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RESEARCH PAPER

Evaluation of different rice varieties in relation to growth indices and economics

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Abstract : A field experiment was conducted during *Kharif* season 2008 at Livestock Farm, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) to evaluate different rice varieties in relation to growth indices and economics. Growth analytical parameters *viz.*, crop growth rate(CGR), relative growth rate(RGR), net assimilation rate (NAR) differed significantly among the varieties as the growth stages advances and with regard to economics, the net monetary returns was maximum with variety JGL-3844 (Rs. 28487/ha) closely followed by MR-219 (Rs. 27396/ha) and WGL-3828 (Rs. 27228/ha) and B: C ratio was maximum with variety JGL-3844(2.81) closely followed by MR-219 (2.74), WGL-32100 (2.73) and it was minimum (1.53) with Pusa basmati-1 variety.

Key Words : Rice varieties, Growth indices, Economic viability of the varieties

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INTRODUCTION

Rice (*Oryza sativa* L.) is the main staple food crop of more than half of the world's population and constitutes about 20 per cent of the total food energy intake of the world's population providing 43 per cent of calorie requirement for more than 70 per cent of Indian population. In Asia, more than 2 billion persons derive between 60 to 70 per cent of their dietary energy from rice and its by-products. Rice systems support a wide variety of plants and animals, which also helps in the supplement of the rural diets and incomes. According to FAO (2006), almost a billion households in Asia, Africa and the America depend on rice systems for their main source of employment and lively hood. The rice species *Oryza sativa* L. is popularly grown in Asia. Long, medium and round grains are the three main types of rice varieties.

The development of recent high yielding varieties (HYVs) have shown better yield potential than the previous varieties mainly due to presence of longer sink (Singh *et al*., 2005). After the evolution of high yielding varieties with their biology, it becomes imperative to make a comparative assessment of growth studies and their influence on grain yield to maximize the net returns. Therefore, present study was planned to find out evaluation of different rice varieties in relation to growth indices and economics.

MATERIALS AND METHODS

The field experiment was conducted at Livestock Farm, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) during *Kharif* season 2008. The soil was black in colour, sandy clay loam in texture, neutral in reaction with normal electrical conductivity (0.48 dS m^{-1}). The OC content were low (0.68%) in the soil and analyzing in low available N (215 kg ha^{-1}), P (9.2 kg ha^{-1}), and medium available K (318 kg ha^{-1}) contents. The experiment was laid out in randomized complete block design and replicated thrice, with 11 varieties as the treatments *viz.*, V_1: JRH-8, V_2: Jagtial Sanala, V_3: WGL-14, V_4: NPT(S) 7-1, V_5: P-1121, V_6: MR-219, V_7: MTU-1010, V_8: WGL-32100, V_9: JGL-3828, V_{10}: Pusa Basmati – 1 and V_{11}: JGL-3844. Healthy seeds of all eleven rice varieties were selected by putting the seeds in a salt solution with specific gravity of 1.08 (1.2 kg common

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salt dissolve in 10 litres of water). Healthy seeds which settled at the bottom were collected, washed, dried in shade and finally treated with Thirum @ 3g /kg of seeds before sowing in the nursery bed. The treated seeds were sown in line nursery bed on June 30, 2008 and covered with well decomposed FYM. Single seedling was transplanted on July 11, 2008 under planting geometry of 20cm x 20cm for each variety separately, on after eleven days. All the agronomic practices are carried out as per crop recommendations.

Crop growth rate (CGR) :

The crop growth rate (CGR) was determined at 30, 60 and 90 DAT stages by using the formula suggested by Watson (1952) and it is expressed in g/m^2/day.

$$CGR = \frac{W_2 - W_1}{P(t_2 - t_1)}$$

Relative growth rate (RGR) :

It was determined on the growth, when DM production was noted. It was worked out by the formula as suggested by Watson (1952) as g/g/day.

$$RGR = \frac{Ln - W_2 - L_n W_1}{t_2 - t_1}$$

Net assimilation rate (NAR)

The net assimilation rate in rice per unit leaf area was determined by expressing the increase in plant biomass at any instant on leaf area (A) basis. Formula used for computing NAR is given below as suggested by Nichipororovich (1967).

$$NAR = \frac{W_2 - W_1}{LA_2 - LA_1} x \frac{Ln\,LA_2 - Ln\,LA_1}{t_2 - t_1}$$

where,

P= Ground area, W_1= Dry weight of plant/m^2 at time t_1, W_2= Dry weight of plant/m^2 at time t_2, LA_1 and LA_2 are the leaf area at the time t_1 and t_2, Ln= Natural log, t_1 and t_2 were the interval of time, respectively.

The crop did not face infestation of any insect-pest and disease above to the economic threshold limit; hence no plant protection measure was needed during the crop season. The data collected during the investigation were analysed statistically by the method of analysis of variance. The significance of various results were judged as suggested by Fisher (1937), applying F-test.

RESULTS AND DISCUSSION

The results of the present study as well as relevant discussions have been presented under following sub heads:

Growth indices :

The crop growth rate (CGR) linearly increased till 90 DAT in all the varieties and it declined there after till the maturity. The rate of increase in CGR was much rapid during the period between 30 to 60 DAT almost in all varieties. The CGR declined at maturity stage compared to previous stage because total DM accumulation was faster between 60 to 90 DAT than between 90 to maturity stages. At 60 to 90 DAT, the CGR was significantly the highest in JGL-3844 among all varieties (Table 1).

