

# A Study on Status of Farm Power and Scope of Farm Mechanization in the Agro - Climatic Zone of Chhattisgarh Plains

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## Abstract

An investigation was carried out to know the status of farm mechanization in Chhattisgarh plains. A survey conducted in eight villages of the agro-climatic zone of Chhattisgarh state revealed that the average percentage share of tractive power, stationary power, and draught animal power, & cropping intensity and irrigation intensity of Chhattisgarh plains was 49.32 (0.43 kW/ha), 15.55 (0.12 kW/ha), and 33.59 (0.28 kW/ha), & 164.77 and 64.77 respectively of cultivable area. Average farm power availability and land holding per family in Chhattisgarh plains was 0.84 kW/ha and 2.18 ha respectively. Average farm power availability of the selected villages was found to be less than the national average (1.6 kW/ha). The study revealed that the villages had sufficient draught animals, indigenous implements, and hand tools like indigenous plough, biasi plough, *kopar*, *patela*, pick-axe, crowbar, spade, wooden mallet, and so forth. The study indicated a dire need of increasing farm power availability and farm mechanization in this agro-climatic zone to increase the productivity of the land.

**Keywords:** farm mechanization, farm power availability, Chhattisgarh plains, agro-climatic zone, indigenous implements, hand tools.

**JEL Classification :** Q010, Q100, Q190

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Increase in agricultural production with existing cultivable land is a great need of any country due to increasing population. India, now self-sufficient in agricultural production, is also an exporter of food grains and other agricultural products. This self sufficiency has been achieved by incorporating agricultural engineering inputs besides other agricultural inputs. Use of appropriate agricultural mechanization inputs in agricultural production and post production leads to an increase in agricultural output due to timeliness of farm operations, conservation of soil and water, appropriate application of water/fertilizers, and post harvest technologies reduce post harvest losses and add value to the agricultural products, and so forth. Thus, agricultural mechanization is helpful to bring about significant improvement in agricultural productivity. Mechanization of farm operations mainly depends on sources of power both animate and electromechanical.

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Farm power is the use of various power sources and improved farm tools and equipment in agriculture for timely field operations like tillage, intercultural operations, irrigation, harvesting, threshing, and other post harvest operations. At the time of independence, Indian agriculture was dependent on bullock drawn ploughs, wooden peg tooth harrows, wooden planks for pulverization compaction and smoothening of soil, bullock carts, and hand tools such as *khurpi*, crowbar, spade, hoe, sickle, axe, and so forth.

During the last 50 years, the average farm power availability in India increased from about 0.30 kW/ha in 1960-61 to about 1.73 kW/ha in 2009-10. Over the years, the shift has been towards the use of mechanical and electrical sources of power, while in 1960-61, about 92.30% farm power was coming from animate sources, in 2009-10, the contribution of animate sources of power reduced to about 13.15%, and that of mechanical and electrical sources of power increased from 7.70% in 1960-61 to about 86.85% in 2009-10 (Singh, Singh, & Singh, 2011).

