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Level of Knowledge and Adoption of Water Saving Technologies by farmers in Sri Muktsar Sahib District of Punjab

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Abstract

A study was undertaken in the year 2015−16 to find the adoption and knowledge level of farmers regarding selected recommended water saving technologies (Direct seeded rice, Zero tillage in wheat, Laser leveler and Tensiometer) in Sri Muktsar Sahib district of Punjab. A total of 150 farmers were randomly selected from 8 villages of two blocks based on the probability proportion to the number of farmers in each village. Data were collected by personally interviewing the farmers. It was found that majority of the farmers were of the middle age group of 38−50 years, had gained education of matriculation level and fell in the category of medium (10−25 acres) operational land holdings. Majority of the respondents belonged to low mass media exposure, extension contacts and participation in extension activities It was found that majority of the respondents (58%) had low knowledge level about direct seeded rice, whereas about 57% and 49% of respondents had medium knowledge about zero tillage and laser leveller respectively. The adoption of laser leveler was appreciably high whereas adoption of DSR and ZTW was found to be comparatively quite low. Among the DSR adopters, about 90% had applied the recommended pre emergence herbicide for weed control. In case of ZTW, none of adopter had applied the pre sowing/emergence herbicide. Majority of respondents in both DSR (95.24%) and ZTW (79.31%) had applied a higher dose of nitrogenous in fertilizer than recommendations of PAU, Ludhiana due to lack of knowledge.

Keywords: Knowledge, adoption, direct seeded rice, zero-till wheat

1. Introduction

The state of Punjab contributed 43% of wheat and 29% of rice to central pool during the year 2013–14 (Anonymous, 2014a). To meet the food requirements of country, the area under rice and wheat in Punjab increased but this crop rotation consumes huge amount of water, much higher than the average annual rainfall and renewable supply in the region, leading to severe groundwater depletion. In spite of the negative long-term consequences of these policies, policy-makers have always considered these incentives to be politically untouchable (Sharma et al., 2012). Rice wheat system demands large amount of water which has been met by exploiting groundwater resources. In state, almost 99% of the net sown area is irrigated, 72% of which is contributed by tubewells and the remaining 28% by canals (Anonymous, 2015). Ground water level is depleting rapidly in the state and 110 out of 141 blocks have already been categorized as over-exploited or dark blocks and 3 other blocks are at critical stage (Anonymous, 2014b). The fall in water table in Punjab, even more so in central Punjab, which comprises the rice belt of the state was becoming more serious day by day. The rate of fall in water table per year was 18 cm during 1982-87; it increased to 42 cm during 1997–2002 (Hira et al., 2004) and further to 75 cm during 2002–06 (Singh, 2006). At the same time, there is growing pressure on country to meet the increasing demand of grains, especially for food; with the increasing demand for non-grain crops poised to be an even greater challenge. It is clear that increasing agricultural production via mono-cropping and intensification cannot be the solution. To meet the future crop demand, country will need to increase the water productivity. Therefore, better water saving technologies, efficient irrigation system, soil-centric rather than crop-centric policies and better awareness with regards to conservation techniques are the need of the hour (Mittal, 2008). A variety of water saving technologies have been developed and recommended by Punjab Agricultural University, Ludhiana such as direct seeded rice, zero tillage in wheat, laser leveller and tensiometer etc. Yet there is a dearth of information on the potential barriers to adoption of these technologies. Farmers were opting for water saving practices but to a lesser extent (Kaur and Vatta, 2015). So, it is necessary to assess the adoption and knowledge level of farmers regarding water saving technologies to enhance

the adoption of these technologies.

2. Materials and Methods

The study was planned in 2014−15 and conducted 2015−16 in Sri Muktsar Sahib District of Punjab, because of convenience of the investigator. There are four blocks in Sri Muktsar Sahib District. Out of the four blocks of Sri Muktsar Sahib district, two blocks were selected purposively, where selected recommended water saving technologies such as direct seeded rice, zero tillage in wheat, laser leveler and tensiometer were being practiced by the farmer. A list of villages, where these selected recommended water saving technologies were practiced by the farmers, was procured from respective agriculture development officers of selected blocks. From each selected block, further four villages were selected purposively. These eight villages were Mehraj Wala, Bham, Tamkot, Phullewala, Khirkia Wala, Ghoori Sangar, Dhoorkot and Kauni. A total of 150 respondents were randomly selected from 8 villages based on the probability proportion to the number of farmers in each village.

