Economic aspects of soybean farming sustainability in Central Java, Indonesia

by Titik Ekowati

Economic aspects of soybean farming sustainability in Central Java, Indonesia

View the article online for updates and enhancements.

Economic aspects of soybean farming sustainability in Central Java, Indonesia

W Roessali, T Ekowati, E Prasetyo and Mukson

Faculty of Animal and Agricultural Sciences, Diponegoro University
Tembalang Campus, Semarang, Central Java, Indonesia 50275

E-mail: wilroessali@live.undip.ac.id

Abstract. Imbalances in supply and demand of agricultural commodities results in fluctuations in the prices of these commodities. High price fluctuations will have an impact on farmers' income and agricultural sustainability. This study aimed to determine the production performance and sustainability of soybean farming in Central Java, Indonesia. Survey studies were conducted in two areas which were purposively selected as the center of soybean production. A descriptive analysis was used to describe the condition of soybean farming sustainability. The results of the study showed that soybean price stability was low, indicating that soybean prices fluctuated with a coefficient of variation of 15.70%. Soybean farming income shows the positive R/C values in Grobogan and Wonogiri, namely 1.18 and 1.15, respectively. The profitability achieved was above the credit interest rate, demonstrating that soybean farming is still feasible. The percentage of the contribution to farm and household incomes is 37.77 and 18.87% respectively.

1. Introduction

One of the strategic commodities in Indonesia that has been sought to be competitive is soybean. The need for soybean increases along with the increase in the population and the development of the food and animal feed industries, which needs the raw material from soybean. The projection of soybean consumption in 2020 will be 3.01 million tons, an average increase of 2.1%, while the projection of its average production in 2020 will be deficit of 1.6 million tons or it will have an average decline of 0.98% [1]. The annual average need for soybean is ± 2.2 million tons, but currently the ability of domestic production is merely as high as 43.95% from the need, while the remaining 56.05% is fulfilled from imports [2]. The gap between the domestic demand and the production is overcome by soybean imports. It is predicted that the import of soybean increases by 5.2% in 2019 or amounting 3.23 million tons which tends to increase [3]. Soybean production is significantly affected by soybean imports [4]. Soybean production is influenced by the use of superior seeds [5] and the soybean productivity [6]. Therefore, it is necessary to make the socialization of technology to improve the productivity of domestic soybean on an ongoing basis [7].

Sustainability in the agricultural context basically means the ability to remain productive while still maintaining a resource base. Agriculture is sustainable if it is ecologically stable, and if it can continue economically, fairly, humanely and flexibly. Sustainability can be interpreted as keeping the effort and ability to survive and keeping from degenerating [8]. Economic sustainability means that farmers are

able to result in products to fulfill their own needs or get sufficient income to restore energy and the costs incurred.

Although soybean farming has a prospective future, its business is highly dependent on nature, causing the price of agricultural commodities to be relatively changed over time, and this condition can threaten the farming sustainability. One indicator of farming sustainability is the amount of farm productivity and its stability and growth, even though the internal and external environmental conditions change. Farming productivity includes the amount of production that can be achieved per unit of land area. Stability is strongly influenced by input and output prices. High price fluctuations make farmers' income from farming activities very volatile. Commodity price fluctuations basically occured due to an imbalance between supply and consumer demand [9]. Economically, excessive supply will decrease the price, whereas a decrease in supply results in an increase in the price of the commodity [10].

The farm income is also an indicator of the level of farming sustainability [11]. Profitability that can be achieved by farmers will be an incentive, encouraging the interest of farmers to do agricultural business. To be able to know the profitability of farming, an analysis is needed to determine the level of profit [12]. Maximum farm income is how farmers are able to organize and coordinate the use of production factors effectively and efficiently [13]. Efficiency is an effort to achieve the desired production and productivity by using minimum input [14]. Efforts to increase productivity can be done through technological changes by using a more advanced technology, increasing technical efficiency and business scale.

Soybeans are one of eight strategic food commodities in Indonesia [15]. It need as a raw material for the food and feed industries increases rapidly over years, but domestic soybean production is not sufficient. Based on the data, domestic soybean import has always increase where the import dependency ratio is 71.26% while the self-sufficiency ratio (SSR) is 29.05% [16]. The high demand for the import of soybean is caused by the fact that the soybean-based industries are growing rapidly along with the increase in the population number. The low national soybean production is caused by several factors, such as: (1) unavailability of land allocation that is definitely and specifically intended for the soybean production system; (2) high-risk soybean farming, low productivity and low soybean farming income; (3) perpetrators of soybean farming of traditional farmers with a small business scale; (4) slow adoption of production technology; and (5) program to increase soybean production which is not focused because the harvest area data is not accurate [17].

