Factors effecting pepper production and quality in several production center

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Abstract. The decrease of Indonesian pepper production caused by the decrease of productivity in production centre. Many problems faced by smallholders. To find out the real problems of pepper cultivation, a research had been carried out in several production centre such as Lampong, Bangka, Central and West Java with the objectives : a) to explore the problems and the performance of pepper plantation, and b) to identify technology adoption and technology needed. The research were conducted from May through October 2017. The method used was survey by collecting primary and secondary data. Primary data were collected through interviewing farmers, local government, businessman and extension workers. SWOT analysis and FGD were used to arrange policy recommendations. The problems found out in pepper development in all areas were a) there was limited technologies adoption of seeds, cultivation and processing, b) the shortage of superior varieties in production centre, c) the shortage of farmers capital because of very rare partnership between farmers and businessman, d) very high attack of pest and deseases so that farmers changed their plant into oilpalm and rubber, e) world price fluctuation that farmers could not manage the plantation, d) climate change and e) the shortage of farmers mastering the technology.

1. Introduction
Pepper is one of the plantation crops especially spices that produce foreign exchange for Indonesia. Pepper cultivation has existed in the country since the 16th century and its products have been traded at high prices, even used as a means of exchange in trade. It was this pepper product that started the history of Indonesian colonization by European explorers, the glory of pepper plants continued and Indonesia became the No. 1 producer country in the world. But after 2000 productivity began to decline. National pepper productivity was 734 kg/ha/year in 2012, lower than the productivity of other countries, namely Brazil at 1,750 kg/ha/year and Vietnam at 2,400 kg/ha/year and compared to the potential for superior pepper production which reaches 4 tons/ha/year. This productivity continuously fluctuated until 2018 based on pepper area. The Indonesian pepper production in 2017 and 2018 reached only 87 029 ton and 87 934 ton. Most of the production came from Bangka-Belitung and Lampong Province with the production of 33142 ton and 17080 ton. From 2000 through 2018 national pepper area continuously increased from 150 000 ha to 180 000 ha, but productivity continuously decreased caused Indonesian production constant at low level.

Black pepper productivity in Lampung has decreased from 485 kg/ha in 2006 to 466 kg/ha in 2010. Whereas in Bangka Belitung, pepper productivity decreased from 1,023.4 kg / ha in 2000 to 783 kg / ha in 2006. Planted area decreased from 64,572 ha in 2001 to 36,790 ha in 2010, but the production in Bangka Belitung dan Lampong fluctuated about 50 000 ton.
It has been stated that the price, disease attack and micro-climate were the factors of the determinants for farmers' choices in expanding their farming. Until 2018, the price of pepper in Bangka, Lampong, South Sulawesi and West Java decreased to Rp 81236/kg, Rp 70108/kg, Rp 88939/kg and Rp 84000/kg.

The majority of pepper plantations in Indonesia are smallholders’ plantations (99.9%), so their productivity is low, however Indonesia is still a major producer and exporter of pepper in the world in recent years. The government is aware that there is intense competition in the world market, it is necessary to find new technologies to improve productivity and quality. Research on spice plants, especially pepper has been done since the Dutch era.

Various attempts have been made to increase the productivity of pepper, ranging from the research for superior varieties, cultivation technology to pest control and various environmentally friendly cultivation and pest control technologies discovered in recent years, but it seems that the application in the field is not in accordance with the recommendations. In order to explore the problems in the field, the technology needed and the acceleration of the application of the technology, it is necessary to carry out a quick study by observing directly farmers’ cultivation in the field and interviewing them included pepper traders. The purpose of this study is to explore the performance and problems of pepper cultivation in several production centers and to identify the technologies that have been adopted and needed.

2. Methodology

The research had been carried out in four pepper production centers, namely Lampung, Bangka, Central Java and West Java, from May through December 2017. In the last month data processing activities, preparation of policy synthesis through Focus Group Discussion and reports were carried out.

