Original Research Article

Economics of Super seeder technique of Wheat Cultivation in Haryana

ABSTRACT

A survey was carried out in Karnal and Kaithal districts of Haryana with different sowing techniques (conventional technique and Super Seeder) of wheat (Triticum aestivum L.) during 2021-22 to detect the most applicable method of wheat sowing after rice crop in Haryana state. A sample of 100 farmers growing paddy and using various methods of paddy straw management, viz. conventional technique and super seeder, was taken for the study. Super seeder was revealed to be the most economical approach for handling paddy straw without burning it before sowing wheat crops. The conventional technique (48.72 q/ha) sowing method obtained a lower grain yield than the super seeder (50.74 q/ha) in Haryana. However, the ratio of benefit-cost was higher by Super Seeder (2.91:1) as compared to the conventional technique (2.64:1). The better net return obtained from super Seeder Rs. 18724.44/ha as compared to the conventional technique (7688.95 /ha). The grain yield by the super Seeder method of sowing was higher, and it successfully produced a better net return and benefits of cost ratio. Super Seeder technology provided timely sowing operation of wheat and scope against paddy residue burning.

KEYWORDS: Economics, Wheat, Super seeder, conventional technique, residue management

INTRODUCTION

India is the second leading producer of wheat cultivation, world average annual production of 109.52 Mt (million tonnes) in 2020-21 (Anonymous, 2022). It accounts for around 11.79% of global wheat output. Rice has a nearly 43.8 Mha area in India, with a total production of 177.6 MT and productivity of 4,057 kg ha-1. In contrast, wheat has a 29.3 Mha area, 103.6 MT productions, and a productivity of 3,533 kg ha-1. (FAOSTAT, 2021). Haryana is the country's fourth most important wheat-cultivating state, behind Uttar Pradesh, Madhya Pradesh, and Punjab, producing 12.36 Mt of wheat with a yield of 48.36 quintals per hectare. (Anonymous, 2022). Haryana accounts for 11.28 percent of total wheat production in India. Numerous obstacles associated with plough-based conventional production practices in the Rice-Wheat system, such as declining feature productivity, shrinking farm profits due to rising energy and labour costs, rising irrigation water calamity, and current climate change challenges, are major threats to food security. (Jat et al., 2009). Surface management of crop residues as mulch has a variety of impacts. These save irrigation water by retaining soil, using a prudent thermal regime, controlling weeds, and improving soil health. Saving irrigation water using straw mulch can save up to 70-300 mm in summer crops for equivalent yield. (Jalota et al, 2007). Crop straw mulching also reduces water evaporation. (Jalota & Arora, 2002). Planting wheat with a happy seeder in the presence of rice residue saves pre-sowing irrigation and reduces post-sowing soil

water evaporation losses by 45 mm. (Sidhu et al., 2009). Crop residue retention also contributes significantly to an increase in the sustainability index. (Alvarez & Steinbach, 2009; Jat et al, 2011; Jat, 2013). However, due to the complexity of the sowing operation in comparison to the conventional technique, conserving technologies in wheat crops are only being implemented in Haryana to a limited extent. Considering these considerations, a study was conducted to assess the feasibility of directly drilling wheat in the presence of heavy loads of paddy residue. Straw management systems on combine harvesters, zero till drills, PAU Happy Seeder, Super Seeder, rotavator tillage, rice straw chopper, cutter-cum-shredder, and other technologies are advised for in-situ management of loose paddy residue. (Singh et al, 2020; Gupta et al, 2021). In the late 1970s and early 1980s, Haryana and Punjab switched from conventional crops (pulses, pearl millet, maize, and oilseeds) to a rice-wheat farming rotation. The farming patterns were altered to ensure that the country produced adequate food; thus, there was no concern about resource sustainability. Haryana and Punjab presently have a highly active rice-wheat region in the IGP, accounting for around 69% of total food production (nearly 84% wheat and 54% rice). Despite its importance, there have been issues over residue production and crop management in rice and wheat crops. Although paddy straw burning is a problem in several states, the most major instances are in Punjab and Haryana. Burning is the most frequent strategy for handling rice crop wastes because of its simplicity, low cost, increasing mechanical harvesting, the short window between rice harvest and wheat sowing, and lack of practical uses for residues. Around 50 Mt of rice, straw is burned annually, roughly half of which occurs in northwestern India between October/November (Kaur et al., 2022). Although Happy seeder is quite economical, wheat crops sown using this method face the attack of pink stem borer and rodents (Singh & Walia, 2022), and super seeder is an advanced generation of happy seeders. As a result, it is essential to investigate the economics of various wheat-sowing strategies for wheat establishment in farmer's associations for large-scale adoption in Haryana. Keeping this in mind, it is necessary to assess the cost of residue management for various sowing techniques and the constraints that farmers face when using techniques. The study aimed to determine the cost and return of wheat cultivation by adopting super seed technology.

