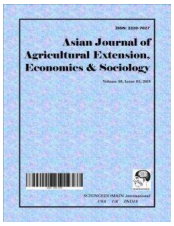

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Role of Custom Hiring Centers in Implementation of *In-situ* Crop Residue Management Scheme in Ambala District (Haryana)

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Authors' contributions

This work was carried out in collaboration among all authors. Author GP designed the study and wrote the first draft of the manuscript. Authors RK and AK managed the analyses of the study. Authors US and HN managed the literature searches. Author Anurag generated the picture. All authors read and approved the final manuscript.

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ABSTRACT

The farmers generally burn the rice residue to vacate their fields for the timely sowing of wheat, because residues interfere with tillage and seeding operations. In Haryana, approximated 27.83 million tons of agricultural residues are produced and out of which 11.22 million ton is surplus every year. The residue of crop can play an important role in the cycling of nutrients as rice straw at harvest contains significant amount of nutrients. Government of India initiated Central Sector Scheme on "Promotion of Agricultural Mechanization for In-Situ Management of Crop Residue" in the states of Punjab, Haryana, Uttar Pradesh and NCT of Delhi during the year 2018 to curb the residue burning. In this scheme, farmers were appraised to set up Custom Hiring Centers (CHCs) at subsidized rates. The subsidy on the selected crop residue management related machinery/

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implements were directly deposited to the accounts of farmers. Information about the scheme was spread via latest ICT tools among the farmers of Ambala district. Hands on training programmes were imparted to CHC owners by Krishi Vigyan Kendra (KVK) for the efficient operation of the machinery/implements during sowing of next crop by mulching or incorporation of the residue.

Keywords: Crop residue; CHCs; implements; subsidy; Ambala.

1. INTRODUCTION

Rice-wheat (RW) cropping system of the Indo-Gangetic Plains has played a significant role in the food security of India. It occupy about 10.3 mha and accounts for 23% and 40% of India's total rice and wheat area, respectively [1]. The two northwestern (NW) states i.e. Punjab and Haryana constitute a highly productive rice-wheat zone in the IGP contributing about 69% of the total food output in the country (about 84% wheat and 54% rice) occupying and this region is called the "food bowl of India." In this concern, it is important to note that 58 percent of cultivated area is under rice-wheat cropping system in Haryana. Out of total paddy area which is around 1.21 m ha, about 65% area of rice was under the cultivation of scented rice and 35% under non-scented rice varieties & hybrids during year 2010-11 in the state [2].

Scented rice varieties are harvested manually as its residue can be used as animal feed and avoid shattering losses during mechanical harvesting. Non-scented rice varieties and hybrids are harvested mechanically by means of combine harvesters. Due to high silica content in rice straw in general and in straw or residue of non-scented rice varieties and hybrids in particular, it is considered poor feed for animals. Thus, farmers generally burnt the rice residue on to their fields to vacate fields for the timely sowing of wheat, because residues interfere with tillage and seeding operations.

In Haryana, approximated 27.83 million tons of agricultural residues are produced and out of which 11.22 million ton is surplus every year [3] and 9.06 million ton of residue burnt every year [4]. The residue of crop can play an important role in the cycling of nutrients as rice straw at harvest contains typical amounts of nutrients are 5-8 kg N, 0.7-1.2 kg P, 12-17 kg K, 0.5-1 kg S, 3-4 kg Ca, 1-3 kg Mg, and 40-70 kg Si per ton of straw on a dry weight basis [5]. Mulching with rice straw along with sowing of wheat in no-till conditions emerged as one of the important system [6] known as In-situ crop residue management. In Punjab the wheat yield in plots sown with happy seeder was significantly more (3.24%) than the conventionally sown wheat [7]. The mulching with rice straw increased wheat grain yield, reduced crop water use by 3-11% and improved WUE by 25% compared with no mulch [8,9]. Therefore we need to adopt the newer technology for sustainability of the rice-wheat cropping system.

