Yield and benefits performance of tabasco pepper farming in Indonesia

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Abstract. Tabasco pepper is the third-largest horticultural commodity after shallots and cabbage cultivated by Indonesian farmers. This study aims to determine the efficiency of farming tabasco pepper, through the analysis of agricultural input-output data from 27 provinces of Indonesia using the revenue cost ratio method. The results showed that Java Island is the center of tabasco pepper production in Indonesia. The cultivation of tabasco pepper was efficient in the country, as illustrated in the value of RC Ratio > 1, which was between 1.12 (South Sumatra and Yogyakarta) - 3.69 (NTT) with an average value of 1.77. The average benefit level reached by farmers was IDR 32,483,363/ha/season. Furthermore, the maximum benefit was IDR 88,847,100 ha/season while the minimum was IDR 7,805,500/ha/season. The average productivity of tabasco pepper was 3,084 kg/ha, with the highest yield in West Java being 6,423 kg/ha. However, the lowest was Gorontalo at 1,210 kg/ha. The average selling price at the farm level was IDR 27,005/kg, while the highest in West Papua was IDR 46,266/kg, and the lowest in South Sulawesi was IDR 14,824/kg. Therefore, tabasco pepper farmers have an opportunity to increase profits by IDR 56,363,737/ha/season and productivity by 3,339 kg/ha.

1. Introduction
Chili is an important horticultural commodity widely used as an ingredient in Indonesia dishes to add spice, give a red color and increase appetite. It has several types, which include large, curly and tabasco pepper with significant difference in sizes and level of spiciness. Tabasco pepper has the smallest size and the highest level of spiciness compared to the others.

The Statistics Indonesia data [1] showed that in 2013-2018, the harvested area for Indonesian tabasco pepper increased by 38.14%, from 125,122 ha to 172,847 ha. This was higher compared to the harvested area for shallots and large red chilies in 2018, which were 156,779 ha and 137,596 ha respectively. Furthermore, vegetable production data for 2018 showed that tabasco pepper was in third place with a total production of 1,335,624 tons, below that of shallots and cabbage which were 1,503,446 tons and 1,407,940 tons respectively. Based on the production growth from 2013-2018, the trend of tabasco pepper increased greatly from 713,502 tons to 1,336,624 tons compared to other commodities such as shallots, cabbage, potatoes and large red chilies, which are the 5 vegetables with the highest level of production. Furthermore, as a source of income, chilies are the foundation of 1,641,120 farmers in Indonesia. In accordance with the price data [2], it was seen that the price of tabasco pepper at the consumer level fluctuated every month. For example, in January 2019 the price of tabasco pepper was...
IDR 59,150/kg, which decreased in February to IDR 31,650, relatively increased slowly until its peak in August to IDR 95,000/kg and finally decreased until the end of the year to a price of IDR 41,650/kg. Although, its production shows positive conditions, various obstacles are still encountered in the development of its farm at the on-farm level in Indonesia. Some of the obstacles are the relative fluctuation of prices in various regions due to infrastructural conditions and distribution distances [3] and difference in harvest seasons [4]. Meanwhile, some of the obstacles faced by farmers include productivity level below its potential, risk of crop failure due to the unfavorable climate, attacks by pests and diseases and perishable chili commodities [5]. Due to these problems, this study was carried out to review the production performance and benefits of farming in Indonesia.

2. Research methods
The secondary data used for this study was obtained from various sources such as the Central Bureau of Statistics, the Ministry of Agriculture, the Ministry of Trade and other relevant literature. Meanwhile, the primary data used was obtained from the survey on cost of horticultural plant business structures in 27 provinces in Indonesia. Furthermore, this study was carried to describe the production performance and benefits of chili farming.

The data was analyzed using descriptive statistical methods. Some of the indicators used were income analysis and RC ratio, which are formulated as follows [6,7].

\[ B = TR - TC \]  

\[ RC \text{ ratio} = \frac{TR}{TC} \]  

where:
- \( B \) = Benefit or income farmer
- \( TR \) = Total revenue from tabasco pepper sales (IDR)
- \( TC \) = The total cost of cocoa farming (IDR)

The criteria for RC ratio are:
- \( RC \) ratio > 1, then it is feasible or efficient farming
- \( RC \) ratio = 1, then it is break even point
- \( RC \) ratio < 1, then it is not feasible

3. Results and discussion
3.1. Results and benefits of Indonesian tabasco pepper based on large islands
Discussion on the yields and benefits of tabasco pepper in Indonesia were made in the form of comparisons, specifically on large islands and provinces. The performance of tabasco pepper production by island is seen in Figure 1.

