



Effect of Time and Method of Sowing in Wet Direct Seeded Rice

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ABSTRACT

Background: Direct wet seeding offers the advantage of faster and easier sowing, reduced labour and less drudgery, 7-10 days earlier crop maturity, more efficient water use and higher tolerance to water deficit, less methane emission, and often higher profit in areas with assured water supply. There is a possibility of intercropping green manures during early growth stage of rice with less interference on the crop growth, which also smothering the weed growth to enhance the productivity of wet direct seeded rice.

Methods: A field experiment was conducted during *Kharif*, 2019 and 2020 at the Department of Rice, Tamil Nadu Agricultural University, Coimbatore, to study the time of sowing and method of sowing under wet direct seeded rice. The experimental trial was laid out in split plot design with three replications. Treatments comprising of time of sowing in main plot viz., normal sowing time in first fortnight of July and delayed sowing time in second fortnight of July. In sub-plot, method of sowing viz., broadcasting method, line sowing method, paddy drum seeder method, paddy + dhaincha drum seeder method and direct planting method.

Result: The results revealed that, sowing of wet direct seeded rice during first fortnight of July month by using Paddy + Dhaincha drum seeder method recorded higher grain yield of 5707 kg/ha which resulted 33 per cent higher yield than that of broadcasting method.

Key words: Method of sowing, Productivity, Time of sowing, Wet-seeded rice.

INTRODUCTION

Rice is a staple food crop in Asia and has been traditionally cultivated mainly by transplanting. The wet direct seeding technique, which aims to realize labour saving in paddy rice cultivation, has continued to gain popularity in recent years (Ryma Labad *et al.*, 2020). Unlike the traditional transplanting method, in which young rice plants are first grown and then transplanted to a paddy field, wet direct seeding is a technique in which the seed is sown directly, where it germinates and establishes and the rice is harvested from the same paddy. Because the work of raising and transplanting seedlings can be omitted, wet direct seeding can make an important contribution to labour saving (Kumar and Ladha, 2011). In India, manual transplanting of rice seedlings into puddled soil is the common method of rice establishment. Transplanting after repeated puddling is the conventional method of rice growing which is not only intensive water user but also cumbersome and laborious. Different problems like lowering water table, scarcity of labour during peak periods, deteriorating soil health demands some alternative establishment method to sustain productivity of rice as well as natural resources. Direct seeded rice (DSR), probably the oldest method of crop establishment, is gaining popularity because of its low-input demand. It offers certain advantages viz., it saves labour, requires less water, less drudgery, early crop maturity, low production cost, better soil physical conditions for following crops and less methane emission, provides better option to be the best fit in different cropping systems (Jagmohan Kaur and Avtar Singh, 2017).

Direct seeding includes both the dry and wet seeding of rice, practiced depending on water availability in the region. Sowing of sprouted rice seed or wet-seeded rice in puddled soil though becoming increasingly important as a method of crop establishment under lowland rice is beset

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with weed problems, particularly grassy weeds besides other management practices. Weeds emerge at about the same time that the rice seeds germinate and therefore the yield losses caused by weeds will become greater with the trend towards wet seeding. Effective weed control is one of the key issues and major requirements to ensure a successful wet-seeded rice crop. Wet direct seeding method in the past has received relatively less attention than transplanting. Rice farmers in the tropics practice wet seeding by broadcasting or line seeding of germinated seeds on the puddled soil surface. As the seeds are sown on the soil surface, they are often splashed by heavy rain, destroyed by birds and rodents and are likely to dry-up due to water scarcity and direct exposure to sunlight, resulting in poor seedling establishment. In addition, the plants are prone to lodging due to poor anchorage. To circumvent these deterrents inherent in surface seeding, anaerobic seeding which consists of seeding pre-germinated seeds under the surface of puddled soils merits investigation (Pandey and Velasco, 2005).

Weeds in direct-seeded rice cause 73 per cent loss in yield and the farmers may end-up using most of the labour

saved by wet seeding to control weeds (Milberg and Hallgren, 2004). There is a possibility of intercropping green manures during early stage of rice crop with less interference on the crop growth. This situation can effectively be capitalized upon by raising *dhaincha* (*Sesbania aculeata*) as a green-manure crop conjointly with wet-seeded rice, and incorporating it at 35-40 days of growth using conoweeder. Hence, the present study was constituted to study the time and methods of sowing to assess the cost effective agronomic management practices to enhance the production of wet direct seeded rice.

MATERIALS AND METHODS

A field experiment was conducted during *Kharif*, 2019 and 2020 at the Department of Rice, Tamil Nadu Agricultural University, Coimbatore, to study the time of sowing and methods of sowing under wet seeded rice. The soil of the experimental field was clay in texture with a pH 8.22, organic carbon (0.45%), low in available nitrogen (212 kg/ha), medium in available phosphorus (22 kg/ha) and high in available potassium (478 kg/ha). Entire dose of phosphorus applied as basal, N and K applied in four splits at basal, tillering, panicle initiation and flowering stages.

