International Journal of Research in Economics and Social Sciences (IJRESS)
Available online at: http://euroasiapub.org
Vol. 7 Issue 7, July- 2017, pp~355-364
ISSN(o): 2249-7382 | Impact Factor: 6.939

Economics under different crop establishment techniques in rice: a review

Hans.R[1].
M.Sc Student, CCSHAU,HISAR

Kuldeep Yadav[2],
MBA (Business Economics) Student,
Institute of Management Studies and Research, MDU Rohtak.

Dr.Ashok Yadav[3]
Principal ,
College of Agriculture
CCS Haryana Agricultural University, Bawal.

Abstract: A field experiment was conducted during the *kharif* season of 2014 at Chaudhary Charan Singh Haryana Agricultural University, Regional Research Station, Karnal, India to evaluate three genotypes of scented *basmati* rice (PB 1121,HB 2 and CSR 30), six coarse grain rice genotypes (HKR 47, HKR 48, HKR 127, HKR 128, PR121 and PR 122.) and one hybrid (HSD 1) under direct seeding (*vattar*) and puddled transplanting in a strip plot design with three replications.

Among different rice genotypes, plant height, number of tillers, panicle length and B: C ratio were higher in *basmati* genotypes as compared to coarse grain genotypes except HKR 48. On the other hand, dry weight, number of grains per panicle, grain yield, straw yield, biological yield, harvest index, total variable cost and gross returns were higher in coarse grain genotypes. Maximum 1000-grain weight was recorded in genotype PB 1121. Among coarse grain genotypes, highest number of tillers, leaf area index, dry weight, number of effective tillers, 1000-grain weight, grain yield, harvest index, gross returns, net returns and B:C were recorded in HKR 48 and plant height in HKR128

There was significant reduction in grain yield of coarse grain genotypes of rice, viz. HKR 47, HKR 48, HKR 127, HKR 128, PR 121 and PR 122 under DSR over PTR. Least reduction in grain yield under direct seeding was recorded in coarse grain genotype HKR48 with maximum grain yield recorded under DSR. Grain yield under DSR was lower than PTR in all genotypes.

Keywords: Direct seeded rice (DSR), puddled transplanted rice (PTR), *basmati,* coarse grain genotypes, growth, yield parameters, economics.

Purpose: Economics under direct seeding and puddled transplanting methods of rice.

Introduction

Direct seeding was a viable alternate method of *basmati* rice establishment. Dry direct seeding under *vattar* conditions and wet DSR were comparable to PTR in terms of grain yield. However, compared to wet DSR and PTR,*vattar* DSR could be better as there was water saving (30-40%), puddling was not required and yields were comparable. Performance of *basmati* cultivars was more satisfactory under DSR compared to coarse grain genotypes, where yield penalties were more. Seed rate of 20 kg/ha was realized to be optimum under DSR. (Yadav et al, 2011)

Direct seeding of rice is an alternative to transplanting that can reduce the delays and cost of rice establishment (Malik and Yadav, 2006). Mazid *et al.* (2002) reported similar average yield of dry seeded and transplanted rice. But, variability in the yield estimated by the coefficient of variation was higher in dry seeded rice (DSR). The higher variation in yield of dry seeded rice was probably caused by fluctuation in time and amount of early season rainfall and effectiveness of control of weeds. Dry seeded rice produced significantly higher yield than transplanted rice when rainfall was lower.

Ninety two percent of the Muda (Malaysia) farmers reported that the yield of direct seeded rice was superior to that of transplanted crop (Ho and Romli, 2002). General yield trends were in the order: wet seeding > dry seeding > volunteer seeding. Studies conducted in the Muda area indicated that the technological possibilities of raising rice yield potential would come from direct seeded rice.

