Strengthening Production with Liquid Organic Nano Fertilizer Technology in Ornamental Plant Business in the Sekar Sempol Farmer Group

Sutrisno[1*], Mulyono[1], *Sigit* Wibowo[2], and *Zuhud* Rozaki[1]

[1] Departement of Agribusiness, Universitas Muhammadiyah Yogyakarta, Jl. Brawijaya, Kasihan, Bantul, Yogyakarta 5518, Indonesia
[2] Departement of Business Law, Universitas Proklamasi 45 Yogyakarta, Jl. Proklamasi No.1, Caturtunggal, Kec. Depok, Kabupaten Sleman, Yogyakarta 55281, Indonesia

Abstract. The ornamental plant business is increasing due to the high demand of this plant. This program solves production of ornamental plant problems. Sekar Sempol Farmer Group is one the who produce the ornamental plant. The production problems that were resolved were poor growth and performance of ornamental plants and damaged greenhouses because they were made of bamboo. Production problems were resolved by training and treatment in liquid nano organic fertilization technology to produce good ornamental plant performance. Increasing the production of ornamental plants is also carried out by changes the greenhouse. The output of this program is improving the skills of ornamental plant farmers in using liquid organic nano fertilizer to improve ornamental plant production. Experimental research for using nano organic fertilizer supporting to better ornamental plant performance. A modern and stronger greenhouse made of galvalume material to be standardizer greenhouse make more conducive microclimate to ornamental plant growth.

1 Introduction

Ornamental plants are flowering plants or all forms of plants that produce flowers (generative organs) [1]. According to other experts, ornamental plants are all plants that are cultivated with the aim of enjoying their beauty. It is not only limited to flowering plants, but ornamental plants also include plantation or forestry plants which have aesthetic value and are cultivated for the purpose of adding beauty and comfort to the living environment [2].

There are around 20 types of ornamental plants managed by the Sekar Sempol Farmer Group, namely aglonema, monstera, orchids, septuvilum, germanium, anthurium, bonsai, mini elephant grass, manila grass, japanese grass, purslane, karambusa, red soka, indian soka, bougainvillea, adenium, pule, palm, paper flowers, and yellow broccoli. All of these plants are placed in a greenhouse measuring 12 x 14 m^2 which is made of bamboo with 85% paranet. Lack of maintenance and damaged greenhouse conditions cause the growth and performance of ornamental plants to be poor and unattractive.

* Corresponding author: sutrisno_agrifp@umy.ac.id

One effort to increase plant production and performance is the use of nanoparticle technology. Nanoparticle technology can be applied in solid or liquid fertilizer. Research shows that spraying nanoparticles on plant leaves will affect stomata openings resulting in improved photosynthesis [3]. Other research shows that the use of phosphate nanoparticles has been proven to improve plant growth [4].

Nanotechnology is the engineering process of creating and using very small (nano) sized materials/particles which have unique properties and are different from the original material. The application of nanotechnology in the fertilizer production process is to create nutrients that have unique characteristics which are composed of very small particles [5]. The increase in agricultural yields through the application of nanotechnology is due to increased absorption of nanotechnology-based fertilizers and reduced levels of pest attacks on plants [6].

The research results show that the application of nanotechnology fertilizer has a real influence on several growth variables such as plant height, number of leaves, leaf area and dry weight [7]. Another research result is that using nano NPK fertilizer and nano pesticides can increase growth, yield and reduce disease intensity in plants [8]. Making organic fertilizer using nano technology can be done using agricultural waste [9].