Extension services in India have traditionally been funded and delivered by government. Till the 1960s, agricultural extension was purely a function performed under the guidance of the State Departments of Agriculture. ICAR also initiated some programmes such as Lab-to-Land Programme in 1979 and the Operational Research Programme in 1976 that were merged with the KVKs in the 1990s [10]. Likewise to cater the problem of residue burning, the government of India initiated Central Sector Scheme on "Promotion of Agricultural Mechanization for In-Situ Management of Crop Residue" in the states of Punjab, Haryana, Uttar Pradesh and NCT of Delhi during the year 2018 with an outlay of 1152 crores for this scheme. Information, Education and Communication (IEC) were the important component of this scheme and state agri. departments/ KVKs, ICAR Institutes and SAUs are the important partners in this endeavor. The main emphasis of this project was on capacity building, environment building and stimulating young minds for making awareness among all stakeholders for the in-situ crop residue management [11].

2. MATERIALS AND METHODS

Ambala is an intensively rice-wheat growing district in Haryana (Fig. 1). Conventional rice-wheat rotation was being followed on the field from last 15 years. The climate of the area is semiarid, with an average annual rainfall of 1100 mm (75–80% of which is received during July to September), minimum temperature of 0 to 4ºC in January, maximum temperature of 38-42ºC in June, and relative humidity of 67 to 83 per cent throughout the year. It has six blocks i.e. Ambala-I, Ambala-II, Saha, Barara, Naraingarh and Shahjadpur shown in the map (Fig. 1).