The primary difference between direct seeding and transplanting of rice is the amount of labour used for crop establishment. In a study, Erguiza *et al.* (1990) found that total paid out costs were 16 per cent higher for transplanted rice, largely because of the high cost of hired labour for crop establishment. Analytical studies on labour use by Wong and Morooka (1996) indicated that on an average, farmer used only 80 person h/ ha per season in direct seeding compared with 237 person h/ ha per season for transplanting. The direct seeded crop required only 34 per cent of the total labour requirement of the transplanted crop. After analyzing the economic effect of direct seeded rice cultivation, Lee *et al.* (2002) reported that the labour requirement for tillage to seeding in dry seeding was 41 h/ha, which was 73 and 23 per cent lower than that of machine transplanting and wet seeding, respectively. The total labour requirement for dry seeding was approximately 234 h/ha, which was 30 and 50 per cent lower than that of transplanting and wet seeding, respectively. Thus, the direct cost of rice production by direct seeding was about 21 per cent lower than machine transplanting. Pandey *et al.* (2002) reported 50 per cent lower labour use in direct seeded crop than transplanted crop. The total production cost for transplanting was higher than direct seeded rice. The difference was mainly due to the higher labour requirement for transplanting.

The saving in production cost is another significant factor in encouraging farmers to switch from transplanted rice to direct seeded rice. The economic analysis based on experimental data and farmers' interview revealed that the highest net return of 33 per cent was achieved from drill direct seeded rice followed by zero-tillage direct seeded rice (22%) and wet seeded rice

(21%) over conventional transplanted rice (Tripathi *et al.,* 2004). The savings of 44 per cent in drill direct seeded, 45 per cent in zero-tillage direct seeded and 32 per cent in wet direct seeded were recorded in the total variable costs as compared to conventional transplanted rice. Establishment cost, irrigation cost and weed management cost appeared to be three main variable costs influencing the economics of different methods of rice cultivation (Tripathi *et al.,* 2004). Budhar and Tamilselvan, (2001) recorded that the net income and benefit: cost was highest in wet seeding by manual broadcasting closely followed by wet seeding by a drum seeder. Using wet seeding could result in a higher net income and benefit: cost than traditional transplanting method. While considering the net monetary returns and B:C due to different sowing method of rice, Jha *et al.* (2006) reported that direct seeding of sprouted seed with drum seeder produced higher net returns of Rs. 30,473/ha with B:C of 2.37 as compared to transplanting with net returns of Rs. 28,000/ha and B:C of 2.27.

Research on farmer's fields showed that direct seeded rice was profitable to farmers, giving net return of Rs. 13,350/ha for direct seeding and Rs. 11,592/ha for wet seeding compared to Rs. 10,343/ha for puddle transplanted rice (Yadav *et al.,*2006a). Total saving was around Rs. 3,500/ha due to saving in labour and seed paddy in broadcast method as compared transplanting method (Jayawardena and Abeysekera, 2006). Kandyasamy and Chinnusamy (2005) reported that in drum seeding + dhaincha, net income and B:C (Rs. 22,084/ha and 3.25, respectively) were higher as compared to broadcasting method (Rs. 16,341/ha and 2.59, respectively).

Singh *et al.* (2006b) reported higher profitability under reduced till direct seeded rice and zero-tillage rice by Rs. 2,745 and Rs. 3,139/ha compared to transplanted rice in western Uttar Pradesh and Haryana, respectively. Jat *et al.* (2006) when studied the economics of system found that the profitability of rice-wheat system was higher with double zero-tillage practice (US $ 1101/ha) compared to US $ 1050 and US $974 with direct seeded rice and zero-tillage wheat and puddle transplanted rice and zero-tillage wheat practices, respectively. Among different methods of transplanting, mechanical method of transplanting proved its superiority over the methods of rice establishment. The next best treatment was hand transplanting closely followed by drum seeding and both produced significantly higher net returns than zero-tillage drilling of rice (Bohra *et al.,* 2006). The net return was highest in case of zero-tillage transplant (Rs. 15,632/ha), followed by puddle transplant (Rs. 9,315/ha), FIRBS (Rs. 7,681/ha) and direct seeding (Rs. 7,300/ha) (Singh and Kumar, 2005). Similarly, Gupta *et al.* (2006c) reported that the net returns were higher in unpuddle transplanted compared to puddle transplanted conditions by Rs. 940 and 4,151/ha in western Uttar Pradesh and Haryana, respectively.

