Agro Bali : Agricultural Journal
Vol. 7 No. 1: 17-23, March 2024

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i1.1506

The Intention of Using Biofertilizer Among Shallot Farmers in Nganjuk Regency, East Java Province, Indonesia

Amelia Ulfa♥, Burhanuddin, Joko Purwono

Agribusiness Science Program, Faculty of Economic and Management, IPB University, Bogor, Indonesia
♥Corresponding author email: amelia22amelia@apps.ipb.ac.id

Article history: submitted: August 30, 2023; accepted: March 22, 2024; available online: March 30, 2024

Abstract. The excessive use of chemical fertilizer leads to a critical contribution to the environment, such as the decline of soil fertility and shallot productivity in the future. Whereas biofertilizer is one of the alternative ways to diminish the usage of chemical fertilizer to support sustainable agriculture. However, the majority of shallot's farmers have a lack of knowledge towards biofertilizer. This study aims to analyze the influence of attitude, subjective norms, and perception toward the intention of using biofertilizers. This research was conducted in September 2022 – November 2022 in Gondang and Rejoso District, Nganjuk Regency, East Java, Indonesia. The respondents are considered by census method, and it is distributed to 140 shallot farmers who consist of biofertilizer users. The data was analyzed by using Partial Least Square (PLS) in order to examine the influence of attitude, subjective norms, and perception towards the intention of using biofertilizer. Overall, it is illustrated that attitude, subjective norms, and perception have a positive and significant influence on the intention of using biofertilizers among shallot farmers.

Keywords: biofertilizers; intention; partial least square; shallot

INTRODUCTION

Nowadays, shallot has become one of the strategic crops with an annual increase of production in Indonesia. Furthermore, shallot's production reached 2.01 million tons in 2021. Afterward, it rose to 10.42% compared to the yield in 2020, which reached 189.15 thousand tons (BPS, 2023). In Indonesia, East Java is the second largest shallot production after Central Java. It has contributed 24,99% with a total production of 500.99 thousand tons, and the total harvested area is 53.67 thousand hectares. However, Nganjuk Regency is the main producer of shallots in East Java. The production of shallots in Nganjuk Regency increased by 193.6 thousand tons in 2021 when it controlled 39.83% of the total production of shallots in East Java (BPS, 2022).

Despite the improved trend of shallot production, it is important to pay attention to the utilization of agricultural input, particularly chemical fertilizer. Chemical fertilizers are one of the main agricultural inputs that have a significant role in raising crop production. Nevertheless, chemical fertilizers are used exaggeratedly to increase shallot's yield without concerning the environmental issue. The excessive use of chemical fertilizers contributes to reducing soil fertility and inhibits nutrient uptake. Thus, it has an impact on soil health and the yield of shallotin the future (Situmorang et al., 2021; Sun et al., 2019).

However, applying biofertilizer is one of the alternative ways to decrease the hazards of chemical fertilizers in order to support sustainable agriculture. In addition to that, biofertilizers are substances containing a diversity of living micro-organisms that have many advantages such as enhancing soil fertility, improving crop yield, increasing plant nutrient uptake, raise crop resilience towards abiotic and biotic stress (Atieno et al., 2020; Dasgupta et al., 2021; Mącik et al., 2020)

Therefore, the advantage of using biological fertilizers is able to replace 23-52% of nitrogen fertilizers usage (Rose et al., 2014). Afterward, another finding revealed that the combination of applying biofertilizer, chemical fertilizer, and organic manures can improve onion yield and bulb quality and maintain soil fertility. In addition to that, this application can reduce 25% of chemical fertilizer(Thangasamy & Lawande, 2015).

Although biofertilizers can improve soil fertility and contribute to chemical fertilizer

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i1.1506

use efficiency, the findings from (Naveed et al., 2015) demonstrated that the habit of farmers and their dependency on using chemical fertilizers, which has a purpose to rise production rapidly and the limited knowledge about the benefits of biofertilizers are the main barriers to use biofertilizer. Furthermore, there are other issues that contribute to farmers' restricted usage of biofertilizers, such as the majority of farmers still have inadequate knowledge, information, and skills, as well as a lack of access to biofertilizers (Kassem et al., 2021; Leila & El-Hafid, 2020).

