

Study of Rice (*oryza sativa*) Seed Breeding Based on Farmer Groups in Pangandaran Regency, West Java Province

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Abstract. The study was conducted in Sukanagara Village, Padaherang District, Pangandaran Regency from July to December 2021. This study consisted of three activities, namely: (1) demonstration of technology for rice seed production covering an area of 10 ha; (2) capacity building of farmers through technical guidance; and (3) initiation of farmer group-based rice seed production system. The objectives of this study are to: (1) produce certified rice seeds; (2) improve the capacity of farmers on rice seed production technology; (3) growing farmer groups for rice seed breeders. The data collected are: (a) the characteristics of the study site and the number of certified rice seeds were analyzed descriptively, (b) farmer capacity before and after technical guidance was analyzed by comparing changes in knowledge, attitudes, and skills of farmers before and after the technical guidance. The results of the study reported: (1) The demonstration of rice production technology produced 10 tons of certified rice seeds for each Inpari 32 and 42 varieties; (2) Farmers' capacity for rice seed production technology increases after technical guidance, and (3) Rice seed breeding farmer groups through a systems approach and technological and institutional assistance by officers were successfully formed.

Keywords: farmer group, breeding, rice seed,

INTRODUCTION

In the 2020-2024 State Medium-Term Development Plan, the government has set a target of rice availability from 39.2 million tons in 2020 to 46.8 million tons in 2024. However, the realization of rice production in 2020 did not reach the target of only 34, 99 million tons. This production was lower than the production data in 2018 which was 37.90 million tons. The decline in production was caused by a decrease in harvested area and low productivity of rice plants. The low productivity of rice plants is partly due to the use of low-quality seeds, so that the varieties planted do not produce yields in accordance with their potential. According to Juanda, [2], the decline in rice production is strongly influenced by the availability of quality seeds. It is because the use of poor quality seeds will reduce production. Without good seeds, although other factors are quite good, fertilizer and soil management and irrigation, production still cannot increase.

High-yielding varieties of rice seeds are one of the technological components that have a real role in increasing the productivity and quality of rice yields [3] and [4]. According to [5] the contribution of increasing the productivity of new high-yielding varieties to national rice production is quite large, around 56%. Furthermore, [6] stated that the contribution of interactions between irrigation water, new superior rice varieties (NIRVs), and fertilization to the rate of increase in rice production reached 75%. The availability of seeds on time, in the right quantity, on price, on quality, on location and on the right variety is still an obstacle at the farmer level, resulting in the use of quality seeds is still very limited or few. The results of the research of [7] show that the average rate of use of labeled seeds over the past ten years is only 22 percent, but the last two years tend to increase to 27 percent. The level of awareness of farmers to use high-quality seeds is still very limited. In general, farmers set aside part of their crops to be used as seeds in the next growing season. According to [8] around 60% of the rice seeds used by farmers come from the informal sector, namely in the form of grain that is

set aside from part of the previous season's harvest which is carried out repeatedly. This seed is of course not guaranteed the quality [9].

From 2007 to 2020, the Indonesian Agency for Agricultural Research and Development (IAARD) through the Indonesia Institute for Rice Research (ICRR), has released more than 100 NIRVs of site-specific rice for all agroecosystems [10]. However, some are less developed in the community, especially farmers. The low utilization of new certified superior varieties of rice seeds at the farmer level is thought to be caused by several things, including: (1) farmers are not familiar with certified seeds, (2) farmers are not familiar with NIRVs, (3) lack of information and counseling, and (4) there is no institutional or lack of existing formal and non-formal seed institutions [11].

In order to support the increase in rice production, productivity and quality, the development of farmer group-based rice seeds is carried out, involving all subsystems starting from upstream, onfarm (cultivation), downstream (processing and marketing), and supporting subsystems (extension). The objectives of this study are to: (1) Produce certified rice seeds; (2) Increasing the capacity of farmers in terms of rice seed production technology; (3) Growing farmer groups for rice seed breeders

METHODOLOGY

The study of rice seed (*Oryza sativa*) based on farmer groups was carried out at the Tirta Rahayu Farmer's Group, Sukanagara Village, Padoherang District, Pangandaran Regency, from July to December 2021. The study was carried out in a participatory manner on farmers. involving a number of farmers, Field Agricultural Extension, Plant Pest Organism Observer, and Seed Supervision and Certification Center, West Java.

