Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.6609

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (6):** 562-578 (2018)

International Journal of Pure & Applied Bioscience

Review Article

OPEN ACCESS

Use Pattern of Direct Seeded Rice (DSR) Technology in Paddy

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Received: 5.02.2018 | Revised: xx.xx.2018 | Accepted: xx.xx.2018

ABSTRACT

The recent methods of paddy cultivation i.e direct seeded rice in Haryana is limited to the few paddy growing districts and only with the assistance of the Department of Agriculture, Haryana. Extension officials are motivating farmers by field demonstration, exposure visits, and subsidies on inputs and training on various aspects related to DSR so that they could adopt this resource conservation technology. It has been observed that the adoption of this technology has brought the desired results and helped the farmers using this technique.

Key words: *Direct seeded rice, Technology.*

INTRODUCTION

Agriculture is the backbone of Indian economy and is the main occupation of the country's as 65 per cent of population is still associated with agriculture and it contributes about 14 per cent to the country's GDP. The agricultural sector and its problems have always dominated the Indian economic scenario. In 1950's, India depended upon other countries to fulfill the food grain requirements of countrymen but after green revolution, India became self-sufficient in food production and further emerged as the exporter of agricultural products in recent years. Indian economy is predominantly an agricultural economy characterized by small scale, fragmented farming, employing traditional technology. The introduction of modern technology in agriculture has resulted into a remarkable increase in agricultural production, but, it is not uniform in different regions among different size of farms and even within the crops having relatively low technological breakthrough. However, agricultural development in India has initiated the shift from traditional to modern farming system. Due to predominance of agriculture in the national economy, the overall rate of economic growth depends to a large extent on the growth of agricultural sector.Among various food grains, rice is the staple food of more than fifty percent of the world population. The population of the world at present is 7.4 billion. In India the present population is 1,329 million which will increase to 1,708 million and rank first by 2050. This increase is approximately 11.15 million people per year.

Cite this article: Kumar, R., Batra, S.C. and Kumar, M., Use Pattern of Direct Seeded Rice (DSR) Technology in Paddy, *Int. J. Pure App. Biosci.* **6(6):** 562-578 (2018). doi: http://dx.doi.org/10.18782/2320-7051.6609

India requires increasing rice production by 3 million tonnes every year to ensure food security[7]. Rice-wheat is the major cropping sequence in India and India is the second largest producer of rice next to China. It was the largest exporter of rice in 2015-16 followed by Thailand, Vietnam and Pakistan. Basmati rice trade was 2.02 million tonnes in 2009-10 which increased to 4.04 million tonnes in 2015-16. The area under rice cultivation was 427.54 lakh hectares during 2012-13 which increased up to 438.56 lakh hectare during 2014-15. The production was 105.24 million tonnes in 2012-13 and decreased to 104.80 million tones. It is because that the yield of rice was 2461 kg/ha during 2012-13 which decreased to 2390 kg/ha during 2014-15. Rice receives a large amount of water during land preparation and the growing period, causes poor crop water productivity and lower net benefits. Over exploitation of ground and surface water resources is a major threat to the sustainability of rice production in India. The main problem which becomes havoc to the Indian agriculture is heavy irrigation in the areas which receive ample quantity of water. The long term effects have been seen in terms of soil degradation. Soils with heavy irrigations converted into barren lands due to soil salinity, which in turn resulted into lower productivity per unit area. The population is increased many folds but the area under agriculture is reducing every year. So, to manage this problem, the different aspects of production of field crops have to be taken in consideration. Paddy is a crop which is grown in irrigated areas only and traditionally, in India, Uttar Pradesh and Punjab were major states in terms of production. There were reports that for production of 1kg rice, 3500 liter water is needed. It means to say that India is not exporting rice, but water which in the coming year will become the commodity in the world. Rice production needs to increase to feed growing population. Although a comprehensive assessment of the extent of water scarcity in Asian rice production is still required but there are clear signs that declining quality and quantity of water resources are threatening the sustainability of the irrigated rice-based production system. Beside, drought is also one of the main constraints for high yield in rain-fed rice. Exploring ways to produce more rice with less water is essential for food security and sustaining environmental health in Asia[3]. Direct seeded rice method of planting in paddy can result into saving of money of the farmers and the inputs used in the system can be efficiently utilized with the small changes in the cultivation practices. Direct seeding of rice was a common practice in India before green revolution. Currently, direct seeded rice in Asia occupies about 29 Mha which is approximately 21% of the total rice area in the region. The machines used in direct seeded rice can also influence the costs as compared to transplanted paddy. Land preparation duration was significantly reduced in direct seeded rice compared to transplanted rice. This led to a significant reduction in irrigation and total water input (rainfall and irrigation) before crop establishment. However, during the crop growth period in the main field, transplanted rice had a significantly shorter crop growth duration and total water input than direct seeded rice. Also, the land direct seeded rice captures more rainfall after crop establishment[8].

The recent methods of paddy cultivation i.e direct seeded rice in Haryana is limited to the few paddy growing districts and only with the assistance of the Department of Agriculture, Haryana. Extension officials are motivating farmers by field demonstration, exposure visits, and subsidies on inputs and training on various aspects related to DSR so that they could adopt this resource conservation technology. It has been observed that the adoption of this technology has brought the desired results and helped the farmers using this technique.

Main objective of the study:

The main objective of the study is a comprehensive analysis of conventional (Trans-planted) and direct seeded rice (DSR) technology. It has very implication on the front of net income of farmers and conservation of resource like water and labor.

Data Sources

Both secondary and primary data were collected for the study. Secondary data were collected from state agriculture department and various website of govt. of Haryana and India. The primary data were collected through well structured, pre-tested and comprehensive schedules exclusively prepared for the study from farmers by personal interview method. The schedule used for the primary data collection was designed based on the objectives of the study. The primary data collected related to (i) crop yield, (ii) inputs used, (iii) price of inputs and output, (iv) number of irrigations, (v) socio-economic condition of farmers.

Sampling Design

Sampling design relates to the four stage sampling i.e selection of districts, selection of blocks, selection of villages and selection of respondents i.e DSR adopters.

Selection of districts

For the Selection of the districts for the study maximum area under cultivation, district wise productivity of the crop and maximum numbers of adopters of DSR technology (district wise) was given utmost importance. Earlier when we choose the topic for the study and presented synopsis before departmental review committee then it was assumed that Kaithal and Kurukshetra were the two top districts in terms of area under paddy crops .But when I studied in detailed and compared district wise data obtained from Department of Agriculture and Farmers Welfare, Govt. of Haryana, then it was found that Karnal and Kaithal are two top districts which best fit in all the above criteria. Besides, the geographical consideration was taken into account. Karnal lies on National highway no.1 while Kaithal lies on national highway no.65. The district wise data of area under rice for the year 2014-15 and 2015-16 is shown in table 1 while Table 2 provides information about the area under rice with DSR technique .It had become clear from these two tables that among all the major paddy growing districts Karnal and Kaithal were top two in terms of total area under the rice crop as well as area under DSR technique. So these district of Haryana were selected purposively for conducting the study.