Moreover, the majority of farmers havea moderate passive attitude towards using biofertilizers. The main obstacles are the lack of technical expertise in utilizing biofertilizers and the availability of high-quality biofertilizers (Barragán-Ocaña and del-Valle-Rivera, 2016). According to the descriptions above, this study will examine the influence of attitude, subjective norms, and perceptions toward the intentions of shallot farmers to use biological fertilizer.

METHODS

This study was conducted in September 2022 – November 2022 in Gondang and Rejoso District, Nganjuk Regency, East Java, Indonesia. The research location was chosen purposively while the selection of respondents was conducted by census method. The respondents consisted of 140 biofertilizer users. The data analysis are presented by quantitative method.

The data analysis is conducted by usinga structural equation measurement model with the Partial Least Square (PLS) by using SmartPLS software. *Partial Least Squares (PLS)* is a widely recognized structural equation modeling method that provides a highly accurate and efficient estimation strategy for a set of multiple regression equations estimated simultaneously. Moreover, PLS can be employed for model fit testing (Hair et al., 2014). This methodology is effective for structural equation models involving latent variables and causal relationships. Furthermore, PLS can be utilized by researchers with the capability to explore relationships between variables and identify pathways among them (Vinzi *et al.* 2010). SMART (Partial Least Squares Structural Equation Modeling) PLS has several advantages over other structural equation modeling (SEM) techniques like covariance-based SEM (CB-SEM), such as suitable for complex models and small sample sizes, no distributional assumptions, efficiency, predictive capabilities, flexibility, easier to use and interpret and handle complex with fewer observation (Hair et al., 2014).

In this study, there are several variables that are used namely latent and manifest variables. The further test is to measure the validity and reliability of each latent. This studywas to screen the initial model based on the loading factor for each indicator. The indicator for each construct is outputstepwise based on the lowest external exposure value until the final result of the loading factor value is greater than 0.5 (Hair et al., 2021).

Afterward, the inner model is tested in order to examine the influence of the latent construct. For the structural model, R square on the endogenous construct is also tested in order to estimate a path coefficient. The number of R squares has a coefficient from the endogenous construct. Thus, it is used for a goodness-of-fit model test (GoF). The goodness-of-fit (GoF) is a statistical model that describes how well it fits to observations, and it aims to validate the overall structural model (Maydeu-Olivares & García-Forero, 2009).

Nevertheless, the estimation of path coefficient value, which examines the relationship between latent variables, is conducted by the bootstrapping procedure. Thehigh contribution of the latent construct is reflected by indicators with a high number of loading factors. The latent variables are divided by attitude, subjective norms, perception, and intention.

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i1.1506

Tabel 1. Latent and indicator variables

Latent Variables	Indicator Variables
Attitude (SK)	Knowledge of biofertilizer (SK1)
	Importance of biofertilizer (SK2)
	Biofertilizer can improve soil fertility (SK3)
	Ingredients of biofertilizer (SK4)
Subjective Norms (NS)	Farmers community (NS1)
	Farmer's friends (NS2)
	Biofertilizer agents (NS3)
Perception (PS)	The convenience of biofertilizer (PS1)
	Environmental friendly (PS2)
	Low dosage of biofertilizer (PS3)
	The efficiency of chemical fertilizer (PS4)

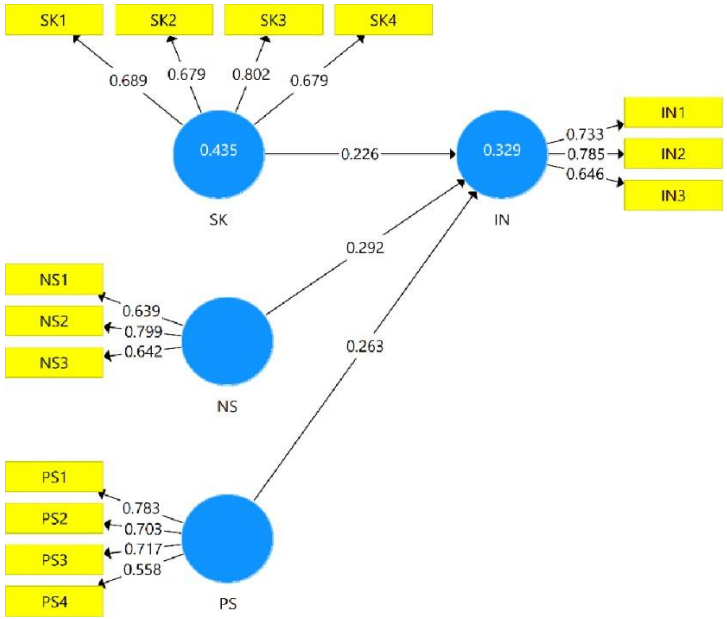

Figure 1. Path diagram of the structural equation of farmer's intention towards using biofertilizer

