Agripreneur, 12 (1) (2023) pp.26-32
Published by:IOCSCIENCE
Agripreneur: Journal of Agribusiness Agriculture
Journal homepage:www.iocscience.org/ejournal/index.php/Agripreneur

Effect of Transplanting Age and Spacing System on Growth and Yield of Glutinous Rice (Oryza sativa L.var glutinosa) Grendel Variety

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Abstract
The research was conducted in the paddy fields of the Nanjung Tani farmer group, Rawameneng Village, Blanakan District, Subang Regency, at a height of 25 m above sea level, from August 2022 to November 2022. This research aimed to study the effect of the interaction between the spacing system and the age at which the garden was moved on the growth and yield of glutinous rice. latch. The environmental design used a completely randomized design (CRD) with a factorial pattern, the plant spacing treatment (j) consisted of 3 levels, namely j1 = Legowo 2 ; 1, j2 = 30 cm x 30 cm tiles, j3 = 4:1 thinning and the age of transplanting (u) consists of 4 levels, namely u1 = 10 HSS, u2 = 15 HSS, u3 = 20 HSS and u4 = 25 HSS . The results showed that the effect of transplanting age and spacing had an interaction effect on the number of tillers and the number of productive tillers, whereas on plant height, wet sample weight, dry sample weight, 1000 grain weight, empty grain weight, panicle length , number of seeds per panicle and tiles showed no interaction.

Keywords: Glutinous Rice, Transfer Age, Planting Spacing

1. Introduction

Rice (Oryza sativa L.) is a primary need for Indonesian people, because it is a source of energy and carbohydrates for them so that rice is the most important food crop commodity and is widely cultivated by Indonesian people.(Sahrianti, 2021),(Dian, 2023),(Jalil, Nurba, Subandar, Amin, & Malikon, 2018). According to BPS (2022), national rice productivity in 2022 is estimated at 52.26 ku/ha with total production of 55.67 million tons of GKG(Sutawi, 2022),(Tamma & Shafira, 2023). Increasing rice productivity in Indonesia is still very possible if farmers continue to implement efficient and location-specific innovations(Elizabeth, 2021). In the rice SL-PTT technology package recommended by the government(Dewanti, 2017), the use of young seeds/young planting age which is believed to increase production per unit area(Lan, 2019),(Andayanie, 2016). Young planting age will produce higher seedlings than older seeds. In conventional rice cultivation, the transplanting technique from the nursery to the paddy field is carried out at the age of 20 - 25 days after sowing, while in rice cultivation using the SRI method, the transplanting age is 5 - 10 days after sowing or young planting.(Robana, Maulana, & Sudrajat, 2023),(Makmur, Karim, Hasanuddin, & Suryadi, 2020)(Robana et al., 2023). The age of transplanting will have an effect on plant growth, which begins with the process of plant adaptation when transplanting, where the age of young seeds adapts faster so plant growth is expected to be better.(Herliana, Hadi, & Cahyani, 2019),(Wangiyana & Laiwan, 2018). The age of transplanting turns out to be very influential on the formation of seedlings, so that different ages of transplanting require different areas of growing space(Arisanty et al., 2024),(Lubis, 2020).

2. Methods

The experiment will be carried out in the rice fields of the Nanjung Tani Farmers Group,

Rawameneng Village, Blanakan District, Subang Regency with an altitude of 25 m above sea level. The experiment will be carried out from August 2022 to November 2022. The material used in this experiment is the Grendel variety rice seeds obtained from the CV seed breeder. Independent Subang Citizens. The fertilizer used is Urea (46% N), SP-36 (36% P2O5), NPK 15-15-15, and to control rice pest organisms, contact and systemic pesticides are used. The herbicide used is Penoxaprof-P-ethyl 60 OD + ethoxysulfuron 9 + isoxadifen 20, contact fungicide Propined 70 WP, systemic fungicide Tebukonazole 430 SC, insecticide used Imidachloropide 5 WP, Carbopuran 5 WP, Ethiprole 100 SC, Abamectin 18 EC and BPMC 500 EC. The tools used are tractors, hoes, stakes, raffia rope, buckets, measuring tapes, hand sprayers, rice threshers, digital scales, ovens, writing tools and Leaf Color Charts (BWD). This research was carried out with an experimental approach using a Split Plot Design (RPT) factorial pattern consisting of two factors, namely the first factor is Planting Distance (j) with 3 levels as the Main Plot (a factor that is less important) and the second factor is age transplanting (u) at 4 levels as sub-plots (factors that are more important), repeated three times, so that there are 36 units or plots placed randomly. The experimental unit plot measures 3m x 3m, so the total land required is 395 m2.