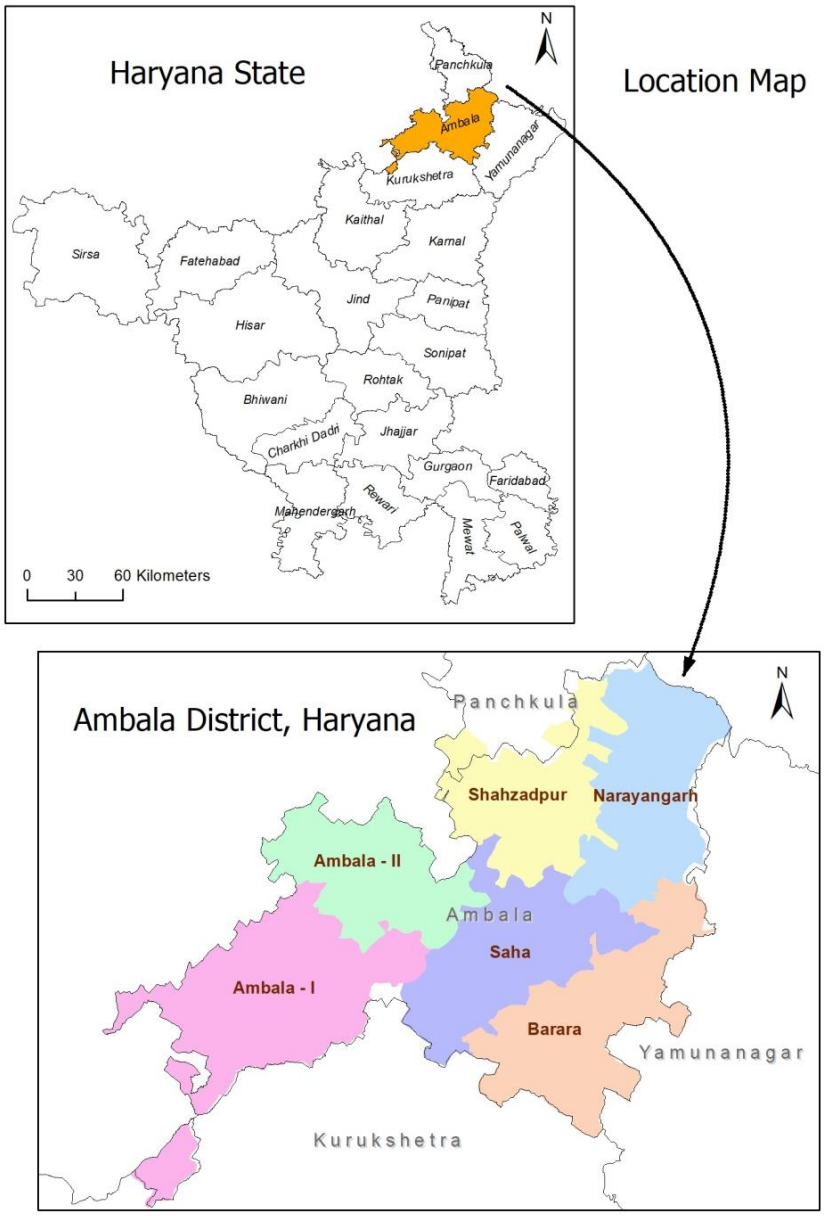

Fig. 1. Location map of Ambala District, Haryana, India

In view of above and in pursuance to the Budget 2018 announcement regarding a special Scheme to support the efforts of the governments of Haryana, Punjab, Uttar Pradesh and the NCT of Delhi to address air pollution and to subsidize machinery required for in-situ management of crop residue, a new Central Sector Scheme on 'Promotion of Agricultural Mechanization for In-Situ Management of Crop Residue in the States of Punjab, Haryana, Uttar Pradesh and NCT of Delhi' for the period from 2018-19 to 2019-20 has been approved.

The scheme was having following objectives:-

- Protecting environment from air pollution and preventing loss of nutrients and soil micro-organisms caused by burning of crop residue;
- Promoting in-situ management of crop residue by retention and incorporation into the soil through the use of appropriate mechanization inputs;
- Promoting Farm Machinery Banks for custom hiring of in-situ crop residue

management machinery to offset the adverse economies of scale arising due to small landholding and high cost of individual ownership.

- Creating awareness among stakeholders through demonstration, capacity building activities and differentiated Information, Education and Communication strategies for effective utilization and management of crop residue.

For the final implementation of the scheme in the Ambala district, a district level executive committee (DLEC) was constituted in which Deputy Commissioner allotted as the Chairman, Deputy Director Agriculture (DDA) as Member Secretary and Assistant Agricultural Engineer (AAE) as Co-Member Secretary of the committee. DLEC was responsible for carrying forward the objectives of the scheme for project formulation, implementation and monitoring. In this notification the individual farmers, Co-operative Societies of farmers, FPOs, Self-Help Groups, registered Farmers Societies/farmers groups, Private Entrepreneurs, Group of women farmers or self-help groups were invited to avail the benefits of scheme.

The newspaper, public agriculture sector, television, radio are the major source of accessing latest information by the farmers in Haryana [12]. Therefore, for wider coverage of the scheme both the agencies i.e. department of agriculture and Krishi Vigyan Kendra-Ambala were also utilized these tools. These were broadcasting of the information about the scheme through newspapers, radio jingles on FM radio and television programmes via DD-Kisan channel. Department of agriculture published the notification in various newspapers and on the official website of department of Agriculture and by using kisan message portal the KVK broadcasted the message about the scheme. Placing of hoardings which address the benefit of using CRM machinery, slogan writing at prominent places in the Ambala district. The leaflets were also distributed among the framers by which they can know about the ill effects of burning, benefits to civil society, improvement in soil health and recent development in crop management related machinery and equipment.

3. RESULTS AND DISCUSSION

In Ambala district for establishment of custom hiring centers and for individual farmers two kinds of schemes were launched i.e. in the first case for CHC, the targeted group have to purchase the machinery from the 8 listed machineries and their cost should be of 35 percent of the total cost of the CHC. The CHC should have minimum of Rs. 10 lac and maximum of Rs. 75 lac. The assistance in the form of subsidy was given as 80% of the project cost of the in-situ crop residue management implements. The remaining other 65% project cost may include other machinery and equipment for crop production for which financial assistance was given as 40% of the project cost. In the other scheme, in which the targeted beneficiary was the individual farmer have to purchase the 1-3 among the 9 listed crop residue management related machinery. The 9 listed machinery were Super straw management system for combine harvester, Happy Seeder, Paddy straw chopper/Mulcher, Shrub master/Cutter cum spreader, Hydraulic reversible mould board plough, Rotary slasher, Zero tillage seed drill and Rotavator. For the purchasing of quality machinery for efficient operation, the government also empaneled the approved manufacturers from the testing agencies.

To curb the residue burning in Ambala, the department has set up the 75 custom hiring centers. Out of 75 CHCs, 17 centers were related to kisan club or societies and 58 related to the farmers. The Ambala district categorized into 6 blocks i.e. Ambala-I, Ambala-II, Saha, Barara, Shahjadpur and Naraingarh. These blocks consists the number of CHCs as Ambala-I (23), Ambala-II (6), Saha (14), Barara (20), Shahjadpur (8) and Naraingarh (4) respectively. The number of implements and their kinds under both the 80 and 40 percent schemes are given in the Tables (Tables 1 and 2). Approximated Rs. 3.50 crore and Rs. 2.71 crore as subsidy under both the CRM and SMAM schemes were disbursed as DBT to the CHCs owner bank accounts. In which 326 and 176 implements were purchased by the CHCs owners under both the schemes respectively [13]. Block wise spatial distribution of the CHCs in Ambala district has been shown in the maps (Maps 2 to 7). For widespread coverage of the area under CRM, we send the details of CHCs to the Farmers of nearby villages via social group network of whatsApp.

