

# Analysis of Peanut Farming in The 3<sup>rd</sup> Planting Season in Pemalang District, Indonesia

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**Abstract.** Peanuts are regarded as the second most important commodity after soybeans which have quite high economic value. Its production tends to decrease every year due to the reduction in planting areas. Meanwhile, the rainfed paddy fields land in Central Java is quite potential, thus its utilization can be used as an alternative to developing peanut. Accordingly, this study aims to find out the level of income and feasibility of peanut farming in Tegalsari Barat, Ampelgading Subdistrict, Pemalang District, Indonesia. The sampling was performed using purposive random sampling method with a total of 22 people. The level of profit could be found by using the return cost ratio (R/C ratio). The results indicated that during one planting season, the average cost was IDR 12,647,000 ha<sup>-1</sup>. The average production of peanut was 4,600 kg ha<sup>-1</sup> wet pods with a selling price at farm level of IDR 8,500, so the average revenue was IDR 39,100,000 ha<sup>-1</sup>. The analysis of R/C feasibility showing the value of 3.09 (R/C > 1) indicates that peanut farming in the 3<sup>rd</sup> Planting Season (PS-3) in Pemalang District is feasible to be cultivated.

## 1 Introduction

Peanut (*Arachis hypogaea* L.) is one of the world's largest legume crops which ranks second after soybeans [1]. Peanut as one of the main commodities of Indonesia which its source of vegetable protein is important for food diversification in supporting national food security. Peanuts are an important food crop that needed by community because it has important roles, especially to meet the needs of protein and fat. According to [2] the basic composition of peanuts is 1.55% water, 40-50% fat, 23.68-27% protein, 18-21.51% carbohydrate, and Vitamin B complex.

National productivity of peanuts from 2014 to 2018 increased by around 7.34% (Table 1). The productivity of peanut in 2014 was around 12.79 q ha<sup>-1</sup> and increased by 13.73 qha<sup>-1</sup> in 2018 [3]. It also mentioned that the productivity of peanuts in Indonesia is relatively low compared to the USA, Vietnam, China, and Argentina which have reached more than 2 tons/ha. The productivity is only around 1 ton ha<sup>-1</sup> on average. National production of Groundnuts even continued to decline from 638,895 tons (2014) to 512,198 tons (2018).

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Nutrient management in inappropriate peanut lands is one of the causes of the low productivity of peanuts in Indonesia. According to [4], the lack of nutrients causes the process of filling the peanuts pods not full, even cipo (peanut pods that do not contain and whose bulkhead is unclear). According to [5], most peanut farmers in dry areas apply a small amount of fertilizer and sometimes only fertilize with one or two elements so that the plants do not get sufficient nutrients. Inadequate needs of nutrient and unbalanced nutrients result in low productivity. Furthermore, [6] suggested that the use of biological fertilizers in groundnut cultivation can help to provide nutrient N and/or nutrient P for the plants, without chemical residues in the environment as well as to increase the microbial population in plant roots.

**Table 1.** The Production of Groundnuts in Central Java and at National Level 2013 – 2018.

Year	Central Java			Indonesia		
	Harvest area (ha)	Yield (q)	Productivity (q.ha <sup>-1</sup> )	Harvest area (ha)	Yield (q)	Productivity (q.ha <sup>-1</sup> )
2014	91.862	120.158	13.08	499.338	638.895	12.79
2015	81.395	109.204	13,42	454.349	605.449	13.33
2016	74.639	105.338	14.11	436.382	570.477	13.07
2017	64.526	91.234	14,14	374.382	495.396	13.23
2018	63.341	86.603	13,67	91.662	512.198	13.73

Source: [3, 7, 8]

