

Seed Independence Efforts in Mojokerto District, East Java, to Support the Soybean Self-Sufficiency Program

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ABSTRACT

Soybean is an important food commodity that has very large market potential and its needs continue to increase. For the sake of achieving self-sufficiency in soybeans, one important factor is the availability of scatter seeds. Provision of appropriate soybean seeds has a strategic role as a means of supporting increased soybean production. In the field, the seed flow system in Mojokerto Regency, East Java Province, is still facing problems, namely the absence of seed channels for rainy season cultivation in dry land so that it cannot grow a sustainable "Jabalsim" system. For this reason, this activity aims to 1) produce superior soybean seeds according to farmers' preferences to meet market demand, 2) grow seed producers in soybean development areas to ensure adequate supply and distribution of quality seeds of superior varieties, and 3) as well as assist in the application of technological innovations to reduce the yield gap. The results showed that the activity of seed production in Wuwut Village, Mojoanyar Sub-District, Mojokerto District could be categorized as independent. Indicators of independence are: 1) Establishment of a seed producer on behalf of Arifin with a certificate of breeder as Extention Seed producer number 030 / UPT.PSBTPH / MJK / VII / 2019, 2) Superior Varieties of Soybean has been adopted and developed (Dega I, Devon I, Deja II) at the research location even outside the research area, 3) Availability of seeds at all times for the needs of members, and 4) the emergence of a soybean seedling business that has partnered with seed providers. To maintain the continuity of the seeds producer that have been formed, monitoring of their business developments on a regular basis was needed. In addition, in the future, it is necessary to provide access to seed programs that are assisted as one of the seed providers and provide physical infrastructure support so that the speed and volume of seed production can increase.

Keywords: *independent, seeds, soybean*

1. INTRODUCTION

Soybean is an important food commodity that has a very large market potential and its needs continue to increase. The country with the largest soybean consumption in the world is China followed by Indonesia. Soybean in Indonesia is used as a raw material for tempeh and tofu, two foods that are of great interest to the public. [1] noted that Indonesia's soybean imports during the first semester of 2020 reached 1.27 million tons or US \$ 510.2 million or around IDR 7.52 trillion (exchange rate IDR 14,700).

A total of 1.14 million tonnes of which came from the US.

According to [2], until 2020 soybean production is predicted to increase at a rate of 0.19% / year, while [3] reported that consumption will increase by 2.36% / year. The projection results of soybean demand per capita in 2018– 2022 are estimated continue to increase, an average of 3.92% per year. A significant increase in soybean consumption occurred in 2019 amount to 7.19%, from 2018 amount to 2.26 million tons to 2.42 million tons. In 2022, the national consumption of soybeans is

estimated to be close to 3 million tons, which is 2.75 million tons [4]. [5] reported that the average import of Indonesian soybeans reaches 2 million–2.5 million tons per year. Of the total import volume, around 70% is allocated for tempeh production, 25% for tofu production, and the leftovers for other products. Meanwhile, the average demand for soybeans in Indonesia reaches 2.8 million tons per year. Indonesia actually experienced self-sufficiency in soybeans in 1992. At that time, domestic soybean production reached 1.8 million tons.

In order to achieve self-sufficiency in soybeans, one of the most important factors is the availability of high yielding varieties because it is the key to increasing production. However, the success of developing superior varieties is determined by the availability of seeds and the quality of the seeds themselves [6]. Public sector breeding activities and private sector seed companies can be effectively involved, the adoption by these farmers will support a breeding process that focuses on the variety niche, meet the demands of small farmers, so that the market will come forward and develop to absorb the yields, and the policy will be implemented. to support market development, inputs and outputs [7]. Problems in soybean seedlings, among others: a) the unsatisfactory condition of the seeds that meet the six right conditions, b) less attractive soybean seeds business, so that the number of seeds producers is limited, c) the risk is quite high because the seeds are less durable for long storage, d) good seeds storage space is not available, e) weak market guarantee (unclear demand map), f) planting area per smallholder so that the need for seeds is small, and g) availability of source seeds is limited. Provision of appropriate soybean seeds has a strategic role as a means of technology to support increased soybean production [8, 9, 10].

