

Weed Management Strategy of Farmers in Wheat in North India

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ABSTRACT

India has achieved a record wheat production of 93.50 mtn 2015-16 (4th Advance estimate). Weeds account for about one third of total losses caused by the pests of wheat. The study was conducted during 2010-11 and 2011-12 in Haryana and Punjab respectively in different cropping system from two districts of Haryana and four districts of Punjab in the North Western India were selected randomly. From each district, four villages and from each village 10 farmers were randomly selected, making the sample size 240. The respondents were aware of crop rotation strategy to manage weeds and 41.25 per cent of them had adopted it. All the sample farmers applied herbicides to control weeds, some of them did use herbicide twice in the same year. The losses caused by weed can easily be minimized through different management strategies such as adopting different crop rotation, higher seed rate, retention of crop residue on soil surface, adopting zero tillage technology of wheat sowing and by use of chemical for both broad and leaf weed specifically, timely and uniform spray, standard chemical, rotation of herbicide and crop rotation are effective methods for weed control in wheat. Adoption of these strategies of weed control in wheat has to be stepped up to enhance wheat production.

Keywords: Crop rotation, punjab, haryana, weed management, wheat.

INTRODUCTION

Agriculture is the backbone of Indian economy. About 58 per cent population depends on agriculture and living in rural areas in India. The contribution of wheat in food security is significant in India. India has achieved a record wheat production of 93.50 million tons during 2015-16 (4th advance estimate, 2015-16), however; concerted efforts need to be made to meet the food requirement of ever increasing population. There is at least yield gap of 0.54 to 1.43 ton per ha across the wheat growing zones and weed problem is one of the important reasons for this (Yaduraju *et al.*, 2006). The intensified cultivation under rice wheat system results more weed infestation and thereby causing significant regional productivity loss every year (Harrington *et al.* 1992). Not only weeds causes 25 to 30 per cent yield loss in wheat crop but increases cost of cultivation, interfere with agricultural operations, impair quality, acts as alternate hosts for several insect pests, diseases, and nematodes. The yield losses due to weeds can be as higher as about 65 per cent depending on the crop, degree of weed

infestation, weed species and management practices (Yaduraju *et al.*, 2006). Weeds also account for about one third of total losses caused by the pests of wheat (Ladha *et al.* 2000; Timsina and Connor 2001). Weed management in wheat is very tedious practices. Identification of farmer perceptions influencing particular weed and farm management decisions provide an opportunity to more effectively focus on extension strategies.

Though a number of studies on weeds have been conducted but the contribution of many such studies to improve planning of extension has often been disappointing (Llewellyn *et al.* 2005). Herbicides have been widely used by the farmers in wheat. The study aims to identify weed management strategies adopted by the farmers and to suggest the effective approaches.

METHODOLOGY

The study was conducted during 2010-11 and 2011-12 in Haryana and Punjab respectively in different

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cropping system. Hisar and Mohindergarh districts of Haryana and Sangrur, Patiala, Jalandhar and Mansa districts of Punjab in the North Western India were selected randomly. From each district, four villages and from each village 10 farmers were randomly selected, making the sample size 240. The cropping systems studied were cotton-wheat, bajra-Wheat and guar-wheat in Haryana. Rice-wheat, potato-wheat-maize, rice-potato-wheat, and cotton-wheat in Punjab. The sampled farmers were randomly distributed in the above said cropping systems. Conventional analytical tools like frequency, percentage and tabular analysis were done to give meaningful inferences.

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**Table 1: Socio-personal profile of the respondents
Frequency (%)**

Parameters	Haryana (n=80)	Punjab (n=160)	Total
Age (Years)			
Young (upto 25)	03 (03.75)	16 (10.00)	19 (07.92)
Middle (25-50)	53 (66.25)	116 (72.50)	169 (70.42)
Old (>50)	24 (30.0)	28 (17.50)	52 (21.67)
Education			
PG	02 (02.47)	1 (0.63)	3 (01.25)
Graduate	09 (11.11)	12 (07.50)	21 (08.75)
10+2	08 (09.88)	34 (21.25)	42 (17.50)
Matric	23 (28.40)	36 (22.50)	59 (24.58)
Middle	17 (20.99)	25 (15.63)	42 (17.50)
Primary	10 (12.35)	23 (14.38)	33 (13.75))
Illiterate	11 (13.58)	29 (18.13)	40 (16.67)
Experiences in agriculture (Years)			
<10	19 (23.75)	46 (28.75)	65 (27.08)
10-20	24 (30.00)	48 (30.00)	72 (30.00)
20-30	37 (46.25)	41 (25.63)	78 (32.50)
30-40	00 (00.00)	18 (11.25)	18 (7.50)
40-50	00(00.00)	07 (4.38)	07 (2.92)
Average	22.48	20.00	48 (20.00)
Family Type			
Nuclear	41(51.25)	44 (27.50)	85 (35.42)
Joint	39(48.75)	116 (72.50)	155 (54.58)

