see the attributable impact of *the glebagan* system on the income generated from shallot-based agribusiness. The estimated model can be considered robust, which is indicated by R^2 = 0.728, which means that about 73% of the variation in income is explainable to all variations of factors included in the regression model. The F-test value is high enough to provide a very high significant level by means that all factors simultaneously influence income.

Partially, we can see from the table that land, fertilizers, pesticides, irrigation, and shallot price has a significant effect on income. Land obviously impacts income since it represents farming scale, where the larger the scale of farming, the higher the income gained by farmers. Additional land of one ha leads to an additional income of about IDR 8 million, keeping other factors unchanged. Fertilizers show a significant positive impact on income. This indicates that shallot was still responsive to fertilizers the value of production resulting from fertilizers offsets the costs. Pesticides also significantly impact income; this indicates that shallot farming still needs protection from pest infestations and diseases (Mariyono *et al.*, 2013; Mariyono, 2018b). The value of production saved by pesticides is still higher than the production costs of pesticides. Irrigation has a highly significant impact on income. This indicates that water is vital for shallot farming. Shallot needs perfect water management since this crop needs wet soil conditions but not unflooded (Huang *et al.*, 2006; Tabuni, 2017). Farmers regularly irrigate the shallot farming in the study sites to ensure enough water for plants. Shallot price provides a highly significant impact on income, and this is economically logical. Shallots with high quality will have good prices (Wahyudin *et al.*, 2015), and commonly, the quality of shallot harvested from the *glebagan* system is better than that of the counterpart.

Table 5: *Estimated regression model.*

No	Variables	Coefficients	Std Error	p-value
1	Constant	$1.06{\cdot}10^8$	$1.483{\cdot}10^7$	0.000
2	Land	$8.82{\cdot}10^6$	$4.960{\cdot}10^6$	0.041
3	Planting material	0.11	0.61	0.669
4	Fertilizers	4.79	2.69	0.076
5	Pesticides	1.16	0.62	0.061
6	Labor	0.27	0.74	0.513
7	Irrigation	30.73	2.96	0.000
8	Shallot price	7172.14	843.43	0.000
9	Age	-61662.57	95708.65	0.420
10	Education	462607.67	954366.07	0.528
11	Experience	-5345.35	4633.45	0.221
12	Glebagan	$16.52{\cdot}10^7$	$4.96{\cdot}10^6$	0.000
	R^2 = 0.728			
	F-stat = 43.78 , p < F-value=0.001			

Note: *The dependent variable is income (IDR). The regression model has passed the classical assumption that multilinearity and heteroscedasticity are not problems, and thus, the estimates are robust.*

Factors that do not affect the income include planting material, labor, age, experience, and education of farmers. The insignificant effect of planting material on income indicates that farmers grew shallot in a high-density planting area, and the population of plants was saturated. This corresponds to the significant effect of land on income by means that the crop can develop when there is available space. Note that shallot bulbs are common in the study areas and are replaced with other planting materials, such as true seed shallots, under experiments (Pratiwi *et al*., 2018; Tabor, 2018). The same case applies to labor, which has no significant effect. Shallot farming is labor-intensive and drudgery. However, labor allocation has been saturated in this case. Additional labor devoted to farming will not provide any gain. Age, experience, and education of farmers have insignificant effects. This is understandable since farmers have been experienced in farming. They have almost similar skills in shallot farming management.

Now let us focus on the variable of interest: The *glebagan* system. After controlling other factors in the regression model, the attributable impact of *the glebagan* system was very significant. Farmers operating shallot-based agribusiness under a hectare of land in the *glebagan* system earned about IDR 160 million higher than their counterparts. The plant grows better in the glebagan system, resulting in a good harvest quality. Infestation of pests and diseases in the *glebagan* system was considered low since there was no accumulation from the previous system. Soil condition is also fresh for shallot because of different cropping systems from the previous system. Studies support this condition that diseases and soil nutrient deficiency are two factors that influence shallot production in Indonesia (Sudadi *et al*., 2019; Marais *et al*., 2019) and other countries (Vermeulen and Mosquera, 2009; Dahal and Manandhar, 2021).

Other farmers are encouraged to use the *glebagan* system for shallot farming since many benefits can be obtained. In case there are limited lands under the *glebagan* system, farmers can modify it by rotating with other crops for at least one year. The rotation could be with rice, maize, and soybeans to refresh the soil. This type of crop rotation is expected to have a similar effect to the natural *glebagan* system.

Conclusions and Recommendations

This study showed the improvement of shallot farming under the *glebagan* system, comparable to a conventional system. The performance of shallot farming under the *glebagan* system was superior, as indicated by the income generated from shallot farming under the *glebagan* system, which was more than double that under the conventional system. The *glebagan* system enabled farmers to reduce fertilizers, pesticides, and labor. It is highly recommended that other farmers utilize lands in the *glebagan* system for shallot farming or other high-value crops such as chili. Whenever the land of the *glebagan* system is limited, the modification of crop rotation with rice, soybean, and maize over one year is a good alternative. It would be stronger if the system modification could be institutionalized into local policy. The local government can collaborate with non-government organizations to share the benefits of the *glebagan* system with other farmers who still need to adopt the system. Further studies are encouraged to investigate the farmers' willingness to grow shallot and other high-valued horticultural crops under *glebagan* system.