RESULTS AND DISCUSSION

The measure of the outer model describes the relationship between latent variables and their indicators. The evaluation of the assessment on the outer model in this study describes 15 indicators drawn from the final model with corresponding latent variables,which are attitude (SK), subjective norm (NS), perception (PS), and intention (IN). which can be seen in Figure 1. Indicatorswith outer loading values less than 0.5 shouldbe deleted or removed from the construction.

According to Figure 1, a variable of attitude reflected by biofertilizers can improve soil fertility (SK3) with a loading factor value of 0.802. The subjective norm variable is reflected by the farmer's friends (NS2) with a loading factor value of 0.798. The perception variable is described by an indicator variable, namely the convenience of using biofertilizer (PS1) with a loading factor value of 0.783. Afterward, the intention variable is demonstrated by the intention to use biofertilizer (IN2), which has a high-value loading factor of 0.785. The model can be illustrated as a discriminant if theAVE's

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i1.1506

value is greater 0.5 (Hair et al., 2021). According to table 2, all latent variables show that the square root of AVE is greater than 0.5. Therefore, all latent variables fulfill the requirements of the discriminant validity test. A variable isconsidered to be reliable if the compositereliability is greater than 0.7. According to Table 3, all the latent variables are reliable due to the number of composite reliability being more than 0.7. Furthermore, the last step is to find out the significant effect of the independent variable on the dependent variable by considering the parameter's coefficient and Statistic. The significant effect can be viewedbased on the bootstrapping test in Table 4. In addition to that, the significant level is illustrated by the path coefficients with the number of t-statistics>1.96, α=5%, and p-value <0.05 (Hair et al., 2012). Referring to Table 4, it is interpreted that all the variables have a positive and significant effect onthe intention of utilizing biological fertilizers.

Table 2. The square root of AVE and the correlation of latent variables

Latent Variables	IN	NS	PS	SK
Intention (IN)	0.724*			
Subjective Norms (NS)	0.451	0.632*		
Perception (PS)	0.399	0.247	0.695*	
Attitude (SK)	0.418	0.431	0.302	0.714*

*=Square root of AVE

Table 3. Composite reliability in each construct

Latent Variables	Composite Reliability
Intention (IN)	0.767
Subjective Norms (NS)	0.722
Perception (PS)	0.787
Attitude (SK)	0.806

Table 4. The results of bootstrapping

Path Coefficient	Original Sample	T-Statistics	P Values
Attitude -> Intention	0.226	2.144	0.033
Subjective Norms -> Intention	0.292	2.363	0.019
Perception -> Intention	0.263	3.053	0.002

*significant to α=5%

The Influence of Attitude, Subjective Norms and Perception Towards Intention

The results of this study show that shallot farmers have a high awareness of using biological fertilizers because they have acknowledged their advantages and their importance in the long term. The results of this study are related to the findings of (Ataei et al., 2022), which demonstrated that the more farmers understand the knowledge and benefits of using biofertilizers, the more their intention to utilize biofertilizers raised. This is in accordance with the results of the study (Daxini et al., 2019) that farmers' decision-making regarding the use of chemical fertilizers is a major concern for policymakers. The excessive utilization of chemical fertilizers may result in environmental pollution and financial setbacks for farmers. Therefore, the implementation of *a nutrient management* plan can aid in mitigating environmental impacts. Farmers perceive the *Nutrient Management Plan to be* beneficial and, therefore, have the

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i1.1506

intention to implement the plan. Hence, attitude exerts a positive and noteworthy impact on the intention to implement the *Nutrient Management Plan.*

