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Development of Demonstration Plots and Assistance of Farmer Group Yellow Soybean Based on Local Wisdom Supporting Food Security in Cilacap District, Central Java, Indonesia

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Abstract: *The mentoring and demonstration plot program with the application of technology carried out by the Faculty of Agriculture Universitas Gadjah Mada Team was proven to be able to increase the productivity and quality of soybeans, although some were only applied partially (not completely) from the recommended technology package, this was constrained by many factors in each mentoring area. In the Cilacap area, the demonstration plot results showed a fairly high potential reaching 2.24 tons/ha in Bantarsari, 2.94 and 3.77 tons/ha in Kawunganten, while in Majenang before harvesting soybeans showed good potential with 130-140 pods. per plant, this is of course the potential yield can reach above 3.0 tons/ha, but unfortunately it was affected by the flood due to the broken embankment, so the soybeans were inundated and damaged (rotten) in a relatively short time. The process of technology transfer and adoption that occurred went well, and many farmers gave testimony that this mentoring program was good to be developed and continued, so that under conditions according to the growing season, they would be able to show even better potential..*

Introduction

The importance of Indonesia to be self-sufficient in soybeans is based on at least two arguments. First, soybeans are a cheap source of protein for Indonesians, which has been around for a very long time. Without producing in quantities that meet demand, it will be a weak point that can affect various aspects, including social, economics and politics. Second, the inability to be self-sufficient will deplete foreign exchange, which can be a weak point for the country in a wider aspect and spectrum. The wasting of foreign exchange for importing soybeans is a step backwards, because foreign exchange can be used for more strategic purposes and has a multiplier effect, for example for manufacturing development that can absorb labour from the agricultural sector, and support the transformation of the agricultural sector into the non-agricultural sector, more productive agriculture. [1]

Until now, Indonesia's dependence on imports tends to continue to increase. In the period 1999-2004, for example, the import dependency ratio, or the proportion of imports of the total soybean available in Indonesia, increased from 48.49 to 62.29.[2] This rapid increase was due to the high rate of consumption and reinforced by the slow pace of production. The danger of dependence on imports on social, economic and political conditions is when world soybean volumes shrink or price fluctuations occur. This concern about the danger has been proven when there was a spike in world soybean prices at the end of 2007, where the world soybean price rose from 306 US dollars per tonne in January 2007 to 520 US dollars per tonne in January 2008. Prices paid by processing industry craftsmen Tofu and tempeh for imported soybeans at KOPTI (Tofu and Tempe Cooperative) at that time reached Rp. 7,500/kg, an increase from the price of Rp. 3,000/kg. The price hike had stopped the activities of many tempe and tofu processing industries. With the test of price spikes, forcing the government to set a soybean self-sufficiency target to be achieved in 2015, which until 2021 has not been achieved.

Technology plays an important role in efforts to increase production, even according to, [3] technology must continue to change for the better as an absolute requirement for agricultural development, as well as in soybean development. Without

[1] Badan Litbang Pertanian Kementerian Pertanian RI, "Mutu Kedelai Nasional Lebih Baik Dari Kedelai Impor - Balitbangtan," *Badan Litbang Pertanian Kementerian Pertanian RI*, last modified February 12, 2008, accessed June 4, 2022, http://old.litbang.pertanian.go.id/press/one/12/.

[2] Balitkabi, "Inovasi Teknologi Kedelai Menuju Swasembada Kedelai Tahun 2014," *Litbang Deptan RI*, last modified 2010, http://balitkabi.litbang.deptan.go.id.; Badan Litbang Pertanian Kementerian Pertanian RI, "Mutu Kedelai Nasional Lebih Baik Dari Kedelai Impor - Balitbangtan."; dan F.B.M. Debukke Syafa'at. N., P.U. Hadi, D.K. Sadra, E.M. Lokollo, A. Purwoto, J. Situmorang, *Proyeksi Permintaan Dan Penawaran Komoditas Utama Pertanian. Laporan Akhir Penelitian: Proyek/Bagian Proyek Pengkajian Teknologi Pertanian Partisipatif (The Participatory Development of Agricultural Technology Project/PAATP)* (Bogor, 2005).

[3] Bob Carlisle and Jonathan Wadsworth, *TECHNOLOGY AND ITS CONTRIBUTION TO PRO-POOR AGRICULTURAL DEVELOPMENT* (London, 2020).

technology that continues to develop in soybean farming, it is difficult to expect an increase in production and income

The area of planting, production, and productivity of yellow soybeans still often experiences sharp fluctuations, this is also in accordance with the national condition of soybeans as shown in Table 1.

