The performance of the distribution and use of improved varieties of rice in West Java Province

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Abstract. West Java Province is one of the centers of rice production in Indonesia. The use of improved varieties continues to be pursued to support the increase in production. This study aims to analyze the performance and problems of distribution and the use of improved varieties in rice farming. The study was conducted in Majalengka and Cianjur Districts in 2020. The study sample consisted of 60 rice farmers and research-related institutions. Data analysis was carried out quantitatively by calculating the percentage of the distribution area and qualitatively descriptive. The results of the study show that in Cianjur District, from a total distribution area of 154,075 ha (in 2019), the distribution area of Ciherang and Mekongga varieties is 36.46% and 35.88%, respectively. While in Majalengka District, on the contrary, from the total area of 127,957 ha, the distribution of new improved varieties was more dominant, namely for Inpari 32 and Inpari 43 at 67.25% and 7.28%, respectively. Problems faced in the spread of new improved rice varieties include limited availability of seeds, limited demonstration plot activities, and resistance of varieties to pests and diseases. In rice farming activities in the study area, new high-yielding varieties produce relatively higher productivity compared to old improved varieties. In order to increase the spread of new improved varieties of rice, it is necessary to provide adequate seed support, description of the improvement of improved seeds, demonstration plots, as well as support for government policies and programs for the development of new improved varieties.

1. Introduction
One of the successes in increasing rice production in recent years is more dominated by increasing productivity compared to the increasing harvested area [1]. The increase in lowland rice productivity contributed about 56.1%, while the contribution of the increase in harvested area was 26.3%. Increased productivity of rice farming is generated through the adoption or use of technological innovations of improved varieties of rice cultivation, especially innovations of new improved varieties of lowland rice and upland rice [2–5].

In recent years, the distribution of new high-yielding varieties for rice that have been produced by the Indonesian Agency for Agricultural Research and Development (IAARD), and even several varieties of rice have also been recognized and used by farmers. Based on Minister of Agriculture
Regulation Number 07 of 2018, agricultural technology produced by the Ministry of Agriculture is from AARD, one of which is rice plant varieties [6]. According to Nugraha and Sayaka [7], the impact of using high-yielding rice varieties on increasing production will be seen if these varieties are planted on a large scale. However, in the field, it turns out that farmers are still dominant in planting the Ciherang variety (reaching 47% of the total varieties planted by farmers).

During the 2017‒2019 period, the development of new improved varieties for rice was still relatively limited. This is due to the large number of farmers who still grow rice with improved varieties that have been around for a long time. However, new high-yielding rice varieties, such as Inpari 30 and Inpari 32, have begun to be developed in several areas, one of which is in West Java Province. The Inpari 30 variety is an improvement from the Ciherang variety by inserting the Sub1 gene (soaking resistance) for 15 days in the vegetative phase, and its tolerance is better than the Ciherang variety.

In general, farmers in South Kalimantan will choose rice varieties by considering plant age, panicle length, plant type, grain shape, and plant height. Meanwhile, based on the characteristics of the varieties, the preferred order of farmers is Mekongga, Inpari 30, Inpara 6, Inpari 9, Inpari 17, Ciherang, and Inpara 8 [8]. Meanwhile, the research results of Murshid et al. [9] revealed that the use of seeds of the Ciherang variety is influenced by user tastes, seed quality, and productivity of the varieties it produces. Furthermore, the research results of Noviyanti et al. [10] revealed that intensive extension strategies and pilot activities would further increase the use of superior varieties of lowland rice in Cianjur, West Java.

When compared to the wide distribution of improved rice varieties in 2019 with 2017, it has decreased to -27.22%, where the wide distribution of improved rice varieties in 2017 reached 13.32 million ha [11]. This is due to the fact that in 2017 there was a special effort program by the Ministry of Agriculture in order to support increased production of rice, corn and soybeans.

