Development and problems in the spread of new improved rice varieties in Central Java Province

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Abstract. To support increased rice production, the government is trying to increase the use of superior varieties in farming. In line with this, a study has been carried out aimed at analyzing developments, problems in the distribution, and farming of improved rice varieties. The research was conducted in Central Java Province in 2020. The research sample consisted of 30 rice farmers and various institutions related to this study. Data analysis was carried out quantitatively and descriptively qualitatively. The results of the study showed that the distribution of superior rice varieties (2015-2019) was dominated by Ciherang (31.5%) and IR64 (18.1%) varieties, while the new superior variety Inpari had only 3.9% of the spread. Problems faced in the distribution of superior rice varieties include: limited availability of good quality seeds, low yield productivity, and insufficient resistance to pests and diseases. The results of rice farming analysis at MT-II 2020, farming profits for the Ciherang and Inpari 32 varieties, respectively, are IDR. 9.5 million and in IDR 11.0 million per hectare per season. In order to increase the spread of improved rice varieties, it is necessary to support the provision of seeds with high productivity potential, farming pilots and support from government programs.

1 Introduction

Rice is the main food commodity in Indonesia. In order to meet the food needs of the community, which is increasing along with the increase in population, the government has made various efforts to increase rice production. One of the efforts made is through the use of new improved varieties of rice [1]. This is currently being prioritized because the area of agricultural land in Indonesia is decreasing, making it difficult to increase rice production through increasing planting area. According to [2], the real contribution of the use of superior varieties to the increase in rice production in Indonesia can be seen from the

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achievement of rice self-sufficiency in 1984. Furthermore, [3] revealed that superior varieties can contribute to increasing national rice production by up to 75% if integrated with irrigation and fertilization technology.

In order to support efforts to increase rice production, the Agency for Agricultural Research and Development has produced various new improved rice varieties (NIRVs) with their respective advantages, including having a high level of productivity, specific agro ecosystems, responsiveness to fertilization and resistance to biotic and abiotic stresses. Of the various NIRVs that have been developed, until now the level of distribution is still very limited. In general, farmers tend to still use superior varieties of rice that have been released for a long time, such as Ciherang, Mekongga, and IR64. According to [4]The factors that are considered by farmers in using superior rice varieties include the characteristics of the superior rice varieties (such as plant age, productivity, and resistance to pests and diseases) and the availability of seeds. In this case, farmers are actually interested in using new high-yielding varieties of rice, but are constrained by the low level of seed availability. Likewise research results [5]who revealed that one of the obstacles in increasing rice production in South Sumatra is the use of new, low-yielding varieties. Several factors have hampered the adoption of these NIRVs, including low seed availability, low labor availability due to competition from other businesses, and less guaranteed availability of fertilizers.

Central Java is one of the centers of rice production in Indonesia. During the period 2015-2018, rice production in Central Java decreased by 12.42% [6]. With the relatively stable development of rice planted area in Central Java, the decline in production may occur due to a decrease in productivity. Most of the farmers in Central Java still use the old varieties, so that if used continuously it is feared that it will cause resistance to certain pests and cause a decrease in productivity. Meanwhile, the use of new improved varieties of rice in Central Java is still very low. The total use of Inpari varieties in Central Java only reaches 6% of the total rice varieties used [7].

Based on the description above, this paper aims to analyze the spread of new improved varieties, the factors that influence it and the problems in the distribution of new improved varieties in Central Java.

2 Methodology

2.1 Study areas and respondents

This study was conducted in Batang District, Central Java Province. The primary data was obtained from interviewing 30 respondent farmers. Meanwhile, the secondary data in this study were obtained from various sources or related agencies such as the Directorate General of Food Crops, Indonesian Center for Rice Research (ICRR), Department of Agriculture and Plantation, and the Seed Supervision and Certification Center (SSCC).

2.2 Methods

The data collection used survey methods and focus group discussions with several parties/officials in relevant agencies such as the Directorate General of Food Crops, Indonesian Center for Rice Research (ICRR), Department of Agriculture and Plantation, and the Seed Supervision and Certification Center. The analysis method used in the study was qualitative descriptive, presented in table and pictures with a simple analysis. The recommendation for strategies to increase the spread of new improved rice varieties to

increase national rice production was obtained from the synthesis of the result and discussion.

