

Strategy for Developing Organic Rice Farming in Sleman Regency, Special Region of Yogyakarta

Eni Istiyanti^{1*}, Indah Widowati², Triyono¹ and Novia Angger Trisnanti¹

¹ Department of Agribusiness, Universitas Muhammadiyah Yogyakarta, Kasihan, Bantul, Daerah Istimewa Yogyakarta, Indonesia

² Department of Agribusiness, Universitas Pembangunan Nasional Yogyakarta, Daerah Istimewa Yogyakarta, Indonesia

Abstract. Sleman Regency is a centre for organic agriculture development in the Special Region of Yogyakarta, as evidenced by the large number of farmer groups that have received organic certification. Sayegan is one of the districts in Sleman Regency that is developing organic rice although it is still in the transition stage from conventional to organic rice, namely semi-organic rice. The research objective is to determine the strategy used for developing organic rice farming. The sample in this study consisted of 12 key persons, namely the Head of the Technical Implementation Unit (UPT), Field Agricultural Extension Officer (PPL), the Officer for Controlling Plant Pest Organisms (POPT), 4 heads of farmer groups, and 5 farmers who own land of 1 hectare. The research was conducted by survey in Sayegan District. The analysis technique uses Analysis Hierarchy Process (AHP). The results showed that the strategy for developing organic rice farming in Sleman Regency consisted of (1) the provision of production facilities of good quality on time and in the right amount, (2) encouraging farmers to use labelled superior seeds, and (3) increased motivation, knowledge, and skills of organic rice cultivation.

1 Introduction

Food security is one of the national development priorities in Indonesia. To support the achievement of food security, the Four Agricultural Success program was implemented, covering the achievement of self-sufficiency in five important food commodities, namely rice, corn, soybeans, sugar, and beef. During the last five years, Indonesia has been able to provide sufficient food to meet the needs of its citizens, but the quality of food consumption on average is still below the recommendations of nutritionists [1].

Organic food ingredients have good quality because they do not contain genetically modified organisms and food additives. In addition, organic food is included in green products because the process uses environmentally friendly methods that do not use pesticides or chemical fertilizers [2]. Indonesia is one of the developing countries which according to the 2019 Indonesian Organic Agriculture Statistics data has 7.92% of permanent

* Corresponding author: eniistiyanti@umy.ac.id

consumers and 56.60% of non-permanent consumers in consuming organic products for reasons of environmental health [3].

The development of organic rice in Indonesia is still confined because of various barriers, which include: lack of understanding of organic philosophy amongst farmers, inconsistent supply in phrases of quality, quantity, and continuity, authenticity of organic products (certification required), and no clear market certainty [4]. However, there are more organic rice producers in Indonesia compared to other organic products. The demand for organic rice is increasing in line with the increase in land conversion for organic rice. The area of organic rice land in 2016 was 1,401 ha, increasing to 53,874 ha in 2018 [3]. In addition, organic rice production and income are higher than non-organic rice as happened in Sambu, Boyolali Regency [5], Perbaungan, Serdang Bedagai Regency [6] and Nepal [7].

Sleman Regency is the main food barn for the Special Region of Yogyakarta with rice production of 80,000 – 100,000 tons annually, has the most important paddy field land and the largest quantity of organic licensed rice farmer groups. The demand for organic rice in Sleman Regency tends to increase, however farmers have not been capable of meet the market demand because of limited land so that production has not been maximized. Land used for organic rice cultivation needs unique requirements and the method of moving from traditional to organic systems takes 1-3 years [8].

The development of organic rice farming in Sleman Regency is important to do with consideration, organic rice farming preserves the environment, the existence of consumer demand that tends to increase, can increase farmers' income. Strategies related to the use of inputs, cultivation techniques, post-harvest and marketing need to be carried out. The research objective is to formulate a strategy for developing organic rice farming in Sleman Regency. The results of the Analysis Hierarchy Process can determine the main priority aspects in the development of organic rice farming.