The production system, certification, and distribution of certified seeds is currently regulated [11]. However, the implementation in the field still occurs several problems including: a) the provision of seeds is late so that it is not suitable for the planting season, b) the number of seeds need is not fulfilled, c) the quality of the seeds is not good, d) the available varieties are not in accordance with the needs of farmers, and e) the quality of the seeds is not good. Until now, soybean self-sufficiency has not been achieved because it is faced with various obstacles in its implementation as a result of (a) low farmers' interest, (b) the underdeveloped application of recommended technology at the farm level, especially the use of superior quality seeds and the use of balanced fertilizers, (c) increase in soybean imports

due to the ease of import trading with reverse LC and (d) competition for land resource use with other commodities, particularly maize [12].

The spread of new high yielding soybean seeds varieties is still an obstacle, while the requirements to become seeds producers are still classified as heavy, namely: must have adequate facilities (land, processing and storage facilities), skilled personnel, comply with regulations in seeds production and certification [13]. Therefore, it is necessary to assist farmers in accessing and obtaining good quality seeds. One of the important factors in increasing agricultural production is the use of high-quality seeds [14]. In addition, it is necessary to strengthen farmer groups or individual farmers in the area to become seeds producers, so that the continuity of the supply of seeds is guaranteed with good quantity and quality.

The Indonesian Agency for Agricultural Research and Development (IAARD) determines several policies: (1) The Seeds Independent Village Model (*Model Desa Mandiri Benih*) is changed to the Seeds Independent Area Model, namely a model for providing seeds to meet the needs of local seeds by empowering prospective seeds producer to become formal (certified) seeds producer, (2) Model of Independent Rice Seeds Areas in 24 Provinces, Corn in 7 Provinces, Soybean in 12 Provinces [15]. To improve the ability and capacity of farmers as seeds producer was done through the process of production, processing, organizational management and marketing through indoor and field training, therefore Field School of Seeds Independent of Soybean is needed. Seed's independence is created in the sense of fulfilling the needs of its own seeds or meeting the needs of group, village or area seeds from varieties that are in accordance with farmer preferences and location-specific adaptive. The objective of the Seed Independent Village was to facilitate farmer groups, seeds producers' groups or joint seeds producers' groups to increase capacity (capacity building) in order to produce seeds to meet the needs of seeds in their area [16].

To support these activities, Indonesian Legumes and Tuber Crops Research Institute (ILETRI) is tasked with: (1) Providing sources seeds for superior varieties, (2) Providing technical guidance on seeds production, (3) Duplicating technical guidelines for seeds production and processing, and (4) Monitoring at mentoring locations. Meanwhile, Assessment Institute of Agriculture Technology (AIAT or *BPTP*) has the task of: (1) Assisting in planning to meet the needs of seeds in an area, (2) Identifying non-formal

seeds producer as candidate of seeds producer, (3) Providing technical assistance and guidance for seeds production, (4) Distributing certified seeds to seeds producers, (5) Facilitating seeds producers in the seed's certification process. The Indonesian Center for Food Crops Research and Development (ICFORD) was assigned the task of compiling a General Guidelines for the development of an independent seeds area, drafting a Ministerial Assignment letter regarding the provision of certified seeds for rice, maize, soybeans, and compiling a schedule for the implementation of activities.

The research objectives were: producing superior soybean seeds according to farmer preferences to meet market demand. In addition, growing seeds producers in soybean development areas to ensure adequate supply and distribution of high-quality superior variety seeds, as well as assistance to reduce yield gaps between farmers by improving cultivation.

2. MATERIALS AND METHODS

2.1. The Scope of Research

The scope of this activity was a model of soybean seeds independent area and its development. Activities were carried out include: 1) Identification of existing technology, 2) Planning of seed requirements, 3) Identification of prospective seeds producers and potential locations. Selected locations that have farmer groups (*Poktan or Gapoktan*), as well as the existence of support groups that focus on agriculture, 4) Provision of certified seeds (mapping surveys and seed needs and farmers' access to formal seedlings in the Seed Independent area), 5) Technical assistance and guidance of production seeds, 6) Facilitation and guidance of the seed certification process (in collaboration with the Agriculture services and Technical Implementation Unit for Supervision and Certification of Food Crops and Horticulture Seeds (*UPT PSB-TPH*), 7) Seeds information systems, and 8) Monitoring, evaluation and reporting of seeds production.