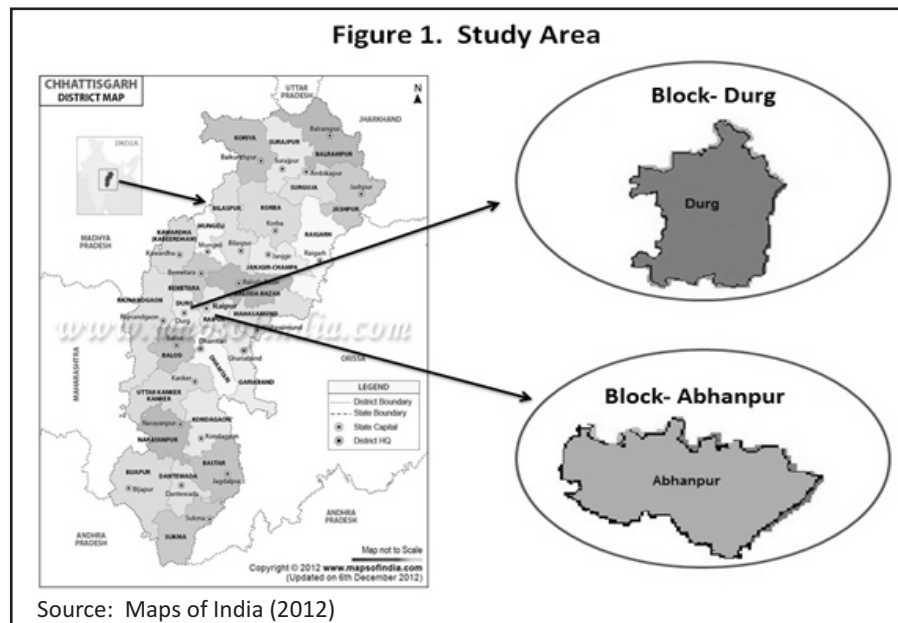
Over the years, the contribution of animate sources of power, especially that of draught animals, has been going down drastically. It is an accepted fact that higher levels of production in agriculture need higher levels of power availability. In the absence of adequate power supply, agricultural operations cannot be completed in time, and yields are adversely affected. Availability of adequate farm power is very crucial for timely farm operations for increasing production and productivity and handling the crop produce to reduce losses. In the changing scenario, it has become more important to have projection estimates of the total number of tractors, power tillers, diesel engines, electric pumps, and other power-operated agricultural machinery and implements for the future years (Tyagi, Singh, Kher, Jain, & Singh, 2010).

Chhattisgarh State occupies 13.51 million hectares, with a gross cropped area of about 5.68 million ha. It comprises of 27 districts, and it is divided into three agro-climatic zones namely Northern hills, Chhattisgarh plains, and Bastar plateau. Bastar plateau and Northern hills are the tribal dominant agro-climatic zones of the state. In Chhattisgarh, which came into existence in November 2000 as the 26th state of the Republic of India, had average farm power availability of 0.43kW/ha during the year 2001-02 as compared to the national average of 1.23 kW/ha, which increased to the 0.74 kW/ha in the year 2009. It needs to be increased from the present level by 2-3 kW/ha till 2015, mainly through increased use of tractors, diesel engines, and electricity. The population of the tractors was about 4 nos. per 1000 hectare in the year 2009, which effectively controlled the area of 47.4 million hectare of cultivable land out of 137.9 million hectare of the total geographical area of Chhattisgarh (Palia, 2011).

The present study was undertaken to collect information from farmers regarding the use of farm implements, machines, tools and cultivation practices in total status of farm mechanization at the village level. The present study will be useful to know about the scope, constraints, and need of farm mechanization in the villages of Chhattisgarh.

## Materials and Methods

The study was carried out in the year 2011-12 in two selected districts of the agro - climatic zone of Chhattisgarh plains as shown in the Figure 1. A benchmark survey was conducted in two districts - Durg and Raipur. Three villages namely Borigarka, Khopli, and Pauwara from Durg block of Durg district and five villages namely, Ulba, Kopedi, Belar, Bhatagaon, and Rakhi from Abhanpur block of Raipur district were selected for this study. Thirty farmers from each village comprising only small and marginal categories were interviewed for the present study. Personal interviews of the farmers belonging to different categories from the selected villages were conducted by using a pre - designed performa (as given in the Table 1). The information on the villages as a whole, their households, number of total cultivators, population, land less households, population of bullocks and buffaloes, population of tractors and agricultural machines, cultivated area, irrigated and non irrigated area, cropping pattern, cropping intensity, implements used, and management practices followed by farmers were collected by personal interviews, and the same information was verified from the official records of the villages. The collected data was further compared with the national and state level.



**Table 1. Performa for Data Collection from Farmers Regarding Farm Mechanization Status in the Agro - Climatic Zone of Chhattisgarh Plains**

1. Name of farmer: \_\_\_\_\_

2. Address : \_\_\_\_\_

3. Family farm labours \_\_\_\_\_

4. Land holding (ha): \_\_\_\_\_

Source of farm power: Tractor/Bullocks/He-buffaloes/tractor + bullocks

5. Irrigation facility: yes / no –irrigated area (ha) \_\_\_\_\_

If yes: (1) River (2) Well (3) Pond (4) Canal (5) Tube well (6) \_\_\_\_\_

Tube well, Name: - \_\_\_\_\_ H.P. of tube well \_\_\_\_\_

6. Cropping pattern: (1) Kharif cropping (2) Rabi cropping (3) Hot weather

7. Tillage operation:

(A) Primary tillage operation: (1) Country plough (2) M.B. plough (3) disc plough (4) By Tractor (cultivator) Powered by: (a) Bullock/He-buffaloes drawn \_\_\_\_\_ (b) Tractor drawn \_\_\_\_\_