Land Holding	Haryana (n=80)	Punjab (n=160)	Total (n=240)
Marginal (Upto 2.5)	12 (15)	35 (21.88)	47 (19.58)
Small (2.5to 5.0)	23 (28.75)	39 (24.38)	62 (25.83)
Medium (5.0 to 10.0)	24 (30)	26 (16.28)	50 (20.83)
Large (>10)	21 (26.25)	60 (37.50)	81 (33.75)

Majority (70.42%) of the farmers were of middle age followed by old (21.42%). There were only 7.92 young farmers cultivating their land (table-1). There appears less interest among the young generation in agriculture. Majority of the farmers were literate 86.33%. A little above one-fourth of the farmers were educated up to matric (24.58 %) followed by middle&intermediate (17.50 %), illiterate (16.67%), graduate (8.75%) and post graduate (1.25%).

Most of the farmers (32.50%) had more than 20 years of experience in agriculture. About three fourth had more than 10 years and about one fourth had less than 10 years of experience. Average experience of the respondents was 48 years indicating more old farmers in the agriculture occupation. Majority of respondents had joint family (54.58%) followed by nuclear families (35.42%). There were 33.75 percent large farmers followed by small (25.83%), medium (20.83 %) and marginal (19.58 %) (Table 1).

**Table 2: Management of Wheat Crop
Frequency (%)**

Parameters	Haryana (n=80)	Punjab (n=160)	Total (n=240)
Seed Source			
Self	10 (12.50)	96 (60.00)	106 (44.17)
Private	52 (65.00)	152 (95.00)	204 (85.00)
Government	18 (22.50)	27 (16.88)	45 (18.75)
Others farmers	00 (00.00)	11 (06.88)	11 (04.58)
Seed treatment			
Treated	59 (73.75)	122 (76.25)	181 (75.42)
Not treated	21 (26.25)	38 (23.75)	59 (24.58)
Sowing Method			
Line Sowing	60 (75)	142 (88.75)	202 (84.17)
Broadcasting	20 (25)	18 (11.25)	38 (15.83)
No. of varieties grown			
One	45 (56.25)	65 (39.38)	108 (45.00)
Two	27 (33.75)	52 (30.00)	75 (31.25)
three	08 (10.0)	35 (15.63)	33 (13.75)
More than three	0 0(00.00)	08 (2.50)4	04 (01.67)
Seed rate (kg/acre)			
40 (Recommended)	41 (51.25)	106 (66.25)	147 (61.25)
40 -50	37 (46.25)	46 (28.75)	83 (34.58)
35-40	02 (2.5)	08 (5.00)	10 (04.17)
Irrigation (no.)			
Two	02 (02.50)	07 (4.38)	9 (3.75)
Three	12 (15.00)	22 (13.75)	34 (14.17)
Four	14 (17.50)	28 (17.50)	42 (17.50)
Five	15 (18.75)	56 (35.00)	71 (29.58)
Six	16 (20.00)	42 (26.25)	58 (24.17)
Seven	06 (07.50)	05 (3.13)	11 (04.58)
Eight	11 (13.75)	00 (00.00)	11 (04.58)
Ten	04 (05.00)	0 0(00.00)	04 (01.67)

Figure in parentheses indicates percentage.

Source of seed is also major component for increasing wheat production in the country. Farmers in majority (85%) had purchased seed from private agencies. A significant number of farmers used their own seed (44.17%). Seed policy of the government has influenced the behavior of farmers to use good quality seed. Farmers in majority had purchased the seed from the market or private firm which was treated by using the chemical supplied with the seed bag. One fourth of the farmers (24.58 %) had not treated the seed. It is evident from data (table 2) that majority of the farmers (84.17 %) had used line sowing as a method of crop establishment followed by broadcasting (15.83 %). Majority of the respondents (45.0 %) had sown single variety viz, PBW 343, PBW 502, PBW 550, HD 2851, WH 711 and DBW

17 only. Almost one third (31.25 %) of the farmers had sown two varieties and 13.75 per cent had sown three varieties. Farmers were growing more than one variety to avoid the risk of failure of one variety. The scientists as well as extension officers have always advised the farmers to grow more than one variety to minimize risk particularly due to diseases (Table 2).

