Virginia tobacco sustainable production in Indonesia

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Abstract. In Indonesia, tobacco has a very important and strategic role. Cigarette production in Indonesia reaches 362 billion cigarettes and needs 362 thousand tons of tobacco. Meanwhile, the national tobacco production was only about 180 thousand tons of 220 thousand hectares. To cover the shortage of raw materials, imports are carried out. Types of imported tobacco are mainly Virginia tobacco which reaches 110 thousand tons, Oriental and Burley. Assuming that Virginia's tobacco productivity reaches 2 tons per hectare, an area of approximately 55 thousand hectares is required to cover the demand for Virginia's tobacco. Opportunities for the development of Virginia tobacco in Indonesia can be carried out in several areas. It must be covered and supported by technology and policy for tobacco development that is land suitability, varieties, cultivation technology, pest and disease control, harvesting and processing technology, and marketing. With this support, the sustainability of tobacco cultivation is expected to meet the needs of raw materials on an ongoing basis.

Keywords: tobacco, Virginia, prospect, development

1. Introduction
Tobacco is a raw material for the cigarette industry as a source of foreign exchange which is quite high for the country. Tobacco provides a significant contribution as a source of income for farmers and provides employment. Virginia tobacco is the main raw material for the cigarette industry in Indonesia, mainly used as raw material for the manufacture of white cigarettes. In Indonesia, cigarette production is increasing from year to year in line with the increase of smokers. Cigarette production growth is around 5.0% to 7.4% per year with an average increase of 5.3% per year [1]. So with the increase in cigarette production, the need for tobacco as a raw material also increases. In 2019, cigarette production reached 362 billion sticks. Assuming that the weight of each cigarette is about one gram on average, without taking into account the weight of paper filters and cloves, to produce as many as 362 billion cigarettes, around 362 thousand tons of tobacco are needed.

On the other hand, the total area of tobacco in Indonesia is only about 220,000 hectares, with a total production of approximately 180,000 tons. The development of the tobacco area in Indonesia fluctuates, influenced by previous tobacco prices. Farmers will follow the success of the previous year's planting season [2]. If the previous tobacco price were high, the following year, the area would increase, and vice versa. If the tobacco price were low, the following year, the area would decrease. Meanwhile, the productivity and quality of tobacco are strongly influenced by climatic conditions. If the climate is dry, the productivity and quality of tobacco will be high. And if the climate with high rainfall during the growth of tobacco can cause high rates of plant death, stunted growth, and low quality of tobacco
produced. If tobacco lacks water during growth, productivity and quality are less than optimal. Tobacco needs water for photosynthesis [3], water needs in dry conditions can be met through watering by implementing optimal plant management [4].

Because there is a big difference between tobacco demand and national tobacco production every year, tobacco imports are carried out to meet the needs of tobacco. Imports of Virginia, Oriental, Burley, and other tobacco in Indonesia averaged 113,107.62 tons/year with an average value of US$ 552 million/year [5], mostly Virginia tobacco, which reached 110,000 tons. Based on the data above, if it is assumed that the productivity of Virginia tobacco is 2 tons/ha, then there is an opportunity of 55,000 ha of Virginia tobacco that can be developed by tobacco farmers in the country [6]. The results of a study from [7] that domestic cigarettes have not been able to fully supply the needs of the domestic cigarette industry, due to the limited number of productions, the low quality of the tobacco they produce, and the continuity of the supply of tobacco.

Tobacco farming is profitable compared to other seasonal crop commodities such as corn. The profit of maize cultivation is IDR 8,236,000.00, which is lower than tobacco with an R/C ratio of 1.84. The profit of tobacco farming is economically feasible (R/C value > 1) with farming income of IDR 14,142,500.00 per hectare per season with an R/C ratio of 1.43 [8]. The R/C ratio is 1.9 with an average profit of IDR 42,349,763.00 per hectare [9]. From the research results in 2014 and 2019, there was an increase in profits of IDR 28,207,263 per hectare. In development areas, especially in Central Lombok Regency, farmers plant Virginia tobacco in rice fields after planting rice because Virginia tobacco provides greater profits than other commodities. The production of Virginia Lombok tobacco is more efficient to meet domestic needs or import substitution than exported [10]. The competitiveness of Virginia tobacco in the national market is determined by cost and quality. Tobacco quality is assessed by graders, the better the quality of the tobacco, the higher the price. Tobacco prices are relatively more expensive when compared to food crops and other commodity crops such as rice, corn, green beans, and other types of crops.

