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RESEARCH PAPER

Management of seedling and fertility level for higher productivity of hybrid rice (*Oryza sativa*)

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ABSTRACT

A field experiment was conducted at during *Kharif* seasons of 2005 and 2006 to find out the effect of seedling age, number of seedlings/ hill and nutrient levels on growth and yield of hybrid rice (*Oryza sativa* L.). 10 days old seedlings recorded significantly higher crop growth rate during 25-50 DAT, and 100- maturity period (11.2 and 6.66 g/m^2, respectively), effective tillers (239/m^2) grain and straw yield (6628 and 9024 kg/ha). Number of seedlings did not influence growth and yield parameters. 125 per cent recommended nutrient level (150: 75: 60 kg/ha of N: P_2O_5 and K_2O) recorded significantly higher CGR (11.89, 27.49, 19.40 and 6.36 g/m^2/day), effective tillers (250/m^2), filled grains/panicle (158.07), panicle weight (5.00 g) and 1000 grain weight (24.32 g) compared to 75 and 50 per cent recommended level of nutrient thereby producing significantly higher grain and straw yield (7384 and 9965 kg/ha).

Key Words : Age of seedling, Number of seedling, Hybrid rice

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Rice is life for more than half of population in the world. More than 90 per cent of the world's rice is grown and consumed in Asia. It is grain that has shaped the cultures, diets and economies of billions of people in Asia. For them, life without rice is simply unthinkable. Between now and 2020, about 1.2 billion new rice consumers will be added in Asia. Feeding these people will require the greatest effort especially rice production. In Asia, rice is grown in 135 million ha with an annual production of 516 million tons (Roy and Misra, 2002). Transplanting of healthy seedlings of optimum age ensures better rice yield. When seedling is transplanted at right time, tillering and growth proceed normally. If the age of seedlings is less than optimum, tender seedlings may die in greater number due to high temperature and ultimately the plant population is reduced. On the other hand, if the age of seedlings is more than optimum, the seedlings produce less tillers due to reduce vegetative period and thereby results in poor yield (Ahmad *et al.*, 2002). The practice of transplanting one or two seedlings per hill has a potential to increase rice yield through reducing transplanting stress or injury and increasing tiller and root number on lower nodes. It is generally accepted that growth of rice roots are supported by substrate supply from lower leaves. Since shading of lower leaves by upper leaves was less severe at 1 plant per hill than that at 3 plants per hill for a prolonged period, more substrate could be supplied to developing roots (San-oh*et al.*, 2004).

RESEARCH METHODOLOGY

A field experiment was conducted at Agronomical Research Farm of Birsa Agricultural University, Ranchi during *Kharif* 2005 and 2006 to evaluate the efficacy of age and number of seedlings and nutrient level on productivity of rice. The soil of the experimental field was sandy loam in texture, low in

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available nitrogen (225kg/ha), medium in P_2O_5 (21 kg/ha) and K_2O (115 kg/ha) with slightly acidic in reaction (pH 6.2).

Treatments consisted of three seedling age *viz*., 10, 20 and 30 days old in main plots and combination of seedlings numbers *viz*., one, two and three/hill and 50, 75, 100 and 125 per cent of recommended nutrient levels of nutrients in sub plot laid out in a split plot design and replicated thrice. The recommended level of fertilizer was 150: 75: 60 kg /ha of N: P_2O_5 and K_2O. The rice seedlings were raised in different dates to have desired plant age as per treatment and were transplanted on 25th July, during 2005 and 2006.

RESULTS AND REMONSTRATION

The results of the present study as well as relevant discussion have been summarized under following heads:

Effect on crop growth rate (g/m²/day) and leaf area index (LAI):

10 days old seedling recorded 5.70 and 16.93 per cent and 13.65 and 35.36 per cent higher crop growth rate at 25 to 50 days after transplanting and 100 days after transplanting to maturity (11.12 and 6.66 g/m²/day), respectively than 20 and 30 days old seedling. However, 30 days old seedlings recorded 21.40 per cent and 11.25 per cent higher LAI at 25 days after transplanting while at 75 days after transplanting, 10 days old seedlings recorded 3.7 per cent and 8.48 per cent higher LAI as compared to 30 days old seedlings (Table 1 and Fig. 1 and 2). This suggests that transplanting of 10 days old seedlings accumulated dry matter faster compared to 20 and 30 days old seedlings. Mishra and Solakhe (2008) also suggested that the age of seedlings at the time of transplanting appears to be most important factor affecting rice growth and tiller production. Increase in plant height, tiller number and dry matter production in young seedlings (12 days) as compared to older seedlings (30 days), could be due to early