This study used a survey method, by collecting primary and secondary data. Primary data were collected through interviews of farmers, local governments, and traders using questionnaires. Crop performance was observed in the field. Secondary data was collected at the head office (Ditjenbun, BPS and others). Sampling of sub-districts and villages is carried out based on the level of area or number of pepper farmers. Examples of farmers taken starting from the district, sub-district to village level. In both the production center and development areas 30 sample farmers were taken. Primary data collected: farmer profile, plant material, method of propagation, variety of origin of planting material, cultivation system, how to harvest, method of processing, climbing pole pepper, shrub pepper, life time, problems in each component, the technology needed, the technology that has been utilized. Secondary data collected: total area per province and all, productivity, exports, imports, prices and distribution of plants. Data collected was processed using tabulation, while economic feasibility was calculated with MBCR. SWOT analysis based on internal and external factors in technology dissemination was used to formulate policy recommendations for the acceleration of adoption of superior pepper technology in production centers.

3. Results and discussion

3.1. Bangka Belitung

3.1.1. Location and farmer characteristics. Bangka Belitung Islands is an area of white pepper production centers which is well known for its trademark of high piperin content. Bangka Belitung is known for its White Pepper with price is higher than black pepper. The taste of white pepper from Bangka Belitung is very famous all over the world and is called MunTok White-pepper, sometimes Indonesian white pepper is exported only to be mixed with other countries' pepper. Bangka-Belitung agroecosystem is suitable for the growth of pepper and this plant has existed since ancient times when it was discovered by the Netherlands in 1883, therefore the average land ownership of pepper farmers is highest among other white pepper producing provinces in Indonesia, which is more than one hectare.
per farmer (interview results, 2017), while in 2016 it was still below one hectare. Based on the Statistical Office of the Bangka Belitung Islands (2017), the area of pepper plantations at the end of 2016 reached 50 880 ha (increased annually) involving 56 940 farmers. The distribution of pepper plantations in Bangka Belitung is presented in table 1.

**Table 1. The distribution of pepper plantations in Bangka Belitung**

| No. | Regency         | Area (ha) | Productivity (t/ha/yr) |
|-----|-----------------|-----------|------------------------|
| 1   | South Bangka    | 24,421    | 1.25                   |
| 2   | Belitung        | 8,948     | 1.14                   |
| 3   | West Bangka     | 5,639     | 1.42                   |
| 4   | Main Bangka     | 4,994     | 1.39                   |
| 5   | Central Bangka  | 3,211     | 1.42                   |
|     | **Average**     |           | **1.32**               |

The export value of Indonesian white pepper is 219 627 921 US Dollars for the volume of 19 661 tons to 31 countries, while black pepper 302 020 517 US Dollars for 33 437 tons to 38 countries. But Indonesia also imports white pepper from three countries, namely Thailand, Malaysia and Vietnam amounted to 61.2 tons and black pepper amounted to 1263 tons from 6 countries in 2015. Pepper prices are very volatile, the highest in 2015, and the lowest is obtained at the moment that is Rp 65.000-Rp 80.000.

Based on the results of interviews, it shows that the age of farmers in South Bangka Regency ranges from 42 to 56 years with varying education from elementary to high school. Those with a high school education have the opportunity to have other jobs such as bank employees, village office employees or teachers. In South Bangka, pepper farming is generally a hereditary occupation so that the land is wide, besides cultivating pepper they also plant rubber and palm oil, some farmers grow upland rice. In the districts of Bangka Induk and West Bangka, farmers are still young between 35-45 years with junior and senior high school education. It seems that finding a job besides farming is now difficult, so they continue their parents' farming, however the land area is only between 0.2-1.0 ha.

3.1.2. Farming performance. As described in the previous paragraph, the land of pepper farming in South Bangka covers an area of between 0.5 to 16 ha per person, because the area of available dry land is quite large for plantation operations compared to other districts which is 218 539 km². The average area of land for pepper based on surveys is around 3 ha. With an area of their land, farmers can plant other plantation crops such as rubber and palm oil, because it is quite long to wait for the harvest of pepper once a year according to them while oil palm can be harvested once a month and rubber can be harvested once a week. The second reason is that they always faced yellow disease and bud-stem Rot which is still difficult to overcome.

The variety of clones planted in South Bangka is quite varied, namely Petaling, Merapin, Jambi, Natar, LDL, LDK and Telungkup. Whereas in West Bangka LDL, Telungkup and Merapin. Plant materials generally come from other farmers or from their own production field, because there are no certified breeders. Only a few farmers buy from BPTP Bangka Belitung. Telungkup clone is a selected clone from the island of Bangka and will be released in the near future by Balittro in collaboration with Gapoktan in Central Bangka. This clone has hopes that in addition to high productivity.

