Study of Production and Distribution of Soybean Seeds In Central Java

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Abstract. The study on the production and distribution of soybean seeds was carried out in January-September 2020. The location of soybean seed production was 33 ha across Central Java Province, Grobogan, Kendal, and Brebes districts. The seeds produced are SS1 class consisting of Grobogan (22 ha), Anjasmoro (10 ha), and Dega 1 (1 ha). Seed production was carried out by cooperating with soybean seed partners. The data collected includes data on prospective soybean seed production, yield, and distribution of soybean seeds. Existing data were analyzed descriptively. The study results showed that the Grobogan seed's productivity was 2,150 kg/ha on average, while the Anjasmoro was 2,030 kg/ha, and Dega 1 was 2,120 kg/ha. Overall yields of soybean seeds from 33 ha were 73,803 kg. The percentage yield of Grobogan was 79.072%, Anjasmoro 80.20%, and Dega 1 was 66.67%. The seeds were distributed to seed producers in the Central Java Province recommended by the Central Java Seed Monitoring and Certification Agency and the Central Java Seed Producers and Traders Association.

1 Introduction

Soybean is a strategic commodity in the national food security system because it has become an essential part of most people's diet in Indonesia, both in urban and rural areas. Therefore, soybeans need to be available in sufficient quantities for a population whose numbers continue to increase from year to year. Domestic soybean production can only meet 30-40% of the need, while the rest must be imported [1]. Soybean demand in Indonesia increases from year to year, but production decreases due to a decrease in a harvested area [2]. Hasan *et al*.[3] state in their research which seeks alternative solutions in meeting soybean needs in Indonesia by using a dynamic system approach. The scenario results show that soybean production can be produced to meet the demand for soybeans in Indonesia for 20 years by increasing land expansion at least 70% per year, using seeds with a minimum production level of 2.4 tons/hectare or using short-lived seeds that can increase the planting index. at least 2.0, the use of biological fertilizers that can increase seed productivity at least 125%. Aside from being a food ingredient, soybean oil is a potential

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source of biodiesel. Adi and Kurniawati [4] research found that genotype G9 (L. Central Java × Sinabung-85) yielded 2,670 kg ton/hectare yield and seed oil production reached 504 kg ha-1. G9's maturity day is 80 days. The G9 genotype is prospective to be developed as a biodiesel source in Indonesia, a potential biodiesel source.

The results showed that most farmers (89%) had used high-yielding varieties, some used derivatives of high-yielding varieties of seeds from the yields of previously planted high-yielding varieties, and local varieties with a proportion of less than 2% [1] Various available literature states that soybean productivity in Indonesia can reach 2.0-2.5 t/ha. However, it cannot quickly adopt the technology described in these books, so soybean productivity in Indonesia is still around 1.0-1.5 t/ha, with an average of 1.25 t/ha [5].Soybean cultivation with an integrated plant and resource management approach (PTT) can produce 1.76-2.03 t/ha [6].

Soybean productivity increased by an average of 1.70% per year during the period 1970-2004. During 1990-2004, soybean productivity growth has declined but remains positive, around 1.01% per year. Increased productivity is a reflection of advances in soybean cultivation technology. However, productivity growth is still far below the rate of decline in harvested areas, so soybean production has declined sharply over the last 15 years [7]. The national average of soybean productivity at the farm level is only about 1.3 t/ha with a range of 0.6-2.0 t/ha, while at the research level, it has reached 1.7 -3.2 t/ha varying according to land fertility the application of technology[8]. Research in the Upper West Region of Ghana shows that the experience of farmers in soybean production dramatically affects the technical efficiency of output. With existing production technology and resources, soybean farmers can increase their current soybean production rate by 41% by implementing best production practices [9].