Table 1. Harvested area, production, and productivity of Indonesian soybeans in 2014-2018[4]

Variable	2014	2015	2016	2017	2018	Growth 2018/2017 (%)
Harvested area (ha)	615.685	614.095	576.987	355.799	680.373	91.22
Production (ton)	954.997	963.183	859.653	538.728	982.598	82.39
Productivity (ton/ha)	1.55	1.57	1.49	1.51	1.44	(4.62)

Source: Central Bureau of Statistics and Directorate General of Food Crops, 2019.

In 2019, the target area for soybean cultivation development is set at 350,000 ha. There is also an intercropping pattern of 350,000 ha of corn-soybean and 350,000 ha of soybean-paddy, so the Ministry of Agriculture targets to produce 2.8 million tons. Whereas in the last four years the soybean planting area has only been around 600,000-680,000 ha. The enthusiasm for growing soybeans did not continue to strengthen, this was because it was unable to compete with imported products that were cheaper on the market. In addition to incentives felt by farmers who are considered less able to compete with other food crops, especially rice and corn, this is also caused by the low productivity of soybean farmers (still far below 2.0 tons/ha). This of course makes it more difficult for the movement to raise the enthusiasm of farmers in trying to cultivate soybeans. So one of the solutions that must be implemented is to establish a "4 Pillar Partnership: A-B-C-G" in a more committed, synergistic, and sustainable manner.

The 4 Pillars Partnership: ABCG is a collaboration between A: Academy (academics and researchers from both universities and research centers) whose role is to oversee the application of appropriate location-specific technology, B: business (private industry) to ensure market absorption at a reasonable price, C : community (community: producer farmers) plays a role in providing land and producing raw materials for production according to industrial quality standards, and G: government

[4] Badan Pusat Statistik RI, "Statistik Hortikultura 2019," *Badan Pusat Statistik RI*, last modified 2019, accessed June 4, 2022, https://www.bps.go.id/publication/2020/08/28/5eb79ca777ce4ba7a2908a4d/statistik-hortikultura-2019.html.

(government) acts as a regulator and facilitator in arousing the enthusiasm of farmers to plant and develop soybeans. If this is done properly and sustainably, it is hoped that the achievement of the national soybean target can be met soon, so that dependence on imported soybeans can be suppressed or reduced. There needs to be a more active contribution and strong commitment from all components in implementing cooperation, so that the nuances of revival in soybean management will be more real in realizing national food security and sovereignty.

The stages of mentoring activities carried out can be based on the thoughts of Phillips and Pittman[5] which have been modified according to the needs in the field, which include: team formation, formulation of goals, identification of stakeholders, collection and analysis of needs, determining priority of problem solutions, preparation, implementation with socialization in stages, seed distribution and planting training, mentoring, training on the manufacture of liquid organic fertilizer and development of biological fertilizers, prevention and control of plant pest organisms, review and evaluation and continued with determining new needs and targets (Figure 1)

Figure 1. Stages of farmer assistance activities carried out based on the thoughts of Phillips and Pittman (2008) which have been modified according to the needs in the field.

Assistance is carried out to practice soybean cultivation techniques, especially soybeans which have been assisted by the government through the Ministry of Agriculture (Kementan). Farmers and farmer groups are directly taught and practiced soybean cultivation since land preparation, the correct way to plant seeds, intensive maintenance, determination of ready-to-harvest criteria, as well as harvest and post-harvest handling. This has been socialized in the form of Soybean Cultivation SOPs to increase soybean productivity and quality. Assistance is also provided during the practice

[5] Rhonda Phillips and Robert Pittman, *An Introduction to Community Development* (Routledge, 2008).

of making liquid organic fertilizers, developing Bacillus Plus biofertilizers as an alternative to meet the nutritional needs of plants in maintaining soybeans in order to increase productivity and yield quality.

In this activity, mentoring was carried out in a demonstration plot practice by involving members and administrators of farmer groups both within the demonstration plot area and outside the demonstration plot area (non-demonstration plot). This activity is carried out starting from land preparation, seed preparation, seed planting, plant maintenance, harvest and post-harvest handling. It is hoped that this demonstration plot can be used as an active and independent learning medium among members and administrators of farmer groups both in the demonstration plot and non-demonstration areas.

Methods

Implementation Time and Place

Assistance activities for soybean cultivation have been carried out in one planting season in the 2021 fiscal year, starting in May-December 2021. The location for the assistance is in Cilacap Regency, Central Java. In Cilacap Regency, planting in August 2021 in Bantarsari, Kawunganten, and Majenang Districts covering 50, 100, and 150 ha (total 300 ha) and in October 2021 an area of 595 ha in Gandrungmangu District, Kampung Laut, (where the previous planting period was yields are still below 1 ton/ha) due to lack of water.