There is a new phenomenon occurring in Bangka, farmers who used to use dead climbing poles have now been interested in live climbing poles, because beside the expensive price of wood or iron wood is now difficult to obtain, so generally farmers buy cheap wood or take their own in the forest generally only last three years. In the third year, farmers prepare live climbing poles such as Glirisidia to be planted next to dead climbing poles as a support. The second phenomenon is that farmers unload their pepper crops after fruiting two or three times and replace them with new crops with the reason to avoid disease and reduce the use of fertilizers. BCR value obtained depends on the area of land and capital ownership.
In South Bangka the BCR value is between 0.85 and 4.38 depending on the use of seeds, fertilizer and climbing poles. They can already guess that if the price is low and the seeds used are not good, fertilization is only done with the lowest dosage. In West Bangka with a narrow area of land, all farming activities are carried out on their own because when using labor outside the family the BCR is only 0.5-0.7, but if it is done by themselves BCR can reach 3-7 assuming there is no pest attack.

3.1.3. Adoption of Technology and its problems. The varieties planted by farmers mostly come from varieties that have been released except for Merapin, Jambi and Telungkup, however farmers do not get plants from certified seed and breeders but from their own gardens or from other farmers from one group. Plant material is cuttings of 5-7 segments and directly planted in the field, not planted before in a polybag. They didn't adopt the recommended technology, because to wait for one-section cuttings to 5-7 segments took almost 3 months, it's better to plant the cuttings directly. Farmers also do not care whether the seeds are certified or not, they don’t think that it will affect productivity. The planting hole is very varied depending on their capital. Most of them did not follow the recommended fertilizers, mostly only used manure. What they did with inorganic fertilizer is all types of fertilizer are mixed and then one plant got one spoon. The problem they faced is farmers do not understand the use of planting holes and the function of each type of fertilizer. It is very rare for extension agents to go to the field, even if there is a priority for food crops. Inorganic fertilizers are rarely found, and expensive. The farmers couldn’t find subsidies for plantation crops.

Pruning on pepper plants and living poles is only done once at the beginning, then pruning is not done so the humidity under the canopy is high enough to facilitate disease to attack. Disease control still uses chemical insecticides, if the attack does not decrease the plant is pulled out but not burned. Oil palm or rubber are planted while waiting for the pepper to bear fruit. On the other hand, Other farmers still continuously weeding without mulching so that the plants are dry out. The harvest time is appropriate but the fruits are generally soaked in ex-mine pole, so the seeds are of low quality.

3.2. Lampung

Lampung is known as the largest producer of black pepper in Indonesia, even well known in foreign countries. Lampung Province consists of 15 regencies / cities, and from those 15 regencies only three regencies do not plant pepper, namely Tulang Bawang, Tulang Bawang Barat and Mesuji. The five largest regencies that have the largest area of pepper are presented in Table 2.

| No. | Regency       | Area (ha) | Ranking |
|-----|---------------|-----------|---------|
| 1   | North Lampung | 11,401    | I       |
| 2   | Way Kanan     | 10,088    | II      |
| 3   | West Lampung  | 7,686     | III     |
| 4   | Tanggamus     | 7,371     | IV      |
| 5   | East Lampung  | 4,815     | V       |

Tanggamus is a new pepper development area. The total area of pepper in Lampung is 45863 ha, which is the second area of pepper after Bangka Belitung. Black pepper products are very famous in the world by the name of Lampong Black Pepper and are exported to 38 countries in the world.

3.2.1. Location and Farmer Characteristics. East Lampung Regency is the largest regency in Lampung province with an area of 5,325.03 km2, and distance from the provincial capital ± 80 km. Generally the area is low-land with an average altitude of 50 m above sea level (asl), which consists of 24 districts. East Lampung is one of the pepper producing regions in Lampung with a production of 2,199 tons. There are 10 districts which are the biggest pepper producers, including Marga Tiga (814 ha), Sekampung Udik (259 ha), Jabung (374 ha), Marga Sekampung (226 ha), Bandar Sribhawono (172 ha),
Melinting (962 ha), Gunung Patron (863 ha), Way Jepara (137 ha), Sukadana (388 ha), and Bumi Agung (254 ha). Sukadana is the widest district, which is 756.76 km², with an area of 388 ha pepper plantation and production of 235 tons. While Marga Tiga sub-district has an area of 250.73 km², with an area of 863 ha pepper plantation with a production of 401 tons in 2015. Sukadana and Marga Tiga sub-districts are located at the same height which is 25 m above sea level. Average rainfall ranges from 46-320 mm/month in 2014.