Furthermore, this study finds that subjective norms have a significant impact on willingness to use biofertilizers supplied by farmers' friends. It is associated with another study, which revealed that subjective norms are the strong influence of personal norms toward farmers' intention to utilize biological fertilizers. It canbe concluded that stricter social normsimprove the necessity to use biofertilizers.The result also goes hand-in-hand with (Adnan et al., 2018), which revealed that the social pressure that farmers feel affects their intentions to utilize biofertilizers. Additional research indicates that green manure serves as an environmentally friendly technology for cultivating clean agricultural products. This technology not only contributes to mitigating environmental and health issues but also has the potential to enhance productivity. Green manure is particularly crucial for rice production, yet the level of acceptance of this technology remains relatively low. Farmers' subjective norms regarding the utilization of green manure positively impact their intentions to adopt it. Within the real of subjective norms, the influence of farmers' friends plays a role in shaping their attitudes toward using green fertilizer (Valizadeh et al., 2023).

Moreover, perception has a significant effect on the intention to use biofertilizers. Farmers considered using biofertilizers because of their convenience. Furthermore, perception has a significant impact on farmers' intentions to use biofertilizers. Respondents considered using biofertilizers due to convenience. The easiness of using biofertilizers is due to the fact that the majority of farmers use granular and solid biofertilizers, and there are no other tools required for this type of biofertilizer. The results of this study are related to another study which revealed that farmers have a better reason to use biologicalfertilizers when they consider that it is easy touse (Ataei et al., 2022). It can be concluded that perception is an important factor in the emergence of intentional processes among farmers. The factors that determine whether or not to take advantage of a new innovationdepend on the situation, access, and perception of its benefits. Based on other research results, farmers revealed that perceptions of the use of biofertilizers give a positive response because they believe that biofertilizers are able to increase crop yields and become the right choice of agricultural inputs for farmers in supporting soil fertility. Farmers are aware of the negative Influences of using chemical fertilizers and have started using biofertilizers Khan, 2016).

CONCLUSION

These findings contributed to a good awareness concerning the intention of using biofertilizers among shallot farmers. The results revealed that the value of attitude, subjective norms, and perception have a significant impact on the intention of using biofertilizers.

REFERENCES

Adnan, N., Nordin, S. M. & Ali, M. (2018). A solution for the sunset industry: Adoption of Green Fertiliser Technology amongst Malaysian paddy farmers. *Land Use Policy*, *79*, 575–584. https://doi.org/10.1016/j.landusepol.2018.08.033

Ataei, P., Karimi, H., Klöckner, C. A., Es'haghi, S. R. & Zarei, R. (2022). The promotion of biofertilizer application on farms: Farmers' intentional processes. *Environmental Technology and Innovation*, *28*. https://doi.org/10.1016/j.eti.2022.102722

Atieno, M., Herrmann, L., Nguyen, H. T., Phan, H. T., Nguyen, N. K., Srean, P., Than, M. M., Zhiyong, R., Tittabutr, P., Shutsrirung, A., Bräu, L. & Lesueur, D. (2020). Assessment of biofertilizer use for sustainable agriculture in the Great Mekong Region. In *Journal of Environmental Management* (Vol. 275).

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i1.1506

Academic Press. https://doi.org/10.1016/j.jenvman.2020.111300

Badan Pusat Statistik. 2022. The Data of Shallot's Production 2019-2021. Nganjuk. Badan Pusat Statistik. Retrieved from https://nganjukkab.bps.go.id/indicator/55/250/1/produksi-bawang-merah-menurut-kecamatan.html

Badan Pusat Statistik. 2023. The Production of Vegetables Crop. Jakarta. Badan Pusat Statistik. Retrieved from https://www.bps.go.id/indicator/55/61/1/produksi-tanaman-sayuran.html

Barragán-Ocaña, A. & del-Valle-Rivera, M. del C. (2016). Rural development and environmental protection through the use of biofertilizers in agriculture: An alternative for underdeveloped countries? *Technology in Society*, *46*, 90–99. https://doi.org/10.1016/j.techsoc.2016.06.001

Dasgupta, D., Kumar, K., Miglani, R., Mishra, R., Panda, A. K. & Bisht, S. S. (2021). Microbial biofertilizers: Recent trends and future outlook. *Recent Advancement in Microbial Biotechnology: Agricultural and Industrial Approach*, 1–26. https://doi.org/10.1016/B978-0-12-822098-6.00001-X

Daxini A, Ryan M, O'Donoghue C, Barnes AP. (2019). Understanding farmers' behaviour. *Land use policy*. (85):428-437.doi:10.1016/j.landusepol.2019.04.002.

