



## Effect of Planting System and Seed Age on Yield and Yield Components of Paddy Rice (*Oryza sativa* L) Inpari 32 Variety

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### Abstract

*The research aims to determine; (1) The effect of the interaction between the planting system and seed age on the growth and yield of rice plants, and (2) the planting system and age of the seed that gives the best yield and growth. The research was carried out in Sukamandijaya Village, Ciasem District, Subang Regency, starting from April to August 2021. The research was carried out with an experimental approach using a randomized block design (RAK) with a factorial pattern of strip plot design consisting of two factors, the first factor being a three-level planting system (tile system, jajar legowo 2 : 1, and jajar legowo 4 : 1, and three levels of seed age (7 DAS, 14 DAS and 21 DAS) so that for each replication there were 9 treatment combinations and repeated three times To determine the effect of planting system treatment and seed age, analysis of variance through the F test was used, with the follow-up using Fisher's LSD/BNT follow-up test at a 5 percent. level of significance. The results showed that: (1) there was an interaction effect between planting system treatment and seed age on the yield of dry grain harvested per plot. The independent planting system affected the number of tillers per clump, the number of productive tillers, the number of grains of grain per panicle, the number of pithy grains per panicle and the weight of 1000 grains of grain. The age of the seed independently affected the number of tillers per clump, the number of productive tillers, the number of grains of grain per panicle, the number of pithy grains per panicle and the weight of 1000 grains of grain, and (2) the row planting system of legowo 4: 1 and the age of the seeds 14 days after sowing. gave the highest yield of dry grain harvest per plot, namely 7.83 kg per plot or equivalent to 8.70 tons of GKP per hectare.*

*Keywords: Planting System, Seed Age, Growth and Yield of Rice*

### Abstract

Penelitian bertujuan untuk mengetahui ; (1) Pengaruh interaksi antara sistem tanam dan umur benih terhadap Komponen Hasil dan hasil tanaman padi, dan (2) Sistem tanam dan umur benih yang memberikan hasil dan pertumbuhan terbaik. Penelitian dilaksanakan di Desa Sukamandijaya Kecamatan Ciasem Kabupaten Subang, mulai dari bulan April sampai dengan bulan Agustus 2021. Penelitian dilaksanakan dengan pendekatan eksperimen menggunakan Rancangan Acak Kelompok (RAK) pola faktorial rancangan petak teralur (strip plot design) yang terdiri dari dua faktor yaitu faktor pertama adalah sistem tanam sebanyak tiga taraf (sistem tegel, jajar legowo 2 : 1, dan jajar legowo 4 : 1, dan faktor umur benih tiga taraf (7 hss, 14 hss dan 21 hss) sehingga setiap ulangnya terdapat 9 kombinasi perlakuan dan diulang tiga kali. Untuk mengetahui pengaruh perlakuan sistem tanam dan umur benih, digunakan analisis varian melalui uji F, dengan

uji lanjutan menggunakan uji lanjut Fisher's LSD/BNT pada taraf nyata 5 persen. Hasil penelitian menunjukkan bahwa : (1) terdapat pengaruh interaksi antara perlakuan sistem tanam dan umur benih terhadap hasil gabah kering panen per petak. Sistem tanam secara mandiri berpengaruh terhadap jumlah anakan per rumpun, jumlah anakan produktif, jumlah bulir gabah per malai, jumlah gabah bernas per malai dan bobot 1000 butir gabah. Umur benih secara mandiri berpengaruh terhadap jumlah anakan per rumpun, jumlah anakan produktif, jumlah bulir gabah per malai, jumlah gabah bernas per malai dan bobot 1000 butir gabah, dan (2) sistem tanam jajar legowo 4 : 1 dan umur benih 14 hari setelah sebar memberikan hasil gabah kering panen per petak tertinggi yaitu 7,83 kg per petak atau setara dengan 8,70 ton GKP per hektar.

Key words: Planting System, Seed Age, Growth and Rice Yield.

## 1. Introduction

Rice (*Oryza sativa* L.) is an important food crop which has become the staple food for more than half of the world's population. In Indonesia, rice is the main commodity to support people's food. Indonesia, as a country with a large population, faces challenges in meeting the population's food needs. Therefore, food security policies are the main focus in agricultural development. According to BPS data (2019), rice consumption in 2019 reached 111.58 kg / capita / year with a population of 280 million people, so that national rice consumption in 2019 reached 31.31 million tons. The need for rice continues to increase along with the rate of population growth which is faster than the growth of available food production.

