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Problems and Constraints in Adoption of Zero Tillage Wheat;Farmers Perceptions

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Abstract

Zero tillage is an important technique of growing wheat which helps to reduce cost per unit. It has the potential to solve the problem of stubble burning after rice cultivation, a major threat to the environment of northern India. Besides the economic and environmental benefits of no tillage wheat, adoption rate of this technique is very slow. Present study is undertaken to assess the problems and constraints of no tillage wheat in Punjab and the farmers perception regarding them. In order to achieve this objective, 40 farmers belonging to different blocks of Amritsar district provided information with the help of structured questionnaire. Study concluded that cooperative societies, friends, relatives played an important role in the diffusion of this technology. 87.5 percent of the farmers reported that this technique has favourable impact on reducing the air water and soil pollution. 75 percent of the farmers reported its contribution in yield enhancement and maintaining the soil quality. Major problems and constraints in the adoption of this resource conserving technology is the non availability of zero till drill, management of standing stubble and non awareness about this technology. All the farmers agreed that it is a time saving, fuel saving, labour saving technology which reduces the soil compaction and helps in more microbial population in soil.

Key words; wheat, Zero tillage, farmers perceptions,

1. Introduction

Tillage is one of the major crop production operations. It is an important contributor to the total cost of production and time required for field preparations. Excessive tillage is energy, time and cost consuming and is considered harmful to the soil health. During the past few years, scientists have suggested that physical properties favorable for plant growth are destroyed by too much tillage. The cost of hydrocarbon fuels is rising every day and is a well known fact that they are bound to be exhausted sooner or later. Keeping these factors in views scientists world over evolve new low cost/resource conservation technologies like zero tillage, reduced tillage, and strip tillage etc. .

No tillage or direct drilling are genetic name describing the sowing of seeds into untilled soils. Direct drilling as a means of crop and pasture establishment involves placement of seed into untilled soils. Minimum tillage is defined as reducing field trips by machinery for seed bed preparation to a minimum numbers. Strip tillage is a practice of tilling a narrow strip head of the drill opener, so the seed is sown into tilled soil but the soil between the sown rows remains undisturbed. Research has also indicated that drilling of wheat after paddy harvest gives 24 percent higher yield than when sown under conventional tillage (Aslans and Thomson,1989).The on-farm economic impact of zero tillage wheat in Punjab showed that shifting from conventional tillage to zero tillage wheat production system, the saving of farmers in total input cost were 21.56 percent and return over variable cost improved by about 14.04 percent.(Kaur and Mehra 2018)

2.Burning Rice Stubble;A Major Threat to the Environment of Punjab

Northern India especially Punjab is famous for quality rice production; many farmers grow late-maturing, fine-grained, long duration basmati rice, causing delay in sowing of wheat. Satellite data captured by Punjab Remote Sensing centre showed that there were 40,510 fire incidents in Punjab alone

between September 27 and November 9, 2017 roughly coinciding with kharif harvest season.(economic times.indiatimes.com retrieved on November 08.2018 at 21:12p.m.). Farmers go for this easy option of burning rice stubble in order to clear their field for sowing wheat on time. But these burning incidents led to further delay of sowing operations as entire north India came under the layer of thick smog and no sunshine for at least 20 days. A couple of days later, entire north India including Punjab, Haryana and Delhi found itself under a thick canopy of toxic smog leading to closure of all primary schools and outdoor activities for at least 20 days. The air quality in these areas deteriorated to an alarming level, besides creating various health hazards. It also caused a lot of ill will and criticism at the international level for the country as a whole when a foreign cricket team refused to play match in capital city Delhi. The delay of every successive day in planting beyond third week of November decreases the grain yield progressively (Ali *et al*., 2010; Irfaq *et al*., 2005; Sharma, 1992).

No tillage offers a way of optimizing productivity and ecosystem services offering a wide range of economic, environmental and social benefits to the producers and to the society. At the same time, no tillage farming is enabling agriculture to respond to some of global challenges associated with climate change, land and environmental degradation and increasing cost of food, energy and production inputs (Rolf *et.al*, 2010).

Aryal *et al.*, (2015) In assessing the mitigation potential of zero tillage, the differences in input use and crop management, especially those contributing to GHGs emissions, between zero tillage wheat and conventional tillage wheat. their estimate shows that shifting from conventional tillage to zero tillage based wheat production reduces GHG emission by 1.5 Mg CO_2 eq ha^{-1} $season^{-1}$. Overall, zero tillage has both climate change mitigation and economic benefits, implying the win-win outcome of better agricultural practices.