The farmers used optimum quantity of seed and there were only 4.17 per cent who used less than 40 kg/acre. Farmers in majority (55.53 %) had applied five to six irrigation through flood method of irrigation. Those farmers who had adopted drip irrigation applied more than six irrigations (Table 2).

Table 3: Sources of information (%) according to education

Education	Magazine		Other farmer		SAO		SAU		Newspaper		Radio		TV		Input dealer	
	Hry	Pb	Hry	Pb	Hry	Pb	Hry	Pb	Hry	Pb	Hry	Pb	Hry	Pb	Hry	Pb
PG	02.50	-	01.25	-	01.25	-	01.25	-	01.25	-	01.25	-	00.00	-	01.25	-
Graduate	01.25	2.50	10.00	8.13	01.25	2.50	06.25	1.88	07.50	5.63	01.25	1.25	06.25	3.13	07.50	2.50
10+2	01.25	1.88	06.25	21.25	02.50	2.50	10.00	3.13	03.75	5.63	00.00	0.63	02.50	3.75	05.00	00
Matric	07.00	0.63	20.00	22.50	03.00	5.00	11.00	2.50	04.00	4.38	09.00	0.63	06.25	3.75	16.25	00
Middle	01.25	00	16.25	15.63	03.75	3.13	08.75	1.25	01.25	3.13	06.25	0.63	03.00	3.13	07.50	0.63
primary	00.00	00	10.00	14.38	00.00	2.50	05.00	2.50	00.00	2.50	01.25	3.75	00.00	2.50	07.50	00
Illiterate	00.00	00	15.00	18.13	00.00	0.63	02.50	3.13	00.00	00	02.50	1.88	01.25	3.13	08.75	00
Total	13.25	5.01	78.75	81.89	11.75	15.63	44.75	11.26	17.75	21.27	21.50	6.89	19.25	16.26	53.75	3.13

Hry= Haryana Pb= Punjab SAO= State Agri. Officer

Majority of the farmers in Haryana (78.75 %) and Punjab (81.89%) had consulted other farmers as source of information for wheat management. Input dealers were least consulted in Punjab (3.13) than Haryana (53.75%). State Agriculture Universities consulted by the farmers of Punjab and Haryana was 11.26 and 44.75 per cent respectively. As most of the farmers were literate so newspaper (38.68) and magazine (18.26 %) were also consulted by the farmers of Punjab and Haryana. Radio was main source of information in Haryana (21.50%) than Punjab (6.39 %). TV was also used by 19.25 and 16.26 per cent in Haryana and Punjab respectively. (Table 3) Singh et al. 2007 reported that fellow farmers, agriculture department and research institutes were the major sources of information for the farmers in Karnal district of Haryana.

DBW17	04.50	19.96
PBW 550	2.63	19.55
RAJ 3765	02.04	17.33
JK Seeds	01.53	23.00
WH 416	01.02	20.00
WH 542	00.68	17.00
C-306	00.59	17.14
WH 283	00.34	17.00
PBW 373	00.34	20.00
RAJ3077	00.34	18.00

PBW 343 (40.92%) was still the ruling variety in the study area despite of low yield followed by PBW 502 (19.64%), HD 2851 (13.06), WH 711 (12.38%).

There were other new varieties like DBW 17, PBW 550, Raj 3765, JK Seeds, WH 416, C-306, WH 283, PBW 373 and Raj 3077 used by the farmers (Table 4).

Table 4: Percent area occupied by different varieties and their average yield

Variety	% Area	Av. Yield (q/acre)
PBW 343	40.92	18.62
PBW 502	19.64	19.87
HD2851	13.06	24.32
WH 711	12.38	18.60

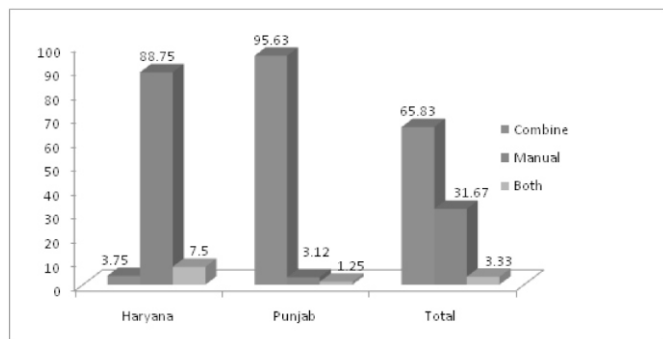


Fig.1: Harvesting Method Adopted by Farmers in Wheat

Overall majority of the farmers (65.83%) harvested wheat crop by followed by manual (31.67 %). There were only 3.33 per cent who used both combine as well as manual method of harvesting in wheat.(Fig.1). Majority (95.83 %) in Punjab have adopted mechanized of harvesting in wheat due to labour scarcity.

