Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(4): 3061-3064
Received: 19-05-2018
Accepted: 23-06-2018

Chandrashekhar
Agronomy, College of Agriculture, UAHS, Shivamogga, Karnataka, India

M Hanumanthappa
Agronomy, College of Horticulture, Mudigere, Chikkamangaluru, Karnataka, India

S Sridhara
Agronomy, College of Agriculture, UAHS, Shivamogga, Karnataka, India

R Jayaprakash
Soil Science and Agricultural Chemistry, Krishi Vigyana kendra, Brahmavara, Karnataka, India

Correspondence
Chandrashekhar
Agronomy, College of Agriculture, UAHS, Shivamogga, Karnataka, India

Effect of transplanting dates on yield traits and yield of rice (*Oryza sativa* L.) under different methods of establishment

Chandrashekhar, M Hanumanthappa, S Sridhara and R Jayaprakash

Abstract
A field experiment was conducted to identify the optimum transplanting date for different establishment methods in rice in sandy loam soil at Zonal Agricultural and Horticultural Research Station, Brahmavara during *kharif* 2017. Results indicated that number of panicles per hill, panicle length, number of grains per panicle, number of filled grains per panicle, number of chaffy grains per panicle, test weight, harvest index, grain and straw yield were observed significantly higher in SRI method of establishment compared to conventional method of establishment in June 3rd week followed by July 1st week.

Keywords: rice, yield, dates, transplanting, establishment

Introduction
Rice is a crucial food for more than half of the world's population. It is the staple food of millions of peoples in Asia and African countries. In these areas, population growth rate is high and will be likely to remain so for at least for the next decade. Rice will continue to be their prime source of food. In India, it may hold the key to sustainable food production by contributing 20-24 per cent and assures food security for more than fifty per cent of the population. Rice provides for fifty five per cent of total cereal production in the country (Anchal Dass *et al*., 2015). In India per capita food intake is 2234 calories per day of which 30 per cent comes from rice (Anon., 2016) [1]. Rice is cultivated using various methods. Among these techniques of rice cultivation, transplanting method is the most dominant and traditional method of rice cultivation under irrigation, which not only consumes more water but also causes wastage of water and soil leads to degradation of land. A significant concern in rice production techniques is the dwindling trend of availability of water resources. In Asian countries per capita water resource availability shrinked by 40-60 per cent in the period of 1955 to 1990 and assumed to decline by 15 to 54 per cent by the year 2025 compared to 1990. The area under rice is supposed to be reduced to about 40 million hectare in the next ten to fifteen years, (Mishra *et al.*, 2006) [5] and most of this reduction are due to water dearth and urbanization. Hence water saving methods in paddy cultivation is need to develop and adopt so that production and productivity levels are exalted despite the rising water crisis.
Key factors influencing rice production are sowing date and method of establishment. Temperature is a significant environmental factor that determines the rate of plant growth and development. Different ways of rice establishments may behave differently under similar ecological conditions. This study aims to optimize the transplanting of window for different rice establishment methods.

Material & Methods
A field experiment was organized at the Zonal Agricultural and Horticultural Research Station, Brahamavara, (13^0 24' N latitude and 74^0 45' E longitude with an altitude of 10 m above sea level) during *kharif* season 2017 in the sandy loam soil, slightly acidic in reaction (pH 5.30), medium in organic carbon (1.28 g kg^{-1}) as well as in available nitrogen (318.11 kg ha^{-1}) and available potassium (158.12 kg ha^{-1}), and high in available phosphorus (46.89 kg ha^{-1}). Experiment was designed in Split-plot design with three replication. Two main treatments *viz*,. Conventional method (M_1) and System of Rice Intensification (M_2) method. Five dates of transplanting as subplots viz., June 3rd week, July 1st week, July 3rd week, August 1st week and August 3rd week. The soil of experimental field was sandy loam and acidic in nature. Thirteen days old seedling of rice (var. MO-4) were transplanted at 20 cm x 10 cm spacing for conventional method and for SRI method twenty one days old seedling were transplanted at 25 cm x 25 cm. The recommended fertilizer dose for rice under coastal condition is 60:30:60 kg

N: P_2O_5: K_2O ha^{-1} + 20 kg $ZnSO_4$ per hectare + 10 tonnes of FYM per hectare (Package of practice, UAS, Bengaluru). Nitrogen and potash fertilizers are applied at three and two splits respectively, in first split fifty per cent of recommended Nitrogen with full dose of phosphorous and fifty per cent of recommended potash fertilizer applied at the time of transplanting as basal dose, in second split Nitrogen fertilizer applied at 30 days after transplanting and third split nitrogen and potash fertilizer applied 60 at days after transplanting. Observation on yield and yield attributes were recorded. The attained data was statically analyzed as per the methods by Gomez and Gomez, 1984 [4].