A knowledge test was prepared to measure the knowledge level of respondents regarding selected recommended water saving technologies such as direct seeded rice, zero tillage in wheat, laser leveller and tensiometer. Different type of questions like multiple choice and fill the blanks were prepared related to the selected recommended water saving technologies. A score of 1 was given to each correct answer of an item and zero to a wrong or no answer. Knowledge test were administered to 20 farmers from non sampled area. After pre testing, necessary modifications were made. Data were collected by personally visiting the study area and interviewing the farmers. Data were analyzed using frequency, percentage, range method and cumulative frequency cube root method.

3. Results and Discussion

Results have been discussed under the following heads

3.1. Socio personal characteristics

The information regarding socio-personal characteristics of selected farmers which include age, education, operational land holding, crop rotation, mass media exposure, extension contacts, member/office bearer of organizations and participation in extension activities was discussed and has been given in Table 1.

Table 1: Distribution of respondents according to their socio-personal characteristics

Sl. No.	Characteristics	Category	Frequency	Percentage (%)
1.	Age (years)	25–37	48	32.00
		38–50	62	41.33
		51–63	40	26.67
2.	Education	Illiterate	9	6.00
		Primary	29	19.33
		Middle	23	15.33
		Matric	48	32.00
		Senior secondary	26	17.33
		Graduate	13	8.67
		Post Graduate	2	1.33
3.	Operational land holding (acres)	Marginal (<2.5)	1	0.67
		Small (2.5–5.0)	4	2.67
		Semi-medium (5–10)	26	17.33
		Medium (10–25)	73	48.67
		Large (>25)	46	30.67
4.	Crop rotation*	Rice-Wheat	150	100.00
		Cotton-Wheat	17	11.33
5.	Mass media exposure	Low (12−15)	69	46.00
		Medium (15−18)	58	38.67
		High (18−21)	23	15.33
6.	Extension contacts	Low (5−8)	104	69.33
		Medium (8−11)	30	20.00
		High (11−14)	16	10.67
7.	Social participation	Office bearer	8	5.33
		Member	142	94.67
8.	Participation in extension activities	Low (4−7)	102	68.00
		Medium (7−10)	34	22.67
		High (10−13)	14	9.33

3.1.1. Age

Age is an important characteristic of an individual as it governs the physical, psychological and behavioral development of the person. Data in Table 1 indicates that age of farmers varied from 25−63 years. Most of the respondents (41.33%) belonged to the age group 38–50 years followed by 32.00% of them falling in category of 25–37 years. Rest of the farmers (26.67%) were in the age group of 51–63. These finding are in line with Kaur et al. (2015); Kaur et al. (2016b) and Ram et al. (2015).

3.1.2. Education

It is assumed that educational background of the farmers play a significant role trait of innovativeness. With this consideration in mind the education level of the respondent was studied and categorized into seven groups i.e., illiterate, primary, middle, matric, secondary, graduate and post-graduate. Data presented in Table 1 showed that about one third of the respondents were matriculates followed by 19.33% cent who had gained education upto primary level, 17.33% were educated upto senior secondary level, nine per cent were graduate and only one per cent of them were post

graduate. There were 6% farmers, who never got any formal education. Similar findings were reported by Kaur et al. (2015); Kaur et al. (2016a).

3.1.3. Operational land holdings

The farmers were categorized into five groups according to their operational land holding. Data in Table 1 revealed that 48.67% of the farmers had medium (10–25 acres) operational land holdings, followed by 30.67% having large (>25 acres) operational holdings and almost 17% farmers had semi-medium (10–25) operational holding. Only about three per cent and one per cent of the farmers had small and marginal operational land holding respectively. These findings were in agreement with Kaur et al. (2015); Kaur et al. (2016b).

3.1.4. Crop rotation

In Punjab, rice-wheat rotation is mostly followed by the farmers, but crop rotation varies with geographical conditions and resources available. Data presented in Table 1 revealed that all the respondents were following rice-wheat crop rotation. Only 11% of them had some area under cotton-wheat crop rotation also.