The development model of soybean seeds independent village was implemented in Mojokerto District, which was carried out from January to December 2019. The activity was carried out in a model of production field school by holding a field laboratory. The variety planted in field laboratory is the Dega I variety, which is a cross between the Grobogan and Malabar varieties [17]. The production techniques used are as recommended by ILETRI with technology and quality management assistance. It is

hoped that the one-hectare area around the field laboratory can be used as a supporting area for these activities.

2.2. Implementation

Prospective seeds producers who are targeted to become seeds producers in the seeds independent area model are seeds producer or farmers who were usual to producing seeds but, in the production, process have not yet certified the seeds to Seed Supervision and Certification Center (*BPSB*). The identification process coordinates with *BPSB* to determine prospective non-formal seeds producers to be coached. Fostering the seeds producers included: seed production techniques (pre- and post-harvest) as well as the seed certification process, so that the informal seeds producers can develop into formal seeds producer.

The selection of prospective locations for the seeds independent area model was based on the planted area of Rice-Corn-Soybean (or *Pajale*), which mean that the seeds independent area model located in both the central area and the development of *Pajale*. The Field School – Village of Soybean Independent Seeds (*SL-DMB*) activities were held in Wuwut Village, Mojoanyar Sub-District, Mojokerto District, in Harapan Jaya and Tani Mulyo Farmers Group.

This activity uses Foundation Seeds (FS) class from ILETRI and seeds was planted in one hectare of field laboratory as a place for farmers to learn firsthand how to produce seeds and see the appearance of the varieties being introduced. The Stock Seeds (SS) class produced can be used by prospective seeds producers to produce Extension seeds (ES) if desired. Production of ES seeds class in field laboratory will be registered with *BPSB* by the formal seeds producers that established in the region.

3. RESULT AND DISCUSSION

3.1. The characteristics of soybean *SL-DMB* activity locations (*Ex-ante*).

The results of a survey to 49 prospective implementers of Soybean *SL-DMB* showed that the agricultural area in Wunut Village is 112 hectares, divided into two cropping systems, namely the dry season I (rice-soybeans-soybeans) covering 6 hectares and the dry season II (rice-rice-soybean) covering an area of 106 hectares. The planting system of dry season I covering an area of 6 hectares, was found in the Harapan Jaya Farmer Group of 1 hectare

and Tani Mulyo covering an area of 5 hectares. For dry season II, it is divided into 26 hectares in Harapan Jaya Farmers Group, 34 hectares in Tani Mulyo, 20 hectares in Harapan Makmur I, and 26 hectares in Harapan Makmur II.

3.2. Seeds Origin

Mojoanyar sub-district has no seeds producers, especially soybeans. So far, soybean seeds are obtained from: 1) Purchasing at a kiosk that is far from the location, 2) Buying from other farmers in bulk (*jabal sim*), 3) Self-harvesting, and 4) Government assistance (Figure 1). The varieties grown include: Grobogan, Gepak Ijo, Wilis, Devon, and Dega. The Devon and Dega varieties were the result of the previous year's Field School activities

kept by cooperator farmers of *SL-DMB* (Figure 1B).

The problem that often occurred that the seeds used are not in accordance with the six right principles, namely: 1) Right variety, not in accordance with farmers wishes, especially assisted seeds or those in agricultural kiosks, 2) Appropriate quality, low growing power, 3) Right amount, it can be ascertained that the seed assistance from the government is not sufficient, 4) Right location, the location of the agricultural kiosk is in the city, the distance is relatively far from the location. 5) On time, the availability of seeds in kiosks and accommodation seeds is not on time when needed, and 6) Right on price, farmers feel that the price of soybean seeds is still too expensive, ranging from IDR 10,000 - IDR 12,500 per kg.