A field experiment was conducted during *kharif* season of 2014 at Regional Research Station, Uchani, Karnal of CCS HAU, Hisar, India on **"Evaluation of rice genotypes under direct seeding and puddled transplanting"**. The methods of crop establishment were direct seeded rice (DSR) and puddle transplanted rice (PTR) in main plots and rice genotypes, PB 1121, HB 2, CSR 30, HKR 47, HKR 48, HKR 127, HKR 128, PR 121, PR 122 and HSD 1 in sub-plots. The experiment was laid out in strip plot design with three replications. Soil of experimental field was clay loam in texture, low in available N and P and medium in available K with slightly alkaline in reaction (pH 8.1). The crop was raised with recommended package of practices by the state university(Hans R,2015)**)**

Between the two methods of crop establishment, grain yield was recorded significantly higher under PTR (7211 kg/ha) as compared to DSR (5035kg/ha) (Table 1). Among different genotypes, highest grain yield was recorded in HKR 48 (6794 kg/ha) which was statistically at par with HKR 128 but significantly higher than the remaining genotypes (Table 18). Grain yield of genotype PR 121 was statistically at par with PR122, HKR 47 and HKR 127 and significantly higher than PB 1121, HB 2, CSR 30 and HSD 1. The lowest grain yield was recorded in genotype CSR 30 (3217 kg/ha).

The interaction between methods of establishment and genotypes on grain yield was significant (Table 2). A significantly higher grain yield was obtained in genotype HKR 48 under DSR than the remaining genotypes. The grain yield of genotype HKR 128 was significantly higher than the remaining genotypes under PTR except genotype PR 121. Genotype PB 1121 produced similar grain yield under DSR and PTR.

Straw yield was recorded significantly higher under PTR (7156 kg/ha) than under DSR (6806 kg/ha) as depicted in Table 1. Genotype HKR 128 produced significantly higher straw yield (8789 kg/ha) as compared to other genotypes under study. Genotypes HKR 127, PR 121 and HKR 47 produced similar straw yield. The lowest straw yield was recorded in genotype HB 2 (4890 kg/ha) which was statistically lower than all other genotypes.

Table 1: Effect of different methods of crop establishment and genotypes of rice on grain and straw yield the crop

Treatments	Grain yield (kg/ha)	Straw yield (kg/ha)	Biological yield (kg/ha)	Harvest index (%)
Method				
DSR	5116	6806	11922	42.6
PTR	5996	7156	13152	45.0
SEm±	21.2	34.1	13.0	0.3
CD 5%	87.6	140.7	53.5	1.1
Genotype				
PB 1121	4079	5402	9481	43.0
HB 2	3301	4890	8191	40.3
CSR 30	3217	5765	8981	35.8
HKR 47	6327	7603	13930	45.4
HKR 48	6794	7334	14128	48.1
HKR 127	6368	7709	14077	45.1
HKR 128	6745	8789	15534	43.4
PR 121	6390	7697	14087	45.2

PR 122	6365	7545	13909	45.6
HSD 1	5976	7072	13048	45.8
SEm±	25.7	44.2	44.0	0.2
CD 5%	63.1	108.4	107.9	0.5

Table 2: Interaction effects of methods of establishment and genotypes of rice on grain yield (kg/ha)

Methods / Genotypes	PB 1121	HB 2	CSR 30	HKR 47	HKR 48	HKR 127	HKR 128	PR 121	PR 122	HSD 1	Mean
DSR	4043	3215	3161	5767	6581	5624	6238	5540	5567	5426	5116
PTR	4115	3387	3272	6886	7006	7112	7251	7240	7162	6526	5996
Mean	4079	3301	3217	6327	6794	6368	6745	6390	6365	5976	

Factors	**SE(m)**	**CD 5%**
Methods	21.2	87.6
Genotypes	25.7	63.1
Genotypes at same method	37.7	77.4
Methods at same Genotype	31.6	109.6

A significantly higher biological yield was recorded under PTR (13,152 kg/ha) as compared to DSR (11,922 kg/ha) as presented in Table 1.