Study consists of three activities, namely:

- 1) Demonstration of rice seed production technology on 10 ha of irrigated rice fields owned by farmers which was carried out outside the usual season for local farmers, namely in the 3rd planting season (MK II). All stages of demfarm activities starting from registration of seed certification, land preparation, seed preparation, roguing plant selection, maintenance, harvesting and post-harvesting, were carried out in a participatory manner involving 45 cooperative farmers.
- 2) Increasing the capacity of farmers through technical guidance (Bimtek) using the learning by doing method, namely, theoretical explanations and discussions in the room followed by direct practice in the field. Farmers participating in the technical guidance are all farmers involved in demonstration activities. The material for the technical guidance provided is rice seed production technology which includes:
 - (a) Seed preparation; (b) Nurseries and planting methods; (c) Pest/disease control, (d) Selection of rogue plants in the following phases: (a) early vegetative 35-45 days after planting (DAT), (b) late vegetative phase/maximum tiller (50-60 DAP)); (c) early generative/flowering phase (85-90 DAP) (d) late generative/mature phase (100-115 DAP); and (5) harvest and post-harvest technology for rice seed candidates. With this technical guidance, it is hoped that the knowledge, attitudes and skills of farmers in producing rice seeds will increase so that they become quality rice seed breeders according to predetermined standards.
- 3) Initiation of farmer group-based rice seed production system with the following stages:
 - a) Determine the goals to be achieved by the system as a whole
 - b) Identify what subsystems are needed to build a farmer group-based rice seed system and what is the role of each of these subsystems.
 - c) How is the relationship and interaction between one subsystem with another subsystem.
 - d) Verification and facilitation so that each subsystem can run according to their respective roles

The data and information collected were: (a) characteristics of the study site (biophysical and socio-economic, performance of existing rice farming, supporting institutions for rice farming), (b) growth of rice

plants (plant height and number of tillers), yield components (panicle length, number of panicles/clumps, number of filled grain/panicles, number of empty grains/panicles, weight of 1000 grains), and yield, (c) knowledge, attitudes, and skills of farmers to rice seed production technology before and after the technical guidance.

Data collection techniques used include: (1) Farm Record Keeping (FRK); (2) participation observation/observation; (3) direct measurements in the field; and (4) interviews. The data on the characteristics of the study site and the yield of certified rice seeds were analyzed descriptively [12] and then tabulated and tabulated to make it more informative and easy to understand. Farmer capacity data were analyzed by comparing changes in the knowledge, attitudes and skills of respondent farmers before (pre-test) and after (post-test) the technical guidance was carried out [13].

RESULTS AND DISCUSSION

1. General Condition of Study Site

Sukanegara Village is part of Padoherang District, located at an altitude of 10.72 m above sea level (asl) with an area of 118.74 km². The distance between Sukanegara Village to the District Capital is 7.09 km, while the distance to the Regency capital is 56.6 km [14]. In terms of accessibility, Sukanegara village is relatively good with the availability of support for adequate transportation facilities. Transportation to the sub-district, district and provincial capitals can be accessed by road, both two-wheeled and four-wheeled.

In 2019, Sukanegara Village had a population of 8,260 people, consisting of 4,170 women and 4,240 men. The total population of 8,260 people, most (67.09%) are in the productive age (15-65 years), 27.17% are in the unproductive age (0-15 years) and 5.74% are in the unproductive age (over 65 years). The majority of the population in Sukanegara Village (more than 95%) make a living as farmers, generally rice farmers.

2. Characteristics of Existing Rice Farming

Rice farming is the main livelihood of residents in Sukanegara Village, with an average area of 0.2 hectares cultivated with the status of most of the production sharing system. The rice fields in Sukanegara Village are relatively large, covering an area of 876 hectares, which are technically irrigated rice fields with water source from the Citanduy river with a planting index (IP) of 200 or 2 plantings in one year. If the need for rice seeds per hectare is 25 kg, then 21.9 tons of rice seeds are needed every season. The varieties of rice that are commonly grown are very diverse, including: Ciherang, Mawar, Inpari 42, Sintanur, Logawa, IR 32, with seed sources generally coming from ngalean (own harvest). Seeds are planted between 18-25 days after sowing, planted with a tile system with a spacing of 27 x 27 cm or 30 x 30 cm. The fertilizers used consisted of urea fertilizer of 150-200 kg/ha, and NPK phonska fertilizer of 100-200 kg/ha.

