



Optimization and Modeling for the use of Machine and Maintenance in Agricultural Production System in Allahabad District (Uttar Pradesh), India

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Abstract— This study constitutes the status of Machinery Power in Allahabad district based upon the survey conducted and data as references and hence proposing an estimated data of the current status of power utilization in Allahabad district and more specifically its three block; viz, Chaka-Block, Jasra-block and Shankargarh-block. Based on these three different block's differences, the study was conducted for different farming system of Allahabad district to find the status of energy inputs and availability of farm machinery for particular system in blocks. The survey was carried out in the month of March to April, 2016 find the ". One hundred and sixty seven farmers were selected considering the owning improved implements of bullock, tractor and power operated categories were surveyed this study. The data were collected in the prescribed profarma (Appendices .A,B,C and E,F,G) w.r.t. farmers and implements separately, The data regarding farm machines and implements have also been collected from Block development office Allahabad, The survey data indicate that the number of implement per hector, cultivated area in different selected blocks was 361.65%, 274.96% and 333.41% in Chaka, Jasra and Shankargarh, respectively with the district average of 36.3. The percentage of Chaff-cutter in different blocks varied from 16.66%, 19.64% & 19.60% in Chaka, Jasra and Shankargarh blocks, respectively. Plant protection equipment was very low as the number of sprayer and duster 75%, 8.35% & 72.54% cultivated area in surveyed blocks. However, most of the farmers were using plant protection equipment and other machines on custom hiring basis. Power operated centrifugal pump sets were most common for under around water pumping and its availability was highest in Chaka block 10.71 % cultivated area followed by 13.33% and 11.76% in Jasra and Shankargarh blocks, respectively.



Keywords— Agriculture production system, optimization of machine, modeling of machine, maintenance of machine, Lucknow, Agricultural Engineering.

I. INTRODUCTION

Agriculture being the backbone of Indian economy needs a thrust, as recent surveys show that agricultural growth rate seems to be stagnant. Agriculture has an immense effect on our GDP growth rate. As about 13.6 of our GDP come from agriculture, Nearly 58% of our

country population depends up on agriculture as sources of their livelihood. But after numerous govt. Initiatives the results are not up to the mark.

Farm mechanization helps in effective utilization of input to increase the productivity of land and labour. Beside it helps in reducing the drudgery in farm operation.

The early agricultural mechanization in India was greatly influenced by the technological development in England. Irrigation pump, tillage equipment, chaff cutters, tractor and thresher were gradually introduced for farm mechanization. The high yielding varieties with assured irrigation and higher rate of application of fertilizers gave higher returns that enabled farmers to adopt mechanization inputs, especially after Green revolution in 1960s.

Agricultural mechanization is the process whereby equipments, machineries and Implements are utilized to boost agricultural and food production. It is the application of machineries, equipments and implements in the day to day farm activities to increase marginal output in food production and poverty eradication.

Uttar Pradesh has a population is estimated to be 215 million people, of which nearly 70% is dependent on agriculture directly or indirectly. Therefore, about 13 corer people are linked to farming activities, over 21 million lands holding and six to seven people linked to each land holding. Agriculture is the most crucial sector for socio economic development of state. It contributes the highest share of 33% to the total income of the state. A higher growth in the state's total economy cannot be achieved or sustained on a long term basis, without good growth in Agriculture. In U.P., Agriculture plays a dominant role in the economy and growth rate of Agriculture and allied sector is 5.3 percent that of primary sector of 5.4 percent, and the national figure is 4.0 percent. Secondary and Tertiary sector are also growing very fast in the country as a whole but in U.P though growth of secondary sector is close to national figure, the tertiary sector is lagging behind. Yet Agriculture and allied sector growth being the lowest has a potential to improve and thus provide boost to the overall economy of the state. So by using farm mechanization and proper training of advanced machinery of agriculture, the productivity of the agriculture field and economy of the state could be improved. Farm machinery can reduce the time of different process of the agriculture and help the farmers to improve the quality of their crops.

As major increase of agricultural production and rural development, mechanization aims are increase the power input to farming activities, hence putting more land into production. There are direct and as well as indirect effects of agricultural machinery and implement on productivity through better use of other input more efficient and timely completion on agricultural operation and increase in cropping intensity (Venugopal, 2004). Agricultural mechanization and conservation agriculture refers to interjection of improved tools, implements and

machines between farm workers and materials handled by them. Independent Indian ushered in a process of agricultural mechanization and revival of rural agro-processing which got acceleration during post-green revolution period. Irrigation pump sets, power thresher, tractor, power tillers and matching implements, including for 65 million draft animal have become popular.