Table 1. List of Plant Spacing System Treatment Combinations and Planting Age

Planting Distance (h)	Seed Age (u)			
	U1 (10 hss)	U2 (15 days)	U3 (20 days)	U4 (25 hss)
Legowo 2 : 1 (j1)	U1 J 1	U2J 1	U3 J 1	U4 J 1
Tiles 30cm x 30 cm (j2)	U1 J 2	U2 J 2	U3 J 2	U4 J 2
Thinning 4 :1 (j3)	U1 J 3	U 2J 3	U 3J 3	U4 J 3

HSS = day after sowing

Table 2. Variable Operationalization

No.	Variable Type	Sub Variable	Variable Indicator
1.	Independent Variable (Independent Variable)/ Treatment	1. Planting Age (u)	U1 = Age 10 HSS U2 = Age 15 HSS U3 = Age 20 HSS U4 = Age 25 HSS
		2. Plant Spacing System (j)	J1 = Legowo 2 : 1 J2 = Tiles 30 cm x 30 cm J3 = Thinning 4:1
2.	Response Variable (Dependent Variable)	1. Rice Plant Growth Characteristics	1. Plant height 2. Number of offspring
		1. Components of Rice Crops	1. Number of productive offspring 2. Number of Filled Grains per Panicle 3. Panicle length 4. Weight 1000 items

5. Sample wet weight
6. Sample dry weight
7. Empty grain weight
8. Tile weight

Table 3. List of Analysis of Various Split Plot Designs

Variety Source	DB	JK	KT	Fh	F0.05
Deuteronomy (r)	2	JK (r)	JKr/DBr	KTr/KTGalat	6.94
Plant spacing	2	JK (a)	JKt/DBt	KTt/KTGalat	6.94
Error (a)	4	JK (Error a)	JKJ/DBg	KTJ/KTGalat	-
Seed age	3	JK (b)	JKU/DBb	KTU/KTG error	3.16
Jartam x Seed Age	6	JK (ab)	JKJU/DBJU	KTJU/KTGalat	2.66
Error (b)	18	a(b-1)(n-1)	JKr/DBg	KTr/KTGalat	-
Total	35	Abn-1	-	-	-

Source: Toto Warsa and Cucu SA (1982)

Information : DB = Degrees of Freedom JK = Sum of Squares Fh = Fcount
KT = Middle Square F0.05 = F Table Rate 5%

3. Results and Discussion

3.1 Observation of Plant Height

The results of the analysis of variance showed that there was no interaction effect between the plant spacing system and seed age on plant height in each observation period.

Table 4. Effect of Planting Distance and Seed Age on Plant Height

TREATMENT		Plant Height (CM)							
		2 WAP		3 WAP		4 WAP		5 WAP	
FACTOR	planting distance								
j1	Legowo 2 : 1	55.38	a	64.22	a	87.15	ab	71.90	a
j2	30 cm x 30 cm	54.85	a	63.72	a	85.68	a	71.62	a
j3	Thinning 4 : 1	57.60	a	69.25	b	88.20	b	77.23	b
FACTOR	Seed age								
u1	10 HSS	55.98	a	65.84	a	84.07	a	72.07	a
u2	15 HSS	55.60	a	64.40	a	85.80	a	72.64	a
u3	20 HSS	56.29	a	66.42	a	89.09	b	75.64	b
u4	25 HSS	55.91	a	66.24	a	89.09	b	73.98	ab

Note: The average treatment number followed by the same letter in each column is not significantly different according to the Least Significant Difference test at the five percent significance level.

3.2 Observation of the Number of Tillers

The results of the analysis of variance showed that there was no interaction effect between the planting spacing system and seed age on the number of tillers in the observation periods of 3 WAP and 5 WAP, but there was an interaction in the observation periods of 2 WAP and 4 WAP.