The obstacles and challenges faced in realizing national food security are competition in the use of land and water resources. One of the factors that influences increasing yields is improving the planting system and seed age. This increase can be done through planting efficiency by regulating the planting system and streamlining the lifespan of seeds in the nursery. Setting the correct planting system and seed age, as well as the use of superior rice varieties, apart from being effective in plant growth, is also time efficient and obtains optimal productivity.

Efforts to increase through extensification (expansion of planting areas), is currently considered expensive and difficult to do, because the availability of agricultural land is shrinking day by day and most of this land shrinkage occurs on the island of Java. The shrinkage of agricultural land area on the island of Java occurred partly as a result of land conversion or land mutation from agricultural land to the non-agricultural land sector, for example the construction of housing, offices, transportation facilities and so on.

The influence of the use of planting systems and seed age will affect the growth and production of rice plants. Starting from this, to obtain clearer information it is necessary to carry out further research regarding the influence of the planting system and the age of the Inpari 32 variety rice seeds, so that optimal rice growth and yield can be obtained.

## 2. Materials and Methods

The research uses experimental methods, the research will be carried out in Sukamandijaya Village, Ciasem District. Topographic conditions in the Sukamandijaya Village area are

generally flat with a height above sea level ranging from 10 m - 15 m above sea level. Climate conditions are generally hot with temperatures ranging between 30°C -35°C during the day and temperatures at night ranging between 22°C - 28 °C with air humidity ranging between 40% -60% and average rainfall of 1,073.5 mm per year. The soil type in the Sukamandijaya Village area is generally Alluvial/Grumosol soil type. Alluvial soil is soil formed from river mud that settles in the lowlands which has fertile soil properties and is suitable for agricultural land. The depth of the soil solum ranges from 100 cm - 200 cm and the soil pH is 4.5 - 5.5 (acid).

This research examines plant growth and yield in response to the use of planting systems and seed age. Based on these objectives, the nature of this research is experimental verification. The research period will be carried out from April 2021 to August 2021.

The materials and tools used in this research were rice seeds of the Inpari 32 variety, Urea Fertilizer, NPK Phonska, and Organic Fertilizer, hand tractor, hoe, sickle, threshing machine, plant distance measuring equipment, scales, nameplates, and writing tools.

This research was carried out using a Randomized Block Design (RAK) factorial pattern. Strip plot design is an arrangement of plots as experimental units consisting of row plots for the first treatment and column plots for the second treatment, factors The first is the planting system which consists of three levels, namely the tile planting system, the 2:1 Legowo planting system and the 4:1 Legowo planting system and the second factor is the age of the seeds consisting of three levels, namely the seed age of 7 days, 14 days and 21 days.

Table 1. Combination of Planting System Treatments and Seed Age

Planting System	Seed age (hss)		
	u <sub>1</sub>	u <sub>2</sub>	u <sub>3</sub>
j <sub>1</sub>	j <sub>1</sub> u <sub>1</sub>	j <sub>1</sub> u <sub>2</sub>	j <sub>1</sub> u <sub>3</sub>
j <sub>2</sub>	j <sub>2</sub> u <sub>1</sub>	j <sub>2</sub> u <sub>2</sub>	j <sub>2</sub> u <sub>3</sub>
j <sub>3</sub>	j <sub>3</sub> u <sub>1</sub>	j <sub>3</sub> u <sub>2</sub>	j <sub>3</sub> u <sub>3</sub>

Information: j<sub>1</sub> = tile system, j<sub>2</sub> = Legowo system 2: 1, j<sub>3</sub> = Legowo system 4: 1 u<sub>1</sub> = seed age 7 after, u<sub>2</sub> = seed age 14, u<sub>3</sub> = seed age 21 after

Table 2. Operational Independent Variables and Dependent Variables

No	Variable Type	Sub Variable	Variable Indicator
1.	Independent Variable (Treatment)	1. Planting system (j) 2. Seed Age (u)	- -
2.	Dependent Variable (Rate of change)	1. Interaction between planting system and seed age 2. Rate of change in growth and yield of rice plants	1. Number of tillers per hill 2. Root loss ratio 3. Number of productive offspring 4. Number of grains per panicle 5. Number of grains of grain per panicle 6. Weight of 100 items 7. Dry grain harvest