Common problems encountered in the distribution of Inpari 30 varieties compared to Ciherang are related to resistance to pests and are more sensitive to blast disease. Likewise, the Inpari 32 variety, which is an improvement over the Ciherang variety, also has resistance to bacterial leaf blight (BLB) disease. Since 2004, the Ciherang variety has shifted the dominance of the IR64 variety. In the 2003/2004 MT and 2004 MT, Ciherang variety had a distribution area of up to 703,599 ha (39.9%), while IR64 was only 486,801 (27.6%) [12]. Other problems faced related to the distribution of improved varieties are that the knowledge that farmers have about new technology is still very limited, and it is difficult to change the attitude of farmers in accepting the change because the mindset of farmers is still traditional [13].

Based on the description above, this study aims to analyze the performance and problems of distribution, and the use of improved varieties in rice farming in West Java Province.

2. Materials and methods

2.1. Materials

The study was conducted in 2020. The data collected includes primary and secondary data. Primary data was collected through interviews with rice farmers, officials at the Center for Rice Seed Certification and Supervision [14] and officials at the Food Crops Agriculture Service at the research sites in Cianjur and Majalengka Districts, West Java Province. A total of 60 farmers were interviewed. Secondary data were collected from the Directorate General of Food Crops-Jakarta, the Food Crops Agriculture Service at the research location, and the Center for Rice Seed Certification and Supervision in West Java.

2.2. Methods

In this study, data collection was carried out using a survey method, and in-depth discussions with several parties related to the research, namely Center for Certification and Supervision of Rice Seeds and the Office of Food Crops Agriculture in the research location of Cianjur and Majalengka Districts, West Java Province. The primary and secondary data collected were then analyzed quantitatively by
calculating the percentage of the distribution area and also equipped with qualitative descriptive analysis.

3. Results and discussion

3.1. Performance and problems in the spread of improved rice varieties

Rice seed breeding in West Java Province in 2019 began to shift from many Ciherang varieties to Inpari varieties, both Inpari 32 and Inpari 30. According to [14], the new improved varieties of Inpari rice has been widely spread and used by farmers in West Java. For the Inpari 31 (2013) variety, the average productivity is up to 7.60 tons/ha harvested dry grain (HDG). This variety is in great demand by farmers in certain areas (WBC endemic) in West Java Province. Furthermore, for the Inpari 32 (2013) variety with the resulting productivity up to 8.00 tons/ha. This variety is growing rapidly (adopted by farmers) in West Java because of the high productivity and yield of grain (rice), according to consumer preferences (long, fluffier), and adaptive in the rice center area of West Java.

Increasing rice production is very dependent on the availability of quality and quality seeds [15–17], so that the target of providing quality and quality seeds at the farmer level must continue to be considered properly. In addition, the application of appropriate and location-specific technology is an important component in it.

In terms of planting rice varieties by farmers until 2019, a number of rice farmers such as in Indramayu District are still using the Ciherang variety dominantly in their farming activities. Until early 2019, the highest distribution area of the Ciherang variety was in Karawang District, which was 71,286 ha. Meanwhile, the highest distribution of Inpari 32 variety was found in Majalengka, Subang and Karawang Districts [17].

Rice farming in Southeast Sulawesi with the results achieved shows that in the rainy season (MH) and dry season (MK), Inpari 30 gives the highest production compared to 4 other varieties, namely Inpari 15, Mekongga, Inpari 6 and Ciherang [18]. It is necessary to rotate varieties using new superior varieties. These new superior varieties have higher productivity and are more early in age.