For maximum utilization of the budget provided to the department of agriculture and to reach tail end farmers, the individual farmers were also called for the purchasing of limited number of implements under the scheme. In which total 183

individual farmers were purchased the machinery. Out of 183 farmers from whole district, block wise number of farmers i.e. 82, 10, 31, 19, 17 and 24 from Ambala-I, Ambala-II, Saha, Barara, Shahjadpur and Naraingarh respectively purchased the different crop residue related machinery. In terms of type of implement, 22 Happy Seeder, 1 Mulcher, 4 Reversible mould board plough, 11 Rotavator, 20 Straw management system for combine harvester, 7 Straw chopper and 16 Zero till drill were purchased in the Ambala-I block. In Ambala-II block 3 Happy Seeder, 1 Mulcher, 3 Rotavator and 4 Zero till drill were purchased by farmers. In Barara block 3 Happy Seeder, 4 Mulcher, 4 Rotavator,3 Reversible M.B. plough, 2 Zero till drill, 2 S.M.S. and 1 Straw chopper were purchased by farmers Total subsidy of Rs. 1,07,38,788.00 was disbursed into the bank accounts of farmers.

Table 1. List of implements and subsidy disbursed in CRM scheme @ 80% for the year 2018-19

Sr. No	Name of implement	No of implements	Subsidy disbursed (In Lac.)
1	Happy Seeder	78	35,065,766.00
2	Mulcher and Paddy Straw Chopper	60	
3	Reversiable MB Plough	47	
4	Rotatory Slasher	7	
5	Rotavator	71	
6	Shrub Master	9	
7	Super straw Management System (S.M.S)	11	
8	Zero Till Seed Drill	43	
	Total	326	