3 Results and discussion

3.1 Dynamics of planted area and rice seed production in Central Java

Rice planted area in Central Java in general has increased from 2009-2018. However, rice production is decreasing. This can be seen in 2018 rice production is lower than 2017 even though there was an increase in planting area in that year which was accompanied by an increase in the need for rice seeds in Central Java. Since 2013-2018, there has been a deficit in meeting the needs of rice seeds in Central Java.

Table 1. Development of rice seed production and demand in Central Java, 2009-2018

Year	Planted Area (ha)	Seed production (tonnes)	Seed requirement (tons)	Pros/Disadvantages (tons)
2009	1,780,190	46,858,17	44,504.75	2,080.42
2010	1,801,397	51,706.82	45,034.92	6,671.90
2011	1,754,729	63,447.88	43,868.23	19,579.68
2012	1,796,919	54,412.64	44,922.98	9,489.68
2013	1,858,044	39,716.51	46,451.10	-6,734.59
2014	1,804,761	38.250.00	46,138,20	-7,888,82
2015	1,899,767	39,586.00	47,494.18	-7,900,18
2016	2.160.584	41,402.00	54,014,60	-12,612.60
2017	1,980,978	39,753.00	49,524.45	-9,771.45
2018	1,991,680	38,667,00	49,792.00	-11,125.00

Source: [7]

Rice seed producers in Central Java are only able to meet 39,000 tons of rice seeds, while the need for rice seeds reached 49,000 tons in 2018. The shortage of rice seeds is usually met from other regions, such as West Java and East Java. The current shortage of rice seeds in Central Java is much different from the conditions in 2011-2012. At that time, Central Java was able to produce rice seeds of up to 60,000 tons. To develop seed production in Central Java, the Central Java Provincial Government empowers seed breeders and supports a program of 1,000 seed independent villages in Indonesia. The number of villages involved in the national program reached 55 villages.

Rice seeds that are mostly produced in Central Java are staple seeds (BP) which reach 89%. The most widely produced rice staple seeds in Sragen Regency are:as much as 8,724.8 tons. Meanwhile, the spread seeds (BR) and basic seeds (BD) only reached 10% and 1% of the total seed production in West Java.Rice seed production at UPBS-SSCC Central Java at the end of 2018 was 19.30 tons. The seeds are classified as Basic Seed (FS/Foundation Seed/White Label) and Principal Seed (SS/Stock Seed/Purple Label). Rice seed production for several new improved varieties in UPBS BPTP Central Java can be seen in table 2.

Table 2. Seed production of several NIRVs at UPBS-SSCC Central Java, 2019.

Seed varieties	Production by seed class (tonnes)	
	BD/FS (white label)	BP/SS (purple label)
Inpari 30	7.42	2.54
Inpari 32	-	3.78
Inpari 42	1.45	2.70
Inpari 43	1.41	-

Source:[8]

The results of the production of rice source seeds from UPBS BPTP Central Java have all been distributed according to demand both through sales and assistance to several districts in Central Java Province, including Brebes Regency, Pemalang Regency, Sragen Regency, Batang Regency, Pekalongan Regency, Kebumen Regency and Regency Boyolali. There are four NIRVs that have been produced and are most in demand by farmers, namely Inpari 32, in addition to Inpari 30, 42 and 43. However, the seed production of NIRVs in UPBS BPSB Central Java is still relatively low when compared to the total need for seeds. which is there.

3.2 Distribution of new Improved varieties of rice in Central Java Jawa

During the period 2014-2018, the Ciherang variety was still dominantly used by farmers in Central Java. This is evident from the planted area of the Ciherang variety, which still ranks first among other varieties from year to year. After that followed by varieties IR64, Situ Bagendit, Mekongga and others. Meanwhile, new high-yielding varieties such as Inpari have not developed too much in Central Java, but from year to year it has begun to show an increase. The total planted area of the Inpari variety in 2018 showed an increase of more than 100% from 2014. However, the total planted area of the Inpari variety in Central Java only reached 6% of the total planted area of rice in Central Java.