Allahabad District is in the Uttar Pradesh, Allahabad district is located at the confluence of Ganga and Yamuna. The Allahabad district is located at 25°26' N/ 81°50' E at elevation of 98m (322FT). 25.45 latitude and 81.83 longitude and it is situated at elevation 104 meter above sea level. Allahabad District is one of the productive regions of Uttar Pradesh and a majority of farmers are employed in agricultural activities. optimization to assess status of mechanization have been done in past, but due to the advent of new machine and technological advancement the use of farm machines has considerably increased. So a current optimization was felt needed. This study will help to make strategies for propagation of mechanization in the region.

It has been reported by the research workers (Srivastava et al. 2000) that timely and proper seed bed preparation results in increase of production by 20 to 30 percent. Similarly, proper placement of seeds, results in 10 to 20 percent higher yields. Weed control and plant protection are important tools for increased production. Timely harvest by appropriate implements and machines results in more and better quality agricultural produce. The increased intensity of cropping in the modern agriculture also leads to the increased use of improved implements and mechanical equipments for land leveling, ploughing, seed-bed preparation, sowing, plant protection, inter-culture, harvesting and threshing. It also leads to the requirement for better facilities for transport of crops storage. Processing and marketing.

The scope of farm mechanization has generated demands for design and manufacture of new agricultural implements and machinery in the country. It has been observed that tools /implements/machines developed as a result of research and development efforts of ICAR and agricultural universities have not been adapted by the farmers to the desired level. Commercialization of these machines also takes long time. This is due to insufficient efforts put in to analyze the users need and identification of product specifications and their development with due consideration of its market. Farmers need analysis has to take into account the cropping systems and farming practices prevalent and the socio-agro-economic condition in the region.

The mechanization process being emphasized in the country is still beyond the scope of the small scale farmers who produce the bulk of the food. The present study was planned to study the status of mechanization of major cropping system and agricultural practices followed in the Yamuna par region of Allahabad to identify mechanization gaps and needs of farm tools machines along with their broad specification for development.

Status of Agricultural Mechanization in India:

Verma (1988) studied the appropriate farm mechanization for sustainable agriculture in Eastern U.P. The study showed that in eastern region only one type of mechanization can not be adopted due to great diversity in land holding size, farm size, power source, socio economic condition of farmers. The use of improved and matching equipment package showed the increase in grain yield by 15-20 % of different crops and considerable saving in production cost with an increased command area in comparison to traditional fanning .Study also showed that level of mechanization had improved considerably in India, but efforts were not only to be continued, but also to be accelerated.

Position and Utilization of Farm Tractors in India:

Ram (1996) conducted study to observe trends of farm mechanization in South Bihar alluvial plain zone. It was observed that the maximum number of tractors (44%) was operated for 800-1100 h per year. The common implements used were field cultivator, mould board plough, leveler, crop thresher and trolley. The tractors were used for about 32 % of time for custom work.

Singh and Dohery (1999) studied the position of tractor industry in India. Their analysis showed the number of tractor produced in India had increased from 0.12 million in 1971 to 1.24 million in 19-91 with overall annual growth rate of 9.25 percent.

Singh, Gyenendra (1999) studied the use of draught animal power in India and concluded that use of draught animal power is reduced in farm power. Percentage of draught animal power in total power available KW/ha has decreased from 52.12 percent so 12.72 percent between 1971 to 1991

De et al. (2000) analyzed the data of the AICRP on Energy Requirements. in Agricultural Sector to assess the farm power availability in selected states which showed that draught animal population, mainly derived from bovines, was 80.17 million in 1972 and reduced to 67.02 million by 1982. Thereafter, the population recorded increase to 78.54 million in 1992. Analysis showed that national scenario about tractor population .Tractor population in India has from 119.39 thousands in 1971 to

2600 thousands in the year 2000 at an annual growth rate of 11.21 percent between 1971 to 1981, and decreased to 9.25 percent during next ten year. 2.3 Farm Power Availability in India:

Impact of Mechanization on Cropping Intensity and Productivity:

Srivastava (1999) suggested ways in which the Agricultural Engineering Technology could help in accelerating the growth of agricultural production in next ten years to achieve high target. He observed that the some farmers who had achieved yields of 8-12 tonnes/ha they are belonged to mechanized category of farmers. On the basis of analysis of trend in food grain production in important states during 1996-97, it was observed that the main reason of low productivity was low availability of farm power per ha, non availability, of improved and high capacity precision equipment for timely farm operations, less irrigation, low fertilizer consumption, less use of high yielding varieties and non availability of appropriate post harvest technology for reducing post harvest losses. The improved farm implements and machinery had to play important role in timely farm operations at reduced cost, maximizing efficiency of agricultural inputs by-proper placement/application and minimizing losses in production, processing, handling, transport and storage of grains, fruits, vegetables and other agricultural produce.

Impact of Mechanization on Employment

Balishter, Gupta and Singh (1991) conducted a study in Mathura district of Uttar Pradesh on the basis of three levels of mechanization, i.e. (i) non-mechanized farms having neither tube-well nor tractor (ii) Partially mechanized farms having only tube-well and (iii) mechanized farms having both tube-well and tractor. The yield was reported to be higher about 10 to 27 percent in mechanized farms and by about 2 to 26 percent in partially mechanized farms in comparison with non- mechanized farms for all the major crops grown on the sample farms.

II. MATERIALS AND METHODS

The survey has been conducted to all eight Tehsil of Trans-Yamuna region of Allahabad Districts; by choosing 167 farmers who have different land capacity. The methodology adopted has been described under the following heads provided with the entire study of optimization and modeling for the use of appropriate machine and maintenance in agricultural production system of Allahabad.

Description of Study Area

Allahabad Division of Uttar Pradesh. Allahabad is a district in the Uttar Pradesh State of India. Total area of

Allahabad is 5,482 km² including 5,279.07 km² rural area and 202.93 km² urban area. Allahabad has a population of 59, 54,391 peoples. The Allahabad district is further divided into 20 Blocks/Tehsils for administrative purposes.

Classification of Energy on the basis of Farm operations (MJ/ha)

Land preparation: Typically involves ploughing, harrowing and leveling the field to make it suitable for the crop established. Draft animals, such as buffalo or tractor can all be used as power sources in land preparation. The initial soil tillage can also be performed with a cultivator instead of a plough.

Sowing : It is the process of casting handfuls of seed over prepared ground broadcasting (for which the technology term is derived from). Usually, a drag or harrow is employed to incorporate the seed into the soil. Though labor intensive for any but small areas. A hand seeder can be used for sowing, though it is less of help it is for the smaller seeds of grasses and legumes. Seeds now sown using a seed drill, pneumatic planter which offers greater precision; seed is sown evenly at the desired rate. The drill also places the seed at a measured distance below the soil, so that less seed is required. The standard design used a fluted feed metering system, which is volumetric in nature; individual seeds are not counted. Row is typically about 10-30cm apart, depending on the crop species and species and growing conditions. Several rows drawn by the tractors, but can also be pulled by horses

Irrigation : It is an artificial application of water to the soil. It is used to assist in the growing of agricultural crops, maintenance of landscapes, and re-vegetation of disturbed soil in dry areas and during periods of inadequate rainfall. Additionally, irrigation also has a few other uses in crop production, which includes protecting plants against frost, suppressing weed growing in grain fields and helping in preventing soil consolidation. In contrast, agriculture that relies only on direct rainfall is referred to as rain-fed or dry land farming. Irrigation is also used for dust suppression, disposal of sewage, and in mining. Irrigation is often studied together with drainage, which is the natural and artificial removal of surface and sub-surface water from a given area. Various types of irrigation technology differ in how the water obtained from the source is distributed within the field. Tube wells pumping sets operated by diesel engines were used for irrigation.

Harvesting: Sickles were used for manual harvesting. Farmers generally use Combine harvester, Reaper binder, mower self-propelled or tractor operated for harvesting their crops.

Threshing: Method of threshing includes beating the crop material with bamboo grates or wooden plank manually while in partly mechanized system threshing was done by the tractor operated thresher. Mechanical threshers for wheat and paddy and pedal operated paddy thresher are used by the large and medium farmers.

Population and sample size : From a 3 different block population of Allahabad Fast Track Land Reform Program (FTLRP) of 2000 successfully resettled a total population 9,76,733 households under A1 model and 1,684 beneficiaries under A2 farming. The study used data from 80 Fast Track Resettlement farmers, and a control group of 10 traditional commercial farmers, purposively sampled. A stratified random sampling technique was used to select 167 Resettled farmers in the study area.