3.1.5. Mass media exposure

Mass media plays an important role in adoption process. Mass media awares and influences the farmers to adopt new technologies. In the present study, the farmers were placed into three categories pertaining to their mass media exposure on the basis of their scores using range method. It was studied in terms of reading farm literature, viewing television programme and listening to radio. Data given in Table 1 indicated that more than 45% of the farmers had low mass media exposure and 38.67% of them had medium mass media exposure. Only 15.33% of the farmers were found to have high mass media exposure.

3.1.6. Extension contacts

Extension contacts play a significant role in the adoption of an innovation. It not only helps the farmers to get new information but also change the mindset of the farmers towards the adoption of new technologies. Data presented in Table 1 showed that majority of the farmers (69.33%) had low extension contacts. So it can be concluded that farmer-extension linkage were not very strong and farmers' visit to the various agricultural organizations such as PAU, Krishi Vigyan Kendras (KVKs) were not very frequent. Twenty per cent of the respondents had a medium level of extension contacts and about 10% farmers had high level of extension contacts.

3.1.7. Social participation

Farmers registered themselves with some of the organizations either as life member or some of them as office bearer of these organisations. A perusal of data given in Table 1 further indicated that all the respondents were engaged with the organization of cooperative agricultural service society because they get fertilizers and other agricultural inputs from this society. About 95% respondents were engaged as life member and other 5% respondents were office bearers on the positions such as secretary, *pradhan* etc.

3.1.8. Participation in extension activities

To get the information regarding water saving technologies, farmers participate in different extension activities. Participation of farmers in extension activities was studied in terms of *kisan mela's*, field day, demonstrations and campaigns. Data presented in Table 1 revealed that majority of the respondents had low (68.00%) participation in extension activities while about 23% of them had a medium participation in extension activities. Only about 9% of respondents had a high participation in extension activities.

3.2. Knowledge level of the farmers regarding selected recommended water saving technologies

The findings related to the knowledge level about water saving technologies have been presented as following:

3.2.1. Knowledge level of respondents regarding direct seeded rice (DSR)

Data given in Table 2 showed that 58% of the respondents had low level of knowledge, while 37% farmers had a medium knowledge level. There were only about five per cent farmers, who had high level of knowledge regarding DSR.

Table 2: Distribution of respondents according to their knowledge level about direct seeded rice n=150

Knowledge level (Scores)	Frequency	Percentage (%)
Low (2–7)	87	58
Medium (7–12)	56	37.33
High (12–17)	7	4.67

3.2.2. Knowledge level of respondents' regarding zero tillage in wheat (ZTW)

It can be divulged from the data given in Table 3 that about 57% of the respondents had a medium level of knowledge followed by 28% of the respondents having a high knowledge level regarding zero tillage in wheat. A small proportion i.e. 14.67% of the respondents had a low knowledge level regarding ZTW.

Table 3: Distribution of respondents according to their knowledge level about zero tillage in wheat n=150

Knowledge level (Scores)	Frequency	Percentage (%)
Low (1–4)	22	14.67
Medium (4–7)	86	57.33
High (7–10)	42	28.00

3.2.3. Knowledge level of respondents regarding laser leveler

Data given in Table 4 indicated that about half of the respondents belonged to the medium knowledge level category. A little more than 40% farmers had a high level of knowledge about laser leveler and only 10% of them had a low knowledge level regarding this technology.

Table 4: Distribution of respondents according to their knowledge level about laser leveler n=150

Knowledge level (Scores)	Frequency	Percentage (%)
Low (1–3)	15	10.00
Medium (3–5)	74	49.33
High (5–7)	61	40.67

3.2.4. Knowledge level of respondents regarding tensiometer

A negligible number of the respondents had used tensiometer but they discontinued this technology. Knowledge level of respondents regarding tensiometer did not yield any significant information.

