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PROPOGATION OF DIRECT SEEDED RICE - A CASE OF MUKTSAR CITY

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Abstract: *Production of conventional puddle transplanted is facing severe constrains because of water, labour, scarcity & climatic changes. Direct Seeded Rice (DSR) is an alternative to conventional puddle transplanted rice with good potential to save water, reduce labour requirement, mitigate green house gas emission and adapt to climatic risks. Scientists are concentrating in developing suitable varieties and agronomic packages for promoting the DSR. This was cost-effective for farmer', but requires now technological innovation. The article assesses the resource and environmental constraints of conventional puddle transplanted rice production, outlines the production technology of DSR, and suggests option for promotion of DSR.*

Keywords: *Direct Seeded Rice, Conventional Puddle, High weed Infestation, Green House Gas.*

Introduction

Rice is the world's most important crop and is a staple food for more than half of the world's population. Worldwide, rice is grown on 161 million hectares, with an annual production of about 678.7 million tons of paddy (FAO, 2009). About 90% of the world's rice is grown and produced (143 million ha of area with a production of 612 million tons of paddy) in Asia (FAO, 2009).Rice provides 30–75% of the total calories to more than 3 billion Asians. To meet the global rice demand, it is estimated that about 114 million tons of additional milled rice need to be produced by 2035, which is equivalent to an overall increase of 26% in the next 25 years. The possibility of expanding the area under rice in the near future is limited. Therefore, this extra rice production needed has to come from a productivity gain.

The major challenge is to achieve this gain with less water, labor, and chemicals, thereby ensuring long-term sustainability. The Green Revolution technologies (the combination of higher-yielding cultivars, use of agrochemicals, including fertilizer, and irrigation) led to a rapid rise in rice yield, production, and area, which resulted in lower rice prices, thereby benefiting poor consumers in rural and urban areas in Asia . Although the overall increase in rice production has kept pace with population growth in Asia, growth in rice productivity has been declining since 1985 and, in more recent years, has fallen below the population growth rate. If continued, this sluggish growth in rice productivity will cause significant imbalances between long-term supply and demand. In recent years, globally, consumption of rice surpassed production, which has led to the depletion of stocks. Current stocks are at their lowest since 1988 (IRRI, 2008). Because of all these factors, the long-term decline in rice price ended in 2001, with a sharp increase in 2008 to a level that had not been seen for decades (IRRI, 2008). The productivity and sustainability of rice-based systems are threatened because of:

1. The inefficient use of inputs (fertilizer, water, labor),
2. Increasing scarcity of resources, especially water and labor,
3. Changing climate,
4. The emerging energy crisis and rising fuel prices,
5. The rising cost of cultivation, and
6. Emerging socioeconomic changes such as urbanization, migration of labor, preference of nonagricultural work, concerns about farm-related pollution.

The agronomic scientists try to manage the above issues by technological innovations in Asia. Rice is commonly grown by transplanting seedlings into puddled soil (land preparation with wet tillage) in Asian countries. Puddling benefits rice by reducing water percolation losses, controlling weeds, facilitating easy seedling establishment, and creating anaerobic conditions to enhance nutrient availability. But, repeated puddling adversely affects soil physical properties by destroying soil aggregates, reducing permeability in subsurface layers, and forming hard-pans at shallow depths, all of which can negatively affect the following non-rice upland crop in rotation.

Moreover, puddling and transplanting require large amount of water and labor, both of which are becoming increasingly scarce and expensive, making rice production less profitable. Also, the drudgery involved in transplanting a job largely done by women is of serious concern. All these factors demand a major shift from puddled-transplanted rice production (CTTPR) to direct seeding of rice (DSR) in irrigated areas. According to (Pandey & Velasco, 2004) ,low wages and adequate availability of water favor transplanting, whereas high wages and low water availability favor DSR. Depending on water and labor scarcity, farmers are changing either their rice establishment methods only (from transplanting to direct seeding in puddled soil [Wet-DSR]) or both tillage and rice establishment methods (puddled transplanting to dry direct seeding in unpuddled soil (Dry-DSR).