2 Research method

2.1 Sampling method

The research was conducted using survey in the Sleman Regency, precisely in Sayegan District. The location selection was carried out purposively based on consideration of the activeness of the farmer groups and the extension system so that Sayegan District is famous for its organic rice. In addition, the UPT BP4 which oversees the Sayegan District is among the top 5 national best in 2017 (Sleman District Government).

Respondents taken in this study are key persons or stakeholders who play a direct role in organic rice farming activities and have information and competence in the development of organic rice farming. Respondents consist of 4 heads of farmer groups and 5 farmers who own land more the same or larger than 1 hectare. Head of UPT BP4 Region III as the person in charge of the program or supervisory agency for organic rice farming activities in the Seyegan area. PPL and POPT each amounted to 1 person.

Farmers with a land area of 1 hectare are used as key persons because farmers are directly involved in organic rice farming and the large area of land affects production and productivity. Farmers have a lot of information and are subjects that are intensively integrated with organic rice farming activities. Determination of farmer group leaders based on their active role in finding and absorbing new technology, disseminating, and mobilizing members to implement it. The head of the farmer group can also be an informant on what has been done by its members in carrying out organic rice farming.

The Agricultural Field Extension Officer is used as a key person because the instructor acts as a teacher (changing attitudes, knowledge and skills), analyst (observing problems in

the field, and analysing alternative problem solving), advisor (advisor in choosing the most appropriate and profitable alternative for farmers), motivator (generating motivation to accept innovation), initiator (making innovation designs by adjusting conditions, times and technology) [9]. Field Agricultural Extension Officers have a lot of information and have competent knowledge and knowledge from many sides of the roles they carry out.

The Control Officer of Plant Destruction Organism has the task of securing plants from disturbances of plant pest organisms. by observing and controlling. Therefore, it has completed and competent information in controlling plant-disturbing organisms in organic rice farming. Chairperson of UPTD BP4 Region III Seyegan who has the duties and functions of compiling and implementing extension programs, taking an inventory of farming problems and their solutions, carrying out learning processes and trials of developing farming models, developing leadership, entrepreneurship, and institutions, holding meetings, and providing facilities for information services, consultations, education, and training. The existence of the functions and duties mentioned above makes the UPTD chairman a competent respondent and has a lot of information.

Collecting data in this study by means of FGDs, interviews, and observations. The FGD was conducted to ensure and formulate together with the keyperson the development factors as criteria that will be used as a strategy to develop organic rice farming.

2.2 Technical analysis

The analysis technique uses the Analytical Hierarchy Process (AHP) which is a decision support model that discusses various factors and complex criteria so that they become a hierarchy, [10]. The concept of AHP changes qualitative values into quantitative values, so that decisions taken can be more objective. According to [11] the AHP method is carried out through the following steps:

1. The first step is to determine the goal based on the background of the problem.
2. The second step is to determine the criteria and alternatives that will be input for policies that must be completed based at the results of the FGD with competent key persons. These criteria and alternatives can be arranged hierarchically as follows: at level one is the goal, the second level is the criteria for achieving the goal and the third level is filled with alternatives.
3. The third step is to conduct personal interviews with key persons accompanied by a previously prepared questionnaire.
4. The fourth step is to compile a matrix of the average results obtained from the questionnaire and processed using Expert Choice.
5. The fifth step is to analyze the processed results (output) of the expert to determine the value of inconsistencies and priorities. If the inconsistency value is greater than (zero point one) then the result is inconsistent. On the other hand, if the result is less than zero point one, the result is consistent.

The criteria in the development factor consist of farmers' production inputs, treatment and knowledge of semi-organic rice cultivation, farmers' activities in post-harvest handling, harvest marketing systems and the role of government and farmer institutions in organic rice farming. Each of the development factor criteria has several alternatives as shown in Table 1.

The next step is compiling a comparison matrix scale by assessing between criteria and alternatives on each criterion. Assessment of the importance of using a scale of 1-9 as in Table 2.

