

## FARMING PRODUCTION COSTS AND RELATIVE COMPETITIVENESS OF INDONESIAN BLACK AND WHITE PEPPERS

*Biaya Produksi dan Daya Saing Relatif Usahatani Lada Hitam dan Putih Indonesia*

Agus Wahyudi and Ekwasita Rini Pribadi

Indonesian Spices and Medicinal Crops Research Institute  
Jalan Tentara Pelajar No.3 Bogor 16111

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### ABSTRACT/ABSTRAK

Indonesia is one of the major pepper (*Piper nigrum* L.) producer countries in the world. The main pepper products are distinguished into black and white pepper. Each region has a tradition to produce each of the products and influencing cultivation practices and cost structure. This research was aimed to analyze the cost of productions of black and white pepper and their relative competitiveness to the pepper price at the farm level with conventional and improved cultivation practices. The survey methods were used to obtain the primary data from respondents selected with the snowball sampling method. Lampung and Bangka Belitung Islands were chosen to represent the black and white peppers of smallholders, respectively. The result showed that the farms with conventional cultivation practices did not have sustainable relative competitiveness, indicating higher production costs than the lowest prices received in the long term. On the other hand, relative competitiveness was relatively better in farms that implemented improved cultivation practices. Therefore, to achieve sustainable relative competitiveness, pepper farms should apply improved cultivation practices. The relative competitiveness of white pepper was better than black pepper because the productivity of white pepper was higher even though the production cost was also a little bit higher than black pepper.

*Indonesia merupakan salah satu negara produsen utama lada (*Piper nigrum* L.) dunia, dengan lada hitam dan lada putih sebagai produk utamanya. Setiap daerah memiliki tradisi tersendiri untuk menghasilkan diantara produk tersebut sehingga ada perbedaan sistem budidaya dan struktur biayanya. Penelitian ini bertujuan untuk menganalisis biaya produksi lada hitam dan lada putih dan daya saing relatifnya terhadap harga lada di tingkat petani. Metode survei digunakan untuk mendapatkan data primer dari responden yang dipilih dengan metode snowball sampling. Lampung dan Bangka Belitung dipilih untuk merepresentasikan budidaya lada hitam dan lada putih. Hasil penelitian menunjukkan bahwa perkebunan lada dengan budidaya yang konvensional kurang memiliki daya saing relatif berkelanjutan, yang ditunjukkan oleh biaya produksi yang lebih tinggi dibandingkan dengan harga terendah yang diterima dalam jangka panjang. Daya saing relatif lebih baik di perkebunan yang telah menerapkan budidaya yang baik. Daya saing relatif lada putih lebih baik daripada lada hitam, karena produktivitas lada putih lebih tinggi meskipun biaya produksinya juga sedikit lebih tinggi.*

\* Alamat Korespondensi : aguswahyudi211@gmail.com

## INTRODUCTION

Indonesia is one of the major producers and exporters of black and white peppers. However, during 2009-2018, pepper export volume declined from 51,000 tons to 48,000 tons (BPS, 2013 & 2018). The decline occurred due to the increased competition among pepper-producing countries. Therefore, as a main pepper producer country, Indonesia should increase its competitiveness by improving cultivation efficiency, developing new markets, and diversifying products (Wahyudi *et al.* 2017).

Indonesia's pepper production centers are mainly located in Bangka-Belitung Islands, Lampung, South Sumatra, South Sulawesi, and East Kalimantan Provinces. However, pepper products from Lampung and Bangka Belitung Islands are well known globally as Lampung Black Pepper and Muntok White Pepper. In addition, West and East Kalimantan are also farming areas of white pepper that have existed for a long time and are traditionally associated with a kind of Sarawak White Pepper that has been well known globally (Wadley & Mertz 2005). In 2018, Bangka Belitung Islands Province produced 38.92% of the total national pepper production, Lampung 16.41%, followed by South Sumatra (9.30%), South Sulawesi (7.33%), and East Kalimantan (6.91%), while other provinces contributed 21.13% (Zikria 2019).

Pepper farming in Indonesia has not provided optimal added value and increased farmers' income because of various constraints, including low inputs use and the under-development of processed industries (Kemala 2006). Another problem in pepper farming is that most pepper farming in Indonesia is smallholders identical to traditional management (Damanik 2001). In traditional pepper cultivation, farmers use chemicals as the main input in their cultivation as a determinant of the success of their farming. Therefore, when fertilizers and pesticides are difficult to obtain, the intensity of fertilization and pest control will also decline, resulting in decreased productivity. The low pepper productivity was one of the driving factors as farmers switched to planting other commodities and reduced the area of smallholders' pepper plantations (Kardinan *et al.* 2018).

