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Innovative Post Harvest Management of Residue through Adoption of Super Seeder

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***Abstract*:** During the time of wheat sowing, farmers generally burn paddy residue in north states in India, which decrease the soil fertility and produce harmful gases for human beings, animals and environment. Super Seeder is the most successful implement for sowing wheat in paddy residue without burning straw. A study was planned in Fatehabad district of Haryana state (India) among 120 adopters and non-adopter farmers to judge the level of adoption of super seeder and socio-economic factors associated with the adoption level along with socio-economic impact of adoption of Super Seeder. There was high level of adoption among farmers regarding Super Seeder (53.33 per cent) followed by medium and low level of adoption. Factors significantly associated with adoption level were age, education of the respondents, size of land holding, subsidiary occupation, annual income, social participation, mass media exposure and socio-economic status of the adopter farmers. Overwhelming majority of the medium size land holding farmers (85.71%) reported increase in good lesioning with extension officials and increased expenditure on performance of social ceremonies.

***Keywords*:** Super seeder, Stubble burning, Environment pollution, Wheat, Paddy, Socio economic impact

Rice and wheat are the two main crops grown in North West India, with a cropping intensity of roughly 200 percent. In 15-20 days following paddy harvest, an enormous quantity of straw needs to be managed in order to grow the following wheat crop on the same land. Farmers opt to burn crop remains because they interfere with the processes necessary to grow following wheat crop. About one ton of paddy straw includes 400 kg of carbon, 50-70% of the micronutrients that rice may absorb 1.2 kg of S, 2.3 kg of P2O5, and 5.5 kg of nitrogen (Patel et al 2022). While burning the straw, these micronutrients were lost, which not only results in financial loss but also deteriorates the health of the soil. In the northwest Indian states of Punjab, Haryana, Uttarakhand, and western Uttar Pradesh, rice-wheat cropping system (RWCS) takes up about 4.1 Mha of land and 34 Mt of rice residue produced in these states. (Singh et al 2020).

In Haryana, 80% of the state's i.e. 4.42 million hectares of total land area is used for agriculture, with irrigated land making up 84% of the total area under cultivation. The state produces 13.1 million tonnes of food grains, with a cultivation intensity of 181%. Paddy-wheat crop rotation is one of the most popular in the state. (Rakshit et al 2021). Under this arrangement, farmers benefit more, but they also deplete natural resources like groundwater, soil fertility, soil fauna and flora. In addition, they harmed agro-ecosystem, increased insect pest and disease resistance, decreased soil organic matter, and did other things to the agro-ecosystem. It has been estimated that this crop rotation will result in around 40 million tonnes of crop waste. (Kathpalia et al 2022) Biomass burning of agricultural field residue (stalks and stubble) during wheat and rice harvesting periods in the Indo-Gangetic plains is an important source of atmospheric pollution in this region (Venkataraman et al 2006). The paddy residue burning by farmers lack of sufficient time to sow next crop because require one and half months to decompose and ranked first, followed by paddy straw management delays wheat sowing, paddy residue burning is cheap option , paddy residue (except for Basmati variety) are harder to chew by animals . Farmers are not satisfied with adoption of machines and use of combine harvester machine leaves large straw after harvesting *etc.* (Rohilla et al 2022). To reduce losses from crop residue burning, many straw management techniques have been developed. The special machine called Super Seeder is used to plant seeds in standing stubble crops. The Super Seeder is a single-pass solution that meets the demands of modern farming and prevents crop residue burning. This tractor-operated tool performs three tasks at once: it prepares the land for the subsequent crop by ploughing and simultaneously incorporates crop residue from the previous crop and sows seeds for the subsequent crop. In a single process, all of these tasks are completed along with straw management. The Super Seeder has a zero till drill and rotavator for

handling the paddy straw and wheat sowing, respectively. The rotavator which cut the standing stubbles, loose straw and it will incorporate into the soil. Seed bed preparation also done by passage of rotavator, placement of the seeds takes place in the soil at a time. Super Seeder is an eco-friendly and it also conserves the soil moisture content (Arigela 2023). So keeping in mind the operational benefits of Super Seeder a study was planned to know the adoption of the farmers regarding Super Seeder along with factors associated with adoption level and to find out the socio economic impact of adoption on the farmers' families.