Figure 1 shows that Java Island is the center of tabasco pepper production in Indonesia, outperforming other islands with a production share of 55.55% followed by Bali-Nusa Tenggara and Sumatra at 18.53% and 14.33% respectively. Furthermore, the distribution of the monthly production of Indonesian tabasco pepper shows that the production trend in Java and Lesser Sunda Islands (Bali-Nusa Tenggara) were reversed, where the production in Java from January-March increased sharply with a peak of 87,461 thousand tons. Meanwhile, it became relatively stagnant till May and decreased suddenly till December with the lowest production of 44,247 thousand tons. Conversely, the production of tabasco pepper in Bali and Nusa Tenggara at the beginning of the year declined, where the production of 16,980 thousand tons fell to 7,367 thousand tons in January. Furthermore, chili production increased slowly until it reached its peak in October at 36,385 thousand tons. Meanwhile, the production in 4 other large islands, such as Sumatra, Kalimantan, Sulawesi and Papua-Maluku, were relatively stagnant with
each monthly production averaging 15,945 thousand tons, 2,547 thousand tons, 9,330 thousand tons, and 1,032 thousand tons.

Figure 1. Monthly tabasco pepper production by Island in 2018 (Data [8], processed)

The difference in harvest time between the islands of Java and Bali-Nusa Tenggara may be viewed positively. Therefore, it is possible to trade tabasco pepper inter-island as an effort to fill its production shortages between regions. Furthermore, when Java is surplus, distribution is made to other islands such as Sumatra or Bali, and vice versa. The difference in harvest time was caused by various factors such as weather and planting time [9]. An overview of the performance of tabasco pepper farming by islands in Indonesia is shown in Table 1.

Table 1. The performance of tabasco pepper farming in Indonesia by island in 2018

| Island              | RC Ratio | Benefit (IDR/ha) | Revenue (IDR/ha) | Cost (IDR/ha) | Tabasco pepper price (IDR/kg) | Productivity (kg/ha) |
|---------------------|----------|------------------|------------------|---------------|------------------------------|----------------------|
| Sumatera           | 1.63     | 33,490,571       | 88,046,114       | 54,555,543    | 25,490                       | 3,507                |
| Java                | 1.48     | 24,581,425       | 79,272,800       | 54,691,375    | 17,129                       | 4,696                |
| Kalimantan          | 1.74     | 42,005,225       | 102,188,125      | 60,182,900    | 35,553                       | 2,930                |
| Sulawesi            | 1.79     | 18,441,760       | 42,694,120       | 24,252,360    | 26,132                       | 1,811                |
| Bali-Nusa Tenggara | 2.24     | 42,422,500       | 82,441,500       | 40,019,000    | 27,188                       | 3,016                |
| Papua-Maluku        | 2.03     | 46,339,567       | 91,393,333       | 45,053,767    | 37,121                       | 2,566                |
| Average             | 1.82     | 34,546,841       | 81,005,999       | 46,459,157    | 28,102                       | 3,088                |
| Minimum             | 1.48     | 18,441,760       | 42,694,120       | 24,252,360    | 17,129                       | 1,811                |
| Maximum             | 2.24     | 46,339,567       | 102,188,125      | 60,182,900    | 37,121                       | 4,696                |
| Deviation           | 0.27     | 11,104,240       | 20,391,209       | 13,101,562    | 7,332                        | 969                  |
| Coefficient of variation (CV) | 0.15 | 0.32 | 0.25 | 0.28 | 0.26 | 0.31 |

a Source [10], processed
From Table 1, it was concluded that tabasco pepper farming in various islands was profitable to farmers. This was seen from a positive profit value of greater than 0. The highest profit rate was obtained in Papua-Maluku with a value of IDR 46,339,567/ha, due to the income received by farmers and the selling value of tabasco pepper (IDR 37,121/kg), which was higher than the average Rp. 28,102/kg. Meanwhile, the lowest was in Sulawesi with IDR 18,441,760/ha. In addition, the highest production costs incurred by farmers in Kalimantan was IDR 60,182,900/ha and the lowest in Sulawesi was IDR 24,252,360/ha, while the average farmer spends IDR 46,459,157/ha.

It was further concluded that the price of chili at the farmer level between islands was diverse. The highest price of chili was received by Papua-Maluku farmers at IDR 37,121/kg, while the lowest was in Java at IDR 17,129/kg, with an average of IDR 28,102/kg. A review of the coefficient of variation on various indicators showed that the lowest coefficient of variation was on the RC ratio indicator with a value of 0.15, while the highest were profit and production, for this reason, the two values deviated further compared to the average. Meanwhile, previous studies discovered that the difference in price between regions and times were caused by factors of the season (rainy/dry), production costs, production levels, distribution channels, pests and diseases and religious holidays such as Ramadan [3,9,11,12]

3.2. Results and benefits of Indonesian tabasco pepper by province

Production performance and benefits of tabasco pepper by province is shown in Table 2.

