

**FEASIBILITY STUDY  
OF COFFEE INTERCROPPING MODELS DEVELOPMENT  
FOR IMPROVING SMALLHOLDER COFFEE FARMING SYSTEMS  
IN TANGGAMUS REGENCY, LAMPUNG PROVINCE”**

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**Summary of the report**

There were four-model proposed to the development of recommendation of intercropping models for smallholder coffee farmers in Tanggamus Regency, Lampung Province. *First*, model-1 (coffee, pepper/lamtoro, chili, and avocado. *Second*, model-2 (coffee, pepper/lamtoro, chili, and banana). *Third*, model-3 (coffee, pepper/lamtoro, chili, and clove). *Fourth*, model-4 (coffee, pepper/lamtoro, chili, avocado, banana, and clove). As a result, model-1 was selected to be implemented as a continuation of recommendation of coffee intercropping models development for improving smallholder coffee farming systems in the respected area.

As a continuation of recommendation, it is required to provide technical direction to the implementation of selected coffee intercropping model. In addition, there is an assignment to assess the alternative model, namely intercropping coffee and vanilla. It is considered since vanilla is a high-value agricultural product (green gold) due to increase market demand along with the enhancing number of industrial products.

With regard to intercropping coffee and vanilla, it is required to assess the feasibility of these crops both in term of agronomic and socioeconomic aspects. This is because the implementation of intercropping coffee and vanilla is not only aimed to support farming system development but also intended to gain the additional and diversified income of smallholder coffee farmers.

As stated in the objectives of this assignment, the field work activity generally includes two aspects. *First*, the provision of technical direction to recommended demonstration farm model. *Second*, the existence of vanilla farming and the prospect of intercropping coffee and vanilla.

The provision includes preparing the cultivation and directing the technical agronomic aspect such as density of coffee intercropping plantations, fertilizing, treatment, and other necessary GAPs related to selected intercrops. It discusses the general and farm descriptions as well as the technical aspect provided.

The recommended demonstration farms model comprises coffee, pepper, *lamtoro* (shading plant), chili, and avocado (border plant). The planting space of each crop is 3 x 2 meters (coffee), 6 x 4 meters (pepper/lamtoro), 1 x 0.6 meters (chili), and 6 meters (avocado). Therefore, the number of crops per 0.5 hectares would be 600 coffees, 143 pepper/lamtoro(s), 910 chilies, and 43 avocados.

Totally, there are 50 units of demonstration farms model assigned. Thirty units are purposed for intercropping coffee with pepper/lamtoro, chili, and avocado. About 25 units were complete land clearing in which four units had planting holes, and one unit had not yet handled. Moreover, the rest (20 units) are planned for intercropping coffee with vanilla.

Three units of recommended demonstration farm model were evaluated. The technical direction for each evaluated demonstration farm model was provided. Based on progress description namely land clearing, planting holes for coffee, pepper, and avocado, and planting shading trees, as well as composting were technically good performance. Up to this point, there was only different practice to the implementation of recommended model, namely the use of shading tree species. The farmers used *Gamal* (*Gliricidia sepium*) rather than recommended *Lamtoro* (*Leucaena glauca*). This is because *Lamtoro* was unable in the field. Using such a species (*Gamal*) could be the alternative and considered suitable because it is available at farmers' field, which was easy to transport. It is technically acceptable as long as the low branches of *Gamal* are pruned appropriately. However, using *Lamtoro* as shading plant is essentially recommended.

It could be noted that it is necessary to improve some aspects which are weaknesses and maintain the advantages. The productivity of the Robusta coffee plant is determined not only by the seeds planted, the

cultivation techniques, and the production inputs provided, but also by the optimum plant population and cropping system.

Some superior clones of Robusta coffee are recommended by the Indonesian Coffee and Cocoa Research Institute (ICCRI) with production potentials of 2.0-3.5 tons per hectare. The clones are BP 436, BP 936, BP 358, BP 409, BP 534, BP 939, and SA 203 (ICCRI, 2013). However, anecdotal evidence shows that some farmers were worried about the clone of ICCRI (Box 1).