Table-1 District-wise area under rice in Haryana (Area in '00' Ha)

District	2014-15	2015-16
Karnal	**1725**	**1722**
Kaithal	**1614**	**1618**
Jind	1229	1293
Kurukhetra	1195	1196
Fatehabad	995	1105
Sonepat	881	1073
Ambala	830	845
Sirsa	812	924
Panipat	750	758
Yamunanagar	702	740
Hisar	478	617
Rohtak	414	438
Jhajjar	350	369
Palwal	342	344
Bhiwani	210	248
Faridabad	112	122
Panchkula	93	93
Mewat	66	75
Gurgaon	50	54
Rewari	20	22
Mahendergarh	0	0

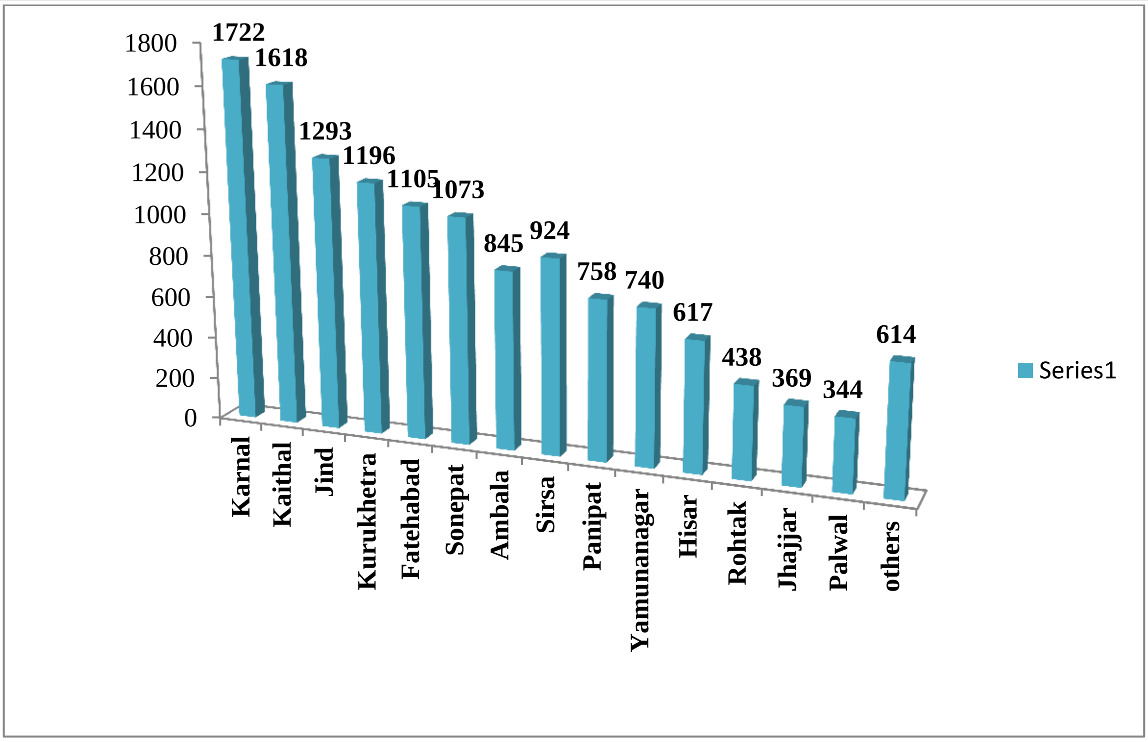


Fig. 1: District-wise area under Rice crop in Haryana in 2014-15

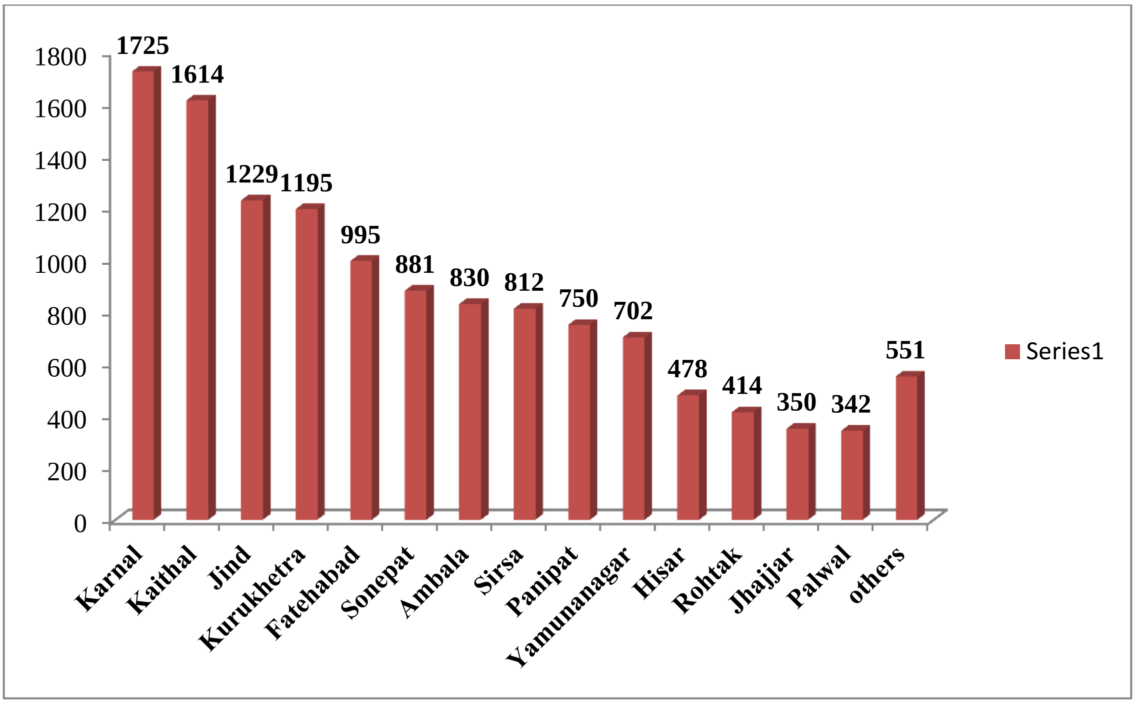


Fig. 2: District-wise area under Rice crop in Haryana in 2015-16

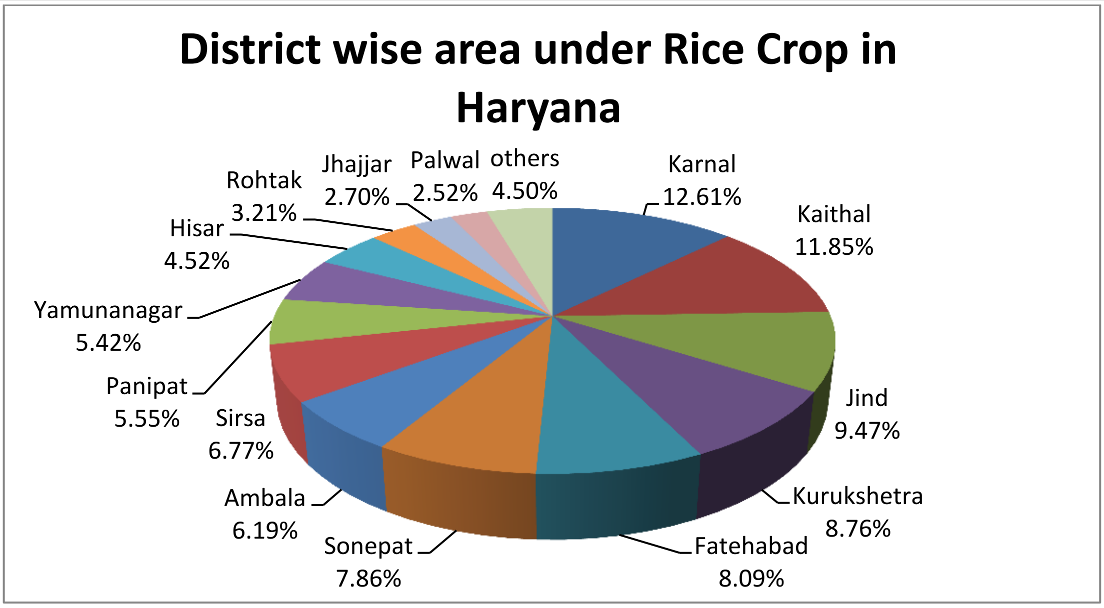


Fig. 3: District wise Percentage of area under Rice crop in Haryana

Table 2: DSR demonstration plots in Haryana under RKYV scheme (2014-2015)