One of the technological innovations that can increase soybean productivity is superior varieties. From 1918 to 2015, 83 soybean varieties were released and attempted to be distributed to farmers. These high-yielding varieties have various characteristics of yield potential, harvest age, seed size, seed coat color, resistance to biotic/abiotic stress, and adaptation area. Varieties is one of the most important technology in seed; therefore, varieties must continue to be improved and develop pests, diseases, and other stresses. Apart from this, the formation of new varieties should also follow the preferences of users, especially farmers. Diversity of varieties is needed so that there is a choice of varieties for users. Early maturity, seed size, and yield potential are essential characters in Indonesian farmers' decision making in adopting new high yielding varieties [10].

The ability of the seed industry to supply quality seeds to rural areas is a prerequisite in accelerating the development of new high-yielding varieties. As with other food commodity seed systems, the soybean seed system also refers to aspects of efficiency, competitiveness, and continuity [11].

The problems faced in soybean seeding today are: not all of the high yielding varieties released can be adopted by farmers or used, the availability of source seeds and seeds that are spread "six right" cannot be fulfilled, the production and quality control institutions of seeds are not optimal, and not all farmers using high quality/certified seeds [11]. This paper will discuss the production and distribution of source seeds carried out by UPBS BPTP Central Java.

2 Methodology

An assessment of the production and distribution of soybean source seeds was carried out in January-September 2020. The location of seed production is 33 ha, in three areas in Central Java, namely in Grobogan, Kendal, and Brebes Regencies. The location in Brebes

Regency is in Glonggong Village, Wanasari District, the location in Grobogan Regency is in Tarub Village, Tawangharjo District, while in Kendal Regency, it is located in Kaliyoso Village, Kangkung District. The seeds produced were SS1 class soybean sources, consisting of varieties Grobogan (22 ha), Anjasmoro (10 ha), and Dega 1 (1 ha) Table 1). Seed production in collaboration with partners/soybean seed breeders. The data collected includes data on the production of prospective soybean seeds, yield, and distribution of soybean seed sources. Data were analyzed descriptively.

Table 1. Location, area, variety, and source of seeds used in the assessment 2020

No.	Discription	Location						
		Grobogan		Kendal		Brebes		
		Block 1	Block 2	Block 1	Block 2	Block 1	Block 2	Block 3
1.	Area (ha)	5	5	5	1	10	5	2
2.	Varieties	Grobogan	Grobogan	Grobogan	Dega 1	Anjasmoro	Grobogan	Grobogan
3.	Seed source	MMS	MMS	Agro Lestari	Balitkabi	Balitkabi	Agro Lestari	Agro Lestari

3 Results and Discussions

3.1 General description of the area

The soybean harvested area in Central Java in 2018 was 104,899 ha, with a production of 166,195 quintals and an average production of 15.84 quintals/ha [12]. The study location is soybean-producing in Central Java, namely in Brebes, Kendal, and Grobogan. The location in Grobogan Regency is in Tarub Village, Tawangharjo District. Tawangharjo sub-district has 8,360.39 ha consisting of 2,502.00 ha of paddy fields and 5,858.39 ha of dry land. All of the existing rice fields are rainfed land. Tarub Village is one of the villages in the Tawangharjo District, which has a rice field area of 242.36 ha, all of which are rainfed land and 447.47 ha are dry land [13]. Grobogan Regency is the most significant contributor to soybean production in Central Java. Based on (BPS Central Java Province, 2019), in Grobogan Regency in 2018, soybean production was number 1 in Central Java (41,866 quintals), followed by Cilacap Regency (30,495 quintals) and Purbalingga Regency at 11,479 quintals.

Kangkung Subdistrict, Kendal Regency has an area of 38.98 km2, most of which are rice fields. Rice fields are divided into two, namely irrigated rice fields and non-irrigated rice fields with an area of 18.25% (4,682 ha), and the rest for non-agricultural land of 1,341 ha (34.39%) and non-agricultural land of 732 ha (18,79%). Kalypso Village, one of the areas in Kangkung District, has 145 ha (3.72%) [14].