In terms of planting space, the arrangement of four rectangles with a spacing of 3 x 2 meters will be better than the square planting system within spacing of 2.5 x 2.5 meters. At a spacing of 3 x 2 meters, Robusta coffee plants will be easier to pollinate between plants with wind assistance because of the effect of the hallway on the condition that in one area should be planted 2-3 different clones and placed on a row of intermittent plants. Another advantage, four percent more plant population than the 2.5 x 2.5 meters spacing and space between the rows of plants (distance of 3 m) can be planted other crops as intercropping plants, will be more manageable in maintenance, without disturbing the coffee plant as the main crop. In addition, there are positive effects from solar light on the canopy of coffee plants (production branches), so that the possibility of photosynthesis from the canopy exposed to sunlight will be higher, which in turn can increase productivity.

On the one hand, the plant cultivation techniques that are applied need to refer to its standard GAPs including weed control, fertilization, pruning, pest and disease control, shading plant arrangement, as well as soil and water conservation improvement such as making *rorak* as catch ditch/sediment trap. Any ideas in relation to the implementation of cultivation techniques should be taken into consideration. On the other hand, it can be explained that the density of coffee intercropping plantation of about 1,600 plants per hectare with planting space of 3 x 2 meters is recommended.

In Indonesia, almost all vanilla plants (99%) are cultivated by smallholder farmers. The central region producing area of vanilla is Sulawesi, Bali and Nusa Tenggara, Java, Sumatra, Maluku and Papua, and Kalimantan. Total area and production of vanilla in Indonesia was 13,246 hectares and 3,211 tons with the productivity of about 4.12 tons per hectare. Meanwhile, the central producing area of vanilla in Sumatra region is Lampung, North Sumatra, South Sumatra, West Sumatra, Bengkulu, and Jambi. Total area and production of vanilla in Sumatra region was 398 hectares and 167 tons with the productivity of about 2.38 tons per hectare. Hence, Sumatra region only shares about 4-5 percent to the national vanilla (Ditjenbun, 2014).

Lampung was ranked one as provincial producing area in Sumatra region. This province shares about 47-60 percent to regional vanilla of Sumatra.

Technically, there are environmental suitability criteria for vanilla plant. It entails climate condition, soil type, and other related factors (Table 7). In line with the environmental condition of Lampung province particularly Tanggamus regency, it can be generally categorized that this area is suitable to very suitable for vanilla farming. This is at least related to the suitable to less suitable altitudes of 250 to 950 meters above sea level, suitable rainfall intensity of 1,600 to 2,100 millimeters per year, and very suitable number of rain days of 110-130 days per year (BMKG, 2018).

It was observed that farmers applied various planting patterns, mostly used semi-regular plants with a spacing of 1 x 0.3 meters and 1 x 0.5 meters (monoculture), or 2 x 1.5 meters and 2.5 x 2.5 meters as well as 8-10 x 0.6 meters (among other annual crops). Those planting patterns were considered very dense, even extreme. The number of monoculture vanilla was about 20,000-33,333 plants per hectare, while the number of polyculture vanilla plants was 6,666-13,332 plants per hectare. The high number of vanilla plants was due to too tight planting space with the large number of vanillas namely 2-4 plants per clump. It is alarming that the excessive number of vanilla plants within limited land size area might affect on lack of sunlight, high humidity, compete in taking nutrients, and encourage disease attacks. Consequently, the respected vanilla plant would produce lower production than its potential.

Preferably, the planting space of coffee and shading plants is 3 x 3 meters and 6 x 4 meters, respectively. Two cutting tendrils of Vanilla are planted in each shading plant.

Vanilla can be harvested after 8 months to 2.5 years of planting, depending upon quality of cutting tendril and climate condition. This plant can be harvested as soon as the tips begin to turn yellow which is happen approximately 8-9 months after pollination. The harvesting period of vanilla in the respected area mainly falls in February, April, June, July, August, and October.

The harvested vanilla consists of three criteria namely super vanilla (quite mature), young vanilla, and mixed vanilla. Super vanilla comprises 25-60 fresh pods per kilogram, while young vanilla consists of 100 fresh pods per kilogram. One kilogram of dried super vanilla equals to 4-7 kilogram of fresh vanilla and 12-15 kilogram of fresh vanilla is equivalent to one kilogram of young vanilla.