Direct seeding can be categorized as :

a) Wet-DSR, in which sprouted rice seeds are broadcast or sown in lines on wet/puddled soil,
b) Dry DSR, in which dry rice seeds are drilled or broadcast on unpuddled soil either after dry tillage or zero tillage or on a raised bed.
c) Another category of DSR is water seeding, in which sprouted rice seeds are broadcast in standing water.

Wet-DSR is primarily done to manage the labor shortage, and is currently practiced in Malaysia, Thailand, Vietnam, the Philippines, and Sri Lanka but with the increasing shortages of water, the incentive to develop and adopt Dry-DSR has increased. Dry-DSR production is negligible in irrigated areas but is practiced traditionally in most Asian countries in rain fed upland ecosystems. Water seeding is widely practiced in the United States, primarily to manage weeds such as weedy rice, which are normally difficult to control. Both Dry- and Wet-DSR have the potential to reduce water and labor use compared with CT-TPR. In the on-farm studies in the Philippines observed on average 67–104 mm (11–18%) of savings in irrigation water in Wet-DSR compared with CT-TPR when irrigation application criteria was same for both establishment methods. In the Muda region of Malaysia found that irrigation water application in Dry-DSR was about 200 mm (40%) less than that in CTTPR. Similarly, 10–50% savings in water have been claimed with Dry-DSR compared with CT-TPR from India when irrigation application criteria after crop establishment (CE) were either the appearance of hairline cracks or tensiometer based. Similar to saving in water, DSR can reduce total labor requirements from 11% to 66% depending on season, location, and type of DSR compared with CT-TPR. Labor requirements for CE decrease by more than 75% with direct seeding compared with transplanting.

The way DSR is currently practiced differs considerably in different countries. Land preparation (tillage), establishment methods, seed rate, water management, weed management, and nutrient management vary from location to location. For example, seeding rates range from 20 to 60 kg ha1 in South Asia to up to 200 kg ha1 in some Southeast Asian countries. Cleaning and plastering of bunds are an important component of field preparation for both weed and water management in Wet-DSR in Sri Lanka. A mix of traditional and modern practices based on farmers' long experiences and research innovations are being followed.

Although a wealth of available information can lead us to develop DSR technologies that are suitable for wider agro ecological conditions, more innovations are needed in the context of emerging challenges that future rice cultivation is likely to face.

During the past decade or so, there have been numerous efforts to find alternatives to the conventional practice of CT-TPR. Many of these studies have also considered ways to avoid or minimize extensive land preparation/tillage, which most farmers currently practice. In addition, there is a rich body of literature on case studies of DSR from countries where it is practiced widely. We believe that a systematic inventory and critical review of past and recent work would provide insight to enable us to develop efficient and viable rice production systems needed in the twenty first century. Therefore, the purpose of this review is to take stock of DSR. Specifically, we:

1. Analyze the reasons for a shift from puddled transplanting to different types of DSR,
2. Summarize the current management practices of DSR in different countries,
3. Compare the performance of different types of DSR with CT-TPR,
4. Summarize the technological package of Dry-DSR including under zero tillage for major rice-based systems in South Asia, and
5. Suggest future research needs for making direct-seeding systems more productive and sustainable.

We aim to primarily target irrigated or favorable rain fed rice lowlands, which would continue to supply the growing rice demand (presently supplying 75% of world rice from about 50% of total rice area), and where the impact of shifts to DSR in saving of resources (i.e., labor and water) would be the greatest. Various modifications of tillage/land preparation and CE are used to suit site-specific requirements. For the purpose of simplicity, these modifications are commonly referred to as alternative tillage/CE in this chapter. However, specific modifications are described when necessary.