3. Data base and Methodology

In order to achieve the objective of the study, a field survey was conducted. An elaborated questionnaire was used for survey. Since this technology is mainly being adopted for the cultivation of wheat, the impact assessment period was restricted to this crop only. The survey was conducted in Amritsar district of Punjab. In the first step four blocks were selected i.e.; Chogawan, Harsha chhina, Ajnala and Jandiala. At the second stage two villages from each of four blocks were selected. A List of the farmers adopting this technology for at least two years in each village was prepared. From these lists, using probability proportion size random sampling technique, 40 adopters were taken for the study. In order to undertake impact assessment task of this technology, almost an equal number of non-adopters from the same vicinity were also taken as a control group in the analysis. Therefore, a total sample of 80 farmers (40 adopters plus 40 non adopters) covering eight villages, four blocks, and one district of Punjab was finally chosen for the ultimate analysis.

4. Results and Discussion

4.1 Diffusion Pattern of the Technology;

The respondents were imparted the knowledge of the technology by various agencies like state government, state agricultural department, co-operative societies, fellow farmers, etc. The Table 1 showed that the major source of technology diffusion was the farmer to farmer interaction. About 32.5 percent of the farmer came to know and adopted the technology through learning from each other. The progressive farmers of the area diffused the knowledge about the technology to their areas. The co-operative societies played the important role in the diffusion of the technology; their share was about 35 percent. The source of Knowledge of 25 percent of the farmers regarding this technology was their friends/relatives, and the remaining 7.5 percent farmers got to know about this technology from the other sources including Government, agriculture department, kisan melas, campaigns etc.

Table- 1. Awareness sources of zero tillage technology among the adopter respondent, Punjab, 2015-16

Sources	Number of Respondents	Percentage
Co-operative society	14	35.00
Friends/Relatives	10	25.00
Farmers to farmer	13	32.50
Other sources	3	7.50
Total	40	100.00

4.2 Qualitative Perceptions of the respondents regarding zero till technology

The qualitative perceptions of the adopters regarding the zero till technology have been presented in table 2 The perusal of data revealed that about 75 percent adopters were affirmative of the yield enhancement and an improvement in by-product availability. 45 percent respondents also confirm the less risk in crop failure. 75 percent express beneficial effect of zero tillage system on soil health. 87.5 percent

respondents from zero tillage express pollution control capacity of this system. 82.5 percent respondent expresses that this system create employment via hiring zero till drill. 70 percent viewed that it is good for small and marginal farmers. 25 percent have the view of water saving. 27.5 percent respondents have the view of less physical damage to soil, i.e. less soil compaction.

Table 2.Qualitative perception of the adopters regarding the impact of zero tillage technology

(Multiple response)

Indicator	Number	Percentage
Yield enhancement	30	75.00
Improvement in by product availability	15	37.50
Minimizes the risk of crop failure	18	45.00
Maintain/enhance soil quality	30	75.00
Neutral or positive effect on pollution of air, water and soil	35	87.50
Generates additional employment opportunities	33	82.50
Benefits poorer/marginal farmers	28	70.00
Less water requirement	10	25.00
Less soil compaction problem	11	27.50

4.3 Constraints and suggestions for rapid adoption of zero tillage technology;

No doubt zero till technology is a resource conservative technology and farmer in Punjab are adopting this technology very fast. To make the adoption of this technology still faster, there is need to identify the constraints inhibiting the adoption of this technology and solution thereof. The various constraints of this technology faced by the adopters have been identified and the same have been presented in the table 3

Table 3. Constraints/Problem faced by sample respondents of zero tillage technology, Punjab, 2015-16

(Multiple response)

Constraints	Adopters	Percentage
Non-availability of zero till drill	13	32.50
Non-Unawareness about the technology	8	20.00
Management of standing stubbles	12	30.00
Depth of seeding	7	17.50
Afraid of low yield	05	12.50

Large percent of the farmers didn't report any constraint or problem worth mentioning, in adoption of technology, and only about 32.5 percent farmers reported that problem of non-availability of the drill. About 20 percent farmers reported that they were not fully aware of the technology, resulting in slow technology adoption process. About 30 percent farmers reported that there was problem of sowing with the zero till drill in the standing stubbles. The standing stubbles lead to the slowing of process and also the breakage of the drill, thus, they burn the stubbles before sowing. Only17.5 percent farmers reported that the depth of sowing was a constraint in their way. The zero till drill sows the seed to a depth of about four inches, which according to them leads to non-emergence of the seed. About 12.5 percent farmers were afraid of the low grain yield. They were of the opinion that the tillage practice was necessary in the process of cultivation their ancestors have been doing it for last so many years.

