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Response of New Superior Rice Varieties to Integrated Cultivation Technology in the Karangsambung Agroecosystem

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Abstract

This study aims to examine the growth response and results of several new superior varieties (VUB) of paddy rice to the application of integrated cultivation technology in the Karangsambung Agroecosystems. Integrated cultivation technology is an agronomic approach that combines superior variety selection, balanced fertilization, efficient water management, and integrated pest and disease control. The study was organized using a Complete Group Random Design with four replicates. Cultivation techniques are carried out according to the instructions for the application of integrated technology. Observations were made on the characteristics of agronomic diversity and results. The results of the variant analysis showed that there were differences between the varieties tested in the result character, the number of seedlings, the flowering age of 50%, the number of empty grains per panicle and seed set and did not show any real differences in the other characters. Inpari 44 (6.8 tons/ha), Bawor (6.55 tons/ha), Inpari 43 (6.5 tons/ha) and Inpari 32 (6.15 tons/ha) showed a higher adaptation than the Ciherang comparative variety (6.1 tons/ha) Agroecosystems karangsambung.

Keywords: Agroecosystems, integrated technology, rice paddies, superior varieties

Introduction

Rice field farming in Indonesia is one of the most important sectors, both in terms of economy and food security. According to the Central Statistics Agency (BPS) in 2021, Indonesia produced around 54 million tons of rice, making it one of the largest rice-producing countries in the world after China and India (BPS, 2021). However, the challenges faced by the sector are increasingly complex, including climate change, pest and disease attacks, and the need for increased productivity to meet the growing demand. In this context, the application of integrated technology to new superior varieties of paddy rice is very important to increase agricultural resilience and productivity.

New superior varieties of paddy rice, such as Inpari 30 and Inpari 32, have been developed to improve yield and pest resistance. According to research conducted by Supriyanto et al. (2020), the Inpari 30 variety is able to provide a yield of up to 8.5 tons per hectare, higher than the local variety which only reaches 5-6 tons per hectare. However, to achieve this potential, the application of appropriate technology is needed, such as efficient use of fertilizers, integrated pest control, and a good irrigation system.

Ciherang and IR64 over time are no longer resistant to pests and diseases of rice plants. This is because the continuous planting of varieties causes resistance to pests and diseases to decrease. Based on observations in the field, Ciherang is less resistant to bacterial leaf blight or what is often called cracker disease. Bacterial leaf blight is caused by the bacterium Xanthomonas oryzae pv. oryzae (Xoo) (Kadir et al., 2009). The

high temperature and humidity range favors the development of bacterial leaf blight disease when the plant enters the late vegetative stadia 40-50 days after planting (Lestari et al., 2007). The most effective and economical control of bacterial leaf blight is to use resistant varieties. Bacterial leaf blight attacks in Indonesia in 2012 reached 81,119 hectares (Directorate of Food Crop Protection, 2012). Bacterial leaf blight if it attacks rice plants based on research can reduce rice production so that rice harvest results will not be optimal. Similar to the IR64 variety, based on observations in the field, this variety is less resistant to leafhopper pest attacks. If leafhopper pests have attacked crops and cannot be controlled, the rice production will decrease and can even cause crop failure. as in 1986, leafhoppers attacked the Central Java area covering an area of ± 75,000 ha (Rugaya and Dahyar, 2013). In the period of 2000-2005, the area of rice plantations affected by brown stem leafhopper pests reached 20,000 ha per year (Kartohardjono, 2011). Brown stem leafhopper pest attacks reached 23,187 ha until June 2010 (Rice Crop Research Institute, 2011). The severe attack is due to the ability of this leafhopper pest to adapt and can form new biotypes very quickly and is able to transmit grass dwarf virus and vacuum dwarf virus which can cause more severe damage to rice plants (Effendi, 2009).

Another obstacle in Karangsambung District is the lack of development of information about new superior varieties of rice that have higher production and are resistant to plant pest organisms to farmers so that farmers still always plant Ciherang and IR64. For these problems, a solution is needed so that the rice production of farmers in Karangsambung District can increase, namely by introducing new superior varieties of rice with adaptation tests of new superior varieties of rice. New superior varieties of rice that have high production and are resistant to plant pest organisms will be planted in farmers' experimental fields, so that farmers can recognize and choose new superior varieties of rice that they like with high yield indicators and resistance to pests and diseases. It is hoped that from this activity a new superior variety of rice will be obtained that is high-yielding and resistant to pests and diseases and is able to increase farmers' references to the list of names of rice varieties to more and can cultivate them so that farmers' rice production will be higher than if planting with Ciherang and IR64 varieties.