Burning of residue

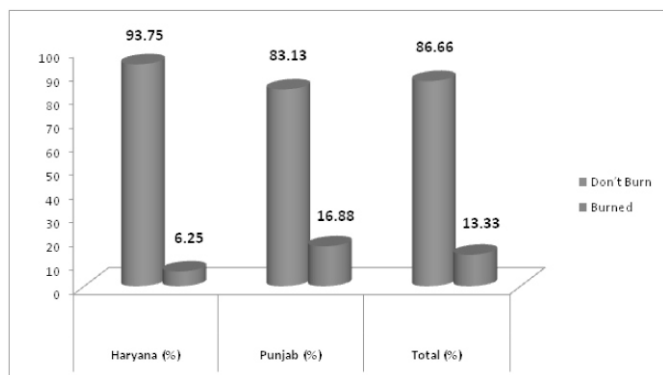


Fig. 2 : Burning status of wheat residue by Farmers in Wheat

According to estimates from Streets *et al.* (2003), farmers burnt 16 Per cent of crop residue. The results from Venkataraman *et al.* (2006) suggest that farmers in India burnt 116 million metric tons of crop residue in 2001, albeit with a strong regional variation. Their estimates suggest that, in all, open burning of crop residue accounted for about 25 per cent of black carbon, organic matter, and carbon monoxide emissions, 9-13 per cent of fine particulate matter (P.M2.5) and carbon dioxide emissions and about 1per cent of sulphur dioxide emissions. Field burning in the major agricultural states of Punjab, Haryana and western Uttar Pradesh was the largest potential contributor to these emissions.

Majority of the sample farmers 86.66 did not burn wheat residues in Punjab (83.13 %) and Haryana (93.75 %) during that period. Only 16.88 & 6.25 per cent farmers burnt the residue of wheat stubbles Punjab and

Haryana respectively to avoid hindering while sowing (Fig.2).The area burnt by the farmers was very less which indicate the awareness of farmers about residue management after harvesting. The law enforcement by Govt. of Punjab and Haryana to stop burning has also played major role in this direction. The state department of agriculture is working hard to educate the farmers about ill effects of residue burning on soil, living beings and environment. Happy Seeder can play an important role in residue management. Policy-makers and other interested parties should play a more proactive role in promoting it through extension services (Ridhima Gupta, 2012).

Weed Management Strategies adopted by Farmers

Table 5 : Knowledge and adoption of agronomic management practices for weed control

Method	Haryana		Punjab		Total	
	Knowledge	Adoption	Knowledge	Adoption	Knowledge	Adoption
Advance sowing	20 (25.00)	10(12.50)	52(32.50)	10(06.25)	52 (21.67)	20 (8.33)
ZT reducing <i>Phalaris minor</i>	01 (1.25)	00(0)	22(13.75)	04(02.25)	23 (9.58)	4 (1.67)
Crop residue retention	26 (32.50)	15 (18.75)	52(32.50)	24(15.00)	78 (32.50)	39 (16.25)
Crop rotation	58 (72.5)	29 (36.25)	111(69.38)	70(43.75)	169 (70.42)	99 (41.25)
Increase seed rate	28 (35.0)	28 (35.0)	62(38.75)	26(16.25)	90 (37.50)	54 (22.50)

Figure in parentheses indicate per cent.

Farmers in majority had managed the weeds by using herbicides. Some of the farmers did not apply herbicide and tried to control weed either through mechanical method or crop rotation. Knowledge of the farmers about weed control was poor. Farmers were having knowledge of advance sowing, retention of crop residue, crop rotationand increased seed rateto control weeds. Crop rotation was adopted by 41.25 per cent of the farmers for weed control followed by increased seed rate (22.50 %) crop residue retention (16.25 %) and advance sowing (8.33%)(Table5).

Reasons for Poor Weed Control

Table 6 : Possible reasons of poor weed control

Reasons	Haryana (%)	Punjab (%)	Total (%)
Foggy weather during spray	41 (51.25)	32 (20.18)	73 (30.42)
Use of same herbicide over years	28 (35.00)	24 (15.22)	52 (21.67)
Substandard chemical	07 (08.75)	39 (24.15)	46 (19.17)
Spray not uniform	04 (05.00)	23 (20.50)	27 (11.25)
Do not know	00 (00)	32 (20.18)	32 (13.33)

Figure in parentheses indicate per cent.