4.4 Conservational aspect;

The perusal of Table 4 showed that 90-100 percent respondents of zero tillage system reported more water saving, time saving, fuel saving, less pollution, less compaction of soil and addition of organic matter in the soil which may lead to more microbial population in the soil. 88 percent farmers responded that there was less weed problem due to no tillage.

Table 4. Effect of zero tillage on conservations of resources

(Multiple response)

Particular	No. of Respondent	Percentage
Water saving	36	90.00
Time saving	40	100.00
Fuel saving	40	100.00
Labour saving	40	100.00
Less weedicide use	35	88.00
Less pollution	40	100.00
Less compaction of soil	40	100.00
More microbial population in soil	40	100.00

Regarding risks in zero tillage and conventional tillage system Table 5 showed that lodging was more in conventional tillage system. Plant emergence is a problem under conventional system when there is rain after sowing. Under heavy rain, crop failure is more in conventional system. Insect pest and weed problem are also less in zero tillage system. 88percent of no tillage farmers reported that crop lodging was not problem whereas a very high percentage of farmers (75 percent) faced this problem under conventional tillage system. The reason for this may be that no tillage consumes less water as compared to conventional tillage due to which roots of plants stay firm in the soil. Problem of crust formation due to rain is faced under conventional tillage (88percent) whereas this problem is nil in no tillage. The reason for it may be that due to excessive tillage, upper layer of soil becomes soft which get harden due to rain, leading to crust formation. In case of no tillage, soil was already hard and rain did not led to crust formation. Majority of the farmers under no tillage system of

cultivation agreed that problem of weeds was less. It may be due to the reason that stubbles of rice remain in the field which acted as mulch. It helped to control the growth of weeds. In case of conventional tillage problem of weeds remain very high (88 percent). Farmers practicing zero tillage wheat faced lower pest attack (22 percent) as compared to conventional tillage (88percent). This may be because of the fact that zero tillage do not disturb hiding places of insects which lead to natural control by beneficial insects like beetles, spiders, ants etc.

Table 5. Perceptions about Different Kinds of Risk in Zero Tillage and Conventional Tillage Wheat.

Particulars	Zero Tillage No of Respondents (percent)		Conventional Tillage No of Respondents (percent)	
	Yes	No	Yes	No
Crop Lodging	5(12)	35(88)	30(75)	10(25)
Crust Formation if rain	-	40 (100)	35 (88)	5 (12)
Harm to crop under more rain	10 (25)	30 (75)	32 (80)	8 (20)
Insect pest attack	9 (22)	31 (78)	37 (93)	3 (7)
Weed problem	15 (38)	25 (62)	35 (88)	5 (12)

5. Conclusion

Study concluded that according to farmers no tillage system of wheat cultivation enhances the soil quality, minimizes the risk of crop failures and thus helps in yield enhancement. No tillage needs less water, does not require stubble burning and hence helps to maintain the quality of air, soil and conserve water which makes this technology environmentally viable. It is also socially desirable as it generates additional employment opportunities and hence benefits the poor / marginal farmers. Major problems of wheat cultivation under conventional system like crop lodging, crust formation due to rain and the problem of weeds and insects (which increases the cost of production) are also minimized with zero tillage. Following suggestions can be drawn to improve the area under zero tillage wheat.

1. It play vital role in conservation of environment by efficient use of water, crop residue management, soil conservation, reduce environment pollution via reducing fossil fuel burning, increase underground water recharging via increased infiltration rate etc. Zero tillage technology represents a major departure from the conventional way of cultivation. This implies that the whole range of management practice will need to be evolved, evaluated & matched in the context of new system. The guidelines for the different farm operations may be published and provided to the farmers ,for the proper crop management and appropriate input quantity may be mentioned to avoid the over usage of the various inputs like the seeds, urea, and DAP etc.
2. The demonstration or some exhibitions may be arranged to make the people familiar to the technology and clear any doubts and misperception like lower grain yield and the fear of even non-emergence of the seeds from minds.
3. Although significant successful efforts have been made in developing and promoting machinery for seeding wheat in no till system, the successful management of standing stubbles and deep sowing of the seed require future improvement in machinery

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