Table 3. Development of rice planted area per variety in Central Java, 2014-2018 (tonnes)

Varieties	2014	2015	2016	2017	2018
IR 64	357,109	362,108	384,487	341,682	300,361
Membramo	21,223	32,665	32001	24,979	20,590
Way Apo Bro	12,180	6,939	8,210	16,991	14,568
Cheerang	657,930	470,678	607,001	629,933	608,285
Situ Bagendit	287,902	207,770	219,108	247,198	203,400
Pepe	61,456	86,431	64,398	95.570	82,347
Logwa	57,580	46,317	31,885	36,311	34,044
Mekongga	75,929	99,901	103,703	166,943	125,654
Inpari	24,176	21,685	36,800	51,046	119,690
Sidnuk	12,918	34,445	31,877	25,093	19,849
Others	277,124	530,828	641,114	345.232	462.892
amount	1,845,527	1,899,767	2,160,584	1,980,978	1,991,680

Source:[7,8]

When viewed from the development of planting area per variety from year to year, the Ciherang variety showed a decline from 2014 which reached 35.65% to 30.54% in 2018 of the total rice planted area in Central Java. Likewise with the IR64 variety, in 2014, the percentage of planted area in Central Java reached 19.35% and then continued to decline until in 2018 it reached 15.08 percent. Meanwhile, the Inpari variety actually showed an increase in planted area of more than 100% during 2014-2018. This shows that farmers in Central Java are becoming interested in using new improved varieties such as Inpari.

In 2019, there was a decrease in the area of rice planted in Central Java compared to 2018. The development of the distribution of rice varieties in Central Java in 2019 has not changed much. Ciherang, IR64, Mekongga and Situ Bagendit varieties also still dominate in Central Java. As for the Inpari variety, the most widely used is Inpari 32. The distribution area of the Inpari 32 variety in Central Java reaches 190,397 hectares (Table 4). In 2020, it is estimated that the distribution area can increase again. It is based on data from [8]which shows that until April 2020, the distribution area of the Inpari 32 variety has reached 107,617 ha. Meanwhile for the Inpari 30 variety, in 2019 it was not used by farmers in Central Java. This can be because farmers cannot access the seeds of these varieties. However, in 2020, the Inpari 30 variety began to be used again with a distribution area of 9,432 hectares (until April 2020).

Table 4. Wide distribution of rice varieties in Central Java, 2019

No.	Varieties	MT. 2019	MT. 2020 (until April)
1.	Ciherang	517,344	249,790
2.	Mekongga	105,074	41,769
3.	Situ Bagendit	189,393	69,208
4.	Cilamaya Appears	11,333	2,424
5.	IR 64	247,361	70,415
6.	Inpari 30	0	9,432
7.	Inpari 32	190,397	107,617
8.	Inpari 42	11,212	51,612
9.	Cigeulis	3,044	1,141
10.	Way Apo Buru	8,182	1,848
11.	Other Varieties	318,738	227,930
	amount	1,602,078	605,256

Source:[8]

3.3 Factors that influence and problems with the spread of new improved varieties of rice

The results of the study through interviews with respondent farmers in Batang Regency, Central Java, showed that the factors that determine farmers in adopting/using new improved varieties of rice, among others, are the characteristics of the NIRVs and the availability of seeds. Other than that, [9] also revealed that access to irrigation, access to credit, and membership of farmer groups positively and significantly affect the adoption of superior varieties.From the aspect of rice variety characteristics,High crop productivity is not the only major consideration for farmers in choosing varieties. The age of the plant and the size of the grain are also one of the considerations in the use of superior varieties. This is because the size of the grain affects the price of rice at the consumer level, related to consumer preferences in West Java. According to [10,11], in the market driven era, all production processes refer to the satisfaction of market needs so that the decision to

determine the value of the final product involves consumer opinion. The people of Central Java prefer rice with an unscented aroma of rice and a fluffier texture of rice.

Efforts to increase the use of NIRVs in Central Java have been carried out to replace old varieties. This is done because it is feared that the use of the same variety continuously will actually cause resistance to certain pests so that it will reduce productivity [12]. Efforts to replace these varieties are not easy because some producers or breeders are less interested in producing seeds that are not yet commercial. In addition, the productivity of NIRVs with varieties that have been circulating for a long time is not much different, low yield, small grain size, less fluffier taste of rice, resistance to pests and water shortages, and poor quality of seeds (especially aid seeds), so that farmers are reluctant to switch to using certain new improved varieties. The seeds of new improved varieties that have been produced will be in vain if they are not used by farmers, therefore they need to be published or communicated by means of dissemination or dissemination to stakeholders. This is in line with the research results of [13] which revealed that in order to increase the spread of high-yielding rice varieties in Nepal, it is necessary to disseminate information through counseling and field demonstrations.