Among different genotypes, highest biological yield was recorded in HKR 128 (15,534 kg/ha) which was significantly higher than all other genotypes (Table 1). Biological yield of HKR 48 was statistically at par with HKR 127 and PR 121 but significantly higher than CSR 30, PB 1121,HB 2, HKR 47, PR 122 and HSD 1. Lowest biological yield was recorded in HB 2 (8,191 kg/ha).

The interaction between methods of establishment and rice genotypes on biological yield was significant (Table 3.). Under DSR, genotype HKR 128 produced significantly higher biological yield than the remaining genotypes. Genotypes PB 1121, CSR 30 and HKR 48 showed no differences in biological yield under DSR and PTR while the differences between the two methods were significant for the remaining genotypes.

Table 3: Interaction effects of methods of establishment and genotypes of rice on biological yield (kg/ha)

Methods / Genotypes	PB 1121	HB 2	CSR 30	HKR 47	HKR 48	HKR 127	HKR 128	PR 121	PR 122	HSD 1	Mean
DSR	9459	8052	8950	13720	14102	13171	14724	12648	12548	11847	11922
PTR	9504	8329	9013	14140	14154	14984	16344	15526	15271	14249	13151
Mean	9481	8191	8981	13930	14128	14077	15534	14087	13909	13048	

Factors	**SE(m)**	**CD 5%**
Methods	13.0	53.5
Genotypes	44.0	107.9
Genotypes at same method	54.0	123.7
Methods at same Genotype	50.4	137.6

The data on cost of cultivation are presented in Table 4. Total variable cost was higher under coarse grain genotypes as compared to *basmati* genotypes under all the methods of crop establishment. The total variable cost was higher under PTR than DSR.

Gross return was highest in genotype PB 1121 as compared to other genotypes under the two methods of establishment (Table 1). Among different methods, gross return was higher under PTR as compared to DSR. Return over variable cost was higher in PB1121 as compared to other genotypes under the two methods of crop establishment. The total variable cost was higher under PTR as compared to DSR. Return over variable cost was higher under DSR in case of *basmati* genotypes as compared to PTR. Lowest return over variable cost was recorded under DSR.

Table 4: Economic analysis of different treatments.

Treatment	Total variable cost (Rs/ha)	Total cost (Rs/hac)	Gross returns (Rs/ha)	Returns over variable cost (Rs/ha)	B-C ratio
DSR					
PB1121	26125	79938	122247	96122	1.53
HB2	26125	79938	98235	72110	1.23
CSR30	25603	79363	106152	80550	1.34
HKR47	27379	81317	80738	53359	0.99
HKR48	27379	81317	92134	64755	1.13
HKR127	27379	81317	78736	51357	0.97

HKR128	27379	81317	87332	59953	1.07
PR121	27379	81317	77560	50181	0.95
PR122	27379	81317	77938	50559	0.96
HSD1	30514	84765	75964	45450	0.90
PTR					
PB1121	33231	87754	124335	91104	1.42
HB2	33231	87754	103223	69992	1.18
CSR30	32709	87179	109704	76996	1.26
HKR47	34485	89134	96404	61919	1.08
HKR48	34485	89134	98084	63599	1.10
HKR127	34485	89134	99568	65083	1.12
HKR128	34485	89134	101514	67029	1.14
PR121	34485	89134	101360	66875	1.14
PR122	34485	89134	100268	65783	1.12
HSD1	37620	92582	91364	53744	0.99

4.3.2 Benefit-cost ratio

Irrespective of methods of crop establishment and rice genotypes, highest B-C ratio was recorded in PB1121 (Table 5). Both under DSR and PTR, lowest B-C ratio was recorded for genotype HSD 1.

Table 5: Effects of establishment methods & genotypes of rice on BC Ratio.