Results

1. Yield traits

The yield traits of rice such as number of panicles per hill, panicle length, number of grains per panicle, number of filled grains per panicle and number of chaffy grains per panicle as influenced by methods of establishment and transplanting dates presented in Table 1.

Table 1: Total Number of panicles $hill^{-1}$, panicle length (cm), number of grains $panicle^{-1}$, number of filled grains $panicle^{-1}$ and number of chaffy grains $panicle^{-1}$ of rice as influenced by date of transplanting under different methods of establishment.

Treatment	No. of panicles $hill^{-1}$	Panicle length(cm)	No. of grains $panicle^{-1}$	No. of filled grains $panicle^{-1}$	No of chaffy grains $panicle^{-1}$
Crop establishment (M)					
M_1:Conventional method	13.73	21.43	99.73	84.86	14.66
M_2:SRI	20.73	22.82	120.40	107.80	12.60
S.Em. ±	0.49	0.34	1.79	1.81	0.18
C. D. at 5%	1.46	1.01	5.33	5.39	0.53
Time of transplanting (S)					
S_1: 3rd week of June	20.66	23.36	121.00	110.66	10.33
S_2: 1st week of July	20.16	23.14	118.17	107.33	10.83
S_3: 3rd week of July	17.16	22.24	114.83	102.16	12.66
S_4: 1st week of August	15.16	21.79	106.00	91.00	15.00
S_5: 3rd week of August	13.00	20.10	90.33	70.50	19.83
S. Em. ±	0.78	0.74	2.54	2.56	0.76
C. D. at 5%	2.35	2.20	7.64	7.70	2.30
Interaction (M X S)					
M_1S_1	16.33	22.83	110.33	99.67	10.67
M_1S_2	16.00	22.68	107.33	96.33	11.00
M_1S_3	14.33	21.37	103.67	90.67	13.33
M_1S_4	11.67	20.88	92.33	75.67	16.67
M_1S_5	10.33	19.40	85.00	62.00	23.00
M_2S_1	25.00	23.93	131.67	121.67	10.00
M_2S_2	24.33	23.67	129.00	118.33	10.67
M_2S_3	20.00	23.12	126.00	113.67	12.33
M_2S_4	18.67	22.67	119.67	106.33	13.33
M_2S_5	15.67	20.73	95.67	79.00	16.67
S. Em. ±	1.11	1.07	3.60	3.63	1.08
C. D. at 5%	NS	NS	NS	NS	NS

1.1 Number of panicles per hill

Crop establishment methods show significant difference on number of panicles per hill. SRI method of establishment was recorded significantly higher number of panicles per hill (20.73) and it was superior over conventional method of crop establishment (13.73). In sub plot treatments, transplanting dates shows significant difference with number of panicles per hill, higher number of panicles per hill were observed in June 3rd week (20.66) compared to July 3rd week (17.16), August 1st week (15.16) and August 3rd week (13.00), it was on par with July 1st week (20.16). Combined effect of establishment methods and transplanting dates on number of panicles per hill were found to be non-significant.

1.2 Panicle length

Crop establishment methods show significant difference on Panicle length. SRI method of establishment was recorded significantly higher panicle length (22.82 cm) and it was superior over conventional method of crop establishment (21.43 cm). In sub plot treatments, transplanting dates shows significant difference with number of panicle length, higher number of panicle length were recorded in June 3rd week (23.36 cm) compared to August 3rd week (20.10 cm), it was on par with July 1st week (23.14 cm), July 3rd week (22.24 cm), August 1st week (21.79 cm). Combined effect of establishment methods and transplanting dates on panicle length in rice crop were found to be non-significant.

1.3 Number of grains per panicle

Crop establishment methods show significant difference on number of grains per panicle. SRI method of establishment was observed significantly higher number of grains per panicle (120.40) and it was superior over conventional method of crop establishment (99.73) In sub plot treatments, transplanting dates shows significant difference with number of grains per panicle, higher number of grains per panicle were observed in June 3rd week (121.00) compared to August 1st week (106.00) and August 3rd week (90.33), it was on par with July 1st week (118.17) and July 3rd week (114.83). Combined effect of establishment methods and transplanting dates on number of grains per panicle in rice crop were found to be non-significant.

