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Impact of Sowing Technologies of Wheat Cultivation in Ferozepur, Punjab

Anand Gautam* and Gurjant Singh Aulakh

Krishi Vigyan Kendra, Ferozepur-152001, Punjab, India
*Corresponding author email id: anand-coaefpm@pau.edu

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ABSTRACT

A field experimentation was carry out with four different sowing methods on different three locations of district of Ferozepur (Punjab) during 2021-22, to detect the most applicable method of wheat sowing after rice crop in district Ferozepur of Punjab state. The experiment was carried out including Broadcasting + Mulcher, PAU Happy Seeder, Zero Till Drill and Super Seeder. The utmost grain yield was obtained by PAU Happy Seeder (54.45 q/ha) sowing method as compared to Brodcasting + Mulcher (51.85 q/ha), Super Seeder (49.15 q/ha) and Zero Drill (45.95 q/ha). However, the ratio of benefit-cost was higher by PAU Happy Seeder (3.71:1) as compared to as compared to Brodcasting + Mulcher (3.51:1), Zero Drill (2.76:1) and Super Seeder (2.38:1). The better net return obtained from PAU Happy Seeder Rs. 120602.50/ha as compared to Brodcasting + Mulcher (109548.75/ha), Super Seeder (95236.25/ha) and Zero Drill (93055.00/ha). The grain yield by PAU Happy Seeder method of sowing was higher as well as it successful to produce better net return and benefits of cost ratio. PAU Happy Seeder technology provided timely sowing operation of wheat and scope against burning of paddy residue in Punjab.

INTRODUCTION

India is in the second leading producer of wheat cultivation in the worldwide with an average annual production of 109.52 Mt (million tonnes) in current years (Anonymous, 2022). It accounts for in the order of 11.79 per cent of world's wheat production. Punjab is an important wheat cultivating state in the country and produces 18.262 Mt of wheat with yield level of 5.188 tonnes per hectare (Anonymous, 2020). About 19 per cent of the wheat production and 11 per cent of rice production in India comes only from Punjab, which accounts for just 1.5 per cent of the geographical area of the country. Disorganized lifting of ground water in Punjab transversely the past several decades has in hazard of extinction the viable of not only the environment but also of the agronomy of paddy crop. It was reported that the ground water diminishing by 0.6 m per year in Punjab (Hira et al., 2004) and in adding up to the water-hassle, agricultural practices such as wide-ranging and unwarranted use of chemicals and fertilizers have degrade the soil fertility and ground water quality. Numerous obstacle allied with plough based conventional production practices in Rice-Wheat system including deteriorating feature productivity, flinch farm profits due to rising energy and labour costs, rising irrigation water calamity and current challenges of climate change are primary to a foremost hazard to food security (Jat et al., 2009). Surface maintenance of crop residues as mulch is known as assorted outcomes. These retain soil water, judicious thermal regime, curb weeds and improve soil health, and end result irrigation water saving. The advantages of saving irrigation water by straw mulch are as much as 70–300 mm in summer crops for equivalent yield (Jalota et al., 2007). Straw mulching in crops also decrease water evaporation (Jalota & Arora, 2002). Planting of wheat with Happy seeder in the presence of rice residue not only saves pre-sowing irrigation, but also reduces 45 mm post-sowing soil water evaporation losses (Sidhu et al., 2009; Singh et al., 2011a,b).

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Crop residue hold on to also leads to considerable enrichment in sustainability index (Alvarez & Steinbach, 2009; Jat et al., 2011; Jat, 2013). However, conserving technologies in wheat crop are of partial implementation in Punjab, due to complicatedness in sowing operation as compared to conventional method. Observance these position in view a trial was performed to analyse the achievability of direct drilling of wheat in the presence of heavy loads of paddy residue. The recommended technologies for in-situ management of loose paddy residue include straw management system on combine harvesters, zero till drill, PAU Happy Seeder, Super Seeder, rotavator tillage, rice straw chopper and cutter-cum-shredder etc. (Singh et al., 2020; Gupta et al., 2021). Therefore, it is essential to study the economics of different wheat sowing practices for wheat establishment in farmer's association form for large scale adoption in district Ferozepur of Punjab. Objective of the study was to study the impact of incorporation, residue removal and surface maintenance on wheat yield and the economic index was coordinated.

METHODOLOGY

A field experiment was convoyed during *rabi* 2021-22 on different three locations of district, Ferozepur (Punjab), to find out the most appropriate method of wheat sowing after paddy crop in Ferozepur district of Punjab state. The area is characterized by semi arid- arid type of climate with hot and dry early summers from April-June followed by hot and humid period during July - September and cold winters during December-January. The experimentation was carried in randomized complete block design with three locations. In the area combine harvesting of rice and wheat is now a common practice leaving large amount of residues in the fields. Farmers commonly practices burning the paddy residue onto their fields to get rid of it and to make certain timely sowing of the wheat crop as delayed sowing decreases the final grain yields (Singh & Sidhu, 2014). To elucidate the concern, the field experiment was carried out with five sowing methods i.e. T1- Broadcasting + Mulcher, T2- PAU Happy Seeder, T3- Zero Till Drill and T4-Super Seeder. In the followed treatment T1 the practice after combine harvesting the crop residue in field the mulching operation done with help of mulcher after broadcasting of wheat. In T2 after the operation of combine harvesting of paddy crop, the loose straw of the crop were unvaryingly distributed to the whole field and sowing was done with the help of PAU Happy Seeder. In T3 the loose straw of the crop were collected by baler and sowing was done with the help of zero till drill. In T4 after combine harvesting of paddy crop, the loose straw of the crop were uniformly distributed to the whole field and sowing was done with the help of Super Seeder.