Methods Genotypes	**PB 1121**	**HB 2**	**CSR 30**	**HKR 47**	**HKR 48**	**HKR 127**	**HKR 128**	**PR 121**	**PR 122**	**HSD 1**	**Mean**
DSR	1.53	1.23	1.34	0.99	1.13	0.97	1.07	0.95	0.96	0.90	1.11
PTR	1.42	1.18	1.26	1.08	1.10	1.12	1.14	1.14	1.12	0.99	1.15
Mean	1.47	1.20	1.30	1.04	1.12	1.04	1.11	1.05	1.04	0.94	

B-C ratio was recorded higher under DSR than PTR in *basmati* genotypes (PB 1121, CSR 30 and HB 2) (Table 5). In coarse grain genotypes, B-C ratio was higher under PTR than DSR except HKR 48. Highest B-C ratio was recorded under DSR than PTR for genotype PB 1121. Lowest B: C was recorded for genotype HSD 1 under both DSR and PTR.

Highest B: C was recorded under DSR as compared to PTR. The reason could be due to lower variable cost with respect to gross return and due to higher net return over variable cost under DSR as compared to PTR. Similar results were also reported by Veeresh *et al.* (2011). Total variable cost and gross return were lower under *basmati* than coarse grain genotypes due to lower fertilizer requirement and lower grain yield of *basmati* genotypes. In *basmati* genotypes, return over variable cost and net return over variable cost was higher under DSR as compared PTR. While in coarse grain genotypes, return over variable cost and net return over variable cost was higher under PTR as compared DSR. Similar resulted were reported by Singh *et al.* (1997). Higher profit under DSRwas reported by De Datta, 1986, Singh *et al.*(2001), Prasad *et al.* (2001), Parihar, (2004),

Choudhary *et al.* (2004), Gathala *et al.* (2006), Manjunatha *et al.* (2009) and Akhgari and Kaviani (2011). However, Ladha *et al.* (2008) reported similar net return under DSR and PTR.
B-C ratio was recorded higher under DSR than PTR in *basmati* genotypes, PB 1121, CSR 30 and HB 2. In coarse grain genotypes, B-C ratio was higher under PTR except genotype HKR 48. Lowest B: C was recorded in genotype HSD 1 under both DSR and PTR mainly due to high seed price which resulted in to high total cost in respect of gross returns.

Conclusion:

Plant height and dry weight were significantly higher up to maturity under DSR as compared to PTR. In general, *basmati* rice genotype PB1121 attained higher plant height as compared to all other genotypes. Higher numbers of effective tillers/m.r.l. were recorded under DSR than PTR. Among different rice genotypes, more number of grains/panicle was found in PTR than DSR. Grain yield of *basmati* rice genotype PB 1121 was similar under DSR and PTR. Straw yield of *basmati* rice genotypes was similar under DSR and PTR. Performance of coarse grain genotypes was poor under DSR as compared to PTR; however, yield penalties in genotype HKR 48 were comparatively less under DSR. Net return and B: C was higher in *basmati* rice genotypes under DSR than PTR. In *basmati* genotypes, DSR had advantage over PTR. Grain yield under DSR was lower than PTR in coarse grain genotypes.

Based on the findings of present investigation, it may be suggested to the stakeholders to grow *basmati* rice genotypes under DSR. Since yield reductions in coarse grain genotypes under DSR are substantial, further research may be required to evaluate the suitability of these genotypes at multiple locations.

Refrence:

Bohra, S.S., Verma, K.R., Singh, R.P., Singh, J.P. and Singh, Y. 2006. Crop establishment options in rice-wheat system under irrigated conditions of Varanasi. Extended summaries, Golden Jubilee National Symposium on "Conservation Agriculture and Environment", Oct. 26-28, 2006. Indian Society of Agronomy, BHU, Varanasi, India, Pp: 48-49.

Budhar, M.N. and Tamilselvan, N. 2001. Evaluation of stand establishment techniques in low land rice. *International Rice Research Notes,* **26**: 72-73.

Erguiza, A., Duff, B. and Kahn, C. 1990. Choice of rice crop establishment techniques : Transplanting Vs wet seeding. IRRI Research paper Series No. 139, IRRI, Los Banos, Philippines.

Gupta, R.K., Jat, M.L., Singh, Samar, Singh,V.P. and Sharma, R.K. 2006c. Resource conservation technologies. *Indian Farming,* **56**(7): 42-45.