Acknowledgment

The authors thank the farmers and enumerators for their valuable time gathering information about this study. They acknowledge that this study was funded by the Faculty of Animal and Agricultural Sciences, Universitas Diponegoro. The results and interpretations of this study do not represent the opinions of the funding provider, and the authors are responsible for all interpretations and any shortcomings in this paper.

Novelty Statement

The novelty of this article includes glebagan system applicable to shallot farming that has not been analyzed, methodological aspects that incorporate socio-economic factors serving as control variables to see the robustness of glebagan system in increasing shallot production.

Author's Contribution

Joko Mariyono, Wulan Sumekar, Kadhung Prayoga, Agus Subhan Prasetyo, Tutik Dalmiyatun and Siwi Gayatri: Conceptualized the research work.
Joko Mariyono and Tutik Dalmiyatun: conducted data cleaning, and econometric analysis, and prepared the initial draft of the paper.
Agus Subhan Prasetyo, Kadhung Prayoga, Siwi

Gayatri and Wulan Sumekar: Supervised the analysis, and reviewed and edited the final draft.

Conflict of interest

The authors have declared no conflict of interest.

References

Akamine, A., J.C. Bidogeza, J.R. Minkoua and V. Afari-Sefa. 2017. Efficiency and productivity analysis of vegetable farming within root and tuber-based systems in the humid tropics of Cameroon. J. Integrat. Agric., 16: 1865–1873. https://doi.org/10.1016/S2095-3119(17)61662-9

Amiri, Z., M.R. Asgharipour, D.E. Campbell, K. Azizi, E. Kakolvand and E.H. Moghadam. 2021. Conservation agriculture, a selective model based on emergy analysis for sustainable production of shallot as a medicinal-industrial plant. J. Cleaner Prod., 292(126000): 1-19. https://doi.org/10.1016/j.jclepro.2021.126000

Aryanta, R.W.I., 2019. Bawang merah dan manfaatnya bagi Kesehatan. E J. Widya Kesehatan, 1(1): 12-20. https://doi.org/10.32795/widyakesehatan.v1i1.280

Astuti, T. L. W., A. Daryanto, Y. Syaukat and H.K. Daryanto. 2020. Efficiency analysis of shallot farmer in Brebes, Central Java. Int. J. Res. and Rev., 7(11): 551–558.

Calica, G.B. and M.M.N. Dulay. 2018. Assessment of the postharvest systems and losses of shallots in Ilocos, Philippines. Asian J. Postharv. Mechan., 1(1): 101-115.

Dahal, S. and B. Manandhar. 2021. Soil management practices in commercial vegetable farming in changing socioeconomic context in Makawanpur, Nepal. Environ. Chall., 4: 10018. https://doi.org/10.1016/j.envc.2021.100188

Hidayat, S., M.A. Girsang, P.S. Tobing, P. Nainggolan and L. Haloho. 2020. *Economic analysis* of shallot commodity development in north Padang Lawas district. Agriculture, 32(2): 163-172. https://doi.org/10.24246/agric.2020.v32.i2.p163-172

Hindarti, S., A.J. Saputro and L.R. Maula. 2023. Social economic factors affecting the technical inefficiency of shallots in Malang District. Agrisocionomics, 7(1): 39-47.

Huang, B., X. Shi, D. Yu, I.O. Born, K. Blomba, T.F. Pagella, H. Wang, W. Sun and F.L. Sinclair. 2006. Environmental assessment of small-scale vegetable farming systems in peri-urban areas of the Yangtze River Delta Region, China. Agric. Ecos. Environ., 112: 391–402. https://doi.org/10.1016/j.agee.2005.08.037

Marais, A., C. Faure, S. Theil and T. Candresse. 2019. Characterisation of the virome of shallots affected by the shallot mild yellow stripe disease in France. PLoS One, 14(7): e0219024. https://doi.org/10.1371/journal.pone.0219024

Mariyono, J., G.C. Luther, M. Bhattarai, M.A. Ferizal, R. Jaya and N. Fitriana. 2013. Farmer field schools on chili peppers in Aceh, Indonesia: Activities and impacts. Agroecol. Sustain. Food Syst., 37(9): 1063–1077. https://doi.org/10.1080/21683565.2013.819827

Mariyono, J., 2018a. Productivity growth of Indonesian rice production: Sources and efforts to improve performance. Int. J. Prod. Perf. Manage., 67(9): 1792–1815. https://doi.org/10.1108/IJPPM-10-2017-0265

Mariyono, J., 2018b. Empowering rural livelihoods through farmers' field school on vegetable production in aceh province-Indonesia. J. Rural Dev., 37(1): 129–145. https://doi.org/10.25175/jrd/2018/v37/i1/122696

Mohamad, H., M.H. Shahrajabian, W. Sun and Q. Cheng. 2020. Chinese onion, and shallot, originated in Asia, medicinal plants for healthy daily recipes, Notulae Sci. Biol., 12(2): 197-207. https://doi.org/10.15835/nsb12210725

Mubyarto and Daryanti. 1991. Gula: Kajian Sosial-Ekonomi, Yogyakarta: Aditya Media, pp. 11. https://doi.org/10.20885/unisia.vol11.iss9.art1

Nicholson, W. and C. Snyder. 2008. Microeconomic theory: Basic principles and extensions, eleventh Ed. South-Western, Cengage Learning.