Peanuts commodities are evenly found in the district/cities in Central Java. The production accounts for 0.37% of total food crop production in Central Java [7]. The cultivation of peanuts was mostly found in areas with medium rainfall level and planted after rice cultivation because peanuts were intended as intercropping in dry season. According to [9], growth of peanuts was affected by different uncontrollable environmental conditions. Suitable environmental conditions will spur the growth and production of peanuts plants. [10] stated that the formation there is a real influence on dry peanut production due to the combined treatment of urea and compost fertilizers because of the ability of peanut plants to utilize nutrients received with the assumption of using the right dosage of fertilizer. Each plant needs to obtain fertilization with the appropriate dosage to occur balance of nutrients in the soil that can cause plants to grow and develop well and produce optimal production. N fertilizer application rates can be adjusted based on the actual crop need by accounting for the amount of N retained by the previous crop [11]. [12] suggested that excess application of N fertilizer scan be avoided by considering site-specific conditions that affect residual soil N, such as crop management practices and rotation systems.

The Indonesia's average peanut productivity in 2018 reached 13.73 q ha<sup>-1</sup>, meaning that there was an increase compared to 2017 which reached 13.23 q ha<sup>-1</sup>. However, production declined from 86,603 tons (2018), declined by around 5.07% compared to 2017 which reached 91,234 tons. The average peanuts productivity in Central Java last five years (2014-2018) was 13.68 q ha<sup>-1</sup>, 1.68% higher than the average national productivity. However, productivity in 2018 is lower when compared to 2017 productivity. The decline was influenced by a decrease in harvested area. Peanuts plants in Central Java were widely planted in paddy fields, so when the development program for rice, maize, and soybeans increased, the planting was then obstructed. The harvested area of peanuts was around 63,341 hectares in 2018, while the harvested area reached 64,526 hectares in 2017, resulting in a decrease of 1.84%.

The pattern of peanut production in Central Java in 2018 is the same as that of in 2017, where there was a decline in the May-August period and the September-December period. The decline in production in the above period was due to relatively low rainfall. By the

presence of the minimum water availability, a lot of land commonly planted with peanuts switched to other crops or was bare land. The production of peanuts can be increased by maintaining several components, such as planting area, harvested area, production, and productivity [12]. Also, some strategic steps to increase the production of peanuts can be achieved through applying appropriate production technology and developing as well as applying the latest cultivation technology, expanding the area of cultivated land and optimizing the land by utilizing land marginal of both dry land and rainfed paddy fields and other agricultural lands. Central Java has dry land and rainfed paddy fields which are quite extensive and spread over several regions. Dry land area in Central Java is 723,056 ha and rainfed lowland area is 272,364 ha [8]. Dry land and rainfed paddy fields are the second food barns after irrigated rice fields. According to [13] the use of dry land and rainfed paddy fields lowland is a potential and realistic alternative for future food procurement by increasing cropping index. In the dry land rotational cropping patterns, [14] suggested that using biochar as a soil amendment in first cropping maize farming can be increasing the second peanut farming production.

The relatively stable price is one of the advantages in the production of groundnut seeds. Meanwhile, an optimal peanut production is affected by the availability of quality seeds. The high demand for peanut seeds is not balanced with the ability to produce peanut seeds, so the development of peanuts seed production is still quite potential to develop. Also, the use of peanuts is increasingly diverse. In addition to being consumed directly, peanuts have the potential to meet the supply of industrial raw materials, for instance, dried bean industry or other processed products that are ready for consumption. [15] stated that peanuts can be used as raw materials for soap and oil industries and peanut stover can be used for animal feeds and fertilizers. Accordingly, the demand for peanuts increases by years, meanwhile, the peanuts needs at national level cannot be met from domestic production.