METHODOLOGY

The research was conducted in the Karnal and Kaithal districts of Haryana. The climate of the Karnal and Kaithal districts is semi-arid, with an annual average rainfall of 675 and 623 mm. respectively (Anonymous, 2021). The districts of Karnal and Kaithal in Haryana were selected purposively. Five blocks were chosen at random from each district, namely Karnal, Gharaunda, Nissing, Indri, Nilokheri, and Pundri, Kaithal, Kalayat, Guhla, Siwan blocks from Karnal and Kaithal districts, respectively. From each selected block, one village was selected randomly.

The districts and villages were chosen using purposeful and multistage random sampling. Further, fifty respondents were interviewed for each technique, namely the conventional technique (CT) and super seeder technique (SST). Thus a total of 100 sample farmers were interviewed for the study.

RESULTS AND DISCUSSIONS

Profitability from wheat cultivation in the Karnal district of Haryana is presented in Table 2. Cost of cultivation in conventional technique (CT) and super seeder technique (SST): The cost of wheat cultivation under the CT and SST of wheat in the Karnal district of Haryana is presented in Table 1. The total cost of cultivation in the CT of wheat (Rs.109937.83/ha) was estimated to be higher than the SST, i.e. (Rs.102954.56/ha). The share of the variable cost of 37.64 percent (Rs. 41378.17/ha) and fixed costs of 62.36 percent (Rs. 68559.66/ha) in the total cost of the CT of wheat was observed. Similarly, in the SST for wheat, the shares of variable and fixed costs were determined to be 34.17 percent (Rs. 35182.69/ha) and 65.83 percent (Rs. 67771.87/ha), respectively. Similar results were obtained by Grover et al. (2011) in their study on comparative analysis of traditional /conventional planting systems with zero tillage farms in Haryana. Gross returns (Rs. 121036.40/ha), as well as net returns (Rs.18081.84/ha), were estimated to be higher in SST as compared to CT (Rs.107516.01/ha)and (Rs.6570.89/ha), respectively. Regarding the benefit-cost ratio, SST was observed to be profitable (1.18) over CT (1.06) in the study area. The findings of the studies by (Sidhu et al., 2011; Grover et al., 2011; Raju et al., 2012; Yogi et al., 2015; NAAS, 2017; Lohan et al., 2018; Singh et al., 2021 and Kirandeep et al., 2020) were closely correlated with these results.

The cost of wheat cultivation under CT and SST in wheat in the Kaithal district of Haryana is presented in Table 3. The total cost of cultivation in CT of wheat (Rs.107041.03/ha) was estimated to be higher than SST, i.e. (Rs. 100251.12). The share of the variable cost of 38.36 percent (Rs. 41061.59/ha) and fixed costs of 61.64 percent (Rs. 65979.45/ha) in the total cost of CT of wheat was observed. Similarly, in the SST for wheat, the shares of variable and fixed costs were determined to be 34.70 percent (Rs. 34790.84/ha) and 65.30 percent (Rs. 65460.28/ha), respectively. Similar results were obtained by (Grover et al., 2011& Singh et al., 2021) in their study. Profitability from wheat cultivation in the Kaithal district of Haryana is presented in Table 4. Gross returns (Rs. 119620.70/ha), as well as net returns (Rs. 19369.58/ha), were estimated to be higher in SST as compared to CT (Rs. 115388.20) and (Rs. 8347.17/ha), respectively. Regarding the benefit-cost ratio, SST was observed to be profitable (1.19) over CT (1.08) in the study area. These results are confirmatory with (Grover et al., 2011& Raju et al., 2012) in their study.