Research Method

The research was carried out from May to August in Seling village, Karangsambung District, Kebumen Regency. The land used is technical irrigation rice fields. The tested material was planted on the experimental land by comparing 10 new superior varieties of rice with 2 varieties that are commonly grown by local farmers, namely Ciherang and IR64 using an integrated technology application approach (PTT). The ten new varieties of rice used are Inpari 30, Bawor, Inpari 32, Inpari 33, Inpari 42, Inpari 43, Inpari 44, Siliwangi, Padjajaran, Cakrabuana. The research design used was a Group Random Design (RAK) with a single factor, namely a new superior variety of rice. Each plant variety was planted with a 2:1 legowo planting system (planting distance of 25 x 12.5 x 50 cm) with a plot area of 4m x 5m with four repetitions. PTT was used in this study, namely seeds using labeled seeds, soil tillage was carried out perfectly, the age of young seedlings was 17 days after sowing (HSS) and the use of fertilizers according to the dose, namely NPK Phonska fertilizer 250 kg/ha and Urea 200 kg/ha with a fertilization frequency of 3 times, namely fertilization I = 7 days after

planting (HST), II = 22 HST and III = 35 HST. Weed control and pest and disease control are carried out using the principle of Integrated Pest Control (PHT). Observations were made on the agronomic characteristics of plants such as plant height, number of seedlings, flowering age , number of panicles, number of filled grain per panicle, number of empty grain per panicle, weight of filled grain per clump, *seed set* (fertility), weight of 1000 grains and yield (harvested dry grain). The observation data was then analyzed using *SAS statistical software* and the average difference between varieties was tested using the LSD test method at an error threshold of 5%.

Results and Discussion

In general, the implementation of experiments in the field went smoothly. However, there is an attack of bird pests on the Padjajaran and Cakrabuana varieties when the plant enters the flowering phase, which is around the age of 60 HSS. This is because the variety has a very fertile flowering life so that bird attacks are inevitable. Efforts to control bird pests are carried out in the field by installing bird repellent devices and are also guarded by farmers so that the attack does not become severe. The effect of this vigorous flowering age gives rise to locust pests to attack these two varieties so control with pesticides is carried out to prevent yield loss due to this locust pest. During the implementation of the ongoing research, no leafhopper pests were found to attack plants, but there were symptoms of disease attacks that attacked the IR64 variety where the IR 64 variety was almost in all replicas attacked by bacterial leaf blight with an attack presentation of 75% while for other varieties it was safe from this disease attack. This proves that the new superior varieties that are being adapted tested have resistance to bacterial leaf blight.

Table 1. Analysis of Variance of Agronomic Character and Response of New Superior Rice Varieties to Integrated Cultivation Technology in the Karangsambung Agroecosystem

No	Variabel Pengamatan	Nilai F	Probabilitas
1	Hasil	4.69	0.000*
2	Tinggi Tanaman	0.87	0.59
3	Jumlah Anakan	3.12	0.000**
4	Umur Berbunga 50%	34.56	0.000**
5	Jumlah Malai	0.99	0.48
6	Gabah Isi/malai	2.1	0.04
7	Gabah Hampa/malai	6.49	0.000**
8	Berat Gabah Isi/rumpun	0.89	0.58
9	Seed Set	4.2	0.000**
10	Berat 1000 butir	18.99	0.000**

Remarks: ** = very real difference at the error level of 1%
* = real difference in error level

The results of the variant analysis showed that there were differences between the varieties tested in the result character, the number of seedlings, the flowering age of 50%, the number of empty grains per panicle and seed set and no real difference in the

other characters (Table 1). The agronomic behavior and the results of the adaptation test of new superior varieties of paddy rice based on the application of integrated technology in Karangsambung District, Kebumen Regency are shown in Table 2.

