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Influence of path-rows and direct seeded system on productivity of rice (Oryza sativa l.)

Srie Juli Rachmawatie[1], Tri Rahayu[2]
[1]Agrotechnology Department of Agricultural Faculty, Islam Batik University, Surakarta Regency, Central Java, Indonesia
**Coressponding author : sriejulirachmawatie@gmail.com*

ABSTRACT

Rice is one of the staple foods in Indonesia that recently its production still has quite a lot of problems, including limited land, low soil fertility, and declining crop productivity. The experiment of path-rows planting system and direct seeded was conducted to find out the productivity level of rice plant with different planting systems. The design of experiment used on-farm research design by making observations on the specified variable. The experiment of path-rows planting system and direct seeded system was done in district Mojolaban, Sukoharjo Regency. On the system, plants are grown using path-rows in 2:1 line model, square size 2.5 x 2.5 meter, plant spacing at 20 x 10 cm. Whereas, on the system of the crop planted, direct seeded with a distance of 20 x 20 cm. Samples were taken randomly (5 plants) and replicated 3 times. The variable observed includes plant height, number of tillers, dry grain yield, and dry weight of the milled grain. The data are analyzed using One Way Anova test. The results showed that path-rows planting system can increase dry weight of the milled grain 45% and the dry weight of the harvest grain by 10%, while the direct seeded system increased rice productivity by 15% than the conventional cropping system.

***Keywords**: Path-rows, direct seeded, rice productivity*

INTRODUCTION

Rice is one of the staple foods for most Indonesians has been receiving serious attention since 1970. Indonesia has declared for rice self-sufficiency in 1984 with a production achievement reached 25.835 million tons. These achievement can not be separated from various technological innovations that have been implemented on programs of agricultural intensification and extensification. However, to maintain its self-sufficiency, there are some challenges such as unpredictable climate, pests and diseases, and soil cultivation alternative, and conventional rice cultivation. Those challenges declined rice production in 1994-1995, where we have imported 2.4 -2.9 million tons of rice. Therefore, it is necessary to find technologies to improve the rice production.

The state of food in a country can be unstable if there is unbalance between the needs and food availability. This is the reason why the cultivation

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of rice plant remains preserved despite various obstacles, from upstream to downstream. Rice plant gets the main attention in the food crop cultivation.

Rice (*Oryza sativa L.*) is the main strategic commodity in Indonesia. According to the Indonesia Statistic Centre (BPS) (2015), the rice productivity in Indonesia increase about 6.42% compared to its productivity in 2014. However, the increase of rice productivity still can not fill the food needs of Indonesia society. Program solutions could be offered to increase rice production through both extensification and intensification. Some technologies cap be applied intensively, i.e. by using path-rows planting system and direct seeded system that can increase the productivity of rice. This research aims to determine the level of productivity of rice plants between path-rows planting systems and direct seeded system.

MATERIALS AND METHODS

The research was conducted in August-November 2017 in Mojolaban, Sukoharjo.

Intruments/tools used were the planter machine, gunny sacks, sprayer, scythe, bamboo, rope raphia, stationery, and scales. Growers, sprayer, farming tools, and scales. Materials used were rice seeds of Sidenuk variety, organic fertilizer, chemical fertilizer (NPK), and pesticide.

This experiment was done by on farm research by observing the specified variables. Sampling was done by square measurements, which is made a plot area of 2.5 x 2.5 meters with a plant spacing of path-row20 x 10 cm so that the number of plants were 156 plants. While planting seeds directly, which is made a plot area of 2.5 x 2.5 meters with a plant spacing of direct seeded of 25 x 15 cm. Then from a sampling square was taken five plants randomly, used as data with 3 times replication. The experiment parameters included plant height, number of tillers, dry grain yield, and dry weight of milled grain. All data obtained were analyzed using statistical analysis.

RESULTS AND DISCUSSIONS

Plant Height (cm)

Based on variance analysis, rice plants grown with path-row planting system had plant height significantly different from direct seeded cropping. Plant height in path-row system is higher (117 cm) than direct seeded cropping system (72.6 cm) as presented in Figure 1. In general, rice plants grown at narrow spacing experience a decrease in quality in their growth. The path-row planting system provides a long aisle between crops that can provide a better micro climate between plants and intensively utilization of solar radiation so that plants can grow optimally. Several studies have shown that individual

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appearance of rice plants at wide spacing is better than narrow spacing (BPPP Ministry of Agriculture, 2013).

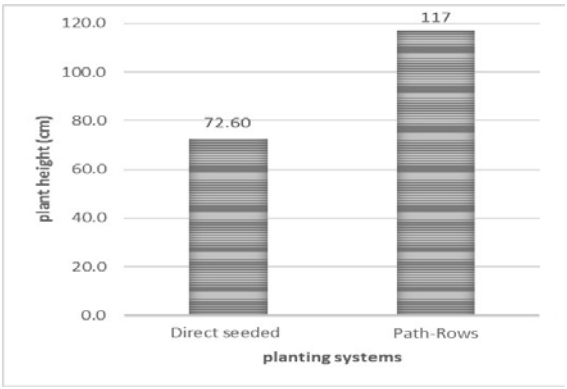

Figure 1. Plant height of Sidenuk variety in path-row and direct seeded planting systems

Number of tillers

The number of tiller per hill is one indicator of rice production. The large number of shoots per clump determines the dry weight of harvested grains. The results of variance analysis showed that the tiller number (27 tillers) in the path-row planting system was significantly different with direct seeded system (23 tillers) as presented in Figure 2. This means that the formation of seedlings in path-rows's cropping system is 14.8% higher than in the direct seeded system. Path-rows cropping system has advantages in increasing plant population. The research results by BPTP Jambi (2013) showed that plant population in path-rows 2: 1 increased by 30%. The increase in the number of tiller per hill in the path-rows planting system can be seen in Figure 2.