Table 1. Criteria and alternative development factors

Criteria	Code	Alternative
Provision of production inputs	A1	Provision of production facilities (seeds, fertilizers, pesticides, agricultural tools) of good quality, on time and in the right amount
	A2	Establishment of cooperatives within the scope of farmer group in providing agricultural inputs.
	A3	Opening opportunities for the private sector to invest in fertilizers and prices on the market mechanism (without subsidies).
Organic rice cultivation	B1	Regular assistance to farmers in the application of appropriate organic rice cultivation technology.
	B2	Use of pesticides (biological agents) or organic fertilizers as recommended in cultivation activities.
	B3	Encouraging farmers to use labelled superior seeds.
	B4	Increased motivation, knowledge, and skills of organic rice cultivation.
Post-harvest handling	C1	Ownership of farmer groups or a combination of farmer groups scale storage warehouses.
	C2	Provision of post-harvest machinery assistance by the government or the agricultural service
	C3	Price control (fixed price and floor price).
	C4	Conducting the certification process and laboratory testing of organic rice.
Marketing	D1	Formation of farmer partners with wholesalers (middlemen).
	D2	Establishment of farmer partners with organic rice factories
	D3	Formation of farmer partners with the government (Bulog).
	D4	Sales of crops with an online system using social media.
Government and institutions	E1	Intensive counselling for institutional strengthening of farmer groups.
	E2	Revitalization of extension institutions.
	E3	Maximizing farmer institutional empowerment.

Table 2. Criteria comparison matrix

Value	Information
1	Criteria/alternative A is as important as criteria/alternative B
3	A is slightly more important than B
5	A is clearly more important than B
7	A is clearly more important than B
9	A is more important than B
2,4,6,8	When in doubt between two adjacent values

In order to find out whether the data provided by the respondent is consistent or not, the CI (Consistency Index) and CR (Consistency Ratio) are calculated using the formula [12]:

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (1)$$

$$CR = CI/RI \quad (2)$$

Description: λ_{max} = average value of consistency vector

N = number of criteria elements

RI = Random Index

3 Result and discussion

The outcomes of the analysis the use of the Analytical Hierarchy Process (AHP) technique of 5 criteria in the formulation of strategies for developing organic rice farming in Sayegan District, Sleman Regency, can be seen which strategies are the most priority and which are not priority. The priority factor that has the largest weight value will be the main priority in determining the strategy for developing organic rice farming in Sleman Regency. The value of the weights on the 5 standards may be visible in table 3 below:

Table 3. Weight Values Between Criteria

Criteria	Weight Value	Priority
Provision of production inputs aspect (A)	0.267	1
Organic rice cultivation aspects (B)	0.213	2
Post-harvest handling aspects (C)	0.162	5
Marketing aspects (D)	0.177	4
Government and institutional aspects (E)	0.180	3

Inconsistency value = 0.02

Primarily based at the outcomes of the Analytical Hierarchy Process (AHP) from a combination of 12 respondents, it is known that the highest weight value or the main priority for the rice farming development strategy in Sleman Regency is the provision of inputs with a weight of 0.267 and the second priority is organic rice cultivation with a weight of 0.213. The third priority, namely the government and institutions, has a weight of 0.180, the fourth priority is marketing aspects with a weight of 0.177 and the fifth priority is post-harvest handling with a weight of 0.162. Organic fertilizers are still an obstacle for farmers to obtain, especially for farmers who do not have livestock, while manufactured organic fertilizers are more expensive than chemical fertilizers. This case is in keeping with what happened in Sumenep Regency [13] and in Sragen Regency [14].

The aspect of organic rice cultivation is the second priority that needs attention in formulating development strategies. Organic rice farmers in Sayegan District are still in the transition stage from conventional to organic rice which is called semi-organic [15]. Lowland rice cultivation with a semi-organic system uses at least 50% organic material from plant needs and is combined with less than 50% inorganic materials [16]. As time goes by, the use of chemical fertilizers and pesticides should be reduced in order to immediately reach organic rice farming. Organic farming systems are agricultural systems that use natural ingredients and without chemicals [17].