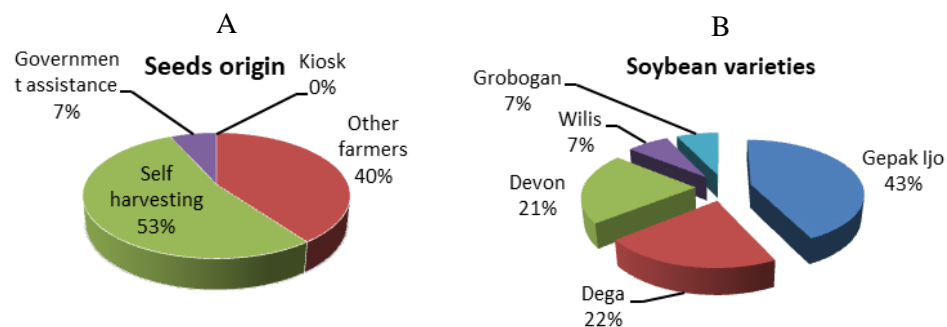


Figure 1. Diagram of: A. Origin of Seeds and B. Soybean varieties before the implementation of Soybean *SL-DMB* (Dry season I 2018).

3.3. Soybean Planting Area

Mojoanyar sub-district in the 2018 planting season has a soybean planting area of 277 hectares, ranking second after Bangsal District (415 hectares). In general, the area of soybean cultivation in Mojokerto Regency in 2018 has decreased significantly compared to the previous year, namely in 2017 the area of 3636.9 ha decreased to 1480 ha in 2018 (decreased 59.31%) (Figure 2A). This is caused by the price of soybeans is low, so it switches to corn.

3.4. Average of soybean production in 2018 (before the soybean *SL-DMB* was carried out)

Soybean production during the planting season of dry season I in 2018 before the 2019 Soybean *SL-DMB* activities very fluctuated among farmers (Figure 3). This is because farmers think soybeans are not a superior commodity because of their low selling price, so that it has an impact on less intensive cultivation methods, including: spread planting, not fertilizing, weed control and pest control are not optimal.

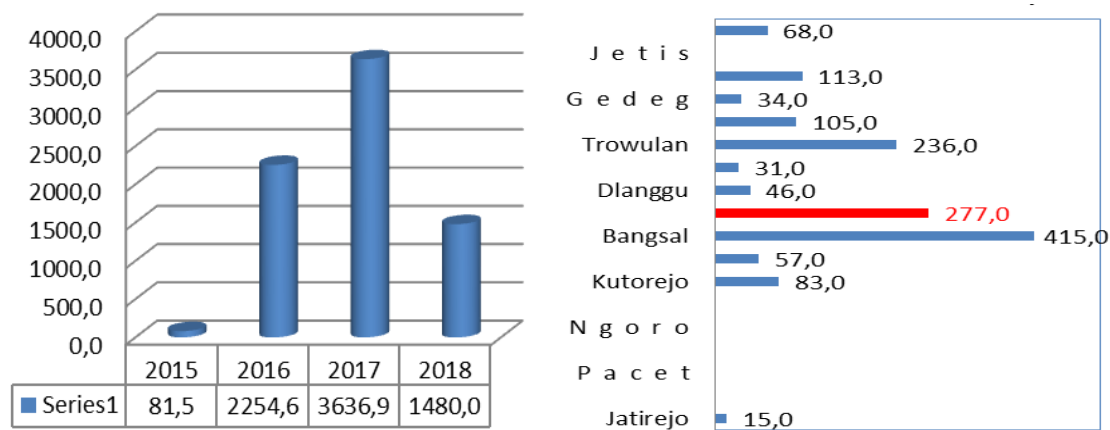


Figure 2. Soybean planting area in Mojokerto District: A. Total soybean planting area in Mojokerto district. B. Soybean planting area per subdistrict in Mojokerto

3.5. Implementation of Soybean SL-DMB Activities in 2019

3.5.1. Determination of seeds producers

Prospective seeds producers are determined based on the selection of Soybean *SL-DMB* participants at the time of socialization and under the direct supervision of officers from the Technical Implementation Unit for Supervision and Certification of Food Crops and Horticulture Seeds. From the three names of seeds producers that submitted, one name that met the requirements to become a seeds producer was chosen, namely Arifin and finally obtained a certificate with a recommendation number as *Bina Seed Producer* No. 030 / UPT.BPSBTPH / MJK / VII / 2019, with the business name "Maju Jaya".