Table 2. Agronomic study and adaptation test results of new superior varieties of paddy rice based on the application of integrated technology in Karangsambung Agroecosystem

No	Varietas	UB 50%	JA	GABHAM	SS	B1000	H
1	Inpari 30	86 b	14 ab	21 bcd	84.75 ab	25.75 cd	5.68 bc
2	Bawor	84 cd	15 ab	20 bcd	85.75 ab	28.75 a	6.55 ab
3	Inpari 32	85 bc	15 ab	21 bcd	83.25 ab	26 bc	6.15 abc
4	Inpari 33	83 de	15 ab	15 d	87 ab	27 b	5.88 abc
5	Inpari 42	86 b	13 b	25 b	85.25 ab	23.25 f	5.25 cd
6	Inpari 43	80 f	17 a	26 b	82.5 b	20.75 g	6.5 ab
7	Inpari 44	91 a	17 a	40 a	74.25 c	24.25 ef	6.8 a
8	Siliwangi	82 e	17 a	24 ab	84 ab	25.75 cd	5.9 abc
9	Padjajaran	75 g	15 ab	17 d	87.25 ab	24.75 de	4.05 e
10	Cakrabuana	76 g	15 ab	16 d	87.75 a	26 bc	5.15 cd
11	Ciherang	85 bc	16 ab	18 cd	87 ab	25.25 cde	6.1 abc
12	IR 64 80 f	16 ab	19 bcd	82.5 b	24.25 ef	4.3 de	
	LSD 5%	1.95	3.02	7.16	5	1.19	1.07
	CV	1.64	13.75	22.87	4.13	3.28	13.04

Remarks: Numbers followed by the same letter in the same column did not differ significantly on the 5% LSD test JA= number of chicks; UB= flowering age 50% (HSS); GABHAM= the amount of empty grain/panicles; SS= seed set (%); B1000= weight of 1000 grains (g); H= yield (t/ha)

The results of statistical analysis show that there is a real influence of various varieties on the flowering age of 50% of the twelve varieties studied listed in Figure 1 below. The adaptation test of the new superior varieties of paddy rice at the 50% flowering age (HSS) character (Figure 1) showed that the Padjajaran variety has the most mature or fastest flowering life compared to other varieties, which is 75 days after spreading. Followed by the Cakrabuana variety which also has a flowering age of 76 days after spreading. However, it is different with the Inpari 44 variety, which actually shows the deepest or longest flowering life of 50% when compared to other varieties, which is 91 days after spreading (Figure 1). Flowering age is closely related to harvest age. Varieties that flower faster, the harvest life will be faster. This mature variety is very suitable for planting during the dry season which is related to the availability of water so that rice plants are quickly cultivated with limited water and quickly harvested so that they are not too wasteful in their water use. Therefore, the Padjajaran and Cakrabuana varieties are very suitable for planting during the dry season because the flowering life is short so that the harvest life is also short so that it will be harvested faster. The difference in flowering age is caused by genetic differences from varieties characterized by differences in vegetative stadia and different plant responses to growing places (Edi S, 2013).

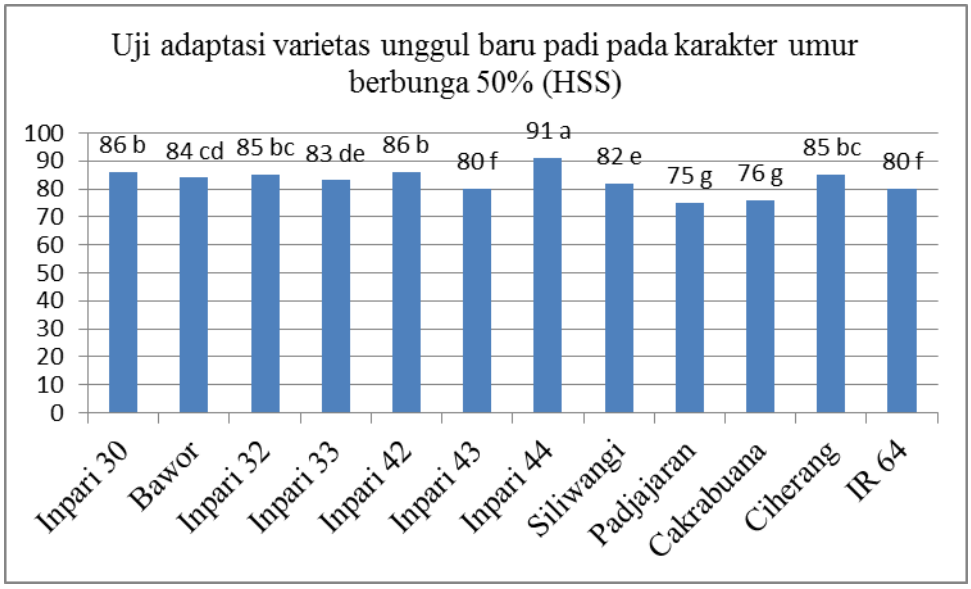

Figure 1. Adaptation test of new superior varieties of paddy rice at the character of 50% flowering age (HSS)