Review of Literature

- **(D E Johnson, 2005)** The study was conducted with weed management option for DSR tested and widely promoted on farmers' field. The project continued field experimentation initiated under project under project R377 around Pantnagar in Uttrakhand and extended the activities to U.P. and Bihar state.
- **(Chauhan, 2012)** Studied methods to provide a logical perspective of what can be done to improve weed management strategies in DSR.
- **(Joshi, Kumar, Lal, & Vyas, 2013)** revieweed the integrated package of technologies for DSR, potential advantages and problems associated with DSR, and suggest likely future patterns of changes in rice cultivation.
- **(Kamalpreet, Prabhjot, & R.K.Dhalwal, 2015)** Five districts of Punjab viz Moga, Muktsar, Faridkot, Sangrur and Patiala were purposively selected based on their crop productivity; majority of farmers had medium level knowledge

Objectives of the study

1. To analyze the area of DSR cultivation,
2. To examine the main problems in DSR cultivation,
3. To study the market of Agri-Input products, used in DSR cultivation.

Hypothesis of the study

1. The area of the Direct Seeded Rice Cultivation increased marginally but comparative to last year the DSR cultivation is decreased due to price fluctuation of Basmati Rice.
2. The main problem in DSR cultivation is the farmers are illiterate and they are having lack of knowledge.
3. Wholesalers and Commission agents have monopoly control over the market of Agri-Inputs.

Area of the study

The study is being conducted in the Muktsar district of Punjab State.

Need of the Study

In Punjab, Direct Seeded Rice (DSR) cultivation is only in few districts. Muktsar is the district which only have the 21% of Direct seeded rice cultivation in the Punjab state. The some other DSR cultivation districts are Ludhiana, Moga, and Fazilka. The area of direct seeded rice in the state has increased marginally during last decade. There are

some companies which are promoting DSR machines and equipments which are related to the cultivation of Direct Seeded Rice. Basmati is the most important variety of the paddy crop which is cultivated in the Punjab state. In previous years Basmati's price has fallen down in the international market which is directly affected to the DSR cultivation. The market size for the food consumption in India is expected to reach US $ 344 Billion till 2025, which shows that there is a huge potential for basmati rice.

The study aims for assessing the area of Direct Seeded Rice and unearthing main problems of Direct Seeded Rice. The results of the study will be useful for policy makers, farmers and inputs agencies involved in promotion of Direct Seeded Rice cultivation in formulation of policies and strategies to boost the cultivation of rice through DSR cultivation.

Limitations of the study

1. The present study about DSR is confined to Muktsar district.
2. There most of the farmers are illiterate

Research Methodology

Description of the study area:

Punjab is in northwestern in India and has an area of 50362 square km. (19445 sq. mi.). It extends from the latitudes 29.30° north to 32.32° north and longitudes 73.55° east to 76.50° east. It is bounded on the west by Pakistan on the north by Jammu & Kashmir on the northwest by Himachal Pradesh and on the south by Haryana & Rajasthan. Most of the Punjab lies in the fertile, alluvial plain with many rivers and an extensive irrigation canal system a belt of undulating hills extended along the north western part of the state at the foot of the Himalayas. Its average elevation is 300 meters (980 ft.) above sea level with the range from 180 meters (590 ft.) in the south west to more than 500 meters (1600 ft.) around the northeast border the southwest of the state is semiarid eventually merging into the Thar Desert the Shiwalik Hills extend along northwestern part of the state at the foot of the Himalayas.

The soil characteristics are influenced to a limited extent by the topography vegetation and parent rock. Punjab's climate is characterized by extreme hot and extreme cold conditions Annual temperature in Punjab range from 1° to 46° c but can reach 49°c in summer and 0°c in winter.

The important crops grown in the state are: wheat, paddy, lady finger, cotton, pearl millet, maize, sugarcane among the fodder crops are bajra and jwar. Punjab comprises 22 districts, Muktsar district is chosen for the study about Direct Seeded Rice Cultivation Technique.

