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Assessment of Knowledge and Adoption of Drip Irrigation in Cotton Crop among Farmers of Haryana

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ABSTRACT

The study was set about in the state of Haryana to gauge the knowledge and adoption level of the drip irrigation system (DIS) in the cotton crop amongst the farmers. The research highlighted that more than two-thirds of the farmers (68.33%) had a high level of knowledge of DIS. The socio-economic factors such as the family income, size of the landholdings, exposure to the mass media, education level and the socio-economic status of the respondents were significantly correlated with the overall levels of knowledge and adoption of DIS by the farmers. On a whole, more concentrated efforts are the call of the hour to increase the knowledge levels and adoption of micro irrigation techniques on a wider scale.

INTRODUCTION

Cotton is considered one of the dominant cash crops in our country and is also a way to earn livelihood for millions of farmers and people associated with its cultivation. The importance of cotton as a cash crop can be accorded to the fact that it is considered a source of income for the people associated with its trade, processing etc. (Jeya, 2020; Ranadive et al., 2020). The role that cotton production plays in industrial and agricultural sector development has accorded it the status of “white gold”. Also, providing the rudimentary raw materials to the cotton textile industry and the inevitable need for the cash crop has given it the status of “King of the Fiber Crops” (Navya & Nayka, 2021). In India, the major cotton- producing states are Maharashtra, Gujarat, Telangana, Rajasthan and Haryana. The overall area under production is 120.69 lakh hectares and the production is projected at 362.18 lakh bales for the years 2021-22 (PJTSAU, 2022).

At the global level, India has the largest area under cultivation with 120.69 lakh hectares which is 37 per cent of the global area under cultivation. Although, the yield is pretty low with 469 kg per hectare as compared to USA and China with 951 kgs and 1892 kgs per hectare respectively. The global production of cotton is expected to increase by 9 per cent from the previous season with the consumption also estimated to be 25.6 million tonnes (ICAC, 2022).

Over the years, India has significantly increased its Cotton production. The kick start of the technology mission on cotton by GoI in 2000 has led to an increase in yield through the use of HYVs, technological transfer, farm management practices and induction of Bt cotton. The fundamental changes that have happened in the Cotton ecosystem have shown remarkable results throughout the country (The Cotton Corporation of India Limited, 2022). As far as the state of Haryana is concerned, the agriculture department has set a target of increasing the area under cotton cultivation up to 19 lakh acres. The major districts in the state of Haryana taking up cotton production are Sirsa, Fatehabad, Hisar, Bhiwani, Palwal etc. (Hindustan Times, 2022). The encouraging results that have been gathered from various studies and reports have showcased that the production of cotton is increasing at a burgeoning rate. The study was an endeavour to delve into the aspects of knowledge and succeeding adoption of drip irrigation systems among cultivators in the state of Haryana.

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METHODOLOGY

The present investigation was carried on in the districts of Sirsa, Fatehabad, Hisar and Bhiwani which happen to be the leading cotton-producing areas in the state. From the Sirsa district, Keharwala, Mammer kheda, Dukra and Raipur villages were selected and similarly, Pili Mandori and Khara Kheri from Fatehabad district; Mangali Surtia, Dhani Jatan and Gawar from Hisar district and Sirsi, Chahar Khurd, Chahar Kalan, Nangal, Bidhwan and Dariyapur from Bhiwani district were selected. Sixty respondents were taken randomly from these villages of selected districts. A total of 21 questions were meticulously framed and centred around the total increase in yield as compared to the conventional method, water efficiency, knowledge regarding subsidy schemes, usage of the fertilizers, checking of drip filter, usage of water-soluble fertilizer, less weed, overall improvement in the health of the soil, attack by pink ball worms etc. The respondents' replies were segmented into having full proper knowledge, partial or limited knowledge and no knowledge with score of 3, 2, 1 respectively.

The total score was calculated for every individual framer by summation of the knowledge points and was categorized as high, moderate and low. Similarly, to compute the adoption level of drip irrigation concerning cotton production we developed an elaborative index and the score of each farmer was calculated based on area under drip irrigation, year of installation of DIS, cropping intensity, higher yield, less weeds intensity, income, reduced labour requirement, inclusion of cash crops, percentage of area under drip irrigation to total area, disease control and softened soil.

Scores were assigned for each response given by the farmers on various aspects of drip irrigation and scores achieved by each respondent were classified as high, moderate, and low levels of knowledge and adoption. The data was analyzed using different statistical tools like chi-square test and coefficient of contingency. Significant inferences were contemplated to draw valid conclusions as per objectives of the study.