In Relative Growth Rate (RGR) values gradually declined in all the variety with their advancement of growth stages till the maturity stage (Table 1).The RGR values were maximum at 0 to 30 DAT because previously accumulated DM by plants was zero in the beginning. But at advance growth stages, the previously accumulated DM by plant was higher which attributed to declined in RGR values. Net assimilation rate is

Table1: Effect of different rice varieties on CGR, RGR and NAR at different growth stages

Varieties	CGR (g/ m^2 /day)			RGR (g / g / day)			NAR (g/m^2/day)		
	0-30 DAT	30-60 DAT	60 - 90 DAT	0-30 DAT	30-60 DAT	60 - 90 DAT	0-30 DAT	30-60 DAT	60 - 90 DAT
V_1 – JRH-8	1.41	15.91	23.72	0.124	0.083	0.028	0.033	0.046	0.053
V_2 – Jagtial sanala	1.11	17.13	24.64	0.117	0.093	0.028	0.026	0.051	0.056
V_3 – WGL-14	1.56	15.37	24.49	0.128	0.079	0.030	0.037	0.045	0.055
V_4 – NPT(S) 7-1	1.05	14.25	23.32	0.114	0.089	0.030	0.023	0.038	0.047
V_5 – P-1121	1.31	15.87	23.50	0.122	0.085	0.028	0.030	0.046	0.053
V_6 – MR-219	1.35	15.92	23.43	0.123	0.084	0.028	0.030	0.042	0.045
V_7 – MTU-1010	1.39	15.35	24.39	0.124	0.082	0.029	0.032	0.044	0.053
V_8 – WGL-32100	2.11	15.80	24.50	0.138	0.071	0.028	0.047	0.043	0.049
V_9 – JGL-3828	2.18	16.10	24.29	0.139	0.070	0.028	0.049	0.044	0.052
V_{10} – Pusa basmati 1	0.83	12.37	19.42	0.107	0.092	0.030	0.019	0.036	0.045
V_{11} – JGL-3844	1.58	16.43	25.44	0.128	0.081	0.029	0.034	0.042	0.049
S.E.±	0.12	1.17	1.25	0.006	0.003	0.002	0.012	0.005	0.005
C.D. at 5 %	0.36	3.46	3.67	0.018	0.010	NS	0.036	NS	NS

NS = Non-significant

Table 2: Economic analysis of different rice varieties on per hectare area basis

varieties	Cost of cultivation (Rs)	Gross monetary returns (Rs/ha)	Net monetary returns (Rs/ha)	B:C ratio
V_1 – JRH-8	16620	37320	20700	2.24
V_2 – Jagtial sanala	15720	38257	22537	2.43
V_3 – WGL-14	15720	39702	23982	2.52
V_4 – NPT(S) 7-1	15720	34265	18545	2.17
V_5 – P-1121	15720	24848	9228	1.58
V_6 – MR-219	15720	43116	27396	2.74
V_7 – MTU-1010	15720	39054	23334	2.48
V_8 – WGL-32100	15720	42948	27228	2.73
V_9 – JGL-3828	15720	42092	26372	2.67
V_{10} – Pusa basmati-1	15720	24184	8464	1.53
V_{11} – JGL-3844	15720	44207	28487	2.81
S.E.±	-	960	350	-
C.D. at 5%	-	2840	1024	-

the physiological potential for converting the total dry matter into grain yield. The NAR is used as a measure of the rate of photosynthesis minus respiration losses (Sun *et al.*, 1999). The net assimilation rate (NAR) is the rate of assimilation of photosynthate by the photosynthetic area by the plant grown in a particular ground area. It gradually increased with the most rapid rate of increase during the early stages (0-30 DAT). The NAR values significantly differed between the varieties at early growth stage (0-30 DAT), but they did not differ significantly during advanced growth stages. The similar result was also reported by (Horie *et al.*, 2003) with high yielding of rice varieties.

Economic viability of the varieties :

The economic viability of varieties has much concern for farmer's point of view. The economic valuation of varieties was made in four important heads *viz.*, cost of cultivation, GMR, NMR and B-C ratio.

Cost of cultivation did not differ among the varieties, because they were grown under similar input supply and production technologies. But cost of cultivation was remarkably higher for hybrid JRH-8 than remaining 10 varieties tested because of increase of cost of hybrid seeds (Table 2).

The GMR is the value of seeds and straw on the existing on farm market price. Thus, it is directly related to the grain and straw yields of the varieties. The GMR was maximum (Rs. 44207/ha) with JGL-3844 closely followed by MR-219 (43116/ ha), WGL-32100 (Rs. 42948/ha), JGL-3828 (Rs. 42092/ha). The NMR is true monetary gain under a particular treatment, because it was determined by subtracting the cost of cultivation from the GMR of the same treatment.

The cost of cultivation of ten varieties out of eleven varieties tested was the same; therefore, the NMR of all these ten varieties followed the same trend as to their GMR. A hybrid JRH-8 was tested along with ten inbred needed more cost of cultivation because of high cost of seeds. Hence, position of this hybrid changed. The NMR was maximum (28487/ha) with JGL-3844 closely followed by MR-219 (Rs 27396/ha) and WGL-32100 (Rs. 27228/ha). The NMR was minimum (Rs. 8464/ha) with Pusa basmati-1 which was at par to P-1121 (Rs. 9228/ha). Rest of the varieties were in intermediate position for NMR ranging from Rs. 18545 to Rs. 26372/ha. The results are close confirmaly with the findings of (Maiti *et al.*,2003).

B:C ratio is the monetary profitability over each rupee of expenditure. The B: C ratio was maximum (2.81) with JGL-3844 closely followed by MR-219 (2.74), WGL-32100 (2.73), JGL-3828 (2.67) and WGL-14 (2.52). It was minimum (1.53) with Pusa basmati-1 and other varieties (Table 2).

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