Wanasari District, Brebes Regency has an area of 7,534.27 ha consisting of 3,962.36 ha of paddy fields, 1,478.21 ha of non-rice fields, and 2,093.70 ha of non-rice fields. Glonggong Village is one of the Wanasari District areas, which has an area of 255.67 ha consisting of 178.11 ha of rice fields, 61.57 ha of non-rice fields, and 71.11 ha of agricultural land [15].

3.2 Soybean Production at the study site

The production of certified soybean seeds in Central Java in 2015-2018 is presented in Table 2. When related to the soybean harvested area in Central Java (104,899 ha), in 2018,

there was a shortage of seeds of - 1,328,130 kg (-21.10%). The shortcoming is that farmers generally use random seeds purchased in the market (consumable soybeans) and harvest.

Table 2. Production of certified soybean seeds in Central Java 2015-2018

No.	Year	Seed production (kg)				
		UD. Sujinah	**PB.Utama**	**PB. Agro Lestari**	**PB. Selvika Tani**	**Total**
1	2015	2,346,500	747,600	47,000	137,080	3,278,180
2	2016	1,831,000	44,540	580,100	127,650	2,583,290
3	2017	3,842,500	1,052,520	29,980	149,740	5,074,740
4	2018	4,068,900	739,100	68,700	89,110	4,965,810
Total		**7, 911,401**	**2,583,760**	**725,780**	**503,580**	**11,724,521**

Soybean seed varieties produced are Grobogan, Anjasmoro, and Dega 1, all three of which are superior varieties in great demand by farmers. According to [10], high-yielding varieties with large seeds in demand by farmers include Anjasmoro, Argomulyo, Grobogan, and Dega 1. Grobogan comes from breeding soybean plants that have long developed in Central Java, especially in the Grobogan Regency. The superior varieties of Grobogan, apart from having large seeds, are also early in age. Da-yong *et al*. [16] state that the preference reasons of farmers to the improved varieties are the High yield variety of soybean, non-pod shattering, grain size and color, and resistance to pests and diseases. Efforts to increase soybean productivity on upland are continuously carried out according to the principles of sustainable agriculture. Sustainable agriculture is concerned with the practical, productive, and inexpensive external input systems; respects local wisdom, and involves the role of farmers in the management and conservation of natural resources and agriculture

The variety of superior soybean varieties increases the choice and fulfills the preferences of soybean users. The superior soybean varieties available in Indonesia have various ripening ages, namely between 71 to 100 days, seed size between 7.0 and 23 g/100 seeds, green, yellow, black skins, and specific land adaptability, namely rice fields, dry acidity, dry land, and tidal land. Yield potential is genetically controlled. Potential yields will only be achieved under unimpeded management and cultivation conditions, a condition that is rarely encountered. However, supporting the right cultivation technology and selecting suitable locations and seasons will bring the potential closer to the actual results [10]. The grain size trait is controlled by many genes in soybeans and plays an essential role in determining the yield, quality, and appearance of seeds [17].

Weed control is an integral part of soybean cultivation and is very important to obtain high soybean yields. The development of economic thresholds for weed species is experiencing significant progress. Integrated weed management is focused on the effect of planting date, spacing, cultivators, use of cover crops, and decreasing herbicide levels. In this context, there is no single, ready, and indeterminate validity solution for weed management. Choosing an intelligent system that integrates basic ecological concepts and species biology into available tools (genetically modified crops, herbicides, biological control, etc.) will help with weed management [18].

Soybean seed size in Indonesia is categorized into three, namely: small (< 10 g/100 seeds), medium (10-14 g/100 seeds), and large sizes (> 14 g/100 seeds). Based on this classification, the grouping of 150 soybean genotypes showed that seed size was dominated by large seed size and was reflected in the average (15.80 g/100 seeds) [19]. Large-seed soybeans (>14 g per 100 seeds) have prospects for industrial raw materials, therefore increasing large-seed soybean varieties will provide many choices for farmers according to the cultivation environment and its designation. The availability of soybeans with large seed sizes is expected to be acceptable to reduce dependence on imported soybeans. Large

seeds are essential to support the fulfillment of industrial raw materials. So far, imports of soybeans with large seeds are mainly for the tempe industry [10]. Balitkabi has produced many varieties of large-seed soybeans. Anjasmoro, Grobogan, and Dega 1 varieties are soybean varieties included in large-seed soybeans weighing more than 14 g per 100 seeds.