The average pepper productivity in Indonesia, both on smallholders and large private plantations, is still lower than 1.0 ton.ha<sup>-1</sup> (Zikria 2019). In 2010, pepper productivity in Indonesia reached 756 kg.ha<sup>-1</sup>, then increased in 2018 to 802 kg.ha<sup>-1</sup> (Anonymous 2019). The low productivity was caused by planting in agro-climatically

unsuitable areas, the use of local seeds, and pest and disease infestations (Rosman & Suryadi 2018).

The low intensity of crop cultivation can also trigger lower pepper productivity. This is because farmers attempted to save production costs when the selling prices were low or declined based on previous experience. Consequently, this often exacerbates production unit costs, as diminishing cultivation intensity will decrease the productivity that outweighs the production cost saved by the farmers.

Production costs are an indicator for farmers' decision-making in determining the intensity of pepper cultivation, especially when farmers face the uncertainty of pepper price levels. Therefore, the right decision is to increase productivity to keep the unit cost of production lower than the possible lowest price. Suppose that condition can be achieved in the long term. In that case, it indicates pepper farming has relative competitiveness in the international market, signifying that Indonesian pepper has product competitiveness to be distributed in the global market competing with suppliers from other countries (Chursin & Macarov 2015).

According to Maikhati (2001), calculating production costs is useful in determining and controlling expenses in the production and distribution process to set favorable selling prices and decision-making considerations for future business development. It implies that the production cost can be used to control the production to keep the relative competitiveness. This research was aimed to analyze the unit cost of production and the comparative competitiveness of black and white peppers based on the conventional and improved practices in Lampung and Bangka Belitung.

## METHODOLOGY

### Location and respondent selections

Pepper smallholders in Sukadana District-East Lampung, Payung District-South Bangka, and Dendang District-East Belitung were studied as subjects and sources of information and data. In April and May 2019, the farm surveys were conducted in South Bangka and East Belitung as subject farms produced white pepper, while in August 2019 the survey was conducted in East Lampung for black pepper farms.

Respondents were selected through snowball sampling (referred to former respondents according to the researchers' purposeful characteristics, and the initial respondents were

selected with the determined characteristics) (Ghaljaie *et al.* 2017). The respondents were categorized as the peppers of smallholders that cultivate conventional and improved practices. In-depth interviews with 21 respondents consisted of seven, nine, and five respondents in Lampung, Bangka, and Belitung.

Data and information obtained from the subjects were the production (cultivation and processing) activities of black and white pepper smallholders from planting, maintaining young and productive plants, harvesting and processing practiced in the farms, and the costs expensed and relevant to the activities.

### Structure of production costs

Cost of production is the sum of all expenses in production activities in a given period. The costs can be categorized based on activities and time of occurrence. For example, the expenses of planting and maintaining young plants are classified as investment costs; meanwhile, activities for maintaining productive plants, harvesting, and processing are categorized as operating costs. The investment cost is expensed in Year-0, Year 1-3, and Year 1-2, while operating costs in Year 4-10 and Year 4-10 respectively for black and white pepper (Table 1).

In Year 0, laborers were required for land preparation, setting up supports, pepper planting, whereas materials purchased were pepper seedlings, wood supports, fertilizer, and miscellaneous materials. Labors were also required to sustain young plants for preserving soil fertility, controlling pest and disease, replacing dead plants, maintaining water availability, and other activities to uphold plant growth. Materials required were pepper seedlings, inorganic and organic fertilizer, pesticides, and miscellaneous labors and materials.

Subsequent activities are continued to maintain young plants after planting in Year 0.

Young plant maintenance depended on the supports type. The maintenance of young plants using living support, such as in Lampung that produces black pepper, required three years. However, plant maintenance in Bangka, which utilized dead support and produced white pepper, was shorter (2 years). The activities continued in Year 4-10 and Year 3-8 for black and white peppers, respectively, to retain productive plants, harvesting, and processing.

As well as in young plants, labor was also needed to keep the productive plants healthy. The activities were almost similar such as conserving soil fertility, controlling pests and disease, replacing dead plants, maintaining water availability, and other activities. In harvesting and processing activities, laborers were required for picking up the mature green berries from vines, threshing, drying, grading, and packaging for black pepper; picking up the fully ripe orange berries from vines, threshing, soaking, removing the outer skin of berries, washing, drying, grading and packaging for white pepper (Ravindran & Kallapurackal 2012).

