Research Article

Effect of Methods and Time of Sowing on Soil Moisture and Yield Paramaters under Machine Transplanted Rice Fallow Blackgram (*Phaseolus Mungo* L.)

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Abstract

This study aimed to investigate the effects of different methods and time of sowing soil moisture on the yield of rice fallow blackgram *(Phaseolus mungo l.*) in southern India 2012 to 2013. The experiment comprised three method of sowing namely, line dibbling (M_1), random dibbling (M_2), broadcasting (M_3).Four time of sowing soil moisture trearments were performed at 10 (T_1), 7(T_2), 4 (T_3) and 1 (T_4) days before rice harvest during *kharif* and *rabi* season. The soil moisture content (%) of blackgram was higher substantially 81.90 and 75.10 at 15 DAS, 35.38 and 35.26 at 30 DAS and 17.92 and 15.86 at 45 DAS during *kharif* and *rabi* respectively. The leaf area index, Dry matter of M_1 was higher than those of M_2, M_3 and the time of sowing T_1 soil moisture treatment. The increase in grain yields was significant in M_1T_1 soil moisture treatments were realized higher seed yield of 685kg ha^{-1}during *kharif* and 622 kg ha^{-1}during *rabi* season. In conclusion line dibbling 10 days before (M_1T_1) soil moisture treatments were good agronomic measures to increase the yield of machine transplanted rice fallow blackgram in southern India.

Keywords: Soil moisture, LAI, black gram, DMP, Yield, Machine transplant

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Introduction

At present globally 60 million tonnes of pulses are produced annually from 70 million hectare. India is the largest producers and consumer of pulses in the world accounting for 29 percent of the world area and 17 percent world production of pulses in the country. Researchers have improved some approaches to enhancing crop yield, including increased planting density, early station, improved fertilization and straw mulching.

The rice fallow pulses survive entirely on residual moisture and fertility left over by the preceding rice crop [1] and [2]. Unlike other crops, rice fallow pulse need no irrigation, weed and nutrient management excluding seed cost and labour charges for sowing and harvesting. Terminal moisture stress under rice fallow conditions results in poor yield [3]. The rice fallow pulse survives entirely on residual moisture and fertility left over by the preceding crop of rice [4].

As cost of cultivation of the crop is very less, the profit is many fold than the conventional system of cultivation. In fact, rice fallow pulse is a boomerang to the wetland rice growers as they could able to fetch more income with less management and input cost [5].

The present study determined the effects of various sowing methods and sowing time soil moisture on leaf area, drymatter accumulation, grainyield and suitable method of sowing for rice fallow blackgram in Madurai Southern India

Materials and Methods

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 TamilNadu. 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, $_P$H 6.37,7.52,EC 0.12,0.32 *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 growth stage from july 2012 to march 2013. The experiment was laid out in split plot design with three replications. The layout plan adopted for the experiment is 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 leaf area index, dry matter production and yield observation of the plant mean value were recorded. The experimental data were statistically analyzed by following procedure described by [6]. The data pertaining the critical difference were worked out at 5 percent probability level p=0.05 and non-significant values were denoted as NS.

General view of field experiment

Results and Discussion

Moisture percentage

The soil moisture percentage was significantly influenced by methods and time of sowing (**Tables 1** and **2**). The statistical analysis of the data recorded on 15, 30 and 45 DAS. Under methods of sowing, line dibbling (M_1) recorded higher moisture percentage *viz*.61.60 and 56.39 at 15 DAS, 28.79 and 27.81 at 30 DAS and 14.44 and 12.63 at 45 DAS during *kharif* and *rabi* respectively (**Figure 1a-b**). The time of sowing, 10 days before rice harvest (T_1) had influenced the soil moisture content (%) to 73.45 and 68.23 at 15 DAS 31.60 and 32.36 at 30 DAS and 15.59 and 14.55 at 45 DAS during *kharif* and *rabi* respectively and it was followed by 7 days before rice harvest (T_2) during both the seasons. Combined effect of methods and time of sowing was significant on soil moisture content in black gram during *kharif* and *rabi* seasons. The soil moisture content (%) of blackgram was increased substantially (81.90 and 75.10 at 15 DAS,35.38 and 35.26 at 30 DAS and 17.92 and 15.86 at 45 DAS) during *kharif* and *rabi* respectively when line dibbling combined with the time of sowing of 10 days before rice harvest (M_1T_1).The M_1T_1 compare to 49, 12,6 % higher than next best one in 15,30,45 DAS. This was in agreement with the findings of [7] who reported the available soil moisture content were higher from.