The cost of wheat cultivation under CT and SST in wheat in Haryana is presented in Table 5. The total cost of cultivation in CT of wheat (Rs.108490.45/ha) was estimated to be higher than SST, i.e. (Rs. 101604.11). The share of the variable cost of 37.99 percent (Rs. 41220.80/ha) and fixed costs of 62.01 percent (Rs. 67269.65/ha) in the total cost of CT of wheat was observed.

Similarly, in the SST for wheat, the shares of variable and fixed costs were determined to be 34.44 percent (Rs. 34987.92/ha) and 65.56 percent (Rs. 66616.19/ha), respectively. Similar results were obtained by (Grover et al., 2011) in their study. Profitability from wheat cultivation in Haryana is presented in Table 6. Gross returns (Rs. 120328.55/ha), as well as net returns (Rs. 18724.44/ha), were estimated to be higher in SST as compared to CT (Rs. 116179.40) and (Rs. 7688.95/ha), respectively. Regarding the benefit-cost ratio, SST was observed to be profitable (1.18) over CT (1.07) in the study area. These results are confirmatory with (Grover et al., 2011& Raju et al., 2012) in their study.

Table:1 Cost of wheat cultivation in Karnal district of Haryana: 2021-22 (Rs. /ha)

Sr. No.	Inputs	Conventional technique		Super seeder technology	
		No./Qty	Value (Rs.)	No./Qty	Value (Rs.)
1	Preparatory tillage (No.)	4.50	6945.57 (6.32)	-	-
2	Pre-sowing irrigation (No.)	1.00	650.68 (0.59)	-	-
3	Seed (kg)	107.00	2889.00 (2.63)	112.00	3024 (2.94)
4	Seed Treatment		122.51 (0.11)		126.46 (0.12)
5	Sowing		1783.34 (1.62)		4663.36 (4.53)
6	Ridging		229.71 (0.21)		245.02 (0.24)
7	FYM (QTLs)	26.08	1043.33 (0.95)	-	-
8	Fertilizer Nutrients				
	(a) Nitrogen (Kg)	155.00	2015.00 (1.83)	165.00	2145.00 (2.08)
	(b) Phosphorus (Kg)	54.44	2558.68 (2.33)	54.33	2553.51 (2.48)
	(c) Potash (Kg)	12.00	364.80 (0.33)	9.48	288.19 (0.28)
	(d) Sulphur (kg)	6.50	585.00 (0.53)	5.34	480.60 (0.47)
	Total Fertilizer investment		5523.48 (5.02)		5467.30 (5.31)
9	Fertilizer application cost		680.31 (0.62)		690.12 (0.67)
10	Irrigation (No.)	4.04	2628.75 (2.39)	4.07	2648.27 (2.57)
11	Hoeing/ Weeding				
	(a) Chemical cost		1317.99 (1.20)		1045.11 (1.02)
12	Weedicides application cost		449.54 (0.41)		399.65 (0.39)
13	Pesticide cost		701.48 (0.64)		660.92 (0.64)
14	Pesticides application cost		264.29 (0.24)		245.51 (0.24)
15	Harvesting		4574.44 (4.16)		4584.32 (4.45)
16	Wheat straw making		4352.14 (3.96)		4421.30 (4.29)
17	Miscellaneous		298.87 (0.27)		304.30 (0.30)
	Total 1 to 17		39978.91 (36.37)		33992.94 (33.02)

18	Interest on working capital @ 3.5 percent	1399.26 (1.27)	1189.75 (1.16)
19	Variable cost (A)	41378.17 (37.64)	35182.69 (34.17)
20	Transportation	1264.64 (1.15)	1294.00 (1.26)
21	Management charges @10 percent	4137.82 (3.76)	3518.27 (3.42)
22	Risk factor	1012.00 (0.92)	1012.00 (0.98)
23	The rental value of land	62145.20 (56.53)	61947.60 (60.17)
24	Total Fixed cost (B)	68559.66 (62.36)	67771.87 (65.83)
25	Total cost (A+B)	109937.83 (100.00)	102954.56 (100.00)