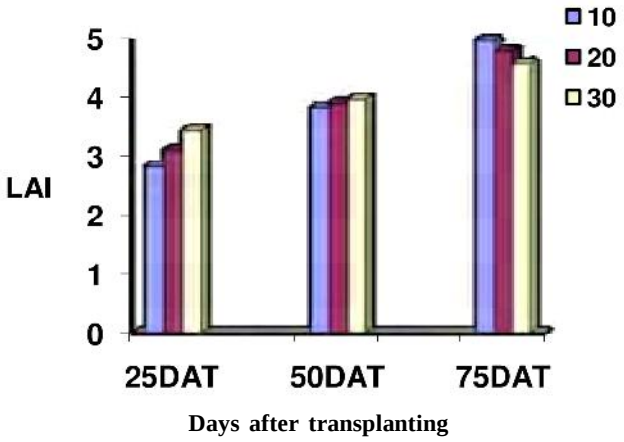

Fig: 1: Effect of seedling age on LAI of rice

Table 1 : Crop growth rate (g/m²/day) and leaf area index (LAI) as affected by age of seedling, number of seedling/hill and nutrient level (Pooled of two years)

Treatments	Crop growth rate				Leaf area index		
	25-50 DAT	50-75 DAT	75-100DAT	100 DAT –maturity	25DAT	50DAT	75DAT
Age of seedling (days)							
10	11.12	23.77	17.24	6.66	2.85	3.84	4.99
20	10.52	24.09	17.42	5.86	3.11	3.92	4.81
30	9.51	22.94	16.76	4.92	3.46	3.99	4.60
S.E. ±	0.11	0.30	0.18	0.09	0.06	0.06	0.07
C.D. (P=0.05)	0.43	NS	NS	0.35	0.24	NS	0.28
Number of seedling/hill							
One	10.19	23.07	16.83	5.75	3.07	3.85	4.74
Two	10.60	24.13	17.45	5.84	3.14	3.93	4.82
Three	10.36	23.61	17.15	5.85	3.20	3.97	4.85
S.E. ±	0.13	0.35	0.20	0.09	0.07	0.07	0.08
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS
Nutrient level (%)							
125	11.89	27.49	19.40	6.36	3.50	4.30	5.24
100	11.45	26.36	18.74	6.15	3.35	4.14	5.08
75	9.84	22.19	16.33	5.58	2.98	3.7	4.61
50	8.36	18.36	14.11	5.17	2.72	3.47	4.38
S.E. ±	0.15	0.40	0.23	0.11	0.08	0.08	0.09
C.D. (P=0.05)	0.42	1.11	0.64	0.30	0.22	0.22	0.25

NS=Non-significant

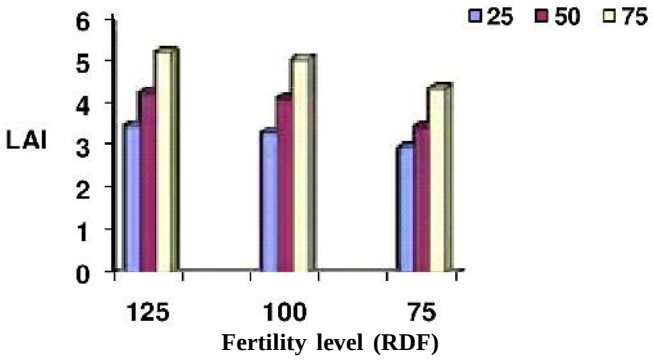

Fig: 2 : Effect of fertility level on LAI

phyllochron stage and less root damage during uprooting, as root length was less than that of older ones. This results in full utilization of root structure for the absorption of nutrients, and their upward flow in young seedlings, producing vigorous plants at later growth stages.

Plants fertilized with 125 per cent recommended level of nutrients produced 20.83 and 42.22 per cent; 23.88 and 49.73 per cent; 18.79 and 37.49 per cent and 13.98 and 23.02 per cent higher crop growth rate at 25 to 50, 50 to 75, 75 to 100 and 100 days after transplanting to maturity (11.89, 27.49, 19.40 and 6.36 gm/m^2/day), respectively over 75 and 50 per cent recommended level of NPK and was at par with 100 per cent recommended level of NPK at all stages except at 75 to 100 days after transplanting. 125 per cent nutrient level also recorded 17.45 and 28.68 per cent, 16.22 and 23.92 per cent and 13.66 and 19.63 per cent higher leaf area index over 75 and 50 per cent recommended nutrient level NPK. (Table 1 and Fig. 2). Confirmation by researchers (Kumar and Singh, 2002 and Maiti *et al.*, 2006).