3.1 Alternative Strategy Criteria Aspects of Provision Production Inputs

Alternative aspects provision of production inputs has 3 alternative criteria, namely (A1) Provision of quality, timely and appropriate production facilities, (A2) Formation of cooperatives within the scope of the Association of Farmers Groups or Farmers Groups in providing agricultural inputs, (A3) Opening up opportunities for the private sector to invest in the fertilizer sector at prices based on market mechanisms (without subsidies).

Table 4. Alternative Weight Values of Provision of Production Inputs Criteria

Alternative Criteria	Weight Value	Priority
A1	0.524	1
A2	0.241	2
A3	0.235	3

3.2 Alternative Strategy Criteria for Organic Rice Cultivation

Alternative aspects of organic rice cultivation have 4 alternative criteria, namely (B1) Routine assistance to farmers in the application of appropriate organic rice cultivation technology, (B2) Use of pesticides (biological agents) or organic fertilizers as recommended in cultivation activities, (B3) Encouraging farmers in using the use of labelled superior seeds and (B4) Increased motivation, knowledge, and skills of organic rice cultivation

Table 5. Alternative Weight Values for Cultivation Criteria

Alternative Criteria	Weight Value	Priority
B1	0.101	4
B2	0.283	3
B3	0.308	2
B4	0.309	1

Inconsistency = 0.00336

Based on table 5 on the criteria for organic rice cultivation, the main priority is increasing motivation, knowledge, and skills of organic rice cultivation with a weight of 0.309. The role of agricultural extension workers and the Technical Implementation Unit (UPT) in increasing motivation, knowledge and skills is very much needed. The lack of awareness of organic philosophy among farmers is one of the obstacles inside the development of organic rice in Indonesia [4]. The high and low production of organic rice is strongly influenced by knowledge related to organic farming before farmers start organic farming. As many as 59.2% of farmers in Temon District have high knowledge of organic farming, 40% of farmers have moderate knowledge and 0.8% have low knowledge [18]. The second priority is to encourage farmers to use superior seeds labelled with a weight of 0.308. Seed is a very important plant material. The majority of farmers in Sayegan use labelled seeds from buying at the farm shop, but there are still those who use seeds from previous harvests which means they are not labelled. Therefore, farmers need to be encouraged to use labelled seeds of guaranteed quality. The third priority on the criteria for organic rice cultivation is the use of pesticides (biological agents) or organic fertilizers as recommended in cultivation activities with a weight of 0.283. Organic used by farmers in the form of manure is the main fertilizer in organic rice farming because it incorporates elements of N, P, K and C with a ratio among C and N of approximately 40% needed through rice plants [19]. In addition manure also serves to enhance the physical, chemical and biological properties of the soil [20]. The common use of manure is 700 kg/ha, because of this it is inside the low class, due to the fact the dose of manure must be 2 tons/ha [21]. The fertilizers used by farmers do not only come from organic materials, but farmers still use chemical fertilizers (Urea, NPK, KCl, Za) even though in small portions. Farmers need to be encouraged to maximize the use of organic fertilizers and reduce chemical fertilizers,

The fourth priority is regular assistance to farmers in the application of appropriate organic rice cultivation technology. Assistance has actually been carried out by field agricultural extension workers and Plant Pest Organism Control officers (POPT) but their effectiveness needs to be improved. Regular farmer group meetings are held every 35 times and are always attended by PPL

3.3 Alternative Strategy Criteria for Post-Harvest Handling Aspects

Alternative aspects of post-harvest handling have 3 alternative criteria, namely: (C1) Ownership of farmer group or union of farmer group-scale storage warehouses, (C2) Provision of post-harvest machinery assistance by the government or the agricultural service, (C3) Price control and (C4) Conduct certification and testing processes organic rice

laboratory. The weight values for alternative post-harvest handling are presented in table 6. Use italics for variables (*u*) and bold (**u**) for vectors. The order for brackets should be $\{ \{ () \} \}$, except where brackets have special significance.

