

SUSTAINABILITY OF SHALLOT FARMING ON SANDY BEACH LAND IN SANDEN SUB-DISTRICT, BANTUL DISTRICT

Nabila Nafi'atul Aflah¹ & Anung Pranyoto²

^{1,2}Department of Agricultural Social Economics, Faculty of Agriculture, Universitas Gadjah Mada

Corresponding author: nabila.n.a@mail.ugm.ac.id

Received : 10 June 2025

Accepted : 29 August 2025

Published : 30 September 2025

ABSTRACT

Measuring the sustainability of shallot farming in coastal sandy soil includes 5 dimensions, namely economic, social, ecological, institutional, and technological. Sanden sub-district is the largest shallot producing area in Bantul regency. This study aims to determine (1) the sustainability of shallot farming in a multidimensional manner; (2) the most influential attributes of each sustainability dimension; (3) farmer characteristic factors that affect the sustainability of shallot farming. The research location was determined by purposive sampling method, while sampling was done by stratified random sampling method with a total sample of 60 respondents. The basic method used is descriptive analytical method. The sustainability of shallot farming is measured using Multidimensional Scaling, while attributes in dimensions that have a strong influence on sustainability are measured using Leverage Analysis. The results showed that shallot farming on coastal sandy land is highly sustainable in multidimensional terms with each dimension having the most influential attributes and the characteristic factors of age, education, number of family members, and farming experience affecting sustainability.

Keywords: *sandy beach land, shallots, sustainability*

INTRODUCTION

Utilization of sandy beach land (marginal land) for agricultural activities is an alternative to sustainable agriculture. This is due to the phenomenon of a decreasing trend in land area for agricultural activities (Saidi, 2020) which has resulted in a shift in agricultural land use to marginal land as a priority for utilization of cultivation areas (Kaparang & Sedyono, 2013). The limited characteristics of sandy beach land (Gunadi, 2022) with low nutrient content can be managed in a comprehensive and integrated manner to support agricultural activities (Rawung, 2015; Indrayanto, 2012). Despite the low nutrient content, Musofie (2008) stated that coastal sandy soil has the potential to be used for sustainable farming business development with further land treatment efforts.

Coastal sandy soil in Indonesia has an area of ±1,060,000 ha (Yuwono, 2009) which is considered to be a substitute for shrinking agricultural land if managed optimally. One area that has utilized coastal sandy soil for farming activities since 1983 is the Sanden Sub-district, Bantul Regency (Widodo, 2015).

Farming management on marginal land needs to pay attention to the principle of sustainability, which refers to the process of maintaining the provision of food that is always

productive without damaging the environment in the long term. Farm sustainability includes 5 dimensions, namely economic, social, ecological, institutional, and technological (Razae, 2015; Nurmalina, 2008). The five aspects interact dynamically to form a sustainable agricultural system, where incentives, participation, environmental carrying capacity, governance, and innovation reinforce each other in achieving long-term prosperity and resilience so that the complexity can be explained by the multidimensional method (MDS) (Gunadi *et al.*, 2018). These five dimensions cover all the variables used in determining the level of sustainability of farming in a region.

Shallot is a strategic cash crop commodity that dominates farming in the coastal sandy soil of Sanden Sub-district, Bantul Regency. The development of shallots on sandy beach land in the Sanden sub-district is based on the relatively high selling value with a relatively short planting time. Bantul Regency shallot production from all sub-districts reached 169,008 quintals of the total production of the Special Region of Yogyakarta (DIY) of 298,087 quintals in 2021 (Rahmawati, 2022). Bantul Regency is able to provide 60% of the shallot supply for Yogyakarta (Sidik, 2022) and is the center of shallot production. However, in recent years shallot production has experienced

a declining trend (BPS Bantul, 2022). The declining trend of production may result in a lower sustainability status. The purpose of this study is to determine the sustainability status of farming, to identify sensitive attributes in the sustainability dimension and factors affecting the sustainability of shallot farming.