Increasing national soybean production not only through increasing productivity but also related to price stability. Efforts to increase productivity related to government policies in increasing the competitiveness of domestic soybeans. There is an economic rescue policy package for soybean price stabilization through the Indonesian Minister of Trade Regulation No. 45 / M-Dag / PER / 8/2013 [18]. As the price level has reduced the interest of farmers to grow soybeans, they have switched to planting more profitable food crops [19]. This has caused the sustainability of soybean farming to be somewhat disturbed. A study showed that the increase in farmer participation in soybean farming was constrained by the lack of availability of high-quality seeds, high risk of farming, and there was no price guarantee for soybean products [20]. The purpose of this study was to determine the production performance and sustainability of soybean farming in Central Java.

2. Methods

The research was conducted in July - September 2017 in Grobogan and Wonogiri Regencies. The locations were determined purposively with the consideration of highest soybean production in Central Java [21]. Then from each regency, two subdistricts were chosen, namely Pulokulon and Purwodadi In Grobogan, as well as Batuwarno and Manyaran in Wonogiri. Two villages were chosen in each subdistrict, then 25 households were randomly selected at each village, resulted in total of 100 respondents. The survey was conducted to collect data using structured questionnaires [22]. Primary data was obtained through records of agricultural activities, observations and direct interviews.

Secondary data were obtained from the data series in the period of 2001 - 2015 to estimate the trend in soybean prices. Data analysis was conducted in quantitative descriptive.

Sustainability analysis refers to the multidimensional scaling model (MDS) which is a modification of the rapid appraisal of the status of fisheries (RAPFISH). However, this study only assesses the economic aspects which include the contribution of soybean farming to farmers' income and the stability of product prices. Soybean farming income is calculated based on the difference between total revenue (TR) and the total costs that are sacrificed (TC). The TR is the product of the quantity of production and its price, while the costs are the physical units of each input multiplied by the price [23]. The contribution of soybean farming income is the percentage of income from soybean farming to total the farming income. Soybean price stability is calculated based on the monthly price of soybeans for the past year, calculated by the coefficient of variation (CV), which is a measure of relative risk obtained by dividing the standard deviation with the expected value [24]. The calculation of the coefficient of variance is to find out the uniformity of the data, where the smaller the value, the more uniform the data, and vice versa [25]. The smaller CV indicates that the soybean price is more stable.

3. Results and discussions

3.1. Characteristic of the respondent
The socio-demographic characteristics of the respondents showed that about 37% of respondents' ages ranged from 51 to 60 years. Most of the respondents are males (91%) while the rest (9%) are females. About 78%% of the respondents had an elementary school education level (Table 1).

Table 1. Socio-demographic characteristic of the soybean farmers

Characteristic	Grobogan	Wonogiri	Central Java (%)
Age			
31-40	16 (32)	5 (10)	21
41-50	17 (34)	13 (26)	30
51-60	9 (18)	28 (56)	37
>60	8 (16)	4 (8)	12
Gender			
Male	45 (90)	46 (92)	91
Female	5 (10)	4 (8)	9
Education			
Non-formal school	-		
Elementary school	47 (94)	31 (4)	78
Junior high school	3 (6)	9 (16)	12
Senior high school		8 (18)	8
Diploma/University		2 (62)	2
Experience			
Less than 10 years	14 (28)	18 (36)	32
11- 20 years	24 (48)	17 (34)	41
21-30 years	9 (18)	12 (24)	21
More than 30 years	3 (6)	3 (6)	6

*) Values in parentheses represent percentages.

3.2. Production performance
The average area of soybean planting in Wonogiri is smaller (0.34 ha) compared to Grobogan (0.46 ha). All respondents in Wonogiri only cultivate soybeans once per year with different varieties. While all respondents in Grobogan only cultivate Grobogan varieties of soybeans. This variety is a large seed-sized variety released in 2008 and can reach productivity of 2.77 tons per hectare with a seed weight of 15 g and harvesting age of 84 days [26]. The average soybean productivity in Grobogan

region was higher than Wonogiri Region (Table 2). Table 2 shows the percentages of seed costs in both research sites were relatively similar, but there were differences in the costs of fertilizers and pesticides. Labor cost in Wonogiri was lower than in Grobogan. In both regions the largest percentage of the total cost was the soybean planting. Other costs incurred by farmers in Grobogan included the cost of threshing machines leasing in the post-harvest period.