The population of both sub-districts, both Sukadana and Marga Tiga, consists of various tribes, including the native inhabitants of Lampung, Java, Sundanese and others. This distinguishes the way and work ethic as a pepper farmer. Pepper farmers in East Lampung vary, some have been passed to new generation. This can be reflected in the age of pepper plants that reach > 20 years and generally cultivated monocultures. The farmers aged between 28-55 years with education between elementary and high school, only one person who has a bachelor's degree. New pepper growers get information about pepper cultivation from nearby farmers. The way of cultivation is influenced not only by the culture of farmers, but also by the price of pepper. If the pepper is high then the plantation will be maintained and protected, but if the price is low the farmers are lazy to manage the plants.

Tanggamus is a district with an area of 3020.64 km², and distance from the provincial capital ± 80.78 km. which consists of 20 districts. The number of residents in 2015 was 573,904 inhabitants. Tanggamus is one of the pepper producing areas in Lampung with pepper plantation area in 2015 of 5,843 ha with a production of 2,154 tons.

3.2.2. Farm Performance. The performance of pepper farming in Lampung can be illustrated by the performance of farming in East Lampung and Tanggamus Regencies as shown in Table 3.

| No. | Farm indicator   | Performance                      |
|-----|------------------|----------------------------------|
| 1   | Land of farm     | Average 1.57 – 1.6 ha           |
| 2   | Spacing          | 2m x 1.5 m – 2m x 2m             |
| 3   | Number of trees  | Average 1,726 – 1,749 tree/person |
| 4   | Plant population | Average 1,330 tree/ha           |
| 5   | Productivity     | 640 – 800 kg/ha                 |
| 6   | Fertilizers use  | NPK and organic with varying doses |
| 7   | Climbing poles   | gamal, randu, cottonwood, lamtoro, trembesi |
| 8   | Varieties        | Natar 1 (25%), local            |
| 9   | Plant material   | Cutting                         |

In summary the problems of pepper farming in Lampung are a) the absence of a main garden as a source of plant material used for propagation of pepper seedlings. Farmers obtain seedlings from production plantations, while the recommended good seedlings are from plants with age of 12-24 months. In addition, there are no certified seed breeders, because there are those who have submitted as breeders but have not yet graduated as a result of the use of random plant material. Coaching has been done but not yet intensive as in food crops, b) planting on sloping land without terrace. This causes the land prone to erosion. In addition, the use of hole size that is not appropriate causes the root growth range to be somewhat limited, thus root development is not optimal, c) most farmers minimize input, but in general they understand that plants need to be fertilized, but they do not understand that the less fertilizer the less the yield, As a result, fertilizer application is in accordance with their wishes, especially because the price of pepper is low, so the plants are not fertilized. In addition to lack of farmer’s knowledge, the economic condition is also poor, d) generally pepper plants with age of 12 and 24 months in the East Lampung area are not pruned, this is due to lack of information about trimming pepper plants. Pruning pepper plants is done with the objective to stimulate the fruit branches to grow more e) IPM control is generally done by using chemical pesticides. This is done so that it does not spread and can
be controlled more quickly. Farmers do not know about environmentally friendly controls, f) limitations of drying facilities in the rainy season, usually farmers dry the pepper in the yard so if it rains it will be difficult to lift it.

3.3. Purbalingga, East Java

Location and Farmer Characteristics

Purbalingga Regency lies at an altitude of ± 40 - 1,500 meters above sea level. In the northern part, there is a series of mountains (Mount Slamet and the Dieng Plateau). The southern part is the Serayu Depression, which is drained by two large rivers of the Kali Serayu and its tributaries, the Pekacangan River. Administratively, Purbalingga Regency covers 18 sub-districts, bordering Pemalang Regency in the east and south, and Banyumas Regency in the west and south. In general, Purbalingga has a tropical climate with an average rainfall of 3,739 mm - 4,789 mm (average an average of 3,130 mm) per year\textsuperscript{17}.