MEHODS

The basic method used in this research is the descriptive analytical method. The sample of the research area was determined using the purposive sampling method and the research sample was determined using the stratified random sampling method. This research was conducted in Sanden Sub-district, Bantul Regency, Yogyakarta, involving 60 respondents. The sustainability of shallot farming on coastal sandy soil using primary data and secondary data related to 5 (five) dimensions of sustainability, namely economic, social, ecological, institutional, and technological. The five dimensions are the basis for the preparation of question items regarding sustainability based on farmers' perceptions.

Before all questions are used in research, the validity and reliability tests of each question used are carried out. The validity test is carried out to measure whether a questionnaire is valid or not

from each question used, while the reliability test is used to measure variables repeatedly with consistent data results (Dahruji, 2017) using the Cronbach's Alpha coefficient, which is greater than the standard value of the Cronbach's Alpha coefficient comparison of 0.6 (Putra & Hanggara, 2022; Siregar, 2017). After all indicators are declared valid and reliable, then all questions can be used in research. The sustainability of shallot farming on coastal sandy soil is measured through farmers' perceptions to produce a sustainability index. The measurement of the sustainability index is done using the Multidimensional Scaling (MDS) method.

How to determine the sustainability index

$$\text{Sustainability index} = \frac{\text{score obtained}}{\text{maximum score}} \times 100$$

The sustainability status of farming is categorized according to the sustainability index according to Rasihen *et al.* (2021) as follows:

- a. Index 0 - 25 (poor/unsustainable)
- b. Index 25 - 50 (less sustainable)
- c. Index 51- 75 (moderately sustainable)
- d. Index 76 - 100 (good/very sustainable)

Table 1. Indicators of Assessment of the Dimensions of Sustainability of Shallot Farming Businesses

Dimension	Item Pertanyaan	Sumber
Economy (X_1)	The existence of post-harvest measures ($X_{1,1}$)	Kurniati (2019)
	Onion price stability ($X_{1,2}$)	Sudiono <i>et al.</i> (2017)
	Affordability of agricultural input prices ($X_{1,3}$)	Sudiono <i>et al.</i> (2017)
	Off-farm income ($X_{1,4}$)	Ustriyana & Artini (2018)
Social (X_2)	Achieving farmer and family welfare ($X_{2,1}$)	Suyitman <i>et al.</i> (2009)
	Availability of labor for farming ($X_{2,2}$)	Suyitman <i>et al.</i> (2009)
	Time allocation for farming business ($X_{2,3}$)	Suyitman <i>et al.</i> (2009)
	The existence of family support ($X_{2,4}$)	Kurniati (2019)
	Efforts to increase knowledge ($X_{2,5}$)	Kurniati (2019)
Ecology (X_3)	Use of pesticides according to recommended usage ($X_{3,1}$)	Sudiono <i>et al.</i> (2017)
	Use of organic fertilizer ($X_{3,2}$)	Sudiono <i>et al.</i> (2017)
	Use of chemical fertilizers ($X_{3,3}$)	Kurniati (2019)
	Natural pest and disease control ($X_{3,4}$)	Kurniati (2019)
	The importance of maintaining soil fertility and looseness ($X_{3,5}$)	Suyitman <i>et al.</i> (2009)
	Sufficient water availability ($X_{3,6}$)	Zuhdi <i>et al.</i> (2021)

Institutional (X_4)	Access to financial institutions and capital is sufficient ($X_{4.1}$)	Sudiono <i>et al.</i> (2017)
	The existence of farmer groups ($X_{4.2}$)	Sudiono <i>et al.</i> (2017)
	Intensity of farmer group meetings ($X_{4.3}$)	Saida <i>et al.</i> (2011)
	There is coordination between related institutions ($X_{4.4}$)	Suyitman <i>et al.</i> (2009)
	Easy access to field agricultural extension workers ($X_{4.5}$)	Sudiono <i>et al.</i> (2017)
	Frequency of counseling by agricultural extension workers ($X_{4.6}$)	Randu & Hartanto (2020)
Technology (X_5)	Availability of road access and transportation to farmland ($X_{5.1}$)	Suyitman <i>et al.</i> (2009)
	Availability of agricultural tools and machinery ($X_{5.2}$)	Sudiono <i>et al.</i> (2017)
	Use of soil re-tillage technology ($X_{5.3}$)	Amalia <i>et al.</i> (2021)
	Level of technology mastery ($X_{5.4}$)	Pawingela <i>et al.</i> (2020)
	Level of technology application ($X_{5.5}$)	Dzikrillah <i>et al.</i> (2017)