Treatments comprising of time of sowing in main plot *viz.*, normal sowing time of first fortnight of July (M_1), delayed sowing of second fortnight of July (M_2). In sub-plot, method of sowing *viz.*, broadcasting method (S_1), line sowing method (S_2), paddy drum seeder method (S_3), paddy + dhaincha drum seeder method (S_4) and direct planting method (S_5). The variety chosen for this study was CO 51 and the experimental trial was laid out in split plot design with three replications. In sub plot, for broadcasting method seeds were broadcasted and in line sowing method, sowing was done by using the manual labour with a spacing of 20 cm apart. In drum seeder method, paddy drum seeder was used maintain a row spacing of 25 cm apart and in paddy + dhaincha drum seeder method, one row of paddy and one

row of dhaincha sowing was done alternatively. Intercropped dhaincha was incorporated *in-situ* at 35 days after sowing using conoweeder. The row-to-row spacing was 25 cm between rice with one row of dhaincha in the middle. In direct planting system, seeds were broadcasted manually at 20 DAS, by using conoweeder 25 cm row to row spacing was maintained by incorporating seedlings in to the field.

The recommended doses of 150:50:50 kg/ha of N:P:K in the form of urea (326 kg /ha), single super phosphate (312.5 kg/ha) and muriate of potash (83.3 kg/ha) were applied. Nitrogen and potassium were applied in four equal splits at 21 DAS, active tillering, panicle initiation and heading, whereas the entire dose of P was applied basal before sowing. A very thin film of water was maintained at the time of sowing. For the next 8-10 days, irrigation and drainage were alternated to enable germination of seeds and establishment of seedlings. Thereafter, the crop was irrigated to 5 cm depth at required intervals when the water was completely drained, and irrigation was withheld 10 days before the harvest. Need-based plant-protection measures for rice were followed. The sampling techniques for all the growth and yield characters including estimation of yield were followed as per standard procedures. Weed density at active tillering and panicle initiation stages and yield attributes of number of panicles/m², panicle weight and the grain and straw yields at harvest were recorded. The recorded data were pooled analysed statistically as per the method suggested by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Weed growth

Total weed density was recorded lesser under Paddy + Dhaincha drum seeder method of sowing when compared to other sowing methods. Total weed density of 10.9/m² and 6.2/m² was recorded under normal time of sowing *ie.* first fortnight of July sowing (Table 1). Weather parameters that prevailed during the crop growth period were more

Table 1: Effect of treatments on total weed density (Number/m²) at tillering and panicle initiation stage of wet DSR.

Treatments	Total weed density at active tillering stage				Total weed density at panicle initiation stage			
	Normal sowing (I st fortnight of July)		Delayed sowing (II nd fortnight of July)		Normal sowing (I st fortnight of July)		Delayed sowing (II nd fortnight of July)	
				Mean				Mean
Broadcasting method (S_1)	5.78	(32.95)	5.92	(34.55)	5.85	(33.75)	3.53	(11.95)
Line sowing method (S_2)	5.15	(25.98)	5.31	(27.65)	5.23	(26.81)	3.38	(10.90)
Paddy drum seeder method (S_3)	4.10	(17.21)	3.90	(19.55)	4.80	(22.55)	3.04	(8.73)
Paddy + Dhaincha drum seeder method (S_4)	3.22	(10.9)	3.57	(11.95)	3.50	(12.13)	2.65	(6.23)
Direct planting method (S_5)	4.28	(17.8)	4.40	(18.90)	4.34	(18.35)	3.34	(10.63)
Mean	4.75	(22.04)	4.90	(23.52)			3.25	(10.09)
	M	S	M × S	S × M	M	S	M × S	S × M
S.Ed	0.02	0.05	0.07	0.07	0.02	0.03	0.05	0.05
CD (0.05)	0.08	0.10	NS	NS	0.08	0.07	NS	NS

(*Figures in parentheses are original values).

favourable and played a crucial role in dhaincha growth, which is essential for smothering of weeds and accumulation of more N. The total weed density decreased sharply at 45 DAS and rice + *dhaincha* recorded less density than broadcasting method. This might have resulted due to the use of cono weeder, which besides incorporation of the green-manure also destroyed the weeds. However, at later stages (20-35 DAS) due to faster growth and canopy spread by dhaincha, the germination and growth of weeds were effectively repressed, with a concomitant increase in weed-smothering efficiency (Ravisankar *et al.*, 2007a). The accumulation of more dry matter in crop due to lower weed pressure and better soil environment, which increased the grain yield (Brar and Bhullar, 2013). In addition to weed suppression, other benefits of sesbania co-culture are atmospheric nitrogen fixation and facilitation of crop emergence in areas where soil crust formation is a problem. Sesbania co-culture was more effective against broad leaved weeds and sedges and less effective on grasses (Sheeja and Elizabeth, 2017).