(B) Secondary tillage operation: (1) Cultivator (2) Harrow (3) Rotavator (4) Puddler \_\_\_\_\_

8. Sowing method:

(A) Traditional: (1) Broadcasting (2) Transplanting

(B) Mechanical: (1) Transplanter (2) Dibbler (3) Planter (4) Seed drill (5) Seed-cum Fertilizer drill (6) Any Others \_\_\_\_\_

9. Intercultural equipment: (1) Khurpi (2) Hoe (3) Spades (4) Any others \_\_\_\_\_

10. Plant protection equipment:

(A) Sprayer: Yes / No, If yes, type \_\_\_\_\_ capacity \_\_\_\_\_

(B) Duster: Yes / No, If yes, type \_\_\_\_\_ capacity \_\_\_\_\_

**11. Harvesting:**

(A) Manually harvesting: (a) Plain Sickle (b) Serrated Sickle

(B) Mechanical harvesting:

(C) Reaper: (a) Tractor mounted (b) Power tiller (c) Self propelled

Size of reaper: Width (meter) \_\_\_\_\_ power source (hp) \_\_\_\_\_

(D) Combine harvester: Yes / No, If yes, type \_\_\_\_\_ field capacity (ha/h) \_\_\_\_\_

**12. Threshing:**

(A) Traditional: Yes / No, If yes,

(1) By tractor treading: Capacity(t/h) \_\_\_\_\_ H.P. \_\_\_\_\_

(2) By bullock treading: Capacity(t/h) \_\_\_\_\_

(3) By hand beating: Man-h \_\_\_\_\_ (t/h) \_\_\_\_\_

(4) By roller (animal): \_\_\_\_\_ (t/h) \_\_\_\_\_

(B) Mechanical threshing:

Thresher: Yes / No, If yes, type \_\_\_\_\_ Capacity (t/h) \_\_\_\_\_ Hp required \_\_\_\_\_

**13. Tractor available:** Yes / No, If yes, Name \_\_\_\_\_ H.P. \_\_\_\_\_ No. \_\_\_\_\_

**14. Power tiller available:** Yes / No, If yes, Name \_\_\_\_\_ H.P. \_\_\_\_\_ No. \_\_\_\_\_

**15. Tractor Trolley available:** Yes/No, If Yes Capacity \_\_\_\_\_ No. \_\_\_\_\_

**16. Bullock Cart available:** Yes/No, If Yes Capacity \_\_\_\_\_ No. \_\_\_\_\_

## Results and Discussion

Data collected from the survey was analyzed and is presented in the Table 2 and Table 3. It can be observed from the data presented in the Table 2 that bullocks and buffaloes are popular draft animals in the region. However, the buffaloes were preferred more under wet land cultivation. In all the villages, it was found that the availability of animal drawn implements, that is, *desi* plough for tillage operation, *patella* (planker) for levelling, *Biasi* plough for interculture operations, and bullock carts for transportation were popular among the farmers of all the villages. However, for threshing work, tractors were found to be popular in all the villages. Sowing, transplanting, weeding, and crop harvesting by sickle were generally preferred to be performed manually. It was found that the diesel pump and electric pump were popular among the farmers of all the villages. Among the farmers, the spraying operation was found to be mechanized, showing dependency on sprayers. The use of winnowing fan was very popular among the farmers for winnowing work. The use of hand tools such as pick axe, spade, and crow bar was popular in all the villages.