The results of statistical analysis show that there is a real influence of the variety of varieties on the diversity of the number of saplings of the twelve varieties studied as shown in Figure 2 below. The higher the productivity of rice plants is determined by the number of saplings, namely saplings that are able to form panicles and are able to fill the panicles (Sutaryo and Suprihatno, 1994). The adaptation test of new superior varieties of paddy rice on the character of the number of saplings (Figure 2) shows that the Inpari 43, Inpari 44 and Siliwangi varieties have the highest number of saplings when compared to other varieties, namely 17 saplings. In contrast to the Inpari 42 variety, which actually has the least number of saplings compared to other varieties, namely 13 saplings (Figure 2).

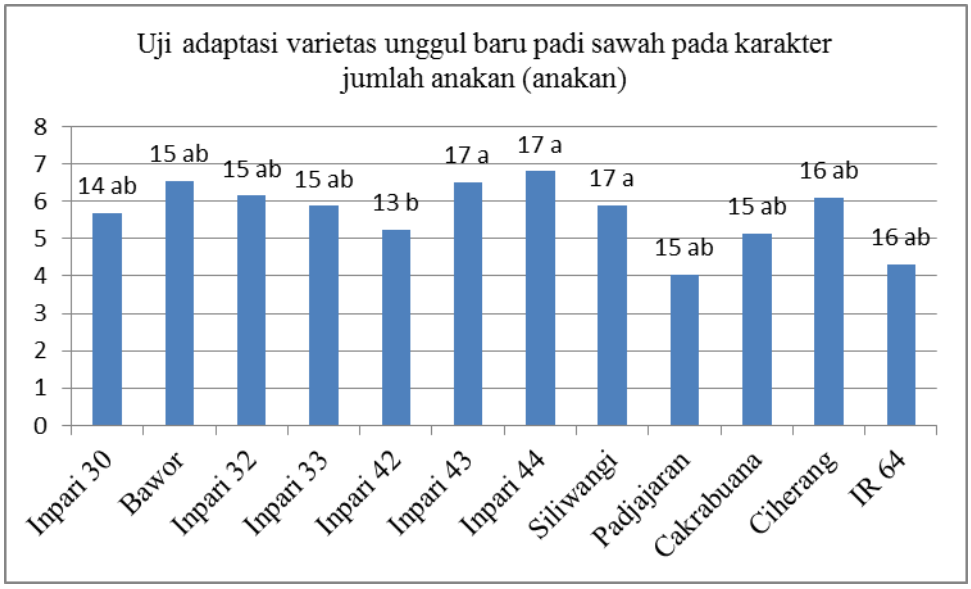

Figure 2. Adaptation test of new superior varieties of paddy rice on the character of the number of saplings (Saplings)

The results of statistical analysis show that there is a real influence of the variety on the number of empty grains per panicle from the twelve varieties studied listed in Figure 3. The adaptation test of the new superior varieties of paddy rice on the character of the number of empty grain per panicle in Figure 3 shows that the Inpari 33, Cakrabuana and Padjajaran varieties have the least amount of empty grain per panicle compared to other varieties, namely 15 grains, 15 grains and 17 grains. This is inversely proportional to the Inpari 44 variety which actually has the most number of empty grain per panicle compared to other varieties, which is 40 grains (Figure 3). The difference in the amount of grain per panicle produced from each variety is caused by the genetic factors of each variety. This is in line with the opinion of Guswara (2007) that the amount of grain per panicle is influenced by genetic factors. In addition, environmental factors also play a role in the high and low amount of permalade grain, because sunny weather conditions can increase the rate of photosynthesis, light energy is needed by plants for the photosynthesis process where the resulting photosynthate will be stored in stem and leaf tissue, then will be translocated to maturation level grain. A lot of empty grain will affect the size of plant productivity. If there is a panicle in a panicle, it will affect the productivity of the plant which is lower and the yield per hectare is smaller (Gardner *et al*, 1991).