Tools and Materials

The tools used in the soybean cultivation mentoring program are agricultural equipment to support soybean cultivation activities and one unit of Bacillus Plus biological fertilizer propagation equipment and a knapsack sprayer for the application of biological fertilizers, liquid organic fertilizers, and pesticides. The materials used were in the form of an aid package from the Ministry of Agriculture (soybean seeds, Rhizobium, NPK fertilizer, liquid biological fertilizer, and pesticides) and a technology package from the Faculty of Agriculture, Universitas Gadjah Mada in the form of Bacillus Plus, Mikoriza sp. Feedstock (MF), Super Soybean fertilizer (fertilizer) Micro elements) which was applied to the demonstration plot area.

Assistance Management

Implementation in the assistance activities of soybean cultivation development programs are:

First, Coordination and synchronization of mentoring programs with the Department of Agriculture and Food Security (DPKP) in Cilacap, continued at the sub-district level, namely at Agricultural Extension Centers (BPP) in Bantarsari,

Kawunganten, Majenang, Cimanggu, Kampung Laut, and Gandrungmangu. This includes farmer groups in the targeted area of the local BPP and village governments who are used as mentoring areas in the soybean development program.

Second, Farmer assistance is carried out directly by fielding Field Assistants for one soybean planting season and must stay in the location so that they can always interact actively with farmers, farmer groups, as well as with field officers at each mentoring location. The mentoring program carried out includes planning and implementing farming businesses from planting to harvesting and post-harvest handling, monitoring and evaluation, as well as the introduction of technological innovations, and empowerment of farmer institutions.

Third, Socialization, training, and Focus Group Discussion (FGD) were conducted in the mentoring area, specifically focused on the 3 villages that were the demonstration plot areas while still actively involving representatives of farmer groups from outside the demonstration plot area. In fact, sometimes training and FGD are also carried out in villages outside the demonstration plot area as representatives of the mentoring area.

Fourth, Monitoring and evaluation in the form of routine and incidental visits according to the needs in the field. From each monitoring activity, an evaluation is also carried out by both the Field Assistant and the Expert Team who carry out monitoring together with the Field Assistant and farmer groups. This is done simultaneously to identify and take inventory of the problems faced by farmers and farmer groups, and to seek alternative solutions for solving problems related to soybean production, in a fast, focused, and integrated manner, so that farmers and farmer groups can follow up properly. If the problem faced is a major problem in soybean cultivation (eg rat pest attack), then farmers and farmer groups are immediately gathered in a meeting to be given socialization related to anticipation, prevention, and control of rat pests, so that farmers and groups can coordinate and follow up efforts control by applying the concept of overlay control with various combinations of control techniques under the management of farmer groups.

Fifth, Demonstration plots for soybean cultivation were carried out in 3 villages as representatives of superior, mainstay, and development areas, each with an area of 5 ha. The demonstration plot activity was carried out on land owned by farmers belonging to the farmer group, accompanied by Field Assistants and Field Extension Officers (PPL in Inonesian) who were guided by a Team of Experts.

Sixth, Data collection and analysis. Data collection, both primary and secondary data, is carried out to identify and at the same time evaluate the mentoring program that has been carried out. Primary data in the form of quantitative and qualitative data directly obtained from the field (observation results) as well as from interviews with farmers, farmer groups, and field officers. Meanwhile, secondary data was obtained from related agencies or other sources relevant to the soybean cultivation assistance program.

Primary data to determine soybean productivity in the demonstration plot area was by making tile plots with a size of 2.5 m x 2.5 m in each demonstration plot unit. This activity is carried out together with agricultural extension officers (field extension officer (PPL) from the local District Field Extention Center (BPP) and farmer groups. Data was collected by calculating the number of plants, the number of pods per plant, and the wet weight of the pods, which were then calculated using the formula:

Soybean production weight = (wet weight of soybean) x 36.9 % x 1,600 = ton/ha

The data obtained were then compared with the results of soybean productivity outside the demonstration plot area, to find out the benefits of the assistance provided.

Seventh, Dissemination and Reporting. Dissemination is carried out to disseminate the results of applied technology or innovations that are planned, directed, and managed so that the process of exchanging information through discussions both offline and online through zoom meetings. Reports are carried out in stages from all mentoring activities in the field and the results of monitoring and evaluation from both the Field Assistant and the Expert Team, including the results of joint evaluations with the AKABI Team both offline and online through zoom meetings.