Growth attributes

Time and methods of sowing were greatly influenced by the growth parameters in wet direct seeded rice. Total number of tillers/m² (Fig 1) and total dry matter accumulation (g/m²)

(Fig 2) was recorded higher under first fortnight of July sowing in Paddy + Dhaincha drum seeder method when compared to other sowing methods. Growing of *Daincha* as intercrop and its mechanical incorporation at the early stage of wet-seeded rice increased the number of tillers/m² which results in higher total dry matter accumulation (Ravisankar *et al.*, 2007b) and (Singh and Chinnusamy, 2007).

Yield attributes

Based on the two years of experimental study, the results revealed that first fortnight of July sowing by using Paddy + Dhaincha drum seeder method recorded higher number of panicles/m² (349) and panicle weight (2.98 g) whereas, broadcasting method recorded lesser number of panicles/m² (259) and panicle weight (1.94 g) (Table 2). This may be due to decrease in weed competition decreased the nutrient removal by weeds, which provided a competition-free environment for rice. These results were in conformity with the findings of Vasanatha Kokilam *et al.*, (2019) and Mani sankar *et al.*, (2019).

Grain yield

The results revealed that, sowing of wet direct seeded rice during first fortnight of July month by using Paddy + Dhaincha drum seeder method recorded higher grain yield

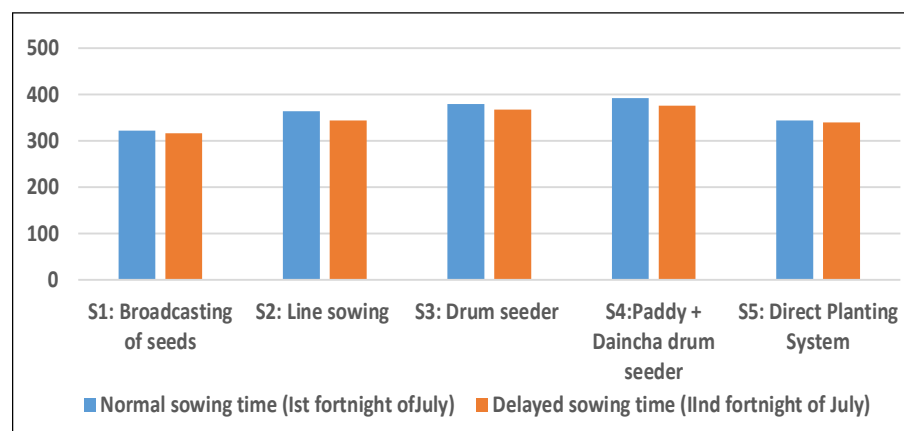


Fig 1: Effect of treatments on number of tillers/m² of wet DSR.

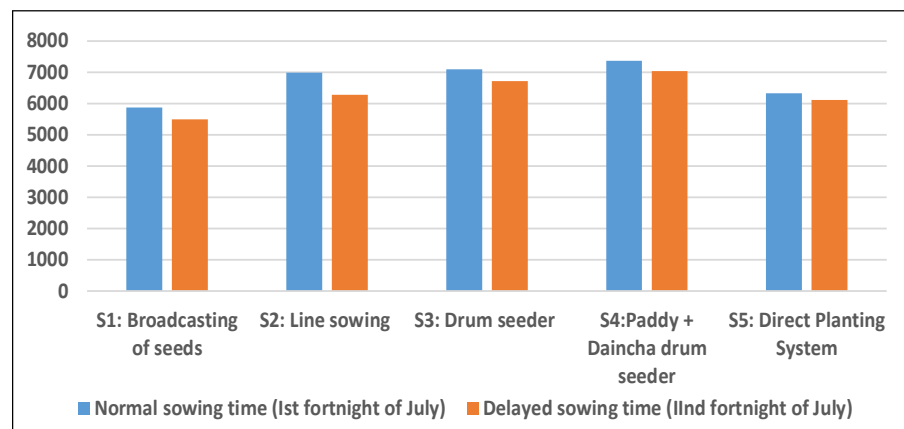


Fig 2: Effect of treatments on dry matter accumulation (g/m²) at 105 DAS of wet DSR.

of 5707 kg/ha (Table 3) which resulted 33 per cent higher yield than that of broadcasting method. Growing of dhaincha between paddy rows smothering the weed growth in early stages and incorporation of dhaincha at 30 days after sowing by using cono weeder which accelerates root aeration and also adds organic nutrients in to the soil. This may be due to decrease in weed competition decreased the nutrient removal by weeds, which provided a competition-free environment for rice. Rice + dhaincha increased the grain yield substantially due to the effective suppression of weeds,

restriction of nutrient drain by weeds and increase in nutrient uptake by the crop. Peak release of $\text{NH}_4\text{-N}$ from dhaincha coincided with panicle initiation stage signifying N availability at critical stage (Ravisankar *et al.*, 2008) and (Parameswary *et al.*, 2015). Straw yield also showed a similar trend (Fig 3).