Data collection techniques

Interviews

An interview is a series of questions a researcher addresses personally to the farmers. Both structured (clearly defined questions) and unstructured, questioning led to the farmer of the interviewee were used. Interviews were advantageous in discovering with individual farmers thought and felt about impacts of mechanization on the current trends of agricultural performance and kind of farmers had such opinions.

Questionnaires

A questionnaire with a series of questions was applied to respondents for questions, to get their response. The way the data were to be analyzed influenced according to the layout of the questionnaire. The questionnaire made use of closed questions which provided boxes for the respondents to tick. The study avoided open questions as these would require respondents to write answers, though giving more freedom of information;

Analytical tools

Mechanization index: qualitative and quantitative criteria by which the impact of mechanization was used to identify the significance machinery use efficiencies with different farm categories.

III. RESULTS AND DISCUSSION

Based on the objectives the Results derived were quite of use for us. Agricultural mechanization in different Farming practices in blocks, the studies were conducted and the results found are hence wise compiled and is presented here as followings.

The status of selected farm implement used for different farming system :

The Farm Implements used generally in Allahabad regions are Cultivator, Mould Board Plough, Disc Plough, Harrow, Leveler, Sprayer, Seed-Drill, Planter, Transplanter, Reaper and Thresher. In all the blocks, the farming system defined these implement are in use of Cultivator, Mould Board Plough, Disc Plough and other farm implements. Hence, it can easily be said that Farming practices for three block can be use with any farm implements. (Appendix A,B,D; Table A-1, A-2, A-3).

Status of Improved Implements Use

For the purpose of this study, information regarding availability of improved tools and equipment used by farmers in die selected villages have been collected and presented below.

Status of manually operated equipment use

The block wise data regarding the use of manually operated tools and equipment based on sample survey on the basis of marginal ,small and medium of cultivated area have been given in the table for Chaka ,Jasrs and Shankargarh. For weeding purpose manually operated improved weeders were not found in all selected surveys villages whereas there is good scope of their introduction because most of the crops are shown in line. For Chaka, Jasra and Shankargarh block in Allahabad district serrated sickle, was used by 28.33%,35.71% & 25.49% farmers. Herbicide were used by 8.33%, 7.14% &7.84% farmers.

The number of chaff cutters in different blocks 16.66%,19.64% & 19.60% aried from to marginal, small & medium.The table indicates that the use of self purchased plant protection equipment was very low as the number of sprayer and duster varied from 75%,8.35% & 72.54% only in different surveyed blocks .

Status of tractor and tractor drawn equipment

The position in respect of the numbers of tractors and tractor drawn equipment like disc harrow, cultivator, cage wheel. leveler, bund former, seed cum ferti drill, potato digger, ridger, harvester, thresher, trolley, puddler etc. In three selected villages of each block of district Allahabad has been studied and data are presented in. The block-wise data of these equipments based on this sample survey are also given in(Appendix A,B,D).

. The sample survey data given in table indicates that the number of tractor per ha cultivated area in different selected blocks was 361.65%, 274.96% and 333.41% in Chaka, Jasra and Shankargarh respectively . The tractor drawn primary tillage implement like ploughs, sub soiler etc. were almost non existent through out the all selected villages. It was observed that the tractor drawn

cultivator is the only equipment which is available with almost every tractor owners. The harrow which is one of the most important secondary tillage implements was also owned by 32.14%,30% & 31.36 of tractor owner farmers. The other seed bed preparation implements like leveler, puddler, ridger, etc. were very rarely found with the farmers. The trolley is another equipment which was very much popular and almost all tractor oweners were trying to have during survey 83.33%,73.21%,& 76.46 % tractor farmers were found to be own it. The number of seed cum ferti drill varied from 23.33%,17.85 & 41.16% in surveyed blocks. The use of seed cum ferti drill was found in Chaka, Jasrs and Shankargarh blocks by some tractor owners, but other farmers and also some of tractor owners hire seed-drill to fulfill their requirement. The use of other tractor drawn equipments like potato digger, sugar cane planter, reaper etc. were rarely found in selected blocks of Allahabad district.

Status of Engine operated equipment use

Information in respect of power operated equipment like centrifugal pumps, water pumps collected from selected villages are given in Appendix G Table 2. The consolidated block-wise based on sample survey have been presented.