Some areas that produce Virginia tobacco include NTB (Lombok Island), Bali (Buleleng), East Java (Bondowoso and Bojonegoro), D.I. Yogyakarta and North Sumatra and each of these areas also have the potential for expansion or development of Virginia tobacco. However, the development of Virginia tobacco especially in new areas that need more in-depth study related to social, cultural, and environmental issues in terms of processing method. In 2009, West Nusa Tenggara contributed about 66% of the national production with the potential of Virginia tobacco area about 58,515 hectares.

For farmers, tobacco cultivation can increase income significantly when compared to other crops. Even farmers stated that there is no other crop that can replace the position of tobacco plants in increasing income. Tobacco also affects farmers’ income by around 50-75% thereby increasing the standard of living of farmers in Bojonegoro Regency [11], and 69% in Temanggung Regency[12].

2. **Virginia tobacco center and development opportunities**

Tobacco plantations in Indonesia centralized in the two islands of Java and Nusa Tenggara Barat [13]. Virginia tobacco production in Indonesia during four years (2014-2017) is mostly generated in the four provinces of West Nusa Tenggara, East Java, Bali, and in D.I Yogyakarta. The largest area is in the province of West Nusa Tenggara and the next in East Java. The average planted area of Virginia tobacco in the four provinces for the four years respectively was 21,441 ha, 8,291 ha, 381 ha, and for D.I Yogyakarta, Virginia tobacco was only planted in 2014 with a planted area of 3 ha. Trend acreage in Virginia tobacco production centers in West Nusa Tenggara province shows an increasing trend, whereas East Java tends to decrease (Table 1).

The results of another study [7] produced and planted area of Virginia tobacco in East Java had decreased in the last 10 years. The average planted area is 13,477 hectares with a productivity of 13,311 tons. Virginia tobacco cultivation centers in West Nusa Tenggara are located in West Lombok Regency, Central Lombok Regency, East Lombok Regency, and a few in West Sumba. Meanwhile, Virginia tobacco cultivation centers in East Java Province are located in Bojonegoro Regency, Lamongan Regency, Ponorogo Regency, Blitar Regency, and Malang Regency. According to [13], the main
suppliers of Virginia tobacco are Bojonegoro Regency and West Nusa Tenggara. Virginia tobacco produced in West Nusa Tenggara is of higher quality and able to compete with other imported products because of its special scent.

Table 1. Virginia tobacco cultivated area in Indonesia.

| No. | Province               | Planted area (ha) |
|-----|------------------------|-------------------|
|     |                        | 2014  | 2015  | 2016  | 2017  |
| 1.  | West Nusa Tenggara    | 20,717| 19,152| 19,916| 25,977|
| 2.  | East Java              | 9,452 | 9,354 | 5,924 | 8,432 |
| 3.  | Bali                   | 348   | 443   | 312   | 422   |
| 4.  | D.I Yogyakarta         | 3     | 0     | 0     | 0     |

Secondary data source: [14]

The potential area for tobacco cultivation is still quite available. In Bojonegoro Regency, an area of about 15,657 hectares of S2 class paddy fields and more than 50,000 hectares of S3 class paddy fields is suitable for Virginia tobacco development [16]. And on the island of Lombok, there are 9,055 hectares of land available for S1 class, 42,000 hectares for S2 class, and 116,660 hectares for S3 class [15]. The results of the evaluation land suitability for tobacco plants showed that most (72.25%) tobacco land in East Lombok Regency was classified as quite suitable suitability class (S2), and only 14.99% classified as very suitable (S1) while the rest is a marginal fit (S3) of about 12.76% [18].

The planted area in the four Virginia tobacco production centers contributed an average of 42,745 tons in four years. Virginia tobacco production in each production center for four years in Table 2.

Table 2. Virginia tobacco production over four years.

| No. | Province               | Production (ton) |
|-----|------------------------|------------------|
|     |                        | 2014  | 2015  | 2016  | 2017  |
| 1.  | West Nusa Tenggara    | 33,416| 29,865| 33,464| 36,345|
| 2.  | East Java              | 11,426| 7,760 | 5,151 | 10,751|
| 3.  | Bali                   | 634   | 746   | 574   | 840   |
| 4.  | D.I Yogyakarta         | 8     | 0     | 0     | 0     |
|     | Amount                 | 45,484| 38,371| 39,189| 47,936|

Secondary data source: [12]