The Faculty of Agriculture UGM and the Directorate of Various Nuts and Bulbs of the Ministry of Agriculture collaborated in assisting soybean farmers. This assistance aims to increase soybean productivity to support Indonesia's food security. Efforts and efforts are made to include the active participation of farmers and farmer groups in developing the existing potential (both natural resources and human resources) with good results, namely by using technology developed by Universitas Gadjah Mada in order to improve and obtain maximum agricultural yields. Piloting by developing demonstration plots and developing an interaction process from, by, and for assisted farmers. The mentoring process begins with land preparation, land management, provision of quality seeds, planting, maintenance, harvesting, and post-harvest handling. During the maintenance, pilots and socialization were carried out on the manufacture of some organic fertilizers that can be developed by farmers to support the increase in soybean productivity. In addition, knowledge about climate mitigation and how to deal with unfavorable climatic conditions during the cultivation and post-harvest processes is also provided. With the actions or assistance carried out, it is expected to produce results that are in accordance with the goals that have been sought from the beginning. In addition, it can also build farmers' independence in fertilizers and independence in increasing soybean yields.

Results and Discussion

Location of Administrative Areas Coverage of Soybean Farmer Assistance

The mentoring area is located in 6 sub-districts in Cilacap Regency, Central Java, including the Districts of Majenang, Cimanggu, Gandrungmangu, Bantarsari, Kampung Laut, and Kawunganten. Astronomically, Cilacap Regency is located at 7°30'20"-7°45 South Latitude and between 108°4'30"-109°22'30" East Longitude with an area of 225,361 km2. Cilacap Regency is geographically located in the southern part of Central Java Province, facing directly to the waters of the Indian Ocean with a coastline of about 105 km. Assistance in Cilacap Regency is carried out on rice fields and plantation areas with a planting area of 895 ha.

The topography of the Cilacap Regency consists of sloping and hilly surfaces with an altitude between 6-198 m above sea level. The lowest topographic areas are generally in the southern part which is a coastal area with an altitude between 6-12 m above sea level, which includes the East Cilacap area, namely Nusawungu, Binangun, Adipala, Part Kesugihan, North Cilacap, Central Cilacap, South Cilacap, Kampung Laut, and part of Kawunganten. While the topography is lowland and slightly hilly, among others, Jeruklegi, Maos, Sampang, Kroya, Kedungreja, and Patimuan sub-districts with an altitude between 8-75 m above sea level. While the topography which includes highlands or hills covers the western part of Cilacap, namely Daeyeuhluhur, Wanareja, Majenang, Cimanggu, Karangpucung sub-districts, with an altitude between 75-198 m above sea level, and Cipari, Sidareja, part of Gandrungmangu, and part of Kawunganten with an altitude. between 23-75 m above sea level.

Land Use

From Table 2, land use in the location of farmer assistance has a variety of land uses. Dominantly land in the lowland areas of Kawunganten and Kampung Laut sub-districts has a tendency to use land as irrigated rice fields and rainfed rice fields in several locations that cannot be reached by irrigation coverage. In some conditions use pump irrigation if necessary. Meanwhile, the sub-districts of Majenang, Cimanggu, Bantarsari, and Gandrungmangu sub-districts have a uniform tendency with the type of land use as rainfed rice fields and dry fields. The complete land use can be seen in the table below.

Table 2. Landuse discription on Cilacap regency.

Location	Landuse description
Majenang district	Rainfed rice fields, there are several irrigated rice fields with open irrigation systems, there are several mixed gardens and dry fields.
Cimanggu district	Rice cultivation system – rice – secondary crops/horticulture.
Gandrungmangu district	Rainfed rice fields, dry land and mixed gardens.
Bantarsari district	Tendency to use intercropping system with perennial plants such as sengon and teak.
Kampung Laut district	Rainfed rice fields, irrigated rice fields, dry fields and mixed gardens.
Kawunganten district	Tendency to use intercropping of annual crops such as oranges, sengon, and teak.

Implementation of Mentoring Activities

Coordination of Site Survey and Determination of Demonstration Plot

Cilacap Regency as a representative of Central Java province experienced quite fluctuations in determining CPCL (Candidate Recipient Candidate Location) data. This was due to the unavailability of soybean seeds for CPCL in June, so there was a change of CPCL in August that was offered from the Service to PPLs to find vacant land locations. While that month was almost approaching the first planting season (Planting Season 1) and the climate and weather conditions in August were still quite a lot of rain, so for soybean planting in August there were concerns at the farmer level regarding the inaccuracy of the planting season for soybeans.