SN	District	Demonstration Allotted	Demonstration executed
1	**Karnal**	**4000**	**2444**
2	**Kaithal**	**1500**	**1475**
3	Sonepat	1000	1000
4	Palwal	1000	1000
5	Jind	800	800
6	Kurukhetra	2000	549
7	Panipat	500	500
8	Fatehabad	500	500
9	Sirsa	500	500
10	Bhiwani	200	200

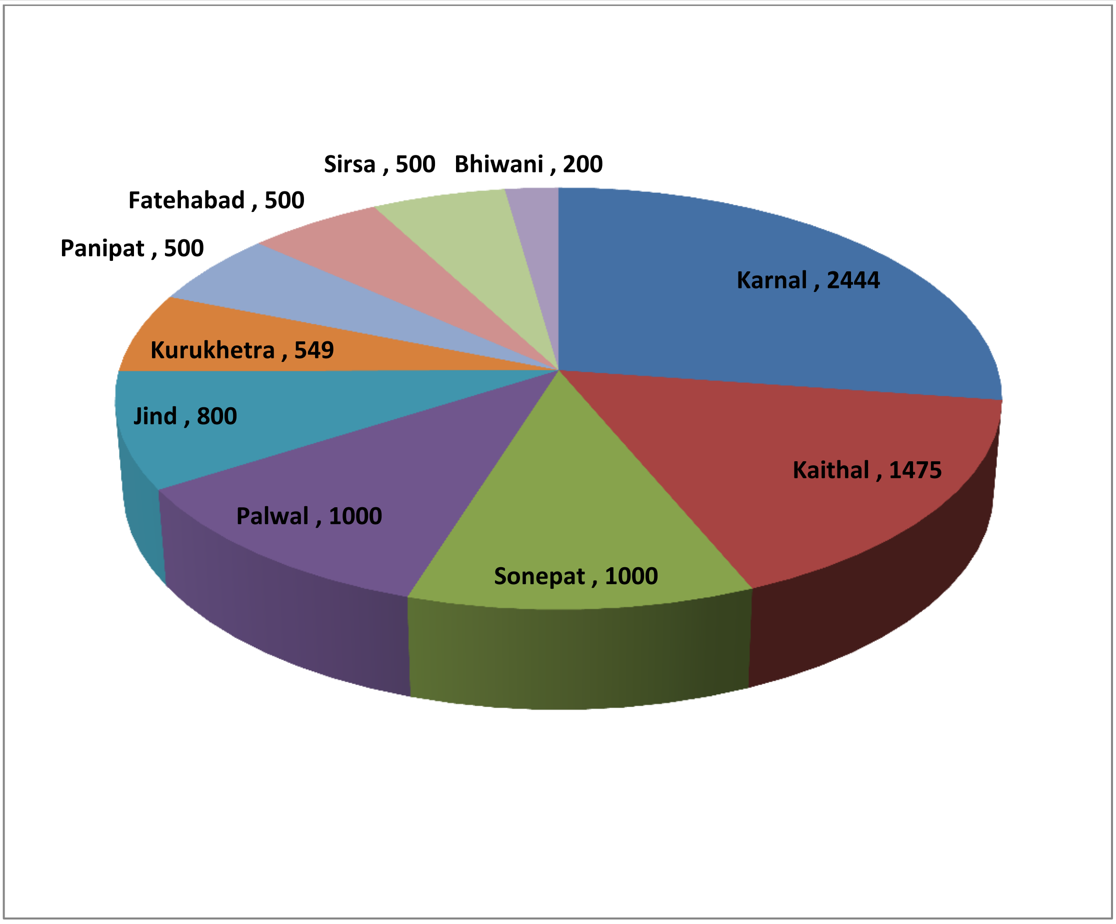


Fig. 4: District-wise no. of demonstration plot (DSR) executed in 2014-15

General information about the selected districts

A) Karnal

Karnal is one of Historical Districts of Haryana. It is also known as a city of 'Daanveer Karn'. It is known all over the world for production of Rice, Wheat and Milk. It is also known for agriculture research Institutions like NDRI, CSSRI, Wheat Research Directorate, National Bureau of Animal Genetics Resources, Sugarcane Breeding Institute etc.