On the basis of the survey of draft animals, it was found that in the selected villages, it ranged between 400 – 1000 kg/pair. The weight of buffaloes was on higher side in all the villages, that is, between 800 – 1000 kg/pair. The Table 3 depicts that power availability, contribution of tractive power, stationary power, draught animal power of Durg and Raipur Districts of Chhattisgarh plains were found to be 0.28 kW/ha and 0.57 kW/ha, 0.17 kW/ha and 0.07 kW/ha, & 0.24 kW/ha and 0.32 kW/ha respectively. In terms of percentage tractive power, stationary power, and draught animal power in both the districts was found to be 38.95 and 59.69, 24.21 and 6.90, 33.68 and 33.49 respectively. Hence, in both the districts, sufficient tractive and draught animal power was

**Table 2. Available Farm Power Sources and Farm Implements in Selected Villages in Chhattisgarh Plains**

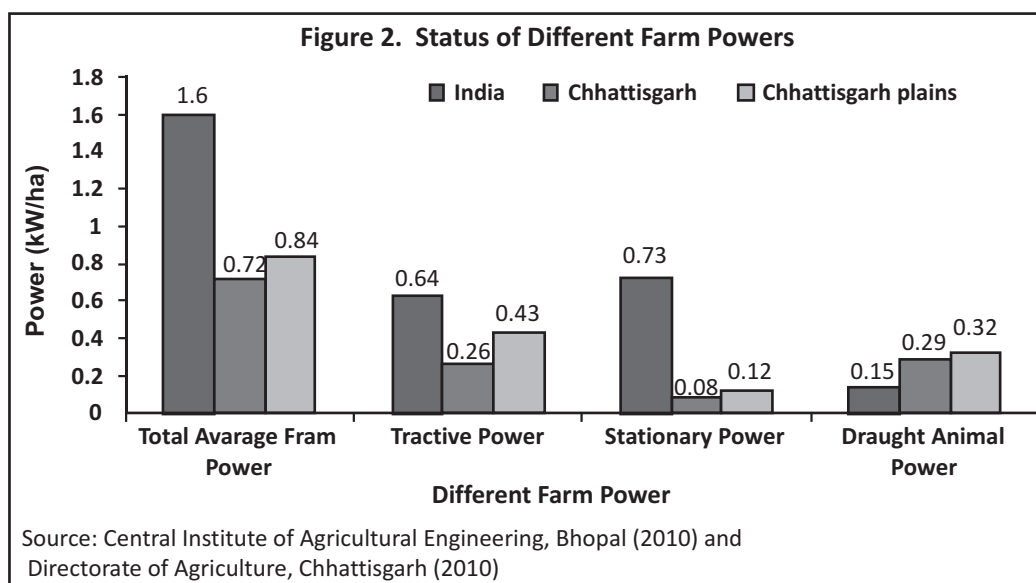
| Agricultural Operations         | Implement /Tools/Draught Animals | Selected villages of Chhattisgarh plains |                   |                   |                   |                   |                   |                   |                   |
|---------------------------------|----------------------------------|------------------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
|                                 |                                  | Durg Distict                             |                   |                   |                   | Raipur District   |                   |                   |                   |
|                                 |                                  | Borigarka                                | Khopli            | Pauwara           | Ulba              | Kopedih           | Belar             | Bhatagaon         | Rakhi             |
|                                 |                                  | (V <sub>1</sub> )                        | (V <sub>2</sub> ) | (V <sub>3</sub> ) | (V <sub>4</sub> ) | (V <sub>5</sub> ) | (V <sub>6</sub> ) | (V <sub>7</sub> ) | (V <sub>8</sub> ) |
| Power Source                    | Tractor                          | 6                                        | 9                 | 5                 | 6                 | 6                 | 4                 | 4                 | 2                 |
| Tillage                         | Desi Plough                      | 208                                      | 382               | 218               | 116               | 90                | 104               | 55                | 92                |
|                                 | Cultivator                       | 6                                        | 9                 | 5                 | 6                 | 6                 | 4                 | 4                 | 2                 |
|                                 | Patela                           | 200                                      | 350               | 176               | 98                | 87                | 95                | 40                | 84                |
| Sowing                          |                                  | Manually                                 | Manually          | Manually          | Manually          | Manually          | Manually          | Manually          | Manually          |
| Inter Culture                   | Biasi Plough                     | Manually                                 | Manually          | Manually          | Manually          | Manually          | Manually          | Manually          | Manually          |
| Irrigation                      | Diesel Pump                      | 8                                        | 13                | 16                |                   |                   |                   |                   |                   |
|                                 | 4                                | 10                                       | 3                 | 2                 |                   |                   |                   |                   |                   |