Meanwhile, there are several new improved varieties of rice which are actually in accordance with the preferences of farmers in Central Java, such as Inpari 32. The level of preference of farmers for Inpari 32 seeds and plantings in Central Java is in the high/positive category, which means that farmers like Inpari 32 seeds and plantings. Thus, the efforts to promote and disseminate the Inpari 32 variety have been successful considering the positive response of the farmers in Central Java. Farmers like the Inpari 32 variety because economically, farming is more profitable than using the Ciherang variety. Comparison of farming analysis using Inpari 32 and Ciherang varieties in Batang district, Central Java can be seen in table 5

Table 5. Comparison of farming analysis using Inpari 32 and Ciherang varieties in Batang district, Central Java, 2020

Description	Varieties	
	Inpari 32	**Ciherang**
A. Reception		
1. Productivity (Kg/ha)	6.260	5.520
2. Price (IDR/Kg)	4,200	4,200
3. Revenue Value (IDR)	26,292,000	23,184,000
B. Production Cost (IDR)	15,290,000	13,690,000
C. Profit from farming (IDR)	11.002.000	9,494,000
D. R/C	1.72	1.69

Based on the results of the analysis, it is known that the total cost of production of Inpari 32 rice is IDR.15,290,000 which consists of wages (tilling, planting, maintenance and harvesting), production costs (seeds, fertilizers, pesticides) and other costs (irrigation and rent). When compared with the Ciherang variety with a total production cost of IDR. 13,690,000, the production cost of the Inpari 32 variety is higher. The production cost of rice farming for the Inpari 32 variety is higher because this variety is less resistant to biotype 2 brown planthopper and bacterial leaf blight than the Ciherang variety. This causes the Inpari 32 variety to require higher maintenance costs than the Ciherang variety, both for wages for maintenance workers, pesticides and other medicines. Meanwhile, the productivity of the Inpari 32 variety was higher than that of the Ciherang variety. With the

same selling price between the Inpari 32 and Ciherang varieties, which is IDR.4,200/kg, the income from rice farming for the Inpari 32 variety is greater than the Ciherang variety. The use of the Inpari 32 variety provides additional income for farmers by 13.41% when compared to using the Ciherang variety.

The income from rice farming of the Inpari 32 variety is greater than that of the Ciherang variety, however, the production costs are also higher. When viewed from the farming advantages of the two varieties, the Inpari 32 rice farming business provides an additional 15.8% profit compared to the Ciherang variety rice farming. Thus, the adoption of the Inpari 32 variety provides benefits for farmers in the form of additional revenue/profits. Meanwhile, if viewed from the value of the R/C ratio, the Inpari 32 variety has a higher value than the Ciherang variety. This shows that the Inpari 32 rice farming business has a higher feasibility level to be developed than the Ciherang variety.

However, until now the distribution of new improved varieties including Inpari 32 in Central Java is still very limited. Farmers revealed that they had difficulty obtaining seeds of the NIRVs due to the low availability of seeds in the market. This causes farmers to return to using old superior varieties.This is in accordance with what was expressed by [14,15]namely that farmers' adoption decisions for NIRVs are determined by access to seeds. Meanwhile, if you only rely on seed production of NIRVs at UPBS BPSB Central Java, it will not be able to meet the needs of farmers' seeds. Therefore, to increase the spread of NIRVs, it is necessary to develop seed breeders at the farmer level [16]. Furthermore [17] also revealed that breeders play a role in the dissemination process to accelerate the adoption of new improved varieties. This is because farmers around the dissemination site will be interested in planting these varieties in the following season if the seeds are available.

4 Conclusion

The distribution of NIRVs in Central Java is still limited. Many farmers in Central Java still use rice varieties that have been released for a long time. The low availability of NIRVs is one of the factors that hinders the spread of NIRVs in West Java because private breeders are less interested in producing seeds that are not yet commercial. To increase the availability of these seeds, it can be done by developing farmer-level seed breeders. Therefore, government support is needed to encourage farmers to breed new high-yielding varieties of rice through the provision of credit facilities for breeder farmers. In addition, efforts to disseminate NIRVs must also continue to increase farmer adoption of NIRVs. In the future, it is hoped that the formation of NIRVs can focus on improving the characteristics of rice varieties that are of interest to farmers. Thus, NIRVs will be more easily accepted by farmers.

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