Table 2. Characteristics of production factors for soybean production in Grobogan and Wonogiri regencies

Description	Regency			
	Grobogan		Wonogiri	
Land area (ha)	0.46		0.34	
Planting Frequency (%)				
- 1 time per year	66		100	
- 2 times per year	34		-	
Soybean seeds (%)				
- Varieties Grobogan	100		74	
- Varieties other than Grobogan	0		26	
Productivity (ton/ha)	1.739		1.596	
Costs				
Land rent and depreciation of equipment	842,500.00	(19.53)	728,500.00	(24.66)
Seeds	734,295.00	(17.02)	411,035.00	(13.91)
Fertilizer	596,331.36	(13.83)	410,266.00	(13.89)
Pesticide	547,104.98	(12.68)	301,417.00	(10.20)
Labor (IDR/s)	1,343,831.40	(31.16)	1,102,755.00	(37.33)
Etc	249,167.01	(5.78)	-	0.00
Production cost (IDR/s)	4,313,229.75		2,953,973.00	

*Figures in parentheses represent the percentage of total production costs

3.3. Economic aspects of farming sustainability

Economic dimension in assessing how the sustainability of farming conditions is consists of 6 parameters, namely: product price stability, product contribution to farmers' income, product contribution to local revenue (PAD), profit transfers, availability of marketing institutions and availability of financial institutions [13]. In this study, the indicators used were price stability and income contribution.

Soybean price stability related to income received by farmers. Price stability can be measured by looking at fluctuations. High price fluctuations pose many risks from nominal prices that occur compared to relatively low prices instability fluctuations. If prices are unstable, the incomes received also fluctuates, thereby reducing the farmers' interest in planting soybean for a certain period [27]. A food price instability in developing countries at a high level has serious consequences for food security both in the short term (consumer access to food) and long-term periods (incentives for producers to invest and increase production) [29]. Price stabilization can be maintained if the supply and distribution arrangements are going well.
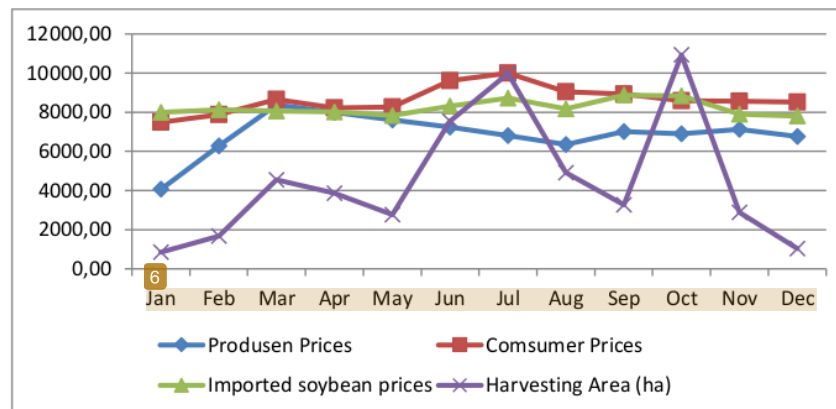
Figure 1. Development of soybean prices at the level of farmers, retailers, imported soybeans and harvesting area in 2016

Soybean prices at the prices of farmers, consumers and, imports (Figure 1) illustrates that in 2016 producer prices were more volatile than retail prices [29]. The surge in local soybean prices at the beginning of the year was close to prices at the retail level in March. At this point, the price of imported soybeans is relatively stable and local soybean prices tend to decline. From May to July, there was an increase in harvest area so that there was an increase in production in that period [30]. Conversely, soybean prices at the retail level showed an increase. The food processing industry with soybean raw materials such as the tempeh industry prefers imported soybeans [31].