Effect on yield attributes and yield:

10 days old seedling being at par with 20 days old seedling produced 9.45 per cent higher rice grain yield of (66.28 q/ha) over 30 days possibly due to 9.13 per cent higher effective tillers (Table 2 and Fig. 3 and 4). Advantage of transplanting younger seedlings has higher tiller production

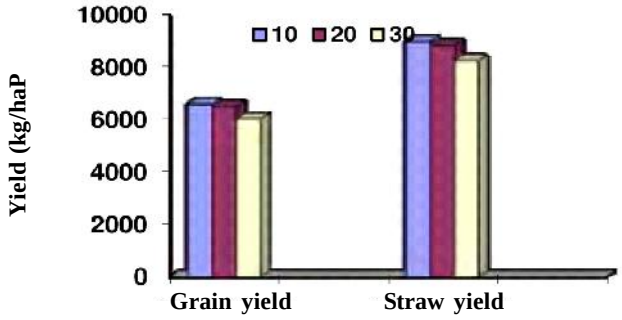

Fig. 3 : Effect of seedling age on yield (kg/ha)

Table 2 : Yield attributes and yield of hybrid rice as affected by age of seedling, number of seedling/hill and nutrient level

Treatments	Effective tillers/m^2	Filled grain/ panicle	Panicle weight (g)	1000 grain weight (g)	Yield (kg/ha)						Harvest index (%)
					Grain			Straw			
					2005-06	2006-07	Pooled	2005-06	2006-07	Pooled	Pooled
Age of seedling (days)											
10	239	150.16	4.66	23.88	65.84	66.70	66.28	89.45	90.64	90.24	42.28
20	234	148.70	4.58	23.82	64.18	66.02	65.12	87.74	89.80	88.77	42.24
30	219	146.22	4.46	23.64	60.28	60.84	60.56	82.81	83.11	82.96	42.09
S.E. ±	3.59	1.54	0.08	0.15	0.89	0.81	0.86	0.88	1.17	1.03	0.07
C.D. (P=0.05)	14.11	NS	Ns	NS	3.50	3.18	3.38	3.46	4.60	4.05	NS
Number of seedling/hill											
One	227	147.65	4.52	23.69	61.96	63.27	62.62	85.03	86.33	85.68	42.15
Two	232	149.06	4.61	23.86	64.89	65.77	65.33	88.65	89.32	88.98	42.25
Three	233	148.38	4.57	23.80	63.54	64.52	64.00	86.72	87.91	87.31	42.21
S.E. ±	3.57	1.55	0.07	0.13	0.98	1.01	0.99	1.17	1.20	1.17	0.08
C.D. (P=0.05)	Ns	NS	Ns	NS	NS	NS	NS	NS	NS	NS	NS
Nutrient level (%)											
125	250	158.07	5.00	24.32	73.22	74.46	73.84	99.02	100.29	99.65	42.55
100	244	152.33	4.76	24.12	70.15	71.58	70.87	95.27	96.95	96.11	42.39
75	222	145.56	4.44	23.60	59.77	61.10	60.44	82.10	83.58	82.85	42.11
50	205	137.48	4.07	23.09	50.63	50.94	50.79	70.80	70.58	70.69	41.76
S.E. ±	4.12	1.79	0.08	0.15	1.13	1.17	1.14	1.36	1.38	1.36	0.09
C.D. (P=0.05)	11.42	4.96	0.22	0.42	3.13	3.24	3.16	3.77	3.83	3.77	0.25

NS=Non-significant

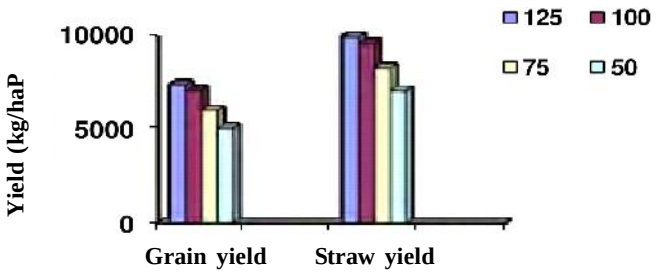

Fig. 4 : Effect of fertility level on yield (kg/ha)

potential than aged seedlings (Yamamoto *et al*., 1998). When seedling stay longer in seed nursery bed, primary tiller buds on the lower nodes of the main culm often degenerate. Primary tiller buds of 4th to 7th nodes are held inside when seedling are planted at 7th leaf age (Matsuo and Hoshikawa, 1993). This also ensures higher nutrient use efficiency and better economics of production, which are prerequisites of a sustainable production system.

125 per cent recommended level of NPK being at par with 100 per cent recommended level of NPK produced maximum grain yield (73.84 q/ha) which was 22.17 and 45.38 per cent higher as compared to 75 per cent and 50 per cent recommended level of NPK (Table 2 and Fig. 4). The higher grain yield under 125 per cent over 75 and 50 per cent recommended level of nutrient NPK was due to higher filled grains/panicle (8.59 and 14.98 %), panicle weight (12.61 and 22.85 %) and 1000 grain weight (3.05 and 5.74 %) and harvest index (1.04 and 1.89 %). Thus transplanting of 10 days old seedling with one or two seedlings/hill and 125 per cent recommended level of nutrient NPK could be an appropriate seedling and nutrient management technique to improve growth and yield of hybrid rice. Impact of increasing levels of nutrients on yield parameters have also been reported by Geetadevi *et al.* (2000) and Shishun *et al.* (2002). Reason for expression of increased yield parameters and yield under higher nutrient levels can be attributed to better plant growth possibly due to enhanced root development.

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