The figure in the parenthesis represents the percent of the total cost

Table:2 Returns from wheat cultivation in Karnal district of Haryana: 2021-22. (Rs. /ha)

Sr.No.	Outputs	Conventional technique		Super seeder technology	
		No./Qty	Value (Rs.)	No./Qty	Value (Rs.)
1	Production (qtls.)				
	(a) Main	49.03	99040.60	51.07	103161.40
	(b) By product		17930.00		17875.00
2	Gross returns		116970.60		121036.40
3	Returns over variable cost		75592.43		85853.71
4	Net returns		7032.77		18081.84
5	B: C Ratio		1.06		1.18

Table: 3 Cost of wheat cultivation in Kaithal district of Haryana: 2021-22. (Rs. /ha)

Sr.No.	Inputs	Conventional technique		Super seeder technology	
		No./Qty	Value (Rs.)	No./Qty	Value (Rs.)
1	Preparatory tillage (No.)	4.80	6700.00 (6.26)	-	-
2	Pre-sowing irrigation (No.)	1.00	740.00 (0.69)	-	-
3	Seed (kg)	106.00	2862.00 (2.67)	110.00	2970.0 (2.96)
4	Seed Treatment		107.69 (0.10)		115.60 (0.12)
5	Sowing		1721.59 (1.61)		4297.80 (4.29)
6	Ridging		232.18 (0.22)		217.36 (0.22)
7	FYM (qtls)	28.00	1102.61 (1.03)	-	-
8	Fertilizer Nutrients				
	(a) Nitrogen (Kg)	152.00	1976.00 (1.85)	160.00	2080.00 (2.07)
	(b) Phosphorus (Kg)	52.86	2484.42 (2.32)	52.00	2444.00 (2.44)
	(c) Potash (Kg)	11.05	335.92 (0.31)	8.47	257.49 (0.26)

	(d) Sulphur (kg.)	4.64	417.60 (0.39)	4.25	382.50 (0.38)
	Total Fertilizer investment		5213.94 (4.87)		5163.99 (5.15)
9	Fertilizer application cost		680.31 (0.64)		690.12 (0.69)
10	Irrigation (No.)	4.00	2960.00 (2.77)	4.02	2974.80 (2.97)
11	Hoeing/ Weeding				
	(a) Chemical cost		1275.05 (1.19)		1120.94 (1.12)
12	Weedicides application cost		390.26 (0.36)		357.20 (0.36)
13	Pesticide cost		824.98 (0.77)		737.04 (0.74)
14	Pesticides application cost		318.63 (0.30)		310.00 (0.31)
15	Harvesting		3735.10 (3.49)		3754.40 (3.74)
16	Wheat straw making		5276.12 (4.93)		5410.12 (5.40)
17	Miscellaneous		318.63 (0.30)		330.98 (0.33)
	Total 1 to 17		39673.03 (37.06)		33614.34(33.53)
18	Interest on working capital @ 3.5 percent		1388.56 (1.30)		1176.50 (1.17)
19	Variable cost (A)		41061.59 (38.36)		34790.84 (34.70)
20	Transportation		1284.89 (1.20)		1294.00 (1.29)
21	Management charges @10 percent		4106.16 (3.84)		3479.08 (3.47)
22	Risk factor		1012.00 (0.95)		1012.00 (1.01)
23	The rental value of land		59576.40 (55.66)		59675.20 (59.53)
24	Total Fixed cost (B)		65979.45 (61.64)		65460.28 (65.30)
25	Total cost (A+B)		107041.03 (100.00)		100251.12 (100.00)

The figure in the parenthesis represents the percent of the total cost.

