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HEALTH TESTING OF DISTRIBUTED PADDY SEEDS IN BENGKULU BY USING THE SEEDLING SYMPTOM TEST

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ABSTRACT

The growth and yield of paddy in the field is mainly determined by the health of the seeds. The purpose of this study was to evaluate the health of paddy seeds distributed in Bengkulu by using the seedling symptom method. The research was conducted in a Completely Randomized Design (CRD) with the treatment of 6 rice varieties (Gorendra, Raja Lele, Mekongga, Inpari 6, Inpari 30, and Sintanur) with 5 replications. Paddy seeds were taken from the Accesment Institute for Agricultral Techonology, Deparment of Agriculture (Balai Pengkajian Teknologi Pertanian, BPTP), and the Institute of Seed Supervision and Certification (Balai Pengawasan dan Sertifikasi Benih, BPSB). The method used was the seedling symptom test by growing paddy seeds in the sterile sand media for 30 days. The results showed that the Sintanur variety had the longest incubation periode, but the Gorendra variety had the lowest disease incidence and severity of leaf spot caused by *Culvularia* sp. Moreover, the Gorendra variety also showed the best number of leaves, fresh weight of seedling, and length of root, while the height of seedlings and time of seedlings emergence showed the same results for the 6 rice varieties. The conclusion is that a Gorendra variety was the healthiest rice seeds, which demonstrated as the best seedling growth.

Keyword: *paddy varities, seed health, seedling symptom test*

ABSTRAK

[PENGUJIAN KESEHATAN BENIH PADI YANG BEREDAR DI BENGKULU DENGAN METODE *SEEDLING SYMPTOM TEST*]. Pertumbuhan dan hasil panen padi di lapangan sangat ditentukan oleh kesehatan benih padi. Tujuan dari penelitian ini adalah mengevaluasi kesehatan benih padi yang beredar di Bengkulu dengan metode *seedling symptom test*. Penelitian disusun dalam Rancangan Acak Lengkap dengan perlakuan 6 varietas padi (Gorendra, Raja Lele, Inpari 6, Inpari 30, Sintanur dan Mekongga) dan diulang 5 kali. Benih padi diambil dari Balai Pengkajian Teknologi Pertanian Dinas Pertanian, Propinsi Bengkulu dan Balai Pengawasan dan Sertifikasi Benih Propinsi Bengkulu. Metode yang digunakan adalah *seedling symptom test* dengan menumbuhkan benih padi pada media pasir steril selama 30 hari. Varietas Sintanur menunjukkan masa inkubasi terlama namun varietas Gorendra menunjukkan persentase serangan dan intensitas serangan *Curvularia sp* terendah. Varietas Gorendra juga menunjukkan jumlah daun, berat brangkasan basah, dan panjang akar yang paling baik, sementara tinggi tanaman dan waktu kemunculan bibit menunjukkan hasil yang sama dari ke-6 varietas padi. Penulis menyimpulkan bahwa varietas Gorendra adalah benih padi yang paling sehat dan memiliki tingkat pertumbuhan bibit yang paling baik.

Kata kunci: *kesehatan benih, seedling symptom test, varietas padi*

INTRODUCTION

Rice is one of the main stapple food crops in Indonesia. The availability of rice is one of the main keys in determining the condition of food security in Indonesia. Rice paddy production in Indonesia in 2019 and 2020 reached 54.60 million tons and 54.65 million tons of paddy dry weight with rice paddy harvested areas in 2019 and 2020 of 10.68 million hectares and 10.66 million hectares. If the rice paddy production above is converted into rice for food consumption, the rice production in 2020 will be 31.33 million tons (BPS, 2021). Rice production of that size is not sufficient for the national rice paddy needs so that Indonesia always imports rice every year. In Bengkulu, the average rice productivity is only 4.5 ton per hectare, which is much lower than the expected yield (Pamekas *et al*., 2021).

Many factors contribute to the low rice productivity in Indonesia. One of them is the use of poor seed quality, such as poor seed health, indicted by low germination rate and poor seedling growth (Ilyas, 2012), which lead to the poor tolerant to abiotic stress and be more sensitive to pathogen attack caused by seed-borne disease inoculum (Balai Besar Pengembangan Mutu Benih Tanaman Pangan dan Hortikultura, 2004). Jo *et al*. (2014) stated that seeds contaminated with pathogens are the primary inoculum for plant diseases in many food crops. Poor seed quality may be caused by long period of storage and poor management of storage room. Some environmental conditions, such as temperature and moisture concentrations, must be introduced after harvesting to ensure that grains remain free of fungal infection and reduce insect infestation (Guenhaa *et al*., 2014; Kanlayakrit & Maweang, 2013; Rehman*et al*., 2021).

Testing the seed health is very important in order to increase rice production in the field. Low quality seed may cause plant disease which can be harmful at any stage of plant growth. Furthermore, the low quality of seeds reduces the vigor, viability, and yield, but enhance the mortality of seedlings or young plants as well increase the chance for disease outbreak in new areas (Agarwal & Sinclair, 1996; Gebeyehu, 2019). Gopalakrishnan *et al*. (2010) reported that 8 genera of seedborne fungal pathogens had been isolated from paddy seeds from Tamil Nadu State, India. One of them was *Curvularia* sp., the leaf spot pathogen.