3.2.5. Overall knowledge level of respondents regarding selected water saving technologies

Knowledge level of farmers about each selected technology was discussed separately. But it was also necessary to find the overall knowledge of farmers about all water saving technologies. From the data given in Table 5, it can be revealed that more than 54% of the respondents had a medium knowledge regarding the selected water saving technologies. About 39% of the respondents had a low knowledge level and only about seven per cent of them had high a level of knowledge regarding selected water saving technologies.

Table 5: Distribution of respondents according to their overall knowledge level about selected water saving technologies n=150

Knowledge level (Scores)	Frequency	Percentage (%)
Low (7–15)	58	38.66
Medium (15–23)	82	54.67
High (23–31)	10	6.67

3.3. Adoption of selected recommended water saving technologies

The finding of the study (Figure 1) revealed that almost all the farmers (98.67%) adopted laser leveler, whereas only 28.00 and 19.33% farmers adopted direct seeded in rice and zero tillage in wheat technologies, respectively.

3.3.1. Adoption of selected recommended water saving technologies by respondents w.r.t. area

Data given in Table 6 showed that laser level had the maximum

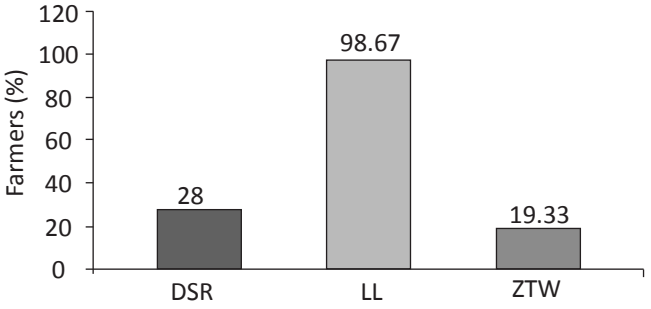

Figure 1: Extent of adoption of water saving technologies

Table 6: Adoption of selected recommended water saving technologies by respondents w.r.t. area n=148

Water saving technologies	Area (acres)	Extent of adoption (%)
Direct seeded rice	462	14.13
Zero-tillage wheat	619	18.93
Laser leveler	3081	94.22
Tensiometer	0	0

extent of adoption among all the selected water saving technologies. Laser leveler had been used by farmers on about 94% area out of total sampled area. Zero tillage in wheat and direct seeded rice had very low extent of adoption i.e. 18.93% and 14.13% respectively. Tensiometer had zero extent of adoption w.r.t area among all the respondents.

3.3.2. Adoption of recommended practices for direct seeded rice

Punjab Agricultural University has given certain recommendations about variety, seed rate, weed control and use of fertilizer, etc in direct seeded rice for good yield of crops. In Table 7 adoption of these selected practices w.r.t frequency of farmers and area has been given.

• *Variety*

According to the Package of Practices for Kharif crops, Punjab Agricultural University, PR 115 was the most suitable variety for DSR. It can be inferred from the data presented in Table 7 that, a large proportion (92.86%) of DSR adopters had sown recommended varieties of paddy and most of them had sown Pusa Basmati 1121. About 5% DSR adopters had sown both

Table 7: Distribution of respondent according to their extent of adoption of selected recommended practices for direct seeded rice n=42; Area=462 acres

Practices	Frequency	Area (in acres)
Variety		
a) Recommended	39 (92.86)	381 (82.47)
b) Non recommended	1 (2.38)	9 (1.95)
c) Both	2 (4.76)	72(15.58)