The centrifugal pumps were the most common engine operated irrigation equipment used for underground water pumping as well as lifting of water from shallow water sources like wells, ponds, rivers, canals, etc, throughout the surveyed area of Allahabad district. The availability of these pumps in Chaka (10.71%) and Jasra(13.33).and Shankargarh(11.76).

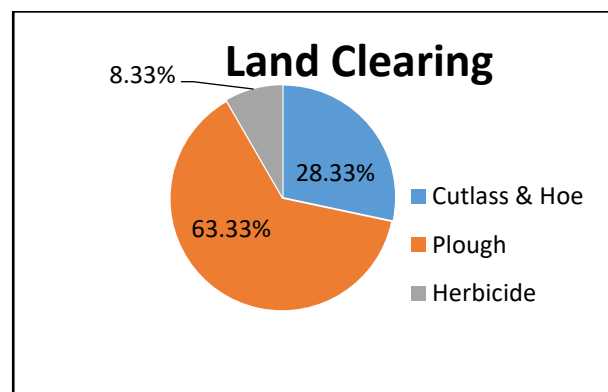


Fig.1: Land Clearing for chaka block

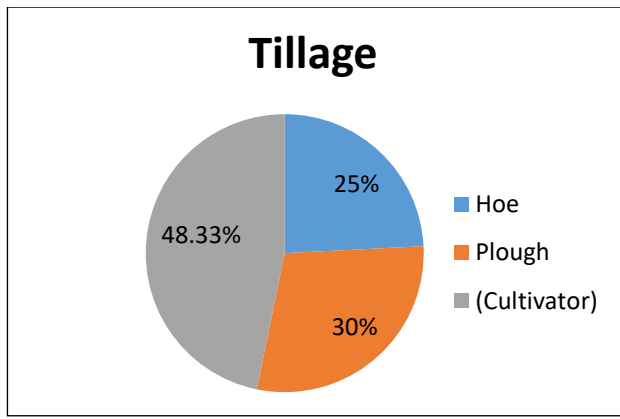


Fig.2: Tillage for chaka block

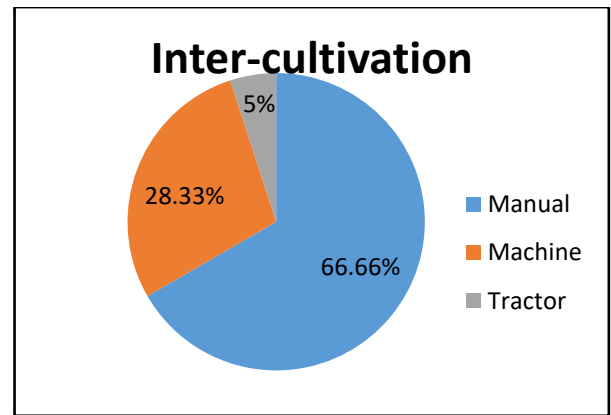


Fig.5: Inter-cultivation for chaka block

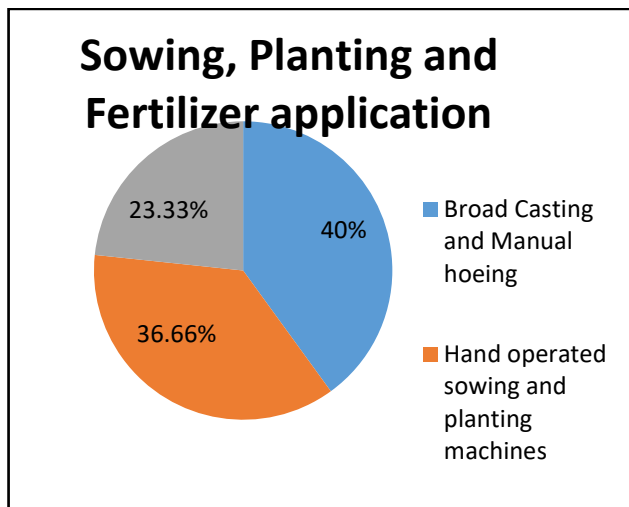


Fig.3: Sowing, Planting and Fertilizer application for Chaka block

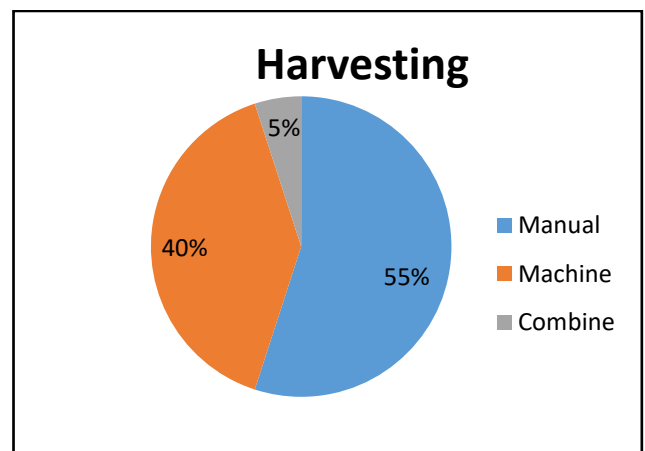


Fig.6: Harvesting for chaka block

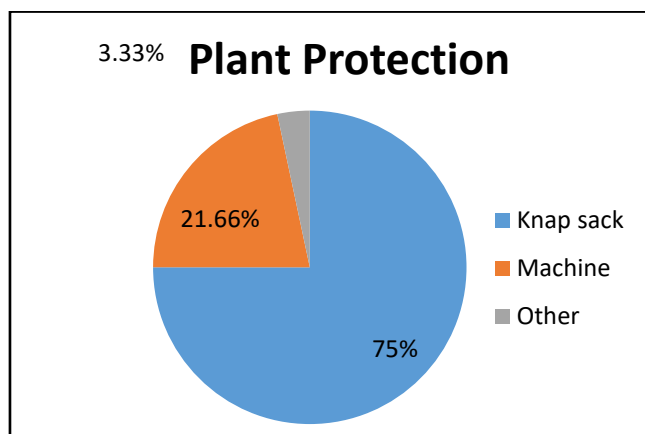


Fig.4: Plant Protection for chaka block

IV. CONCLUSION

The salient findings of the survey are reported herein.

- Land holding size per household fanner was found (0.74 ha/farmer) very low. At present in Allahabad district as per survey data land holding size per household farmer (0.74 ha) was less than operational land holding size of the U.P. state (1.1 ha) according to statistical bulletin (Anonymos-1993). The productivity of land and percentage irrigated area are mostly higher in mechanized fanning areas like Jasra, Shankargarh etc. than other non mechanized blocks of Allahabad district.
- Manually operated improved tools and equipment available with the farmers were serrated sickle(28.33,35.71 % 25.49) plant protection equipment (sprayer 75%,80.35% & 72.54%and duster 3.33%,1.78% & 3.92%) , (16.66%,19.64% & 19.60%)winnow and chaff cutter only.
- Tractor drawn cultivator and trolley were the only equipment owned by most of the tractor farmers. The disc harrow and thresher were other common