RESULTS AND DISCUSSION

Knowledge level of farmers about drip irrigation

The overall knowledge levels were assessed with respect to drip irrigation and cotton production. 68.33 per cent farmers had high knowledge, followed by 26.67 per cent having a moderate knowledge level about drip irrigation (Table 1). Sharma & Kathpalia (2022); Mahendrakar et al., (2018); Jadhav et al., (2018) & Kumar et al., (2020) showed similar level of knowledge. The results on the same lines with medium knowledge levels were also put forth by Shambhrakar et al., (2018) in the Vidarbha region, Deepika et al., (2020) in Tamil Nadu and Khade et al., (2012) for the deshi varieties of cotton. In the study undertaken by Kumar et al.,

Table 1. Knowledge level of respondents about drip irrigation

Level of Knowledge	Frequency (%)
Low (30-38)	3(5.00)
Moderate (39-47)	16(26.67)
High (48-57)	41(68.33)

Table 2. Association of socio-economic variables with knowledge level about drip irrigation.

Age (years)	Low	Moderate	High	Total
Up to 35 years	02(08.00)	05(20.00)	18(72.00)	25(41.66)
36 to 50 years	01(04.55)	11(50.00)	10(45.45)	22(36.67)
Above 50 years	00(00)	00(00)	13(100)	13(21.67)
Total	03(05.00)	16(26.67)	41(68.22)	60(100)
χ^2=12.47**; C=0.41				
Caste				
General	02(03.64)	13(23.64)	39(70.91)	55(91.67)
Backward	01(20.00)	02(40.00)	02(40.00)	05(08.33)
χ^2=02.93; =0.21				
Land Holding (Acres)				
2.5 to 5.0	01(16.67)	04(66.66)	01(16.67)	06(10.00)
5.1 to 10.0	02(10.00)	07(35.00)	11(55.00)	20(33.33)
10.1 to 25.0	02(05.89)	03(08.82)	29(85.29)	34(56.67)
χ^2=14.17*; =0.44				
Type of family				
Nuclear	01(05.26)	04(21.05)	14(73.69)	19(31.67)
Joint	02(04.88)	12(29.27)	27(65.85)	41(68.33)
χ^2=0.44; C =0.08				
Size of family (members)				
Small (upto 4)	03(15.79)	05(26.31)	11(57.89)	19(31.67)
Medium (5 – 8)	00(00)	11(28.21)	28(71.79)	39(65.00)
Large (above 8)	00(00)	00(00)	02(100)	02(03.33)
χ^2=02.65; C=0.20				
Education level of the respondents				
Primary	01(12.50)	02(25.00)	05(62.50)	08(13.33)
Middle	00(00)	12(63.16)	07(36.84)	19(31.67)
Senior secondary	01(05.88)	01(05.88)	15(88.24)	17(28.33)
Graduation and above	01(06.25)	01(06.25)	14(87.50)	16(26.67)
χ^2=19.39**; C=0.49				

Table 2 contd...

Age (years)	Low	Moderate	High	Total
Annual Income of family (Rs.)				
Medium (3.1-6.0L)	01(05.88)	09(52.94)	07(41.18)	17(28.33)
High (Above 6.0 L)	02(04.65)	07(16.28)	34(79.07)	43(71.67)
χ^2= 08.71**; C=0.35				
Social participation				
Nil (0)	03(05.88)	10(19.61)	38(74.51)	51(85.00)
Low (1)	00(00)	06(66.67)	03(33.33)	09(15.00)
χ^2=08.33**; C= 0.34				
Mass media exposure				
Low (upto 9)	03(23.08)	02(15.38)	08(61.54)	13(21.67)
Medium (10-17)	00(00)	09(34.62)	17(65.38)	26(43.33)
High (above 17)	00(00)	04(19.05)	17(80.95)	21(35.00)
χ^2=13.15**; C =0.42				
Socio economic status				
Medium (19-24)	03(08.82)	15(44.12)	16(47.06)	34(56.67)
High (25-31)	00(00)	01(03.85)	25(96.15)	26(43.33)
χ^2=16.45**; C= 0.48				

Figures in parentheses denote percentage; *and **Significant at 5% and 1% level

(2019) in Haryana found that farmers involved in cotton production in Haryana have medium knowledge levels of the inputs used. Kumari et al., (2022) reported that more than three-fifths of farmers had high knowledge levels of drip irrigation systems. Medium knowledge level that farmers possess might be because farmers long have been exposed to various communication channels including social media (Laxman & Mazhar, 2022).