Table 3. Description of soybean varieties Grobogan, Anjasmoro, and Dega 1.

No.	Discription	Anjasmoro	Grobogan	Dega 1
1	Released year	October 22, 2001	2008	September 5, 2016
2	Origin	Mass selection of the pure-line population of Manchuria	Purification of the local population of Malabar Grobogan	A single cross between Grobogan and Malabar
3	Age	82.5-92.5 days	± 76 days	±71 days (69-73 days)
4	Seed coat colour	Yellow	Yellow light	Yellow
5	Average yield	2.03 tons/ha	2.77 tons/ha	2.78 tons/ha
6	Yield potential	2.25 tons/ha	3.40 tons/ha	3.82 tons/ha
7	Weight 100 seeds	14.8-15.3 g	± 18 g	22.98 g
8	Protein content	41.8-42.1 %	43.9 %	37.78%
9	Fat content	17.2-18.6 %	18.4 %	17.29%

Source: [20]

The performance of soybean production at each location can be seen in Table 4. Overall, the yields of prospective soybean seeds for the Grobogan, Dega 1, and Anjasmoro varieties are lower than their potential yields. It is due to many mixtures of other varieties when roughing so that many junction plants are discarded. One of the production processes that distinguish soybean production for consumption and seeds is selecting deviant plants so that soybean purity is guaranteed.

Table 4. Performance of soybean seed production, 2020

No	Description	Districts							
		Grobogan		Kendal		Brebes			amount
		Block 1	Block 2	Block 1	Block 2	Block 1	Block 2	Block 3	
1.	Area (ha)	5	5	5	1	10	5	2	33
2.	Varieties	Grobogan	Grobogan	Grobogan	Dega 1	Anjasmoro	Grobogan	Grobogan	
3.	Yield (kg)	12,500	12,455	9,458	2,120	20,300	12,150	4,820	73,803
4.	Yield mastery (kg)	10,000	10,000	5,000	1,500	20,000	11,000	4,000	61,500
5.	Processing result (kg)	8,000	8,000	4,000	1,000	16,055	9,500	3,000	49,555
6.	Yield (%)	80.00	80.00	80.00	66.67	80,20	86.36	75.00	80.57
7.	Profit sharing (kg)								
	BPTP	7,000	6,000	2,000	600	7,000	5,000	0	27,600
	Partner	1,000	2,000	2,000	400	9,055	4,500	3,000	21,955
8.	Prospective seeds tested (kg)	7,000	6,000	2,000	600	7,000	5,000	0	27,600
9.	Seeds (kg)	7,000	6,000	2,000	600	7,000	5,000	0	27,600

In Table 4, it appears that the overall yield of the 33 and all varieties planted was 73,803 kg. Moreover, that is controlled by the manufacturer is 61,500 kg. After processing, the prospective soybean seeds are 49,555 kg. BPTP received a profit-sharing of 27,600 kg. The candidate seeds belonging to BPTP were laboratory tested to BPSB and declared all passed. The validity period of the soybean seed label according to the rules issued by BPBS is three months. Purwanti *et al*. [21] state that there was no significant difference in moisture content in the seeds for three months of storage. The moisture content increased in the fourth and fifth months of the treatment.