Muktsar District:

Muktsar is located in south-western part of the Punjab state in north India. The city is spread over an area of 12.66 square miles (32.80 square km). The geographical coordinates of the city are 30° 29' 0" North, and 74° 31' 0" East. The average land Elevation of the city is 648.52 feet (197.67 meters) above sea level, Litho logically and density is 348/km^2 (900/sq mi). The district has 4 Blocks comprising 234 villages. The average rainfall is about 351.2 mm annually. Climatically, the western Himalaya in the north and the Thar Desert in the south and south-west mainly influence the climatic conditions. Since the city lies far away from the major river, therefore; it experiences extreme climate situation. Summers are extremely hot, and winters are very cold. The city experiences four distinct seasons; spring (February-March), summer (April-August), fall/autumn (September-October) and winter (November-January) along with the monsoon season setting in towards the later half of the summer. The season experiences heat indices easily breaking 110° F (43°C). Winters are very cold and foggy with few sunny days, and with a December daytime average of 37.4° F (3° C).

Muktsar is a part of the vast Indo-Gangetic alluvial plain, composed of alternate bans of sands, silt and clay with pebbles. Sandy plains, sand dunes and topographic depressions are the common landforms. The soil of Muktsar varies from sandy to loam in texture, and is low in organic carbon, phosphorus, zinc and other micro nutrients, but high

in potassium. The salt affected soil of Muktsar has been categorized as sodic soil and saline sodic soil. The villages surrounding the city produce high yields of cotton, wheat, paddy, ladyfinger and oil seeds.

The main crops of the Muktsar district during kharif season are: Cotton, Paddy, Ladyfinger and Sorghum etc.; the data relevant to these crops according to the area of cultivation (in ha.) of 2014-15 and 2015-16 is given below in the below given Table 1.1

Table 1: Crops of the Muktsar district during kharif season

S. No.	Crops	2014-15 (area in ha.)	2015-16 (area in ha.)
1.	Cotton	74,000	72,000
2.	Paddy	75,9000	80,000
3.	Basmati	74,000	50,000
4.	Ladyfinger	7,000	9,000
5.	Sorghum	2.5	2,000
6.	Others	120	400
7.	DSR	29,400	20,800

Research Design

The present study is focused on the exploratory research design.

Data used

The primary data has been the modus operandi for exploring the difficulties in DSR cultivation whereas, the secondary data has been the base on which the study stands.

Data Source

The primary data for the study has been collected from farmers, dealers and distributors through personal interview method to know the profits of DSR cultivation.

In this study the farmers are predominantly large, medium and small land holders.

Sample population

In this study the farmers are predominantly large, medium and small land holders.

Sample size

The sample for the study was 300 farmers including small, medium and large land holding farmers were selected. More than 50 dealers were selected randomly.

In this study the data was collected from was three tehsils i.e., Gidderbaha, Muluot and Muktsar. More than 300 farmers including small, medium and large land holding farmers and besides 20 dealers and 4 distributors were selected randomly. Details of the sample areas are shown in the below given **Table 2**

Table 2: Details of Tehsils, Villages in the sample

S. No.	Tehsils	Villages
1.	Muktsar	8
2.	Gidderbaha	13
3.	Muluot	1
Total:	3	22

Data collection Source and method:

Primary data source

The primary data for the study was collected from the respondents by personal interview method using pretested schedule. The primary data collected was based on the memory of the respondents. The primary data on the socio-economic characters of the farmer's awareness, land holding, literacy etc. were collected. Besides the data quality and value of various physical inputs, used and the yield obtained, in case of Direct Seeded Rice Cultivation.

Primary data collection method

The primary data had been collected by personal interview method with pre-tested structured schedule prepared for the purpose.

Secondary Data

The secondary data had been collected from Department of Agriculture, Muktsar block.

Chief Agriculture Office, Muktsar, KVK the data related to. Agri-inputs products from Co-operative Societies etc.

Sample area

The study was conducted in Muktsar district of Punjab. The district based on highest area of cultivation of Direct Seeded Rice among districts of Punjab. In Muktsar district there are four sub-districts. Further villages are selected for the purpose of collecting primary data from the respondents.