The purpose of this study was to evaluate the health of paddy seeds distributed in Bengkulu Province by using the seedling symptom test. The information of paddy seed health can be used as guide in making policies for managing of paddy disease, mainly for the seedborne

MATERIALS AND METHODS

The research was arranged in a completely randomized design with treatment of six paddy seed varieties: Gorendra, Raja Lele, and Mekongga from the Department of Agriculture, Inpari 6 and Inpari 30 from BPTP, and Sintanur from BPSB Bengkulu. Each treatment was repeated 5 times. Five paddy seeds were planted on 500 g of sterile sand media in a 1.5 l clear plastic bottle for 30 days (ISTA, 2006).

The variables observed in this study were: incubation periods, leaf spot diseases incidence 1-4 week after seedling, leaf spot disease severity 4 week after seedling, time of seedling emergence, height of seedling after 30 days old, number of leaves, length of root after 30 days, and fresh weight of seedling after 30 days old. The leaf spot pathogen was isolated using tissue planting method (IRRI, 2002).

The incidence of leaf spot disease was accounted according to formula 1, as follow:

$$\text{Disease incidence} = \frac{\text{Number of seedlings infected}}{\text{Number of seedlings}} \times 100\% \quad \text{(Formula 1)}$$

Disease severity of leaf spot disease caused by *Culvuria sp* calculated by using formula 2, as follows:

$$DS = \frac{P \times Q}{R \times S} \times 100\% \quad \text{..... (Formula 2),}$$

Where:
DS : disease severity (%)
P : ∑ number of seedling infected in each category
Q : value of each disease
R : highest scale value
S : number of seedilng observed

Disease severity was calculated using the following scoring.

Table 1. Score for leaf spot disease in rice paddy seedling

Scoring	Description
0	No symptoms of disease
1	Symptoms are not clear
2	Symptoms <5% in per hill
3	Symptoms ≥ 5% - < 25% in per hill
4	Symptoms ≥ 5% - < 50% in per hill
5	Symptoms ≥ 50% in per hill

Source : Standard Evaluation System (SES) for Rice (IRRI, 2002)

The mean data were analyzed using F test 5% following by Duncan Multiple Range Test (DMRT) 5%. The incubation periods and disease severity were analyzed descriptive.

RESULTS AND DISCUSSION

Seed Health

The pathogen causing leaf spot diseases detected in this experiment was *Culvularia* sp. The disease symptoms started from the tip of the leaves then spreading to allover of the leaves. Colonies of *Curvularia* sp. initially white and then brownish white, oval in shape and slightly bent and have very clear septum (Figure 1).

Curvularia sp. had reported as one of the most common fungal pathogens associated in paddy all over the word, including in Southern India (Mohana, 2011). Zakaria *et al*. (2010) had reported that *Curvularia* sp., as well as *Fusarium* sp., had higher occurrence in paddy seed compared with the other fungi. The effect of seed variety on means of incubation periods, disease incidence, and disease severity of leaf spot were presented in Figure 2, Figure 3, and Figure 4. The shortest incubation period was found Raja Lele in while the longest one was on Sintanur (Figure 2), suggesting that Sintanur was the most tolerant seed variety to leaf spot disease cause by *Culvularia* sp. However, it was not the case for disease incidence and disease severity, in which the best performance was demonstrated by Gorendra variety and the poorest one was shown by Inpari 6 (Figure 3 and Figure 4).

Figure 1. Colony and conidia of *Curvularia* sp.

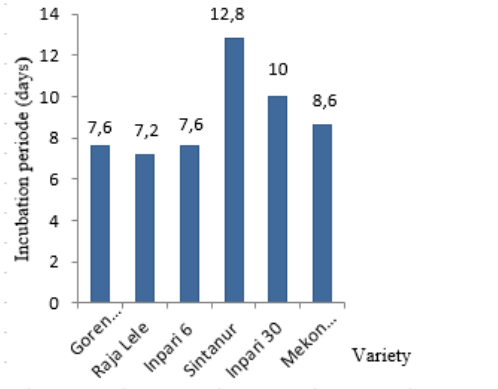

Figure 2. Incubation periode of leaf spot disease in 6 rice varieties

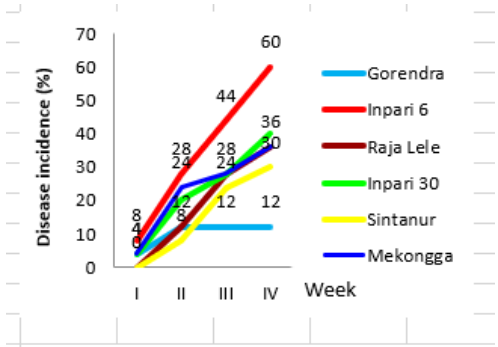

Figure 3. Effect of seed varieties on disease incidence of leaf spot caused by *Culvularia sp*

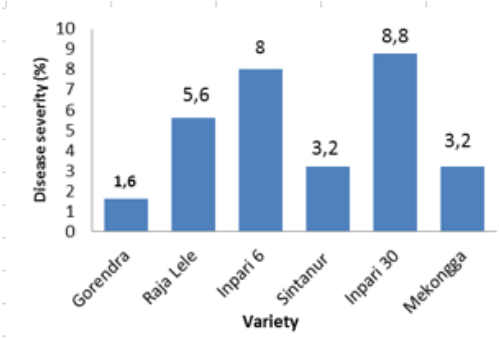

Figure 4. Effect of seed varieties on disease severity of leaf spot caused by *Culvularia* sp.