Based on rainfall data for the past 5 years, the rainy season in this area is 8 months per year, while the dry season is 4 months per year. But what happened in 2016 the rainy season lasts throughout the year (12 months). Purbalingga Regency is one of the pepper development areas, which for the last five years has been the center of pepper production in Java with an area of 2016 reaching 583.94 hectares and 182 tons of white pepper production. Pepper cultivation develops in seven Districts, with two Subdistricts as production centers, namely the Subdistrict of Kejobong and the District of Pengadegan\textsuperscript{17}. Both districts are at an altitude of + 200 m above sea level.

Based on respondent data, pepper farmers in two central districts have age 35-75 years (average 52 years) with various levels of education from elementary to tertiary school. More than 50% of farmers are from high school education and above. Farmers do not fully pursue pepper farming, because only 58.06% work as farmers, the rest (41.94%) as entrepreneurs and village officials.

Farm Performance

Most pepper farmers in Purbalingga Regency conduct pepper farming for generations. In general, farmers apply polyculture planting patterns with a mixture of coconut, duku, cassava, coffee and banana. This condition is different from the main pepper production centers (Bangka and Lampung), pepper cultivation in the production center applies the monoculture pattern, only a small proportion of farmers in Lampung grow pepper mixed with other plants, such as bananas, durian, coffee and secondary crops.

Based on data collected from respondent farmers in Kejobong and Pengadegan subdistricts, the average area of pepper farming is 0.52 ha/all farmers are their own land, plant population is 1,190 trees/ha with a composition of TBM plants 50.12%, TM 33.90%, and TT/TR 15.98%. Plant populations produce an average of 745 trees/ha, equivalent to 29.80% of the normal population of 2500 trees/ha, with an average productivity of 256 kg/ha.

The results of the RAVC analysis, showed that the rate of return on the variable costs of pepper farming in Purbalingga reaches 9.3 million rupiah per 0.52 ha of land ownership area, equivalent to 18 million rupiah per hectare. The role of pepper prices is quite significant to the acceptance of pepper farmers in Purbalingga. Even though the level of productivity is relatively low (256 kg/ha), at a price of Rp 80,000/kg, gross revenue reaches 20 million rupiah per hectare. Besides receiving from white pepper, farmers also receive income from mixed crop yields of 2.2 million rupiah per hectare, equivalent to 10% of the total farm income. With non-intensive management, the variable costs incurred by farmers each year for pepper farming are relatively small (Rp. 4.7 million/ha/yr). So the price level prevailing at the farm level in 2017 still provides a return on variable costs of 18 million rupiah per hectare, equivalent to Rp 1.5 million/ha month. With land ownership of 0.52 ha/kk, farmers' income from pepper farming only reaches Rp 750,000,-/family/month.

Technology Adoption and Problems
Most pepper farmers have not yet applied the recommended pepper cultivation technology. Indeed, the introduction of technology components has been carried out by the local Agriculture and Plantation Office, both through regular activities and in collaboration with related institutions. IPM field-school activities have been carried out in two districts which were the locations of this study in 2014/2015. The establishment of the Main Estate was also carried out in collaboration between the Purba Lingga Regency Pepper Farmers Association with Balittro and IPC, but it was not utilized for the development of pepper in the area but for the supply of seeds to meet the demand from other regions. Extension officers who work in the area actually understand the cultivation of pepper technology, but have not been implemented at the farm level.

Based on the results of interviews with respondent farmers, field observations, and supporting data collection, identified the problem of pepper farming in Purba Lingga can be summarized as follows: 1) Climatic conditions are quite extreme in 2016 and the management of pepper farming which has not yet implemented the recommended technology has caused a massive epidemic of Phythophtora disease. 2) The existing main garden with a single variety (Natar 1) has not been utilized for the development of local pepper and has not been able to meet the needs of seeds (requests from outside the area. 3) Extension workers and farmers generally know the technology of pepper cultivation but have not been fully practiced. 4) Limitations of white pepper processing facilities (especially for soaking)

3.4. Sumedang, West Java
Regional and Farmer Characteristics
Sumedang Regency is one of the regencies under the administration of West Java Province. This regency has an area of 1,522.2 km2 with 26 sub-districts in it. The total population reaches 1,091,674 with 545,740 people are women and 545,934 people are men. The education structure of the local community is not much different from other districts in West Java. Around 2.1 percent of the population enjoys tertiary education and high school education is only 11.5 percent. Agriculture is the main source of live in Sumedang. Nowadays the area of pepper is 440 ha with the productivity 0.561 t/ha. The centre of pepper production are Surian, Buah Dua and Tanjung Medar Subdistrict.