Economics

In economics, sowing of wet direct seeded rice during first fortnight of July month by using Paddy + Dhaincha drum seeder method resulted higher net return (Rs. 52,487/-) and

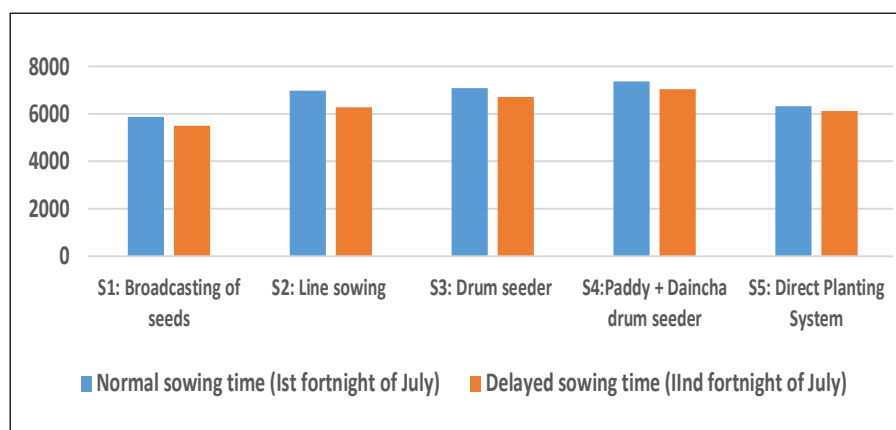


Fig 3: Effect of treatment on straw yield (kg/ha) of wet direct seeded rice.

Table 2: Effect of treatments on number of Panicles/m² and Panicle weight (g) of wet DSR.

Treatments	Panicle number/m ²			Panicle weight (g)		
	Normal sowing	Delayed sowing	Mean	Normal sowing	Delayed sowing	Mean
	(Ist fortnight of July)	(IInd fortnight of July)		(Ist fortnight of July)	(IInd fortnight of July)	
Broadcasting method (S ₁)	259	215	237	1.94	1.83	1.89
Line sowing method (S ₂)	315	260	288	2.57	2.41	2.49
Paddy drum seeder method (S ₃)	329	266	298	2.67	2.51	2.56
Paddy + Dhaincha drum seeder method (S ₄)	349	285	317	2.98	2.87	2.92
Direct planting method (S ₅)	303	246	276	2.49	2.30	2.40
Mean	310	255		2.52	2.38	
	M	S	S × M	M	S	S × M
S.Ed	14	21	28	0.11	0.12	0.17
CD (0.05)	32	36	66	0.35	0.25	0.46

Table 3: Effect of treatments on grain yield (kg/ha) of wet direct seeded rice.

Time of sowing	Grain yield (kg/ha)		Mean
	Normal sowing (Ist fortnight July)	Delayed sowing (IInd fortnight of July)	
Broadcasting method (S ₁)	3801	3655	3728
Line sowing method (S ₂)	5195	4816	5006
Paddy drum seeder method (S ₃)	5476	4952	5214
Paddy + Dhaincha drum seeder method (S ₄)	5707	5010	5359
Direct planting method (S ₅)	4780	4465	4623
Mean	4992	4580	
	M	S	M at S
S.Ed	23	49	65
CD (0.05)	73	100	144

Table 4: Economics of treatments on wet direct seeded rice.

Methods of sowing	Net returns (Rs./ha)		Benefit cost ratio	
	Normal sowing (1 st fortnight July)	Delayed sowing (II nd fortnight of July)	Normal sowing (1 st fortnight July)	Delayed sowing (II nd fortnight of July)
Broadcasting method (S ₁)	24984	22568	1.51	1.45
Line sowing method (S ₂)	44256	38132	1.91	1.76
Paddy drum seeder method (S ₃)	51484	42975	2.15	1.95
Paddy + Dhaincha drum seeder method (S ₄)	52487	42802	2.18	1.91
Direct planting method (S ₅)	39935	34458	1.86	1.72

benefit cost ratio (2.18) when compared to other sowing methods (Table 4). Among the methods of sowing, the broadcasting method resulted lesser net return of Rs. 24,984/- and benefit cost ratio of 1.51.

CONCLUSION

From this study it can be concluded that, wet direct sowing during the first fortnight of July month by using Paddy + Dhaincha drum seeder method is more suitable for enhancing the grain yield under wet direct seeding of rice cultivation during *Kharif* season in Tamil Nadu.

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