Seedling Growth

The result of analysis of variance (ANOVA) showed that the treatment significantly affected number of leaves, length of root, and fresh weight of seedling (Table 2).

The best seedling growth was demonstrated by Gorendra seedling, showing the highest number of leaves, the longest of root, and the weights of seedling fresh weight (Table 3). On the other hand, the poorest performance was found in Inpari 6. These data suggested that the disease incidence and disease severity of seed varieties contributed to the seedling growth.

Table 2. Summary of F-test for seedling growth

Variables	F test 5%
Height of seedling	2.52 ns
Number of leaves	4.72 *
Time of seedling emergence	2.60 ns
Length of root	7.36 *
Fresh weight of seedling	6.17 *

Note: ns = not significant, * = significant at α 5%

Table 3. Effects of seed varieties on number of leaves, length of root, and fresh weight of seedling

Paddy variety	Number of leaf	Length of root (cm)	Fresh weight of seedling (g)
Gorendra	0.26 a	8.05 a	15 a
Raja Lele	0.12 bc	3.38 b	0.08 b
Mekongga	0.16 bc	2.23 b	0.07 b
Inpari 6	0.08 c	1.73 b	0.04 b
Inpari 30	0.18 ab	2.22 b	0.07 b
Sintanur	0.20 ab	1.68 b	0.06 b

Note: The number at the same column followed by different letter was significantly different according to DMRT test at 5% significance level

The high and low of incubation period, the disease incidence and the disease severity of leaf spot disease on the 6 varieties of paddy seed were closely related to field conditions (nursery, planting, maintenance, and harvesting) as well as the storage room conditions (moisture content, temperature, humidity and lighting). All seeds were stored at dim lighting, with 12.0 -13.9% of seed water content, about 65% of humidity and 18 ^{o}C, with the exception that the storage temperature and humidity at the Department of Agriculture were 60% and 16 ^{o}C, respectively. The growth and health of the Gorendra variety of paddy seeds from the Agriculture Deparment of Bengkulu Province was the best among the seeds tested. In addition to the storage room condition, it might also be contributed by the storage period of the seeds before the experiment started. It was 2, 3, and 6 months in the Department of Agricultre (Gorendra), BPSB (Sintanur), and BPTP (Inpari 6), respectively. In this respect, seeds taken from BPTP demonstrated the highest disease incidence and severity. These findings suggested the importance of storage room conditions in affecting the growth and health of the seeds.

Haque *et al*. (2012) stated that the health of seeds will determine the health of plants in order to provide quality production. Seeds contaminated with pathogens are the primary inoculum for plant diseases in many food crops (Jo *et al*., 2014). Rahayu (2016) states that plant seeds must have the ability to live or have high viability. Farmers often experience significant losses in terms of both cost and time, due to the use of low quality seeds. Furthermore, Sutopo (2004) reports that the components that affect seed quality are genetic quality (variety purity), physiological quality (good germination and vigor), physical quality (pithy, homogeneous size, not mixed with other materials, and healthy or free from pests and diseases). Seeds that are stored for a certain period of time can suffer damage due to seed-borne disease. The data on the incidence and diversity of seed-borne fungal species would be of great importance in the region for predicting the extent of post-harvest infection, colonization and subsequent deterioration of cereals. In view of these, throughout the world, much attention has been given to know the diversity, incidence and management of seedborne and toxigenic fungi (Mohana *et al*., 2011).

Furthermore, Kolo & Teffa 2016) reported that the temperature of the seed storage area greatly affects the moisture content of the seeds. Seeds stored at room temperature can increase seed moisture content and reduce seed viability and vigor. This is associated with rapid respiration and rapid fungal infection as well. Samuel *et al*. (2011) explained that the higher the water content in the seeds, the deterioration of the germination capacity of the seeds will accelerate. The fungus on the seeds will not grow if the moisture content of the seeds is below the minimum moisture content. Therefore, the moisture content of the seeds affects the resistance of seeds to fungal attack (Situmeang *et al*., 2014). For this reason, it is necessary to handle the seeds properly so that when planted the seeds are still in adequate condition, namely having good viability, navigation, purity and health (Rahayu, 2016).

CONCLUSION

It was concluded that the Gorendra variety demonstrated as the healthiest seed and showed the best seedling growth while the poorest one was found in Inpari 6 showing the worst seedling growth.

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