Effect of methods and time of sowing on growth indices in rice fallow blackgram (*Phaseolus mungo* L.) under machine transplanted rice system

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ABSTRACT : The field experiments was conducted at Agricultural College and Research Institute, Madurai during *Kharif* 2012 and *Rabi* seasons 2012-2013 to study the effects of methods and time of sowing on soil moisture per cent in rice fallow blackgram. The treatments such as in main plot, three method of sowing, line dibbling (M_1), random dibbling (M_2), broadcasting (M_3) and sub plot, time of sowing 10 (T_1), 7 (T_2), 4 (T_3) and 1 (T_4) days before rice harvest. The soil moisture percentage was significantly influenced by methods and time of sowing. The results were observed line dibbling recorded more in case of growth indices like CGR, RGR and NAR. Random dibbling was the next best method of sowing for getting the increased plant growth indices of rice fallow blackgram during *Kharif* and *Rabi,* respectively when line dibbling combined with the time of sowing of 10 days before rice harvest (M_1T_1). The sowing method of line dibbling coupled with 10 days before rice harvest (M_1T_1) realized higher seed yield of 685 kg ha^{-1} during *Kharif* and M_2T_1 622 kg ha^{-1}during *Rabi* season.

KEY WORDS : Rice blackgram, Transplanted rice system

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In India pulses cultivated in an area of 20.05 million hectare with production of 11.14 million tones with productivity of 556 kg per hectare. In Tamil Nadu, Black gram occupies an area of 2.76 lakhs hectares with a production of 1.33 lakh tonnes which access for average productivity of 488 kg per hectare (Anonymous, 2004). Except barring seed material, farmers followed almost zero input under rice fallow pulses cultivation. Hence, the productivity in rice fallow pulse is always far below the normal. Even what is followed for rainfed crops is not adopted for these energy intensive crops. Hence, it is highly imperative to develop management techniques to realize the yield potential of pulse under rice fallow condition. Even though, sufficient moisture is made available to the sown crop by following the appropriate time of sowing, placement of seeds on the surface of soil in broadcasting is likely to cause poor contact between soil and seeds that may cause poor germination which need to be taken care of by following the proper method of sowing. No doubt that dibbling method of sowing is the best method of sowing for almost all the crops except small seeded crops (Subramanian, 1978). Here the growth

indices show the continue growth and we can determine the yield. As dibbling helps the seeds to absorb required moisture and nutrients due to better contact between soil and seeds at optimum depth of sowing for eg.2-3 cm depth, the crop could able to survive better maintain optimum crop stand (Palaniappan *et al .,* 1978). It is obvious that dibbling is possible in fallow lands and in wide spaced crops (IRRI, 1981). Early sowing (24 December) registered significantly more number of branches/plant (14.7) which is at par with 7 January sowing (13.0). However, delayed sowing (22 January) recorded significantly lower number of branches/plant (Ravisankar *et al.,* 2010).

Chickpea sown on December 1 produced maximum number of pods/plant. Lowest value obtained in December 20 sowing. This could be attributed to higher growth attributes, which may responsible for better source and sink relation (Kabir *et al.,* 2009).The growth indices to stage wise we can follow suitable management for better yield.

RESEARCH PROCEDURE

The research was conducted at the Agricultural College and Research Institute, Madurai, India 9°54'N latitude and 78°54' E longitude at an elevation of 147 m above mean sea level. The farm is located in the Southern Agro climatic Zone of the Tamil Nadu. The experimental farm is characterized by tropical climate with mean annual rainfall of 617.4 mm distributed over 34 rainy days. The mean maximum and minimum temperatures were 35.0°C and 24.5°C, respectively. The mean daily pan evaporation and relative humidity recorded during the crop season were 4.04 mm and 79.9 per cent, respectively. The weather parameters prevailed during the cropping period (July 2012 to March 2013). The type of soil was clay loam, which contained organic carbon (0.44,0.51%), N 230, 262 kg/ha, P 24, 19.78 kg/ha, K 270, 230 kg/ha, pH 6.37,7.52,EC 0.12,0.32 during *Kharif* and *Rabi,* respectively.

Treatments were implemented during the machine transplanted rice harvest stage, rice was hand harvested and their residues were allowed as a part of the continuous rice fallow blackgram rotation experiment. The experiment was laid out in Split Plot Design with three replications. The layout plan adopted for the experiment was main plot-methods of sowing M_1- line dibbling, M_2 - random dibbling, M_3- broadcasting and sub-plot –time of

sowing, T_1- 10 days before rice harvest, T_2 - 7 days before rice harvest, T_3 - 4 days before rice harvest, T_4 - 1 day before rice harvest. Soil moisture at 0-15cm depth was estimated gravimetrically at 15 days interval from each time of sowing. Five plants per plot were sampled was recorded at 20, 40 and 60th day from each time of sowing by measuring the crop growth rate, relative growth rate, net assimilation rate and yield observation of the plant mean value were recorded. The experimental data were statistically analyzed by following procedure described by Panse and Sukhatme (1985). The data pertaining the critical difference were worked out at 5 per cent probability level p=0.05 and non-significant values were denoted as NS.

