EFFECT OF SEEDLING AGE ON TILLERING PATTERN AND YIELD OF RICE (*Oryza sativa* L.) UNDER SYSTEM OF RICE INTENSIFICATION

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ABSTRACT

Field experiments was conducted during *Boro* season of 2008 and 2009 at Uttar Banga Krishi Viswavidyalaya farm, Pundibari, Cooch Behar, West Bengal to study the effect of seedling age on tillering pattern and yield of rice under system of rice intensification (SRI) in Terai zone of West Bengal. The experiments were laid out in randomized block design with seven treatments and replicated thrice. It was revealed that the highest numbers of effective tillers hill^{-1} were produced with seedling of 10 days age. Similarly the plots transplanted with 10 days old seedling also recorded the highest number of grains panicle^{-1}, panicle length and test weight resulted in higher grain yield. Transplantation of 10 days old seedling gave 18.66% and 24.99% more grain yield than T_1 and T_7, respectively. It was also seen that for every days delay in transplanting beyond the age of 10 days, yield was reduced to the extent of 4.5% ha^{-1} year^{-1}.

Keywords: rice intensification system, yield, seedling age, tillering.

INTRODUCTION

Rice is the world's single most important food crop, being the primary food source for more than a third of the world's population and grown on 11% of the world's cultivated area (Khush, 1993). Specially, it is important incase of Asians, Africans, and Latin Americans living in the tropics and subtropics. In these areas, population growth is high and will likely remain high at least for the next few decades and rice will continue to be their primary source of food. For India, it is estimated that the rice demand in 2010 will be 100 million tons and in 2025, the demand will be 140 million tons and the world demand for rice is projected to increase by as much as 70% over the next 30 years. This projected demand can only be met by maintaining steady increase in production over the years through various ways like adoption of hybrid rice, super hybrid rice, transgenic rice, system for rice intensification (SRI) etc. Through SRI, yields can be doubled or more just by changing certain common practices for managing the interactions among rice plants, soil, water, and nutrients (Stoop *et al*., 2002) by transplanting rice seedlings early, carefully, singly and widely spaced with soil kept well aerated i.e., moist but not saturated during their vegetative growth phase (Laulanie,1993). Seedlings with SRI are transplanted when they are very young less than 15 days old and as young as 5 to 8 days (Nemato *et al*., 1995). Much increased yields result from evident synergy between the greater growth of rice plant roots and more growth of tillers. SRI practices promote greater root growth that is easily verifiable and more soil biological activity, which is not so visible. SRI does not depend on purchased, external inputs. Instead, it increases the productivity in India SRI was first introduced into the state of Andhra Pradesh in 2003 by that state’s agricultural university. SRI was found to be effective in all 22 districts of the state on widely varying soils. Now they are looking for extension of this method. But in West Bengal, still now it is unknown to most of the people, so as a part of an Agriculture University we should take the initiative to introduce it in our state.

MATERIALS AND METHODS

Field experiment was carried out in the instructional farm of Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal during *Boro* season of 2008 and 2009. Cooch Behar is situated in the terai agro climatic zone at 26^{0}19'86" N latitude and 89^{0}23'53" E longitude and at an elevation of 43 meters above mean sea level. The soil is sandy loam, (61-63 % sand, 20% silt and 16-18% clay) acidic, with a pH of 5.31, low in available nitrogen (134.15 kg ha^{-1}), high in available phosphorus (28 kg ha^{-1}) and low in available potash (83 kg ha^{-1}). Rice variety ranjit was sow and harvested on 10th January and 5th May in 2008, 6th January and 2nd May in 2009, respectively. The experiment was laid out in randomized block design and each treatment was replicated thrice. There were seven treatments related to the age of seedling viz., 18 days old seedling, 16 days old seedling, 14 days old seedling, 12 days old seedling, 10 days old seedling, 8 days old seedling and 6 days old seedling. Age of seedling was counted from the date of emergence. Single seedling is transplanted/hill at a spacing of 30 x 30 cm and at a depth of 2cm. The unit plot size was 5m x 3m. The fertilizer (60:25:25 kgha^{-1} N: P_2O_5: K_2O) were applied along with 20 t FYM ha^{-1}. First weeding was done 12 days after transplanting thereafter weeding was done once every 10 days with the help of Japanese paddy weeder and simultaneously incorporate the weeds. The observations on tillering pattern were taken at periodical interval, while the observation on yield attributes as well as yield were recorded at harvest accordingly. The data were analyzed statistically for comparing the treatment means.