The main reasons for poor weed control in wheat were, rains after herbicide application, poor quality of chemicals, non uniform spray by the labour and use of same herbicide year after year. Foggy weather during spray (30.42 %) and use of same herbicide over the years (21.67 %) and substandard chemical (19.17 %) were the main reasons of poor weed control in wheat effectively (table 6). The findings also supported by Singh et al (2007).

Table 7: Usage of herbicide according to crop rotation in Haryana

Crop rotation	Herbicide			Total
	Used	No herbicide	Mechanical	
Bajra-Wheat	28 (80.0)	1(2.86)	6(17.14)	35 (100)
Guar-Wheat	11 (68.75)	2 (12.50)	3 (18.75)	16 (100)
Cotton-Wheat	34 (77.27)	8 (18.18)	2 (4.55)	44 (100)
Total	73 (91.25)	11 (13.75)	11 (13.75)	-

A good number of farmers (18.18%) did not apply herbicide in cotton-wheat crop rotation followed by 12.50 percent in guar-wheat. There were only 13.75 per cent who did not used herbicide in any rotation. Some of the farmers had used mechanical method of weed control in all the crop rotations. Majority of the farmers across crop rotation had applied herbicides to control weeds (Table 7).

Table 8: Type of herbicides used by farmers (%) according to crop rotation in Punjab

Herbicides	Cotton-Wheat	Potato-Wheat	Rice-Potato	Rice-Wheat	Total
Axial	-	-	-	02.50	02.50
Algrip	1.88	-	0.63	-	02.50
Algrip; Leader	-	-	1.25	-	01.25
Algrip; Topik	11.88	-	0.63	07.50	20.00
Leader; 2,4D	-	-	-	00.63	00.63
Total	-	-	2.50	00.62	03.13
Leader; Topik	-	-	1.25	08.75	10.00
Leader	-	2.5	8.13	04.37	12.50
Topik; 2,4-D	01.25	-	1.88	01.88	05.00
Topik	10.00	2.5	2.50	28.75	41.25

In cotton-wheat system, 11.88 per cent of the sample farmers used in combination metsulfuron plus clodinofof (Algrip plus Topik) for the control of both broad and narrow leaves weeds (Table 8).

Overall 41.25 per cent of farmers used clodinofof (Topik) in this system for the control of narrow leaf weeds such as Phalaris minor (Mandusi), Avenaludoviciana (jangli jai) and Poannua L. (Poaghas) etc. In potato-wheat cropping system in Punjab Sulphosulfuron (Leader) and Clodinofof (Topik) were used almost at par (2.5%) by the farmers. Different herbicides were used in rice-potato-wheat cropping system, 8.13 per cent used sulphosulfuron (leader) to avoid the losses caused by the both types of weeds. In rice-wheat system majority (28.75%) used Clodinofof (Topik) as major herbicide followed by Algrip + Topik (7.5%) in combination.

Table 9: Suggestions by the farmers to improve weed control

Suggestions	Percent	Rank
Timely and uniform spray	87.15	I
Purchase standard herbicides	78.15	II
Crop rotation	69.38	III
Weed free seed	45.50	IV
Usage of new chemicals	45.32	V
Retain residue	32.50	VI
Rotate herbicides	32.12	VII

The possible reasons for effective weed control were substandard chemical, spray not uniform, foggy weather during spray, and use of same herbicide over years. The farmers suggested that weeds can be controlled by timely and uniform spray of herbicides (87.15%), using standard herbicides (78.15%), crop rotation (69.38%), sowing weed free seed (45.50%), usage of new chemicals (45.32%) and rotate herbicide (32.12%) (Table 9).

CONCLUSIONS

As reported there was heavy loss in wheat crop due to weeds. Losses in wheat crop can be minimized through different weed management strategies such as crop rotation, higher seed rate, retention of crop residue on soil surface, adopting zero tillage technology of wheat sowing and by use of chemical for both broad and narrow leaf weeds. Rotation of herbicide and crop rotation are effective method for weed control in wheat. Some of the farmers were aware of crop rotation, higher seed rate, retention of crop residue on soil surface, zero tillage technology of wheat sowing as weed management strategies. Adoption of these strategies of weed control in wheat has to be stepped up to control weed and enhance wheat production.

Paper received on : December 24, 2018

Accepted on : December 28, 2018

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