Leaf Area Index

Measurement of leaf area is a basic tool for growth analysis and it is directly related with both biological and economic yield (Tables 1 and 2). The leaf area index of blackgram at all the crop growth period varied significantly under the methods time of sowing (**Figure 2**). Leaf area index differed among the methods of sowing at 20 and 40 DAS during *rabi*. Line dibbling (M_1) recorded the highest leaf area index of 1.39 and 2.60 at 20 and 40 days respectively during *rabi*. This was followed by random dibbling (M_2) which recorded the leaf area index of 1.34 at 20 DAS and 2.25 at 40 DAS during *rabi*. Though the above treatments performed better in registering the leaf area index during *rabi*, they were equally effective as that of broadcasting (M_3) during *kharif* at all the stages of crop growth period. The effect of time of sowing on leaf area index was significant at all the period. Among the time of sowing, 10 days before rice harvest (T_1) recorded the higher leaf area indexof1.45 and1.40 at 20 DAS, 3.2 and 2.60 at 40 DAS and 2.70 and 2.20 at 60 DAS during *kharif* and *rabi* respectively. There was no significant effect noticed between methods and time of sowing in recording leaf area index during both the seasons. This was inline with the findings of [8].

Table 1 Effect of methods and time of sowing on blackgram in machine transplanted rice system during, Kharif 2012

Treatment	Moisture content (%)			Leaf area index			Dry Matter Production (kg/ha)			Yield (kg/ha)
	1 th Days	30th Days	45 th Days	20th Days	40th Days	60th Days	20th Days	40th Days	60th Days	
Method of sowing										
M_1- Line dibbling	61.6	28.79	14.44	1.42	2.8	2.22	280	1123	1980	525
M_2- Random dibbling	54.83	26.78	12.99	1.39	2.7	2.17	253	1015	1880	389
M_3- Broad casting	50.13	25.81	11.76	1.37	2.6	2.12	227	882	1679	243
Time of sowing										
T_1 – 10 DBRH	73.45	31.60	15.59	1.45	3.2	2.70	295	1104	2074	459
T_2 – 7 DBRH	64.75	26.53	13.76	1.43	2.9	2.22	267	1030	1898	411
T_3 – 4 DBRH	45.88	25.63	12.52	1.37	2.3	2.02	238	985	1733	366
T_4 – 1 DBRH	38.03	24.68	10.38	1.33	2.3	1.74	213	907	1680	306
SEd										
M	2.09	0.38	0.59	0.01	0.15	0.13	9.06	35.54	55.56	14.47
T	2.50	0.96	0.61	0.01	0.15	0.11	9.56	39.00	36.16	12.63
M at T	4.60	1.5	1.18	NS	NS	NS	18.62	71.93	58.86	27.11
T at M	4.54	1.28	1.02	NS	NS	NS	19.36	67.86	62.63	27.03
CD (P-0.05)										
M	4.11	1.06	1.15	NS	NS	NS	19.04	74.63	113.40	28.37
T	4.91	1.88	1.21	0.02	0.42	0.23	20.08	76.44	75.97	24.77
M at T	9.00	2.94	2.36	NS	NS	NS	39.12	150.07	129.65	53.14
T at M	8.90	2.51	2.01	NS	NS	NS	33.46	141.13	131.59	52.98

DBRH-Days Before Rice Harvest

Table 2 Effect of methods and time of sowing on blackgram in machine transplanted rice system during *Rabi*, 2012-13

Treatment	Moisture content (%)			Leaf area index			Dry Matter Production (kg/ha)			Yield (kg/ha)
	1 th Days	30th Days	45 th Days	20th Days	40th Days	60th Days	20th Days	40th Days	60th Days	
Method of sowing										
M_1- Line dibbling	56.39	27.81	12.63	1.39	2.6	1.77	273	1048	1914	512
M_2- Random dibbling	52.35	25.68	11.89	1.34	2.25	1.72	248	900	1667	346
M_3- Broad casting	49.48	24.40	11.73	1.30	2.12	1.62	218	798	1631	238
Time of sowing										
T_1 – 10 DBRH	68.23	32.36	14.55	1.4	2.6	2.20	294	1015	2071	429
T_2 – 7 DBRH	60.87	28.43	12.79	1.4	2.4	1.72	262	932	1777	408
T_3 – 4 DBRH	46.36	23.53	11.15	1.3	2.2	1.55	220	887	1639	331
T_4 – 1 DBRH	35.51	19.54	9.83	1.2	2.1	1.34	210	827	1541	292
SEd										
M	2.14	0.54	0.40	0.01	0.02	0.132	8.20	33.37	51.72	14.43
T	2.75	1.08	0.55	0.02	0.03	0.11	9.43	31.85	47.00	11.83
M at T	4.89	1.84	0.95	NS	NS	NS	17.63	64.55	96.75	26.18
T at M	4.93	1.95	1.02	NS	NS	NS	18.96	60.24	97.60	26.34
CD (P-0.05)										
M	4.19	1.51	0.79	0.3	0.04	NS	17.22	65.40	101.38	28.14
T	5.40	2.11	1.09	0.04	0.06	0.24	19.81	63.70	92.12	23.18
M at T	9.59	3.62	1.88	NS	NS	NS	37.03	128.75	193.03	51.28
T at M	9.68	3.83	2.01	NS	NS	NS	35.07	122.25	195.20	51.63