Parmawati, R., R. Hardyansah and A. Rahmawati. 2021. Sustainability of corporate based shallot farming business: Evidence from Malang Regency, Indonesia. J. Socioecon. Dev., 4(1): 46-56. https://doi.org/10.31328/jsed.v4i1.1644

Pindyck, R.S. and D.L. Rubinfeld. 2013. Microeconomics, 8th ed. Pearson, Boston.

Prabowo, D., 1994. Penguasaan Tanah dalam Program Tebu Rakyat Intensifikasi (Yogyakarta: Gadjah Mada University Press, pp. 14.

Prakoso, K.I., 2021. Affecting factors of shallots production level in Wanasari Sub-District Brebes Regency. Bus. Econ. Anal. J., 1(1): 27-37. https://doi.org/10.15294/beaj.v1i1.30143

Pratiwi, P.R., S.I. Santoso and W. Roessali. 2018.

True shallot technology adoption rate seeds in Klambu District, Grobogan District. Agraris., 4(1): 9-17.

Setyadjit, S. and E. Sukasih. 2015. Effect of addition of filler on the production of shallot (*Allium cepa var. Ascalonicum* L.) Powder with drum dryer. Proc. Food Sci., 3: 396–408. https://doi.org/10.1016/j.profoo.2015.01.044

Soepeno, B. and W.E. Bindarti. 2017. The peasants' dependence in relation to *glebagan* production system (A case study on land use right PTP Nusantara X Jember). Int. J. Adv. Res., 5(10): 729-738. https://doi.org/10.21474/IJAR01/5581

Solichah, T.U. and K.K. Rangga. 2018. Shallot farmers adaptation towards climate change in Larangan Village. In: T.R. Nuringtyas, A.C. Sukartiko, A. Isnansetyo (Eds.), UGM Digital Press Life Sciences: 1, Proceeding of the 2nd International Conference on Tropical Agriculture, pp. 45–55. https://doi.org/10.29037/digitalpress.21335

Sudadi, S., H. Hadiwiyono, S. Sumarno and D.D. Ciptasari. 2019. Capability of sulphur oxidizing bacteria to inhibit basal plate rot and increase shallot growth on andisols. AGRIVITA J. Agric. Sci., 41(1): 107-116. https://doi.org/10.17503/agrivita.v41i1.829

Tabor, G., 2018. Development of seed propagated shallot (*Allium cepa* L var. aggregatum) varieties in Ethiopia. Sci. Hortic., 240: 89–93. https://doi.org/10.1016/j.scienta.2018.05.046

Tabuni, A., 2017. Budidaya Tanaman Bawang Merah. Agriculture, 3(1): 17-28.

Vermeulen, G.D. and J. Mosquera. 2009. Soil, crop and emission responses to seasonal-controlled traffic in organic vegetable farming on loam soil. Soil Till. Res., 102: 126–134. https://doi.org/10.1016/j.still.2008.08.008

Wahyudin, M., M. Maksum and H. Yuliando. 2015. The shallot pricing in the view of import restriction and price reference. Agric. Agri. Sci. Proced., 3: 132–136. https://doi.org/10.1016/j.aaspro.2015.01.026

Wahyuni, S., J. Hestina, H.P. Saliem, S. Pasaribu and R. Kustiari. 2020. Shallot penetration in the export market, international conference on agriculture and applied science (ICoAAS), Politeknik Negeri Lampung, 19 November 2020.

Wijaya, A.F., A. Kuntariningsih, S. Sarwono and A. Suryono. 2021a. Malnutrition mitigation and community empowerment through the sustainable food reserve programme in Indonesia. Dev. Pract., 31(1): 37–48. https://doi.org/10.1080/09614524.2020.1782845

Wijaya, A.F., A. Kuntariningsih, S. Sarwono and A. Suryono. 2021b. Role and contribution of vegetables in mitigating malnutrition through a sustainable food reserve program. Int. J. Vegetable Sci., 27(1): 65–75. https://doi.org/10.1080/19315260.2019.1703872

Yang, B., S. Banerjee, C. Herzog, A.C. Ramírez, P. Dahlin, M.G.A. van der Heijden. 2021. Impact of land-use type and organic farming on the abundance, diversity, community composition and functional properties of soil nematode communities in vegetable farming. Agric. Ecosy. Environ. 318: 107488. https://doi.org/10.1016/j.agee.2021.107488

Yao F.B., O-.K. Grace, O.S. Kwame and D.L. Payne. 2017. The present status of shallot (*Allium ascalonicum* L.) farming enterprise in Ghana: the case of Keta Municipality, Agric. Com., 5(2): 8-16.