3. The planting system and age of the seeds influence growth and yield 1. Testing changes

Table 3. Analysis of Variety Print List

Diversity Source	DB	JK	KT	Fcount
Group (R)	r-1	JKR	KTR	KTR/KTg
Vertical factor				KTt/KTg
Planting system (A)	a-1	JK A	JK A	KTj/KTg
Error (a)	(a-1) (r-1)	JK (Error a)	KT (Error a)	
Horizontal factor				
Age of seedlings (B)	(b-1)	JK B	KT B	KTb/KTg
Error (b)	(b-1) (r-1)	JK (Error b)	KT (Error b)	
Interaction				KTjb/KTg
AB	(a-1) (b-1)	JK AB	KT AB	
Error (c)	(a-1) (r-1) (b-1)	JK (Error c)	KT (Error c)	
Total (T)	Wed -1			

Source: Montgomery, 2005

### 3. Results and Discussion

#### Number of Saplings per Clump

Based on the variance analysis of the Strip Plot Design, it can be concluded that there is no interaction effect of vertical factors (planting system) and horizontal vector (seed age) on the number of tillers per hill in each observation period (ages 28, 35, 42 and 49 HST), because the interaction value of Fcount is smaller than F0.05. Meanwhile, the vertical factor (planting system) and horizontal factor (seed age) had a real influence on the number of tillers per hill because the calculated F value was greater than F0.05.

Table 4. Effect of Planting System and Seed Age on Number of Tillers per Clump at Age 28, 35, 42 and 49 Days After Planting

Treatment	Number of Saplings per Clump (fruit)			
	28 hst	35 hst	42 hst	49 hst
1. Influence of Cropping System				
j1 (Tile)	9.24 a	11.84 a	17.64 a	23.06 a
j2 (Legowo 2 : 1)	10.01 b	12.37 a	19.21 b	26.51 b
j3 (Legowo 4 : 1)	10.02 b	13.36 b	19.43 b	28.40 c
2. Effect of Seed Age				
u1 (7 days after spreading)	9.17 a	12.58 ab	18.32 a	24.70 a
u2 (14 days after spreading)	9.80 b	13.02 b	18.54 ab	26.39 ab
u3 (21 days after sowing)	10.31 b	11.97 a	19.42 b	26.88 b

Note: Numbers followed by different letters indicate a significant difference based on the LSD/BNT test at the 5% level

At the age of 28 days after planting independently, the planting system had a real influence on the number of tillers per hill. The 4:1 Jajar Legowo planting system treatment gave the highest number of tillers per hill and was significantly different from the other treatments, except that the 2:1 Jajar Legowo planting distance treatment was not significantly different. Meanwhile, the lowest number of tillers per hill was obtained in the tegel planting system. At the age of 35 weeks after planting independently, the planting

system had a real influence on the number of tillers per hill. The Jajar Legowo planting spacing treatment of 4:1 gave the highest number of tillers per hill and was significantly different from other treatments. Meanwhile, the lowest number of tillers per hill was obtained in the tegel planting system.

At the age of 42 days after planting independently, the planting system had a real influence on the number of tillers per hill. The treatments for the Jajar Legowo 2:1 and Jajar Legowo 4:1 planting systems were not significantly different, but the two treatments were significantly different from the tile planting system. At the age of 49 days after planting independently, the planting system had a real influence on the number of tillers per hill. The Jajar Legowo planting spacing treatment of 4:1 gave the highest number of tillers and was significantly different from the other treatments.

### Root Loss Ratio

Based on the variance analysis of the Strip Plot Design, it can be concluded that there is no interaction effect of vertical factors (planting system) and horizontal factors (seed age) on the root decay ratio, because the interaction value of Fcount is smaller than F0.05. Meanwhile, the vertical factor (planting system) and horizontal factor (seed age) had no real influence on the root loss ratio because the Fcount value was F0.05 smaller.

Table 5. Effect of Planting System and Seed Age on Root Pudding Ratio

Treatment	Root Loss Ratio	
1. Influence of Cropping System		
j1 (tile)	5.30	a
j2 (Legowo 2 : 1)	5.48	a
j3 (Legowo 4 : 1)	5.50	a
2. Effect of Seed Age		
u1 (7 days after spreading)	5.38	a
u2 (14 days after spreading)	5.43	a
u3 (21 days after sowing)	5.47	a

Note: Numbers followed by different letters indicate a significant difference based on the LSD/BNT test at the 5% level

Independently, seed age did not have a significant effect on the root loss ratio. The age of seed treatment gave relatively the same ratio of root loss.