3.5.2. Determination of Produced Seeds and Their Utilization.

Determination of soybean varieties produced as seed candidates is based on: 1) the best of new varieties of IAARD from the demonstration plot from a few years earlier, 2) The results of group members' agreement, and 3) Partner Orders. Therefore, two new superior varieties of soybeans were selected, namely: Dega 1 and Devon 1. The Dega variety was chosen because it has advantages, namely large seeds and short life, while the

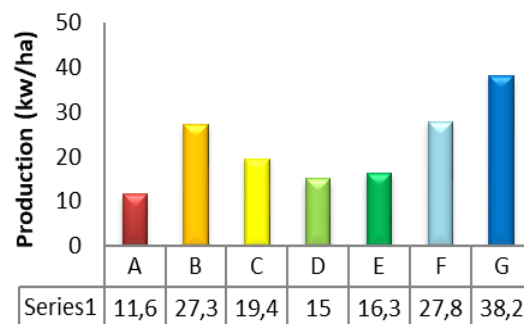


Figure 3. Soybean productivity (average yield, kw. ha⁻¹) at the location of the Soybean *SL-DMB* activity in dry season I 2018 (before assistance was carried out in 2019). A=lowest farmer's yield, B=highest farmer's yield, C=farmer's average yield, D=provincial average yield, E=average yield at SL 2018, F=average yield of Dega 1, G=potential yield of Dega 1.

Devon I variety has higher production than local varieties. In addition, there is Dega 2 variety, a new soybean variety that has never been planted at the location of the activity and has the advantage of being water-saturated, so it is hoped that it will be suitable for planting in the soybean *SL-DMB* activity location in dry season I.

In the planting season of dry season, I in 2019, Soybean *SL-DMB* activities prioritized producing seeds to meet the needs of members of the two farmer groups in the Wunut village area, namely: the Harapan Jaya and the Tani Mulyo farmer group which had the dry season II planting area (± 112 hectares), while the area of soybean in Mojoanyar sub-district in dry season II is ± 266 hectares, so that the soybean seeds needed is $\pm 13,300$ kgs.

3.5.3. The number of seeds produced and their use

Soybean seeds produced in this activity were produced in two planting seasons, namely production in dry season I and dry season II 2019. Seed production in dry season I was prioritized for the needs of group members, while seed production in season dry season II served the needs of members, farmers outside the Wunut area and partnership with East Java AIAT (Table 2).

The problem faced by seeds producers in producing seeds / prospective soybean seeds in large quantities is the lack of facilities and infrastructure they have. Currently, they still use conventional methods in processing seed candidates. In the future, it is hoped that there will be a multipurpose tool / machine, especially to accelerate the processing of prospective seeds. The relatively short time between harvesting and planting in dry season II is also a problem in itself, so the availability of seeds must be fast. This requires readiness and speed of seed processing so that the seeds produced can be utilized optimally.

The impact of limited time and infrastructure has resulted in not all prospective seeds being produced into certified seeds, especially production during the planting season of dry season I (April-July 2019). Meanwhile, most of the production of seeds candidates in dry season II are labeled/certified, because there are not many farmers who are planting soybeans ahead of the rainy season. In addition, partnerships have been established with seed producers (Figure 4).

3.5.4. Stakeholder involvement in technical assistance activities

Indicators of the success of Soybean *SL-DMB* activities are: the emergence of seeds producers in the local area, the development of new varieties, the availability of certified seeds, and the running of the seed business. To create an Independent Seed Village, technical assistance has been carried out by involving relevant agencies, namely: ILETRI, Technical Implementation Unit for Supervision and Certification of Food Crops and Horticulture Seeds (UPT PSBTPH), AIAT, Agriculture and Forestry Service of Mojokerto District.