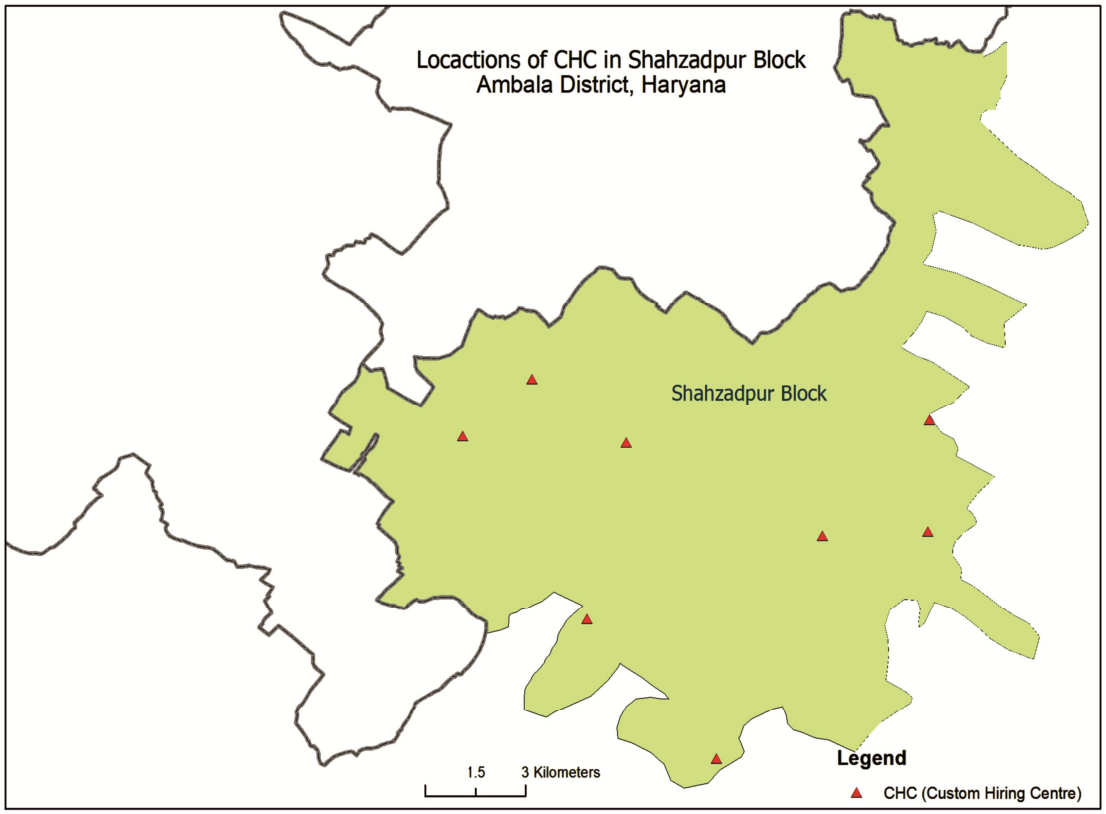

Fig. 2. Location of CHC in Shazadpur block, Ambala, Haryana

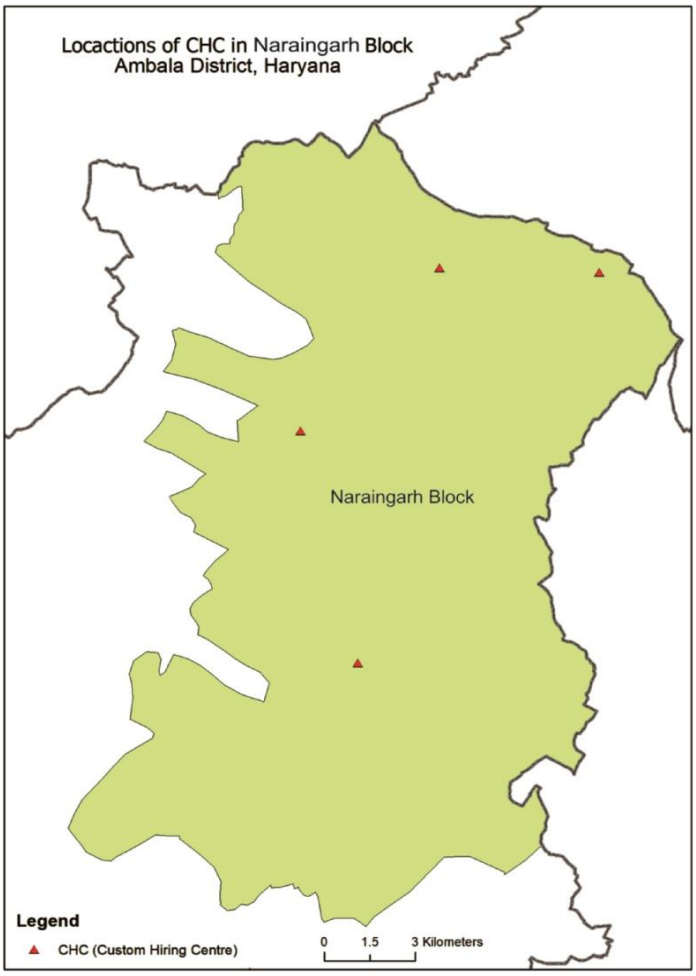

Fig. 3. Location of CHC in Naraingarh Block, Ambala, Haryana

Table 2. List of implements and subsidy disbursed in SMAM scheme @ 40% for the year 2018-19

Sr. No	Name of implement	No of implements	Subsidy disbursed (In Lac.)
1	Combine	1	27,138,108.00
2	Cultivator	17	
3	Disc Harrow	21	
4	Hey Rake	1	
5	Laser Land Leveller	27	
6	Potato Digger	6	
7	Potato Planter	7	
8	Power Harrow	6	
9	Power Tiller	4	
10	Reaper Binder	0	
11	Straw Baller	2	
12	Straw Reaper	8	
13	Tractor mounted spray pump	6	
14	Tractor	70	
	Total	**176**	
	Grand Total	**502**	**62,203,874.00**