The productivity of lowland rice in the research location is still relatively low, with an average of 4.9 tons/ha Milled Dry Grain (MDG) in the rainy season and 3.5 tons/ha Milled Dry Grain (MDG) in the dry season compared to the average productivity of Pangandaran Regency, which is 5.68 t/ha. The low productivity of rice is thought to be due to the low level of fertility of the paddy fields and the high level of attacks of various pests and diseases that attack rice plants.

It is known that farmers at the study site have never fertilized with organic fertilizer and rice straw was never returned to the land (wasted/burned). Pests and diseases that commonly attack rice crops include: rice stem borer, brown planthopper (*Nilaparvata lugens*), walang sangit (*Leptocorisa Oratorius*) and bacterial leaf blight (BLB).

3. Characteristics of Farmer Groups Implementing Rice Seed Breeding

Based on the results of the identification, the Tirta Rahayu farmer group was formed in 2013 and has been registered in Simluhtan, including the advanced group class category with a total of 75 members. The Tirta Rahayu farmer group has met the requirements to become a candidate for rice seed breeders because it has been legally ratified.

Institutionally, the Tirta Rahayu farmer group has not run according to its role and function. According to [15] farmer groups have various roles including as a place for learning, a forum for collaboration, a forum for organization, a farming production unit, and as a unit to respond to feedback on technological performance. Although the Tirta Rahayu farmer group already has a relatively complete organizational structure, each of the fields within the structure has not yet been implemented because the group administrators have not yet understood their respective duties, roles and functions. A clear division of tasks is a very important factor in an organization. According to [16], one of the factors that greatly influences group dynamics is the task function, which is a set of tasks that must be carried out by each group member according to their position in the group structure. The division of tasks is absolutely carried out within the organization so that there is no overlap in the implementation of work. So far, a set of group tasks is still based on and carried out by the group leader.

The Tirta Rahayu farmer group does not yet have AD/ART and a schedule for regular group meetings. Group meetings are only held incidentally, especially when receiving programs from the government. The Tirta Rahayu farmer group also does not have experience as a rice seed breeder and does not yet have the facilities as one of the requirements to become a breeder such as: drying floor, storage warehouse, blower, dryer, etc.

4. Demfarm of Rice Seed Production Technology

Farm demonstration of 10 hectares of rice seed production technology was carried out outside the usual growing season for local farmers, namely in the 3rd Planting Season or the 2nd Dry Season. Meanwhile, the surrounding rice field area is 866 ha which is not planted with rice (fallow). This condition causes the migration of pests and diseases from fallow land to farm demonstration land. This is indicated by the discovery of stem borer pests (*Scirpophaga innotata*) that attack rice plants in the vegetative phase with an attack rate between 12.55%-12.60% and in the generative phase with an attack rate between 2.3%-3.2%; rice bug pest (*Leptocorisa oratorius*), brown spot disease (*Drechslera oryzae*), and Bacterial Leaf Blight which was only found in the generative phase with an attack rate of 11.48% on the Inpari 32 variety and 7.77% on the Inpari 32 variety.

However, these pests and diseases did not cause rice crops to fail (puso) and could relatively be overcome by spraying using biological pesticides on a regular basis once a week. Although not optimal, in general the growth of rice plants is relatively good. The plant height of the two varieties planted was relatively the same as the plant height based on the description, namely, 97.00 cm (Inpari 32) and 93.00 cm (Inpari 42). Meanwhile, the number of productive tillers per clump of the two varieties was relatively lower than the results of other previous studies [17] in Ciamis Regency, namely, Inpari 32 with 29.10 tillers and Inpari 42 with 24.80 tillers. The presence of pests and diseases affects the yield component and the yield of rice obtained. The Inpari 32 variety gave the number of filled grains per panicle of 90.42 grains, lower than the results of previous studies [18] which reached 145 grains/panicle. While the Inpari 42 variety gave the number of filled grains per panicle as much as 93.07 grains, lower than the description (Sasmita *et al*, 2020) which reached 123 grains/panicle.

According to [19] if bacterial leaf blight attacks occur in the flowering phase, then the grain filling process becomes imperfect which causes the grain to be not fully filled or even empty. Under these conditions, yield losses can reach 50-70 percent. Furthermore, according to [20], rice bug attack rice grains that are ripe with milk by sucking liquid rice grains from flower stalks (paniculae) in the initial phase of seed formation or flowering phase. As a result of this pest attack, the rice grains become imperfect. According to [21] in [22] pest attacks can reduce yields by up to 50%. Furthermore, according to Yanti *et al*, (2018) bacterial leaf blight caused by *Xanthomonas oryzae* pv. *Oryzae* (Xoo) can reduce rice yield by 30-40%. Data on rice productivity of Inpari 32 and 42 varieties at the location of the breeding demfarm are presented in Table 1.