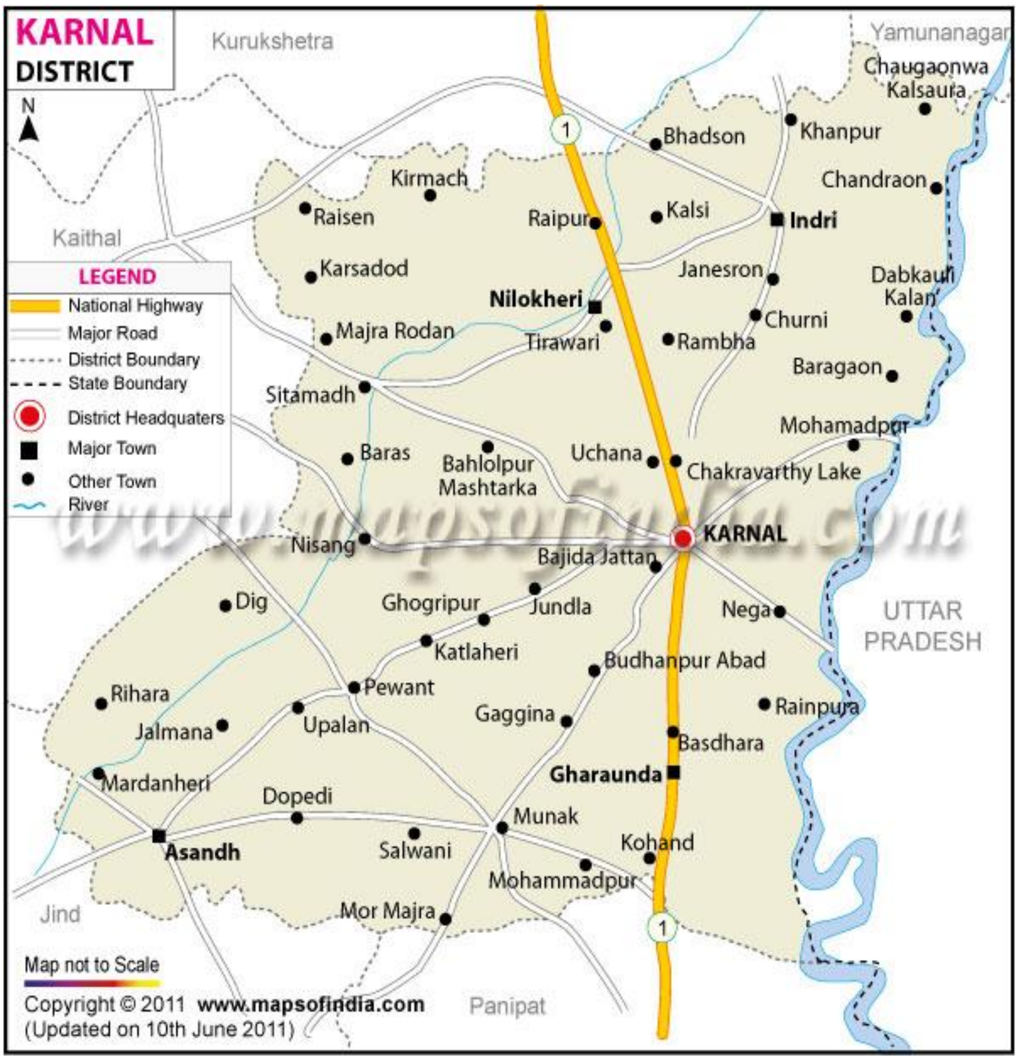
Socio-economic status of sampled farmers

An understanding of the socio-economic condition of the sampled farmers provides an insight to the farm situation and the background information regarding the decision making pattern of farm households under study domain. Details of the socio-economic information are presented in Table 3.Majority of the farmers in the study domain were medium (2-5 ha) holding farmers i.e. 41.26% with average family size of seven members. Small holding farmer category (0-2 ha) included 28.82% of the sampled farmers with average family size of six members. Other (large) farmer (more than 5 ha) category included 29.91% of sampled farmers with average family size of nine members.

Educational status especially higher education was one of the major factors for the decision making, in case of small holding farmers 36.02% were highly educated and only 14.38% illiterate. In case of medium, more than 60% were above secondary and farmers having more than 5 ha, 41.17% were highly educated (Table 3).

Table 3: Socio-economic details of farmers in study area (Karnal district)

Particulars	Small (0-2 ha)	Medium (2-5 ha)	Others (> 5 ha)
No. of farmers (%)	28.82	41.26	29.91
Average size of family (No.)	6	7	9
Education of head of household (% of total)			
Illiterate	14.38	9.71	8.82
Primary	18.33	27.12	21.58
Secondary	31.25	36.38	28.44
Higher	36.02	27.75	41.17



Karnal is important city on Delhi Ambala Rail Line & Sher Shah Suri Marg (G.T.Road), connected with all important places in the country. It is 123 Kilometer from Delhi & 130 Kilometer from Chandigarh. Karnal District lies on the western Bank of river Yamuna which once flows about 11 Kilometer to the east forming eastern boundary of the district. The river Yamuna separates Haryana from Utter Pardesh. The Karnal Distt. including Panipat lies between 29'09'50" and 29'50' North latitude and 76 31' 15" and 77 12'45" East longitude, its height from sea level is between 235 and 252 meters. The Karnal Distt. is surrounded by Kurukhetra District on its north-west, Jind & Kaithal district on its west, Panipat district on its south and Utter Pradesh on east.

Table 4: Cropping pattern of Karnal District (2013-14) (Ha)

Kharif Crops					Rabi Crops			
Paddy	Sugarcane	Cotton	Bajra	Moong	Wheat	Gram	Pluses	Oil Seeds
1,50,000	2,500	3,000	12,000	1,200	1,71,000	500	500	300

GEOGRAPHICAL / PHYSICAL ASPECTS

Yamuna River forms eastern boundary of the district and flows from north to south. The district is a part of the Ganga-Sindus (Indo-Gangestic) plains and has a well spread net work of western Yamuna canal. Its geographical area has been divided in to three agroclimatic regions, Khadar, Bhangar and Nardak belt. Khadar starts from Indri-Karnal road one mile away from Karnal covering the area in between Yamuna river and National Highway Road No.1 upto Patti-Kalyana village. Bhangar area starts from west of Khadar area covering Gharaunda, development block. The nardak area lies in Nissing, Nilokhisi and Assandh development block. However, its water is saline and not fit for irrigation.

Blocks of Karnal (6): Karnal, Nilokhisi, Indri, Gharaunda, Nissing and Assandh.