Table 6. Alternative Weight Values of Post-Harvest Handling Criteria

Alternative Criteria	Weight Value	Priority
C1	0.162	4
C2	0.200	3
C3	0.385	1
C4	0.253	2

Inconsistency = 0.00606

The results of the analysis show that the main priority in the post-harvest handling criteria is price control with a weight of 0.385. The reality on the ground shows that the price of organic rice on the farm level is not any distinctive from that of conventional rice because most farmers sell their rice to middlemen on a slashing basis. Some farmers get higher prices because they sell organic rice directly to consumers. This case is in keeping with research [22] in Boyolali where the sale of organic rice is treated the same as ordinary rice. Efforts that can be made to strengthen the bargaining position of farmers and get a higher price are to sell together. The head of the farmer group coordinates the members to jointly sell rice to companies or farmers specializing in rice or organic rice so that they get a higher price. This is in accordance with the role of farmer groups as a vehicle for cooperation aimed at making it easier for members to meet their needs, both in the procurement of production facilities, marketing and capital [23].

The second priority is to carry out certification and laboratory tests for rice or organic rice with a weight of 0.253. Consumers will be more confident if organic rice is equipped with a certificate issued by an official institution or agency. The existence of certification for organic rice can increase the selling price of rice or organic rice and expand the market [25]. The third priority is the provision of post-harvest machines by the government or the agricultural service with a weight of 0.200. The post-harvest machines include rice threshing machines that are given to farmer groups. The existence of this machine can reduce damage or loss of crop yields and can improve the quality of rice [24].

3. 4 Alternative Strategy Criteria for Marketing Aspect

Alternative marketing aspects have 4 alternative criteria, namely: (D1) formation of farmer partners with wholesalers (middlemen), (D2) Formation of farmer partners with rice factories and (D3) Formation of farmer partners with the government (Bulog) and (D4) Sales of harvested products with an online system using social media. The value of the weights on the marketing alternatives can be seen in table 7 below:

Table 7. Value of Alternative Weights for Marketing Criteria

Alternative Criteria	Weight Value	Priority
D1	0.307	2
D2	0.176	3
D3	0.175	4
D4	0.342	1

Inconsistency = 0.00646

Based on table 7, it is regarded that the main priority on the marketing criteria is the sale of crops with an online system using social media with a weight of 0.342. Social media is believed to make it easier for market participants to communicate with producers, customers and/or potential customers [26]. In the digital era like today, online sales are considered very

effective, manufacturers can offer their goods directly with a wider market reach and consumers also feel comfortable because they don't have to leave the house. One of the farmers has done online sales and has obtained regular customers of his organic rice. Farmer groups need to work together with young people to develop social media to promote and sell organic rice. The second priority is the establishment of farmer partners with wholesalers (middlemen) with a weight of 0.307. Most farmers in Sayegan sell grain to middlemen because they can get money faster. Farmer groups need to collaborate with middlemen so that farmers can get price certainty and increase their income [27].

3.5 Alternative Strategy Criteria for Government and Institutional Aspects

The alternative aspects of the government and institutions have 3 alternative criteria, namely: (E1) Intensive counselling for institutional strengthening of farmer groups (E2) Revitalizing extension services institutions and (E3) Maximizing farmer group institutional empowerment.

Table 8. Alternative Weight Values of Government and Institutional Criteria

Alternative Criteria	Wight Value	Priority
E1	0.542	1
E2	0.189	3
E3	0.269	2

Inconsistency = 0.00089

Based on table 8, it is known that the main priority for government and institutional criteria is intensive counselling for institutional strengthening of farmer groups with a weight of 0.542. The development of organic rice will ignite if it is independent. Farmers must become members of farmer groups and actively participate in counselling to gain knowledge and information related to organic rice. Extension activities in Sayegan District are carried out every 35 days and are attended by field agricultural extension workers (PPL). The second priority is to maximize institutional empowerment of farmer groups with a weight of 0.269.

Farmer groups are not only limited to providing counselling but also have three main roles in agriculture: farmer groups as a vehicle for getting to know, production units, and cooperation [28]. As a vehicle for learning, farmer groups function as a gaining knowledge of and coaching forum for all members to improve understanding, skills, and attitudes. Farmer groups as production units function as farming business units in reaching more worthwhile results, each in phrases of quantity, quality, and continuity. Farmer groups as a vehicle for cooperation make farmer groups give a boost to relations between individuals in a single group or different groups in handling all farming troubles, both technically, managerially, and socially [29].