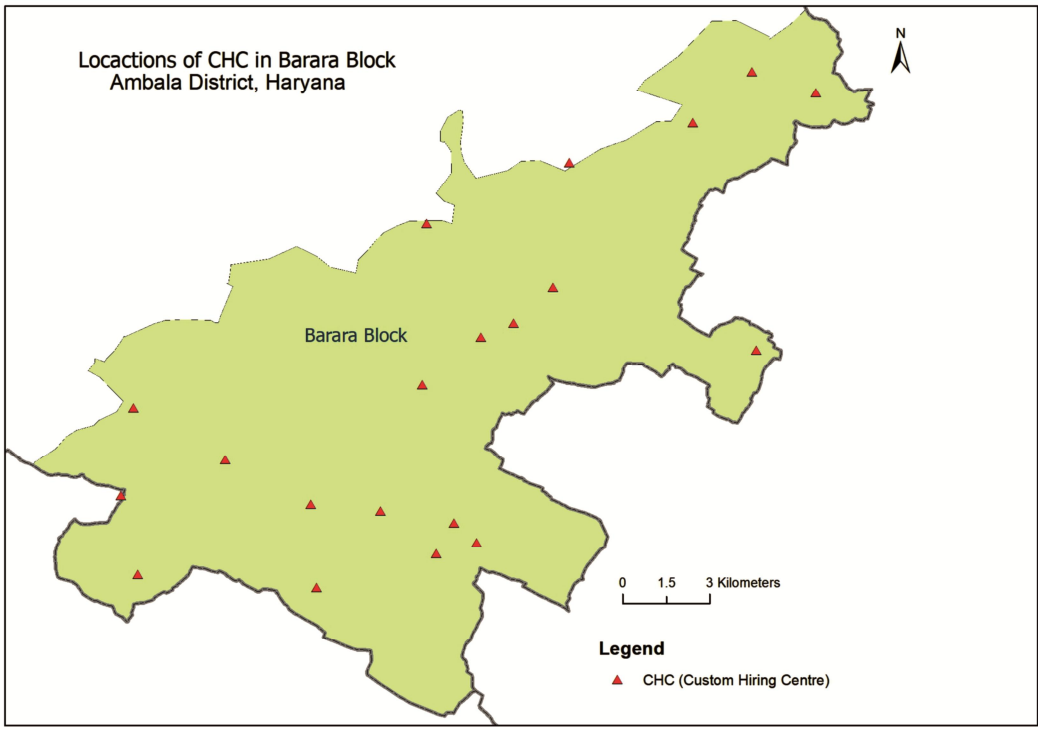

Fig. 4. Location of CHC in Barara Block, Ambala, Haryana

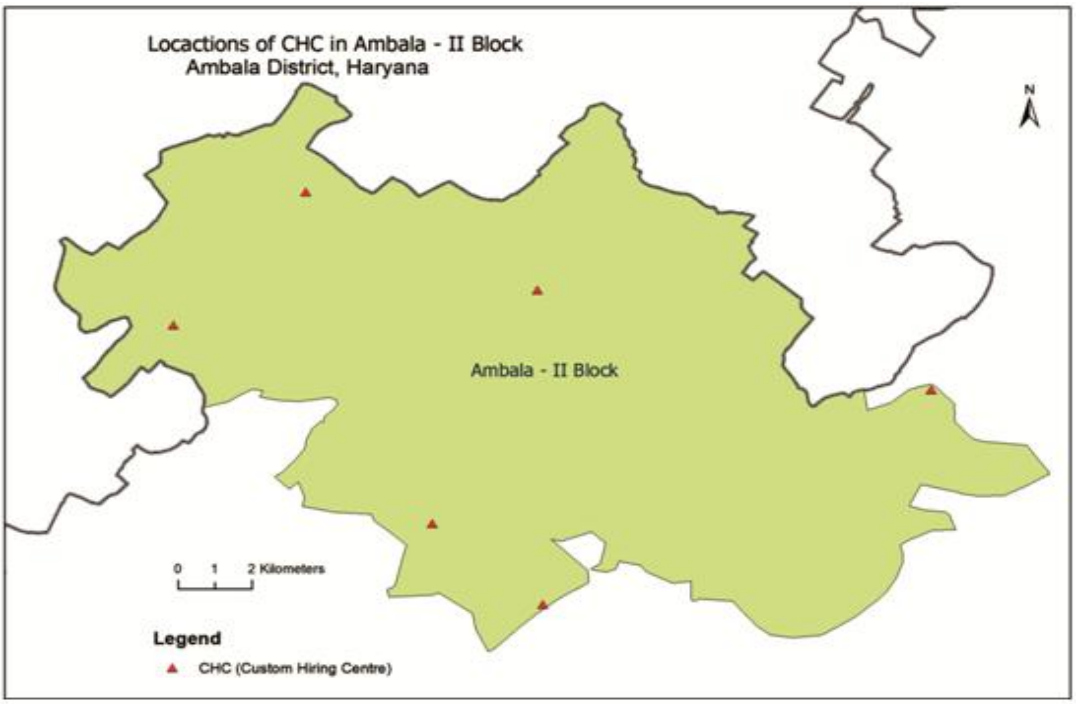

Fig. 5. Location of CHC in Ambala-II Block, Ambala, Haryana

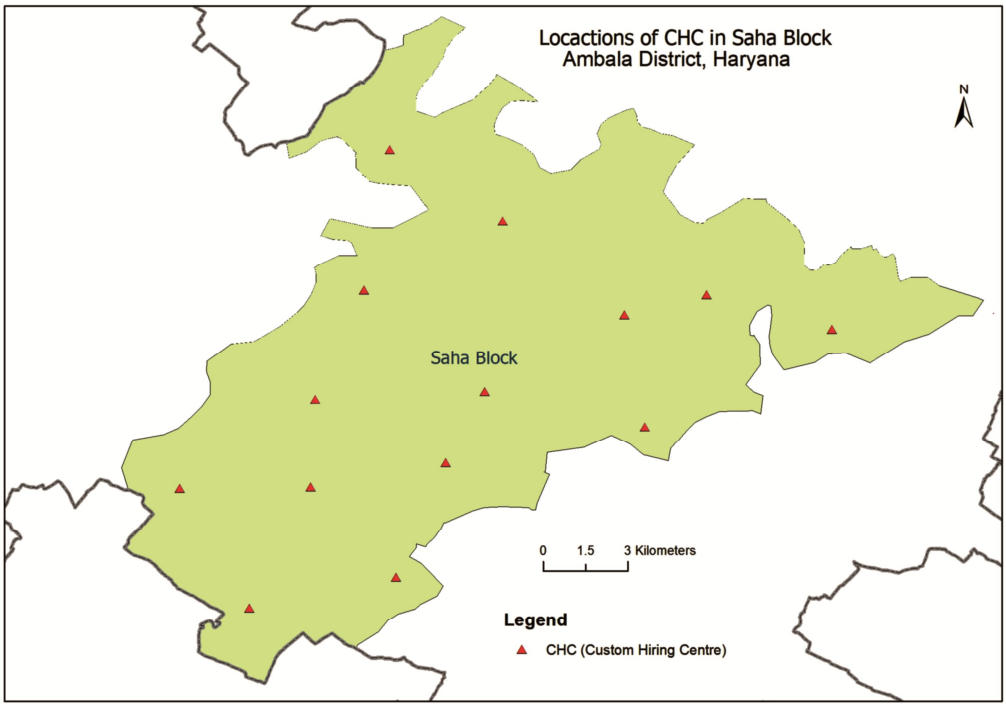

Fig. 6. Location of CHC in Saha Block, Ambala, Haryana

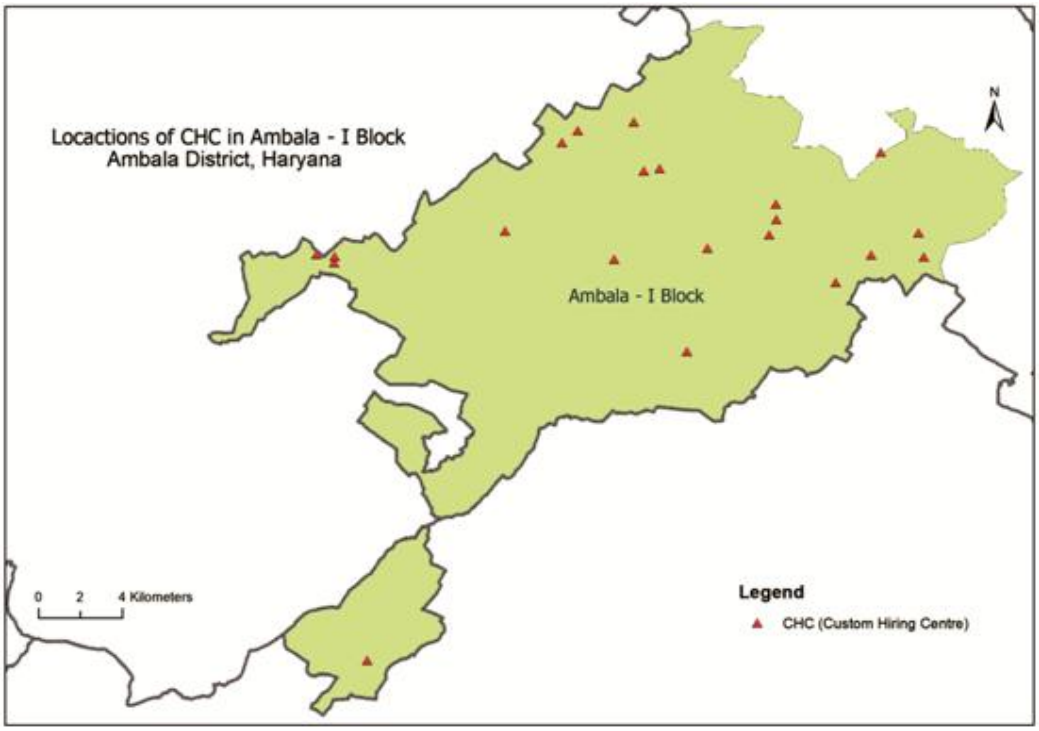

Fig. 7. Location of CHC in Ambala- I Block, Ambala, Haryana

After the purchasing of all machinery purchased by farmers under both the schemes, the Krishi Vigyan Kendra-Tepla, Ambala conducted the hands on training from 11-14, September, 2018. The training programme was organized for the farmers and machine operators on the management of crop residue in general and operating machines in particular. Major emphasis was given to harvest the crop with combine harvester fitted with Super Straw Management System (SMS), which initially cuts the crop into small pieces and other operations can be performed easily in the field with particular references to Happy Seeder and other optional machines for in-situ crop residue management. The trainings helped the participants in getting acquainted to the improved machines and knowing various aspects of machine operation and maintenance. Hands-on-training was an integral part of the trainings as the farmers were to use residue management