### The unit cost of production (UCoP) and relative competitiveness

The unit cost of production (UCoP) should be expensed to produce a unit of product (Lima *et al.* 2008). In other words, UCoP is the sum of the annual cost of production divided by the expected annual yield. The annual cost of production is a total of costs expensed in a year of the production process or the sum of depreciation and operational cost. Depreciation is the difference between the fixed assets acquisition cost and estimated salvage value over the economic lifetime, while operating cost is annual expenses in a productive period (Table 2). Fixed assets were invested in investment periods and utilized a long economic life cycle (Mohammed *et al.* 2017).

Table 1. The activities of production and budgeting are based on activities timing

Tabel 1. Aktivitas produksi dan uraian pembiayaannya

Product/Produk	Activities and timing/Kegiatan dan waktu pelaksanaan			
	Planting/Penanaman	Maintaining young plants/Pemeliharaan tanaman belum menghasilkan	Maintaining productive plants/Pemeliharaan tanaman menghasilkan	Harvesting and Postharvest/Panen dan pascapanen
Black pepper/Lada hitam	Year/Tahun 0	Year/Tahun 1-3	Year/Tahun 4-10	Year/Tahun 4-10
White pepper/Lada putih	Year/Tahun 0	Year/Tahun 1-2	Year/Tahun 3-8	Year/Tahun 3-8
Cost/Biaya	Investment/Modal		Operational/Operasional	

Table 2. Description of production cost and relative competitiveness

Tabel 2. Deskripsi biaya produksi dan daya saing relatif

Component/Komponen	Description/Deskripsi
Investment cost/ <i>Biaya investasi</i>	Sum of expenses in investment (gestation) period/ <i>Jumlah pengeluaran (total biaya) dalam periode investasi</i>
Acquisition cost of fixed assets/ <i>Biaya perolehan aset tetap</i>	The cost to acquired fixed assets use (investment cost)/ <i>Biaya untuk memperoleh/membeli aset tetap (biaya investasi)</i>
Estimated economic lifetime of fixed assets/ <i>Umur ekonomi</i>	Estimated lifetime of fixed assets that economically utilized/ <i>Estimasi masa penggunaan aset tetap yang dapat dimanfaatkan secara ekonomi</i>
Depreciation/ <i>Depresiasi</i>	Difference between acquisition cost of fixed assets and estimated salvage value over the economic lifetime/ <i>Biaya yang ditimbulkan karena aset tetap yang digunakan mengalami penurunan manfaat atau penurunan kualitas (menyusut).</i>
Operational Cost/ <i>Biaya operasional</i>	Sum of expenses yearly in a productive period/ <i>Jumlah pengeluaran tahunan dalam periode produktif</i>
Annual cost of production/ <i>Biaya produksi per tahun</i>	Sum of depreciation and operational cost/ <i>Jumlah biaya penyusutan dan biaya operasional</i>
Expected annual yield/ <i>Potensi produksi per tahun</i>	Expected weight of dried pepper per ha yearly/ <i>Berat produk lada kering per ha tahunan yang diharapkan</i>
IDR unit cost of production/ <i>Harga pokok produk dalam rupiah.</i>	Annual cost of production divided by expected annual yield/ <i>Biaya produksi tahunan dibagi dengan hasil tahunan yang diharapkan</i>
USD unit cost of production/ <i>Harga pokok produk dalam US \$</i>	IDR unit cost of production over conversion rate of USD to IDR1000/ <i>Biaya produksi tahunan dibagi dengan hasil tahunan yang diharapkan yang dikonversikan ke satuan US\$</i>
Relative competitiveness/ <i>Daya saing relatif</i>	Ratio of the lowest yearly long term price to a unit cost of production/ <i>Rasio antara harga terendah pada suatu periode yang panjang terhadap biaya per unit produksi</i>

Pepper plantation that has been built during the investment (gestation) period becomes fixed assets used for production during the economic lifetime. Therefore, the assets should be depreciated as long as the production is conducted. The accumulation of depreciation of fixed assets represents the difference between the acquisition cost (investment cost) and the estimated salvage value of the fixed asset at the end of an economic lifetime. Calculation of depreciation per year can be used in several methods, but the straight-line calculation method is common. By this method, depreciation is the accumulation of depreciation divided by the estimated economic lifetime of the fixed asset (Meylani & Nurjanah 2019).

Competitiveness can be analyzed at the enterprise (farm), sector, or state economy level (Frohberg & Hartmann 1997). This research analyzed competitiveness at the farm level; hence all costs and returns were evaluated in financial value, not in economic value as in analysis for the sector or state economic level.

