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Effect of integrated nutrient management and plant geometry on phenological observation of rice (*Oryza sativa* L.) under SRI technique

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Abstract
The present investigation was conducted at Agronomy Research Farm of Acharya Narendra Deva University of Agriculture & Technology, Acharya Narendra Nagar (Kumarganj), Ayodhya (U.P.) during *Kharif* seasons with the objective to know the effect of integrated nutrient management and plant geometry on growth and yield attributes of rice varieties. The study comprised six treatments of integrated nutrient management (F_0: Control, F_1: RDF (120:60:60) F_2: 50% RDF + 50% Vermicompost, F_3: 75% RDF + 25% N through Vermicompost, F_4: 50% RDF + 50% N through FYM F_5: 75% RDF + 25% N through FYM) with two varieties namely NDR-359 and Sarju 52 and two plant geometry (a) S_1: 20 cm X 20 cm. (b) S_2: 30 cm X 30 cm. The experiments were conducted in Factorial Randomized Block Design (R.B.D.) with three replications. Maximum days taken to 50% heading and maturity was recorded with the application of F_2 (50% RDF + 50% N through vermicompost), varieties (NDR-359) and plant geometry (20 cm ×20 cm). It was at par with F_4 (50% RDF + 50% N through FYM).

Keywords: SRI, maturity, farm yard manure, vermicompost

Introduction
Rice is the staple food of over 3 billion people in Asia, which account for the production and consumption of 90 per cent of world rice. India is the major rice producer next to China. Rice is the main crop in most tropical countries. It is cultivated in sub-tropics and temperate countries also. Generally, rice is a short day plant, the average temp. through out the crop period should be around 21 to 37 °C. The temperature range should be from 30.4 to 32.6 °C for short duration varieties from transplanting to harvest. The temperature required for blooming is 26.5 to 29.5 °C and for ripening is 20 to 25 °C. High altitudes and low temperatures delay flowering and maturity (B. Gururajan and V. Swaminathan, 2008) [2]. Rajesh *et al.* (2003) [5] reported that seedling planted at wider spacing of 30 x 30 cm got sufficient space to grow and also utilized resource in a better way. Therefore, younger seedlings planted at wider spacing was congenial for higher yield of both hybrid (PHB- 71) and non –hybrid (NDR- 359) rice cultivation. Long duration varieties perform better with wider spacing than short duration varieties (Baloch *et al.*, 2002; Stoop 2005) [1, 6]. Which allows a greater realization of tillering potential of rice plants and wide spacing on a square pattern which gives the roots more space to grow and get more sunlight and air (Uphooff and Kassam, 2002). System Rice Intensification (SRI) as defined by Uphoff *et al*., (2002) [8] Seedlings should be transplanted before the fourth phyllochron begins to preserve the tillering potential (Rafaralahy, 2002) [4].

Materials and Methods
The field experiment was conducted during *Kharif* 2015 and 2016 at Agronomy Farm of Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Ayodhya (U.P.). The experimental site located at Kumarganj is situated 42 km away from Faizabad city on Faizabad- Raibarely road. Geographically the experimental site is situated at 26.47^0 North latitude and 81.12^0 East longitude with is an elevation of about 113 m. from mean sea level in the Indo Gangatic Plain Zone of eastern Uttar Pradesh.

The climate in this region is humid and characterized with high rainfall (300 cm year^{-1}). The soil is sandy to sandy loam with a pH of 5.05 and 0.72% organic C. Soil low in available N (127.92 kg ha^{-1}), medium in available P (21.59 kg ha^{-1}) and low in available K (122.46 kg ha^{-1}).

The treatment was carried out with 24 treatment combination formed with six nutrient management levels, two varieties and two levels of plant geometry, in rice which were allocated in split plot design with three replications. The six irrigation levels (a) N_0: Control (b) N_1: RDF (120:60:60) (c) N_2: 50% RDF + 50% Vermicompost (d) N_3: 75% RDF + 25% Vermicompost (e) N_4: 50% RDF + 50% FYM (f) N_5: 75% RDF + 25% FYM with two varieties namely NDR-359 and Sarju 52 and two plant geometry (a) S_1: 20 cm X 20 cm. (b) S_2: 30 cm X 30 cm.

The crop was fertilised with an uniform dose of 60 kg P_2O_5/ha through single super phosphate, 40 kg K_2O/ha through muriate of potash and half dose of the Nitrogen management as per treatments with organic and inorganic.