The production and productivity of peanuts in Central Java fluctuate and this is related to factors affecting its production. According to [16], in Tanzania the peanut production constraints were mainly diseases and pests. Peanut rust caused by *Puccinia arachidis* Speg was the major cause of yield reduction. Drought stress and non availability of seed of improved varieties were is another important constraints. According to [17] over the years in Kenya's Migori District, crop production has fluctuated due to climatic conditions and the socio-economic environment, such as inadequate use of technology, high input costs, lack of agricultural extension services, poor information flow from research stations to farmers, limitations in development infrastructure, a general decline in economic performance. According to [18], argued that from an economic perspective it was influenced by agricultural production facilities, skills and experience in farming. [19] Suggested that Integrated Soil Fertility Management (ISFM) interventions increase groundnut yields. Yields from fertilizer applications (whether inorganic or organic farm yard manure) to soil resulted in higher yields compared to the control, irrespective of the variety

The groundnut farmers in Pemalang District mostly sold their peanuts in a raw condition rather than selling them in a dry condition, even though they felt they had enough income. However, the calculation of income was rarely done by farmers, so there was no information on how much income they had got from peanut farming. Based on the realization found in peanut farmers after crop production, the farmers generally did not use the farm economic analysis yet, meaning that they never count the amount of revenue in a single harvest and make a breakdown of costs in the form of costs for seed, fertilizer, land rent, labor, depreciation, and transportation, so the amount of profit in a single harvest was almost unknown. For this reason, this study is significant to conduct, thus the income earned by farmers can obviously be found.

The planting patterns commonly used in the village of Tegalsari Barat were generally 1-2 times a year (i.e. rice - palawija/vegetables-bare land; maize-maize-bare land and rice-bare land-bare land. The way to increase cropping index by utilizing existing water resources had not been optimally carried out, so it needs to be introduced with peanut cultivation in PS-3. Income analysis has some benefits for both farmers and owners of production factors, including to illustrate the current state of farming and forecasting the impact of planned actions based on the previous analysis. Income analysis helps to measure the success of peanut farming in PS-3 which is applied for profit. This study is expected to increase the income of groundnut farmers through knowledge on production factors that affect groundnut productivity in PS-3.

Based on the above problems, this study aims to determine the amount of income and feasibility of peanut farming in PS-3 in Tegalsari Barat, Ampelgading Subdistrict, Pemalang District.

## 2 Methode

This study was conducted in Tegalsari Barat, Ampelgading Subdistrict, Pemalang District from May to October 2019 in PS-3. The land in the research location during the ps-3 was bare land or not being planted, but given the availability of water sources at the location, the application of technological innovation for groundnut cultivation was done to increase the crop index. The data collection method was carried out using a survey method on 22 peasant farmers conducting demonstration at the research location. The data collection used questionnaires or structured questions list. The data were collected in the form of primary data and secondary data. The former was obtained directly through interviews with the respondents, including the characteristics of farmers, the characteristics of farms, the use of peanut farming inputs, and their production. The latter was obtained from the existing sources, such as library materials, literature, previous research, books from related institutions, and other materials that are relevant to the basis of research theory and supporting data from related agencies.

Data analysis was descriptively performed with qualitative-quantitative method. Descriptive analysis was used to describe the characteristics of farmers and the performance of peanut farming, while quantitative analysis was used to assessing the revenue, expenditure (production costs), and feasibility of peanut farming. A formula based on the instructions of [20] was used to find out the amount of peanut farming income as follows:

$$I = TR - TC \quad (1)$$

Annotation:

I = Income (IDR)

TR = Total Revenue (IDR)

TC = Total Cost (IDR)

According to [21], farming performance can be expressed by R/C, the ratio between revenue and production cost to determine the feasibility of the cultivated peanut farming. The formula is presented as follows:

$$R/C = Revenue/Cost \quad (2)$$

Annotation:

R = Revenue (IDR)

C = Cost (IDR)

Criteria:

If  $R/C > 1$ , then peanut farming is feasible

If  $R/C < 1$ , then peanut farming is not feasible to be cultivated

If  $R/C = 1$ , then peanut farming is not profitable (loss).