RESULTS AND DISCUSSIONS

Tillering pattern

Number of tillers varied from treatments to treatments and with the advancement of crop growth. From the critical analysis of the data, it was found that the number of tillers was increased continuously and attained a maximum value at 60 days after transplanting, which was due to profuse tillering during vegetative growth and then decrease gradually and lowest number of panicle bearing tillers were found due to non-effective side tiller mortality. Pooled analysis of data from each sampling showed that T_5 recorded highest number of tillers plant^{-1} in all the growth stages, followed by T_4 and T_6. Transplanting of 6 days old seedling (T_7) produces lowest number of tillers in all the growth stages of rice. Transplantation of 10 days old seedling produced highest number of tillers at all stages of taking observations and in both the year of investigation. The probable reason might be due to transplantation of young seedling (10 days old) results in quick recovery and establishment and production of more tillers. Roots of aged seedling above 14 days take U shape i.e., the tips of roots face upward which require time and energy to turn downward and establish in the soil.

Table-1. Effect of seedling age on tillering pattern at different growth stages of rice under system of rice intensification.

Age of seedling (days)	**30 DAT**		**45 DAT**		**60 DAT**		**75 DAT**		**90 DAT**	
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
18 days old	13.67	12.53	31.67	30.00	41.27	39.27	35.13	32.40	25.47	23.33
16 days old	14.80	13.53	34.27	32.07	43.87	41.53	35.87	33.87	26.87	23.40
14 days old	15.27	13.20	34.67	33.07	46.93	44.47	37.47	35.67	27.87	23.53
12 days old	19.13	17.00	37.73	35.47	50.00	46.87	38.07	36.93	29.40	25.47
10 days old	19.82	18.27	37.80	37.60	54.07	51.40	40.20	38.87	31.33	26.73
8 days old	16.40	15.20	35.53	33.33	49.27	45.73	38.07	36.67	28.27	24.67
6 days old	13.13	11.60	31.33	28.07	38.80	36.47	32.07	29.33	24.13	22.80
S Em (±)	1.91	0.70	2.96	1.93	1.09	0.70	2.85	0.68	1.85	1.33
CD (P=0.05)	2.59	1.53	6.46	4.21	2.37	1.53	6.20	1.48	4.02	2.90

Yield attributes and grain yield

Among the yield attributes, productive tillers are very important because the final yield is mainly a function of the number of panicles bearing tillers per unit area. Thousand grains weight, an important yield-determining component, is a genetic character and least influenced by environment. The data for different yield attributes viz., panicle length, number of panicle hill^{-1}, panicle weight, 1000 grains weight, number of grains panicle^{-1} and number of filled grains panicle^{-1} was presented in Tables 2 and 3. It was indicated from these data that higher values of all the yield attributes were maximum under T_5 (10 days old seedling) followed by T_4 (12 days old seedling) and T_6 (8 days old seedling) in both the years of investigation. Transplantation of 6 days old seedling (T_7) recorded the lowest values of all the yield attributes in both the years of experimentation. Highest number of sterile grains was found under T_4 (12 days old seedling) in both the years (27.93 and 30.91) which was statistically at par with T_7 and T_3. T_1 (18 days old seedling) achieved lower percentage of sterile grains panicle^{-1} (23.55 and 26.72) in both the years of experimentation.