RESEARCH ANALYSIS AND REASONING

The findings of the present study as well as relevant discussion have been presented under following heads :

Crop growth rate :
The sowing method of line dibbling (M_1) exhibited its superiority to increase CGR by 5.18 and 4.25 gm^{-2} day^{-1} between 20- 40 DAS and 4.33 and 4.14 gm^{-2} day^{-1} between 40-60 DAS during *Kharif* and *Rabi,* respectively (Table 1). It was followed by random dibbling (M_2). Among various time of sowing tried, 10 days before rice harvest (T_1) registered higher CGR of 5.51 and 4.85 $g\ m^{-2}\ day^{-1}$ between 20-40 and 40-60 DAS, respectively during *Kharif* and 4.16and 4.03g $m^{-2}\ day^{-1}$ between 20-40 and 40-60 DAS, respectively during *Rabi* (Fig.1).The interaction effect between the treatments on CGR was not noticed. Similar finding of the higher growth rate recorded from the uniform population (Biswas *et al.,* 2002). Lower growth rate was recorded in broadcasting method of sowing and under time of sowing of 1 day before rice harvest.

Relative growth rate :
RGR was numerically increased by methods and time of sowing (Table 1). Line dibbling (M_1) of blackgram seeds numerically increased the RGR values to 0.022 and 0.036 $g\ g^{-1}\ day^{-1}$during *Kharif* and *Rabi,* respectively between 20-40 DAS and 0.040 and 0.050 $g\ g^{-1}\ day^{-1}$ during *Kharif* and *Rabi,* respectively between 40-60 DAS. It was followed by random dibbling (M_2). Adoption of sowing 10 days before rice harvest (T_1) recorded numerically higher RGR values of 0.022 and

Table 1 : Effect of method and time of sowing of growth indices on blackgram in machine transplanted rice system

Treatments	Crop growth rate (g m⁻² day⁻¹)				Relative growth rate (g g⁻¹ day⁻¹)				Net assimilation rate (mg cm⁻² day⁻¹)				Yield (kg/ha) Kharif, 2012	Yield (kg/ha) Rabi, 2012-2013
	Kharif, 2012		Rabi, 2012-2013		Kharif, 2012		Rabi, 2012-2013		Kharif, 2012		Rabi, 2012-2013		Post-harvest	Post-harvest
	20-40 DAS	40-60 DAS	20-40 DAS	40-60 DAS	20-40 DAS	40-60 DAS	20-40 DAS	40-60 DAS	20-40 DAS	40-60 DAS	20-40 DAS	40-60 DAS		
Methods of sowing														
M_1- Line dibbling	5.18	4.33	4.25	4.14	0.022	0.040	0.036	0.050	0.238	0.137	0.218	0.120	525	512
M_2- Random dibbling	4.65	3.90	3.35	3.25	0.020	0.035	0.028	0.046	0.231	0.134	0.214	0.110	389	346
M_3- Broadcasting	4.15	3.24	2.63	2.5	0.010	0.026	0.020	0.043	0.226	0.131	0.140	0.100	243	238
S.E.±	0.22	0.126	0.19	0.17	0.001	0.001	0.002	0.003	0.010	0.003	0.002	0.001	14.7	14.13
C.D.(P=0.05)	0.44	0.350	0.36	0.34	NS	NS	NS	NS	NS	NS	NS	NS	28.37	28.14
Time of sowing														
T_1- 10 days before rice harvest	5.51	4.85	4.16	4.03	0.022	0.046	0.036	0.048	0.241	0.153	0.210	0.120	459	429
T_2-07 days before rice harvest	5.07	3.53	3.43	3.55	0.020	0.040	0.030	0.047	0.213	0.131	0.190	0.110	411	408
T_3- 04 days before rice harvest	4.41	3.50	3.41	3.3	0.020	0.033	0.030	0.047	0.197	0.128	0.190	0.110	366	331
T_4 - 01 day before rice harvest	3.64	3.42	2.64	2.7	0.011	0.028	0.020	0.044	0.177	0.120	0.130	0.100	306	292
S.E.±	0.242	0.23	0.18	0.16	0.001	0.002	0.002	0.003	0.002	0.004	0.004	0.003	12.63	11.83
C.D. (P=0.05)	0.508	0.43	0.35	0.33	NS	NS	NS	NS	NS	NS	NS	NS	24.77	23.18

0.036 g g⁻¹ day⁻¹ between 20-40 DAS and 0.046 and 0.048 g g⁻¹ day⁻¹ between 40-60 DAS during *Kharif* and *Rabi*, respectively (Fig.1). This was closely followed by 7 days before rice harvest (T_2). Interaction effect was not noticed between methods and time of sowing in respect of RGR during both the seasons.