The attributes within each dimension that had the most influence on the sustainability index were analyzed using Leverage Analysis. Leverage Analysis shows an assessment of the influence of data from specific individuals in the data analysis set with an overall fit (Owen & Kelly, 2014). The influence of each attribute is seen in the form of Root Mean Square (RMS) changes formulated as follows (Jaya, 2020):

$$RMS = \sqrt{\frac{\sum_{i=1}^n \{Vf(i, 1) - Vf(\cdot, 1)\}^2}{n}}$$

in which:

$Vf(i, 1)$ = MDS result value

$Vf(\cdot, 1)$ = Center value of 1st column MDS result

n = Number of attributes analyzed

Factors affecting the sustainability of shallot farming on sandy beach land are farmer characteristics analyzed using multiple linear regression analysis. The dependent variable in this study is sustainability and the independent variables are age, education, number of family members, and farming experience.

$$Z = \beta_0 + \beta_{1-4} + X_a + X_b + X_c + X_d + e$$

in which:

Z = Sustainability

β_0 = Constant

β_{1-4} = Regression coefficient

X_a = Age

X_b = Education

X_c = Number of family members

X_d = Farming experience

e = Error

RESULT AND DISCUSSION

Sustainability of shallot farming on sandy beach land in Sanden Sub-district, Bantul Regency, Yogyakarta

The sustainability index of shallot farming on sandy beach land in Sanden District, Bantul Regency, Yogyakarta (Figure 1) shows the sustainability index of economic (73.52%), social (88.93%), ecological (86.57%), institutional (74.42%), and technological (91.43%) dimensions. The sustainability index obtained shows that the sustainability status of the farming business carried out in each dimension. There are 3 dimensions that have sustainability status in the highly sustainable category, namely the ecological, social, and technological dimensions. Meanwhile, the other two dimensions have a sustainability status in the moderately sustainable category.

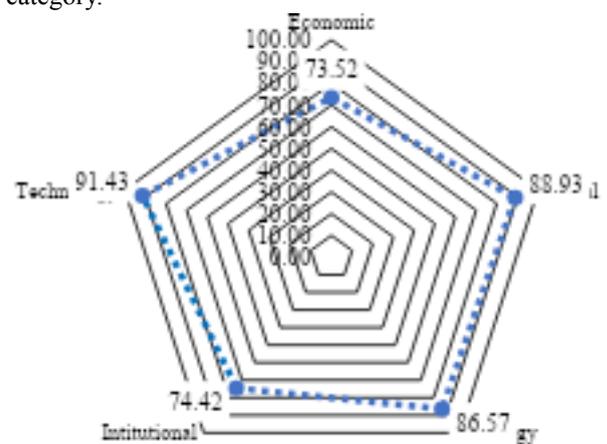


Figure 1. Sustainability Index of Shallot Farming on Sandy Beach Land

Source: Primary Data Analysis, 2023

The main cause of the sustainability index of shallot farming on sandy beach land in the economic dimension is in the category of quite sustainable because the price of agricultural inputs is unstable and cannot be controlled by farmers, which causes large expenditures for farming capital. This is reinforced by Fallo & Batafor (2022), who state that the affordability of agricultural input prices is an external factor that cannot be conditioned by farmers but is a big consideration for farmers in continuing their farming business. Meanwhile, the institutional dimension also has a sustainability index in the moderately sustainable category due to field conditions that show less access to extension services or lack of assistance from related institutions, especially field agricultural extension workers. This shows that the function of extension institutions in facilitating farmers in the process of farming assistance has not been maximized.