On August 13-14, 2021, a survey of land locations and coordination with the Cilacap Regency Agriculture Service and PPL will be carried out in 3 sub-districts designated as areas of the Soybean Cultivation Development Program in August. From the results of the coordination, it was agreed that the yellow soybean mentoring area in 2021 is in the area of 17 groups which are divided into 3 sub-districts, namely Majenang, Kawunganten, and Bantarsari Districts. The results of the coordination and site survey, the land used for determining the mentoring area covers an area of 300 ha.

In October 2021, there was an additional 595 ha of assistance area according to the October CPCL which was divided into 5 sub-districts, namely Majenang, Cimanggu, Gandrungmangu, Kampung Laut, and Kawunganten sub-districts on plantation land and dry land. This is done to meet the requirements for mentoring 1,000 ha of soybean cultivation.

Assistance areas are areas that receive soybean package assistance from the government. The demonstration plot area is determined based on the data and site survey. The main cluster demonstration plot is located in KT (farmer group). Madusari (Majenang), the mainstay cluster demonstration plot is located in KT. Tani Jaya (Kawunganten), and the development demonstration plot is located in KT. Klapa Sawit (Bantarsari) with each demonstration plot of 5 ha.

The demonstration plot area is determined by considering: (a) Suggestions from the PPL or the head of the Gapoktan in each sub-district; (b) Location of land that is close to road access so that it can be seen by group members or other groups; (c) Availability of water and proximity of water sources to land.

The majority of farmers are still doing soybean cultivation for the first time, so that land management cannot be carried out optimally and there is a need for socialization activities and Focus Group Discussions (FGD) so that farmers better understand how to cultivate soybeans in uncertain climate and weather conditions. In agricultural activities, farmers apply the rice-paddy-bero cropping pattern. This is because during the dry season the condition of the land is very dry and the soil is hard and cracked. Meanwhile, in the rainy season, the condition of the land can be flooded which causes farmers to often experience crop failure. As for the cropping system, the farmers as a whole have implemented a “dipanjak” (ditugal) planting system with 2-3 seeds per hole.

Figure 3. Coordination and field visits with PPL BPP Kawunganten District related to soybean cultivation activities.

Training and Focus Group Discussion

The training on making biofertilizers was carried out in the Districts of Bantarsari, Kawunganten, Majenang, and Gandrungmangu. The socialization of the introduction of Bacillus biological fertilizers and training on the manufacture of biological fertilizers were carried out by the Office of Agricultural Extension Center (BPP) Bantarsari District. Participants who attended were representatives of farmer groups in the mentoring area

who received soybean seed assistance. The enthusiasm of the farmer groups who attended was very high.

Figure 4. Training and FGD in Bantarsari District related to the propagation material and practice of making Bacillus sp.

Coordination, Implementation, and Application of UGM Technology in Demonstration Fields

Coordination with farmer groups related to the implementation of soybean planting starting from land processing, planting, and plant care. Farmer group's paddy fields used for demonstration plots are:

Table 3. Distribution of demonstration plots for the application of UGM technology in Cilacap Regency, Central Java Province.

No.	Kelompok Tani (Farmer Group)	Village/District	Area (ha)
1	KT. Klapa Sawit	Bulaksari/ Bantarsari	5,0
2	KT. Ngudi Rahayu	Bojong/Kawunganten	1,5
3	KT. Sri Makmur II	Bojong/ Kawunganten	1,5
4	KT. Tani Jaya	Bojong/Kawunganten	2,0
5	KT. Madusari	Padangsari/ Majenang	5,0
	Total		**15,0**

The implementation of UGM technology with Bacillus biofertilizer and Super Soybean Liquid Fertilizer is carried out with the following schedule:

Table 4. Schedule of UGM technology liquid fertilizer spraying.

No.	Spraying to	Type of fertilizers	Plant age (day after planting/dap)
1	first	*Bacillus*	10-14
2	second	*Bacillus*	17-21
3	Third	*Bacillus* + Super Soybean	24-28
4	Fourth	*Bacillus* + Super Soybean	31-35
5	Fifth	*Bacillus* + Super Soybean	38-42/before flowering
6	Sixth	*Bacillus* + Super Soybean	60-64
7	Seventh	*Bacillus* + Super Soybean	67-71

On August 16-10 September 2021, land preparation was carried out by spraying herbicides and continued with land clearing with lawn mowers and sickles when the grass/weeds had dried up. In addition, starting from August 21 to September 12 2021, planting is also carried out using the panjak (tugal) system alternately with land cultivation in the demonstration plot area. For the demonstration plot area in Majenang District, irrigation is also carried out with the aim that the soil is in a field capacity condition.