DBRH-Days Before Rice Harvest

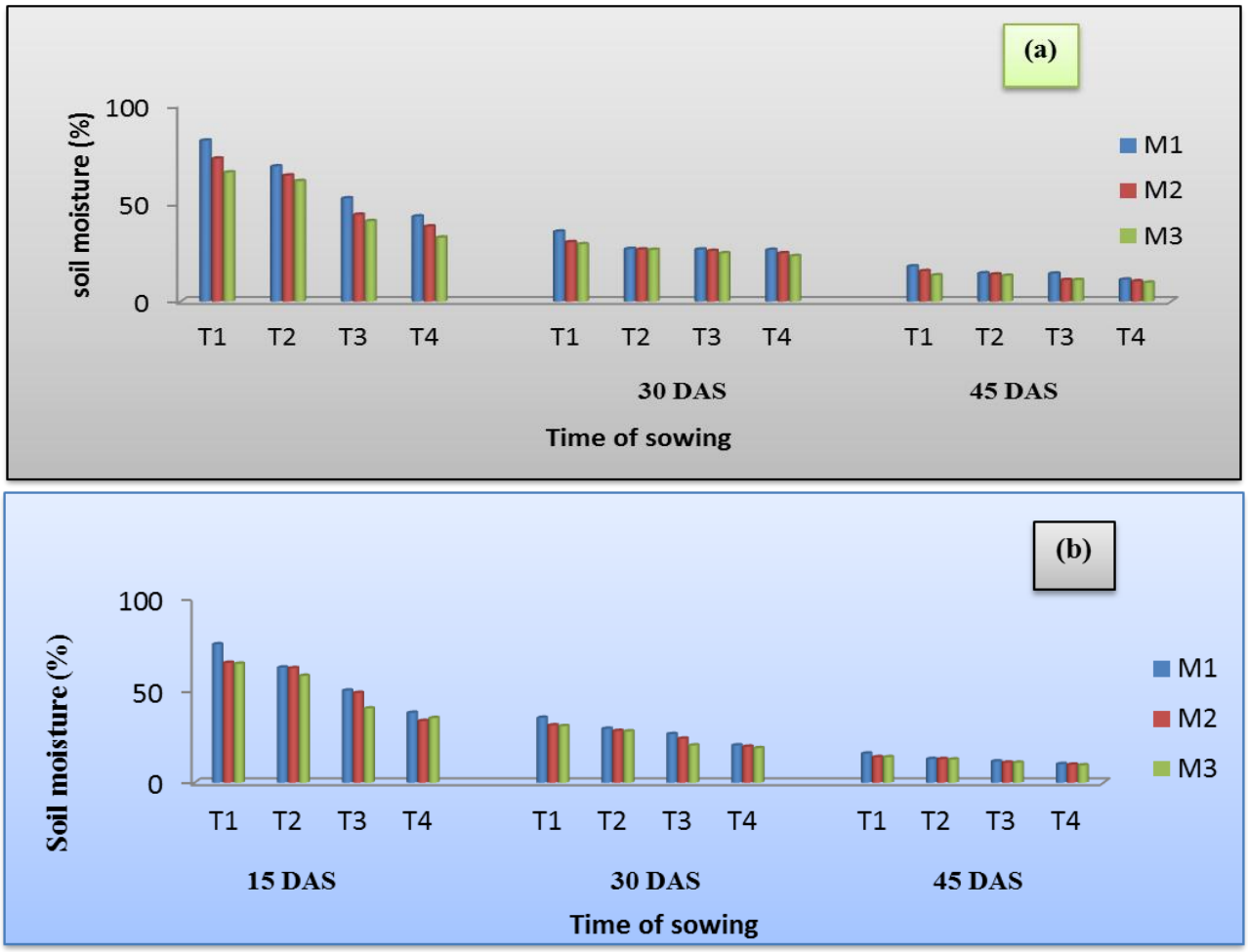

Figure 1 (a) Effect of methods and time of sowing on soil moisture (%) kharif, 2012, (b) Effect of methods and time of sowing on soil moisture (%) *rabi*, 2012-13