Table 3. Coefficient of variation and stability category of soybean prices based on price data for January to December 2017

Component	Coefficient Variation (CV) (%)	Stability
Local soybean producer prices	15.70	moderate
Local soybean consumer prices	8.03	high
The price of imported soybeans	4.67	high

Source: Central Java Province Food Crops Department

Price stability is calculated based on the coefficient of variation in the data series 2017 [32]. Price stability based on the coefficient of variation in the study location (Table 3) showed the coefficient of variation (CV) of the local soybean producer price of 15.7%, which can be categorized as the moderate risk, means that the farmer's soybean prices are quite volatile. Soybean price fluctuations at the consumer level of 8.03% CV indicated quite high price stability, while the price of imported soybeans was relatively more stable throughout 2017. The farmers face more risk than traders because farmers generally cannot manage their sales time to get more favorable selling prices. High price fluctuations caused the income and business profits obtained by farmers very fluctuating. This condition can be understood because the sustainability of agriculture depends on the guaranteed price.

3.4. Soybean farming contribution to farming income
The second indicator in measuring agricultural sustainability is soybean farming's contribution to income. In general, farmers in both regions used agricultural land to be planted with rice, corn, soybeans, sweet potatoes, peanuts in intercropping or take turns. Calculation of farmer income included all income from agricultural and non-agricultural products.

Table 4. Analysis of soybean farming per planting season

Component	Regencies	
	Grobogan	Wonogiri
Production (kg/s)	800.11	552.8
Soybean price (IDR/kg)	6,345	6,150
Revenue (IDR)	5,076,697.95	3,399,720.00
Cost Production (IDR)	4,413,229.75	3,053,973
Profit (IDR)	663,468.20	345,747.00
R/C ratio	1.18	1.15
Profitability (%)	17.70	15.09
Farming Income (IDR)	3,014,395.80	2,459,396.21
Non-farm income (IDR)	3,190,363.98	2,288,960.28
Household income (IDR/season)	6,204,759.78	4,748,356.49

Note: 1 US$ = IDR 13,580 (December 2017)

Table 4 showed that soybean production in Grobogan was higher than Wonogiri. The R/C ratios for Grobogan and Wonogiri were 1.18 and 1.15, respectively, showed profitable soybean farming. Profitability of soybean farming in the two areas amounted to 17.7 and 15.09, respectively, which were greater than the interest rate of Bank BNI retail loans of 9.95. Thus, soybean farming was relatively feasible.

Soybean farming contribution to farming income (Table 5) showed a fairly large percentage of 21.05 in Grobogan and 16.69 in Wonogiri. Farming as a whole is an income derived from various other farms cultivated by farmers, namely rice, corn, livestock, and other food crops. Household incomes include tradings, non-agricultural services, government employees and private employees.

Table 5. Percentage of soybean contribution to farm income and household income

Income	Grobogan	Wonogiri	Central Java
Soybean farming contribution to farm income (%)	43.32	32.23	37.77
Soybean farming contribution to household income (%)	21.05	16.69	18.87

4. Conclusion

The economic aspects of the sustainability of soybean farming based on a price stability review indicated that soybean prices were quite fluctuating at the producer level. Soybean farming income with a positive R/C value and profitability achieved above the loan interest rate, demonstrated that soybean farming was still feasible. The contribution of soybean farming was relatively high, which was 37.77% of agricultural business income and 18.87% of household income. The level of profit that can be obtained and a fairly high contribution to household income give the hope of sustainability of soybean farming.

Acknowledgment

References

[1]   Aldillah R 2015 *Journal of Applied Quantitative Economics* **8** 9–23
[2]   Ministry of Agriculture 2015 *Roadmap for Increasing Soybean Production. Directorate General of Food Crops*(Jakarta)
[3]   Aimon H and Satrianto A 2014 *Jurnal Kajian Ekonomi* **3** 1–13
[4]   Perdana RP, Koestiono D and Syafrial 2013 *Habitat* **24** 120–132
[5]   Subiadi, Sipi S, and Motulo H F J 2015 *Proceedings of the Seminar on Various Peanut and Tuber Crops Research Results 2015* p. 196–203