machines practically in the field and covered the topics such as basic information about the machines, their efficient operation in the field, their maintenance and storage, do's and don'ts etc. The farmers were exclusively selected, which have purchased the residue management related machinery i.e. from blocks Ambala-I, Ambala-II, Saha, Barara, Shahjadpur and Naraingarh. Total 497 farmers participated in the training programme from all the blocks.

4. CONCLUSIONS

Rice-wheat cropping system has contributed immensely to fulfill the food security in India. But has consequently led to many sustainability issues such as degrading soil health, environmental degradation and declining water resources and further responsible for the stagnating or declining crop productivity in Haryana. In-situ crop residue management is the demand of today by adopting the same, we will be able to sustain the natural resources i.e. soil and water. After a long time period, a mega scheme has been launched by the government in which mass farmers were took part to establish custom hiring centers (CHCs) and owing the new generation agricultural machinery at subsidized rates. In the monitoring study of paddy residue burning in North India using satellite remote sensing by Indian Agricultural Research Institute, New Delhi, it was concluded that total burning events detected were 537, 502 and 332 respectively during the years 2016, 2017 and 2018. It means that number of firing events were reduced by 62 and 51 percent in 2018 as compared to firing events in year 2016 and 2017. On the other hand by adopting the technology of in-situ crop residue management we have found reduced cost of cultivation (Wheat) i.e. Rs 28500 ha^{-1} in Happy Seeder as compared to Rs. 36000 ha^{-1} in conventional sowing, 25-30 percent water saving, less weed emergence due to mulching and its cost effective management, qualitative grain yield by suppressing terminal heat effect. Consequently, the farmers will be benefited by having higher net return i.e. Rs. 69065 ha^{-1} in Happy Seeder and Rs. 58500 ha^{-1} in conventional sowing. Thereby the benefit cost ratio was also higher 3.40 in Happy seeder as compared to 2.70 in conventional sowing. It is suggested that the full potential of the distributed CRM machinery and equipment's can only be utilized if the district authorities make sure that combine harvester owners will operate the combine after fitment of the super S.M.S. on to their combine harvester for wider adoption of crop residue management.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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