Seed yield is the percentage of seeds that become seeds after sorting or selecting seeds according to the physical characteristics of the seeds and the character of each variety [22]. Soybean seed yield of the three varieties differed in the range of 66.67-80.00%. The Grobogan variety in Grobogan and Kendal districts was 80.00%, while the yield in Brebes was 86.36% and 75%, with an average yield of 80.68%. According to [23], seed yield does not depend on the number of prospective seeds processed into clean seeds but is determined by the quality of the processed seeds. Umadi *et al*. [24] state that observation on the weight of 100 seeds, the treatment combination generally had more significant results than the weight of 100 grain in the description of Anjasmoro varieties of soybean plants (14.8-15.3g/100 seeds). The importance of 100 seeds sources in their experiment range from 14.53 to 17.23 g/100 roots, which meant that the size of the seed was large (>14 g/100 seeds). The large seeds contain more food reserves and could affect seed germination.

3.3 Distribution of soybean source seeds

Source seeds are planted to be produced into seeds. Soybean seeds produced are source seeds, so that this distribution is devoted to seed producers because they will be used as seeds. According to [25], the number of soybean seed producers in Indonesia in 2019 was 343 seed producers. For seed producers on Java island, most are in West Java with 50 seed producers, East Java with 41, and Central Java with 28 producers.

All producers or companies need to carry out the distribution function so that the resulting products can reach consumers. Three distribution systems are primarily used for agricultural products, namely (a) a direct distribution system, (b) a distribution system through retailers, (c) an intermediary distribution system, namely through agents/distribution. A direct-distribution system is a way of distributing goods or services directly from producers to final consumers. The owner producer controls the distribution of his goods directly to the final consumer. Distribution system through traders (retailers); in this system, producers sell goods to traders so that the goods become the property of traders, then traders sell directly to final consumers. The merchant himself will deliver the goods to the buyer. The intermediary system through agents, namely the marketing system, serves to facilitate the movement of products through the system. They do not have the right to own the product. Intermediary agents consist of brokers (brokers, sales agents, and factory representatives) [26].

In distributing soybean seed, it refers to SE Kabadan Litbang Pertanian No. 211.1/Kpts/TP.040/I/06/2015 and coordinate with the Department of Agriculture and Plantation of Central Java Province (Department of Food Crops Production and "BPSB") and the Association of Seed Producers and Traders to obtain input on potential recipients of soybean seed sources. Seed distribution is aimed at Soybean Seed Producers in the Soybean Seed Mandiri Village area, active and committed seed producers to produce soybean seeds, Parent Seed Centers, and prospective seed producers in collaboration with Seed Producers.

In addition, the distribution process must meet the required stages, starting from applying for seed assistance which is equipped with a prospective planting location and a

statement of ability to produce spread seeds. After obtaining approval from the Head of the Assessment Institut of agricultural technology central Java, seed collection can be carried out. Soybean seed production of 27.6 tons has been distributed to seed producers located in Central Java (Table 5). Soybean seed production of 27,600 kg has been allocated to 9 seed producers and distributed around 690 tons or can meet the seed needs of 11,500 ha.

Table 5. Distribution of soybean seed sources. 2020

No.	Receiver	varieties	Seed class	Number of seeds (kg)
1	CV PB Utama/Purworejo	Grobogan	SS	2,000
2	CV MMS/Sukoharjo	Grobogan	SS	2,000
3	PoktanSumber Agung/Klaten	Grobogan	SS	2,000
4	CV PUP/ Pati	Grobogan	SS	3,000
5	CV Alam Asri Sejahtera/Wonogiri	Grobogan	SS	1,000
6	PB SelvikaTani/Kebumen	Grobogan	SS	2,000
7	CV BerkahTaniMandiri/Sukoharjo	Grobogan	SS	1,000
8	Poktan Sumber Agung/Klaten	Grobogan	SS	2,000
9	Poktan Sumber Agung/Klaten	Grobogan	SS	1,000
10	CV Lulus Tani/Wonogiri	Grobogan	SS	1,000
11	CV Usaha Tani Mandiri/Purworejo	Grobogan	SS	3,000
12	CV Alam Asri Sejahtera/Wonogiri	Anjasmoro	SS	2,600
13	CV BerkahTani Mandiri/Sukoharjo	Anjasmoro	SS	1,000
14	CV Usaha Tani Mandiri/Purworejo	Anjasmoro	SS	2,000
15	CV Lulus Tani/Wonogiri	Anjasmoro	SS	1,000
16	CV Usaha Tani Mandiri/Purworejo	Anjasmoro	SS	400
17	CV Alam Asri Sejahtera/Wonogiri	Dega 1	SS	600
	Total			**27,600**