In table 1, it can be seen that based on the results of the tile samples, the Inpari 32 and Inpari 42 varieties gave lower yields compared to the results based on the description, which were 6.30 t/ha and 7.11 t/ha, respectively [10]. Meanwhile, based on real yields, the 10-hectare demfarm yielded 44.90 tons of grain, namely 23.38 tons of Inpari 32 variety and 21.52 tons of Inpari 42 variety. From these yields, 10 tons of certified rice seeds were produced for each of the 32 and 42 Inpari varieties.

Table 1. Rice productivity of Inpari 32 and 42 varieties at the location of a rice seed breeding demonstration farm in Sukanegara Village, Padaherang District, Pangandaran Regency. 2021.

Sample Number	Inpari 32		Inpari 42	
	Study Results t/ha (KA 14%)	Based on Description t/ha (KA 14%)	Study Results t/ha (KA 14%)	Based on Description t/ha (KA 14%)
1	4.55	6,30	4.05	7,11
2	4.95		4.29	
3	4.77		4.31	
Average	4.76		4.22	

Although the yields obtained are not optimal, the demonstration activities carried out have shown real rice seed production technology and gave confidence to the farmers in the Tirta Rahayu farmer group to continue their rice seed breeding business. This is indicated by the cooperation agreement between the Tirta Rahayu farmer group and CV. "Tunas Pangan Jaya" Tasikmalaya Regency to produce the Inpari 32 variety of rice seeds covering an area of 24 hectares in the next planting season (MT I -2021-2022).

5. The Effect of Technical Guidance on Farmers' Knowledge, Attitudes and Skills

a. Characteristics of Respondents

According to [24], the age distribution of farmers based on economically productive age can be divided into 3 classifications, namely the 0-14 year age group is the unproductive age group, the 15-64 year age group is the productive age group, and the age group above 65 years is an age group that is no longer productive. Respondent farmers who were involved in technical guidance activities as many as 31 people (68.89%) were in the productive age group and 11 people (31.11%) were in the unproductive age group.

Based on the level of education, as many as 14 people (31%) have elementary school education (SD), 14 people (31%) have high school education (SMP), 3 people (6.67%) have high school education (SLA) and 3 people (6.67%) have a bachelor's degree (S1). In terms of farming experience, respondent farmers have the lowest farming experience of 10 years, while the highest is 30 years. This shows that the respondent farmers already have the ability and good experience in carrying out rice farming activities.

b. Knowledge, Attitude and Skills

The technical guidance materials analyzed to see changes in the knowledge, attitudes and skills of respondent farmers focused on roguing plant selection techniques and post-harvest handling of rice seeds. Based on the results of the calculation of the pre-test and post-test scores, it shows that the technical guidance carried out improves the knowledge, attitudes and skills of respondent farmers towards the material provided (Table 2).

Table 2. The effect of technical guidance on the knowledge, attitudes and skills of respondent farmers in Sukanegara Village, Padaherang District, Pangandaran Regency. 2021.

Materi Bimbingan Teknis	Aspects of assessment	Pre Test (Average is correct %)	Post Test (Average is correct %)	Enhancement (%)
Deviant plant selection technique (<i>roguing</i>)	Knowledge	72,50	85,50	13,00
	Attitude	33,00	57,00	24,00
	Skills	35,83	61,67	25,83
harvest and post-harvest technology for rice seed candidates.	Knowledge	63,57	80,71	17,14
	Attitude	25,00	50,00	25,00
	Skills	37,50	65,00	27,50

In Table 2, it can be seen that the skills and attitudes of the respondent farmers showed a higher increase in value compared to the knowledge aspect of the material provided. The higher improvement in the skills and attitudes of respondent farmers is because the majority of respondent farmers (31%) have elementary education but have relatively long experience in farming (10-25 years). Respondent farmers are better able to answer questions through direct practice than answering questions in writing. This is in line with the theory put forward

6. Initiation of Farmer Group-Based Rice Seed Production System

Taking into account the meaning of the system, the initiation of a farmer group-based rice seed production system is carried out in the following stages:

Based on the results of discussions with farmer groups, Farmer Extension Officers (PPL), and the Seed Supervision and Certification Center (BPSB) of West Java, it was agreed that the overall goal of the system is to produce certified rice seeds (ES Class) based on farmer groups.