2 Method

2.1. Pre and Post Test on Making Liquid Organic Nano Fertilizer

Before the training was carried out, a pre-test was conducted to determine basic knowledge and experience regarding liquid organic nano fertilizer. Training on making liquid organic nano fertilizer aims to increase farmers' knowledge and skills. The majority of the Sekar Sempol ornamental plant farmer group has so far only relied on planting media mixed with organic solid fertilizer or chemical fertilizer. Experience is gained from practices carried out by farmers in general. They rarely use liquid fertilizer to increase plant production and performance. Based on previous research, the use of liquid organic fertilizer to increase the production and performance of ornamental plants needs to be introduced to the Sekar Sempol farmer group. The materials used in making liquid organic fertilizer are livestock waste in the form of goat urine and manure. This material is easily available in the environment around Sempol Village. The availability of materials is abundant and the price is very cheap. The material is extracted by stirring and adding water to produce nano material. The addition of decomposer is done to speed up the fermentation process. Stirring the ingredients is done every day for a week. After two weeks, filtering is carried out to obtain liquid fertilizer with smaller particles and the fertilizer is ready for use. After all stages of making liquid organic nano fertilizer, a post-test was conducted to determine the impact or changes in knowledge, attitudes or motivations and skills of ornamental plant farmers.

2.2. Experiment on Using Liquid Organic Nano Fertilizer

After the liquid nano organic fertilizer was ready to use, treatment was carried out on three groups of ornamental plants: adenium, anthurium and aglaonema. Each group consisted of 5 plants. Then one group of plants was made as a control. In the adenium plant group, the variables observed were: moisture of planting medium, leaf green colour, new flower buds, and new branch shoots. In the anthurium plant, the variables observed were: moisture of planting medium, leaf green colour, and brightness of leaves. In the aglaonema plant, the

variables observed were: moisture of planting medium, new stem shoots, brightness of leaves, and increase in plant height. Observations were carried out every week until the fourth week.

2.3. Renovation to Change the Greenhouse Structure

Greenhouse renovation aims to repair the greenhouse building so that it is stronger and looks neater. The old greenhouse was made of bamboo, and it was starting to break down so it looked dirty and chaotic. Repairs were carried out by replacing the bamboo construction with galvalum material which is stronger and more durable. Renovations were carried out by hiring greenhouse building experts. Experts design the greenhouse construction, while the installation work is carried out by members of the farmer group Sekar Sempol who work voluntarily. Greenhouse renovations are continued by repairing and setting plant shelves so that the greenhouse is more conducive to supporting plant growth. Greenhouse renovation also replaces old paranets with new ones. After the newly completed greenhouse structure is completed, an analysis of the total production cost (manufacturing cost) is carried out by paying attention to the depreciation value of the greenhouse according to its economic life. Then a comparative analysis of the old greenhouse (made of bamboo) and the new greehouse (made of galvalum) was carried out

Manufacturing cost (Total Cost) calculated by the formula: [10], [11],[12]

$$TC = TEC + TIC \quad (1)$$

Information:
TC: Total Cost (IDR),
TEC: Total Explicit Cost (IDR)
TIC: Total Implicit Cost (IDR

3 Result and Discussion

3.1. Impact of Training on Making of Liquid Nano Organic Fertilizer

Training on making liquid organic nano fertilizer has raised awareness and motivation of Sekar Sempol farmers. They believe that the manure (solid organic) used in the media and liquid nano organic fertilizer can complement each other for maximum plant growth. This is also in accordance with research [13]. The complete results are described in Table 1.

Table 1 shows that on average Sekar Sempol farmers who trained in making liquid organic nano fertilizer experienced an increase in knowledge from the poor category to the high. The highest increase occurred in knowledge of raw materials for liquid nano organic fertilizer and knowledge of the benefits of liquid nano organic fertilizer. The increase in motivation occurred from the weak category to the very strong. Farmers' motivation has increased greatly to be able to create, apply, and spread liquid nano-organic fertilizer innovations. Farmer skills have increased from the average poor category to the excellent category. The highest level of skill improvement is in how to make and apply liquid nano-organic fertilizer.

Table 1. Impact of Training on Making and Application of Liquid Nano Organic Fertilizer in the Sekar Sempol Group