Agronomical Practices

Nursery beds were prepared at small plot. A common procedure was followed in raising seedlings in the seedbed. The seedbed was prepared by puddling with repeated ploughing followed by laddering. Weeds were removed and irrigation was gently provided to the bed as and when necessary. The sprouted seeds were broadcasted in seedbed on 01.07.2015 and 05.07.2016. The moisture was maintained in the seedbed properly at two to three day interval, which ensured proper growth of all the seedlings in the seedbed. The seed rate for 20 × 20 cm was 6 kg/ha and for 30 × 30 cm was 4 kg/ha.

After the harvest of previous crop the experimental field was ploughed once with soil turning plough and cross harrowed two times. After each ploughing, planking was done to level the field and obtain the fine tilth and lay out was done.

The specific quantity of each fertilizer was calculated on the basis of gross plot size and as per treatment taken per plot. The optimum dose of fertilizers 120:60:60 was calculated for rice. The half quantity of nitrogen and full quantity of phosphorus and potassium were broadcasted in the field during final field preparation as basal dose before the transplanting in the field. The rest half dose of nitrogen was top-dressed in two splits dose after first and second irrigation at 45 DAT and 75 DAT. The crop was fertilised with an uniform dose of 60 kg P_2O_5/ha through single super phosphate, 60 kg K_2O/ha through muriate of potash and half dose of the Nitrogen management as per treatments with organic and inorganic. Two hand weeding were done with 'khurpi' at 20 and 40 days after transplanting.

12 to 14 days old seedlings were transplanted in the prepared plot just after uprooting from the nursery bed and this process completed within two to four hours. Only one seedling was planted per hill in square pattern 20 × 20 (S_1) and 30× 30 (S_2) cm spacing on date 14.07.2015 and 18.07.2016.During the year of experimentation, there were occurrence of sufficient rains during vegetative stage, however there was occasional moisture stress during reproductive phase, hence four irrigations were given at different stages *viz*., 10 DAT, flowering and milking stages and grain filling stage of crop growth.

The crop was harvested manually by serrated edged sickles at physiological maturity when panicle had about 85% ripened spikelet and upper portion of spikelet's look straw coloured. At the time of harvesting the grains were subjected to hard enough, having less than 16 percent moisture in the grains. First of all, the border area was harvested. The harvesting of net plot area was done separately and the harvested material from each net plot was carefully bundled and tagged after drying for three days in the field and then brought to the threshing floor.The bundle of harvested produce of each net plot was weighed after sun drying for recording biological yield. Threshing of each bundle of individual plot was done manually by wooden sticks. The grain yield of individual plot after winnowing was weighed. The quantity of straw per plot was calculated by subtracting the weight of grains from biological produce. Yield of both grain and straw was expressed in q ha^{-1}.

Days taken to 50% heading

Total number of days taken from sowing to heading in 50% plant of the total plant population of each plot were recorded visually.

Days taken to maturity

Total number of days taken from sowing to physiological maturity was recorded visually from each plot.

Geographical situation and climate

The experimental site lies in the Indo Gangatic Plain Zone of eastern Uttar Pradesh. The has sub-tropical zone which in characterized by hot and dry summer with cold winters. Rain is more often confined to the period from July to September with occasional winter and summer rain. The mean annual rainfall ranges from 1000-1200 mm. Weather pattern during the cropping seasons was recorded at the meteorological observatory of the university situated near the experimental field, are given in Fig-1.

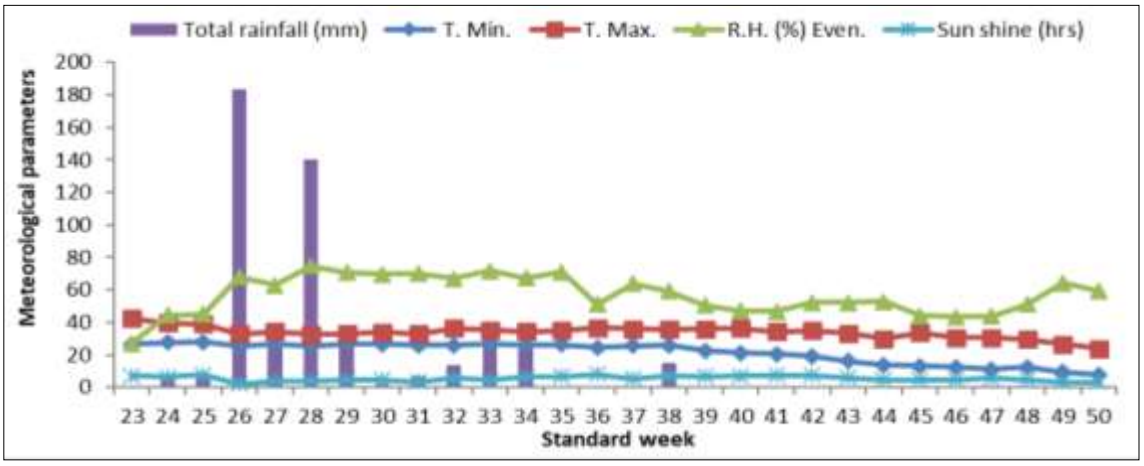

Fig 1: Weekly Meteorological weather data during crop period (June, 2015 to Dec, 2015)

Research Findings

Phonological observation

Days taken to 50% heading

The data on days taken to 50% heading was significantly influenced due to various INM treatments, varieties and plant geometry under SRI technique during Y_1 (2015), Y_2 (2016) and pooled analysis have been presented in Table 1 and depicted in Fig. 2.