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Practices	Frequency	Area (in acres)
Seed rate		
a) More than recommended	11 (26.19)	89 (19.26)
b) Recommended	25 (59.52)	334 (72.29)
c) Less than recommended	6 (14.29)	39 (8.45)
Seed treatment		
a) Treated	15 (35.71)	220 (47.62)
b) Not treated	27 (64.29)	242 (52.38)
c) Mechanical weed control	3 (7.14)	7 (1.52)
Chemical weed control		
Pre emergence herbicide		
a) Applied	39 (92.86)	455 (98.48)
b) Not applied	3 (7.14)	7 (1.52)
Chemical used		
a) Recommended	38 (90.48)	445 (96.32)
b) Non recommended	1(2.38)	10 (2.16)
Dose applied		
a) More than recommended	4 (9.52)	47 (10.17)
b) Recommended	34 (80.95)	398 (86.15)
c) Less than recommended	-	-
Post emergence herbicide		
a) Applied	42 (100.00)	462 (100.00)
b) Not applied	-	-
Chemical used		
a) Recommended	42 (100.00)	462 (100.00)
b) Non recommended	-	-
Dose applied		
a) More than recommended	13 (30.95)	119 (25.76)
b) Recommended	29 (69.05)	343 (74.24)
c) Less than recommended	-	-
Fertilizer used		
Nitrogenous		
a) Less than recommended	-	-
b) Recommended	2 (4.76)	60 (12.99)
c) More than recommended	40 (95.24)	402 (87.01)
Phosphatic		
a) Applied	15 (35.71)	176 (38.10)
b) Not applied	27 (64.29)	286 (61.90)
Potassic		
a) Applied	4 (9.52)	39 (8.44)
b) Not applied	38 (90.48)	423 (91.56)

Figures in parentheses indicate percentage

recommended and non recommended varieties and only two per cent DSR adopters had grown only non recommended varieties i.e. Pusa 44. In case of extent of adoption w.r.t, area, it can be revealed from Table 7 that average area under recommended varieties was 82.47%. On the other hand only about 2% area was under non recommended varieties. The remaining area was owned by those farmers, who had sown both recommended and non recommended varieties of paddy.

• *Seed rate*

Proper seed rate is very important to ensure proper plant population of crop. For direct sowing of rice, 8–10 kg seed acre^{-1} should be used. It is evide nt from the data in Table 7 that about 60% of the DSR adopters were using recommended seed rate at about three fourth area (72.29%). Whereas, from remaining DSR adopters, about 26% and 14% had used more and less than recommended seed rate at about 19% and eight per cent area respectively.

• *Seed treatment*

Soaking of selected seed of paddy should be done before sowing in 10 litres of water containing 20 g Bavistin 50 WP (carbendazim) and 1 g Streptocycline (streptomycin+tetracycline) for 8 to 10 hours. Data in Table 7 showed that 35.71% DSR adopters had treated the seed before sowing for an area of 47.62%, while other DSR adopters (64.29%) had sown the untreated seed in 52.38% area.

• *Weed control*

DSR suffers from some constraints particularly high weed infestation**.** To control weeds different methods such as mechanical methods and chemical methods of weed control were used in combination.

• *Mechanical weed control*

In this method, weeds can be pulled out from field by using mechanical force i.e. hoeing. It is clear from the data given in Table 7 that only about seven per cent of DSR adopters had done hoeing to control the weeds in about two per cent area.

• *Chemical weed control*

Chemical weed control can be done by spraying the herbicides at different stages of weeds like pre emergence and post emergence.

For controlling weeds, Stomp 30 EC (pendimethalin) @ 1.0 l acre^{-1} within two days of sowing should be applied as pre-emergence herbicide.. It can be visualized from the Table 7 that about 93% DSR adopters applied pre emergence herbicide on 98% area. Whereas remaining farmers, who did not apply pre emergence herbicide done hoeing manually. It is evident from the data that 90% DSR adopter had used recommended pre chemical for spraying on 96.32% area. From all DSR adopters about 81% had used the recommended dose of herbicide and area under recommended dose of herbicide was 86.15%, while the other DSR adopters (9.52%),

who applied recommended chemical had used more than recommended dose of herbicide on 10.17% area.

Post emergence herbicide Nominee Gold (bispyribac) 10 SC for swank and paddy mothas and Segment (azimsulfuron) 50 DF for paddy mothas should be applied. Data given in Table 7 have shown that all the DSR adopters had applied the recommended chemical on whole DSR area. Majority of DSR adopters (69.05%) had applied the recommended dose of herbicide on their DSR grown area (74.24%) and remaining 30.95% DSR adopters had applied more than recommended dose of herbicide on remaining area i.e. 10.17%. No farmer had applied less than recommended dose of herbicide.

• *Fertilizers used*

Fertilizers are very important for the growth of plant, their root and shoot development and ultimately to get good yield of crop. A paddy crop needs different type of fertilizers to fulfil the requirement of macro nutrients and micro nutrients. But fertilizers containing some most important nutrients i.e. NPK are discussed in study. These are categorized under recommended and non recommended fertilizers as given below according to recommendations of PAU,Ludhiana.