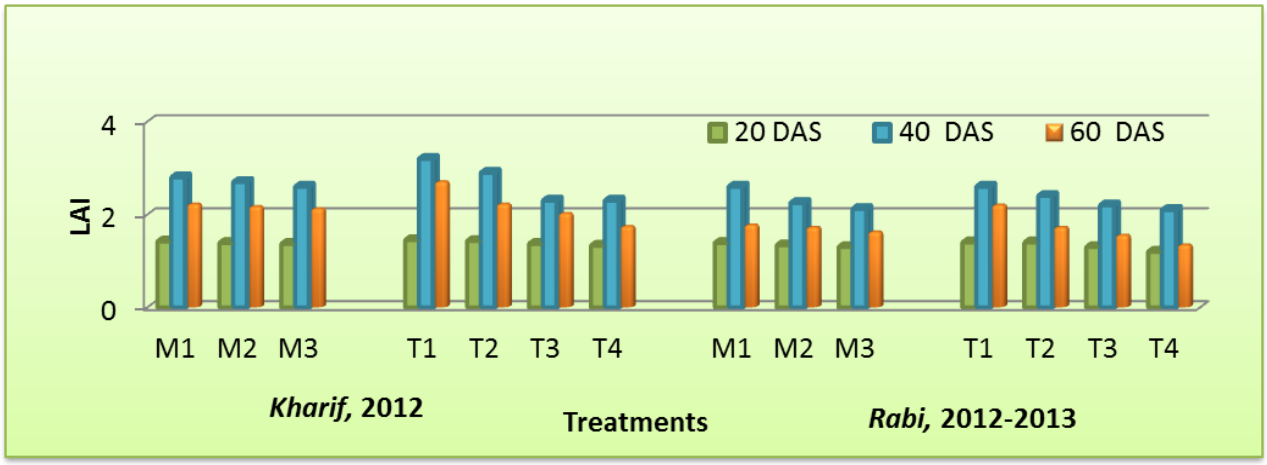

Figure 2 Effect of methods and time of sowing on Leaf area index (LAI) in rice fallow blackgram

Dry Matter Production

Tables 1 and 2 reveals that accumulation of DMP the methods of sowing, line dibbling (M_1) had higher dry matter production of 280 and 273 kg ha^{-1}at 20 DAS, 1123 and 1048 kg ha^{-1} at 40 DAS and 1980 and 1914 kg ha^{-1} at 60 DAS during *kharif* and *rabi* respectively (**Figure 3**).

Regarding time of sowing, 10 days before rice harvest (T_1) was registered with higher dry matter production to 295 and 294 kg ha^{-1} at 20 DAS, 1104 and 1015 kg ha^{-1} at 40 DAS and 2074 and 2071 kg ha^{-1}at 60 DAS during *kharif* and *rabi* respectively.

