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Economic evaluation of the different crop establishment methods in rice

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Abstract
A field experiment conducted during *Kharif* season of 2017 under AICRIP, in Alfisols at Instructional cum Research of Shaheed Gundadhoor College and Agricultural Research Station, Jagdalpur, Chhattisgarh, to study grain yield of rice as influenced by different establishment methods under puddle condition. The significantly highest gross return was registered with treatment line transplanting method (T_1) over rest of the treatments. Significantly highest net return and B: C ratio was registered with treatment wet direct seeded rice using drum seeder (T_3) over rest of the treatments.

Keywords: rice establishment methods, gross return, B: C ratio.

Introduction
Rice is a member of the family Poaceae originated from South-East Asia. In world rice has occupied an area of 158.9 million hectares, with a total production of 685.0 million tonnes in 2011 (Anonymous, 2016) [1]. In Asian countries, rice is the main major staple crop covering about 90% of rice grown in the world, thus rice is immensely important to food security of Asia. Rice (*Oryza sativa* L.) is considered as the 'Global Grain' in 89 nations and it is an important food for more than half of the global population. In India, rice is grown under three major ecosystem: rainfed upland (16%), irrigated land (45%) and rainfed lowland (39%), with a productivity of 0.87, 2.24, and 1.55 t ha^{-1}, respectively. The slogan 'Rice is life' is most appropriate for India**.** It contributes 20 to 25 per cent of agriculture GDP.
Method of establishment is one of the cultural practices, which influences the rice crop through its effect on growth and development (Gobi *et al.*, 2006) [2]. Transplanting of rice seedlings in the traditional way is a laborious, time consuming and causes drudgery. Non-availability of labors for transplanting at appropriate time leads to late planting, which results in poor yields. There are three principal methods of DSR: dry seeding (sowing dry seeds into dry soil), wet seeding (sowing pre-germinated seeds into dry soil) and water seeding (seeds sown into standing water).Wet seeding is sowing of pre germinated seed on to puddled soil which is a major crop establishment system of rice culture in Chhattisgarh and also used in other parts of the tropics and subtropics. This method also became mandatory in case of continuous rains, where direct dry seeding, nursery raising is not possible or in delayed condition.

Materials and Methods
Research trial on "Evaluation of different establishment methods for enhancing productivity and profitability of rice under puddle condition" was conducted at Instructional cum Research Farm, Shaheed Gundadhoor College of Agricultural and Research Station, Jagdalpur, Chhattisgarh during *kharif* season of 2017. The experiment was laid out in randomized block design with four replications. The different methods of establishment viz line transplanting (T_1), random transplanting (T_2), wet direct seeded rice using drum seeders (T_3), wet direct seeded rice by broadcasting (T_4) and direct sowing method (Dry seeded) (T_5) were adopted. The variety Durgeswari was taken as a test which parentage are Mahamaya x NSN 5 (MTC-4, IET 11904), maturity duration 130-135 days, grain type long slender grain. The soil was locally known as Mal (*Alfisols*). It is well fertile soil belongs to mid land situation of landscape in Jagdalpur. During *kharif* 2017, a total of 1602.9 mm rainfall in 82 rainy days was recorded against the normal rainfall of 1195 mm.

Results
The significantly highest grain yield (q ha^{-1}) was registered under the treatment line transplanting method (T_1) which was at par with treatment wet direct seeded rice using drum

seeder (T_3). The lowest grain yield (q ha^{-1}) was recorded with treatment dry direct sowing method (T_5).The significantly highest straw yield (q ha^{-1}) was registered under the treatment line transplanting method (T_1) which was at par with treatment random transplanting (T_2) and wet direct seeded rice using drum seeder (T_3).The lowest straw yield notice under treatment dry direct sowing method (T_5). The data revealed that harvest index of rice found to be non-significant. Many factors determine the yield for rice crop during cultivation such as soil, cultivar, season, environment, planting time, methods of establishment, water management, weed control, cropping pattern, source, form, rate, and time of application and method of application. Mankotia *et al*. (2009) [3] found similar results that among four methods of rice establishment transplanted method of paddy resulted in significantly higher grain yield (3.98 t ha^{-1}) followed by drum seeding (3.37 t ha^{-1}), broadcast seeding (3.27 t ha^{-1}) of sprouted seeds and row seeding (2.95 t ha^{-1}) in prepared bed. (Table 1).

Significantly highest gross return was registered with treatment line transplanting method (T_1) over rest of the treatments. Transplanted flooded rice leads to high losses of water through puddling, surface evaporation and percolation. Significantly highest net return and B: C ratio was registered with treatment wet direct seeded rice using drum seeder (T_3) over rest of the treatments. Further, treatment dry direct sowing method (T_5) registered lowest gross, net and B: C ratio (Table 2).

Table 1: Test weight, yield and harvest index of rice as influenced by different crop establishment methods

Treatment	Test weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index (%)
T_1: Line transplanting method	30.79	6203	7968	43.77
T_2: Random transplanting method	30.54	5660	7594	42.81
T_3:Wet direct seeded using drum seeder	29.84	6097	7885	43.61
T_4: Wet direct seeded by broadcasting	28.25	5415	6921	43.90
T_5: Dry direct sowing method	27.59	4857	6682	42.09
SEm±	0.922	142.7	184.2	0.876
CD (P=0.05)	N.S.	439.9	567.7	N S

Table 2: Economics analysis of rice as influenced by different crop establishment methods

Treatment	Gross return (000 Rs ha^{-1})	Net return (000 Rs ha^{-1})	B:C ratio
T_1: Line transplanting method	108099	64042	1.5
T_2: Random transplanting method	99121	54663	1.2
T_3:Wet direct seeded using drum seeder	106331	81082	3.2
T_4: Wet direct seeded by broadcasting	94314	68465	2.7
T_5: Dry direct sowing method	85307	54569	1.8
SEm±	377	643	0.06
CD (P=0.05)	1175	2003	0.20

Conclusion

The significantly highest grain yield (q ha^{-1}) was registered under the treatment line transplanting method (T_1) which was at par with treatment wet direct seeded rice using drum seeder (T_3). The lowest grain yield (q ha^{-1}) was recorded with treatment dry direct sowing method (T_5).The significantly highest straw yield (q ha^{-1}) was registered under the treatment line transplanting method (T_1) which was at par with treatment random transplanting (T_2) and wet direct seeded rice using drum seeder (T_3). Significantly highest net return and B: C ratio was registered with treatment wet direct seeded rice using drum seeder (T_3) over rest of the treatments. Further, treatment dry direct sowing method (T_5) registered lowest gross, net and B: C ratio.

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