To analyze the competitiveness at the farm (business) level, it can use relative competitiveness indicators that are the ratio between the lowest

selling price that farmers may be received in the long term against the unit cost of production. If the ratio is more than unit, then farming has relative competitiveness towards suppliers in the relevant market.

## RESULT AND DISCUSSION

### Cost of black pepper production with common practices

Smallholders in Lampung usually intercropped black pepper with other crops such as coffee, cocoa, and rubber. Revenue from the pepper was generally saved and sometimes invested for farm assets, building the house, buying vehicles, or spending on special and social expenses such as education, wedding, or pilgrimage. So, it was because the revenues were not regularly received throughout the year. In contrast, income from coffee, rubber, and cocoa plantations was expected to be received regularly to meet daily needs.

Table 3. Structure of black pepper production cost with conventional practices in East Lampung in 2019

Tabel 3. Struktur biaya produksi lada dengan budidaya konvensional di Lampung tahun 2019

Descriptions/Uraian	Unit	Unit Cost/Satuan biaya (IDR1,000 /unit)	Investment Cost/Biaya investasi				Operational Cost/Biaya operasional	
			Year 0		Year 1-3		Year 4-10	
			Unit per ha	Cost/Biaya (IDR1,000)	Unit per ha	Cost/Biaya (IDR1,000)	Unit per ha	Cost per year/Biaya per tahun (IDR1,000)
1. Seedlings/Benih	Cuttings/stek	5	2,100	10,500	-	-	-	-
2. Tree Supports/Tiang panjat hidup	Trees/pohon	3	2,000	6,000	-	-	-	-
3. Manure/Pupuk kandang	ton	1,000	0	-	-	-	-	-
4. NPK Fertilizers/Pupuk NPK	kg	12.50	600	7,500	1,800	22,500	1,000	12,500
5. Pesticides/Pestisida	kg	50	2	100	9	450	5	250
6. Land Preparation/Persiapan lahan	IDR1,000	3,000	1	3,000	-	-	-	-
7. Support planting/Penanaman tiang panjang	IDR1,000	2,000	1	2,000	-	-	-	-
8. Planting/Penanaman	man-day/HOK	90	30	2,700	-	-	-	-
9. Maintenance/ Pemeliharaan tanaman	man-day/HOK	90	-	-	150	13,500	90	8,100
10. Harvesting/Panen	fresh berries/biji basah (per kg)	0.90	-	-	-	-	3,200	2,880
11. Processing/prosesing	dry pepper/lada kering (per kg)	1.20	-	-	-	-	800	960
12. Miscellaneous/Biaya lainnya		-	-	3,000	-	9,000	-	3,000
<b>Total</b>				<b>34,800</b>		<b>45,450</b>		<b>27,690</b>

The common practices of smallholders' activities and material used in the production of black pepper were relatively low in intensity, indicated by the low level in utilizing inputs material and labor (Table 3). Black pepper cultivation used living supports, particularly *Gliricidia maculata* trees. The stem cuttings of gliricidia usually were available from tree pruning from the former rainy season at the cost of IDR3,000/cutting. The gliricidia height can reach 3.5 m with a canopy diameter less than 1 m with the proper maintenance.

Planting activities were followed by maintaining young plants to assure the plants were growing well and keeping the soil fertility by applying fertilizers. Most smallholders usually only provided inorganic fertilizer, but some applied organic fertilizer, although with a lower dosage than recommended in GAP (Good Agricultural Practices). The inorganic fertilizer dosage farmers commonly applied for young plants was 0.3 kg per plant or 600 kg.ha<sup>-1</sup> of NPK compound (15 : 15 : 15), was lower than GAP recommendation (1,000 kg.ha<sup>-1</sup>). Due to the fertilizer prices, which were too expensive for farmers (IDR 12,500 per kg), applying full dosage was unaffordable.

The majority of 8 years old pepper plants in East Lampung were still in good condition with proper maintenance. The investment cost for black pepper was IDR80,150,000 consisted of IDR34,800,000 for preparation in Year-0 and IDR45,450,000 for maintenance of young plants in Year 1-3. The operational cost, which should be expensed annually to cover materials and labor for maintaining young plants, harvesting, and processing, was IDR27,690,000 in Year 4-10. It was much higher than the production cost of other crops such as coffee or cocoa (Evizal *et al.* 2018).