## 3 Result and Discussion

### 3.1 Overview of Research Location

[3] stated that Ampelgading Subdistrict had an area of 2,425.29 ha of paddy fields and 2,754.72 ha of non-paddy fields. Specifically, Tegalsari Barat, Ampelgading Subdistrict had an area of 587.46 ha of land use consisting of rice fields and non-rice fields. The use of paddy land was 368.64 ha and 218.82 ha of non-paddy fields. The use of non-paddy fields in was 363.52 ha and 54.32 ha of the farm area. The building/yard area in Tegalsari Barat was 21.60 ha and 197.22 ha for the rest. The area of land based on the type of irrigation in Ampelgading Subdistrict is divided into two types of irrigation, such as technical irrigation of 2.353,15 ha and  $\frac{1}{2}$  technical irrigation of 222.1 ha. Meanwhile, the type of irrigated rice fields in Tegalsari Barat was 368.64 ha. The crooked land area for dry land was 0.51 ha and 23.13 ha for paddy land.

Based on the harvested area and productivity, the highest rice production was obtained from the area of 4,770 ha with a productivity of 52.95 q/ha followed by corn and green beans with the area of 345 ha and 80 ha with productivity of 57.00 q ha<sup>-1</sup> and 9.75 q ha<sup>-1</sup>, respectively. As for the condition of existing plantations, most farmers only planted 1-2 times a year with a cropping pattern of rice - palawija – bare land or rice- bare land-bare land and maize - bare land-bare land in dry land and rainfed paddy fields, where palawija was usually cultivated with corn or green beans.

### 3.2 Characteristics of Farmers

Characteristics of respondent farmers can be seen from several criteria, including age, education, farming experience, and area of land and status of land ownership (Table 2). These characteristics will affect the decision in farming. Several aspects of farmer characteristics, such as age, education, and status of farming, can affect farmers' skills in managing their farming.

According to the [3], workers with productive age, more than 15 years and less than 65 years, are considered to be more productive and more capable of conducting their compared to those with unproductive age (i.e. below 15 years and above 65 years). The farmers in Tegalsari Barat who were mostly at the age of 25-65 years showed a productive age. Based on the results of this study, all respondents were farmers who were still in productive age based on the determination issued by the Indonesian Central Bureau of Statistics. This means that at this productive age, the enthusiasm and ability to work will be high, that is, it can optimally devote their physical workforce. The age of farmers will affect physical ability, decision making, and response to new things (innovation) in a farming. This is similar to the research conducted by [22] that most peanut cultivators in Benin are farmers aged between 16 and 73 with an average of 38 years.

**Table 2.** Characteristics of Peanuts Farmers in Tegalsari Barat, Ampelgading Subdistrict, Pemalang District 2019

No	Farmer profile	Percentage (%)
1	Age	
	< 25 years old	13,6
	6 – 65 years old	86,4
2	Educational level	
	Elementary school graduate	36,4
	Yunior High School graduate	54,5
	Senior High school graduate	9,1
3	Farming status	
	Main Occupation	100
4	Side Occupation	0
	Farming experience	
	<10 years	18,2
	10-15 years	36,4
5	>15 years	45,4
	Land area	
	<1,0 ha	63,6
	1,0 – 1,5 ha	22,7
6	>1,0 ha	13,7
	Land ownership status	
	Self ownership	86,6
	Rent	14,4

The level of education in general is very influential on the mind-set of farmers related to the knowledge they have, which ultimately affects the efficiency and effectiveness of farming. The higher the education level of farmers, the easier the transfer of knowledge and technology adoption is relatively to accept [23]. The characteristics of respondents based on their level of education include elementary school education (i.e. eight people or 36.4%), junior high school education (i.e. 12 people or 54.5%), high school education, i.e. (one person or 4.55%), and bachelor (i.e. one person or 4.55%) (Table 2). [24] revealed that the level of education was an important instrument in new skill acquisition and technology transfer. The farmers belong to a group that is easy to accept new innovations.