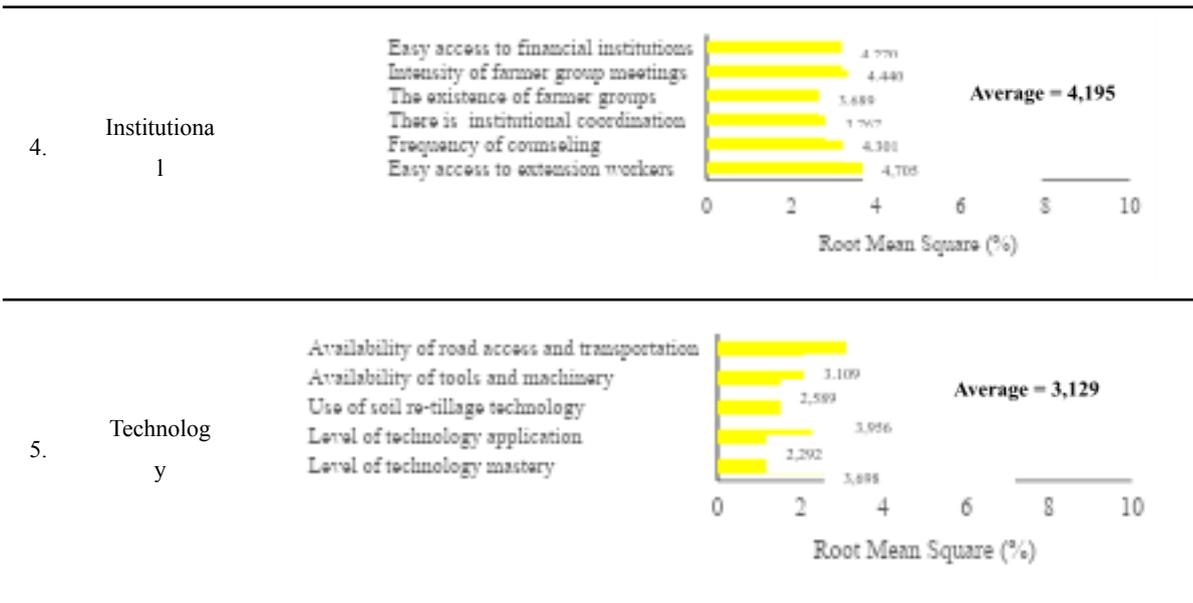
The sustainability status of shallot farming on multidimensional sandy beach land is in the very sustainable category with a sustainability index of 82.97%. The use of sandy beach land for shallot farming in Sanden Sub-district can continue with sustainability requirements in improving farm management and institutional strengthening and maintaining aspects that have prevailed in the social, ecological, and technological dimensions.

Attributes that have the most influence on the sustainability index in each dimension

The magnitude of the sustainability index is influenced by changes in the value generated from the attributes that have the greatest influence on the Leverage Analysis.

Table 2. Analysis of the Role of Attributes Affecting Farm Business Sustainability in Each Dimension

No	Dimension	Attributes	Result
1.	Economy	<ul style="list-style-type: none"> The existence of post-harvest measures Onion price stability Affordability of agricultural input prices Off-farm income 	<p>Average = 5,739</p>
2.	Social	<ul style="list-style-type: none"> Achieving farmer and family welfare Availability of labor for farming Time allocation for farming business The existence of family support Efforts to increase knowledge 	<p>Average = 2,866</p>
3.	Ecology	<ul style="list-style-type: none"> Use of pesticides according to recommendation Use of organic fertilizer Use of chemical fertilizers Natural pest and disease control The importance of maintaining fertility Sufficient water availability 	<p>Average = 2,638</p>



Source: Primary Data Analysis, 2023

Affordability of agricultural input prices (8.53%) is the most influential attribute in the economic dimension because changes in agricultural input prices have an influence on the decision to continue a yield-oriented farming business (Hidayah et al., 2022); Family support (4.15%) is the most influential attribute in the social dimension because the implementation of shallot farming on sandy beach land mostly utilizes labor in the family; The use of organic fertilizer (3.08%) is the most influential attribute in the ecological dimension because the use of sandy beach land requires improvement of soil conditions to continue; Ease of access to agricultural extension workers (4.70%) is the most influential attribute in the institutional dimension due to the important role of extension workers in supporting increased farming activities; and The use of soil reprocessing technology (3.96%) is the

most influential attribute in the technological dimension because the utilization of soil reprocessing technology is important on marginal land to be able to create productive agricultural land (Suriadikarta, 2012).