Based on the results of the identification and analysis carried out in a participatory manner with farmer groups, Farmer Extension Officers, and BPSB, there are four subsystems that play a role and are needed to develop a farmer group-based seed system as follows:

As a subsystem of providing stock seeds (SS class) to be propagated into spread seeds (ES) by the Tirta Rahyu farmer group, namely: "Panca Karya" rice seed breeder group located in Banjarsari District, Ciamis Regency.

As a Subsystem of Extension Seed Producing in this study is the Tirta Rahayu farmer group as a potential breeder who will produce certified extension agents (ES). Because the Tirta Rahayu farmer group does not yet have a recommendation as a rice seed breeder, in this study the Tirta Rahayu farmer group partnered with CV. Gapoktan Mukti is a breeder who already has a recommendation as a rice seed rooter from the BPSBTPH of West Java Province.

The Seed Supervision and Certification Subsystem in this study is BPSBTPH West Java Province, Pangandaran region. BPSB has the function of labeling according to the level of seed to be produced with different colors, for example, purple for the main seed (SS) and blue for the best quality dispersing seeds (ES) and pink for the next grade.

As a marketing subsystem that functions in marketing rice seeds produced by the Tirta Rahayu farmer group, namely: CV. Mukti Gapoktan, distribution kiosks, and farmers around the study site.

The Tirta Rahayu farmer group as *Extension Seed Producing Subsystem* in partnership with CV. Gapoktan Mukti submits an application to become a candidate for rice seed breeders to the local BPSB with the conditions according to the class of seeds to be produced as stipulated in the Indonesian National Standard (SNI).

[illegible]

planting, to seed packaging according to technical instructions under the supervision of BPSBTPH West Java Province, Pangandaran Region as a *Seed Supervision and Certification Subsystem*.

The rice seeds produced by the Sri Rahayu farmer group were then accommodated by CV. Gapoktan Mukti to be marketed to farmers around and outside the study location with labels and packaging still in the name of CV. Mukti Gapoktan. The linkages and interactions between one subsystem in the rice seed production system based on farmer groups in the Sri Rahayu farmer group is presented in Figure 1.

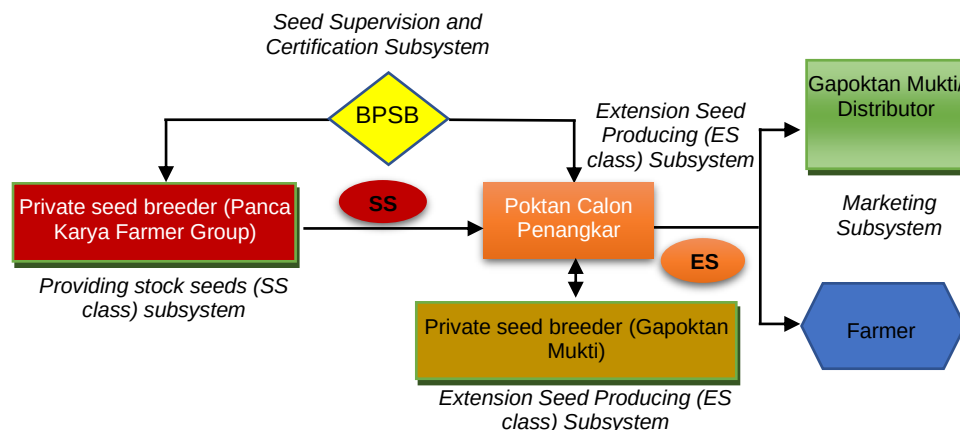


Figure 1. Rice Seed Production System Based on Farmer Groups at Tirta Rahayu Farmers Group, Sukanegara Village, Padaherang District, Pangandaran Regency.

During the seed production process, field extension workers (PPL), POPT and BPSB provide assistance from technical, socio-economic and institutional aspects to ensure the seed production system runs according to the predetermined objectives. The results of the study reported that the farmer group-based rice seed production system was in line with the overall system objective, namely, producing certified (ES grade) rice seed production.

CONCLUSION

1. The results of the study reported that the demonstration of rice seed technology implemented was able to produce 10 tons of certified rice seeds (ES Class) for each of the 32 and 42 Inpari varieties and gave confidence to farmers to continue their rice seed breeding business.
2. The technical guidance which is carried out by means of lectures, discussions, and field practice using denfarm media is effective in increasing the knowledge, attitudes and skills of respondent farmers towards rice seed production technology.
3. The growth and development of rice seed breeding based on farmer groups is carried out with a systems approach through assistance in technical, socio-economic and institutional aspects

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