Nitrogenous fertilizers are very important to have good yield of DSR, but it should be according to the recommendations. In DSR, 60 kg nitrogen acre^{-1} should be applied in three equal splits. But, data given in Table 7 revealed that a large proportion of DSR adopters (95.24%) had applied more than recommended dose of nitrogen in 87.05% area. Only 5% DSR adopters applied recommended dose of nitrogen on about 13% area out of total area under DSR. In DSR, phosphorous and potash should be applied only if the soil test shows deficiency of these nutrients. Phosphorus application to DSR, when sown after wheat grown with recommended phosphorus should be skipped. But, data pertained in Table 7 indicated that 35.71% DSR adopters still applied the phosphatic fertilizer in DSR grown in about 38% area. It can be observed from the data from Table 7 that 9% DSR adopter had also applied potassic fertilizer in addition to other fertilizers on about eight per cent area.

3.3.3. Adoption of recommended practices for zero tillage in wheat

• *Variety*

Wheat is major cereal crops of Punjab, which can be grown on all types of soil except deteriorated alkaline and water-logged soils. All the varieties which are recommended for conventional sowing of wheat such as HD 3086, HD 2967, PBW 677 and PBW 550 etc are also recommended for zero tillage in wheat. It can be inferred from the data presented in Table 8 that all ZTW adopters had sown the recommended varieties of wheat. HD 2967 was the most popular variety among them.

• *Seed rate*

An optimum seed rate is also required for good yield of crop. Seed rate of 45 kg acre^{-1} for PBW 550 and 40 kg acre^{-1} for all other varieties should be used. Data given in Table 8 revealed that more than 55% ZTW adopters used recommended seed rate in about 59% area followed by about 31% ZTW adopters used more than recommended seed rate in 6.30% area. There were also some ZTW adopters (13.80%), who had used less than recommended seed rate in 34.57% area out of total sampled ZTW sown area.

• *Seed treatment*

In termite infested soil, seed should be treated with 4ml Dursban/Ruban/Durmet 20 EC (chlorpyriphos) or 6 ml Regent 5% SC (fipronil) per kg seed and then all varieties except should be treated that of WHD 943, PDW 291, PDW 233 with Vitavax Power 75 WS @ 3 g kg^{-1} (300 g q^{-1}) or Vitavax @ 2 g kg^{-1} (200 g q^{-1}) or Raxil @1 g kg^{-1} (100 g q^{-1}) or Bavistin/Agrozim/Derosal/ JK Stein/Sten 50/Provax/Bencor @2.5 g kg^{-1} (250 g q^{-1}) seed for the control of loose smut. Treat the seed with Captan or Thiram @ 3 g kg^{-1} (300 g q^{-1}) if the seed is infected with black tip and head scab. Data given in Table 8 discloses that majority of ZTW adopters (62.07%) had not treated the seed. So almost half (50.40%) of the area out of total ZTW sown area had sown with non-treated seed. Whereas remaining 49.60% area had sown with treated seed by 37.93% of ZTW adopters.

• *Weed control*

Weeds can be effectively and economically controlled with the use of herbicides. When, wheat is growing without any preparatory tillage and if the field is infested with weeds, half litre Gramoxone (Paraquat) in 200 litres of water before sowing should be applied. But findings in Table 8 revealed that no ZTW adopter had applied any herbicide before sowing of wheat. Any of post emergence herbicide i.e. isoproturon 75 WP @ 300 g ace^{-1}, clodinafop 15 WP 160 g acre^{-1}, sulfosulforon 75 WG 13 g acre^{-1}, pinoxaden 5 EC @400 ml acre^{-1} or fenoxaprop-p-ethyl 10 EC @ 13 g acre^{-1} should be applied. It can be revealed from the data presented in Table 8 that all ZTW adopter had applied the post emergence herbicide of recommended chemical. But majority of them (48.28%) had applied more than recommended dose of herbicide in 42.81% area. About 45% of ZTW adopters applied recommended dose of herbicides in 53.47% area. Remaining seven per cent ZTW adopter had applied less than recommended dose of herbicide for about 4% area.