The number of family heads involved in pepper farming is 2669 families with a total workforce of 1540 people. There are 10 groups of farmers involved in pepper farming. At this time the attention of the relevant agencies on pepper farmers has not been so intensive with the absence of technical and non-technical assistance that is needed by farmers such as technical guidance for cultivation, provision of superior plant materials, fertilizers and medicines. Based on interviews with farmers conducted in three different sub-districts, they did not want to bear the risk of returning the capital if they lost, because the price of pepper was very fluctuated. Farmers in Surian sub-district are still relatively young between 25-56 years. Those aged over 50 years are only 2 people. The Side jobs generally raise livestock, seeking fishponds, trading or teachers. The average area of pepper is 7000 m2. In Tanjung Medar, farmers are 49-79 years old, because they are inherited from their grandparents. All had elementary school education and had side jobs in trading. The land area is very narrow with an average of 3000 m2, only 2 people have one hectare of land and 6000 m2. While in Cimalaka, he is relatively young between 40-65 years old. His education is in junior high school, high school and 1 person in S1, with an average area of 4000 m2, with side jobs as an entrepreneur.

Pepper Farming Performance
Pepper plants in Sumedang Regency are cultivated in a polyculture manner. In general, pepper plants are not staple crops. The type of pepper that is cultivated is mostly climbing pepper using live climbing poles from glirisidida trees, suren wood or jaran wood. But in Wargaluyu Village, Tanjung Medar District, there is a pepper farmer using concrete climbing poles that are wrapped with a injuk, his 1-year-old ladder planted with chillies. The age of pepper plants in Sumedang Regency varies from 1-8 years. There are varieties of pepper cultivated that resemble varetas Petaling 1 (slightly wide leaves), Natar 1 (rather small leaves) and Ciinten (large leaves). There are two kinds of plant materials, namely 5-7 books long cuttings which are directly planted in the field and 5-7 books pepper seeds in polybags.
Pepper shrubs have not been widely cultivated, however, in Padasari Village, Cimalaka Subdistrict, there are some farmers who plant them even though they are not so extensive with plant age 1-3 years. Shrubs pepper plants have not been cultivated intensively. Some breeder farmers in the Cimalaka and Surian Districts have begun to increase their shrub pepper at a price of Rp. 5,000. Plant material is generally taken from the production of pepper gardens, there is no specific parent garden for propagation of plant material.

Pepper plants in Sumedang Regency are mostly not yet intensively cultivated. Farmers assume that pepper plants do not require much care so do not require much cost. This is based on that the results obtained were already quite high. Even though if it is cultivated intensively, the potential of pepper production can reach 4-5 times the productivity achieved in Sumedang Regency, which is only 0.561 tons / ha of white pepper. At present maintenance is still limited to is still limited to the provision of organic fertilizer (manure), inorganic fertilizers such as NPK or urea, SP-36 and KCl have not been done, pepper pruning to increase fruit branches is rarely done so that the canopy of pepper plants looks thin, pruning climbing trees rarely done so as to reach 4-5 meters and incoming sunlight is very little / too lush. Disease that attacks pepper plants in Sumedang Regency is stem rot (BPB) while pests that attack are insects that release foam which can cause stems or branches to rot.