equipment in use. The presence of tractor drawn seed cum fertilizer drill and potato planter were less but farmers enthusiastic to own them. The use of other improved implements like reaper, potato digger, harvester, ridger and cage wheel etc. were very rare.

- Power operated centrifugal pump sets were most common for under ground water pumping and its availability was highest in Chaka block 10.71% cultivated area followed by 13.33% and 11.76% cultivated area in Jasra block and Shankargarh block respectively. But there was need for increasing the number of pump set in Allahabad district to have more irrigated area. The use of electric motor was low as compared to diesel engine due to uncertainty of availability of continuous electricity.
- Most of the farmers of entire district were enthusiastic about the use of improved farm tools and equipments. They felt that the improved farm implement and equipment have increased their production, efficiency and quality of operations and reduced the drudgery involved in conventional farm operations. Presently almost most of the farmers were using locally available improved implements and equipment on custom hiring. It was observed that tractor drawn farm machinery compared to traditional local ploughs, disk harrows and cultivators cover more than 8-10 times and ensure timeliness besides drudgery reduction.
- Survey revealed that the main problems faced by the farmers in adoption of the improved farm implements were: lack of awareness about various implements, non availability of quality implements, lack of effective field demonstration, high initial cost, difficulty in credit availability, high interest rate on credit, poor after - sale service etc.
- The immediate need of farmers of different blocks of Allahabad district with regard to farm implements were almost same. Implements like paddy transplanter, seed-cum-ferti drill, potato planter, potato digger, harvester, sprayer and weeding tool are their common need.

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