1.4 Number of filled grains per panicle

Crop establishment methods show significant difference on number of filled grains per panicle. SRI method of establishment was observed significantly higher number of grains per panicle (107.80) and it was superior over

conventional method of crop establishment (84.86). In sub plot treatments, transplanting dates shows significant difference with number of grains per panicle, higher number of grains per panicle were recorded in June 3rd week (110.66) compared to July 3rd week (102.16), August 1st week (91.00) and August 3rd week (70.50), it was on par with July 1st week (107.33). Combined effect of establishment methods and transplanting dates on number of filled grains per panicle in rice crop were found to be non-significant.

1.5 Number of chaffy grains per panicle

Crop establishment methods show significant difference on number of filled grains per panicle. Conventional method of establishment was observed significantly higher number of chaffy grains per panicle (19.83 cm) and it was superior over SRI method of crop establishment (12.60 cm). In sub plot treatments, transplanting dates shows significant difference with number of chaffy grains per panicle, higher number of chaffy grains per panicle were observed in August 3rd week (19.83) compared to June 3rd week (10.33 cm), July 1st week (10.83 cm), July 3rd week (12.66 cm) and August 1st week (15.00 cm). Combined effect of establishment methods and transplanting dates on number of chaffy grains per panicle in rice crop were found to be non-significant.

2. Grain and straw yield

The test weight, grain yield, straw yield and harvest index of rice influenced by method of establishment and transplanting dates presented in Table 2.

Table 2: Grain yield, straw yield, harvest index and test weight of rice as influenced by date of transplanting under different methods of establishment.

Treatment	Test weight (g)	Straw yield (kg ha^{-1})	Harvest index	Grain yield (kg ha^{-1})
Crop establishment (M)				
M_1:Conventional method	23.11	6658.73	0.36	3975.36
M_2:SRI	23.33	7016.94	0.39	4588.573
S.Em. ±	0.036	53.50	0.005	66.57
C. D. at 5%	0.10	159.43	NS	198.37
Time of transplanting (S)				
S_1: 3rd week of June	23.28	7151.16	0.41	5158.90
S_2: 1st week of July	23.23	7053.15	0.41	5100.28
S_3: 3rd week of July	23.35	7123.66	0.40	4753.83
S_4: 1st week of August	23.37	7064.41	0.33	3580.75
S_5: 3rd week of August	22.88	5796.8	0.32	2816.07
S. Em. ±	0.17	103.71	0.009	144.59
C. D. at 5%	NS	310.94	0.02	433.50
Interaction (M X S)				
M_1S_1	23.23	6992.60	0.41	4903.26
M_1S_2	23.12	6905.46	0.41	4876.06
M_1S_3	23.16	6778.36	0.40	4528.70
M_1S_4	23.42	7043.03	0.32	3266.70
M_1S_5	22.62	5574.20	0.29	2302.06
M_2S_1	23.34	7309.73	0.43	5414.53
M_2S_2	23.35	7200.83	0.43	5324.50
M_2S_3	23.54	7468.96	0.40	4978.96
M_2S_4	23.32	7085.80	0.35	3894.80
M_2S_5	23.14	6019.40	0.36	3330.06
S. Em. ±	0.24	146.68	0.014	204.49
C. D. at 5%	NS	NS	NS	NS

2.1 Test weight (gm)

Test weight differed significantly due to crop establishment methods. Significantly higher test weight (23.33 gm) were recorded with SRI method of establishment. Which was superior over conventional method of crop establishment (23.11 gm). Among different dates of transplanting and interaction effect due to different crop establishment methods with date of transplanting on test weight of rice crop was found to be non-significant.

2.2 Grain yield (kg ha^{-1})

Grain yield differed significantly due to crop establishment methods. Significantly higher grain yield (4588.573 kg ha^{-1}) were recorded with SRI method of establishment. Which was superior over conventional method of crop establishment (3975.36 kg ha^{-1}). Among different dates of transplanting in sub plot treatments significantly higher grain yield were recorded in 3rd week of June (5158.90 kg ha^{-1}) compared to 1st week of August (3580.75 kg ha^{-1}) and 3rd week of August (2816.07 kg ha^{-1}), it was on par with 1st week of July (5100.28 kg ha^{-1}) and 3rd week of July (4753.83 kg ha^{-1}). Interaction effect due to different crop establishment methods with date of transplanting on grain yield of rice crop was found to be non-significant.