Table 1. Need for certified seeds, as well as seed delivery realization for field laboratory and field school

Locations	Varieties	Target seed requirements (kg)	Seeds classes	Realization of Seed Delivery (kg)	Seed Receiving Date	Providing agency for seeds
Field laboratory	Dega 1	50	FS	50	16 April 2019	ILETRI
	Devon 1	50	FS	50		
	Deja 2	50	FS	50		
Field school	Devon	200	FS	200	16 April 2019	ILETRI

Table 2. Business activities for extension seeds in 2019

Location	Varieties	Production plan	Seeds class	Utilization plan	Production realization	Realization of seeds utilization
Planting season I (April - July 2019)						
LL: Poktan Harapan Jaya	Dega I (10 farmers)	1000 kgs	ES	For grup member and non grup member	1.077 kgs	Grup member: 577 kgs Non grup member : 500 kgs
Poktan Tani Mulyo	Deja II Devon (9 farmers)	500 kgs 500 kgs	ES	Grup member	1.240 kgs	Grup member
SL: Poktan Tani Mulyo	Devon (30 farmers)	5000 kgs	ES	For member and non grup member	5.168 kgs	For grup member and non grup member
TOTAL					7.485 kgs	
Planting season II (July -October 2019)						
Poktan Tani Mulyo and poktan Harapan Jaya	Dega Devon	500 kgs 11.500 kgs	ES	Partnership	500 kgs 10.000 kgs	Partnership 100 kgs 10.000 kgs
Poktan Tani Mulyo	Devon Deja		ES	Grup member	2.000 kgs 1.000 kgs	Used for members and nonmembers (preparation dry season I in 2020)
TOTAL					13.500 kgs	

Implementation of assistance to farmers participating in Soybean *SL-DMB*, it is carried out in two ways, namely theory and practice in the field. The AIAT team is tasked with facilitating activities which include coordination with stakeholders and provide infrastructure. UPT PSBTPH provides assistance starting from completing the administration of submitting prospective seeds producers to obtaining certification as seeds, producers as well as providing assistance to the process of submitting seeds and monitoring/physical inspection of soybean plants in the field. ILETRI is responsible for providing source seeds and at the same time providing assistance on cultivation and harvesting methods, introduction of pests and diseases, and production methods of soybean seeds.

3.6. Improvement of Soybean Cultivation Technology

In producing soybean seeds, it is inseparable from good and efficient cultivation methods so that more potential seeds are produced, good quality, and are more cost efficient. Based on data from the previous season (dry season I in 2018), it shows that what needs to be improved is planting methods. Most of the farmers plant soybeans by spreading it, this has an impact on activities in maintenance, especially weed control, which is less than optimal so that productivity is lower than the method of planting sliced (Figure 5).

Table 3. Realization of Technical Assistance in Soybean Seed Production

Type of mentoring	Participants	Place of activities	Interviewees
1. Socialization of the program of Soybean <i>SL-DMB</i> 2019	- Farmer grup Tani Mulyo - Farmer grup Harapan Jaya	Village meeting hall of Wunut	AIAT of East Java
2. Improvement of cultivation techniques	- Agricultural extension of Mojoanyar area - Representatives of the Agriculture Services of Mojokerto		
Soybean seed certification process, rouging, and seed candidate processing	- Farmer grup Tani Mulyo - Farmer grup Harapan Jaya - Agricultural extension of Mojoanyar area	Village meeting hall of Wunut continued activities in the field (5x)	UPT-PSBTPH
1. Cultivation and production principles of soybean seeds	- Farmer grup Tani Mulyo - Farmer grup Harapan Jaya	Village meeting hall of Wunut	ILETRI-Malang
2. The main pests & diseases of soybeans	- Agricultural extension of Mojoanyar area	continued activities in the field (3x)	
3. Harvest and post harvest			