Farming experience is one of the important factors in supporting the success of farming [25]. Low education does not mean knowledge in farming is also low because they get knowledge from their parents for years. Based on the data, the majority of peanut farming was in the range of more than 10 years with a percentage of 81.8%. In addition to hereditary, peanut farming was obtained from the extension officers in 1-4 times. However, the long experience of farming did not necessarily reflect the respondent farmers' willingness to implement a recommended technology. This is indicated by the previous planting technology repeatedly and the inappropriate use of pesticides and fertilizers. The farmers who had the capital could provide fertilizers at the recommended dosage, sometimes even in excess, while those with limited capital generally did not provide enough fertilizers.

The area of land cultivated by the farmers, in fact, affects the level of production of peanuts. Based on the results, this study noted that the area of land used by peanuts farmers about 0.4 ha. The data showed that 63.6% had land area < 0.5 ha (14 farmers), 22.7% (five people) farmers who had arable land of 0.5 ha – 1.0 ha and 13.7% farmers had an area of more than 1 ha (i.e. three people) (Table 2).

Land ownership status generally affects the income of a farmer. Those who have their own land have higher incomes compared to farmers who lease the land. The more extensive

the land, the more production is obtained. Based on the research data, the farmers owning their land were 19 people (86%) and those who leased the land were three people (14.4%).

Labor is one of the crucial factors and the backbone for the success of farming activities that are involved. The results of interviews with the respondents confirmed that the use of labor in conducting peanut farming activities came from inside and outside the family. Based on the results of interviews, the data indicated that it is only a small proportion of farmers who use labor outside the family. i.e. around five farmers (22.7%).

### 3.3 Analysis of Peanut Farming

The analysis of peanut farming was performed to find out the amount of investment, cost, level of production, selling price and profit. This analysis was made in the form of financing, revenue, profit, and analysis of feasibility, such as analysis of Break Event Points (BEP) and Return Cost (R/C) Ratio. The results of the analysis of peanut farming to improve the Planting Index is presented in Table 3.

Production is the yield obtained from peanut farming in one planting season. The total production of peanuts produced by farmers in the research location was 4,600 kg wet pods. By getting this production value, the productivity of peanuts planted on an area of 1 ha is high or equivalent to 14.72 q ha<sup>-1</sup> dried beans. This result is higher than the national productivity yield which only reaches 13.73 q ha<sup>-1</sup> dried beans [3]. The production yield can still be increased if the land is prepared more optimally, considering that the land in PS-3 is always cultivated or not planted by the farmers. Besides, at the beginning of the growth, the plants were experiencing water shortages because the pump was damaged due to minimum irrigation.

Farming income referred to in this study is peanut farming income obtained in one planting season (PS-3), which is the result of a reduction between production revenue and all production costs during the process. The income can be seen in table 3.

**Table 3.** Analysis of Peanut Farming Results (Ton ha<sup>-1</sup>) in Rainfed paddy fields of Tegalsari Barat , Ampelgading Subdistrict, Pemalang District in PS - 3 2018/2019

Input	Volume	unit	Cost	
			IDR	Total
Production input				
Peanut seed	90	kg	21,500	1,935,000
NPK Phonska	190	kg	2,300	437,000
Bioriz	3	Sachet	20000	60,000
Agrimeth	4	Sachet	15,000	60,000
Pesticides dan herbicides	1	Package	650,000	650,000
Land rent	1	Ha	2,000,000	2,000,000
Labor				
Land management	30	wdp	70,000	2,100,000
Planting	30	wdp	40,000	1,200,000
Watering	7	wdp	70,000	490,000
Pest management	8	wdp	70,000	560,000
Plant management	27	wdp	70,000	1,890,000
Harvesting	11	wdp	75,000	825,000
Other				
Fuel	55	liter	8,000	440,000
<b>Sub Total (A)</b>				<b>12,647,000</b>
Income				
Peanut (wet pods)	4,600	kg	8,500	39,100,000
<b>Sub Total (B)</b>				<b>39,100,000</b>
<b>Profit (B-A)</b>				<b>26,453,000</b>
RC				3.09