Ho, N.K. and Romli, Z. 2002. Impact of direct seeding on rice cultivation: lessons from the Muda area of Malaysia. *In* Proceedings of the International Workshop on Direct Seeding in Asian Rice Systems: Strategic Research Issues and Opportunities, 25-28 January 2000, Bangkok, Thailand, pp: 87-98.

Jat, M.L., Ganthala, M., Sharma, S.K., Ladha, J.K., Gupta, R.K., Saharawat, Y.S. and Pathak, H. 2006. Productivity and profitability of rice-wheat system with double no-tillage practices. Abstracts, International Rice Congress, held at New Delhi, India, Oct. 9-13, 2006. Pp: 88.

Jha, A.K., Vishwakarma, S.K. and Sharma, R.S. 2006. Effect of tillage and sowing management on productivity and economics of rice-wheat cropping system. Extended summaries, Golden Jubilee National Symposium on "Conservation Agriculture and Environment", Oct. 26-28, 2006. Indian Society of Agronomy, BHU, Varanasi, India. Pp: 46-47.

Lee, M.H., Kim, J.K., Kim, S.S. and Park, S.T. 2002. Status of dry-seeding technologies for rice in Korea. *In:* Proceedings of the International Workshop on Direct Seeding in Asian Rice Systems: Strategic Research Issues and Opportunities, 25-28 January 2000, Bangkok, Thailand. pp: 161-176.

Malik, R.K. and Yadav, Ashok. 2006. Alternate crop establishment techniques to avert puddle transplanting in rice – Problem and prospective. Abstract, International Rice Congress, held at New Delhi, India, Oct. 9-13, 2006. Pp. 489-490.

Mazid, M.A, Bhuiyan, S.I., Mannam, M.A. and Wade, L.J. 2002. Dry-seeded rice for enhancing productivity of rainfed drought-prone lands: Lessons from Bangladesh and the Phillippines. *In:* Pandey *et al.* (eds) Direct Seeding: Research and Strategies and Opportunities. Proceeding of the International Workshop on Direct Seeding in Asian Rice System: Strategic Research Issues and Opportunities, 25-28 Jan., 2000, Bangkok, Thailand. IRRI. Pp: 185-200.

Pandey, S., Velasco, L.E. and Suphanchaimat, N. 2002. Economics of direct-seeding in North-East Thailand. *In:* Pandey *et al.* (eds) Direct Seeding : Research and Strategies and Opportunities. Proceeding of the International Workshop on Direct Seeding in Asian Rice System: Strategic Research Issues and Opportunities, 25-28 Jan., 2000, Bangkok, Thailand. IRRI. Pp: 139-160.

Singh, Samar, Jat, M.L., Sharma, R.K. and Gupta, R.K. 2006b. Resource conservation technologies in rice (*Oryza sativa*) production. Extended summaries, Golden Jubilee National Symposium on "Conservation Agriculture and Environment", Oct. 26-28, 2006. Indian Society of Agronomy, BHU, Varanasi, India. Pp: 51-52.

Tripathi, J., Bhatta, M.R., Justice, S. and Shakya, N.K. 2004. Direct seeding : An emerging resource conserving technology for irce cultovation in the rice-wheat system. *In:* Proc. 24th national summer crops research workshop. July 8-10, 2004, Lalitput, Nepal. Pp. 273-281.

Won, J.G., Hirahara, Y., Yoshida, T. and Imabayashi, S. 1998. Selection of rice lines using SPGP seedling method for direct seeding. *Plant Prod. Sci.,* **1:** 280–285.

Wong, H.S. and Morooka, Y. 1996. Economy of direct-seeding rice farming. *In:* Recent advances in Malaysian rice production Malaysia : Muda Agricultural Development Authority and Japan : Japan International Research Center for Agricultural Sciences. Pp. 275-287.

Yadav, Dharam Bir, Yadav, Ashok, Gill, G, Kamboj, B.R., Dahiya, S.S. 2011. Direct Seeded Rice In Haryana, and Options for Pre-Emergence Herbicides. *Environment & Ecology*, **29(4)**: 1745-1751.

Hans,R., .2015. Evaluation of rice genotypes under direct seeding and puddled transplanting. Chaudhary Charan Singh Haryana Agricultural University,Hisar,India.