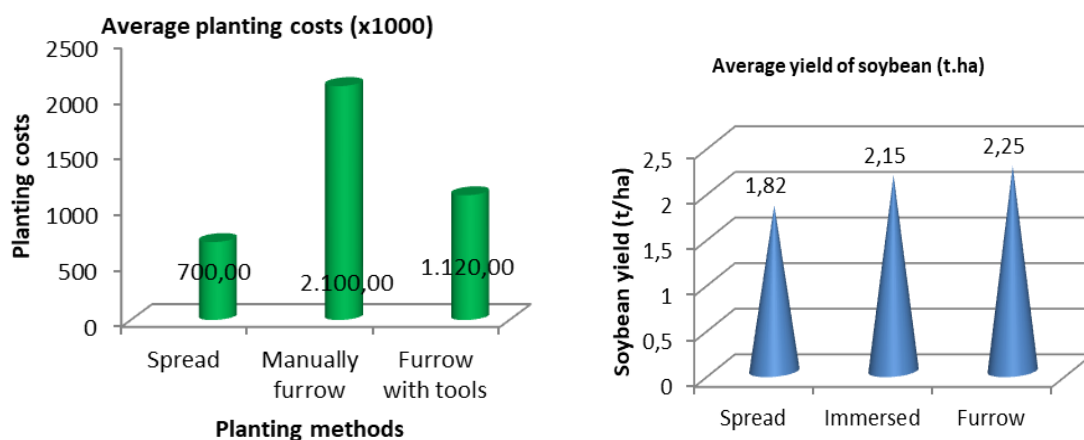


Figure 5. Comparison of wages and yields on different ways of soybeans planting.

3.6.1. Introduction of planting tools

To simplify the planting of the “icir” system, a simple planting tool was introduced (Figure 6), with the aim of speeding up planting times and regular spacing as desired. This has an impact on reducing the use of labor, making plant maintenance easier so that plant growth and yield are optimal.

3.6.2. Street light impact countermeasures

Street lighting has a negative effect on plant growth. Soybean plants that are exposed to street lighting show the following signs: 1) the age of the plant becomes longer, for example Dega is 85 days

old to 150 days old, 2) longer vegetative growth, taller plants, and 3) if the flowers do not appear have a pincer or if it is not pithy. The radius of the land affected by the lights is 25-30 meters from the light point, this is of course very detrimental to farmers who own land along the road. To suppress vegetative growth caused by the influence of street lights, a Growth Regulator was applied which contains the active ingredient Paklobutrazol 250 g·l⁻¹, sprayed with a concentration of 2 cc per liter of water at the age of 15 DAP and 30 DAP. The results showed that soybean plants given ZPT produced 750 kgs / ha while those that were not given the pods were not fertile (did not produce seeds) (Figure 7).

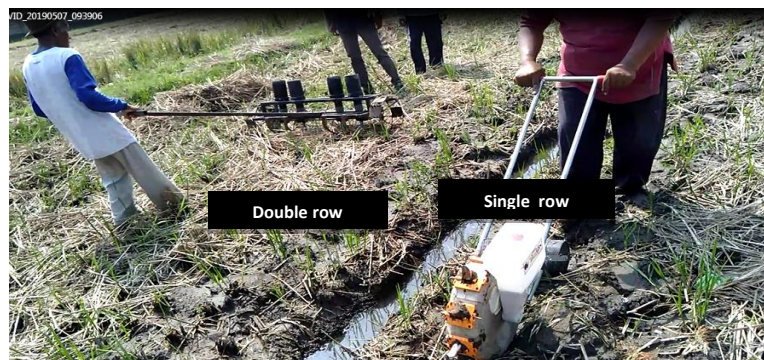


Figure 6. Double row and single row cropping tools



Figure 7. Plant performance affected by street lights (left) and plant performance after ZPT application (right)

For more optimal results, it is necessary to conduct a more in-depth study of the application of ZPT to plants affected by street lights, besides it is necessary for plant breeders to create soybean varieties that are tolerant of street light.

4. CONCLUSION

Soybean seeds production in Wuwut Village, Mojoanyar Sub-District, Mojokerto District have been independent. Indicators of independence were: 1) Establishment of a seeds producer on behalf of Arifin with a certificate as seeds producer number 030/UPT.PSBTPH/drysesason/VII/2019, 2) New soybean varieties have been adopted and developed (Dega I, Devon I, Deja II) in the location of the activities even outside the area of activities, 3)

Availability of seeds at all times for the needs of members, and 4) The emergence of soybean seeds business that has partnered with seeds providers.

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