No.	Activities	Score for Before Project	Score for After Project	Increasing Category
1.	**Knowledge**			
1.a.	Definition of liquid nano organic fertilizer	2.0	4.0	high
1.b.	Raw material for liquid nano organic fertilizer	3.0	4.5	excellent
1.c.	Benefits of liquid nano organic fertilizer	2.0	4.5	excellent
1.d.	Application of liquid nano organic fertilizer	2.5	4.0	high
	Knowledge Average	**1.13 (poor)**	**4.25**	**high**
2.	**Motivation**			
2.a	Motivation to make liquid nano organic fertilizer	1.5	5.0	very strong
2.b.	Motivation for the application of liquid nano organic fertilizer	3.0	5.0	very strong
2.c.	Motivation to spread liquid nano organic fertilizer innovation	2.0	4.0	very strong
	Motivational Average	**2.2 (weak)**	**4.7**	**very strong**
3.	**Skills**			
3.a	Skills in compositioning of liquid nano organic fertilizer raw materials	2.5	4.0	Good
3.b	Skills in making liquid organic nano fertilizer	1.0	5.0	excellent
3.c.	Liquid nano organic fertilizer application skills	2.0	5.0	excellent
	Average Skills	**1.8 (poor)**	**4.7**	**excellent**

Notes
Scale of Score: 1 – 5
Knowledge: (1: low, 2: poor, 3: sufficient, 4: high, 5: excellent)
Motivation: (1: very weak, 2: weak, 3: quite strong, 4: strong, 5: very strong)
Skills: (1: low, 2: poor, 3: sufficient, 4: good, 5: excellent)
Respondents: 10 persons

3.2. Impact of Liquid Organic Nano Fertilizer Application

The application of liquid nano organic fertilizer to the sample plants showed differences in growth and better performance. This shows that the use of liquid organic fertilizer really affects the growth and performance of ornamental plants. The results of this application are

in line with research which shows that organic fertilizer will affect soil fertility, especially soil agrochemical aspects. Organic fertilizer is a very effective factor for increasing plant growth, quality and productivity [14].

From Table 2 it can be seen that the application of liquid organic nano fertilizer was able to increase the humidity of the media even though the same watering treatment was carried out. In control plants, the planting media on average dried faster than the planting media that was given liquid organic nano fertilizer. In adenium plants, the application of liquid organic nano fertilizer causes the potential for the emergence of new flower buds and new stem shoots to be higher than in control plants. The colour of the leaves due to the liquid organic nano fertilizer treatment becomes greener. In anthurium plants, fertilizer application causes differences in leaf brightness but does not cause differences in leaf colour. In aglaonema plants, it causes differences in the emergence of new stem shoots and plant height**.**

Table 2. Impact of Liquid Nano Organic Fertilizer Application on sample plants

No.	Indicator Obtained	Control Plants (average)	Sample Plants (average)
1.	Adenium		
1.a.	Moisture of planting medium	50 %	60 %
1.b.	Leaf green color	++	+++
1.c.	New flower buds	10 %	40 %
1.d.	New branch shoots	10 %	20 %
2.	Anthurium		
2.a	Moisture of planting medium	55 %	70 %
2.b.	Leaf green color	+++	+++
2.c.	Brightness of leaves	+++	++++
3.	Aglaonema		
3.a	Moisture of planting medium	60 %	70 %
3.b.	New stem shoots	30 %	40 %
3.c.	Brightness of leaves	++	++
3.d.	Increase in plant height	1 cm	1.5 cm

Notes:

1. *Applications of liquid organic nano fertilizer are carried out for 2 weeks with 2 fertilizer treatments per week*
2. *Control plants were not given liquid organic nano fertilizer,*
3. *Treat all plants with the same care and watering standards*
4. *Observations were carried out at the end of the second week, on 10 control plants and 10 treatment plants for each type of plant*

3.3. Manufacturing Analysis of Change Greenhouse Structure

The old, damaged greenhouse should be renovated. The damaged bamboo structure and the paranet is torn, causing the greenhouse microclimate not to be optimal for plant growth. A study shows that the greenhouse structure can affect air temperature and humidity. The greenhouse structure must be created to allow good air exchange, so that the temperature and humidity in the room can be suitable [15]. The paranet or shade must also be adjusted to the type of plants in the greenhouse. Paranet or shade will affect the intensity of sunlight entering

the greenhouse. Even though this study states that paranets do not significantly affect growth, providing shade does affect the chlorophyll content [16]. Before the paranet (shade) in the Sekar Sempol greenhouse was repaired, the performance of many plants was not bright green (pale, dull, faded). After the shade was repaired, the ornamental plants displayed fresh green color and better performance.

