



Effectiveness of Planting Pattern Systems and Types of Varieties on the Growth and Production of Rice Plants (*Oryza sativa* L.)

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ABSTRACT

Jajar Legowo planting pattern technology is a planting technique designed to arrange the planting pattern in order to increase production. The purpose of this study is to analyze the Jajar Legowo planting system and different varieties on post-harvest rice production and proximate content. There are 2 types of research methods: quantitative analysis of post-harvest rice, which includes proximate content, and rice cultivation using a Randomized Block Design (RBD) with 5 repetitions. The treatments consist of two factors: the main factor is 2 types of seed varieties (V1) Inpari 32 HDB and (V2) Inpari 49 Jembar, and the second factor is the type of planting system (J1) Jajar Legowo 2:1, (J2) Jajar Legowo 3:1, (J3) Jajar Legowo 4:1. The parameters analyzed are: plant height, number of tillers, number of panicles, wet grain weight, dry grain weight, and moisture content. The research location is in Getas Village, Tanjunganom District, Nganjuk Regency, East Java, at an altitude of 79.9 meters above sea level, with a soil pH of 6.0, alluvial soil type, surrounding temperature of 30-32 degrees Celsius, and about 85% humidity, conducted from April to October 2025. The results showed that the growth and yield of the Inpari 49 variety were higher than Inpari 32 in all planting system combinations

INTRODUCTION

Indonesia is a country rich in food resources. Rice (*Oryza sativa* L.) is one of the food commodities that contains carbohydrates, minerals, and vitamins, making it a good source of carbohydrates and a potential option for food diversification. Rice production in Indonesia is dominated by East Java, Central Java, and West Java. As an agrarian country, Indonesia is working to increase rice productivity to meet the growing domestic consumption needs as the population continues to rise. Jajar Legowo technology is a planting engineering technique that arranges the planting pattern between clumps and rows so that the clumps of rice are more compact within the row and the spacing between rows widens, making it seem like the rice clumps are at the edge of the field, benefiting as edge plants.

The legowo planting system used is the jajar legowo (2:1), which is a method of planting rice where every two rows of plants are separated by an empty row that has a spacing pattern twice that of the spacing between rows, while the plant spacing within a row is half of the spacing between rows. Jajar legowo (3:1) is a rice planting method where every three rows of plants are separated by one empty row, which also has a spacing pattern twice that of the spacing between rows. Jajar legowo (4:1) is a way of planting rice where every four rows of plants are spaced with one empty row, which follows a pattern twice that of the plant spacing between rows.

The purpose of the research is to analyze the effectiveness of planting patterns and various varieties on the growth and production of rice. The benefit of the research is to gain insight into the science and technology of new rice cultivation methods that can increase production. Another benefit is that farmers can improve their welfare. The potential of this planting system can motivate other farmers to develop the cultivation of this crop.

LITERATURE REVIEW

Rice is an annual plant from the Poaceae family (the grass family) and has a relatively short life cycle. This plant comes from a temperate biome and is a cultivated crop from China. Another name for rice is *pari* (Javanese) or *pare* (Sundanese). The scientific name *Oryza sativa* was introduced by Carolus Linnaeus (Plantamor, 2025). The roots of the rice plant are the lower part of the plant that comes from the radicle, which is the first root that appears when the seed starts to germinate.

These hair roots are short-lived and have shapes and lengths similar to fibrous roots. (Irfan M, et al., 2024). The longest leaf blade that wraps around the topmost stem node is known as the flag leaf. Right at the spot where the topmost leaf sheath turns into a ligule and flag leaf, a node is formed that will develop into the rice panicle (where the rice grains grow). (Widyaningtias, Yudoyono, and Supriyanta, 2020). Planting patterns affect the availability of resources such as light, water, and nutrients, and determine the level of competition among plants. (Sutarya, et al., 2018).

Good planting arrangements are really important to reduce competition between plants for light and nutrients, make it easier to take care of things like weeding, fertilizing, and pest control, and improve photosynthesis efficiency since sunlight can reach all parts

of the plants (Yustiana, et al., 2020). Planting patterns directly affect both the vegetative and generative growth of plants. Plants that have ideal growing space will show optimal height, more tillers, and higher grain production per clump.

This also affects the overall harvest results (Iskandar, et al., 2022). The application of the 2:1 jajar legowo planting pattern on the Inpari 32 variety resulted in a significant increase in the number of productive tillers and the weight of dry harvested grains (Rahmawati and Hadi, 2021). Varieties are one of the important technological elements that play a big role in increasing rice production and farm income. According to (BPPSDMP, 2022), with a planting age of around 120 days after sowing, Inpari 32 HDB has a plant height of about 97 cm with an upright posture and flag leaves that stand tall, allowing optimal use of sunlight for its growth.