[6]   Kharisma B 2018 *E-Journal of Economics and Business at Udayana University* **7** 679–710
[7]   Roessali W, Ekowati T, Prasetyo E and Mukson 2017 *The 6th IRSA International Institute* (Manado)
[8]   Louw A and Ndanga L Z B 2010 *The 3rd African Association of Agricultural Economists (AAAE) and 48th Agricultural Economists Association of South Africa (AEASA) Conference, Cape Town, South Africa, September 19-23, 2010* (Cape Town)
[9]   Gilbert C L and Morgan C W 2010 *Journal Phil. Trans. R. Soc. B* **365** 3023–3034.
[10]   Mankiw N G 2009 *Principles of Microeconomics* 5th Ed (South-West Cengage Learning)
[11]   Wardie J, Hartono S, Darwanto D H and Irham 2011 *AGRISEP* **10** 259–272
[12]   Suratiyah K 2008 *Farming Science* (Jakarta: Penebar Swadaya)
[13]   Saragih E S, Sitorus S R P, Harianto and Moeljopawiro S 2009 *Jurnal Agro Ekonomi* **2** 723–44
[14]   Abdulai S, Nkegbe P K and Donkoh S A 2013 *Afr. J. Agric. Res.* **8** 5251–5259
[15]   Hermanto, Azahari D H, Rahmat M, Ilham N, Kariyasa I K, Supriyati, Setiyanto A, Yofa R D, Yusuf ES 2015 *Strategic Food Commodity Outlook for 2015–2019*(Center for Agricultural Socio-Economic and Policy Studies, Center for Agricultural Research and Development)
[16]   PUSDATIN 2016 *Outlook for Soybean Food Crops Commodities* (Center for Agricultural Data and Information Systems, Ministry of Agriculture)
[17]   Sumarno and Adie M M 2010 *Iptek Tanaman Pangan* **5** 49–63.
[18]   Minister of Trade of the Republic of Indonesia. 2013. *The Republic of Indonesia Minister of Trade Regulation No. 45 / M-Dag / PER / 8/2013 Amendments to the Minister of Trade Regulation No. 24 / M-Dag / PER / 5/2013 concerning provisions on the import of soybeans in the framework of the soybean price stabilization program.*
[19]   Swastika DKS 2015 *Agro Economic Research Forum* **33** 149–160
[20]   Zakaria AK, Wahyuning K, Sejati W K and Kustiari R 2010 *Agro Economic Journal* **28** 21–37
[21]   BPS-Statistics of Jawa Tengah Province 2017 *Central Java in Figures 2017*(BPS-Statistics of Jawa Tengah Province)
[22]   Sugiyono 2017 *Qualitative Quantitative Research Methods and R & D*(Bandung: Alfabeta)
[23]   Al-Mansi O K, Mahmood Z H and Abbas N K 2015 *International Journal of Applied Agricultural Sciences* **1** 66–73
[24]   Abdi H 2010 *Coefficient of Variation. In Neil Salkind (Ed), Encyclopedia of Research Design* (Thousand Oaks, CA: Sage)
[25]   Syofian S 2011 *Descriptive Statistics for Research* 5th Ed (Jakarta: Rajawali Press)
[26]   Balitkabi   2011   *Varietas   unggul   kedelai*   Balitkabi   Edisi   Khusus   Penas XIIIhttp://pustaka.litbang.pertanian.go.id/inovasi/kl1106-ek04.pdf accessed 14 Juli 2018
[27]   Harsono A 2011 *Buletin Palawija* **21** 55–62
[28]   Ministry of Trade of the Republic of Indonesia 2015 *Final Report on the Study of Food Price Policy* Center for Domestic Trade Policy Agency for the Assessment and Development of Trade   Policy   of   the   Ministry   of   Trade   http://bppp.kemendag.go.id/ media_content/2017/08/Kajian_Kebijakan_Harga_Pangan.pdf
[29]   BPS-Statistics of Jawa Tengah Province 2015 *Harvesting Area, Production, and Productivity of Corn   and   Soybeans   by   Regency   /   City   in   Central   Java   Province 2015*https://jateng.bps.go.id/statictable/2016/08/22/1312/luas-panen-produksi-dan-produktivitas-jagung-dan-kedelai-menurut-kabupaten-kota-di-provinsi-jawa-tengah-2015.html
[30]   Agriculture and Plantation Service of Central Java Province 2017 *Central Java Food Crops Situation June 2017*http://distanbun.jatengprov.go.id/v/upload/statistik/ktpjuni.pdf
[31]   Zakiah Z 2012 *Mimbar* **28** 77–84
[32]   Central Java Province Agriculture and Plantation Service 2017 *List of commodity prices in Central Java Province wholesale and retail* Central Java Province Agriculture and Plantation Service

Economic aspects of soybean farming sustainability in Central Java, Indonesia