• *Fertilizers used*

Fertilizers should be used on the basis of soil testing, but in absence of soil test it can be estimated that wheat crop require 50 kg nitrogen, 25 kg phosphorus and 12 kg potash per acre. It is clear from the data given in Table 8 that all ZTW adopters applied the nitrogenous fertilizer, but majority of them (79.31%) applied higher dose as compared to recommendations while remaining 20.69% adopters applied recommended dose of nitrogenous fertilizers. So on average in one-fourth area of ZTW, recommended dose of nitrogenous fertilizer was applied, whereas on remaining three-fourth area more than recommended dose was applied.

Table 8: Distribution of respondents according to their extent of adoption of selected recommended practices for zero tillage in wheat n=29; Area=619 acres

Practices	Frequency	Area (in acres)
Variety		
a) Recommended	29 (100)	604 (97.58)
b) Non recommended	2 (6.90)	15 (2.42)
Seed rate		
a) More than recommended	9 (31.03)	39 (6.30)
b) Recommended	16 (55.17)	366 (59.13)
c) Less than recommended	4 (13.8)	214 (34.57)
Seed treatment		
a) Treated	11 (37.93)	307 (49.60)
b) Not treated	18 (62.07)	312 (50.40)
Pre emergence herbicide		
a) Applied	-	-
b) Not applied	29 (100.00)	619 (100.00)
Post emergence herbicide		
a) Applied	29 (100.00)	619 (100.00)
b) Not applied	-	-
Chemicals used		
a) Recommended	29 (100.00)	619 (100.00)
b) Non recommended	-	-
Dose applied		
a) More than recommended	14 (48.28)	265 (42.81)
b) Recommended	13 (44.83)	331 (53.47)
c) Less than recommended	2 (6.89)	23 (3.72)
Fertilizer used		
Nitrogenous		
a) Less than recommended	-	-
b) Recommended	6 (20.69)	153 (24.72)
c) More than recommended	23 (79.31)	466 (75.28)
Phosphatic		
a) Less than recommended	16 (55.17)	316 (51.05)
b) Recommended	6 (20.69)	88 (14.22)
c) More than recommended	7 (24.14)	215 (34.73)
Potassic		
a) Applied	5 (17.24)	168 (27.14)
b) Not applied	24 (82.76)	451 (72.86)

Figures in parentheses indicate percentage

In case of phosphatic fertilizers, majority of ZTW adopters (55.17%) applied less than recommended dose followed by 24.14% respondents, who applied more than recommended dose of phosphatic fertilizers. About 21% had applied recommended dose of fertilizers. So it can be seen from the Table 8 that about one half area (51.05) out of total ZTW sown area was under more than recommended dose of phosphatic fertilizers, about one third (34.73%) area was under more than recommended dose of phosphatic fertilizers and the remaining (14.22%) area was under recommended dose of phosphatic fertilizers. It can be further seen that about 17% respondents had also applied pottasic fertilizers.

Table 9: Distribution of respondents according to gap between two subsequent laser levelling n=148

Gap	Frequency	Percentage
1 year	46	30.67
2 years	42	28.38
3 years or more	53	35.81

3.3.4. Gap between two subsequent laser levelling

There is not any specific recommendation between two subsequent laser levelings. It depends upon the nature of soil and crops. It can be revealed from the data given in Table 9 that majority of laser leveler adopters had used laser leveler after a gap of three or more years between two subsequent laser levelling. About 31% laser leveler adopters repeated laser leveler operation in their fields every year and about 29% of laser leveler adopter maintained two year gap between two subsequent laser levelling. The remaining number of adopter had started use of this technology in the year 2015.

4. Conclusion

Knowledge level of majority of farmers in the case of DSR was found to be low whereas in ZTW and laser leveller, knowledge level was found to be medium. The extent of adoption of laser leveler was found to be appreciably high whereas the extent of adoption of DSR and ZTW was found to be comparatively quite low. So, there is lot of scope for increasing the existing knowledge level of farmers about recommended practices by providing literature. Thus, Training programmes and demonstrations should be organized to impart knowledge to the farmers and enhance adoption about water saving technologies.

5. References

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