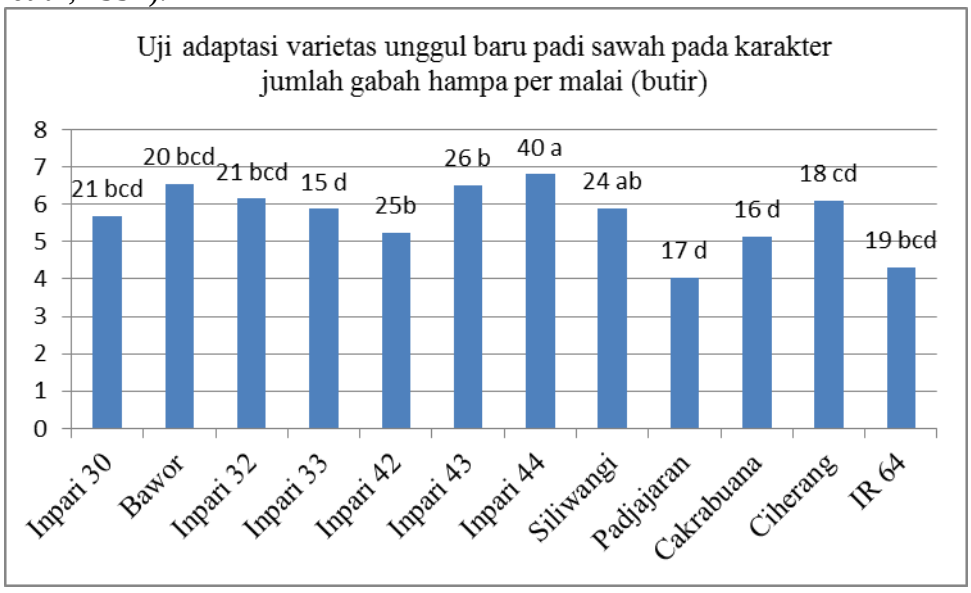

Figure 3. Adaptation test of new superior varieties of paddy rice on the character of the number of empty grain per panicle (Item)

The results of statistical analysis show that there is a real influence of various varieties on seed set fertility/grain fertility of the twelve varieties studied listed in Figure 4. The adaptation test of the new superior varieties of paddy rice on *the character of seed set*/grain fertility in Figure 4 shows that the Cakrabuana variety shows the highest adaptation, which is 87.75% when compared to the adaptation of other varieties. However, the varieties Inpari 30 (84.75%), Bawor (85.75%), Inpari 32 (83.25%), Inpari 33 (87%), Inpari 42 (85.25%), Siliwangi (84%), Padjajaran (87.25%) and Ciherang (87%) also have good adaptation to *the seed set*/grain fertility character even though the adaptation is still below the Cakrabuana variety. In contrast to the Inpari 44 variety, the seed *set*/grain fertility character shows the lowest adaptation, which is 74.25% when

compared to other varieties (Figure 4). The difference in the percentage of grain content is suspected to be caused by the genetic factors of each rice plant variety used. The Cakrabuana variety is relatively more stable than other varieties so it has a high percentage of grain content. The high percentage of grain content per panicle is greatly influenced by the amount of grain per panicle and the available nutrient guarantee. The appropriate growing environment conditions tend to stimulate the panicle initiation process to be perfect, so that the chances of the formation of grain will be more. However, the more grain is formed, increasing the load of the plant to form the grain. The percentage of grain content is one of the indicators of crop productivity, the higher the percentage of grain content obtained by a variety indicates that the variety has high productivity (Mahmud Y. *et al*, 2014).