The postharvest handling was mostly carried out traditionally, starting from the processes of dipping the fresh vanilla wrapped in black cloth into hot water for 10 minutes approximately, draining in the box with a black cloth mat, until drying with black cloth under sunlight. All processes are taken within 15-20 days, depending upon weather condition.

It is believed that coffee can be intercropped with vanilla. Therefore, it is necessary to identify the simply technical aspects of this discourse intercropping model in the respected area. It generally includes seed provision, planting pattern, input requirement, and maintenance management.

The vanilla seeds should be good cutting tendrils originating from selected parent plants such as with categorized as recommended superior clones. For instance, Orchid clone from Malang (East Java) and Thin Leaves clone from Ungaran (Central Java). Those clones have quite high potential production namely 1.9 to 2.2 tons of dried pod vanilla with the ratio of 4-5 kilograms of wet pod vanilla versus one kilogramS dried pod vanilla. The good seeds of vanilla are cutting tendrils which never flowered originating from short segments of vanilla plants with having fruits. It is recommended to plant cutting tendril of vanilla with 7-8 segments and one meter length approximately. The pillar used for climbing vanilla plants should be living plants such as *Lamtoro (Leucaena glauca)*, *Gamal (Glyricidia maculata)*, and *Dadap (Erythrina fulusca)*.

The recommended planting space of those pillar plants for monoculture vanilla is 2.5 x 1 meters, 2 x 1 meter, 1.5 x 1.5 meters, or 1.5 x 1.25 meters. For polyculture vanilla such as intercropping coffee and vanilla, the planting space should be adjusted with the number of coffee plants and its planting space. It is recommended that the planting space of shading plants for intercropping coffee and vanilla 6 x 6 meters (416 plants/ha). Moreover, the planting space of coffee is 3 x 2 meters (1,600 plants/ha), while the number of vanillas is 832 plants per hectare (2 plants/pillar). Based on the recommendations, it is expected that all plants would receive sufficient light intensity (70-80%) and optimum humidity. It is suggested that shading plants should be planted 6-12 months before planting vanilla.

Escalating price of vanilla made its farming was very profitable. Vanilla farming could give huge profit although it was cultivated under minimal input and maintenance. However, the current price is predicted not to take place for long. The price will decrease within two or three years, coincides with better condition in Madagascar as the producer of 80 percent of world vanilla. For reasonable consideration, analysis of vanilla farming has to be based on pessimistic price, slightly higher than USD 50 per kilogram as it was happened previously. According to farmer's experience when selling dry vanilla, the price went down from IDR 4-6 million to IDR 2,5 million within only four months, from August to December 2018.

The summary of monocropping coffee farm profitability is presented in Table 11. The calculation was based on 600 coffee plants per 0.5 hectare. It reveals that within ten years of farming period, the cost is about 40 percent of revenue aggregately. The average benefit was IDR 13.8 million per hectare. The cumulative benefit is obtained at the 4<sup>th</sup> year with optimally achieved at the 10<sup>th</sup> year (IDR 35 million/ha). On average, the benefit cost ratio is 2.44 which imply that the benefit is more than twice the cost expends within the ten years of time period of monocropping coffee farm.

The profitability of monocropping vanilla is summarized in Table 12. With the number of 143 vanilla plants per 0.5 hectare, the benefit is cumulatively gained at the 5<sup>th</sup> year with optimally accomplished the 10<sup>th</sup> year. Averagely, the cumulative benefit of monocropping vanilla farm is about IDR 22.45 million per hectare. It is lower than that of cumulative benefit of monocropping coffee farm. However, the benefit cost ratio of this monocropping vanilla farm is quite higher (3.00).

With regard to the profitability of intercropping coffee and vanilla, Table 13 summarizes that the average cumulative benefit is much higher either comparing to the average cumulative of monocropping coffee or monocropping vanilla. Likewise, the benefit cost ratio is also high. It is noted that the cumulative benefit of intercropping coffee and vanilla farm is about IDR 121.96 million, on average. It is indicated that intercropping coffee and vanilla farm (B/C of 4.03) is more profitable as compared to monocropping coffee farm or monocropping vanilla farm.

It is principally noted that in line with the current farm situation owned by farmers, it can be simulated that the coffee number of about 1,600 plants per hectare should be look like as better monocropping pattern. Based on calculation made, the average price of about IDR 20,000 per kilogram (random coffee) is considered profitable.