Level of adoption of drip irrigation

With reference to the adoption level of drip irrigation, more than two-fifths of the respondents had a higher level of adoption followed by low (31.67%) and 23.33 per cent having medium levels (Table 3). Although the works done in the early phase of research on Bt-cotton analyzed that the majority of respondents (81.97%) had a low level of adoption (Deshmukh et al., 2007). The reason might be due to the costly seeds, lack of information regarding seed cost, proper knowledge etc. which were tackled during the early decade of 2010 (Shah, 2012). Even in the current times, the respondents also do respond to a lower adoption level of Bt cotton due to lack of agricultural labour, high cost of seed, quality seed etc. (Yadav et al., 2019; Sharma et al., 2021). The overall adoption level of different modern practices of cotton cultivation like preparatory tillage, crop variety, sowing techniques etc. were known to almost all the respondents in Bhal area of Gujarat (Joshi et al., 2008). The related work on the adoption of various technologies by Quim (2009) with reference to Bt-cotton did put forth the results of increased yield and net profit margins. Adoption of the knowledge and technology is a conscious decision to fully use the innovative mechanizations at their disposal. Rajput & Chinchmalatpure (2016) in their research on Bt-cotton cultivators constructed the fact that almost three-fourths of the respondents had medium to high extent of adoption of cultivation practices of Bt-cotton. The impact of the adoption of the varied crop management techniques and practices like Bt-cotton hybrids, fertilizer use, seed etc. led to the overall enhancement of the yield by 138 per cent in the Mansa district of Punjab (Singh et al., 2022). The institutionalized adoption of INM practices like phosphoric and potassium fertilizer was observed in the medium category in research conducted by Shambhrakar et al., (2018). A seminal study by Kathage & Qaim, (2012) investigated the profit gains, better household standard, greater consumption expenditure with the adoption of the Bt technology and its interrelated nuances.

Table 3. Adoption level of respondents about drip irrigation

Level of adoption	Frequency (%)
Low (12-14)	19(31.67)
Moderate (15-17)	14(23.33)
High (18-21)	27(45.00)

Association of socio-economic factors with the knowledge and adoption level

Regarding the association of socio-economic factors with knowledge level about drip irrigation, it was found that respondents belonging to the above 50 years age group (100%), having higher exposure to mass media (80.95%), high Socioeconomic status (96.15%), high annual income (79.07%), education up to senior secondary level (88.24%), larger family size (100.00%), medium land holding (75.00%), belonging to the nuclear family (73.67%) and from general caste (70.91%) had high level of knowledge (Table 4). The cumulative knowledge levels were found to be greatly associated with that age structure, education qualification level, size of land holding, annual income, exposure to media and social and economic status of the farmers as arrived through Chi-square results. The study taken forward investigating the knowledge levels of farmers in Gujarat indicated that almost three-fourths (81.11% each) of the respondents had medium to a high level of extension participation and mass media exposure (Sardhara et al., 2020). Bhagat et al., (2002); Nain & Bhagat (2005); Nain & Chandel (2013); Rao et al., (2019); Navya & Nayka (2021) demonstrated the direct relationship between education levels and the adoption levels. Sharma et al., (2018) studied association of socio-economic variables with the level of awareness of farmers and showed that majority of the farmers had high level (71.67%) of awareness regarding effect of climate change on water resources.

Table 4. Association of socio-economic variables with adoption level of drip irrigation