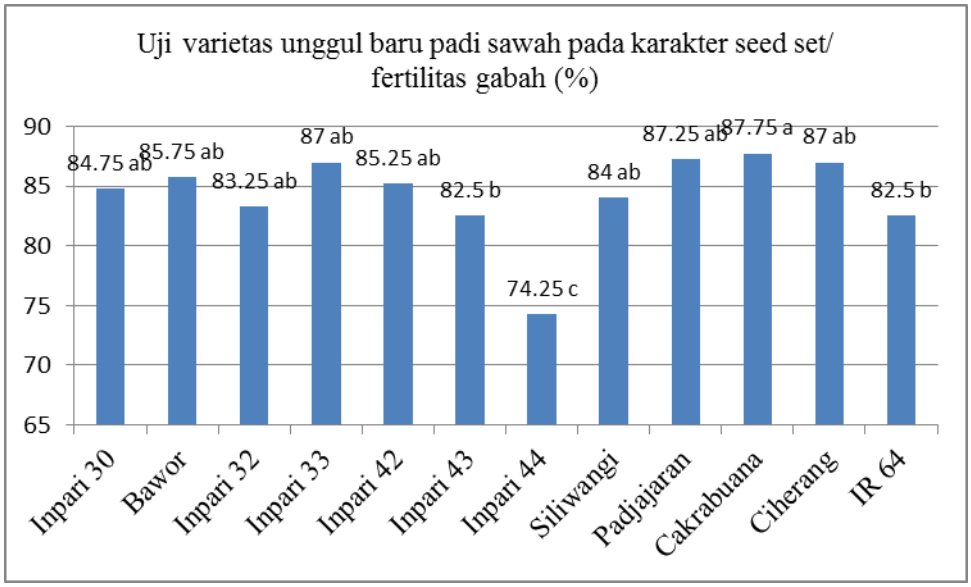

Figure 4. Adaptation test of new superior varieties of paddy rice on *seed set*/grain fertility character (%)

The results of statistical analysis show that there is a real influence of various varieties on the weight of 1000 grains of grain from the twelve varieties studied listed in Figure 5. The adaptation test of the new superior variety of rice rice on the weight of 1000 grains showed that the Bawor variety had the highest adaptation, which was 28.75 grams at the weight of 1000 grains when compared to the adaptation of other varieties (Figure 5). In contrast to the Inpari 43 variety, which actually shows the lowest adaptation of 20.75 grams compared to other varieties of adaptation. The difference in the weight of 1000 grains of grain between the results of the experiment and the description proves that although the variety is genotically stable, environmental factors greatly affect the fenotic nature of a variety.

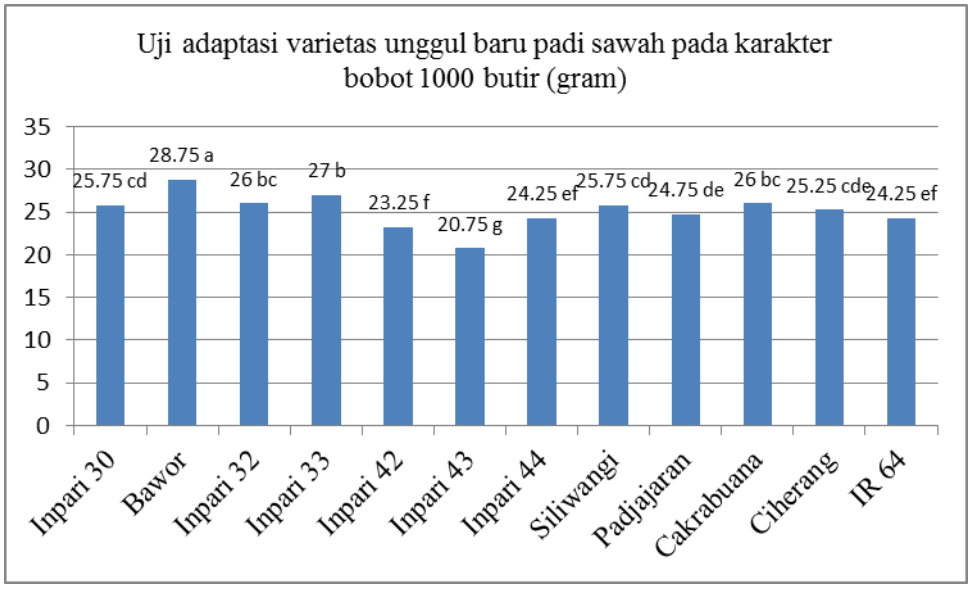

Figure 5. Adaptation test of new superior varieties of rice paddy at a weight character of 1000 grains (Gram)