Factors affecting farm sustainability

Farm sustainability is influenced by several factors within the farmer, including age, education, number of family members, and farming experience. Multiple linear regression analysis with the OLS method is used to determine the factors that influence farm sustainability. Farm sustainability is the dependent variable, while age, education, number of family members, and farming experience are the independent variables.

Table 3. Factor Affecting the Sustainability of Shallot Farming on Sandy Beach Land

Variables	Expected Sign	Coefficient	p-value
Constant	+	27,727	0,000***
Age	-	-0,105	0,001***
Education	+	1,158	0,022**
Number of Family Members	-	-0,811	0,001***
Farming Experience	+	0,063	0,012**
<i>Adj R²</i>			0,237
Probality <i>F_{statistic}</i>		5,579	0,001***

Source: Primary Data Analysis, 2023

Description:

*** : Significance at 99% confidence level ($\alpha = 0,01$)

** : Significance at 95% confidence level ($\alpha = 0,05$)

The value $Adj R^2$ of 0.237 indicates that the variation in the independent variables (age, education, number of family members, and farming experience) can explain the dependent variable (sustainability), while 76.3% of the variation is explained by other variables outside the model. Probability $F_{statistic}$ of 0.001 is smaller than α (1%, 5%, 10%) which states that H_0 is rejected so that there is an effect of age, education, number of family members, and farming experience on sustainability simultaneously.

Based on Table 3, it can be seen that all independent variables have a significant effect on the dependent variable. Age and number of family members have a significant effect at the 99% significance level with a negative influence on sustainability, where the the number of family members can reduce the sustainability of shallot farming by 0.105 and 0.811 units, assuming other factors remain. Meanwhile, education and farming experience have a significant effect at the 95% significance level with a positive influence on sustainability, and farming experience can increase the sustainability of shallot farming by 1.158 and 0.063 units, assuming other factors are constant.

CONCLUSION

Based on the results of the analysis and discussion, it can be concluded that shallot farming on sandy beach land in Sanden Sub-district, Bantul Regency is very sustainable multidimensionally with a sustainability index of 82.97%. Affordability of agricultural input prices, family support, use of organic fertilizer, access to agricultural extension workers, and use of soil reprocessing technology are the most influential attributes of the economic, social, ecological, institutional, and technological dimensions. Education and farming experience have a positive effect on the sustainability of shallots on sandy beach-based land, while age and number of family members have a negative effect.

REFERENSI

BPS Bantul. 2022. Kecamatan Sanden Dalam Angka 2022. BPS Bantul, Bantul.
Dahruji. 2017. Statistik. Duta Media, Pamekasan.
Fallo, F.A.I. dan G.G. Batafor. 2022. Dampak peningkatan harga input dan kombinasi kebijakan terhadap kesejahteraan rumah tangga petani dataran rendah dan tinggi di Nusa Tenggara Timur. *Agricore:*