### Number of Productive Tillers per Clump

Based on the variance analysis of the Strip Plot Design, it can be concluded that there is no interaction effect of vertical factors (planting system) and horizontal factors (seed age) on the number of productive tillers per hill, because the interaction value of Fcount is smaller than F0.05. Meanwhile, the vertical factor (planting system) and horizontal factor (seed age) had a real influence on the number of tillers per hill because the Fcount value was greater than F0.05.

Table 6. Effect of Planting System and Seed Age on Number Productive Tillers per Clump

Treatment	Number of Productive Saplings (fruit)
1. Influence of Planting System	
j1 (Tile)	14.50 a
j2 (Legowo 2 : 1)	15.40 a
j3 (Legowo 4 : 1)	16.78 b
2. Influence of Seedling Age	
b1 (7 days after spreading)	14.77 a
b2 (14 days after spreading)	16.71 b
b3 (21 days after spreading)	15.20 a

Note: Numbers followed by different letters indicate a significant difference based on the LSD/BNT test at the 5% level

The independent planting system has a significant effect on the number of productive tillers per hill. The 4 : 1 Jajar Legowo planting system treatment gave the highest number of productive seedlings per hill, namely 16.78 stems and was significantly different from the tegel planting system and the 2 : 1 Jajar Legowo planting system. The 14 hss seed age treatment gave the highest number of productive tillers, namely 16.71 stems per clump and significantly different from seed age of 7 days and 21 days.

### Number of Grains per Panicle

Based on the variance analysis of the Strip Plot Design, it can be concluded that there is no interaction effect of vertical factors (planting system) and horizontal factors (seed age) on the number of grains per panicle, because the interaction value of Fcount is smaller than F0.05. Meanwhile, the vertical factor (planting system) and horizontal factor (seed age) had a real influence on the number of grains per panicle because the Fcount value was greater than F0.05.

Table 7. Effect of Planting System and Seed Age on the Number of Grain Grains per Panicle

Treatment	Number of Grains per Panicle
1. Influence of Cropping System	
j1 (Tile)	130.46 a
j2 (Legowo 2 : 1)	138.54 a
j3 (Legowo 4 : 1)	150.90 b
2. Effect of Seed Age	
u1 (7 days after spreading)	132.86 a
u2 (14 days after spreading)	150.30 b
u3 (21 days after sowing)	136.74 a

Note: Numbers followed by different letters indicate a significant difference based on the LSD/BNT test at the 5% level

The independent planting system has a significant effect on the number of grains per panicle. The Jajar Legowo planting spacing treatment of 4:1 gave the highest number of

grains per panicle, namely 150.90 grains and was significantly different from the tile planting system and the Jajar Legowo 2:1 planting system. Independently, the age of the seed had an effect on the number of gabar grains per panicle. The seed age treatment of 14 dss gave the highest number of grains per panicle and was significantly different from the seed age of 7 dss and 21 dss.

### Number of Rice Grains per Panicle

Based on the variance analysis of the Strip Plot Design, it can be concluded that there was no interaction effect of vertical factors (planting system) and horizontal factors (seed age) on the number of healthy grains per panicle, because the interaction value of Fcount is smaller than F0.05. Meanwhile, the vertical factor (planting system) and horizontal factor (seed age) had a real influence on the number of grainy grains per panicle because the Fcount value was greater than F0.05.

Table 8. Effect of Planting Distance and Age of Seedlings on the Number of Rice Grains per Panicle

Treatment	Number of Rice Grains per Panicle
1. Influence of Cropping System	
j1 (Tile)	117.11 a
j2 (Legowo 2 : 1)	124.39 a
j3 (Legowo 4 : 1)	135.46 b
2. Effect of Seed Age	
b1 (7 days after spreading)	119.22 a
b2 (14 days after spreading)	134.97 b
b3 (21 days after spreading)	122.77 a

Note: Numbers followed by different letters indicate a significant difference based on the LSD/BNT test at the 5% level

The independent planting system has a significant effect on the number of grainy grains per panicle. The Jajar Legowo planting spacing treatment of 4:1 gave the highest number of grainy grains, namely 135.46 grains and was significantly different from the tile planting system and the Jajar Legowo 2:1 planting system. Independently, the age of the seed had an effect on the number of grainy grains per panicle. The seed age treatment of 14 dss gave the highest number of grainy grains, namely 134.97 grains and was significantly different from the seed age of 7 dss and 21 dss.