Age (years)	Low	Moderate	High	Total
Up to 35 years	13(52.00)	03(12.00)	09(36.00)	25(41.66)
36 to 50 years	05(22.73)	10(45.45)	07(31.82)	22(36.67)
Above 50 years	01(07.69)	01(07.69)	11(84.62)	13(21.67)
Total	19(31.67)	14(23.33)	27(45.00)	60(100)
χ^2=19.36**; C=0.49				
Caste				
General	19(34.55)	10(18.18)	26(47.27)	55(91.67)
Backward	00(00)	04(80.00)	01(20.00)	05(08.33)
χ^2=09.99**; C=0.37				
Size of land holding (acre)				
2.5to 5.0	04(66.66)	01(16.67)	01(16.67)	06(10.00)
5.1 to 10.0	09(45.00)	09(45.00)	02(10.00)	20(33.33)
10.1 to 25.0	06(17.65)	04(11.76)	24(70.59)	34(56.67)
χ^2=23.10**; C =0.53				
Type of family				
Nuclear	10(52.63)	01(05.26)	08(42.11)	19(31.67)
Joint	09(21.95)	13(31.71)	19(46.34)	41(68.33)
χ^2=07.80*; C =0.33				
Size of family (members)				
Small (upto 4)	11(57.89)	01(05.26)	07(36.84)	19(31.67)
Medium (5 – 8)	08(20.51)	13(33.34)	18(46.15)	39(65.00)
Large (above 8)	00(00)	00(00)	02(100)	02(03.33)
χ^2=10.28*; C=0.38				
Education level of the respondents				
Primary	05(62.50)	00(00)	03(37.50)	08(13.33)
Middle	08(42.11)	08(42.11)	03(15.79)	19(31.67)
Senior secondary	02(11.76)	03(17.65)	12(70.59)	17(28.33)
Graduation and above	04(25.00)	03(18.75)	09(56.25)	16(26.67)
χ^2=17.14**; C=0.47				
Income of the family (in Rs.)				
Medium (3.1-6.0L)	05(29.41)	10(58.82)	02(11.77)	17(28.33)
High (Above 6.0 L)	14(32.56)	04(09.30)	25(58.14)	43(71.67)
χ^2=18.66**; C=0.48				
Social participation				
Nil (0)	19(37.25)	08(15.69)	24(47.06)	51(85.00)
Low (1)	00(00)	06(66.67)	03(33.33)	09(15.00)
χ^2=12.19**; C= 0.41				
Mass media exposure				
Low (upto 9)	09(69.23)	01(07.69)	03(23.08)	13(21.67)
Medium (10-17)	07(26.92)	09(34.62)	10(38.46)	26(43.33)
High (above 17)	03(14.29)	04(19.05)	14(66.66)	21(35.00)
χ^2=14.75**; C =0.44				
Socio economic status				
Medium (19-24)	16(47.06)	11(32.35)	07(20.59)	34(56.67)
High (25-31)	03(11.54)	03(11.54)	20(76.92)	26(43.33)
χ^2=11.51*; C= 0.40				

Figures in parentheses denote percentage; *and **Significant at 5% and 1% level

Multiple socio-economic factors were having an impact on the level of drip irrigation adoption (Table 4). Most of the respondents in the age group of 50 years and above (84.62%) and the ones in the age group of up to 35 years (36%) had higher levels of drip irrigation adoption. A non-significant association was found between the caste of the respondents and the adoption levels. The results reported that the adoption level was higher in the general castes (47.27%) as compared to other caste groupings. A significant association was found between the size of landholding and the adoption levels. More than three-fifths of the medium farmers (70.59%) had a higher drip irrigation adoption level whereas two-thirds of the small landholders had low levels of adoption of DIS. It was reported that as the landholding size increased, the farmer's level of adoption also saw an upward trend. The size of the family also showed to have affected the drip irrigation adoption level with large family sizes showcasing a high level of adoption (100%). Another element of exposure to mass media is also shown to have a similar influence on the adoption of DIS by the farmers. The higher levels of exposure led to higher adoption levels by the farmers. The farmers having lower exposure to the mass media platforms had lower adoption levels (69.23%) as well. The socio-economic status of the respondents had also an immense impact on the adoption levels. The higher socioeconomic status of the farmers (76.92) led to higher adoption of the Drip Irrigation System. Similarly, lower SES has led to abysmally lower adoption levels. Kaarthikeyan & Suresh (2019) have highlighted in their

research that the costs involved in the DIS, the landholding of the farmers and the water source tend to be the leading factors behind the adoption levels of the Drip Irrigation System. Arya et al., (2019) investigated post-adoption behavior of farmers towards soil and water conservation technologies and found that twenty one percent dis-continued the adoption of technologies and 23 per cent were adopting with certain technological gap. Mohan et al. (2012) in their seminal work have gone on to explain the positive impact of drip irrigation and the improved socioeconomic condition because of education levels, Kisan credit card and land holding sizes. Jumanne (2016) put forth that the farmers' age, education levels and other economic factors have influenced technology adoption. Similar results reported by Verma & Sharma (2017) in Rajasthan where it was reported that varied variables such as education levels, annual income, mass media exposure etc. had a positive and significant relationship with drip irrigation adoption. The research put forth by Sharma et al., (2021a) revealed that except for education, socio-economic status and caste, other variables such as annual income, age, size of land, media exposure and social participation had a positive correlation with the adoption level of the respondents.

CONCLUSION

The usage of drip irrigation technology has proved to be a harbinger of change in the status of the farmers. The knowledge levels were found high among most of the farmers sampled whereas almost half of the respondents were found to have a high level of adoption of the DIS. Increased funding, better subsidization policies, integrated training programmes, coordinated contact extension activities and better exposure to the mass media will be a new dawn for the entire agriculture scenario in the country. The technological progress coupled with the structural assistance will go a long way to strengthen the position of farmers in particular and the agriculture in general where the sustainable use of resources will benefit for ages to come.

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