Figure 6. Assistance in herbicide spraying and soybean planting activities in the Klapa Sawit farmer group, Bulaksari Village, Bantarsari District.

Starting on September 5, 2021, Bacillus biological fertilizer and super soybean liquid fertilizer will be sprayed according to the age of the plant and the schedule given by the Field Assistant. On August 28-September 23, 2021, NPK fertilizer fertilization activities were carried out according to the age of the plant (14 and 28 DAP) and sprayed

pesticides to anticipate pest attacks. On October 23, 2021, weeding was carried out in the Madusari farmer group, Padangsari Village, Majenang District.

Figure 7. Assistance for weeding activities in the Madusari farmer group.

Assistance in Outer Areas of Demonstration

Assistance is carried out by visiting farmers and surveying the land to be planted with soybeans. Assistance to farmers is carried out by following the process of planting and maintenance activities as well as providing field socialization related to land management methods, plant spacing technology, planting systems, as well as the application and dosage of biological fertilizers and pesticides that have been given from the government. In addition, mentoring activities are carried out by visiting to monitor the growth of soybean plants and obstacles in the soybean cultivation process. Of all the farmers who received assistance in August, they were hesitant to plant soybean seeds because the planting time was approaching Planting Season I or the rainy season. The majority of farmers also complained about the attack of whitefly, walang sangit, and caterpillars in the vegetative phase and the attack of rats in the generative phase or pod filling.

Figure 9. Spraying of biological fertilizers in the Unggul Rahayu farmer group and monitoring soybean cultivation in the Sri Makmur farmer group.

Monitoring and Evaluation from the Ministry of Agriculture and Provincial Offices

On Friday, October 1, 2021, a visit was held from the Directorate of Various Nuts and Tubers (AKABI) of the Indonesian Ministry of Agriculture at the demonstration plot of Majenang District with PPL of Majenang District and AKABI Division of the Cilacap Regency Agriculture Office. The activity began with monitoring soybean plants in the demonstration plot area and continued with discussions on soybean cultivation issues on the land and related to the administration of farmer groups who received soybean seed assistance in August at the house of Mr. Baiquni as the head of the local Gapoktan.

On Wednesday, November 3, 2021, a visit from the Central Java Provincial Agriculture Service was held at the Majenang District demonstration plot with the PPL of Majenang District and the AKABI Division of the Cilacap Regency Agriculture Service. The activity began with monitoring the growth of soybean plants in the demonstration plot area and preparing a harvest schedule so that harvest activities could be carried out and continued with discussions on soybean cultivation issues in the land and related to the administration of farmer groups who received soybean seed assistance in August at the house of Mr. Baiquni as the head of the local Gapoktan.

Figure 10. Monitoring and evaluation of the Directorate of Various Nuts and Tubers (AKABI) of the Indonesian Ministry of Agriculture in Majenang District.

Figure 11. Discussion on soybean development with members of the Dinas in Majenang District.

Soybean Harvest: Demonstration Plots

Harvesting activities in the demonstration plots were carried out on November 17-19 2021 in 3 sub-districts, namely Bantarsari, Majenang, and Kawunganten. Harvesting was done by making tiled plots measuring 2.5 m x 2.5 m and calculating the number of plants, number of pods per clump, and wet weight of pods which were then calculated using the formula:

Soybean production weight = (Soybean wet weight) x 36,9% x 1.600 = ... Ton/ha

1. Bantarsari District

Harvesting activities were carried out on Wednesday, November 17, 2021, starting with Harvest and Postharvest FGDs and evaluation of the application of soybean cultivation technology to achieve successful production with members of the Klapa Sawit farmer group. The technology applied to the demonstration plots was the provision of Arbuscular Fungi Mycorrhizal (FMA) fertilizer which was applied to the seeds and Bacillus Plus fertilizer which was applied by spraying. The demonstration plot area used is 5 ha with the division of technology application, namely 4 ha of Bacillus Plus fertilizer and 1 ha of AMF fertilizer and Bacillus Plus fertilizer.

At the beginning of planting in August 2021, the condition of the demonstration plot area was dry and it was difficult to find a water source for irrigation with the aim of helping the seed growth process so that on an area of 4 ha the plant growth was not good. Meanwhile, the demonstration plot area that was given the addition of AMF fertilizer could grow well. Furthermore, when entering mid-September-November 2021, the intensity of the rain was quite high which caused the plants to be submerged in water so that the 4 ha plant experienced a puso even though efforts had been made to build a drainage channel.