The observations on plant height, yield and yield attributes (effective tillers/m^2, grains/ear and ear length) were recorded at maturity. Statistical analysis of the noted data in direction to study the outcome of diverse sowing techniques and wheat on the yield of wheat was prepared with SPSS version 22 Software. Evaluations were based on a $p = .05$ level of significance. Statement on grain and straw yield of each crop was recorded and statistically analysed. The cost of cultivation of each method was worked out and net return of sowing method was calculated on prevailing market prices. The benefit-cost ratio of each sowing method was also calculated.

RESULTS AND DISCUSSIONS

All the sowing technologies unsuccessful to generate any significant outcome on the plant height, ear length and Number of grains per ear of the wheat crop (Table 1). Whereas, the 1000 grain weight was significantly higher with the PAU Happy Seeder (40.59) which was statistically at par with Super Seeder method (38.96) and zero drill method (39.28) but significantly differ with Broadcasting + Mulcher (38.34) method (Table 1).

Along with the different sowing methods highest grain yield was obtained with the PAU Happy Seeder (54.45 q/ha) method which was significantly higher from broadcasting + Mulcher method (51.85 q/ha), super seeder method (49.15 q/ha) and zero drill method (45.95 q/ha) method. The different planting methods maximum straw yield was also obtained with the PAU Happy Seeder (61.85 q/ha) method which was significantly higher from

Table 1. Growth and yield of wheat crop by different planting methods

Sowing Technology	Plant height (cm)	Ear length (cm)	No. of grains/ ear	1000 grain weight	Grain yield (q/ha)	Straw yield (q/ha)
Broadcasting + Mulcher	95.45^a	10.76^b	49.49^b	38.34^a	51.85^c	57.08^c
PAU Happy Seeder	94.45^a	10.82^b	49.79^b	40.59^c	54.45^d	61.85^d
Zero Drill	92.67^a	10.74^b	49.40^b	39.28^b	45.95^a	53.70^a
Super Seeder	95.33^a	10.79^b	49.61^b	38.96^b	49.15^b	56.83^b
Sig. (p=0.05)	0.004	0.987	0.986	0.002	0.000	0.000

Table 2. Economics of wheat crop as influenced by different planting methods

Sowing Technology	Yield (q/ha)	Straw yield (q/ha)	Input Cost (Rs.)	Gross return of grain (Rs)	Gross return of straw (Rs)	Total Gross return (Rs)	Net Return (Rs)	Benefits of cost ratio
Broadcasting + Mulcher	51.85	57.08	31250.00	103700.00	37098.75	140798.75	109548.75	3.51
PAU Happy Seeder	56.45	61.85	32500.00	112900.00	40202.50	153102.50	120602.50	3.71
Zero Drill	45.95	53.70	33750.00	91900.00	34905.00	126805.00	93055.00	2.76
Super Seeder	49.15	56.83	40000.00	98300.00	36936.25	135236.25	95236.25	2.38

broadcasting + Mulcher method (57.08 q/ha), Super Seeder method (56.83 q/ha) and zero drill method (53.70 q/ha). The result confirms the findings of Gautam *et al.* 2020, who reported that the wheat crop shown with Happy Seeder gave comparative higher yield. These results were in conformity with the verdict of Singh and Sidhu, 2014. They reported Happy Seeder will be provided a healthier option for management of crop residue in rice-wheat cropping system. Paddy straw contains significant quantities of nutrients; their continuous application will have positive outcome on fertilizer management in rice-wheat system. In present study, though the grain and straw yield obtained by PAU Happy Seeder was significantly at par with Super Seeder, Broadcasting + mulcher and zero drill but in the long run the yield may increase in case of Happy Seeder due to above mentioned reason.

Along with the intact different sowing technologies the maximum gross return was obtained with the PAU Happy Seeder method (Rs. 153102.50) treatment followed by Broadcasting + mulcher method (Rs. 140798.75) followed by Super Seeder (Rs. 135236.25) and zero drill (Rs. 126805.00). Gross returns between these sowing technologies were high due to superior grain yield obtained. Least gross return was acquired with the zero drill (Rs.126805.00) sowing method. Whereas, the net return was maximum in PAU Happy Seeder sowing technology (Rs.120602.50) followed by broadcasting + mulcher (Rs. 109548.75), Super Seeder (Rs. 95236.25) and zero tillage methods (Rs. 93055.00. However, the benefit cost ratio was also higher with PAU Happy Seeder (3.71:1) as compared to Broadcasting + mulcher (3.51:1), zero drill method (2.76:1) and Super Seeder (2.38:1). Higher B:C ratio with PAU Happy Seeder was also due to its lesser cost of cultivation as compared to Super Seeder method of sowing. Benefit cost ratio of zero tillage method (2.76:1) of sowing was also higher from the Super Seeder method (2.38:1). Due to the lesser cost of cultivation in zero tillage method the B:C ratio was higher as compared to incorporation and conventional method of sowing.

CONCLUSION

PAU Happy Seeder technology provided the facility of wheat sowing in opposition to burning of paddy residue. This technology saved time because the PAU Happy Seeder can be brought into the field without delay after the rice harvest and is environment friendly. Among the different sowing methods maximum grain yield was obtained with the PAU Happy Seeder Broadcasting + Mulcher and Super Seeder as compared to zero tillage, whereas, higher B: C ratio was obtained by PAU Happy Seeder. Thus PAU Happy Seeder can play an essential character in retaining soil and ecological fitness in Punjab.

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