3.4 Problem

The problems faced in implementing source seed production are the availability of source seeds, certified soybean seeds, competition with other crops, and the need to partner. Conceptually, it can guarantee soybean seed sources from "Balai Penelitian Tanaman Aneka Kacang dan Umbi (Balitkabi") Malang. However, "Balitkabi" operationally has not been able to meet the needs of soybean seed sources nationally because the not yet optimal Information System constrains it for Soybean Seed Needs Nationally. Causes the production of source seeds, both in quantity and variety, to not fully match market demand. Similarly, source seeds are produced by seed producers, often only to meet their own needs and or on an order basis.

In addition to the availability of source seeds, seed producers have difficulty marketing soybean seeds if there is no program from the department. There is a tendency to produce certified seeds only to meet the needs of the official program. Individual farmers seldom use certified soybean seeds. It is indicated by the absence of farmers who buy certified seeds for consumption purposes, and seed producers also state that no farmers have ever purchased certified soybean seeds, so that seed producers do not provide accredited soybean seeds. Policies and institutions are needed that support the use of certified soybean seeds. In turn, the development of soybean plants will be optimal, and will the achievement of soybean self-sufficiency will be achieved.

The rapid deterioration of soybean seeds during storage in the tropics causes the shelf life of soybeans to be relatively low, thereby reducing the supply of quality seeds. The results of [27] showed that the shelf life of soybean seeds was influenced or determined by

the storage space. Soybean seeds of the Anjasmoro variety can be stored for six months in the freezer and refrigerator. Soybean seeds of the Anjasmoro variety can be stored for five months at room temperature storage conditions. In addition, according to the research results by [28], soybean seeds tend to lose their quality properties if stored in inappropriate storage conditions. A controlled atmosphere (CA) with 1 kPa O2 resulted in a higher germination percentage after seven months, but it is not recommended to use temperatures above 25 C during storage. Storage with high CO2 partial pressure had no additional effect on the physiological potential of soybean seed maintenance compared to O2 reduction alone. In line with the study of [29] that seed germination was very fast after harvest and began to decline as seed storage was extended for 3, 6, and 9 months, respectively.

Competition with other crops also causes farmers not to buy certified soybean seeds, and if they want to grow soybeans, they only need to buy them in the market, which is sold as consumption and or get assistance from the government. There is a tendency for farmers to be "forced" to grow soybeans. As an illustration, the R/C ratio for soybeans is 1.2 [30], while for green beans, it is 2.9 [31].

The Central Java Agricultural Technology Assessment Center (BPTP) does not have land to produce source seeds, so it needs partners. Problems arise because not all partners/landowners are willing to cooperate in planting soybean seeds for land suitability and competition with other commodities. It takes cooperation and persuasive negotiation.

4 Conclusions

Soybean seed production carried out by UPBS BPTP Central Java is carried out in partnership with soybean seed producers. The study results showed that the Grobogan seed's productivity was 2,150 kg/ha on average, while the Anjasmoro was 2,030 kg/ha, and Dega 1 was 2,120 kg/ha. Overall yields of soybean seeds from 33 ha were 73,803 kg. The percentage yield of Grobogan was 79,072%, Anjasmoro 80.20%, and Dega 1 was 66.67%. The seeds were distributed to seed producers in the Central Java Province recommended by the Department of Agriculture and Plantation of Central Java Province (the Central Java Seed Monitoring and Certification Agency) and the Central Java Seed Producers and Traders Association.

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