Period of study

The study had been conducted from commencing from1st July to 31st August 2016 and completed in a period of two month

Results and Discussion

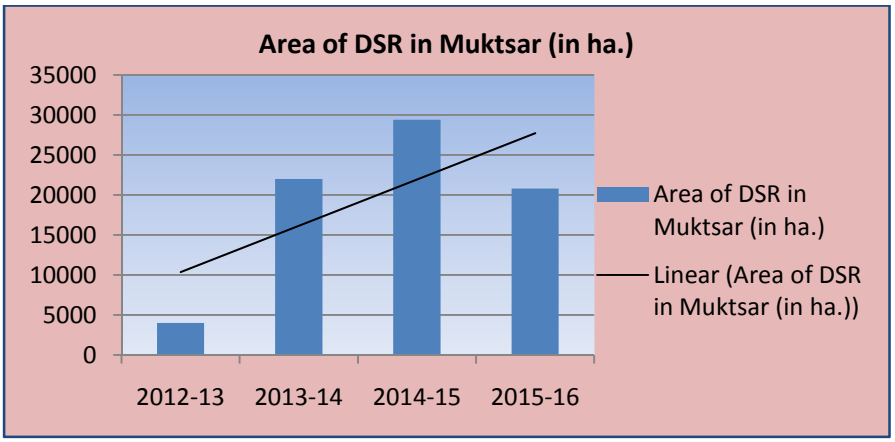
The results of the study are presented in this chapter under the following heads:

1. Examination of the area of DSR Cultivation,
2. Examination the problems and benefits of DSR,
3. Examination of the Agri-inputs.

1. Examination of the area of DSR Cultivation:

The growth rates in respected area of Direct Seeded Rice Cultivation in Muktsar district for the period from 2012-2016 is depicted in given below Figure no.1 the graph shows that area with respected Direct Seeded Rice Cultivation in Muktsar District is decreasing with a negative growth rate of 19.3 %.

Figure 1 Area of DSR in Muktsar



Source: All the data which are mentioned here, is according to Dr. Karamjeet Singh (Project Director ATMA).

Table 3: Area of DSR cultivation in Muktsar District (according to year)

S. No.	Year	Area (in ha.)
1.	2012-13	4,000
2.	2013-14	22,000
3.	2014-15	29,400
4.	2015-16	20,800

Area of DSR Cultivation shared by machine of Industries, Govt. & KVK:

Government and some private industries are also trying to promote DSR by providing machine because it is a better solution of water and labour scarcity. The area distribution is been shown in the Figure no.2 below:

Figure 2 Area of DSR Cultivation shared by machine of Industries, Govt. & KVK

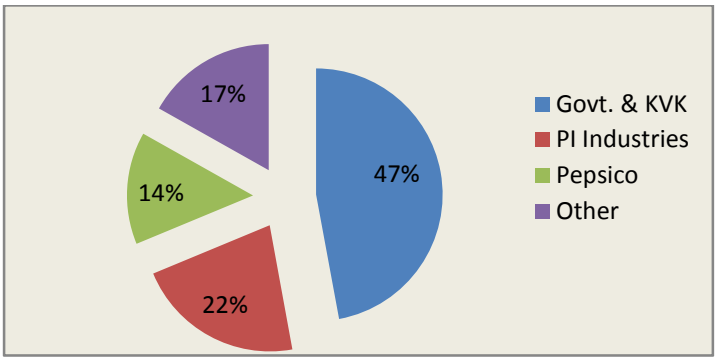


Table 4: Area of DSR Cultivation shared by machine of Industries, Govt. & KVK

S. No.	Particulars	Area (in ha.)
1.	Govt. & KVK	9,800
2.	PI Industries	4,500
3.	Pepsico	3,000
4.	Others	3,500

2. Examination of the problems and benefits of DSR: The main problem in the Direct Seeded Rice is the weed control. The major weeds observed in the study area are:

1. Denebra Retroflexa
2. Ammania Multifora
3. Elusine Indica
4. Solonum Nigrum
5. Euphorbia Spp.
6. Digitania Pasporum
7. Paspalum Spp.
8. Ipoea Aquatica
9. Echinocloa Crusgalli
10. Echinochloa Calona
11. Ischaeum Rugasum
12. Cyprus difformis
13. Cyprus Irea
14. Sripus Spp.
15. Flivrstignis Imilliacae
16. Sagittaria Trifolio