The results of statistical analysis show that there is a real influence of various varieties on the yield of harvested dry grain from the twelve varieties studied listed in Figure 6. The adaptation test of the new superior variety of paddy rice on the character of harvested dry grain yields in Figure 6 shows that the Inpari 44 variety shows the highest yield adaptation, which is 6.8 tons/ha when compared to the adaptation of other varieties. Grain yield is closely related to yield components such as the number of tillers, the number of filled grain per panicle, the percentage of filled grain and the weight of 1,000 grains. The high yield of the Inpari 44 variety is supported by a larger number of saplings than other varieties. The varieties that show higher adaptation compared to the Ciherang comparison variety (6.1 tons/ha) in the yield character are Bawor (6.55 tons/ha), Inpari 32 (6.15 tons/ha), Inpari 43 (6.5 tons/ha) and Inpari 44 (6.8 tons/ha). These varieties can be adopted by farmers to be planted on their land as an alternative to rotation of rice crop varieties so that they do not always plant Ciherang and IR64 continuously and also so that the rice production yield is high. In contrast to the Padjajaran variety which shows the lowest adaptation in the yield character, which is 4.05 tons/ha when compared to the adaptation of other varieties. This is because the Padjajaran variety has a very vigorous flowering life or the fastest compared to other varieties and even compared to rice plantations owned by farmers around so that many panic is attacked by bird pests. Although all countermeasures have been made so that birds do not interfere with the productivity of the Padjajaran variety.

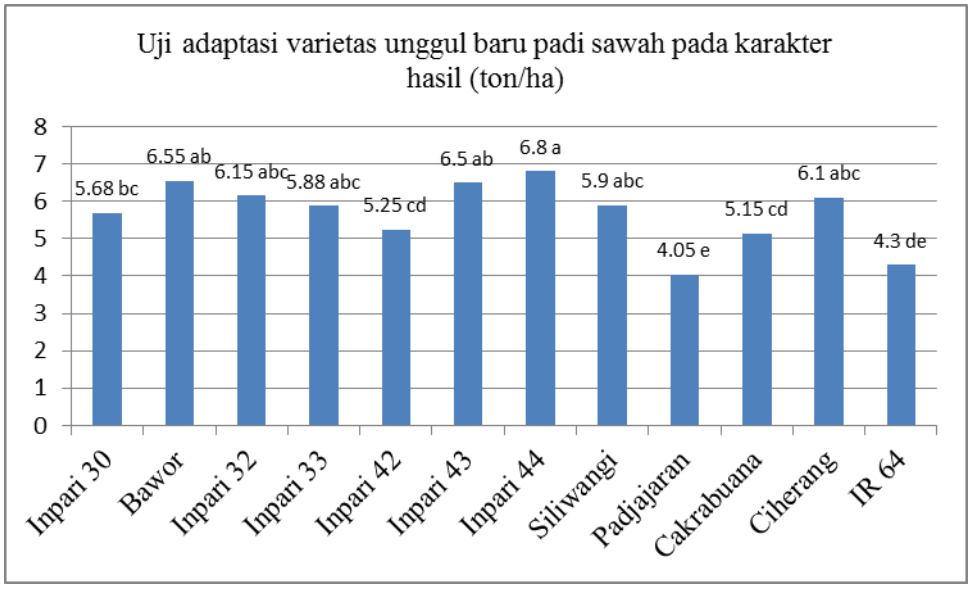

Figure 6. Adaptation test of new superior varieties of paddy rice on the character of harvested dry grain products (Ton/Ha)

Conclusion

In this study, significant variation has been found among the various rice varieties tested, especially in terms of yield characteristics, number of seedlings, flowering age at 50%, number of empty grain per panicle, and seed set level. However, for the other characteristics measured, no significant differences were found between the varieties. This suggests that although there are variations in some aspects, there are also characters that show uniformity among the varieties tested.

From the results of the study, the Inpari 44 variety with a yield of 6.8 tons per hectare, followed by Bawor with 6.55 tons per hectare, Inpari 43 with 6.5 tons per hectare, and Inpari 32 which produces 6.15 tons per hectare, showing a better level of adaptation compared to comparative varieties such as Ciherang which only produces 6.1 tons per hectare, and IR64 which has a yield of 94.3 tons per hectare. This research was conducted in Karangsambung District, Agroecosystem, and the results show the potential of these varieties in existing local conditions.