Figure 13. Comparison of plants without AMF fertilizer and with AMF fertilizer and plant resistance to environmental factors in Bantarsari District.

Harvesting activities were carried out when the plants were 86 DAP by considering the physiological maturity criteria, namely yellowing/dropping leaves, browning pods, and pithy pods. In addition, harvesting activities are carried out by considering environmental factors (high rain intensity) to save crop yields from being submerged in rainwater. The yields on the demonstration plots can be seen in the table below:

Table 5. Soybean productivity results in demonstration plots in Bantarsari District.

Treatments	Planting distance (cm x cm)	Number of clumps	Number of pods	Actual weight (kg/6,25 m²)	productivity (ton/ha)	Price (Rp)
MF, *Bacillus* Plus, and micro elements fertilizers	25 x 25	121	90-100	3,86	2,24	8.000

Figure 14. Land conditions 2 weeks and 1 week before being affected by flooding in Majenang District.

2. Kawunganten District

Harvesting activities will be held on Friday, November 19, 2021 at the Tani Jaya farmer group. The technology applied to the demonstration plots was the provision of Arbuscular Fungi Mycorrhizal (FMA) fertilizer which was applied to the seeds and Bacillus fertilizer which was applied by spraying. The demonstration plot area used is 5 ha with the division of technology application, namely 4 ha of Bacillus fertilizer and 1 ha of AMF fertilizer and Bacillus fertilizer.

At the beginning of planting in August 2021, the condition of the demonstration plot area was dry and it was difficult to find a water source for irrigation with the aim of helping the seed growth process so that on an area of 4 ha the plant growth was not good. Meanwhile, the demonstration plot area that was given the addition of AMF fertilizer could grow well. Furthermore, when entering mid-September-November 2021, the intensity of the rain was quite high which caused the plants to be submerged in water so that the 4 ha plant experienced a puso even though efforts had been made to build a drainage channel. But there are some plots that still survive until harvest.

Figure 15. Land treated with Bacillus fertilizer that still survives until harvest in Kawunganten District.

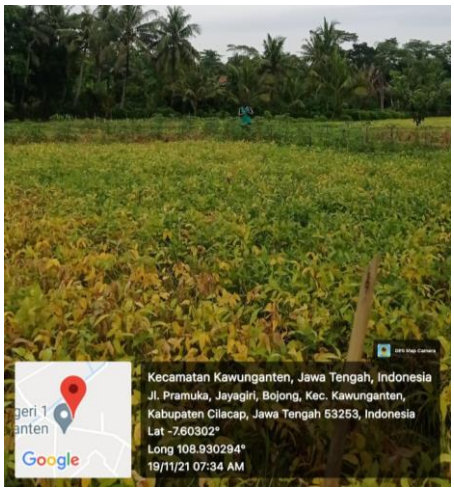

Figure 16. Land treated with FMA and Bacillus fertilizers in Kawunganten District.

Harvesting was carried out when the plants were 88 days after planting for Bacillus fertilizer treatment and 83 days after planting for AMF and Bacillus fertilizers taking into account the physiological maturity criteria, namely yellowing/dropping leaves, brown pods, and pithy pods. In addition, harvesting activities are carried out by considering environmental factors (high rain intensity) to save crop yields from being submerged in rainwater. Yields in the demonstration plots can be seen in the following table.

Table 6. Soybean productivity results in demonstration plots in Kawunganten District.

Treatments	Planting distance (cm x cm)	Number of clumps	Number of pods	Actual weight (kg/6,25 m²)	productivity (ton/ha)	Price (Rp)
FM, *Bacillus* Plus, Micro element fertilizers	25 x 25	144	140-150	6,38	3,77	8.000
Bacillus Plus and micro elements fertilizers	25 x 25	121	140-150	4,98	2,94	8.000

Figure 17. Harvesting process and tile plots on demonstration plot plots in Kawunganten District.

The increase in yields in several locations shows that the technology applied by UGM has a significant effect on soil improvement and nutrient uptake which has implications for increasing production, starting with increasing the number of pods. These results are very encouraging because soybeans are plants that are less responsive to fertilization. Pieter & Mejaya reported that the addition of biological fertilizers did not increase the seed yield of the three soybean varieties tested.[6]

Soybean Planting Outside Demonstration Land

For soybean planting outside the demonstration plot area, each farmer group received package assistance in the form of soybean seeds of the Anjasmoro, Rhizobium varieties, pesticides, liquid biological fertilizers, and NPK fertilizers. The results obtained can be seen in the following table.