Black pepper processing activities in Lampung consisted of harvesting, threshing, drying, and grading. The pepper can be harvested once some berries on a spike become orange, and most of the berries were hard. The maturity of the berries determined quality; immature berries will become light berries which will degrade the quality in general. Afterward, threshing was conducted by removing pepper berries from spikes manually. The berries were then sun-dried until the color was black and the moisture was lower than 13% to prevent fungi contamination. Blanching was recommended before drying by immersing the berries in boiling water for about 5 minutes until the color was black or dark brown. However, farmers have not conducted this process yet. Finally, grading was the activity to separate light berries and could be performed manually. The

recovery rate of black pepper from fresh berries was about 30-35%. So far, the quality of black pepper can fulfill the standards like ASTA (American Spice Trade Association) and FAQ (Fair Average Quality).

### **Costs of white pepper production with common practices**

Smallholders in Bangka Belitung cultivated pepper with a different pattern from Lampung. Pepper was the main business and was mostly grown in monoculture or intercropped with rubber. Therefore, the income from pepper farming was spent on investment and certain expenses and to meet daily needs. Some farmers also did side jobs, such as in tin mining. Therefore, differences in the business orientation may cause differences in the farming intensity.

In Bangka Belitung, pepper planting used dead support (wood). Farmers used to utilize hard and durable wood, but due to its scarcity, farmers currently used different types of woods that were generally last for a maximum of 5 years. In addition, the height of wood supports was mostly 2.5 m, and the canopy diameter could reach 1 m. Therefore, purchasing wood support was IDR35,000, much more costly than the live support.

The common plant spacing was 2 m x 2 m, with 2,500 plants per ha. Most farmers utilized cutting vines (5-7 nodes) from productive plants as seedlings and directly planted in the field. However, some farmers have also adopted certified seedlings in recent years, particularly farmers involved in government programs. The price of seedling was about IDR7,500, higher than in Lampung (Table 4).

The land was prepared two or three months before planting, which consisted of land clearing, digging planting holes, and building drainage channels. Most activities were conducted based on a contract. The support and applying base fertilizer (sometimes including manure and compost) were performed simultaneously with land preparation. Planting was started at the beginning of the rainy season in October-December.

The activities, including fertilizing, weeding, pest and disease control, and sometimes watering in dry seasons, were necessary to conserve the young plants. Maintain plants in producing berries for white pepper as the end product was more intensive, particularly in applying fertilizers and pesticides. However, organic fertilizer was rarely used. As a result, pepper was high in nutrient requirement to support its plant growth and produce a high yield (Sulok *et al.* 2018).

Table 4. Structure of white pepper production cost with conventional practices in South Bangka and East Belitung in 2019

*Tabel 4. Struktur biaya produksi lada dengan budidaya konvensional di Bangka Selatan dan Belitung Timur, 2019*

Description/Uraian	Unit	Unit Cost/Satuan biaya IDR1,000	Investment Cost/Biaya investasi				Operational Cost/Biaya operasional		
			Year 0		Year 1-2		Year 3-8		
			Unit per ha	Cost/Biaya IDR1,000	Unit per ha	Cost/Biaya IDR1,000	Unit per ha	Cost per year/ Biaya per tahun IDR1,000	
1. Seedlings/benih	Cuttings/stek	7.5	2,600	19,500	-	-	-	-	
2. Wood Supports/tiang panjat mati	Wood/tiang panjat	35	2,500	87,500	-	-	-	-	
3. Manure/Pupuk kandang	ton								
4. NPK Fertilizers/Pupuk NPK	kg	12.5	600	7,500	1,500	18,750	1,500	18,750	
5. Pesticides/Pestisida	kg	50	3	150	10	500	5	250	
6. Land Preparation/Persiapan lahan	IDR1,000	3,500	1	3,500	-	-	-	-	
7. Support planting/Pemasangan tiang panjat	IDR1,000	2,500	1	2,500	-	-	-	-	
8. Planting/Penanaman	man day/HOK	100	50	5,000	-	-	-	-	
9. Maintenance/Pemeliharaan	man day/HOK	100	-	-	150	15,000	120	12,000	
10. Harvesting/Panen	fresh berries/buah segar (per kg)	1	-	-	-	-	4,400	4,400	
11. Processing/Prosesing	dry pepper/lada kering (per kg)	1.5	-	-	-	-	1,100	1,650	
12. Miscellaneous/Biaya lainnya		-	-	5,000	-	6,000	-	3,000	
		<b>Total</b>		<b>130,650</b>		<b>40,250</b>		<b>40,500</b>	

In Bangka Belitung, the population of 6 years old-plants was less than 50%. Many farmers, particularly in Belitung Island, planted rubber among the three years old of pepper plants. Thus, when the pepper plants reached 6-years old, and the population decreased, the rubber could start to be harvested. The population decrease of pepper plants in Lampung and Bangka Belitung was mainly due to the infestation of pests and diseases associated with climatic conditions. In drought conditions, the infestation of nematodes (yellow disease infection) increases, particularly in Bangka Belitung.