MATERIAL AND METHODS

The study was conducted in Fatehabad, one of the district of Haryana State of India located on the latitude of 29.511778 and the longitude of 75.455215. The study was carried out among 120 adopter and non- adopter farmers of Super Seeder farm technology. The study was carried out in the rural areas of 4 blocks of the district namely Bhuna, Bhattu Kalan, Ratia, and Fatehabad where maximum number of farmers had adopted Super Seeder farm technology. The total of 60 Super Seeder adopter farmers and 60 non-adopter farmers were selected. Interview schedule was prepared to collect the desired information as per objectives of the study. Data were collected with survey method with the help of well-structured interview schedule. Statistical techniques like frequency, chi square, weighted mean scores and rank order were applied as per the objectives of the study. Level of adoption of Super Seeder of the farmers was measured by developing an index and scores of each farmer was calculated by taking into account 4 parameters like, I- Land holding (up to 1 ha–score 1,1-2 ha - score 2,2-4 ha score 3 and 4- 10 ha score 4), II- income (Rs.200000 - 300000- score 1,Rs.300000 - 4,00,000- score 2 and above Rs. 4,00,000- score 3), III- years of adoption (up to 2 years score 1and more than 2 years score 2), IV- area under technology (up to 2 ha score 1,2-4 ha score 2 and 4 - 10 ha as score 3 were given. The total index score of each farmer was computed and categorized as low level adoption, medium level adoption and high level of adoption.

RESULTS AND DISCUSSION

Adoption level of the farmers: There was high level of adoption among farmers regarding Super Seeder which constitute of 53.33 per cent followed by medium and low level of adoption i.e. 26.67 per cent and 20.00 per cent respectively

Association between socio-economic variables and adoption level of super seeder: Age was significantly associated with adoption rate. More than half of the middle aged farmers (53.33%) have high adoption level whereas farmers above 50 years of age had low level of adoption (25%). Level of education have a significant association with level of adoption as farmers educated till senior secondary and above (46.67%) had high level of adoption whereas farmers educated up to middle school had a low level adoption rate (35%). Subsidiary occupation of family also has an impact on adoption level. Adoption level was high among 70% of the farmers who had an income source from business and services whereas, 38.46 % of farmers who did not have any subsidiary occupation had low level of adoption. Size of land holdings also have a signification association and level of adoption higher among farmers (62.50%) having annual income above 3,00,000 whereas, farmers (60%) with income between Rs.75,000 - 1,50,000 had a low level of adoption rate. There was significant association of social participation, mass media exposure and socio-economic status with adoption level. Farmers with nil social participation had adoption level (57.69) while adoption level was high among farmers (64%) with medium level of mass media exposure. Farmers with medium socio economic status had high level of adoption (62.50%) The farmers belonging from low socioeconomic status (53.84%) had low level of adoption. Kathpalia *et al*. (2022) also reported that age was significantly associated with knowledge level. In young age group high level of adoption (54.16%). Education and land holding were also d significantly associated with knowledge level of Super Seeder adopter farmers.

Cumulative socio economic impact of adoption of Super Seeder: Overwhelming majority of the medium size land holding farmer (85.71%) reported increase in good liasioning with extension officials and increased expenditure on performance of social ceremonies like marriage, death ceremonies and other social occasions (Table 2). More than fifty per cent of the small (55%) and marginal farmers (54.54%) adopter farmers reported increase in investment on quality education of children. Increase in decision making powers and in savings was reported by 71.71% of the medium land holders. Increase in agricultural land on lease and increase in mass media exposure was opined by medium land holders (57.14% each) while increase in social status was reported by medium (85.71%), semi medium (72.72%), small (55.00%) and marginal (36.36%) adopter farmers. Malik et al (2004) observed that earlier sowing improves the ability of wheat to compete against its major weed Phalaris, which was responsible for lower wheat yield and herbicide resistance. Increase in wheat as well as rice yield in next season due to residual effect of straw was also reported by the farmers.

Table 1. Association between socio-economic variables and adoption level of farmers (n=60)