2.3 Straw yield (kg ha^{-1})

Straw yield (kg ha^{-1}) differed significantly due to crop establishment methods. Significantly higher straw yield (7016.94 kg ha^{-1}) were recorded with SRI method of establishment. Which was superior over conventional method of crop establishment (6658.73 kg ha^{-1}). Among different dates of transplanting in sub plot treatments significantly higher straw yield (kg ha^{-1}) were recorded in 3rd week of June (5158.90 kg ha^{-1}) compared to 3rd week of August (5796.8 kg ha^{-1}), it was on par with 1st week of June (7053.15 kg ha^{-1}), 3rd week of July (7123.66 kg ha^{-1}), 1st week of August (7064.41 kg ha^{-1}). Interaction effect due to different crop establishment methods with date of transplanting on straw yield in rice crop was found to be non-significant.

2.4 Harvest index

Harvest index differed significantly due to crop establishment methods did not differ significantly. Among different dates of transplanting in sub plot treatments significantly higher harvest index were recorded in 3rd week of June (0.41) compared to 1st week of August (0.33) and 3rd week of August (0.32), it was on par with 1st week of July (0.41), 3rd week of July (0.40). Interaction effect due to different crop establishment methods with date of transplanting on test weight of rice crop was found to be non-significant.

Discussion

SRI method of establishment which was transplanted on June 3rd week recorded higher grain yield, this is due to optimum weather conditions during different crop growth stages, which helped the SRI method of establishment to express its higher yield potential. Shenguf *et al.* (2002) also obtained the similar results.

On the other hand, delayed transplanting of SRI method of establishment, August 3rd week recorded lower grain yield this is because under delayed transplanting faced the adverse weather condition and affected by pest (leaf folder and stem borer) and disease (false smut of rice and bacterial leaf blight). SRI method of establishment, even though has the high yield potential, the transplanting time is not favorable to express its yield potential. Similar results were noticed by Aziz and Hasan (2000) [3].

Irrespective of method of establishment, June 3rd week transplanting recorded higher yield which was followed by July 1st week. However, further delay in transplanting results in lower yield. Among the methods of establishment, SRI method has recorded higher yield in all the dates of transplanting as in comparison to conventional method of transplanting.

The yield difference (2601 kg ha^{-1}), per cent yield reduction (62.58 %) between SRI method of establishment transplanted on June 3rd week (5414 kg ha^{-1}) and August 3rd week (3330 kg ha^{-1}) were high which clearly indicates that SRI method of establishment is suitable for early transplanting but not for delay transplanting. Praveen *et al.* (2013) [6] and Welch *et al.* (2010) [8] were also observed similar results.

Conclusion

Based on the above findings, it is suggest that SRI method of establishment recorded higher yield traits, grain and straw yield compared to conventional method of establishment. The prime date of transplanting for rice crop in coastal Karnataka is June 3rd week followed by July 1st week irrespective of establishment methods.

Reference

1. Anonymous. Rice-statistics and facts. *http*://*www.statista.com*/ topics /1443/rice, 2016,
2. Anchal Dass and Subash Chandra. Effect of different components of SRI on yield, quality, nutrient accumulation and economics of rice (*Oryza sativa* L.) in *Tarai* belt of Northern India. Indian. J Agron. 2013; 57(1):250-254.
3. Aziz MB, Hasan R. Evaluation of System of Rice Intensification (SRI) in Bangladesh. Locally Intensified Farming Enterprises Project, CARE, Bangladesh. 2000, 4-9.
4. Gomez KA, Gomez AA. Statistical procedures for agricultural research with emphasis on rice. John wiley and Sors, New York, 1984, 680.
5. Mishra D, Ispalasmed M, Rao KV, Bentor JS. Rice research in India-Green revolution to gene revolution. J Rice Res. 2006; 1(1):38-51.
6. Praveen KV, Patel SR, Choudhary JL, Bhelawe S. Heat unit requirement of different rice varieties under Chhattisgarh plain Zones of India. J Agrometerol. 2013; 5(1):123-127.
7. Shengfu A, Xiehui W, Zhongjiong X, Shixiu X. Assessment of using SRI with super hybrid rice variety Liangyoupei 9, Cornell International Institute for Food, Agriculture and Development: *http: // ciifad. Cornell.edu/ SRI.* 2002; 607:255-0831.
8. Welch JR, Vincent JR, Auffhammer M, Moya PF, Dobermann A, Dawe D. Rice yields in tropical/subtropical Asia exhibit large but opposing sensitives to minimum and maximum temperatures. Proceedings of the national academy of science of the United States of America. 2010; 107(33):14562-14567.