METHODOLOGY

This research was conducted at the Experimental Land in Getas Village, Tanjunganom District, Nganjuk Regency, East Java, at an altitude of 79.9 meters above sea level, with a soil pH of 6.0. The study was carried out over 4 months, from April 2025 to July 2025. The materials used included rice seeds from BRMP (Agricultural Assembly and Modernization Agency) with varieties Inpari 32 HDB 500 grams, Inpari 49 Jembar 500 grams, Urea Fertilizer 12.5 grams, NPK Mutiara Fertilizer 2,437 grams, Virtako 300 SC Insecticide (0.65 ml), Score 250 EC Fungicide (0.65 ml), fence plastic 0.35 Mc with a length of 32.5 m and height of 60 cm, wood, water, raffia rope, and sacks. The tools used in this research include a hoe, shovel, sickle, bucket, sprayer, planting ruler, soil pH meter, tape measure, digital scale, and moisture tester.

This research was conducted using a Randomized Block Design (RBD) with 5 replications. The treatments consisted of two factors: The main factor was 2 seed varieties (V), namely: (V1) Inpari 32 HDB, (V2) Inpari 49 Jembar. The second factor was the type of planting system (J), namely: (J1) Jajar legowo 2:1, (J2) Jajar legowo 3:1, (J3) Jajar legowo 4:1. From these two factors, six treatment combinations were obtained: V1J1, V1J2, V1J3, V2J1, V2J2, V2J3. Using a Randomized Block Design (RBD) with 5 replications In one test there are 108 clumps, with a total of 540 plant clumps. Observations were made on several parameters, namely: plant height, number of tillers, number of panicles, wet grain weight, dry grain weight, and moisture content. The data obtained are (soil nutrients, plant height, number of tillers, number of panicles, wet grain weight, dry grain weight, and moisture content). This study uses analysis of variance (ANOVA) to see if there are significant differences in plant growth and yield between different legowo row planting patterns. If a significant difference occurs, a 5% BNT test will be conducted.

RESULT AND DISCUSSION**Plant Height**

The analysis of variance shows that the interaction between planting patterns and varieties has a very significant effect on plant height at 30 days after planting, a significant effect at 60 days after planting, and no significant effect at 80 days after planting. The planting pattern treatment does not have a significant effect on plant height at 30 days after planting, but has a significant effect at 60 days and a very significant effect at 80 days after planting. The results of the 5% BNT test are shown in Table 1.

Table 1. Average Plant Height

Treatment	Average plant height (cm) age (DAS)		
	30	60	80
V1J1	35,13 cd	80,06 c	98,46 c
V1J2	32,93 d	77,8 d	105,66 ab
V1J3	31,2 d	74,46 e	102,8 bc
V2J1	38,53 b	87,66 a	103,66 b
V2J2	42,13 a	84,34 b	106,8 ab
V2J3	42,67 a	80,66 c	109,2 a
BNT 5%	2,51	1,64	4,61

Table 1 shows that the combination of planting pattern and variety that resulted in the highest growth was the V2J3 treatment (Inpari 49 Jembar with a 4:1 planting pattern), with an average increase of 66.53 cm during the 30-80 days after planting. The lowest growth among the combinations of planting pattern and variety was found in the V1J1 treatment (Inpari 32 HDB with a 2:1 planting pattern). The planting pattern between rows that increasingly affects plant height is caused by the plant canopy becoming denser, which reduces the quality of light received, making the plants compete for sunlight for photosynthesis. (Sakti, et al, 2014.) Using planting distance basically gives plants a chance to grow well without too much competition for water, nutrients, and sunlight. (Magfiroh et al, 2017). Furthermore, Suprihatno (2010) added that varieties with short stems will absorb more sunlight compared to sunlight absorption by tall varieties. (Candra et al, 2017).

Number of Offspring

The variance analysis results show that there is no interaction between planting patterns and varieties on the number of plant tillers at 30 and 60 days after planting. The planting pattern treatment has a significant effect on the number of tillers at 30 and 60 days after planting. The variety significantly affects the number of tillers at 30 and 60 days after planting, as shown in Tables 2 and 3. Table 2 shows that the planting pattern has the biggest effect on the number of shoots, with J1 (2:1 planting pattern) producing the most. The planting pattern

helps reduce competition between plants, allowing them to grow taller and stronger stems. The wider space enables the plants to optimize the photosynthesis process, resulting in sturdier stems and more leaves (Ricke, Sigit, and Didik, 2025).