Table 5. Effect of Planting Distance and Seed Age on Plant Height

TREATMENT		Number of Cubs			
		3 WAP		5 WAP	
FACTOR	planting distance				
j1	Legowo 2 : 1	25.87	c	33.63	c
j2	30 cm x 30 cm	20.55	b	28.45	b
j3	Thinning 4 : 1	19.90	a	22.82	a
FACTOR	Seed age				
u1	10 HSS	22.22	ab	28.04	a
u2	15 HSS	21.02	a	27.33	a
u3	20 HSS	21.98	ab	28.44	a
u4	25 HSS	23,20	b	29.38	a

Note: The average treatment number followed by the same letter in each column is not significantly different according to the Least Significant Difference test at the five percent significance level.

Table 6. Effect of Planting Distance and Seed Age on Plant Height

TARAF	u1		u2		u3		u4	
j1	20.40	a	19.53	a	19.47	a	22.33	ab
	A		A		A		A	
j2	22.00	a	17.53	a	17.93	a	18.73	a
	B		A		A		AB	
j3	18.73	a	15.73	a	17.93	a	23.73	b
	A		A		A		B	

Note: The average number of treatments followed by the same letter in the row direction (capital letters) and column direction (lowercase letters) is not significantly different according to the Least Significant Difference test at the five percent significance level.

Table 7. Effect of Planting Distance and Seed Age on Number of Tillers at 4 WAP

TARAF	u1		u2		u3		u4	
j1	30.07	c	29.40	b	28.47	b	33.80	c
	A		A		A		B	
j2	23.40	b	21.80	a	21.93	a	24.27	b
	A		A		A		A	
j3	18.00	a	20.33	a	20.87	a	19,20	a
	A		AB		B		AB	

Note: The average number of treatments followed by the same letter in the row direction (capital letters) and column direction (lowercase letters) is not significantly different according to the Least Significant Difference test at the five percent significance level.

3.3 Observation of the number of productive offspring

The results of the analysis of variance showed that there was an interaction between the effect of the planting spacing system and seed age on the number of productive tillers.

Table 8. Effect of Planting Distance and Seed Age on Number of Tillers at 4 WAP

TARAF	u1		u2		u3		u4	
j1	127.00	b	127.00	b	122.33	b	149.00	b
	A		A		A		B	
j2	134.00	b	113.33	b	110.67	ab	125.67	b
	B		A		A		AB	
j3	81.67	a	83.00	a	91.67	a	86.67	a
	A		A		A		A	

Note: The average number of treatments followed by the same letter in the row direction (capital letters) and column direction (lowercase letters) is not significantly different according to the Least Significant Difference test at the five percent significance level.

3.4 Observation of Sample Wet Weight

The results of the analysis of variance showed that there was no interaction effect between the planting spacing system and seed age on the wet weight of the sample.

Table 9. Effect of Planting Distance and Seed Age on Number of Tillers at 4 WAP

TREATMENT		Sample wet weight (grams)	
FACTOR	planting distance		
j1	Legowo 2 : 1	350.50	b
j2	30 cm x 30 cm	223.67	a
j3	Thinning 4 : 1	175.42	a
FACTOR	Seed age		
u1	10 HSS	254.00	a
u2	15 HSS	261.33	a
u3	20 HSS	230.67	a
u4	25 HSS	253.44	a

Note: The average treatment numbers followed by the same letter in the column are not significantly different according to the Least Significant Difference test at the five percent significance level.

3.5 Observation of Sample Dry Weight

The results of the analysis of variance showed that there was no interaction effect between the planting spacing system and seed age on the dry weight of the samples.

Table 10.. Effect of Planting Distance and Seed Age on Sample Dry Weight

TREATMENT		Sample dry weight (grams)	
FACTOR	planting distance		
j1	Legowo 2 : 1	209.92	b
j2	30 cm x 30 cm	146.50	a
j3	Thinning 4 : 1	124.42	a
FACTOR	Seed age		
u1	10 HSS	164.56	a
u2	15 HSS	152.56	a
u3	20 HSS	155.22	a
u4	25 HSS	168.78	a

Note: The average treatment numbers followed by the same letter in the column are not significantly different according to the Least Significant Difference test at the five percent significance level.

3.6 Observation of the Weight of 1000 Items

The results of the analysis of variance showed that there was no interaction effect between the spacing system and seed age on the weight of 1000 grains.