Conversely, in the rainy season, fungi infestation increased, particularly *Phytophthora capsici*, which cause foot rot disease (Manohara *et al.* 2005). Several other pests and diseases infestation also occurred associated with climatic conditions. Several anticipations, such as farmers in Bangka Belitung, were built drainage channels around the land to reduce floods following the heavy rain. In dry conditions, mulch was provided to keep the soil moisture as well as watering the plants.

White pepper processing in Bangka Belitung differed from Lampung, particularly in harvesting and peeling. Harvesting was an activity to pick mature berries when most of the berries' color was orange to red. Next was threshing which was removing berries from spike manually. Peeling was performed by soaking the berries to soften the outer skin (pericarp and mesocarp), usually for 9-14 days. Thus, it was easier to remove the skin by washing it to obtain greyish peppercorns. Peppercorns were then sun-dried until the moisture content was lower than 13% to fulfill the market quality standard (Adha *et al.* 2019). The recovery rate of white pepper from ripe berries was around 25-28%.

### **Cost of production with improved practices**

Some smallholders have improved the practices of cultivations to increase productivity, hence make their business sustainable. This effort was particularly to adapt and anticipate low prices, as occurred in the last three-four years. To improve productivity, some white or black pepper farmers adapt to more intensive cultivation practices such as applying organic and inorganic fertilizer and watering the plants in the dry season. The surveys

were conducted when the price of pepper was low (2019); hence many farmers were reluctant to intensify their cultivation. However, few farmers remained nuanced with high expectations that prices will increase in the next few years based on their past experiences and obtain higher incomes.

For most farmers that owned productive crops, the addition of operating costs 53% and 50% for black pepper and white pepper, respectively, might be too high; hence it was only affordable for few farmers. Likewise, it also happened to the farmers who possess new crops (young plants). Therefore, even though the investment cost was smaller (14% and 4% respectively for black pepper and white pepper), only a few farmers can afford it because there was no income yet. A similar situation also happened when the pepper prices were high (2013-2017). As a result, only a few farmers were willing to improve their cultivation, although they expected to raise their income.

To achieve sustainable competitiveness, the farmers should improve cultivation practices by intensifying critical input factors such as organic matter and water supply in dry seasons. These improvements were very appealing, but it was affordable only for few farmers due to their economic constraints. Therefore, it should be included in the government development program.

### **The unit cost of production and relative competitiveness**

The pepper plantation that has been built in the investment period then becomes productive assets, meaning that the investment cost can be treated as a cost to procure fixed assets used in the operational period. The cost to utilize fixed assets annually is called depreciation. If it was assumed that the salvage value of assets at the end of economic life was 10%, then the annual depreciation of black pepper with the improved practices was higher than the conventional ones. However, it was otherwise for white pepper (Table 5). The conventional techniques of black pepper cultivation indicated very low intensity; hence higher efforts were necessary to improve the cultivation. The observation result showed that most black pepper plantations were not as good as the white ones and productivity. The productivity in Lampung was the lowest compared to other areas (Evizal & Prasmatiwi 2019).

Table 5. The addition of production cost for improved practises  
 Tabel 5. Tambahan biaya produksi lada pada budidaya anjuran

Description/Uraian	Unit	Unit Cost/Satuan biaya IDR1,000	Investment Cost/Biaya ivestasi				Operational Cost/Biaya operasional	
			Preparation/Persiapan lahan		Maintenance of Young Plants/Pemeliharaan Tanaman Belum Menghasilkan		Maintenance of Mature Plants, Harvesting, and Processing/Pemeliharaan Tanaman menghasilkan, panen dan prosesing	
			Unit per ha	Cost/Biaya IDR1,000	Unit per ha	Cost/Biaya	Unit per ha	Cost per year/Biaya per tahun IDR1,000
<b>Black Pepper/Lada hitam</b>								
1. Manure/Pupuk kandang	ton	1,000	5	5,000	-	-	8	8,000
2. NPK Fertilizers/Pupuk NPK	kg	12.5	-	-	-	-	375	4,688
3. Maintenance/Pemeliharaan	man day/HOK	100	-	-	-	-	20	2,000
4. Harvesting/Panen							4,800	4,800
5. Processing/Prosesing							1,200	1,800
Additional cost/Tambahan Biaya	-	-	-	5,000	-	-	-	21,288
Conventional Practices/Budidaya konvensional	-	-	-	34,800	-	45,450	-	27,690
Improved Practices/Budidaya Anjuran	-	-	-	39,800	-	45,450	-	48,978
<b>White Pepper/Lada putih</b>								
1. Manure/Pupuk kandang	ton	1,000	5	5,000	-	-	10,000	10,000
2. NPK Fertilizers/Pupuk NPK	kg	12.5	-	-	-	-	375	4,688
3. Maintenance/Pemeliharaan	man day/HOK	100	-	-	-	-	30	3,000
4. Harvesting/Panen							<b>3,200</b>	<b>3,200</b>
5. Processing/Prosesing							<b>900</b>	<b>1,350</b>
Additional cost/Tambahan Biaya	-	-	-	5,000	-	-	-	22,238
Conventional Practices/Budidaya konvensional	-	-	-	130,650	-	40,250	-	34,000
Improved Practices/Budidaya Anjuran	-	-	-	135,650	-	40,250	-	56,238