### Weight of 1000 Grains of Grain

Based on the variance analysis of the Strip Plot Design, it can be concluded that there is no interaction effect of vertical factors (planting system) and horizontal factors (seed age) on the weight of 1,000 grains of grain, because the interaction value of Fcount is smaller than F0.05. {There are vertical factors (planting system) and horizontal factors (seed age) which have a real influence on the weight of 1,000 grains of grain because the calculated F value is greater than F0.05.

Table 9. Effect of Planting System and Seed Age on the Weight of 1000 Grain Grains

Treatment	Weight of 1000 Grains of Grain
1. Influence of Cropping System	
j1 (Tile)	21.43 a
j2 (Legowo 2 : 1)	24.37 b
j3 (Legowo 4 : 1)	24.90 b
2. Effect of Seed Age	
u1 (7 days after spreading)	23.54 a
u2 (14 days after spreading)	23.46 a
u3 (21 days after sowing)	23.70 a

Note: Numbers followed by different letters indicate a significant difference based on the LSD/BNT test at the 5% level

The independent planting system has a significant effect on the weight of 1000 grains of grain. The 4:1 jajar legowo planting system treatment gave the highest weight of 1000 grains, namely 24.90 g and was significantly different from the tile yanam system, but not significantly different from the 2:1 jajar legowo planting system.

### Harvested Dry Grain Yield per Plot

Based on the variance analysis of the Strip Plot Design, it can be concluded that there is an interaction effect of vertical factors (planting system) and horizontal factors (seed age) on the yield of dry grain harvested per plot, because the interaction value of  $F_{count}$  is greater than  $F_{0.05}$ . Meanwhile, vertical factors (planting system) and horizontal factors (seed age) have a real influence on yield of dry grain harvested per plot because the  $F_{count}$  value is greater than  $F_{0.05}$ .

Table 10. Effect of the Interaction of Planting System and Seed Age on the Weight of Harvested Dry Grain per Plot

Planting System	Seed Age (hss)		
	u1 (7 hss)	u2 (14 hss)	u3 (21 hss)
j1 (Tile)	4.75 a A	5.32 a A	5.00 a A
j2 (Legowo 2 : 1)	5.35 b A	5.10 a A	5.55 a A
j3 (Legowo 4 : 1)	6.55 b B	<b>7.83 b</b> C	5.05 a A

Note: The average number accompanied by the same lower case letter in the row, or the same capital letter in the column, indicates that it is not significantly different based on the LSD/BNT test at the 5% level

In the tile planting system treatment (j1), it showed that the seed age treatment had no significant effect. In the Jajar Legowo 2 : 1 (j2) planting system treatment, it showed that the seed age treatment had no significant effect on the weight of harvested dry grain per plot. In the Jajar Legowo plant spacing treatment of 4 : 1 (j3), it showed that the seed age treatment of 14 days had a significant effect on the dry grain weight harvested per plot.

#### 4. Conclusion

Based on the results of the research and discussion described above, the following conclusions can be drawn. There is an interaction effect between the planting system treatment and seed age on the harvested dry grain yield per plot. The independent planting system influences the number of tillers per hill, the number of productive tillers, the number of grains per panicle, the number of fertile grains per panicle and the weight of 1000 grains of grain. Seed age independently influences the number of tillers per hill, the number of productive tillers, the number of grains per panicle, the number of fertile grains per panicle and the weight of 1000 grains. The Jajar Legowo planting system of 4:1 and seed age of 14 days after sowing provides the highest dry grain harvest per plot, namely 7.83 kg per plot or equivalent to 8.70 tonnes of GKP per hectare.

Based on these conclusions, the following suggestions can be put forward: To improve the growth and yield of rice plants, this can be done by using a 4:1 row planting system combined with a seed age of 14 days after sowing. To obtain a broader picture of the influence of planting systems and seed age on rice growth and yield, further research is needed with different planting systems and seed age treatments. by using different new superior varieties to increase rice production.

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