Table 2. Average Number of Plant Seedlings

Treatment	Average number of plant sprouts	
	30	60
J1	14,01 a	32,6 a
J2	12,84 b	29,96 b
J3	12,73 b	29,88 b
BNT 5%	0,85	0,80

Table 3 shows that the effect of variety on the number of tillers is highest in V1 (Inpari 32 HDB). As stated by (Sakti, et al, 2014), the number of tillers will be maximized if the plant has good genetic traits combined with favorable environmental conditions. According to (Magfiroh et al, 2017), plants grown at close spacing experience stress on vigor, which inhibits tiller development, and some factors that affect chlorophyll formation in leaves are the presence of light, water, and nutrients such as N, Mg, Mn, Cu, and Zn. If plants are planted closely, competition for the above factors cannot be avoided, so chlorophyll formation in the leaves will be inhibited. The number of tillers will be at its maximum if the plants have good genetic traits along with favorable environmental conditions or conditions suitable for plant growth and development. Furthermore, it is stated that the maximum number of tillers is also determined by the planting distance, as planting distance affects sunlight, mineral nutrients, and the cultivation of the plants themselves.

Table 3. Average Number of Plant Seedlings for Variety Treatments at 30 and 60 Days After Planting

Treatment	Average number of plant sprouts	
	30 HST	60 HST
V1	13,92 a	31,84 a
V2	12,46 b	29,78 b
BNT 5%	0,69	0,65

Number of Tassels

The variance analysis results show that there is an interaction between planting pattern and variety that has a very significant effect on the number of panicles per plant. The planting pattern treatment has a significant effect on the number of panicles. The variety type does not have a significant effect on the number of panicles. The results of the 5% BNT test are in Table 4.

Table 4. Average Number of Panicles

Treatment	Average number of panicles
V1J1	18,4 a
V1J2	16,42 ab
V1J3	11,86 c
V2J1	15,08 b
V2J2	13,52 bc
V2J3	15,66 ab
BNT 5%	2,75

Table 4 shows that the combination of planting patterns with the V1J1 variety (Inpari 32 HDB with a 2:1 planting pattern) has the highest number of panicles. This is suspected because a wider planting pattern affects the number of panicles. Each rice tiller has the potential to produce one or more panicles, which directly contributes to increasing the total grain weight per unit area (Ricke, Sigit, and Didik, 2025). Optimizing the planting pattern also allows crops to use sunlight and nutrients more efficiently, which helps improve overall rice productivity. According to (Magfiroh et al 2017), one way to achieve good growth is by spacing the plants farther apart, because the competition for nutrients, water, and sunlight between plants becomes lower.

Dry Grain Weight

The analysis of variance shows that there is no interaction between planting patterns and varieties on dry grain weight. The planting pattern treatment has a significant effect on dry grain weight. The type of variety does not have a significant effect on dry grain weight. The results of the 5% LSD test are shown in Table 5.

Table 5 shows that planting patterns have a significant effect on the dry grain yield, with J2 (the 3:1 planting pattern) having the highest dry grain weight. The weight of the seeds depends on the amount of dry matter contained in them. The dry matter in the seeds comes from photosynthesis, which can then be used to fill the seeds. (Sakti et al., 2014) The effect of planting distance and the impact of planting on the edges in the legowo row pattern, where plants get enough supply of nutrients, water, and sunlight. This will make the photosynthesis process take place optimally. (Magfiroh et al., 2017)

Table 5. Average Dry Grain Weight by Planting Pattern Treatment

Treatment	Average weight of dry grains (grams)
J2	38,25 a
J1	36,6 ab
J3	29,55 b
BNT 5%	7,25

In calculating productivity, the rice harvest results for varieties with planting patterns per hectare are listed in Table 6.

Table 6. Average Harvest Results on an Area of 1 Ha

Treatment	Population clumps/ha	of Harvest yield tons/ha
V1J1	213.1333	9.0
V1J2	240.000	10.9
V1J3	256.000	7.9
V2J1	213.1333	8.2
V2J2	240.000	9.4
V2J3	256.000	8.9

CONCLUSIONS AND RECOMMENDATIONS

Based on the research that has been conducted, it can be concluded that there is an interaction between the cropping pattern system and variety on plant height, with the best combination being the Inpari 49 Jembar variety with a 4:1 planting pattern, and on the number of panicles per plant, with the best combination being Inpari 32 HDB with a 2:1 planting pattern. The treatment of the jajar legowo planting system had a significant effect on the number of tillers, with the best pattern being 2:1, on wet grain weight with the best pattern 3:1, and on dry grain weight with the best pattern 3:1. The single treatment on the variety type had a significant effect on the number of tillers, with the best variety being Inpari 32 HDB.

FURTHER STUDY

Further research is recommended to test the legowo row planting system with the tegel planting pattern, to distinguish the productivity results produced by each planting pattern.

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