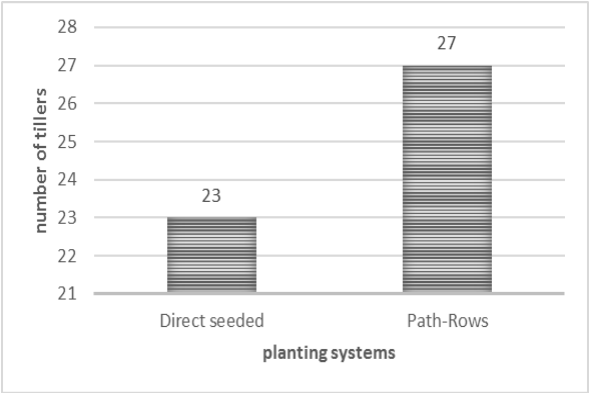

Figure 2. Number of tiller per hill in path-row and direct seeded planting systems

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The wide spacing of path-rows system allows the reception of sunlight and optimal absorption of water and nutrients in rice plants which encourage the growth of shoots. This is in line with research conducted by the Ministry of Agriculture's that the Inpari 9-Elo variety planted at a wide plant spacing (50x50 cm) can produce more than 50 tillers per hill with good vegetative vigor, especially if the soil is sufficient water and nutrients. On the other hand, at tight conditions (20x20 cm) only produces less than 20 tillers per hill.

Dry grain yield

The results of the variance analysis showed that the dry grain yield in path-rows system was not significantly different compared to the direct seeded system (F hitung< F table atau 0.583< 3.57). Path-rows system is able to provide an increase of dry grain yield by 21%. This increase in production is in line with research conducted in Jambi, which shows that the path-rows system provides an increase in dry grain yield by 18% and research in Bejeng Subdistrict, Gowa Regency, with the yield of dry grain reaching 8.5 tons / ha. This result is higher than the production in the non- path-rows system, which is 6.36 tons / ha (BPPP, 2013).

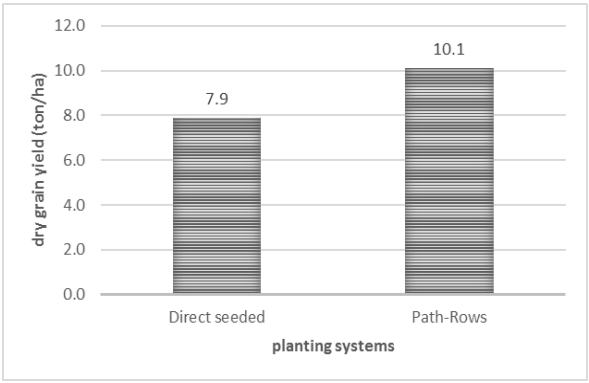

Figure 3. Dry grain yield from different planting systems

Dry weight of milled grain

The result of variance analysis shows that the path-rows system provides a significant increase in the dry weight of milled grain than the direct seeded system (F hitung> F table atau 142,13> 4,64). (Figure 4.)

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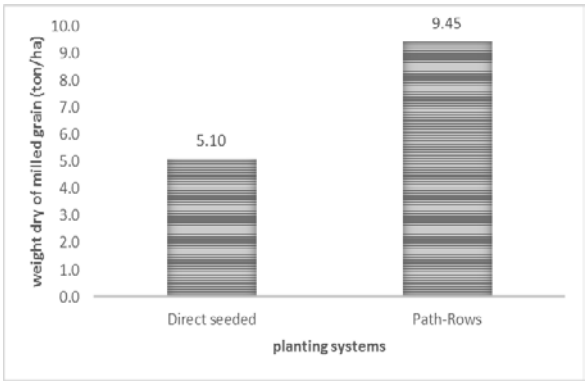

Figure 4. Dry weight of milled grains in different planting systems

This increase in production is in line with the results of the implementation of the path-rows system in Bejeng Sub-district, Gowa Regency, which shows that the yield of dry weight of milled grain reached 8.5 tons/ha. This result is higher than the production in the non- path-rows system, namely 6.36 tons/ha. The results of the study in Subak Dalam, Desa Wani, Krambinan District, Tabanan Regency, Bali in the 2006 showed that the path-rows 2: 1 system improved the yield of Ciherang varieties, by 5.64 tons / ha or there was an increase of 22.7%.

CONCLUSIONS

Differences of planting system will affect the growth and productivity of rice plants. Plant growth (plant height) and rice productivity (tiller number per hill, dry weight of milled grain, dry grain yield) in path-rows planting system were higher than direct seeded system. The results showed that the path-rows planting system could increase grain yield by 4.35 tons/ha or 46% compared to the direct seeded system.

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