In 2015, the maximum days taken to 50% heading (101.59) was recorded with the application of F_2 (50% RDF + 50% N through vermicompost) which, took significantly maximum days to 50% heading than rest of other INM treatments except treatment F_4 (50% RDF + 50% N through FYM). It was statistically at par with treatment F_4. However, the minimum days taken to 50% heading (93.62) were observed in F_0 (control).Variety NDR-359 recorded maximum days to 50% heading (103.29), which was significantly higher than Sarju-52 under SRI technique. The plant geometry S_1 (20 cm × 20 cm) took maximum days to 50% heading (102.59) which, was significantly higher than S_2 (30 cm×30 cm).

Table 1: Effect of integrated nutrient management, varieties and plant geometry on phonological observations of rice under SRI technique.

Treatment	Days taken to 50% heading			Days taken to maturity		
	2015	2016	Pooled	2015	2016	Pooled
Nutrient management						
F_0	93.62	94.94	94.28	130.48	130.96	130.72
F_1	98.90	100.29	99.60	140.20	140.72	140.46
F_2	101.59	103.02	102.31	142.98	143.50	143.24
F_3	102.59	104.03	103.31	137.84	138.35	138.09
F_4	100.60	102.01	101.30	139.78	140.30	140.04
F_5	100.30	101.71	101.00	141.59	142.11	141.85
SEm ±	1.92	1.95	1.37	2.71	2.73	1.92
CD at 5%	5.48	5.56	3.85	7.70	7.78	5.40
Varieties						
V_1	95.91	97.26	96.59	141.89	142.55	142.22
V_2	103.29	104.74	104.01	135.73	136.09	135.91
SEm±	1.11	1.13	0.79	1.56	1.58	1.11
CD at 5%	3.16	3.21	2.22	4.45	4.49	3.12
Plant geometry						
S_1	102.59	104.03	103.31	138.07	135.14	136.61
S_2	96.61	97.97	97.29	139.55	143.50	141.53
SEm±	1.11	1.13	0.79	1.56	1.58	1.11
CD at 5%	3.16	3.21	2.22	4.45	4.49	3.12

In 2016, the maximum days taken to 50% heading (103.02) was recorded with the application of F_2 (50% RDF + 50% N through vermicompost) which, was significantly higher than rest of other INM treatments except treatment F_4 (50% RDF + 50% N through FYM). While, statistically at par with F_4. However, the minimum days taken to 50% heading (94.94) was observed in F_0 (control). Among varieties, variety Sarju-52 recorded maximum days taken to 50% heading (104.74) which, was significantly higher than NDR-359. The plant geometry S_1 (20 cm × 20 cm) recorded maximum days taken to 50% heading (104.03), which was significantly higher than S_2 (30 cm×30 cm) under SRI technique.

In pooled analysis, the maximum days taken to 50% heading (102.31) was recorded with the application of F_2 (50% RDF + 50% N through vermicompost) which was significantly higher than rest of other INM treatments except treatment F_4 (50% RDF + 50% N through FYM). It was statistically at par with F_4. However, the minimum days taken to 50% heading (94.28) was observed in F_0 (control) under SRI technique. Variety Sarju-52 recorded maximum days taken to 50% heading (104.01), which was significantly higher than NDR-359. The plant geometry S_1 (20 cm × 20 cm) recorded maximum days taken to 50% heading (103.31), which was significantly higher than S_2 (30 cm×30 cm).