At the study site in Cianjur District, in 2019, the distribution area of Inpari 30 variety reached 1,610 ha (1.04%), and Inpari 32 reached 3,092 ha (2.01%). It turns out that the old varieties, namely Ciherang and Mekongga, still occupy the highest proportion with a distribution area of 56,178 ha (36.46%) and 55,289 ha (35.88%), respectively. Furthermore, in Majalengka District, it was the opposite where the wide distribution of new superior varieties for Inpari 32 reached 86,048 (67.25%), Inpari 43 reached 9,316 ha (7.28%). Meanwhile, the distribution of old superior varieties, namely Mekongga, was around 9,316 ha (7.28%), and Ciherang was around 5,966 ha (4.66%) (Table 1). Related to the spread of superior varieties, it turns out to be one of the important factors in farming. This is as revealed by the research results of Nurhati et al. [19] and Bello et al. [20] that seed production of high-yielding varieties and their distribution so that they can be accessed at the farmer level are important factors in supporting increased rice production. The same thing was also revealed from other research results, which revealed that the quality of rice seeds available in West Java is a factor that determines the increase in rice production [21].

In order to introduce new improved varieties to the community in West Java, in general, it can be carried out through (1) displaying rice varieties and (2) demonstration plots [22]. Demonstration plots on farmers’ land are needed to be more attractive to farmers to plant new high-yielding varieties because farmers do not easily believe if they have not seen the advantages of the new improved varieties.

Until now, the problems faced in the distribution of new high-yielding rice varieties include limited availability of seeds, limited demonstration plot activities, and resistance of varieties to pests and diseases. On the other hand, the main weaknesses faced by farmers in the Inpari 30 variety compared to Ciherang are resistance to pests, more sensitive to blast disease. Meanwhile, the Inpari 32 variety is an improvement from Ciherang for resistance to BLB (Bacterial Leaf Blight) disease. According to Syahri and Somantri [23], the problems often faced in increasing rice production, among others, are related to the availability and quality of seeds that are not as expected by farmers. Furthermore, plants
that are too tall generally fall easily [24,25]. In addition, plant height and resistance to pests and diseases determine farmers' acceptance of new high-yielding varieties. However, sometimes, it is not easy for farmers to replace the varieties they usually planted unless the varieties have marketing and are adaptive to their farming locations.

Table 1. The area and percentage of distribution of improved rice varieties in Cianjur and Majalengka Districts, West Java Province, 2019 [22]

| No. | Varieties     | Cianjur | %   | Majalengka | %   |
|-----|---------------|---------|-----|------------|-----|
| 1.  | Inpari 30     | 1,610   | 1.04| -          | -   |
| 2.  | Inpari 32     | 3,092   | 2.01| 86,048     | 67.25|
| 3.  | Inpari 33     | -       | -   | 6,425      | 5.02 |
| 4.  | Inpari 39     | -       | -   | 5,861      | 4.58 |
| 5.  | Inpari 43     | -       | -   | 9,316      | 7.28 |
| 6.  | Ciherang      | 56,178  | 36.46| 5,966      | 4.66 |
| 7.  | Mekongga      | 55,289  | 35.88| 9,316      | 7.28 |
| 8.  | Lainnya       | 37,906  | 24.60| 5,025      | 3.93 |
|     | Total         | 154,075 | 100.00| 127,957.00| 100.00|

3.2. The use of improved varieties in rice farming

Based on the results of the analysis of rice farming in the study area, Cianjur District, it is known that the use of the Inpari 32 variety produces a productivity of 7 tons/ha and the Ciherang variety of 6 tons/ha. Meanwhile in Majalengka, the use of the Inpari 32 variety produced a productivity of 7.1 tons/ha and the Ciherang variety of 6.2 tons/ha. Based on the selling price at the farm level, which is IDR 4,500/kg in Cianjur, the revenue value is IDR 31.5 million/ha/season, respectively, for Inpari 32 and IDR 27.00 million/ha/season. Meanwhile in Majalengka, with the selling price of grain at the farm level of IDR 4,400/kg, the revenue was IDR 31.24 million/ha/season for Inpari 32 and IDR 27.28 million/ha/season for Ciherang. In Cianjur, with a farming cost of IDR 13.56 million/ha/season, the profit from farming using the Inpari 32 variety was IDR 17.94 to 31.24 million/ha/season with R/C = 2.32, and by using the Ciherang variety of IDR 13.44 million/ha/season with R/C = 1.99. In Majalengka, with a farming cost of IDR 13.85 million/ha/season, the profit from farming using the Inpari 32 variety is IDR 17.39 million/ha/season with R/C = 2.26, and by using the Ciherang variety. amounting to IDR 13.43 million/ha/season with R/C = 1.97.