Replacing an old greenhouse with a bamboo structure with a new greenhouse with a galvalume material structure is economically more profitable. The greenhouse area is 12 m x 14 m with a bamboo structure and costs IDR 10,000,000 to build. With a galvalume structure, a greenhouse area of 12 m x 14 m costs IDR 18,000,000. Bamboo greenhouses only last a maximum of 4 years, while galvalume greenhouses have an economic life of up to 10 years. This means that the depreciation value of a bamboo greenhouse is IDR 2,500,000/year and the depreciation cost of a galvalume greenhouse is IDR 1,800,000 per year. A detailed explanation can be seen in Table 3.

Table 3. Comparison of the old greenhouse and the new greenhouse after renovation

No.	Obtained indicator	Old Greenhouse	Greenhouse after renovation
1.	Greenhouse area (m2)	12 x 14	12 x 14
2.	Skeletal structure	Bamboo	Galvalume
3.	Paranet (%)	70 %	80 %
4.	Economical age (years)	4	10
5.	Manufacturing Cost (Rp)	10,000,000	18,000,000
6.	Depreciation costs (Rp/year)	2,500,000	1,800,000
7.	Micro agroclimatic	conducive	more conducive

After the production problems were resolved, there were new problems that became the burden of the ornamental plant farmer group Sekar Sempol. From the discussion, new needs were found that needed to be studied further, how to enrich marketing. Suggestions are submitted to improve marketing problems, so that the farmer group Sekar Sempol uses a digital marketing system. Digital Marketing is a marketing or promotional activity for a brand or product using digital media or the internet. Some examples of marketing techniques in digital marketing are SEO (Search Engine Optimization), online advertising such as FB ads and Google Ads, print media promotions, television and radio advertisements, electronic billboards, email marketing, mobile marketing, and others [17] Research shows that the use of social media Instagram and Facebook has a significant effect on increasing awareness of the product brand [18]. Other research proves that the use of social media in digital marketing can increase product sales [19]

4 Conclusions

Strengthening production technology with liquid organic nano fertilizer technology has succeeded in increasing awareness, knowledge, motivation, and skills in its use on ornamental plants in the Sekar Sempol farmer group. Ornamental plant production shows better growth and performance. Greenhouse renovations make the microclimate environment in the greenhouse more conducive to the growth of ornamental plants. After the production issues are resolved, it is recommended to strengthen digital marketing by creating and developing Facebook and Instagram social media accounts.

Acknowledgements

Authors thank to LPM Universitas Muhammadiyah Yogyakarta for funding this research. And also thank to Sekar Sempol Farmer Group for collaborating in this research.

References

[1] G. Acquaah, *Horticulture : principles and practices.* Upper Saddle River, N.J: Prentice Hall, 2002.

[2] Zulkarnain, *Dasar-Dasar Hortikultura*. Jakarta: . PT Bumi Aksara, 2009.

[3] Mulyono, R. F. Erlintang, and T. Hidayat, "Effects of Foliar Application of Oil Palm Empty Fruit Bunch Ash Nanoparticles on Stomatal Anatomy of Potato Leaf Plants (Solanum tuberosum L.)," *Planta Trop. J. Agrosains (Journal Agro Sci.*, vol. 10 (2), no. August 2022, 2022.

[4] G. Genesiska, Mulyono, and A. Hanifah, "Nano Phosphat Fertilizer of Chicken Bone Ash Effectivity by Foliar Application on Growth and Yield of Soybean (Glycine max L.)," *J. Agric. Sci. PLANTATROPICA*, vol. 7 (1), 2022, [Online]. Available: https://jpt.ub.ac.id/index.php/jpt/article/view/211

[5] Ultra Gen, "Pupuk Hayati Organik ULTRA GEN Teknologi Nano." Accessed: Nov. 28, 2023. [Online]. Available: https://ultragen.co.id/organik/apa-itu-ultragen-teknologi-nano/

[6] M. Rusly and D. Y. Rahman, "Perkembangan Penerapan Nano Teknologi Pada Bidang Pertanian," *J. Penelit. Fis. dan Ter.*, vol. Vol. 4 No., 2023.