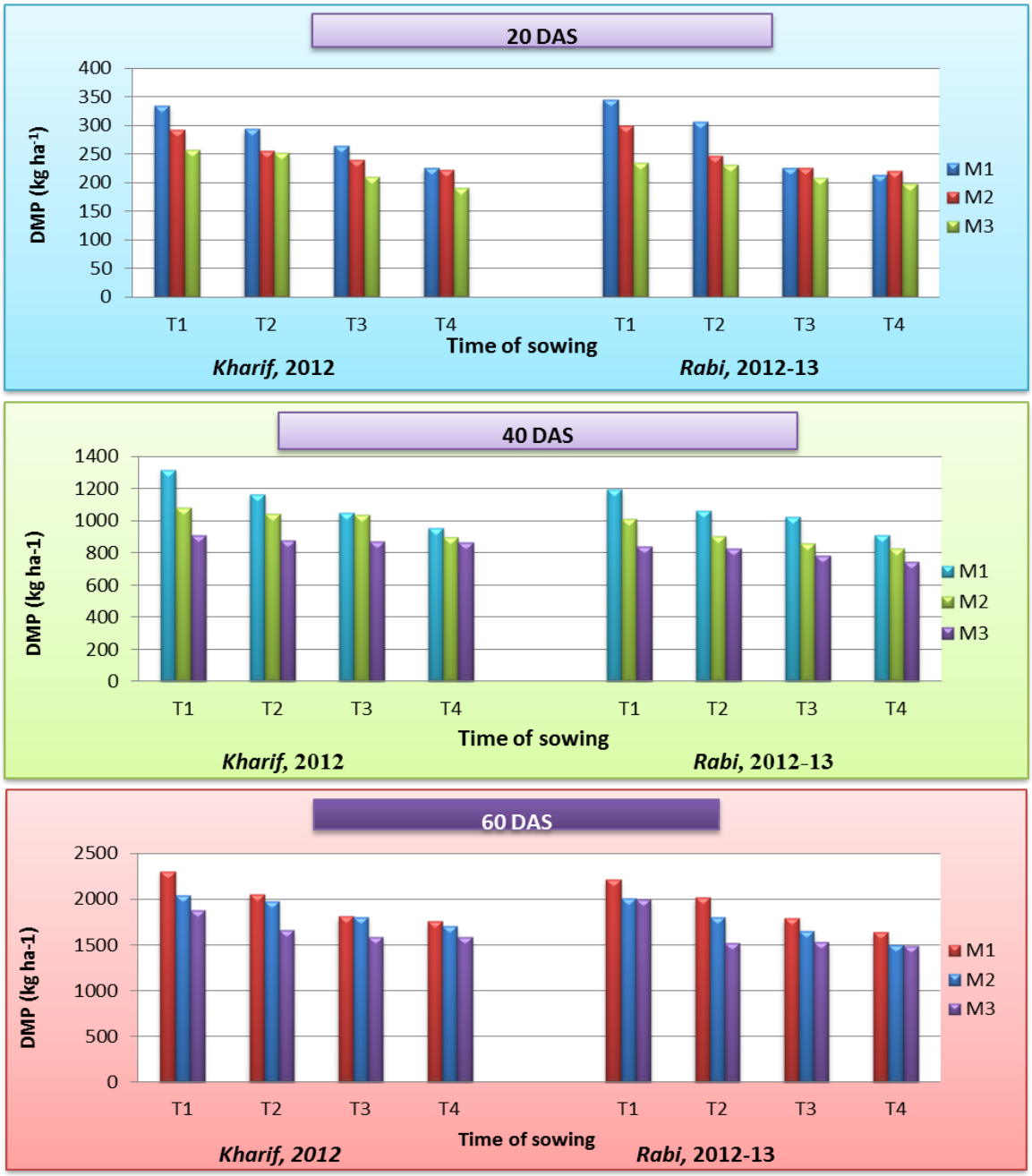

Figure 3 Effect of method of sowing and time of sowing on DMP (kg/ha) in rice fallow blackgram

The interaction effect of methods and time of sowing significantly influenced the dry matter production. Combination of line dibbling and 10 days before rice harvest (M_1T_1) recorded higher DMP of 334, 1318 and 2297 kg ha^{-1} at 20, 40 and 60 DAS respectively during *kharif* and 345,1194 and 2212 kg ha^{-1}at 20,40 and 60 DAS respectively during *rabi*. The treatment combination of line dibbling and 7 days before rice harvest (M_1T_2) ranked 2nd in registering the higher dry matter production during both the seasons. The M_1T_1 compare to 10.61,7.1, 3.4 % higher than next best one in 15,30,45 DAS.This was in conformity with the findings of [9] they observed that the growth of French bean was significantly higher from November 1 sowing compared to delayed sowing on November 16 (or) December 1.Grain yield was significantly and positively correlated with DMP for different growth stages.

Yield

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) (Tables 1 and 2). Broadcasting (M_3) recorded lower seed yield of 243 kg ha^{-1} and 238 kg ha^{-1} during *kharif* and *rabi* respectively (**Figure 4**).