Optimal production of Virginia tobacco is influenced by climatic conditions, soil fertility, cultivation methods, harvest processing, and postharvest. The climate is a determining factor for tobacco production [19]. If there is high rainfall, tobacco production tends to decrease and vice versa, if there is little rainfall, tobacco products will increase. In addition to these conditions, crop rotation plays an important role in increasing tobacco production, productivity, and quality [20]. In West Nusa Tenggara, Virginia tobacco production and planted area increased with a more conducive climate and rainfall conditions compared to East Java [17]. In East Java, Virginia tobacco production and planted area have decreased due to climate constraints and land conversion [7]. The direct impact of climate change on tobacco cultivation is abnormal plant growth, decreased productivity, and quality [8]. The results of other tobacco research [21] show the effect of the variables of rainfall, the number of rainy days, humidity, air temperature, and land area of 96.7% resulting in fluctuations in tobacco production in Jember Regency and 3.3% caused by other factors. Tobacco plants are very susceptible to being influenced by the climatology and geography of the region.

3. Processing and problems of Virginia tobacco

Some problems can be found in the tobacco farming of Indonesia. Weather anomalies often create a serious problem particularly in the processing of the leaves. In Indonesia, Virginia tobacco farmers sell
their products in either fresh or dry leaf form. Farmers that sell the tobacco leaves in the form of wet leaves, give reasons for selling tobacco in the form of wet leaves because it is more practical and less busy and does not pose a risk of failure if climatic conditions are not favorable. Even though such behavior will provide very low profits.

For processing, Virginia tobacco leaves into dry leaves by drying chopped tobacco leaves using sun heat (Sun-cured) and drying tobacco leaves using fuel (Flue-cured). In processing Virginia Sun-cured, the main obstacle is weather problems, while in processing Virginia Flue-cured, the main constraints are the availability of energy sources and environmental damage [22]. Through both processing, it can increase the selling price of tobacco. Good tobacco processing, from harvest to post-harvest, will produce good quality tobacco, which will affect the selling price of the tobacco [23].

Processing chopped tobacco using sunlight as an energy source becomes a problem when climate anomalies occur. Because Virginia tobacco includes Voor-Oogst tobacco planted at the end of the rainy season and harvested and processed during the dry season, it is expected that when harvesting and processing enter the dry season, namely full sun and no rain. When a climate anomaly occurs, it becomes a problem because the drying process of tobacco is disturbed, and then it reduces the quality of the tobacco. Reduced quality also affect the selling price of tobacco leaves. Therefore, it is necessary to make other efforts so that the quality of tobacco does not decrease when the processing is cloudy or rainy. The success of harvesting, processing, storing, marketing requires perseverance, and experience in decision-making success depends on natural factors[24].

In the processing of Virginia Flue Cured tobacco, the main obstacles are the problem of availability of energy sources and environmental damage. Virginia Flue Cured (Virginia FC) tobacco processing technology initially used kerosene as fuel. Virginia FC's tobacco processing technology is very complete, especially for facilities related to the provision of heat sources (Flue-cured), but when kerosene is not available in the market, the processing of Virginia Flue Cured tobacco has problems. The use of other energy sources such as coal is constrained by the difficulty of controlling temperature and pollution problems. Meanwhile, the use of wood charcoal and wood raw materials is faced with the problem of availability and environmental damage due to the large number of trees that must be cut down. Meanwhile, the source of electrical energy for Virginia tobacco processing is still considered quite expensive. Therefore, more intensive research and study efforts are needed on the processing of Virginia Flue-cured more efficient for the development of Virginia tobacco in Indonesia.

In the processing of tobacco, the type of fuel that was most widely used for combing tobacco on Lombok Island was a mixture of wood and coal briquettes (42%), a mixture of wood and bulk coal (10.40%), pure wood (40%), wood, and candlenut shells (2.8%), kerosene mixed with diesel fuel (0.8%) and LPG (0.8%).

Another postharvest process that has a significant influence on the selling price of Virginia tobacco is the sorting and grading process. The sorting process begins with sorting tobacco leaves based on color, texture, and size, especially Virginia Flue-cured tobacco. However, for Virginia Sun-cured tobacco, the sorting process is based on color, aroma, texture, and holding power. A proper sorting and grading process needs to be carried out so that farmers have bargaining power over the tobacco trade system. Several companies and industries of tobacco products have their standards in assessing their quality. But broadly speaking, tobacco farmers already know the quality class of the company to which they sell the tobacco they produce.