Net assimilation rate :

Net assimilation rate (NAR) of rice fallow blackgram was influenced numerically in methods and time of sowing (Table1). Decreasing trend in NAR was noticed with increasing in age of the crop in both the season. Among the methods of sowing numerically more net assimilation rate was recorded in line dibbling (M_1) which were 0.238 and 0.218 mg cm⁻² day⁻¹ between 20-40 DAS and 0.137 and 0.120 mg cm⁻² day⁻¹ between 40-60 DAS during *Kharif* and *Rabi*, respectively. Random dibbling (M_2) has occupied 2nd in registering the net assimilation rate during both the seasons. In the case of time of sowing, 10 days before rice harvest (T_1) has

Fig. 1 : Effect of methods and time of sowing on CGR, RGR and NAR in rice fallow blackgram

numerically recorded higher net assimilation rate (0.241 and 0.210 mg cm^{-2} day^{-1} between 20-40 DAS and 0.153 and 0.120 mg cm^{-2} day^{-1} between 40-60 DAS during *Kharif* and *Rabi,* respectively (Fig.1). This was closely followed by the treatment 7 days before rice harvest (T_2) during both the seasons regardless of stages.The interaction between the methods and time of sowing on net assimilation rate was not significant.

Grain yield :

Significant difference between the methods and time of sowing on seed yield of blackgram was observed during both the seasons. The data on seed yield are presented in Table 1. The seed yield of blackgram was increased markedly with line dibbling (M_1) which recorded the seed yield of 525 kg ha^{-1} during *Kharif* and 512 kg ha^{-1} during *Rabi* followed by random dibbling (M_2) (389 and 346 kg ha^{-1} during *Kharif* and *Rabi,* respectively). Broadcasting (M_3) recorded lower seed yield of 243 kg ha^{-1} and 238 kg ha^{-1} during *Kharif* and *Rabi*, respectively. Regarding time of sowing, 10 days before rice harvest (T_1) recorded with higher seed yield (459 kg ha^{-1} during *Kharif* and 429 kg ha^{-1} during *Rabi*). However, it was at par with 7 days before rice harvest (T_2) during *Rabi*. The seed yield was significantly low under 1 day before rice harvest (T_4) (306 kg ha^{-1} and 292 kg ha^{-1} during *Rabi* and *Kharif,* respectively). Interaction effect of methods and time of sowing on seed yield was found significant during both the seasons. Sowing method of line dibbling coupled with 10 days before rice harvest (M_1T_1) realized higher seed yield of 685kg ha^{-1} during *Kharif* and 622 kg ha^{-1} during *Rabi* (Fig.2). It was followed by line dibbling with 7 days before rice harvest (M_1T_2) which recorded the seed yield to the tune of 581 kg ha^{-1} and 568 kg ha^{-1} during *Kharif* and *Rabi,* respectively. The minimum seed yield of 217 kg ha^{-1}
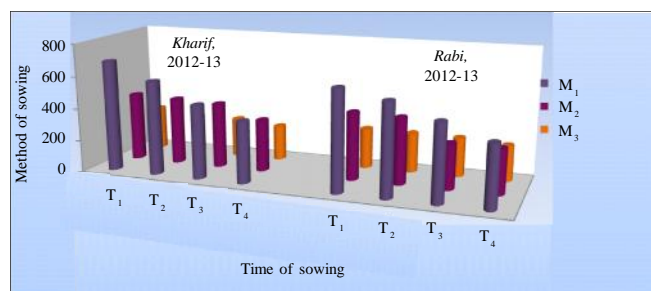
during *Kharif* and 219 kg ha^{-1} during *Rabi* was recorded in the treatment combination of broadcasting with 1 day before rice harvest (M_3T_4). The per cent increase in seed yield was 53.7 and 53.5 over broadcasting during *Kharif* and *Rabi,* respectively. Similar yield increase by the dibbling method of sowing was reported by Kumar *et al*. (1992) who reported that dibbling the seeds immediately after harvest of rice recorded higher seed yield than broadcasting of seeds in standing crop of rice.

Conclusion :

From the investigation, it could be concluded that line dibbling was found to be the best method under method of sowing and 10 days before rice harvest is the best time of sowing under time of sowing to achieve higher growth indices and better crop establishment in rice fallow blackgram. The combination of line dibbling and sowing seeds 10 days before rice harvest is considered as best cultivation mode for getting higher CGR, similar level of RGR, NAR and higher yield of rice fallow blackgram during *Kharif* and *Rabi* season in southern India.

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Fig. 2 : **Effect of methods and time of sowing on seed yield (kg ha^{-1}) in rice fallow blackgram**

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