Grain yield is a function of inter play of various yield components such as number of productive tillers, spikelets panicle^{-1} and 1000 grain weight. It was noted from the present study (Table-3) that there was significant variation in grain yield among different treatments. Transplantation of 10 days old seedling produced significantly higher grain yield followed by T_4 and T_6. Transplantation of 10 days old seedling gave 18.66% and 24.99% more grain yield than T_1 and T_7, respectively. On the contrary, lowest grain yield was found under T_7 (6 days old seedling). Pooled data revealed that transplantation of aged (above 10 days old) and younger (below 8 days old) seedlings reduced the grain yield consistently. For every days delay in transplanting beyond the age of 10 days, yield was reduced to the extent of 4.5 % ha^{-1} year^{-1}. 10 days old seedlings recorded the highest value of all the yield attributes and yield due to profuse root growth which helps in tillering, more tillering provides more photosynthesis to support root growth; both contribute to greater grain filling and larger grains. 10 days old seedling also provides sufficient nutrient for vegetative growth and also for reproductive phase which ultimately leads to increased tillering and yield attributes thereby increased grain yields. 6 days old seedlings take more time to recover and establishment after transplantation in the main field and hence resulting into shallow root system which discourages tillering, less tillering provides less photosynthesis to support root growth; both contribute to lower grain filling and shorter grains, all these were responsible for lower grain yield corresponding to T_7.

Table-2. Effect of seedling age on yield attributes of rice under system of rice intensification.

Age of seedling (days)	**Panicle length** (cm)			**No. of panicle hill^{-1}**			**Panicle weight** (g)			**1000 grain weight** (g)		
	2008	2009	pooled	2008	2009	pooled	2008	2009	pooled	2008	2009	pooled
18 days old	20.07	19.49	19.78	21.20	20.07	20.64	2.14	2.03	2.09	20.07	19.94	20.00
16 days old	20.93	19.64	20.29	22.00	20.80	21.40	2.22	2.06	2.14	20.35	20.14	20.25
14 days old	21.73	20.12	20.93	24.33	22.80	23.57	2.26	2.11	2.18	20.48	20.26	20.37
12 days old	22.28	21.92	22.10	25.07	24.67	24.87	2.30	2.26	2.28	20.87	20.46	20.67
10 days old	22.85	22.25	22.55	28.13	25.73	26.93	2.31	2.29	2.30	21.52	20.83	21.18
8 days old	21.88	21.78	21.83	24.00	23.20	23.60	2.23	2.23	2.23	20.61	20.32	20.46
6 days old	18.17	18.01	18.09	18.67	18.20	18.44	1.82	1.82	1.82	18.71	18.33	18.52
S Em (±)	0.14	0.21	0.13	0.82	0.81	0.560	0.01	0.07	0.04	0.09	0.12	0.07
CD (P=0.05)	0.30	0.46	0.26	1.79	1.77	1.144	0.03	0.16	0.08	0.20	0.25	0.15

Table-3. Effect of seedling age on yield attributes and grain yield of rice under system of rice intensification.

Age of seedling (days)	**No. of grains panicle^{-1}**			**No. of filled grains panicle^{-1}**			**Sterility** (%)			**Grain yield** (t ha^{-1})		
	2008	2009	pooled	2008	2009	pooled	2008	2009	pooled	2008	2009	Pooled
18 days old	140.07	138.62	139.34	107.07	101.53	104.30	23.55	26.72	25.13	5.90	5.65	5.78
16 days old	146.68	143.11	144.90	109.37	104.96	107.17	25.43	26.65	26.04	6.29	6.18	6.23
14 days old	152.46	149.77	151.12	111.35	107.91	109.63	26.96	27.92	27.44	6.59	6.37	6.48
12 days old	162.64	161.77	162.20	117.19	111.75	114.47	27.93	30.91	29.42	6.84	6.73	6.78
10 days old	170.91	170.11	170.51	126.13	120.48	123.30	25.86	29.50	27.68	7.19	7.01	7.11
8 days old	156.33	155.39	155.86	114.04	108.65	111.35	27.04	30.08	28.56	6.63	6.48	6.56
6 days old	120.17	119.40	119.79	87.81	84.59	86.20	26.93	29.16	28.04	5.46	5.21	5.33
S Em (±)	1.22	1.39	0.90	0.88	1.32	0.78	0.88	1.26	0.76	0.06	0.05	0.04
CD (P=0.05)	2.67	3.04	1.84	1.91	2.87	1.60	1.91	2.74	1.55	0.14	0.11	0.09

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