Table 5: Classification of Area (2009-10) of district Karnal

Sr. No.	Particulars	Area '00' (in hectare)
1	Total area according to village papers	2462.51
2	Barren and unculturable land	127.1
3	Land put to non-agriculturable uses	149.09
4	Forest	8.99
5	Culturable Waste	6.3
6	Permanent Patures and other grazing land	100.24
7	Land under misc. trees/crops and groves	8.5
	not included in net area sown	
8	Current follows	92.72
9	Follows land other than current follows	-
10	Net area sown	1969.57
11	Area sown more than once	1919.57
12	Total cropped area	3889.14

(Source: Karnal website)

Table 6: Area under main crops (2009-10) of Karnal

Sr. No.	Name of crop	Area (100 ha)	Per cent to total cropped area
1	Wheat	1714	44.07
2	Rice	1715	44.1
3	Sugarcane	80	2.06
4	Bajra	12	0.31

B) Kaithal

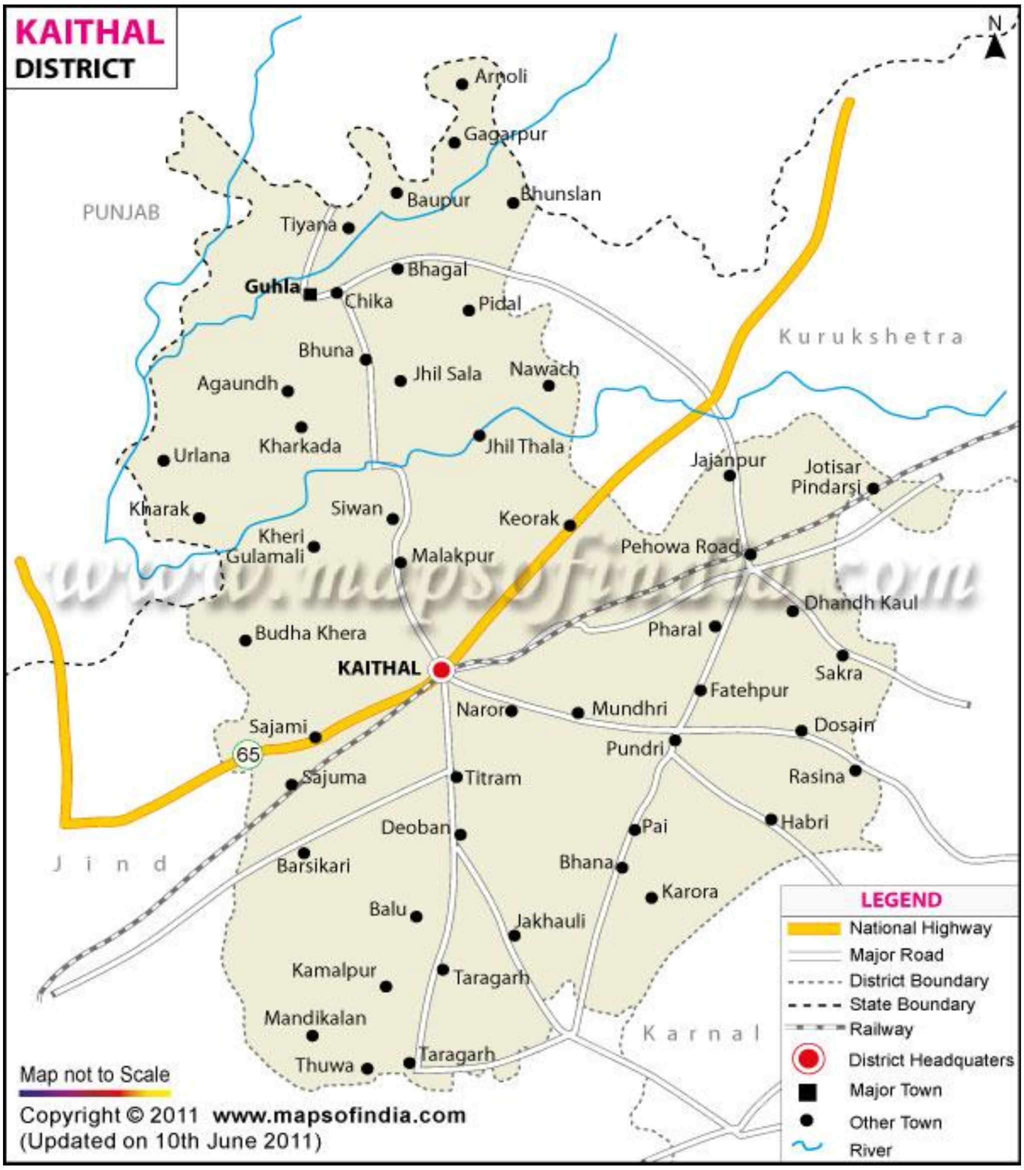
Kaithal came to existence as district of Haryana in 1989. Kaithal district is situated in the North-West of the state. Its North-West boundaries which include Guhla- Cheeka is attached to Punjab State. It has Kurukhetra in North and Nissing, Assandh area of Karnal district. Kaithal is attached to Jind in South and to Karnal in East. Kaithal is spread over 2317 Sq. km. Geographical area. Its total population according to 2001 census is 945631, 80.61% population reside in villages whereas 19.39% population reside in cities. There are 277 villages and 253 Punchayats in Kaithal districts. Kaithal district consists of two sub-divisions two tehsils namely Kaithal & Guhla

& five sub-tehsils namely Pundri, Rajaund, Dhand, Kalayat and Siwan. The name of Kaithal, Pundri, Pharal, Siwan and Kalayat show that the soil of Kaithal has been religious and cultural rich hisitage.

Socio-economic status of sampled farmers in Kaithal district

An understanding of the socio-economic condition of the sampled farmers provides an insight to the farm situation and the background information regarding the decision making pattern of farm households under study domain. Details of the socio-economic information are presented in Table 7

Majority of the farmers in the study domain were small holding farmers i.e. 53.44% with average family size of seven members. Medium farmer category (2-5 ha) included 25.26% of the sampled farmers with average family size of six members. Other (large) farmer (more than 5 ha) category included 21.31% of sampled farmers with average family size of eight members.



Educational status especially higher education is, one of the major factors for the decision making, in case of small holding farmers 46.24% were higher educated. Only 11.49% were illiterate. In case of medium, more than 60% were above secondary and farmers having more than 5 ha, 31.39% were highly educated.

Table 7: Socio-economic details of farmers in study area (Kaithal district)

Particulars	**Small (0-2 ha)**	**Medium (2-5 ha)**	**Others (> 5 ha)**
No. of farmers (%)	53.44	25.26	21.31
Average size of family (No.)	7	6	8
Education of head of household (% of total)			
Illiterate	11.49	8.61	12.78
Primary	16.22	18.02	16.62
Secondary	26.05	39.68	31.39
Higher	**46.24**	**33.66**	**39.20**

Table 8: Block statistics view of district Kaithal

Sr. No.	**Item**	**Kaithal**	**Guhla**	**Rajound**	**Pundri**	**Kalayat**	**Siwan**
1	Population	211114	116016	101659	197679	112458	99367
2	Male	112905	61042	54647	105192	60227	51918
3	Female	98209	54974	47012	92487	52231	47449
4	(0 - 6 Yrs.)	28281	15516	13266	25300	14376	13760
5	SC	46272	32247	26595	43126	23542	31096
6	Literate	120129	65161	58565	120400	63265	57712
7	No. of Households	39252	21718	19233	37933	20990	18893
8	No. of Villages	60	70	23	47	28	39
9	Sex Ratio	870	900	860	879	867	914
10	Sex Ratio (0 -6Yrs.)	834	820	854	804	834	844
11	Literacy rate	66%	65%	66%	70%	64%	67%

(Source: Census of India 2011)

Selection of blocks

The data related to area under direct seeded rice collected from the state agriculture deptt. The block wise data pertaining to area under DSR was arranged in descending order. Among various blocks of two selected districts two blocks from each district were selected on the basis of larger area under rice cultivation with DSR technique. In this way Asandh and Nissang block from Karnal district and Kaithal and Pundri blocks from Kaithal district were selected.