The farmers left their bare land because it was constrained by water and they did not yet understand the way to increase land productivity. The results also indicated that the total expenditure for farming peanuts was IDR 12,647,000. It costs for seeds, medicines and pesticides, fertilizer, land leasing, fuel and labor wage. Table 3 shows that the analysis of peanut cultivation in PS-3 received a high profit, with an income of IDR 39,100,000 and an average production cost of IDR 12,647,000, the income received by farmers was IDR 26,453,000/ ha . By receiving these benefits, the farmers felt satisfied because they got additional income in one lease of land (one year). Therefore, peanuts cultivation in PS-3 can be used as the way to increase land productivity and can increase the cropping index (CI) by from 100-150 to 200-250 compared to the existing zero panting of PS-3.

Having mentioned above, the attitude of farmers in handling cultivation also affects the success of farming. Farmers at the research location did pest control, especially when the planting begun to grow until the flowers bloom was done almost every three days using pesticides. The high use of pesticides had an impact on the costs of production inputs. This was caused by the planting in PS-3, such as peanut cultivation was just done by the farmers for the first time, so their understanding and implementation of the use of pesticides was still low. Excessive spraying of pesticides causes pests, especially caterpillars to become more resistant, thus it is difficult to handle.

In addition to production inputs, several other problems that obstruct the peanut cultivation in Tegalsari Barat were yield marketing. The price of the harvest depended on the middleman, so the farmers found it difficult to get more profit. Although in the peanut supply chain, the middleman need to be taken as strong partner for information sharing purposes. The partnership between farmers and middleman can be used to gain together benefit among peanut stakeholders in its supply chain [26].

The difficult access to capital sources, superior seeds, pest and diseases as well as limited pumping and piping facilities if are also still a barrier to peanut farming for farmers it when planted in PS-3. [27] revealed that the other peanut production constraints in eastern Ethiopia included poor soil fertility, lack of access to improved seed, pre-harvest diseases, use of low yielding varieties , inadequate access to extension services, limited access to credit, and limited availability of improved varieties.

The solution to problems in peanut farming is the need for involvement of various relevant stakeholders. The limited information can be one of the causes of the lack of farmers' adoption of peanut farming technology innovation, so most of the information obtained and carried out by them only rely on hereditary farming experience. Some efforts that need to be carried out include intensive transfer of technological innovation by agricultural officers (researchers/extension officers), for instance, by conducting technical guidance/training, applied studies or information media, especially regarding the application of integrated pest and disease control, the use of fertilizer recommendations, and quality seeds. Seeds of high quality can be obtained by planting in suitable areas/fields and at appropriate times, applying good crop management practices, adoption of proper harvesting and drying techniques, careful handling and processing to minimize mechanical injuries and unwanted seed mixing with other accessions [28].

The level of profit can be determined by using a Return Cost (R/C) Ratio analysis. R/C analysis is a comparison between revenue and cost. This analysis examines how much each cost value is used by farmers in peanut farming that will provide a number of revenues as the benefits. R/C analysis for peanut farming, was  $\text{IDR } 39,100,000 / \text{IDR } 12,647,000 = 3.09$  (Table 3). The results of peanut farming analysis show the R/C value of 3.09, meaning that every IDR 1 incurred by farmers will get a profit of IDR 3.09. Based on the analysis of the feasibility of the R/C ratio, the cultivation of peanuts in PS-3 in Pematang district is feasible to be cultivated because the R/C value  $> 1$  (i.e. the R/C value reached 3.09). This

ratio washigher than the results of research conducted by [29] which produces an R / C value in the cultivation of peanut using groove planting systems by 2.32.

## 4 Conclusion

The results indicated that the costs used for farming peanuts were IDR 12,647,000. The average production of peanuts were 4,600 kg ha<sup>-1</sup> wet pods and the selling price at the farm level was IDR 8,500, so the average revenue was IDR 39,100,000 ha<sup>-1</sup>. Based on the feasibility analysis of R/C for peanut farming, a value of 3.09 means that peanut farming in PS-3 in Tegalsari Barat is feasible to be cultivated because the R/C value > 1.

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