Table 6. Unit cost of production and relative competitiveness  
 Tabel 6. Biaya per unit produksi dan nilai daya saing relatif

Component/Komponen	Unit	Black Pepper/Lada hitam		White Pepper/Lada putih	
		Common	Improved	Common	Improved
		Practices/Budidaya konvensional	Practices/Budidaya anjuran	Practices/Budidaya konvensional	Practices/Budidaya anjuran
Investment (plant) cost or fixed assets/ <i>Investasi kebun atau aktiva tetap</i> )	IDR1,000/ha	80,250	85,250	170,900	175,900
Estimated salvage value to fixed asset/ <i>Nilai buku terhadap nilai aset</i>		10%	10%	10%	10%
Estimated economic lifetime of fixed assets/ <i>umur ekonomi</i>	Years/ <i>tahun</i>	7	7	6	6
Depreciation/ <i>Depresiasi</i>	IDR1,000/ha/year ( <i>IDR1,000/ha/tahun</i> )	10,318	10,961	25,635	26,385
Operational Cost/ <i>Biaya operasional</i>	IDR1,000/ha/year ( <i>IDR1,000/ha/tahun</i> )	27,690	48,978	34,000	56,238
Annual cost of production/ <i>Biaya produksi per tahun</i>	IDR1,000/ha/year ( <i>IDR1,000/ha/tahun</i> )	38,007.86	59,939	59,635	82,623
Expected annual yield/ <i>Potensi produksi/tahun</i>	kg/ha/year ( <i>kg/ha/tahun</i> )	800	2,000	1,100	2,000
IDR unit cost of production/ <i>Harga pokok produksi</i>	IDR1,000/kg	47.51	29.97	49.70	41.35
Exchange rated/ <i>Nilai tukar</i>	IDR1,000/USD	14.50	14.50	14.50	14.50
USD Unit cost of production/ <i>Harga pokok produksi</i>	USD/kg	3.28	2.06	3.43	2.85
The lowest local price in 2010-2019/ <i>Harga jual terendah</i>	IDR1000/kg	27.91	27.91	45.93	45.93
Relative competitiveness/ <i>Daya saing relatif</i>	-	0.59	0.93	0.92	1.11

Several factors were influencing the low productivity of pepper in Indonesia, both technical and non-technical constraints. Higher yields or productivity may be achieved if farmers use high-yielding varieties and adopt the recommended cultural practices. Indonesian Spices and Medicinal Crops Research Institute (ISMCRI) has released high-yielding pepper varieties with 2 – 4.8 tons productivity.ha-1 (Wahyudi & Pribadi 2016). The use of live supports with more than 5.0 m in height, followed by intensified pruning of black pepper vines and their live supports increased the productivity of black pepper higher than 1.5 tons.ha-1 per year (Daras 2016). Tjahjana et al. (2012) reported that pepper productivity in Lampung yielded 1.6 tons.ha-1 from 7 years old plants fertilized with 1.6 kg NPKMg (12:12:17:2) per tree.

The annual cost of production consisted of depreciation and operational cost. The operational cost of improved practices in black pepper increased significantly compared to the conventional practices and was also higher than the additional cost of white pepper. For example, if the yield unit per ha of black pepper was 800 kg.ha-1 and 2,000 kg.ha-1 for the conventional and improved practices, respectively, hence the unit cost of production was DR 47,510 and IDR 29,970 per kg equivalent to USD 3.28 and USD 2.06, assuming that the exchange rate was IDR 14,500 per USD. On the other hand, the unit cost of white pepper production was IDR 49,700 and IDR 41,350 or USD 3.43 and USD 2.85 per kg for conventional and improved practices, respectively (Table 5).