The third priority is the institutional revitalization of extension workers with a weight of 0.189. One agricultural extension officer oversees 3 districts, namely Sayegan, Mlati and Tempel. The three sub-districts have very large areas so that the performance of the extension workers is not optimal. Therefore, it is necessary to revitalize extension workers so that they can work more effectively in assisting farmers. This situation is contrary to the policy of the ministry of agriculture which stipulates one village and one agricultural instructor [30].

The results of the Analytic Hierarchy Process are shown in Figure 1. Based on the figure, the first selected criteria for the organic rice farming development strategy in Sayegan District, Sleman Regency, is the provision of production facilities (seeds, fertilizers, pesticides, agricultural tools) of good quality on time and in the right amount (A1). Organic rice farming requires production facilities that are different from conventional systems and farmers often find it difficult to obtain production facilities, especially organic fertilizers, and pesticides. Farmer groups are expected to provide these production facilities, making it easier

for farmers to obtain them. The second strategy is encouraging farmers to use labelled superior seeds (B3). Seed is a factor that determines success in farming and affects the level of production. There are still many organic rice farmers in Sayegan who use seeds from the previous harvest (not labelled) so they don't have to buy. Therefore, it is necessary to provide labelled seeds to reduce production costs that must be borne by farmers. The use of labelled seeds is expected to increase organic rice production.

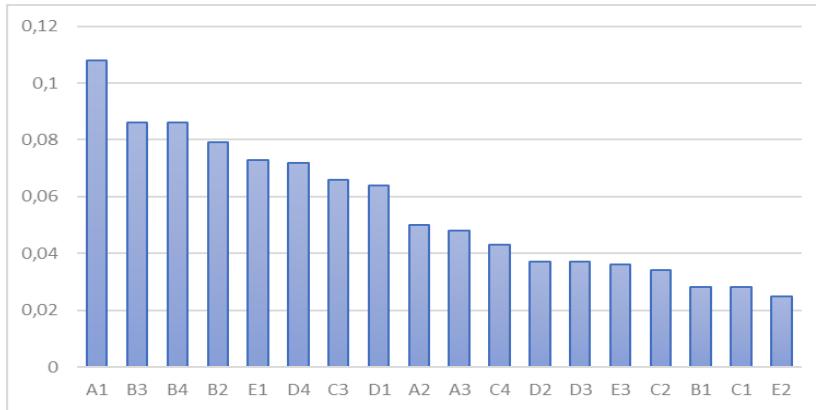


Fig. 1. Results of The Overall of Analytic Hierarchy Process

The third strategy is increased motivation, knowledge, and skills of organic rice cultivation (B4). Most of the rice farmers in Sayegan District are still not growing organic rice for various reasons, including the benefits of organic and non-organic rice are the same, they are not very familiar with the technical aspects of organic rice cultivation, it is difficult to get or make organic fertilizers and pesticides. Therefore, agricultural extension workers need to increase the motivation of farmers by providing an overview of the advantages of organic rice farming. In addition, PPL also routinely provides counselling and training on organic rice cultivation, as well as strategies for strengthening the performance of the red chili agribusiness system in Temanggung Regency [11].

4 Conclusions

Based on the results of the Analytical Hierarchy Process (AHP) from a combination of 12 respondents, it is known the main priority for the rice farming development strategy in Sleman Regency is the provision of inputs, followed by the second priority which is organic rice cultivation, and lastly, the third priority, the government, and institutions, the fourth priority is marketing, and the fifth priority is post-harvest handling.

The strategy for developing organic rice farming in Sleman regency consisted of (1) the provision of production facilities of good quality on time and in the right amount, (2) encouraging farmers to use labelled superior seeds, and (3) increased motivation, knowledge and skills of organic rice cultivation.

Acknowledgment. The writers would like to express gratitude to the Research and Innovation Institute (LRI) of the Universitas Muhammadiyah Yogyakarta for providing funds for this research.