|                                 | Electric Pump                    | 14                                       | 19                | 17                | 1                 | -                 | 2                 | -                 | -                 |
| Plant Protection                | Sprayer                          | 22                                       | 36                | 17                | 24                | 24                | 54                | 44                | 20                |
|                                 | Duster                           | 1                                        | 3                 | 1                 | 23                | 8                 | 18                | 8                 | 7                 |
| Harvesting                      | Manually/ Machine                | Sickle                                   | Sickle            | Sickle            | Sickle            | Sickle            | Reaper            | Reaper            | Sickle            |
|                                 | Power Thresher                   | -                                        | -                 | -                 | -                 | -                 | -                 | 1                 | -                 |
| Threshing                       | Machine                          | By Tractor                               |                   |                   |                   |                   |                   |                   |                   |
| Winnowing                       | Winnowing Fan                    | 56                                       | 76                | 52                | 39                | 23                | 103               | 43                | 28                |
| Transportation                  | Tractor Trolly                   | 6                                        | 9                 | 5                 | 6                 | 6                 | 4                 | 4                 | 2                 |
| Draught Animal                  | Bullock Cart                     | 106                                      | 182               | 102               | 110               | 152               | 106               | 64                | 48                |
|                                 | Bullocks Pair                    | 138                                      | 208               | 118               | 104               | 49                | 109               | 49                | 50                |
|                                 | Buffalo Pair                     | 49                                       | 62                | 56                | 25                | 16                | 24                | 23                | 7                 |
| Hand Tools                      | Pick-axe                         | 204                                      | 340               | 200               | 210               | 90                | 108               | 62                | 89                |
|                                 | Spade                            | 200                                      | 280               | 185               | 170               | 110               | 105               | 54                | 82                |
|                                 | Crow Bar                         | 189                                      | 208               | 195               | 185               | 89                | 94                | 72                | 69                |
| Cropping Intensity(%)           |                                  | 180.63                                   | 188.98            | 158.39            | 170.88            | 119.77            | 172.02            | 181.47            | 146.03            |
| Irrigation Intensity(%)         |                                  | 80.63                                    | 88.98             | 58.39             | 70.88             | 19.77             | 72.02             | 81.47             | 46.03             |
| Average Land Holding per Family |                                  | 1.51                                     | 1.11              | 1.47              | 2.07              | 2.12              | 2.10              | 1.02              | 6.04              |