References

Badan Pusat Statistik Kabupaten Kebumen. 2017. Luas Panen dan Produksi Padi di Kabupaten Kebumen.

Balai Penelitian Tanaman Padi. 2011. Deskripsi Padi. Balai Penelitian Tanaman Padi. Sukamandi, Subang. Diakses pada 5 Desember 2020. http://etd.repository.ugm.ac.id/index.php?mod=download&sub=DownloadFile&act=view&typ=html&id=67872&ftyp=potongan&potongan =S12014-269807-bibliography.pdf.

Direktorat Perlindungan Tanaman Pangan. 2012. Laporan tahunan data luas serangan penyakit hawar daun bakteri tanaman padi. Diakses pada 1 Desember 2020. http://ditjentan.deptan.go.id.

Edi, Syafri. 2013. *Keragaan Varietas Dan Galur Harapan Padi Gogo Pada Daerah Aliran Sungai Batang Asai Sarolangun Jambi.* Program Studi

Agroekoteknologi, Fakultas Pertanian Universitas Jambi. Volume 2 No. 3 Juli – September 2013.

Effendi, T.A. 2009. Jenis Arthopoda Predator Penghuni Tajuk dan Permukaan Tanah di Ekosistem tanaman Padi, M23, 1-7. Diakses pada 5 Desember 2020. http://www.pur-plsounsri. org/dokumen/1_septiana-anggraini_red 1.pdf.

Gardner, Franklin. P R B Pierce. RL Mitchel. 1991. *Fisiologi Tumbuhan Budidaya*. Terjemahan Herawati Susilo. Universitas Indonesia. Jakarta.

Guswara, A.2007. Peningkatan Hasil Tanaman Padi Melalui Pengembangan Padi Hibrida : Dalam Kumpulan RDTP/ROPP. Balai Besar Penelitian Tanaman Padi. Sukamandi.

Harjadi, S. 1993. *Budidaya Tanaman Pangan Padi Hibrida*. Gramedia Pustaka Utama. Jakarta.

Kadir, T., S. I. Hanarida. Utami,W. Koerniati, S. Ambarwati, A.D. Apriana, A. Sisharmini 2009. Evaluasi ketahanan populasi haploid ganda silangan IR64 dan Oryza rufipogon terhadap hawar daun bakteri pada stadia bibit. Bul. Plasma Nutfah 15:13-19.

Kartohardjono. 2011. Penggunaan Musuh Alami Sebagai Komponen Pengendalian Hama Padi Berbasis Ekologi. *Jurnal Pengembangan Inovasi Pertanian*, 4(1): 29-46.

Kementerian Pertanian. (2022). Pedoman Pengendalian Hama Terpadu dalam Pertanian. Jakarta: Kementerian Pertanian Republik Indonesia.

Lestari, A.P., H. Aswidinnoor, Suwarno. 2007. Uji daya hasil pendahuluan dan mutu beras 21 padi hibrida harapan. Bul. Agron. 35:1-7.

Mahmud, Y. dan Sulistyo S.P. 2014. Keragaman Agronomis Beberapa Varietas Unggul Baru Tanaman Padi (Oryza Sativa L.) Pada Model Pengelolaan Tanaman Terpadu**.** *Jurnal Ilmiah Solusi* Vol. 1 No.1 Januari – Maret 2014: 1-10.

Rugaya, A dan Dahyar. 2013. Identifikasi Biotipe Wereng Batang Coklat *Nilaparvata lugens* Stall. (Delphacidae, Homotera) Kaloni Kabupaten Takalar. Seminar Nasional Inovasi Teknologi Pertanian, 2013. *Balai Proteksi Tanaman Pangan dan Hortikultura Sulawesi Selatan*. Diakses pada 5 Desember 2020. http://sumsel.litbang.pertanian.go.id/ind/images/ pdf/seminar.nasional/ 23%20rugaya.pdf.

Suharno, A. (2020). Pengaruh Sistem Tanam Legowo terhadap Pertumbuhan dan Hasil Padi. Jurnal Agronomi, 15(2), 123-130.

Sutaryo, B dan Suprihatno, N. 1995. Evaluasi hasil dan komponen kombinasi hibrida padi turunan beberapa galur pemuliaan baru. *Prosiding Simposium Pemuliaan Tanaman III.* Balai Penelitian Tanaman Pangan. Sukamandi.