Table 4: Returns from wheat cultivation in the Kaithal district of Haryana: 2021-22. (Rs. /ha)

Sr.No	Outputs	Conventional technique		Super seeder technology	
		No./Qty	Value (Rs.)	No./Qty	Value (Rs.)
1	Production (qtls)				
	(a) Main	48.41	97788.20	50.41	101828.20
	(b) By product		17600.00		17792.50
2	Gross returns		115388.20		119620.70
3	Returns over variable cost		74326.61		84829.86
4	Net returns		8347.17		19369.58
5	B: C Ratio		1.08		1.19

Table: 5 Cost of wheat cultivation in Haryana during 2021-22. (Rs. /ha)

Sr.No	Inputs	Conventional technique		Super seeder technology	
		No./Qty	Value (Rs.)	No./Qty	Value (Rs.)
1	Preparatory tillage(No.)	4.65	6822.79 (6.29)	-	-
2	Pre-sowing irrigation (No.)	1.00	695.34 (0.64)	-	-
3	Seed (kg)	106.50	2875.50 (2.65)	111.00	2997.0 (2.95)
4	Seed Treatment		115.10 (0.11)		121.03 (0.12)
5	Sowing		1752.47 (1.62)		4480.58 (4.41)
6	Ridging		230.95 (0.21)		231.19 (0.23)
7	FYM (qtls)	27.04	1072.97 (0.99)	-	-
8	Fertilizer Nutrients				
	(a) Nitrogen (Kg)	153.50	1995.50 (1.84)	162.50	2112.50 (2.08)
	(b) Phosphorus (Kg)	53.65	2521.55 (2.32)	53.17	2498.76 (2.46)
	(c) Potash (Kg)	11.53	350.36 (0.32)	8.98	272.84 (0.27)
	(e) Sulphur (kg.)	5.57	501.30 (0.46)	4.80	431.55 (0.42)
	Total Fertilizer investment		5368.71 (4.95)		5315.65 (5.23)
9	Fertilizer application cost		681.51 (0.63)		690.32 (0.68)
10	Irrigation(No.)	4.02	2795.27 (2.58)	4.05	2812.65 (2.77)
11	Hoeing/ Weeding				
	(a) Chemical cost		1296.52 (1.20)		1083.03 (1.07)
12	Weedicides application cost		419.90 (0.39)		378.43 (0.37)
13	Pesticide cost		763.23 (0.70)		698.98 (0.69)
14	Pesticides application cost		291.46 (0.27)		277.76 (0.27)
15	Harvesting		4154.77 (3.83)		4169.36 (4.10)
16	Wheat straw making		4814.13 (4.44)		4915.71 (4.84)
17	Miscellaneous		308.75 (0.28)		317.64 (0.31)
	Total 1 to 17		39826.8 (36.71)		33804.76 (33.27)
18	Interest on working capital @ 3.5 percent		1393.94 (1.28)		1183.17 (1.16)
19	Variable cost (A)		41220.80 (37.99)		34987.92 (34.44)
20	Transportation		1274.77 (1.18)		1294.00 (1.27)
21	Management charges @10 percent		4122.08 (3.80)		3498.79 (3.44)
22	Risk factor		1012.00 (0.93)		1012.00 (1.00)
23	The rental value of land		60860.80 (56.10)		60811.40 (59.85)
24	Total Fixed cost (B)		67269.65 (62.01)		66616.19 (65.56)
25	Total cost (A+B)		108490.45(100.00)		101604.11(100.00)

The figure in the parenthesis represents the percent of the total cost.

Table: 6 Returns from wheat cultivation in Haryana: 2021-22. (Rs. /ha)

Sr.No	Outputs	Conventional technique		Super seeder technology	
		No./Qty	Value (Rs.)	No./Qty	Value (Rs.)
1	Production (qtls)				
	(a) Main	48.72	98414.40	50.74	102494.80
	(b) By product		17765.00		17833.75
2	Gross returns		116179.40		120328.55
3	Returns over variable cost		74958.60		85340.63
4	Net returns		7688.95		18724.44
5	B: C Ratio		1.07		1.18

CONCLUSION

Super seeder technology provided the facility of wheat sowing in opposition to the burning of paddy residue. This technology saves time because the super seeder is environment-friendly and can be brought into the field without delay after the rice harvest. Among the two sowing methods increasing yield was observed with the super seeder (this may be due to the farmer's practices of happy seeder in previous years, and this year they adopt super seeder increase in yield observed if the farmer continues to use three to four years super seeder)as compared to the conventional technique, whereas, higher B: C ratio(1.18) was obtained by super seeder. Using a super seeder for wheat sowing significantly increased yield, gross returns, net returns, and wheat's B: C ratio. Super seeder with loose straw removal treatment was the most promising in yield, economic feasibility, and environmental friendliness.

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