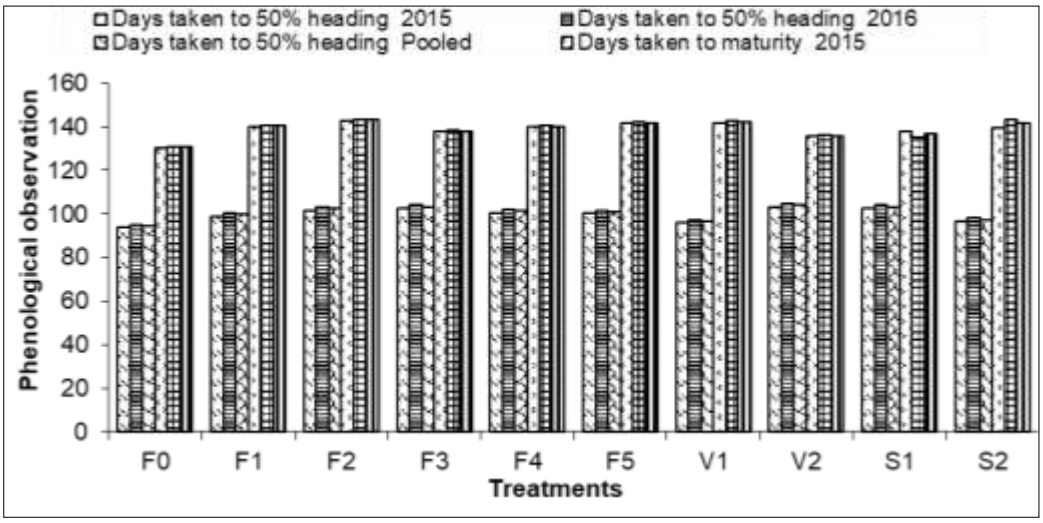

Fig 2: Effect of integrated nutrient management, varieties and plant geometry on phonological observations of rice under SRI technique.

Days taken to maturity

In SRI technique, the data on days taken to maturity was significantly influenced due to different INM treatments, varieties and plant geometry during Y_1 (2015), Y_2 (2016) and over seasons (pooled) and the data has been presented in Table 1 and depicted in Fig. 2.

The maximum days taken to maturity (142.98, 143.50 and 143.24) was recorded with the application of F_2 (50% RDF + 50% N through vermicompost), which was significantly higher than INM treatments over the F_0 (control), F_1-RDF (120:60:60), F_5 (75% RDF + 25% N through FYM) and F_3 (75% RDF + 25% N through vermicompost) It was statistically at par with treatment F_4 (50% RDF + 50% N through FYM). However, the minimum days taken to maturity (130.48, 130.96 and 130.72) was observed in F_0 (control) during both the year and pooled analysis, respectively. Variety NDR-359 recorded maximum days taken to maturity (141.89, 142.55 and 142.22) which, was significantly higher than Sarju-52 during both the year and pooled analysis, respectively. The plant geometry S_2 (30 cm × 30 cm) recorded maximum days taken to maturity (139.55, 143.50 and 141.53), which was significantly higher than S_1 (20 cm × 20 cm) during both the year and pooled analysis, respectively.

Discussion

Days taken to 50% heading and maturity were influenced significantly by different nutrient management. More days to 50% heading and maturity were recorded under the application of F_2 (50% RDF + 50% N through vermicompost) which was significantly higher than rest of other INM treatments except treatment F_4 (50% RDF + 50% N through FYM). It was statistically at par with F_4. The increase in days taken to 50% heading and maturity with increase in nutrient availability might be due to excess nutrient, which increased vegetative growth repoted by (Vananja and Raju 2002) [7] and (Kumar *et al*., 2012) [3].

Conclusion

Finally it may be cocluted that the Maximum days taken to 50% heading and maturity was recorded with the application of F_2 (50% RDF + 50% N through vermicompost), varieties (NDR-359) and plant geometry (20 cm ×20 cm). It was at par with F_4 (50% RDF + 50% N through FYM).

References

1. Baloch AW, Soomro AM, Javed MA, Ahmad M. Optimum plant density for high yield in rice. Asian Journal of Plant Science. 2002;1:25-27.
2. Gururajan B, Balasubramanian R, Swaminathan V. Recent strategies on crop production, A book. Kalyani Publishers. 2008, 1-6.
3. Kumar M, Yaduvanshi NPS, Singh YV. Effect of integrated nutrient management on rice yield, nutrient uptake and soil fertility status in reclaimed sodic soil. Journal of Indian Society of Soil Science. 2012;60(2):132-137.
4. Rafaralahy S. An NGO perspective on SRI and its origin in Madagascar. In Assessment of the SRI Proceedings of the International Conference, Sanya, China, April 1-4, 2002. 2002;12:17-22.
5. Rajesh V, Thanunathan K. Effect of seedling age, number and spacing on yield and nutrient uptake of traditional Kambanchamba rice. Madras Agricultural Journal. 2003;90(1-3):47-59.
6. Stoop WA, Kassam AH. The SRI controversy: A response. Field Crops Research. 2005;91:357-360.
7. Vananja M, Raju AS. Integrated nutrient management-performance in rice crop. Annals of Agricultural Research. 2002;23(1):51-56.
8. Uphoff N, Kassam A. A review of agricultural research issues raised by the system of rice intensification (SRI) from Madagascar: opportunities for improving farming systems for resource poor farmers. Agricultural Systems. 2002;71:24.