Hair, Joe F., Sarstedt, M., Ringle, C. M. & Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science*, *40*(3), 414–433. https://doi.org/10.1007/s11747-011-0261-6

Hair JF, Hult G, TM Ringle, Sarstedt M. (2014). *A primer on partial least squares structural equation modeling*. Los Angels: Sage

Hair, Joseph F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P. & Ray, S. (2021). *Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R*. Springer International Publishing. https://doi.org/10.1007/978-3-030-80519-7.

Kassem, H. S., Alotaibi, B. A., Aldosri, F. O. & Muddassir, M. (2021). Exploring the relationship between information-seeking behavior and adoption of biofertilizers among onion farmers. *Agronomy*, *11*(6). https://doi.org/10.3390/agronomy11061258

Khan MN. (2016). Farmers' perception towards the application of biozote in selected demonstrated rice fields at hafizabad and sheikhupura districts. *Pakistan J. Agric. Res.* 29(3):229-235

Leila, B. & El-Hafid, N. (2020). *Biofertilizers and Biopesticides: Microbes for Sustainable Agriculture* (pp. 257–279). https://doi.org/10.1007/978-981-15-3208-5_10

Mącik, M., Gryta, A. & Frąc, M. (2020). Biofertilizers in agriculture: An overview on concepts, strategies and effects on soil microorganisms. In *Advances in Agronomy* (Vol. 162, pp. 31–87). Academic Press Inc. https://doi.org/10.1016/bs.agron.2020.02.001

Maydeu-Olivares, A. & García-Forero, C. (2009). Goodness-of-Fit Testing. In *International Encyclopedia of Education, Third Edition* (pp. 190–196). Elsevier. https://doi.org/10.1016/B978-0-08-044894-7.01333-6

Naveed, M., Mehboob, I., Shaker, M. A., Baqir Hussain, M. & Farooq, M. (2015). Biofertilizers in Pakistan: Initiatives and limitations. In *International Journal of Agriculture and Biology* 17 (3), 411–420. https://doi.org/10.17957/IJAB/17.3.14.672

Rose, M. T., Phuong, T. L., Nhan, D. K.,

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i1.1506

Cong, P. T., Hien, N. T. & Kennedy, I. R. (2014). Up to 52% N fertilizer replaced by biofertilizer in lowland rice via farmer participatory research. *Agronomy for Sustainable Development*, *34*(4), 857–868. https://doi.org/10.1007/s13593-014-0210-0

Situmorang, H., Noveri, N., Putrina, M. & Fitri, E. R. (2021). Perilaku Petani Padi Sawah Dalam Menggunakan Pestisida Kimia di Kecamatan Harau, Kabupaten Lima Puluh Kota, Sumatera Barat, Indonesia. *Agro Bali : Agricultural Journal*, *4*(3), 418–424. https://doi.org/10.37637/ab.v4i3.743

Sun, Y., Hu, R. & Zhang, C. (2019). Does the adoption of complex fertilizers contribute to fertilizer overuse? Evidence from rice production in China. *Journal of Cleaner Production*, *219*, 677–685. https://doi.org/10.1016/j.jclepro.2019.02.118

Thangasamy, A. & Lawande, K. E. (2015). Integrated nutrient management for sustainable onion production. *Indian Journal of Horticulture*, *72*(3), 347–352. https://doi.org/10.5958/0974-0112.2015.00068.7

Valizadeh N, Jalilian S, Hallaj Z, Esfandyari Bayat S, Hayati D, Bazrafkan K, Kianmehr N, Akbari M. (2023). Encouraging adoption of green manure technology to produce clean rice product. *Sci Rep*. 13(1).doi:10.1038/s41598-023-35964-1.

Vinzi EV, Trinchera L, Amato S. (2010). *PLS path modeling: from foundations to recent developments and open issues for model assessment and improvement*. France:ESSEC Business School of Paris.