Pepper plants in Sumedang Regency have started producing at the age of 3 years. Pepper is harvested at the age of 8-9 months to be used as white pepper. White pepper processing is still done traditionally and not hygienic, namely by soaking the pepper in a sack in a pool of stagnant water. Ponds for soaking are made by digging the soil around the house. But in areas with abundant water sources such as in Cimalaka District, farmers soak pepper in water that flows in small rivers. This soaking takes 7 days, then the pepper fruit that has been soaked rubbed manually using hands so that the skin of the fruit is peeled and then washed clean water and dried for 2-3 days. After it is dried, it is put into a sack. White pepper is marketed in two ways: sold to buyers who come directly to the village or directly to containers in the city of Sumedang. The selling price in the village is generally cheaper than in the city, the difference can be reach Rp. 20,000. The selling price of white pepper per kg in Sumedang Regency is currently Rp. 120,000. While in 2015 and 2016 the price reached Rp. 200,000 and Rp. 150,000 per kg. Economic feasibility analysis shows that the BC ratio varies greatly depending on the many plants that have already produced and the source of seeds. In Surian, the average land ownership is 8380 m2 and new plants learning to bear fruit are around one third, 263 plants. BC ratio also depends on the input used. Seed is generally requested from other farmers, the BC ratio is above 10. Farmers who buy superior seeds have higher input than output, however overall pepper exploitation is still profitable with a BC ratio of 3.11. In Tanjung Medar the average size of ownership 4130 m2 of land and an average of 267 fruits per person. The average BC ratio as a whole is 0.24, because superior seeds are more expensive than Surian and farmers don't want to pay for maintenance.

Technology Adoption and Problems
Currently the price of pepper products is quite high both white pepper and black pepper. This causes the interest of farmers in Sumedang Regency to plant pepper quite high, but the availability of quality plant material is very limited. In addition, farmers and breeders' knowledge of quality pepper seeds is still lacking. Currently farmers and breeders are increasing the number of pepper plants originating from production plantations. Therefore it is necessary to develop a superior variety of pepper main garden as a source of quality pepper seeds.

Farmers in Sumedang do not apply cultivation technologies such as fertilizing, pruning, weeding, pest and disease control. They need guidance from extension service and local government. They need also guidance to increase their knowledge to process white pepper properly to produce safe and good quality product.
4. Conclusions and Policy Implications

Based on the results of a survey in 4 regions of pepper production centers followed by a SWOT analysis and Focus Group Discussion, the conclusions can be drawn as follows:

1. Technologies that have been adopted by farmers in pepper development areas are limited superior varieties, Natar 1 in Purbalingga, Natar 1, Petaling and Ciinten in Sumedang, Natar 1 in Lampung and Natar 1, Petaling 1, LDL, LDK and Telungkup. However, seed technology is generally not adopted.

2. Cultivation technology, starting from planting holes, fertilizing, IPM environmentally friendly, pruning is generally not adopted except for spacing and harvest time.

3. Processing technology generally has not absorbed the SOP for processing by submerging crops in ponds where water does not flow. Black pepper processing does not pay attention to hygienic system.

4. Problems encountered in developing pepper so that productivity is low are; a). cultivation, processing and seed technology is not adopted, b). limited quality seeds due to the lack of a main garden in the production centre c). farmers' capital limitations and partnerships between farmers and entrepreneurs have not yet been established, d). high pest attacks so farmers choose oil palm plants instead, e). fluctuations in world prices, so that if prices are low farmers don't want to maintain their crops, f). climate change, and g). in almost all regions the local government and extension workers do not provide guidance to pepper farmers.

Based on the performance of pepper farming in the production center and its problems, the national pepper development program must be supported by the following policies:

a) Regulatory policies and support that can reduce excessive price fluctuations such as (i) regulations on pepper price control, (ii) development of cooperatives or farmer-owned enterprises (BUMP) that are able to accommodate and process pepper economically, (iii) development pepper farmer partnerships with agribusiness entrepreneurs and pepper exporters.

b) Policies on protection of pepper cultivation against conversion to other commodities, mainly through subsidies of quality seeds and inputs, use of in-situ and homemade organic fertilizer, as well as policies on the use of sub-optimal land especially used land mining with the support of guarantees for the ownership or management rights.

c) Guidance and counseling for pepper farmers, both by extension workers and researchers, both on production systems and derivative product development programs.

d) Development of cropping patterns and modification of pepper cultivation on narrow land or between climbing pole pepper in the new planting area of pepper or among climbing pepper or dwarf pepper among other plantation crops. Integration between plants and livestock should also be applied so that farmers do not depend on inorganic fertilizers.

e) The strategy of research and development of pepper plants, specifically (i) the development of high yielding high yielding varieties and pest resistance, both conventional and molecular approaches, (ii) development of varieties more suitable as dwarf pepper, (iii) development process technology produce quality and competitive secondary pepper products.

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