[6] Yuniati Pieter and Made Jana Mejaya, "Pengaruh Pemupukan Hayati Terhadap Pertumbuhan Dan Hasil Kedelai Di Lahan Sawah," *Penelitian Pertanian Tanaman Pangan* 2, no. 1 (2018): 51–57.; Agus Wahyudin et al., "Respons Tanaman Kedelai (Glycine Max) Varietas Wilis Akibat Pemberian Berbagai Dosis Pupuk N, P, K, Dan Pupuk Guano Pada Tanah Inceptisol Jatinangor," *Kultivasi* 16, no. 2 (2017).

Tabel 7. Soybean productivity outside the demonstration plots in Majenang, Kawunganten, and Bantarsari Districts, Cilacap Regency.

No.	District/village	farmer group / farmer group association	Land area (ha)	production (ton/ha)	Price (Rp)
1	Majenang/ Padangsari	Margo Rahayu	25	-	-
2	Majenang/ Padangsari	Mekar Tani	25	-	-
3	Majenang/ Padangsari	Podomoro	25	-	-
4	Majenang/ Padangsari	Madusari	25	-	-
5	Kawunganten/ Bojong	Ngudi Rahayu	50	1,3-1,4	8.000
6	Kawunganten/ Bojong	Sri Makmur II	50	1,3-1,4	8.000
7	Kawunganten/ Bojong	Tani Jaya	50	1,3-1,4	8.000
8	Bantarsari/ Bulaksari	Karya Makmur	5	0,8-1,0	8.000
9	Bantarsari/ Bulaksari	Sida Sari	5	0,8-1,1	8.000
10	Bantarsari/ Bulaksari	Barokah Tani III	5	0,8-1,0	8.000
11	Bantarsari/ Bulaksari	Klapa Sawit	5	1,0-1,28	8.000
12	Bantarsari/ Bulaksari	Unggul Rahayu	5	0,9-1,0	8.000
13	Bantarsari/ Bulaksari	Satwa Tumangkar	5	0,9-1,0	8.000
14	Bantarsari/ Kamulyan	Mulya Sari	5	0,9-1,0	8.000
15	Bantarsari/ Cikedondong	Margo Mulyo I	5	0,9-1,0	8.000
16	Bantarsari/ Cikedondong	Larasati I	5	0,9-1,0	8.000
17	Bantarsari/ Bantarsari	Sri Makmur	5	0,9-1,0	8.000

The average productivity of soybean outside the demonstration plot area is still relatively low, especially compared to the results of assistance in the demonstration plot area which reached above 3.0 tons/ha. Of course, this shows that the role of mentoring provides many benefits that increase soybean productivity and quality, even though in Majenang Subdistrict was affected by flooding due to a broken embankment, so that soybeans that were ready to harvest were damaged and too late to be saved. However, the number of pods per plant in the range of 130-140 indicates a potential yield that is capable of above 3.0 tons/ha.

Conclusion

The results of the application of technology carried out by the Faculty of Agriculture Universitas Gadjah Mada Team proved to be able to increase soybean productivity and quality, although some were only partially (not fully) applied from the recommended technology package, this was constrained by many factors in each assistance area. In the Cilacap area, the demonstration plot results showed a fairly high potential reaching 2.24 tons/ha in Bantarsari, 2.94 and 3.77 tons/ha in Kawunganten, while in Majenang before harvesting soybeans showed good potential with 130-140 pods. per plant, this is of course the potential yield can reach above 3.0 tons/ha, but unfortunately it was affected by the flood due to the broken embankment, so the soybeans were inundated and damaged (rotten) in a relatively short time.

In terms of price, 2021 is a good price for soybean farmers in all assistance areas, the community can still enjoy selling prices in the range of more than Rp. 8,000.00. On the one hand, this price fluctuation is a good attraction, but on the other hand the timing that is not in accordance with the soybean planting season (especially planting in August or later) has the potential to be high risk as shown in the Cilacap area.

The process of technology transfer and adoption that occurred went well, and many farmers gave testimony that this mentoring program was good to be developed and continued, so that under conditions according to the growing season, they would be able to show even better potential.

The involvement of officers from the Agricultural Extension Center (BPP) and the Department of Agriculture and Food Security (DPKP) in all regions has shown an active contribution since the beginning of the mentoring program. It is hoped that the cooperation that has been going well can be sustainable in fostering and realizing the independence of the farming community in developing agricultural businesses that are suitable for agribusiness.

Disclosure

The authors declare that this is an original article which has not been published before and is not under consideration in another journal.

Conflicts of Interest

Authors declare that there are no conflicts of interest.

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