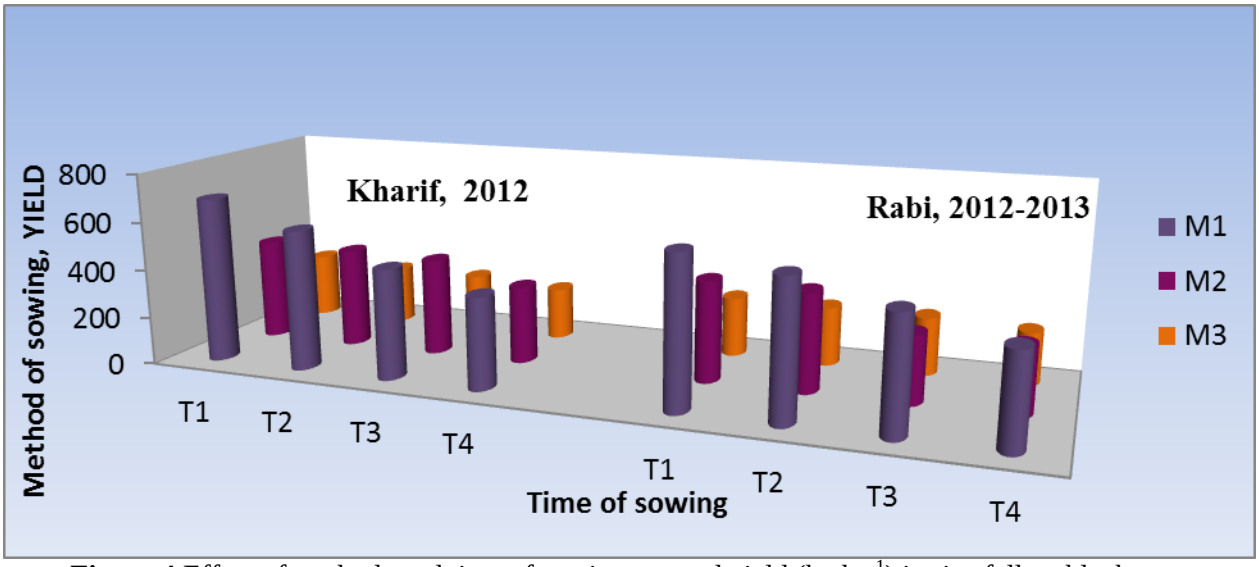

Figure 4 Effect of methods and time of sowing on seed yield (kg ha^{-1}) in rice fallow blackgram

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 on 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*.

Similar yield increase by the dibbling method of sowing was reported by [10] who reported that dibbling the seeds immediately after harvest of rice recorded higher seed yield than broadcasting of seeds in standing crop of rice and LAI is primary physiological determinant of crop yield. The M_1T_1 compare to 9.6% higher than next best one in 15,30,45 DAS.

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 for achieve higher growth 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 LAI, DMP and yield of rice fallow blackgram during *kharif* and *rabi* season in southern India.

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Reference

[1] Appanna, G. 1994. Weed management in rice fallow blackgram. M.Sc. (Ag.). Thesis, Andhra Pradesh Agricultural University, Hyderabad, pp. 38-55.
[2] Satyanarayana, A. 1998. Pulse in rice fallows. An overview. In proc. Short course onrice fallow pulses (20-29 may, 1998), Lam, Guntur, pp. 5-10.
[3] Kannaiyan, S. 1999. Bio resources technology for sustainable agriculture. Associated publishing company, New Delhi. pp. 422.
[4] Geetha, P. and Velayutham. 2009. Refinement of nutrients management techniques for growth yield and nutrient uptake of rice fallow blackgram. Madras Agric. J., 96 (1-6), pp. 163-166.
[5] Mahapatra, I.C., M. Singh, Dayanand and R.N. Singh. 1975. Pulses in cropping systems.
[6] Panse, V.G. and P.V. Sukhatme. 1985. Statistical methods for agricultural workers. Pub. ICAR. New Delhi, pp. 187-197.

[7] Jagvirsingh, K.S. Bhaskar and P.R. Bharambe. 2011. Available soil moisture and yield of rainfed hybrid cotton (Gossypiumhirsutum) influenced by rain water conservation practices. Indian J. Agron., 56 (2), pp. 154-158.
[8] Dasharath Prasad, Bangarwa, A.S. Sathish Kumar and Asha Ram. 2012. Effect of sowing dates and plant population on chickpea (Ciceraritaun) genotypes. Indian J. Agron., 5 (2), pp.206-208.
[9] Sreelatha, D., K.L. Rao, and R.V. raghavaiah. 1999. Effect of sowing dates on growth and yield of French bean cultivars. The Andhra Agric. J., 46 (1 & 2), pp. 81-84.
[10] Kumar, K., H.S. Mavi, K.L. Khera, L. singh and O.P. Jhorar. 1992. Effect of shelter belt, mulching and reflectant on field microclimate and yield of greengram (Vigna radiata) in South west Punjab. Ann. Agric Res., 13 (4), pp. 375-389.

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