| Value | RC Ratio | Benefit (IDR/ha) | Revenue (IDR/ha) | Cost (IDR/ha) | Tabasco pepper price (IDR/kg) | Productivity (kg/ha) |
|-------|----------|------------------|------------------|--------------|-------------------------------|---------------------|
| Average | 1.77 | 32,483,363 | 78,399,885 | 45,916,522 | 27,005 | 3,084 |
| Min | 1.12 | 7,805,500 | 35,108,400 | 18,445,200 | 14,824 | 1,210 |
| Max | 3.69 | 84,887,100 | 149,801,000 | 76,325,000 | 46,266 | 6,423 |
| Deviation | 0.49 | 19,652,012 | 29,005,937 | 17,612,262 | 9,036 | 1,240 |
| C/V | 0.274 | 0.605 | 0.370 | 0.384 | 0.335 | 0.402 |

Table 2 shows the production performance and profits of tabasco pepper by province. Based on the coefficient of variation, the benefits of tabasco pepper were higher than others. Meanwhile, the coefficient of production variation was higher compared to that of price variation, therefore the relative production value of tabasco pepper had a wider range of variations than its price value.

The RC ratio value shows that East Nusa Tenggara has the highest RC ratio (3.69) while South Sumatra and Yogyakarta have the lowest (1.12), with the average RC ratio of 1.77. RC ratio was an indicator used to determine when the farming being carried out was feasible to destruction or not. Furthermore, based on the distribution of RC values which has the smallest value of 1.12, it was concluded that tabasco pepper in all Indonesian provinces were feasible or efficient. For RC value >1, each unit of production cost provided higher revenue than the costs paid by farmers. From previous studies, it was discovered that farming in various regions of Indonesia were feasible to operate with more than one RC, such as in North Sumatra at 1.93 [13], Bali with RC 2.09 [14], Malang, East Java at 1.4 [15] and Tasikmalaya, West Java at 1.77 [16].

Profits are generally expected from farming however, the range of benefits obtained between provinces showed a distance, where the lowest profit was obtained in Yogyakarta (IDR 7,805,500/ha) and the highest was in East Nusa Tenggara. The lowest revenue value of IDR 35,108,400/ha was obtained by Gorontalo and the highest of IDR 149,801,000/ha was obtained by Riau. Furthermore, the highest production cost was incurred by Bengkulu farmers at IDR 76,325,000/ha, while the lowest was by Gorontalo farmers at IDR 18,445,200/ha. The value of revenue was a reflection of the input price of production and the amount used, including that of the revenue description of the production results with the price of tabasco pepper received by farmers. In addition, the coefficient of variation in production (0.402) was higher compared the coefficient of variation in chili prices at the farm level (0.335).
Therefore, farmers faced slightly higher fluctuations in tabasco pepper production than in the price of tabasco pepper. While, a previous study was concluded that the production of tabasco pepper farming in Kediri, East Java was not efficient with an indicator of technical efficiency value of 0.48 [17]. Therefore, the opportunity to increase production became possible.

Increasing revenue was relatively easier for farmers to handle through production growth, compared to controlling prices. This was because the price of tabasco pepper was formed as a balance of supply and demand without the influence of the farmers. Conversely, the amount of chili production depended on the technology applied by farmers in tabasco pepper cultivation. Furthermore, in previous studies, it was concluded that tabasco pepper production were influenced by land area, seeds, labor, fertilizers and pesticides [18]. In addition, farmers need to pay attention to various ways to increase production, such as the use of varieties that are in accordance with the agroecology of the local area, including meeting farmer preferences, the right dosage of fertilizers, controlling pests and diseases, good irrigation and paying attention to the season suitable for plant needs.

In terms of prices, farmers need to have good access to information on consumer price levels consequently, when consumer prices are high, farmers would be able to get price increase. However, the government should policies such as price protection for farmers, in which when prices drop among consumers, chili prices increase sharply at the farmer level. Meanwhile, improvements in logistics infrastructure and production inputs and outputs, are of Importance, which leads to faster input-output distribution time and lower logistics costs. The addition of the quota for subsidized fertilizer should be considered based on conditions at the farmer level, since difficulties are faced in obtaining subsidized fertilizers. In addition, it is important to ensure that subsidized fertilizers are used by the right farmers, tabasco pepper cultivation technology are properly disseminated to increase their knowledge and skills, farmers need to associate with themselves to get a better bargaining position, products should be processed rather than being sold in fresh form and farmers should increase the added value of tabasco pepper products to increase tabasco pepper farming income.

4. Conclusion
Java Island is the center of tabasco pepper production in Indonesia, alongside Bali and Nusa Tenggara. However, the production trend in Java and Bali-Nusa Tenggara are relatively contradictory. Tabasco pepper farming in Indonesia was categorized as feasible or efficient, indicated by an RC value >1. Furthermore, the coefficient of variation in tabasco pepper was higher than that of the price. In addition, farmers income were increased by technological improvements at the farm level, accompanied by government support in disseminating technology, providing production facilities and improving logistics infrastructure.

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