Conventional practices in black pepper indicated that the unit cost of productions (4 years) was higher than the price over the last ten years (Figure 1), while for white pepper, only two units costs were higher. Therefore, the relative competitiveness of black and white pepper prices was not sustainable, particularly in black pepper. Thus, cultivation should be improved to increase productivity. In addition, farmers should be encouraged to apply organic fertilizer, increase the dosage of inorganic fertilizer and build simple irrigation, especially in the dry season when the berries are ripening.

Farms performing conventional cultivation practices revealed a lack of sustainable relative competitiveness, spending higher production costs than the lowest prices in the long term. However, relative competitiveness was relatively better in farms implementing improved practices because the productivity increased higher than the increase in costs; hence the productions cost was lower than the lowest prices received in the long term. Therefore, to achieve sustainable relative competitiveness, pepper farms should apply improved cultivation practices.

The relative competitiveness of white pepper was better than black pepper because the productivity of white pepper was higher even though the production cost was also higher. On the other hand, most black pepper farms still apply conventional cultivation practices resulting in very low productivity and worsened when the selling price collapse.

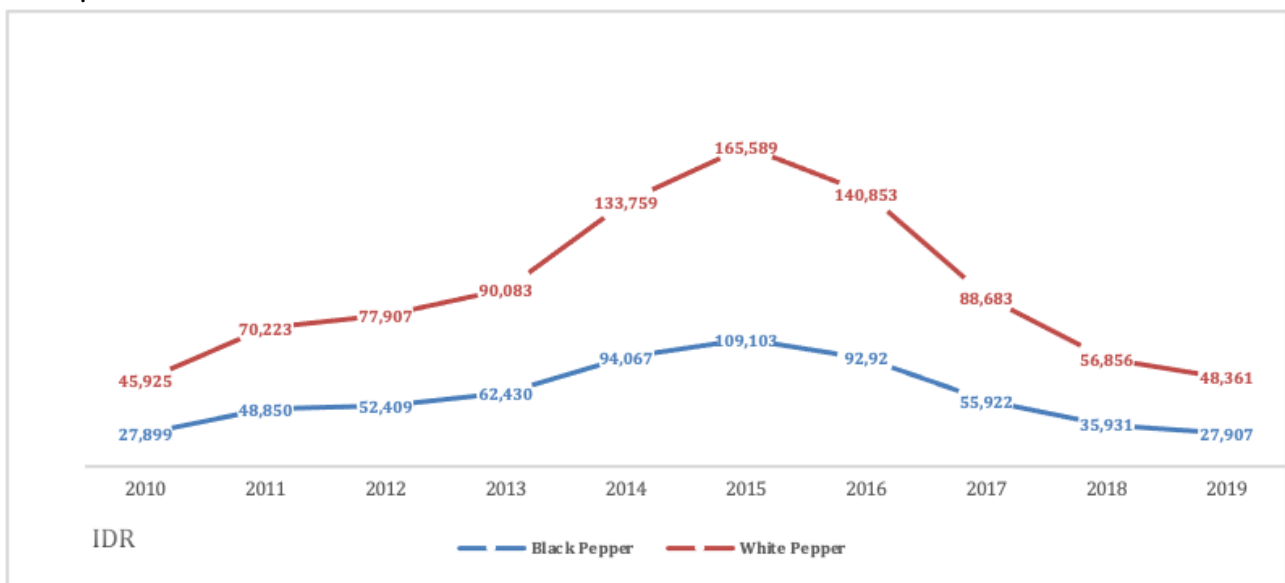


Figure 1. Local price of black and white pepper 2010-2019  
 Gambar 1. Harga lada hitam dan putih di tingkat lokal 2010-2019  
 (Source: Pepper Statistical Year Book 2019, IPC, 2020)

## CONCLUSION

The production costs of black and white pepper can be categorized into investment and operating costs. White pepper's investment and operating cost were higher than the black pepper, mainly because of the higher cost of dead supports utilization than live supports and higher production inputs. Consequently, the unit cost of white pepper was higher than the black pepper, although its productivity was higher. Compare to the lowest local price in 2010-2019, the unit cost of either black or white pepper with conventional practices was higher than improved practices. Thus, black and white pepper had no sustainable relative competitiveness, although white pepper was better than black pepper. The competitiveness of production can be improved by increasing production input factors, particularly organic and inorganic fertilizers, and water management in the dry season.

## STATEMENT OF CONTRIBUTORSHIP

Agus Wahyudi and Ekwasita Rini Pribadi contributed to the design and implementation of the research, the analysis of the results, and the writing of the manuscript.

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