4. The role of technology in improving the reduction and quality of virginian tobacco
Several supporting technologies in Virginia tobacco cultivation include the availability of high-quality of seeds. Seed requirements per hectare of Virginia tobacco plantations range from 13,000-15,000 seeds (50-100 mg/1000 seeds or equivalent to 13,000 seeds g⁻¹) depending on the spacing applied. The closer the spacing, the leaves will be wider and thinner. The first step to optimizing production is by selecting superior varieties of tobacco. Currently, various Virginia tobacco seeds have been developed that farmers use, including PVH 03, NC 297, Coker 176, Coker 319, K326 [25].

In addition to the availability of seeds, the supporting technology that must be considered is the
extensification and intensification of cultivation. Extensification is done by expanding the planting area. The expansion of the planting area is based on information on the land suitability distribution map with several types of land classes, namely: S1, S2, and S3. The expansion of Virginia tobacco growing area with land suitability information to increase production indirectly has an impact on decreasing tobacco imports.

While the intensification of cultivation can be done by using quality and certified seeds, proper land management with the application of good agriculture practices including pruning, topping, suckering, proper fertilization, integrated pest management, processing technology, and appropriate postharvest so that tobacco leaf yields are obtained selling value and high quality and increase farmers’ income. The tendency of inappropriate cultivation processes in the tobacco production process in Indonesia in general, and Bojonegoro in particular affects productivity and inconsistent quality from year to year [26].

The results of the fertilization technology package using compound fertilizers carried out by the Indonesian Sweetener and Fiber Crops Research Institute, resulted in a fertilization package with a dose of NPK Mg fertilizer up to 100 kg N ha⁻¹ to increase growth, production, quality, and index of Virginia tobacco plants which were tested in addition to producing quality index values and highest plant index in all tested varieties. This fertilizer can be used as an alternative fertilizer for Virginia tobacco in Lombok [21]. The application of inorganic NPK compound fertilizers can affect agronomic characteristics and yields [27]. In addition to fertilizing the spacing of plants in Virginia tobacco cultivation, it is also necessary to avoid competition for nutrient absorption. Based on [28] research, the density or spacing of plants affects growth and productivity (fresh weight of leaves and dry weight of leaves kg ha⁻¹).

Virginia tobacco postharvest handling technology is urgently needed for the Virginia tobacco drying process. The drying process aims to reduce the moisture content in tobacco leaves to reduce leaf damage. Drying is done by drying that is using the sun's heat or artificial drying. Artificial drying in addition to overcoming dependence on the weather also reduces the relative humidity. Drying with a hybrid system, which utilizes sunlight and hot air from burning plant residues, can reduce water content by about 64% in a period of 140 minutes [29].

Oven drying technology with indirect heating is used to increase fuel consumption by about 15% [30]. Coal fuel is used as an energy source for ovens by using gasification furnaces or conventional furnaces by installing a cyclone-collector and smoke trap so that the smoke does not pollute the environment. The use of wood fuel needs to pay attention to the balance between supply and consumption as well as environmental conservation. Oven drying technology can reduce starch content significantly while saccharides (including total sugar, glucose, fructose, maltose, and sucrose) increase in preserved tobacco leaves [31]. According to [32], the use of fuel briquettes designed and assembled using modern techniques and telemechanical maturity technology in tobacco chimneys can prevent high temperatures and regular heating can reduce damage to photoelectric elements during the drying of tobacco leaves.

5. Conclusion

The opportunity to develop Virginia tobacco in Indonesia is to meet the demand for tobacco which is currently still imported at 55,000 hectares. The Virginia tobacco development areas, among others, can be carried out in NTB (Lombok Island), Bali (Buleleng), East Java Province (Bojonegoro and Bondowoso), Central Java Province, D.I. Yogyakarta, North Sumatra Province (North Tapanuli), as well as other areas. Development of Virginia tobacco areas in several potential areas by taking into account land suitability.

Virginia tobacco development opportunities must be supported by tobacco development technologies and policies that cover land suitability, varieties, cultivation technology, pest and disease control, harvesting and processing technology, and marketing. The profits of Virginia tobacco farming ranged from IDR 28,207,263.00 - IDR 42,349,763.00 per hectare. With these advantages, it is economically feasible with R/C ratio of 1.43 - 1.90. Tobacco is more profitable than other seasonal crop commodities.
Higher profits are earned by selling Virginia Sun-cured or Virginia Flue-cured but it will decrease if tobacco is sold in the form of wet leaves.

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