References

1. A. Suryana, Forum Penelit. Agro Ekon. **32**, 123 (2014).
2. K. D. L. R. Kapuge, Procedia Food Sci. **6**, 303 (2016).

3. H. Willer and J. Lernoud, *The World of Organic Agriculture. Statistics and Emerging Trends 2019. Research Institute of Organic Agriculture (FiBL) & International Federation of Organic Agriculture Movements (IFOAM). Frick (CH), Bonn (DE)* (2019).
4. M. Arbi, T. Thirtawati, and Y. Junaidi, *JSEP (Journal Soc. Agric. Econ.* **11**, 22 (2018).
5. M. S. Andalas and Sudrajat., *Bumi Indones.* **7**, 1 (2018).
6. S. V. Br. Butar-butur, Salmiah, and M. Roem, *J. Soc. Econ. Agric. Agribus.* **4**, 1 (2015).
7. R. K. Adhikari, *J. Agric. Environ.* **12**, 97 (2011).
8. Y. Surdianto and N. Sutrisna, *Petunjuk Teknis Budidaya Padi Organik, Pertama (BPTP Jawa Barat, Bandung, 2015).*
9. S. P. Sari, H. Wirianata, and ..., *AGROISTA J. ...* **4**, (2020).
10. R. Mamola, C. Marsega, and W. Yulianti, *Inpire J. Econ. Dev. Anal.* **1**, 31 (2021).
11. R. Oelviani, 11 (2013).
12. Thomal L Saaty, *Fundamentals of Decision Making and Priority Theory with the Analytic Hierarchy Process* (RWS Publications, Pittsburgh, 1994).
13. D. Sakina, *Agriscience* **1**, 475 (2020).
14. Basudewo Krisna Jumna, *Econ. Dev. Anal. J.* **4**, 233 (2017).
15. A. Charina, R. Andriani, B. Kusumo, A. H. Sadeli, and Y. Deliana, **14**, (2018).
16. B. N. Fitriatin, *Dharmakarya* **8**, 92 (2019).
17. H. Mayrowani, *Forum Penelit. Agro Ekon.* **30**, 91 (2016).
18. R. Rusiyah, D. S. Widiatmoko, and T. Yuniarto, *Maj. Geogr. Indones.* **26**, 190 (2016).
19. A. Atman, *J. Sains Agro* **5**, (2020).
20. R. Prasetyo, *Planta Trop. J. Agro Sci.* **2**, 125 (2014).
21. P. Permatasari, S. Anantanyu, and W. S. Dewi, *Caraka Tani J. Sustain. Agric.* **33**, 153 (2018).
22. D. Yuniarti, E. S. Rahayu, and M. Harisudin, *Agrisociconomics J. Sos. Ekon. Pertan.* **1**, 112 (2017).
23. A. B. de Oliveira, M. M. de Almeida Lopes, C. F. H. Moura, L. de Siqueira Oliveira, K. O. de Souza, E. G. Filho, L. Urban, and M. R. A. de Miranda, *Sci. Hortic. (Amsterdam)* **222**, 84 (2017).
24. J. G. Atandi, S. Haukeland, G. M. Kariuki, D. L. Coyne, E. N. Karanja, M. W. Musyoka, K. K. M. Fiaboe, D. Bautze, and N. Adamtey, *Agric. Ecosyst. Environ.* **247**, 265 (2017).
25. D. P. I. Ayati, R. Wibowo, and J. A. Ridjal, *J. Ekon. Pertan. Dan Agribisnis* **2**, 279 (2018).
26. Fauzan Habib Zainularifin and Sugeng Riyanto, *J. Indones. Sos. Sains* **2**, 32 (2021).
27. F. Yulianjaya and K. Hidayat, *Habitat* **27**, 37 (2016).
28. D. K. . S. Hermanto, *Anal. Kebijak. Pertan.* **9**, 371 (2011).
29. I. S. Ruhimat and A. Widiyanto, *IOP Conf. Ser. Earth Environ. Sci.* **883**, (2021).
30. K. S. Indraningsih, *Agro Ekon.* **29**, 1 (2011).