[7] A. Mujahid, Sudiarso, and N. Aini, "Uji Aplikasi Pupuk Berteknologi Nano Pada Budidaya Tanaman Bayam Merah (Alternanthera amoena Voss.)," *J. Produksi Tanam.*, vol. 4 (2), 2017.

[8] M. Ernita, Alhidayati, and W. Haryoko, "Pengaruh Pupuk Npk Dan Nano Pestisida Seraiwangi Terhadap Pertumbuhan Dan Hasil Tanaman Cabai Merah (Capsicum Annuum L)," *J. Agrotek*, vol. 4 (2), no. 2 September 2020, 2020.

[9] K. Ningtyas, I. N. Sari, and M. Muslihudin, "Sintesis Nanoselulosa dari Limbah Hasil Pertanian dengan Menggunakan Variasi Konsentrasi Asam.," *J. Penelit. Pertan. Terap.*, vol. 20 (2), no. October 2020, pp. 142–147, 2020.

[10] F. Risvansuna Fivintari, H. Salaf Iswara, and T. Barnabas, "Feasibility and Risk Analysis of Red Chili Farming With Irrigation Systems on Coastal Sandy Land, Bantul," *E3S Web Conf.*, vol. 444, p. 02039, Nov. 2023, doi: 10.1051/e3sconf/202344402039.

[11] D. R. Kamardiani and R. Wulandari, "The Feasibility of Conventional and Environmentally Friendly Shallot Farming at Selopamioro Village Bantul Regency," *E3S Web Conf.*, vol. 316, p. 02052, Nov. 2021, doi: 10.1051/e3sconf/202131602052.

[12] T. Buddhi Satyarini, "Economic performance of the ' Emping Melinjo ' household industry and the entrepreneurial character of the business owner," *E3S Web Conf.*, vol. 316, p. 02009, Nov. 2021, doi: 10.1051/e3sconf/202131602009.

[13] L. Peng and Q. Yang, "Social network, environmental cognition and organic

fertilizer application behavior of small farmers," *E3S Web Conf.*, vol. 293, p. 03016, Jul. 2021, doi: 10.1051/e3sconf/202129303016.

[14] S. Jabborov, B. Azimov, and M. Musurmonova, "Effect of organic fertilizers on agrochemical properties of soil and growth, development and yield of cotton," *E3S Web Conf.*, vol. 376, p. 02012, Mar. 2023, doi: 10.1051/e3sconf/202337602012.

[15] A. Nafila, D. Prijatna, T. Herwanto, and H. Handarto, "ANALISIS STRUKTUR DAN FUNGSIONAL GREENHOUSE (STUDI KASUS KEBUN PERCOBAAN DAN RUMAH KACA FAKULTAS PERTANIAN, UNIVERSITAS PADJADJARAN)," *J. T`eknotan*, vol. 12, no. 1, Sep. 2018, doi: 10.24198/jt.vol12n1.4.

[16] I. Wulandari, S. Haryanti, and M. Izzati, "PENGARUH NAUNGAN MENGGUNAKAN PARANET TERHADAP PERTUMBUHAN SERTA KANDUNGAN KLOROFIL DAN β KAROTEN PADA KANGKUNG DARAT(Ipomoea reptans Poir)," *J. Akad. Biol. , pp. 71-79, Aug. 2016. [Online]*., vol. 5, no, no. Aug. 2016. [Online], pp. 71–79.

[17] W. Pangestika, "Digital Marketing : Pengertian dan Jenis Strategi Penerapan Bisnis," *Mekari J. Indones. 19 Oktober 2023*, no. 19 Oktober 2023, 2023.

[18] R. Yacub and W. Mustajab, "Analisis Pengaruh Pemasaran Digital (Digital Marketing) Terhadap Brand Awareness Pada Ecommerce.," *J. Manajerial,* vol. 12 (2), no. Juni 2020, pp. 198–209, 2020.

[19] A. Larasati Y, A. Pradiptya, and M. Mawardani, "Penerapan Digital Marketing Dalam Meningkatkan Penjualan Produk Ayana Store Pati.," *J. Ilm. Bid. Ilmu Ekon.*, vol. 20 (4), no. Oktober 2022, p. Hal 397-402, 2022.