Table 11. Effect of Planting Distance and Seed Age on Sample Dry Weight

TREATMENT		1000 Grains (grams)	
FACTOR	planting distance		
j1	Legowo 2 : 1	24.78	a
j2	30 cm x 30 cm	24.85	a
j3	Thinning 4 : 1	24.72	a
FACTOR	Seed age		
u1	10 HSS	24.55	a
u2	15 HSS	24.44	a
u3	20 HSS	24.86	b
u4	25 HSS	25.28	c

Note: The average treatment numbers followed by the same letter in the column are not significantly different according to the Least Significant Difference test at the five percent significance level.

3.7 Observation of Empty Grain Weight

The results of the analysis of variance showed that there was no interaction effect between the spacing system and seed age on empty grain weight.

Table 12. Effect of Planting Distance and Seed Age on Empty Grain Weight

TREATMENT		Grain weight is empty	
FACTOR	planting distance		
j1	Legowo 2 : 1	28.42	B
j2	30 cm x 30 cm	21.08	A
j3	Thinning 4 : 1	18.92	A
FACTOR	Seed age		
u1	10 HSS	22.44	A
u2	15 HSS	22.67	B
u3	20 HSS	22.56	A
u4	25 HSS	23.56	C

Note: The average treatment numbers followed by the same letter in the column are not significantly different according to the Least Significant Difference test at the five percent significance level.

3.8 Panicle Length Observations

The results of the analysis of variance showed that there was no interaction effect between the planting distance system and seed age on panicle length, both the planting distance treatment and the transplanting age treatment showed that the results of the analysis were not significantly different from the independent test analysis.

Table 13. Effect of Planting Distance and Seed Age on Panicle Length

TREATMENT		Panicle length (cm)	
FACTOR	planting distance		
j1	Legowo 2 : 1	22.87	a
j2	30 cm x 30 cm	22.50	a
j3	Thinning 4 : 1	22.60	a
FACTOR	Seed age		
u1	10 HSS	22.60	a
u2	15 HSS	22.58	a
u3	20 HSS	22.47	a
u4	25 HSS	22.98	a

Note: The average treatment numbers followed by the same letter in the column are not significantly different according to the Least Significant Difference test at the five percent significance level.

3.9 Observation of the Number of Seeds per Panicle

The results of the analysis of variance showed that there was no interaction effect between the planting spacing system and seed age on the number of seeds per panicle, both the planting spacing treatment and the transplanting age treatment showed that the results of the analysis were not significantly different from the independent test analysis.

Table 14. Effect of Planting Distance and Seed Age on the Number of Seeds per Panicle

TREATMENT		Number of seeds per panicle	
FACTOR	planting distance		
j1	Legowo 2 : 1	141.25	a
j2	30 cm x 30 cm	142.35	a
j3	Thinning 4 : 1	139.48	a
FACTOR	Seed age		
u1	10 HSS	139.20	a
u2	15 HSS	137.69	a
u3	20 HSS	142.29	a
u4	25 HSS	144.93	a

Note: The average treatment numbers followed by the same letter in the column are not significantly different according to the Least Significant Difference test at the five percent significance level.

4. Conclusion

The influence of planting distance and transplanting age gave an interaction effect at 2 WAP with the highest tiller yield in the 4 : 1 (j3) thinning treatment at planting age of 25 DAP (u4) and 4 WAP produced an interaction of number of tillers using the 2 : 1 row legowo system (j1) at planting age 25 HSS (u4) produced the most tillers. And there was also an interaction in the number of the best productive seedlings in the 2 : 1 row legowo system with an age of 25 DAP, which was not significantly different from a planting distance of 30 cm x 30 cm at a plant age of 10 DAP. Plant height, wet sample weight, dry sample weight, 1000 grain weight, empty grain weight, panicle length and number of seeds per panicle did not show any interaction. From the independent test results, the highest tiling was obtained from the Legowo 2 : 1 (j1) planting distance treatment with a yield of 4.44 kg equivalent to 7.1 tons/ha, not significantly different from a planting distance of 30 cm x 30 cm with a yield of 4.24 kg equivalent to with 6.8 tonnes/ha. At 25 HSS (u4) the best tiles produced 4.21 kg, equivalent to 6.74 tonnes/ha. Treatments j1 and j3 with a planting age of 25 HSS showed the highest number of tillers and j1 with a planting age of 25 HSS showed the highest number of productive tillers. This shows a good interaction effect with the conditions of the research site, so it needs to be studied further on the environmental and climatic conditions. different to determine the interaction effect

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