available, but a need for increasing stationary power was observed. On the basis of the selected villages, average power availability in the agro-climatic zone of Chhattisgarh plains was observed to be 0.84 kW/ha, contribution of tractive power, stationary power, and draught animal power was 0.43 kW/ha, 0.12 kW/ha, and 0.28 kW/ha respectively. In terms of percentage total, average tractive power, stationary power, and draught animal power was 49.32, 15.55, and 33.59 respectively. The higher percentage contribution from tractive power clearly indicates that farm mechanization was popular in this area.

The Figure 2 depicts that the total average farm power availability in the agro-climatic zone of Chhattisgarh plains (0.84 kW/ha) was lower than the national average farm power availability (1.6 kW/ha), while this figure was higher than the farm power availability of the state (0.72 kW/ha). Tractive and stationary power of Chhattisgarh plains (0.43 kW/h and 0.12kW/ha) was higher than the state average (0.26 kW/ha and 0.08kW/ha), but was lower than the national average (0.64 kW/ha and 0.73kW/ha). However, the draught animal power of Chhattisgarh plains (0.32 kW/ha) was higher than state (0.29 kW/ha) and national draught animal power (0.15 kW/ha).

**Table 3. Status of Available Farm Power in Selected Villages in Chhattisgarh**

| District<br>Power                            | Durg              |                   |                   | Average       | Raipur            |                   |                   |                   |                   | Average       | Chhattisgarh<br>Plains |
|----------------------------------------------|-------------------|-------------------|-------------------|---------------|-------------------|-------------------|-------------------|-------------------|-------------------|---------------|------------------------|
|                                              | (V <sub>1</sub> ) | (V <sub>2</sub> ) | (V <sub>3</sub> ) |               | (V <sub>4</sub> ) | (V <sub>5</sub> ) | (V <sub>6</sub> ) | (V <sub>7</sub> ) | (V <sub>8</sub> ) |               |                        |
| Tractor(kW)                                  | 156.66            | 234.99            | 130.55            | <b>161.64</b> | 156.66            | 156.66            | 104.44            | 104.44            | 52.22             | <b>114.88</b> | <b>138.26</b>          |
| Diesel Engine(kW)                            | 29.84             | 48.49             | 59.68             | <b>46</b>     | 14.92             | 7.46              | 37.3              | 11.19             | 7.46              | <b>15.67</b>  | <b>30.83</b>           |
| Electric Pump(kW)                            | 52.22             | 70.87             | 63.41             | <b>62.16</b>  | 3.73              | -                 | 7.46              | -                 | -                 | <b>2.24</b>   | <b>32.2</b>            |
| Bullock pair(kW)                             | 102.95            | 155.17            | 88.03             | <b>115.38</b> | 77.58             | 36.55             | 81.31             | 36.55             | 35.81             | <b>53.56</b>  | <b>84.47</b>           |
| Buffalo pair (kW)                            | 36.55             | 46.25             | 41.78             | <b>41.53</b>  | 18.65             | 11.94             | 17.9              | 17.16             | 37.3              | <b>20.59</b>  | <b>31.06</b>           |
| Total power<br>availability (kW/ha)          | 0.72              | 0.69              | 0.72              | <b>0.71</b>   | 0.9               | 1.71              | 0.66              | 0.91              | 0.63              | <b>0.96</b>   | <b>0.84</b>            |
| Tractive power<br>availability (kW/ha)       | 0.3               | 0.29              | 0.24              | <b>0.28</b>   | 0.52              | 1.26              | 0.28              | 0.57              | 0.25              | <b>0.57</b>   | <b>0.43</b>            |
|                                              | 41.24             | 42.4              | 33.33             | <b>38.95</b>  | 57.85             | 73.8              | 41.57             | 62.3              | 38.82             | <b>59.69</b>  | <b>49.32</b>           |
|                                              | (%)               | (%)               | (%)               | (%)           | (%)               | (%)               | (%)               | (%)               | (%)               | (%)           | (%)                    |
| Stationary power<br>availability (kW/ha)     | 0.16              | 0.14              | 0.22              | <b>0.17</b>   | 0.06              | 0.06              | 0.12              | 0.06              | 0.03              | <b>0.07</b>   | <b>0.12</b>            |
|                                              | 21.65             | 20.65             | 31.25             | <b>24.21</b>  | 6.61              | 3.49              | 17.98             | 6.72              | 4.71              | <b>6.9</b>    | <b>15.55</b>           |
|                                              | (%)               | (%)               | (%)               | (%)           | (%)               | (%)               | (%)               | (%)               | (%)               | (%)           | (%)                    |
| Draught Animal<br>Power availability (kW/ha) | 0.27              | 0.25              | 0.24              | <b>0.24</b>   | 0.32              | 0.39              | 0.26              | 0.29              | 0.35              | <b>0.32</b>   | <b>0.28</b>            |
|                                              | 37.11             | 35.87             | 33.33             | <b>33.68</b>  | 35.54             | 22.71             | 39.33             | 31.97             | 55.29             | <b>33.49</b>  | <b>33.59</b>           |
|                                              | (%)               | (%)               | (%)               | (%)           | (%)               | (%)               | (%)               | (%)               | (%)               | (%)           | (%)                    |



★ **Scope of Farm Mechanization in the Agro- Climatic Zone of Chhattisgarh Plains :** The present study revealed that most of the farmers of Chhattisgarh plains have small and fragmented landholdings, which is a major constraint for adoption of complete mechanization. From the mechanization point of view, only tractors and diesel engines or electric motors were used for field preparation/transportation and irrigation purposes

respectively. This partial and low level of mechanization is a constraint for agricultural development in Chhattisgarh. Rice is the major crop of the State, with the largest area under cultivation by farmers and for the cultivation of rice, the farmers are highly dependent on the monsoon. The Rabi crops (wheat and chickpea) are also dependent on the monsoon. To cultivate these crops, timeliness of different farm operations plays an important role to obtain optimal yields from different crops, which can be possible by means of mechanization. For example, due to acute shortage of human labour at the time of transplanting of rice seedlings, delay in transplanting by one month reduces the yield of rice by 25%, and delay in sowing of wheat during the first fortnight of November by one week due to delay in harvesting of Kharif crop decreases the yield of wheat by about 1.50 quintals per acre.