Jurnal Agribisnis dan Sosial Ekonomi Pertanian Unpad 7 (2): 100-107.
Gunadi, F., R.S.S. Nazli, E.I.K. Putri, dan B.P. Noorachmat. 2018. Analisis faktor-faktor teknologi dan sosial yang mengancam keberlanjutan kemandirian pangan pokok di Provinsi Jawa Barat, Indonesia. *Journal of Natural Resources and Environmental Management* 9 (3): 658-670.
Gunadi, S. 2022. Teknologi pemanfaatan lahan marginal kawasan pesisir. *Jurnal Teknologi Lingkungan* 3 (3): 232-236.
Hidayah, A.N., J. Sudrajat, dan W. Fitrianti. 2022. Determinan keberlanjutan usaha tani padi sawah tadah hujan: kasus desa pesisir Kalimantan Barat. *Jurnal Ilmu Lingkungan* 20 (2): 382-395.
Indrayanto, A. 2012. Analisis Produksi dan Pendapatan Petani di Daerah Lahan Pasir Pantai Pandansimo Bantul. Fakultas Pertanian. Universitas Gadjah Mada. Tesis.
Jaya, E.E. 2020. Skenario Berkelanjutan Pengelolaan Hutan Mangrove: Studi Kajian di Mangrove Center Graha Indah Balikpapan. Nas Media Pustaka, Balikpapan.
Kaparang, D.R. dan E. Sedyono. 2013. Penentuan alih fungsi lahan marginal menjadi lahan pangan berbasis algoritma k-means di wilayah Kabupaten Boyolali. *d'CARTESIAN: Jurnal Matematika dan Aplikasi* 2 (2): 18-25.
Musofie, A. 2008. Upaya pengembangan usaha tani di lahan pasir pantai melalui pemanfaatan limbah usaha peternakan. *Prosiding Seminar Nasional Teknik Pertanian*. Yogyakarta 18 – 19 November 2008: 1-15.
Nurmalina, R. 2008. Analisis indeks dan status keberlanjutan sistem ketersediaan beras di beberapa wilayah Indonesia. *Jurnal Agro Ekonomi* 26 (1): 47-79.
Owen, J.S. dan J.F. Kelly. 2014. *Introduction to Population Pharmacokinetic/Pharmacodynamic Analysis with Nonlinear Mixed Effects Models*. Hoboken, New Jersey.
Putra, R.A. dan A. Hanggara. 2022. *Analisis Data Kuantitatif*. Jakad Media Publishing, Surabaya.
Rahmawati, A.A.N. 2022. Varietas Bawang Merah Unggul Spesifik dari Daerah Istimewa Yogyakarta. *Buletin Teknologi dan Inovasi Pertanian*, Repositori Kementrian Pertanian.
Rawung, J.F.M. 2015. Analisis Profitabilitas, Efisiensi, dan Keberlanjutan Usaha Tani

- Konservasi Berbasis Tanaman Aren di Sulawesi Utara. Fakultas Pertanian. Universitas Gadjah Mada. Disertasi.
- Razaee, Z. 2015. *Business Sustainability: Performance, Compliance, Accountability, and Integrated Reporting*. Routledge, New York.
- Saidi, D. 2020. Potensi Marginal untuk Pengembangan Tanaman Singkong (*Manihot Esculenta Crantz*) Spesifik Lokasi Di Daerah Istimewa Yogyakarta. Prosiding pada Seminar Nasional Fakultas Pertanian UPN “Veteran” Yogyakarta. Yogyakarta, 14 Oktober 2020: 382–390.
- Sidik, H. 2022. Melimpah, Produksi Bawang Merah di Sentra Bantul Diperkirakan Capai 14.000 ton. <jogja.antaranews.com>. Diakses pada 22 November 2022.
- Siregar, S. 2017. *Metode Penelitian Kuantitatif: Dilengkapi dengan Perbandingan Perhitungan Manual & SPSS*. Kencana Prenada Media, Jakarta.
- Suriadikarta, D.A. 2012. Teknologi pengelolaan lahan rawa berkelanjutan: studi kasus Kawasan ex plg Kalimantan Tengah. *Jurnal Sumberdaya Lahan* 6 (1): 45 – 54.
- Widodo, A.S. 2015. Pengaruh sistem pengairan dan tanaman penahan angin terhadap risiko produksi usaha tani bawang merah di lahan pantai Kabupaten Bantul. Prosiding Seminar Nasional Hasil Penelitian Pertanian 2015 pada “Peningkatan Sinergi dan Inovasi Teknologi untuk Kedaulatan Pangan”, Yogyakarta, 2015: 671–678.
- Yuwono, N.W. 2009. Membangun kesuburuan tanah di lahan marginal. *Jurnal Ilmu Tanah dan Lingkungan* 9 (2): 137–141.