Selection of the villages

A list of villages prepared on the basis of area under DSR in the selected blocks. Three villages were selected from each selected block having maximum number of farmers adopting DSR technology. Village-Assandh, Ballah and Chochra from Assandh Block and Village Nissang, Bastli and Gogripur from Nissang block of Karnal district were selected (Table-9).

While village Titram, Guhna and Kutabpur from Kaithal block and Dhand, Karora and Bhana villages were selected from Pundri block of Kaithal district (Table 10).

Table 9: Selected villages/farmers from Karnal district

Block-Assandh						**Block -Nissing**				
	Village	**Small**	**Medium**	**Large**	**Total**	**Village**	**Small**	**Medium**	**Large**	**Total**
1.	Assandh	4	6	12	20	Nissing	5	6	9	20
2.	Ballah	5	6	9	20	Bastali	6	6	8	20
3.	Chochra	3	5	12	20	Gogripur	4	5	11	20

Table 10: Selected villages/farmers from Kaithal district

	Block-Kaithal					Block –Pundri				
	Village	Small	Medium	Large	Total	Village	Small	Medium	Large	Total
1.	Titram	3	7	10	20	Dhand	6	7	7	20
2.	Guhna	4	7	9	20	Karora	4	5	11	20
3.	Kutabpur	5	5	10	20	Bhana	4	6	10	20

Selection of the farmers

After selection of villages, 20 farmers from each village, who have experience of both DSR and conventional methods of rice cultivation, were selected randomly for the study. In total, 240 farmers were selected from both the district. The questions were framed fulfilling the objectives like use pattern of DSR in rice cultivation, economic impact of this conservation technology (DSR) and to identify the constraints in adopting this technology.

Collection of the secondary data

The secondary data pertaining to the area under DSR was obtained from Department of Agriculture, Haryana. The information related to DSR technology was collected from various sources and presented in the tabulated form.

Collection of the primary data

Primary data was collected by asking question from the Questionnaire prepared for the specific information related to the farmers. The constraints, the cost of production of DSR and TP were estimated with the specific questions and the rates were taken from the shops for various inputs. The district wise data was compared by taking average of costs under different headings starting from preparatory tillage to the rent value of the land.

Economics of DSR and TPR

Computation of costs

The total costs were divided into two broad categories.

(a) Variable costs
(b) Fixed costs

Variable costs

These were the costs which were the actual costs along with incidental charges incurred towards labour and material costs.

Preparatory tillage

Preparatory tillage includes ploughing, harrowing, laser leveling, planking and puddling costs. The information was collected from the farmers by asking the costs they had incurred in DSR and TPR.

Pre and post sowing irrigation costs

Pre and post sowing irrigation costs were estimated based on the data collected from the farmers in different villages. The mean of the costs were taken and presented in the tables.

Sowing cost

Sowing cost includes sowing the seed with Direct Sowing Rice –cum – Fertilizer Machine in DSR and labour cost involved transplanted rice.

Application of FYM

Well rotted farm yard manure was applied in both the conditions were analyzed and the cost was estimated in terms of trolley applied per acre. The rates of trolley in different districts were collected from the farmers under study and average expenses were worked out.

Application of chemical fertilizers

Chemical fertilizer application cost was worked with the information collected from the respondent farmers. Some farmers who applied Diammonium phosphate (DAP) and others who applied single super phosphate were separately analyzed and the values were as a whole was pooled and likewise the costs of urea and zinc sulphate were worked out. The rates were taken at district levels from the government as well as private firms and based on these total expenses on fertilizer application was worked including labour costs.

Irrigation

Irrigation cost including labour cost and irrigation charges were estimated district wise.

Weed management

Each respondent under study was asked about the input (herbicide) used for management of weeds, The hoeing and weeding costs were also estimated with the labour cost involved at district level.

Plant protection Cost

The input cost on plant protection in both DSR and TP were asked from the respondents and estimated. The cost of application i.e. labour cost was also estimated.

Harvesting and threshing

The harvesting cost included the manual as well as combine used by respondents differently at district levels in DSR and TPR individually and worked out with means in the tabulated form.

Miscellaneous costs

The different operations which were not enumerated in the above costs were taken in miscellaneous costs and estimated at district level both in DSR and TPR and compared accordingly.

Fixed costs

Land rent: The prevailing land rent in the study area was considered.

Interest on working capital: This was calculated on the entire working cost of the enterprise at the prevailing bank interest rate. It was calculated for one crop season.

Cost of cultivation: It was the sum of variable costs and overhead cost on per ha basis.

Returns measures

The value of main product and byproduct was calculated by converting the value of byproducts into the product so as to work out the cost of cultivation for the estimation. The data pertains to agricultural year 2015-16. Gross returns were obtained by multiplying the total product with the price realized.Net returns over operational cost: Net returns were obtained by deducting the total costs incurred from the gross returns obtained.

Data Analysis Technique

Resource use efficiency The prime objective of any farm is to coordinate the farm resources and its utilization in the production process so as to obtain a maximum profit out of it. In order to study the productivity of various resources employed in conventional and conservation agricultural practice under rice crop production, regression analysis is a useful tool in analyzing the resource productivity in any production activity including farming. Different types of production functions such as linear, quadratic, square root, semi log and Cobb-Douglas functions were attempted to exhibit the relationship between inputs and the outputs for the pooled data in the sample farms. The Cobb-Douglas production function which gave the best fit for resource use efficiency was selected to establish the data of year 2015-16 was taken. The Cobb-Douglas type of production function had been the most popular of different algebraic forms of production functions available, as it provided a compromise among (i) adequate fit to the data, (ii) computational simplicity, and (iii) sufficient unused degrees of freedom for statistical testing. One of its serious limitations was that it accommodated constant/ increasing/decreasing marginal productivity and did not allow an input-output curve embracing all the three relationships. Despite of this limitation, it had the greatest use in diagnostic analysis as the regression parameters represented the elasticities and reflected the marginal productivity at the geometric mean level of the input and the output. Because of such overwhelming advantages over the other forms, Cobb-Douglas type of production function was employed for the current study. The relative merits of this function are well documented by Heady and Dhillon. The same model was used by many researchers like Khusro, Hanumantha Rao, Bahadur *et al*., Singh *et al*. and Koppad *et al*. All these workers followed the Cobb-Douglas production function model due to its relative flexibility, case in computation and theoretical fitness to the farm data.