The results revealed that all the treatments gave significant control of weed population. However, the highest weed control was given by manual/hand weeding (98.18%). These findings are that twice hand weeding resulted in lower weed density compared to weedicide and untreated control. As hand weeding is laborious, tedious, and expensive and time consuming method hence cannot be practicable at large scale. Among the weedicides, Nominee Gold gave the highest weed control (90.5%). Rice star and Whip super reduced weed density by 87.19 and 82.08% respectively. The weed control with Saathi was 29.49% that was comparatively lower than other weedicide treatments but it also controls the weeds significantly. The results further revealed that weed density reduced significantly in all the treated plots where as there was 28.34% increase in weed population in untreated (check) plots. It means that in uncontrolled weed fields, their densities continuously remained increasing that may adversely affect the crop growth.

Table 5: Treatments and control

S. No.	Treatments	% of weed control
1.	Nominee Gold	90.5
2.	Ricestar	87.19
3.	Whipsuper	82.08
4.	Saathi	29.49

By choosing Direct Seeded Rice Cultivation method of paddy, the laborious process setting up a nursery, growing paddy seedlings and transplanting them could be easily avoided. Framers would need 30 kg. of rice seeding for one acre while cultivating through transplantation but in Direct seeding only 10 kg. for an acre was needed.

In addition, 10 labourers are needed for each acre while transplanting seeding on the other hand a tractor and four liter of diesel is all one needs in direct seeding. Direct seeding did not even need much fertilizer; only two quintals as compared to the five quintals consumed during the traditional process involving transplanting. Direct seeding is also faster than its traditional counterpart.

The farmers would continue to use this technique an account of its benefits and lower cost and added that they would educate other farmers in this method of paddy cultivation. It is beneficial for the farmers because by choosing (DSR) this they will be able to gain more profit and to reduce input-cost.

The transplanting method, although cost-effective in controlling weeds, may not be feasible when water availability is low or uncertain. The traditional system of direct seeding such as *gogorancah* in Indonesia and *aus* and *beushani* in Bangladesh evolved mainly in response to rainfall uncertainty. Economic incentives for direct seeding increase when labor scarcity and wage rates are high. Much of the recent spread of direct seeding in Southeast Asian countries has been in response to the rising wage rate. Even though a switch to direct seeding may have lowered rice yield slightly compared with transplanted rice, farmers have found such a change economically profitable.

Examination of the Agri inputs:

1. Applied by farmers

Table 6 Agri inputs applied by farmers

Urea	150 Kg./acre	**********
Zinc	5 kg./acre	**********
Sulphur	5 kg./acre	**********
Mixture	500 gm./acre	**********
Mg	3 kg./acre	**********
Ferrous	1 kg./acre	**********
Zerum	500 ml./acre	**********
12:32:16	50 kg./acre	**********
HERBICIDES	**Nominee Gold**	120 + 120 ml./acre
	Saathi	100 gm./acre
	Rice Star	350 ml./acre

2. Recommended by Agriculture officers/KVK

Table 7 Recommended by Agriculture officers/KVK

INPUTS	*Paddy*	*Basmati*
Urea (46% N)	130 kg./acre	60 kg./acre
Zinc (21%)	20 kg./acre	20 kg./acre
Fe (if light soil) (2-sprays)	1 kg./acre	0.5 kg./acre
HERBICIDES		
Nominee Gold	100-120 ml./acre	100-120 ml./acre
Rice Star	350 ml./acre	350 ml./acre

Discussion:

The result of the presented study is discussed in detail in this chapter. The main focus here is to throw a light on some of the cause responsible for the major trends observed in the

finding. Keeping objectives of the study in mind, the results are discussed under the following heads:

1. Examine the area of DSR Cultivation,
2. Examine the problems and benefits of DSR,
3. Examine the Agri-inputs.

1. Examine the area of DSR Cultivation:

The area of DSR Cultivation could be observed from the table 4. The compound growth rate of area presented in this table. It could be seen in this table that a negative and significant growth rate in area of DSR was observed in Muktsar district. The negative growth rate in the area is mainly just because of lack of knowledge and awareness in the farmers about the application of pesticides and in the Muktsar district farmers are growing Basmati rice by the DSR Cultivation method and currently the price of basmati rice get down compared to the previous years. So, these some reasons are responsible for the negative growth rate of DSR Cultivation in Muktsar, to promote the DSR Cultivation we need to create awareness about the DSR.