Table 2. Results of analysis of rice farming per hectare by variety in the study locations of Cianjur and Majalengka Districts, West Java, planting season-2 2020.

| Uraian                        | Cianjur          | Majalengka       |
|-------------------------------|------------------|------------------|
|                               | Inpari 32 | Ciherang  | Inpari 32 | Ciherang  |
| A. Revenue                    |           |           |           |           |
| 1. Productivity (kg/ha) (HDG) | 7,000    | 6,000    | 7,100    | 6,200    |
| 2. Price (IDR/kg)             | 4,500    | 4,500    | 4,400    | 4,400    |
| 3. Value (IDR)                | 31,500,000| 27,000,000| 31,240,000| 27,280,000|
| B. Production cost (IDR)      | 13,556,667| 13,556,667| 13,850,000| 13,850,000|
| C. Profit (IDR)               | 17,943,333| 13,443,333| 17,390,000| 13,430,000|
| E. R/C                        | 2.32     | 1.99     | 2.26     | 1.97     |
The use of seeds of improved rice varieties is strongly influenced by the role of these varieties in increasing farm productivity and income [17]. Furthermore, the acceptance of the introduced technology depends on the ease with which the technology can be applied by farmers, and the technology applied can increase their farming income [26].

3.3. Strategies to increase the spread of improved rice varieties

The use of new improved varieties which are the result of a technological innovation plays an important role in increasing rice production. To encourage the increasing distribution of improved varieties, the rice varieties produced must have better productivity than the previous varieties. In this context, to produce improved varietal technology, maturity (readiness) of the resulting technology is also required.

The existence of significant results in rice farming activities is one of the driving factors for farming so that the introduced technology will continue to be adopted by farmers. Therefore, there are several things that must be considered so that the introduced technology can continue to be used for farmers, including: support for providing adequate seeds, clearly conveying a description of the superiority of improved seeds, conducting demonstration plots, and supporting government policies and programs for the development of improved varieties.

4. Conclusions

In Cianjur District, from a total distribution area of 154,075 ha (in 2019), the Inpari 30 variety is around 1.04% and Inpari 32 is around 2.01%. As for the old varieties, namely Ciherang and Mekongga, the distribution area is still dominant with a distribution area of about 36.46% and 35.88%, respectively. Furthermore, in Majalengka District, on the contrary, from the total distribution area of 127,957 ha, the distribution of new improved varieties for Inpari 32 reached 67.25%, Inpari 43 reached 7.28%. Meanwhile, the spread of old improved varieties, namely Mekongga, was around 7.28% and Ciherang was around 4.66%.

The results of the analysis of rice farming in the study area of Cianjur District, it is known that the use of the Inpari 32 variety produces a productivity of 7 tons/ha and Ciherang 6 tons/ha. Meanwhile in Majalengka, the productivity of rice produced was 7.1 tons/ha for Inpari 32 and 6.2 tons/ha for Ciherang. Thus, the results of farming with new improved varieties in both research locations have shown better results compared to the previous improved varieties.

Problems faced in the spread of new improved varieties of rice include limited availability of seeds, limited demonstration plot activities, and resistance of varieties to pests and diseases. In order to increase the spread of new high-yielding varieties of rice, it is necessary to provide adequate seed support, to describe the superiority of improved seeds, to conduct intensive demonstration plots, and to support government policies and programs for the development of new improved varieties.

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