In order to examine the resource productivity and the efficiency of farmers in the use of resources, all relevant explanatory variables namely, seed expenditure (X_1),fertilizer expenditure (X_2), irrigations expenditure (X_3), plant protection expenditure (X_4) and labour (human+ mechanic) (X_5), in value terms were included in the analysis.

The specific Cobb-Douglas type of production function used for the study was:

$$Y = aX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} \mu \quad \text{……….} (1)$$

Where,

a = Intercept
Y = Output value (₹/ha)
X_1 = Seed expenditure (₹/ha)
X_2 = Fertilizer expenditure (₹/ha)
X_3 = Irrigation expenditure (₹/ha)
X_4= Plant protection expenditure (₹/ha)
X_5= labour (human +machine) expenditure (₹/ha)
μ = Random error term

b_1, b_2….b_5 are the output elasticities of respective inputs. The summation of these gave returns to scale. The equation (1), after logarithmic transformation took the linear form; the parameters were estimated using the Ordinary Least Square (OLS) method. $\ln y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + U$ ….. (2)

The resource use efficiency could be judged based on the marginal value productivity (MVP), which indicates the increase in the gross return from the use of an additional unit of a given inputs while keeping the level of other inputs constant. The marginal value product (MVP) of the i^{th} input factor was measured by using the following formula:

$$MVP = bi \frac{(\bar{Y})}{(\bar{X}i)}$$

Where,
MVP = the marginal value productivity of input factor
$\bar{Y}$ = Geometric mean of output.
$\bar{X}i$ = Geometric mean of expenditure on respective input factor (x_i)
b_i = The elasticity of output with respect to the expenditure on respective input factors.

Use pattern of direct seeded rice (DSR) technology

The detailed results about the use pattern of DSR in the study area are discussed below

Area under DSR in the study area

The use pattern of direct seeded rice technology in study area is presented in Table 11. The table showed that in Karnal district 2444 acre of rice was cultivated under DSR methods in year 2014-15 and increased to 4000 acre in 20154-16.On the other hand 1475 acre of rice was cultivated in Kaithal District in 2014-15 and increased to 7500 acre in year 2015-16. This was an indication that the DSR technology was becoming popular among farmers and level of adoption was increasing.

Table 11: Area under DSR in the selected districts (Area in acre)

Year	Karnal	Kaithal
2014-15	2444	1475
2015-16	4000	7500

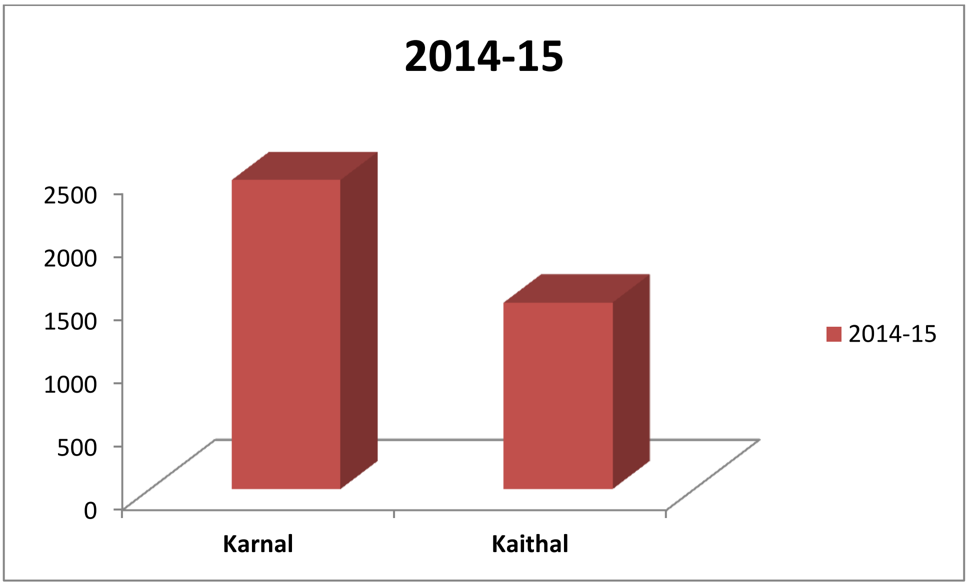


Fig. 5: Area under DSR in selected district during 2014-15

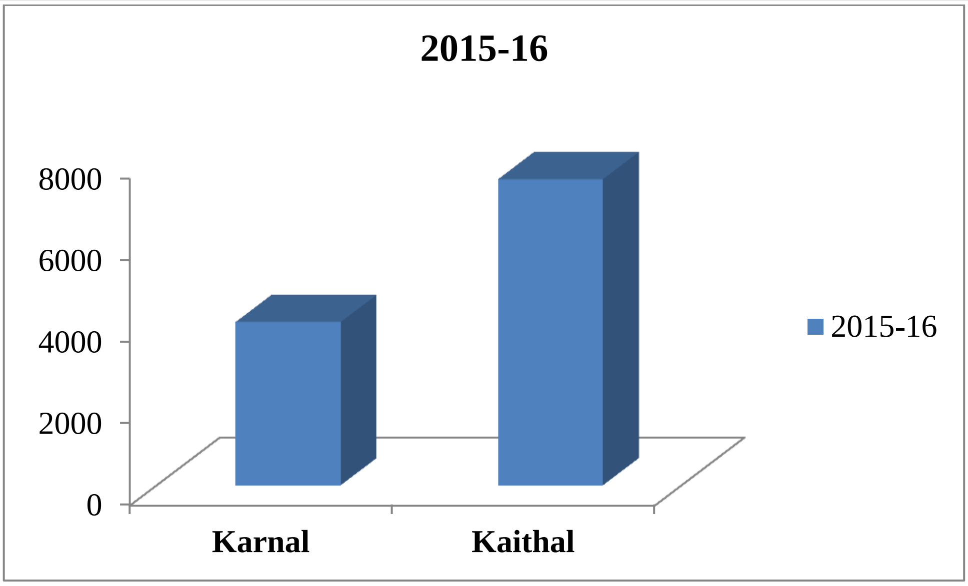


Fig. 6:Area under DSR in selected district during 2015-16

Mass media exposure of farmers

This section comprises different types of media used by the farmers and the extent of their utilization for seeking information regarding farming. The data pertaining to mass media use by farmers of both the districts i.e Karnal and Kaithal, pooled together presented in Table 12 clearly indicate that newspaper and radio were highly used for obtaining agricultural information, while magazines and Kisan Seva Kendra (KVK's) were moderately used mass media, whereas they have least used the source like TV and internet.