2. Examine the problems and benefits of DSR:

In this selected study area the main problems which occurred in DSR Cultivation are weed management and lack of awareness between farmers about DSR. In the DSR Cultivation technique weed management is major problem which farmers are facing there because they have less knowledge about the application time, type and quantity of herbicides or weedicides; sometimes even they are not able to select the right treatment of particular weed just because of lack of knowledge. We can able to handle this problem with the help of table no.5. The farmers are also having less knowledge about the time of sowing and machinery. Govt. and some private industries are providing machinery of DSR and they are also organizing some farmer meetings, fairs and awareness programmes to promote DSR so farmers, have to interact with them by attending such kind of fairs and awareness programmes to know more about DSR Cultivation and to take right solution of their problems regarding with the DSR Cultivation. The DSR Cultivation method is very beneficial for farmers because with the help of this farmers are able to fight with the problem of scarcity of labour and water. Direct Seeded Rice Cultivation is privately profitable for farmers, compared to transplanted rice cultivation technique. A provisional cost-benefit analysis suggests that DSR is also profitable at the national level.

3. Examine the Agri inputs:

In the Muktsar district of Punjab most of the farmers are having less knowledge about the time, type, quantity and application method of agri inputs; so because of this they are facing much kind of problems. It is found during the study; in this district the farmers are using a huge amount of agri inputs which is not recommended and it is useless and it is also very cost effective for the farmers. So it is necessary to spread awareness between farmers about this. We can take a solution of this problem with the help of table no. 6.

Conclusion

It was observed during this study of Direct Seeded Rice (DSR) in Punjab, covering Muktsar district; that majority of the farmers had low level of knowledge about the DSR. So it is necessary that more awareness programmes should be organized to increase knowledge level of farmers regarding Direct Seeded Rice which will help to make a change in present traditional rice cultivation practices. To promote the Direct Seeded Rice Cultivation in Mukatsar PI Industries ltd. is collaborated with KVK, and the company is organizing many awareness programmes on Direct Seeded Rice at KVK campus. Direct seeding is a good alternative of transplanting and yield potential of direct seeded rice is equivalent to the transplanted rice under good water management and weed control conditions. Direct Seeded Rice (DSR) is a feasible alternative to conventional puddle transplanted rice with good potential to save water, reduce labour requirement, mitigate green house gas (GHG) emission and adapt to climatic risks and this is also a good solution of water and labour scarcity problem. The DSR Cultivation method has been proved cost-effective and farmer's friendly so it is very useful for farmers

because by choosing this farmers can gain more and more profit and the input cost will be very less.

References

Chauhan, B. S. (2012). Weed ecology and weed management strategies for dry-seeded rice in Asia. *Weed Technology*, 1-13.

D E Johnson, A. M. (2005). *Promotion of IWM for DSR in Gangetic-planes of India.* FAO.

FAO. (2009). *THE STATE OF FOOD AND AGRICULTURE.* Retrieved from http://www.fao.org: http://www.fao.org/docrep/012/i0680e/i0680e.pdf

IRRI. (2008). *Annual Report 2008*. International Rice Research Institute.

Joshi, E., Kumar, D., Lal, B., & Vyas, A. K. (2013). Management of . *Plant Knowledge Journal* , 119-134.

Kamalpreet, K., Prabhjot, K., & R.K.Dhalwal. (2015). Knowledge level of farmers regarding agronomic practices of direct seeded rice in Punjab. *International Journal of Farm Sciences*, 206-209.

Pandey, S., & Velasco, L. (2004). Trends in crop establishment methods in Asia and research issues. *International Rice Research Institute 2005* (pp. 178-181). Tsukuba,Japan: International Rice Research Institute 2005.