Socio-economic variables	Adoption level			
Age	Low	Medium	High	Total
up to 35 yrs.	7 (38.89)	2 (11.11)	9 (50.00)	18 (30.00)
35˚ to 50 yrs.	2 (6.67)	12 (40.00)	16 (53.33)	30 (50.00)
above 50 yrs.	3 (25.00)	2 (16.67)	7 (58.33)	12 (20.00)
Total	12 (20.00)	16 (26.67)	32 (58.33)	60(100)
x^2 *Cal*=10.20*				
Caste				
General caste	8 (16.67)	15 (31.25)	25 (52.08)	48 (80.00)
Backward class	4 (33.33)	1 (8.33)	7 (58.34)	12 (20.00)
x^2 *Cal*=3.29				
Level of Education				
No formal schooling	1 (10.00)	1 (10.00)	8 (80.00)	10 (16.67)
Up to Middle	7 (35.00)	3 (15.00)	10 (50.00)	20 (33.33)
Senior Secondary and above senior secondary level	4 (13.33)	12 (40.00)	14 (46.67)	30 (50.00)
x^2 *Cal*=9.10*				
Subsidiary occupation of the family				
Nil	10 (38.46)	8 (30.77)	8 (30.77)	26 (43.34)
Business and services	1 (5.00)	5 (25.00)	14 (70.00)	20 (33.33)
Custom hiring	1 (7.14)	3(21.43)	10 (71.43)	14 (23.33)
x^2 *Cal*=12.55*				
Size of land holdings				
Marginal (up to 1 ha)	6 (54.54)	4 (36.36)	1 (9.10)	11 (18.33)
Small (1-2 ha)	2(10.00)	4 (20.00)	14 (70.00)	20 (33.33)
Semi-medium (2-4 ha)	3 (13.64)	6 (27.27)	13 (59.09)	22 (36.67)
Medium (4-10 ha)	1 (14.29)	2 (28.57)	4 (57.14)	7 (11.67)
x^2 *Cal*=14.09*				
Type of family				
Nuclear	6 (18.75)	12 (37.50)	14 (43.75)	32 (53.33)
Joint	6 (21.43)	4 (14.28)	18 (64.29)	28 (46.67)
x^2 *Cal*=4.25				
Size of family				
Up to 4 members	8 (32.00)	6 (24.00))	11 (44.00)	25 (41.67)
5-8 members	3 (11.54)	8 (30.76)	15 (57.70)	26 (43.33)
Above 8 members	1 (11.11)	2 (22.22)	6 (66.67)	9 (15.00)
x^2 *Cal*=4.18				
Annual Income(Rs.)				
Rs.2,00000 - 3,00000	6 (60.00)	2 (20.00)	2 (20.00)	10 (16.67)
Rs.3,00000 - 4,00000	4 (15.39)	7 (26.92)	15 (57.69)	26 (43.33)
Above Rs. 4,00,000	2 (8.33)	7 (29.17)	15 (62.50)	24 (40.00)
x^2 *Cal*=12.68*				
Social organization participation				
No organization participation	2 (11.11)	7 (38.89)	9 (50.00)	18 (30.00)
One organization participation	3 (11.54)	8 (30.77)	15 (57.69)	26 (43.33)
More than one organization participation	7 (43.75)	1 (6.25)	8 (50.00)	16 (26.67)
x^2 *Cal*=9.99*				
Mass media exposure				
Low (4-6)	6 (50.00)	4 (33.33)	2 (16.67)	12 (20.00)
Medium (07-09)	4 (16.00)	5 (20.00)	16 (64.00)	25 (41.67)
High (10-12)	2 (8.70)	7 (30.43)	14 (60.87)	23 (38.33)
x^2 *Cal*=11.61*				
Socio-economic Status				
Low (5-8)	7 (53.84)	3 (23.08)	3 (23.08)	13(21.67)
Medium (09-12)	3 (12.50)	6 (25.00)	15 (62.50)	24 (40.00)
High (13-16)	2 (8.69)	7 (30.44)	14 (60.87)	23(38.33)
x^2 *Cal*=12.65*				

*Significant at 5% level of significance , *Figures in parentheses indicate percentage

Table 2. Cumulative socio-economic impact of super seeder on farming families (n = 60)

Socio-economic impact	Marginal farmers 11 (18.33)	Small farmers 20 (33.33)	Semi-medium farmers 22 (36.67)	Medium farmers 7 (11.67)	Total n=60
Good liasioning with extension officials	4 (36.36)	13 (65.00)	18 (81.81)	6 (85.71)	41 (68.33)
Increased expenditure on performance of social ceremonies like marriage, death	8 (13.33)	12 (60.00)	12 (54.54)	3 (85.71)	35 (58.33)
Increase in Investment on quality education of children	6 (54.54)	11 (55.00)	10 (45.45)	2 (28.57)	19 (31.66)
Increase in decision making powers	5 (45.45)	13 (65.00)	13 (59.09)	5 (71.42)	36 (60.00)
Increase in income	7 (63.63)	7 (35.00)	14 (63.63)	5 (71.42)	33 (55.00)
Increase in Social participation	3 (27.27)	4 (20.00)	13 (59.09)	2 (28.57)	22 (36.66)
Increase in household assets	5 (45.45)	2 (10.00)	8 (36.36)	1 (14.28)	16 (26.66)
Increase in quality of medical treatment	3 (27.27)	8 (40.00)	7 (31.81)	-	18 (30.00)
Increase in agricultural land on lease	-	4 (20.00)	11 (50.00)	4 (57.14)	19 (31.66)
Increase in mass media exposure	6 (54.54)	13 (65.00)	10 (45.45)	4 (57.14)	32 (53.33)
Increase in social status	4 (36.36)	11 (55.00)	16 (72.72)	6 (85.71)	37 (61.66)

Responses were multiple, Figures in Parentheses indicate percentage

CONCLUSION

In order to deploy inputs without affecting the environment, it is essential to make the agricultural sector sustainable. In addition to providing the farmers with numerous benefits, the Super Seeder resolves a significant issue. As a result, managing the stubble becomes easy and convenient for the farmer as there is no longer of need to burn crop residue. Super Seeder is the most productive tool for placing wheat in paddy fields without burning straw in order to maintain soil nutrition value also.

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