Table 12: Mass media exposure of farmers (N=240)

S. No.	Mass media	Used	Extent of utilization			Total score	Weighted mean score	Rank order
			Daily (3)	Often (2)	Some times(1)			
1.	TV	42 (17.5)	0 (0)	8 (8)	34 (17)	25	0.20	V
2.	News Paper	124 (51.66)	86 (129)	26 (26)	12 (6)	161	1.34	I
3.	Radio	86 (35.83)	2 (3)	12 (12)	72 (36)	51	0.42	II
4.	KisanSeva Kendra	48 (20)	0 (0)	26 (26)	22 (11)	37	0.30	IV
5.	Magazine	42 (17.5)	4 (6)	32 (32)	6 (3)	41	0.34	III
6.	Internet	30 (12.5)	0 (0)	10 (10)	20 (10)	20	0.16	VI

Contact status of farmers with Extension functionaries

This section comprises contact of farmers with various extension officials and the frequency of their contact. Various extension officials with whom the farmers had contacts are enlisted in Table 13 with their frequency of contacts.

It is apparent from Table 13 that among the extension contacts of farmers, the most popular contact sources were ADO who ranked first with the weighted mean score 1.93 followed by progressive farmers and scientist which ranked second and third among extension contacts with weighted mean score of 1.10 and 0.66, while NGO and SDAO/SMS ranked fourth and fifth with weighted mean score of 0.55 and 0.27, respectively.

Table 13: Extension contact status of farmers (N=240)

S. N.	Extension official	Frequency of contact					Total score	Weighted mean score	Rank order
		Weekly (4)	Fortnightly (3)	Monthly (2)	Whenever needed (1)	None (0)			
1.	Progressive farmers	36 (72)	14 (21)	24 (24)	32 (16)	134 (0)	133	1.10	II
2.	ADOs	34 (136)	13 (39)	8 (16)	41 (41)	24 (0)	232	1.93	I
3.	Scientist	2 (8)	6 (18)	11 (22)	32 (32)	69 (0)	80	0.66	III
4.	SDAO/SMS	1 (4)	0 (0)	6 (12)	17 (17)	96 (0)	33	0.27	V
5.	NGO	10 (40)	0 (0)	13 (26)	0 (0)	97 (0)	66	0.55	IV

Farmers' Adoption Level of DSR Cultivation Technology

Adoption refers to a decision for full scale continued use of an innovation over a period of time. It is a mental process through which an individual passes from first hearing about an innovation to its final adoption. In between, the adopter tests the innovation in question for its suitability and applicability under his farm conditions. He is subjected to many other considerations, before the final decision is taken to adopt the recommended technology. As a result, the technology recommendation gets different level of adoption by the users. In the present study, an effort was made to ascertain the farmers' adoption level of DSR cultivation technology practices recommended by CCS Haryana Agricultural University, Hisar in Haryana state. Table 14 shows the adoption level of farmers on major aspects of DSR technology.

Table 14: Farmers' use pattern of DSR cultivation technology (N=240)

S. No.	Statements	Adoption level			Total weighted score	Weighted mean score	Rank order
		Fully adopted (%)	Partially adopted (%)	Not adopted (%)			
1.	Land preparation	216 (90)	18 (7.50)	6 (2.50)	345	2.88	III
2.	Method of sowing	120 (100)	0	0	360	3.00	I
3.	Preparation and sowing	96 (40)	114 (47.5)	30 (12.5)	273	2.28	XII
4.	Depth of sowing	224 (93.33)	16 (6.67)	0	352	2.93	II
5.	Recommended variety sown	164 (68.33)	16 (6.67)	60 (25)	292	2.43	IX
6.	Sowing time	134 (58.83)	96 (40)	10 (4.16)	302	2.52	VIII
7.	Recommended seed rate used	62 (25.83)	102 (42.5)	76 (31.67)	233	1.94	XIII
8.	Seed treatment	228 (95)	8 (3.33)	4 (1.67)	352	2.93	II
9.	Recommended weedicides use	206 (85.83)	32 (13.33)	2 (0.83)	342	2.85	IV
10.	Flat pan nozzle used for spray	240 (100)	0	0	360	3.00	I
11.	Time of irrigation	100 (41.67)	128 (53.33)	12 (5)	284	2.37	XI
12.	Interval schedule of irrigations followed	198 (82.5)	38 (15.83)	4 (1.66)	337	2.81	V
13.	Recommended dose of fertilizers used	18 (7.5)	140 (58.33)	82 (34.17)	208	1.73	XV
17.	Disease control	79 (65.83)	33 (27.5)	8 (6.67)	311	2.59	VII
18.	Insect-pest control	78 (65)	37 (30.83)	5 (4.17)	313	2.61	VI
19.	Harvesting at proper time	54 (45)	58 (48.33)	8 (6.67)	286	2.38	X

The rank order of different items revealed that 'method of sowing' and 'flat pan nozzle used for spray' as ranked 1st with weighted mean score (3.00), 'depth of sowing' and 'seed treatment' were ranked 2nd with weighted mean score (2.93), 'land preparation' ranked

3rd with weighted mean score (2.88), 'recommended weedicides use' and 'interval schedule of irrigation followed' ranked 4th and 5th with weighted mean score (2.85) and (2.81), 'insect-pest control' ranked 6th with weighted mean score (2.61), 'diseases control', 'sowing time' and sowing of 'recommended variety' ranked 7th, 8th and 9th with weighted mean score (2.59), (2.52) and (2.43), 'harvesting at proper time' and 'time of irrigation' ranked 10th and 11th with weighted mean score (2.38) and (2.37), 'preparation and sowing' ranked 12th with weighted mean score (2.28), 'recommended seed rate used' ranked 13th with weighted mean score (1.94), 'recommended dose of fertilizers used' ranked 15th with weighted mean score (1.73).

Overall adoption level of DSR cultivation technology

Table 15: Overall adoption level of DSR cultivation technology N=240

S. No.	Adoption level	Frequency	Percentage
1.	Low	86	35.83
2.	Medium	82	34.17
3.	High	72	30

Data pertaining to overall adoption level of DSR cultivation technology are presented in Table 15. It was found that majority of farmers (35.83 per cent) belonged to low level of adoption followed by 34.17 per cent medium adoption level and 30 per cent with high level of adoption. In nutshell, 70 per cent of farmers had low to medium level of adoption means i.e. farmers had not adopted the full package of practices recommended by the university.

Findings:

The findings regarding overall adoption level of DSR technology, it was found that majority of farmers belonged to medium (34.17 per cent) to high level (30 per cent). It implies that majority farmers (70 per cent) had low to medium level of adoption means the farmers had not adopted the full package of practices recommended by the CCSHAU, Hisar. It may be due to poor knowledge of DSR coupled long attachments with conventional method of cultivation. The study gets support from Kaur *et al.* who reported that considering the need of more technical knowledge for the adoption of DSR technology, the government should organize training programme for skill development.

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