Likewise, various other farm operations, that is, land levelling, irrigation, sowing and planting, fertilizer application, plant protection, harvesting, and threshing need a high degree of precision to increase the efficiency of input and reduce the input losses. For example, sowing and application of the required quantity of seeds and fertilizers uniformly at proper depth can only be possible with the use of a proper mechanical device. Mechanization of farm operations saves labour, time, and thereby reduces cost of production. Agricultural mechanization may also create lots of employment opportunities for the rural youth on farms and other sectors through an increase in farming area, agro-industries, and other related services in Chhattisgarh.

#### **\* Constraints in Mechanization of Farms in the Chhattisgarh Plains**

- (1) Small size and scattered farms create difficulty in the use of large farm machinery, thus they remain under utilized.
- (2) As a mono-cropped state, only rice crop is cultivated during the Kharif season by most of the farmers ; hence, purchase of large power operated machines is not economically feasible.
- (3) Costly farm machineries are out of reach of farmers due to their low economic status.
- (4) Lack of awareness and lack of proper knowledge among the farmers regarding selection, purchase, operation, and maintenance of farm machinery leads them to make wrong choices regarding machinery, which is uneconomical in the long run.
- (5) Lack of repair, spares, and service centres, especially in the remote rural areas is another constraint that limits the mechanization of farms in Chhattisgarh.

**\* Efforts for Improving the Status of Mechanization in the Agro-Climatic Plains of Chhattisgarh :** Low level of mechanization is mainly due to the small and scattered farms, lack of knowledge, and poor economy. Looking at these constraints, high horse power (large size machines) and costly agricultural machines are not suitable for the region. Therefore, power tiller operated, self-propelled machineries, animal drawn, and manually operated equipments and tools can play an important role in the improvement of the status of mechanization in the farms. These equipments and tools should be made popular among the farmers to a great extent.

In order to improve the level of mechanization in the State, a lot of efforts have been made by the State Agriculture Department and State Agricultural University. At present, there are three Divisional Agriculture Engineer Offices and four Assistant Agriculture Engineer Offices in the state. Also, there is one State Agricultural University, that is, Indira Gandhi Krishi Vishwavidyalaya, Raipur in the state. The state agriculture department puts in a lot of efforts to introduce newly developed agricultural equipments among the farmers through live demonstration. Special training programmes are organized to train farmers on agricultural mechanization. Subsidy (25-40%) is provided on tractors, power tillers, and self - propelled, animal driven and manually operated machineries under centrally sponsored schemes. Additional subsidy of 10-25% is also given by the State govt. on above machineries to small and marginal farmers. Due to poor economic condition, farmers are unable to purchase costly machines. Looking into addressing this problem, the State government provides tractors with

attachments, dozers, self propelled machines, power tillers, reapers, threshers, and milling machines on custom hiring through the Agriculture Engineer Office. To increase the irrigation facility, the State government provides a subsidy to small and marginal farmers on irrigation pumps (75% upto 5 hp) and for the construction of dug wells (50%). For popularization of agricultural implements in Chhattisgarh, a revolving fund scheme on Farm Implement Manufacturing, Repair and Servicing is running at the Faculty of Agricultural Engineering, Indira Gandhi Krishi Vishwavidyalaya, Raipur. Under this project, 35 different types of implements are being manufactured and distributed/sold to the farmers through the State agricultural department. More than 50,000 different farm implements have been sold to the farmers and other agencies so far. The zero tillage seed cum fertilizer drill was firstly introduced in State by the project in order to facilitate line sowing and increasing the area under double crop in this region. Modified low lift hand pump was also developed and sold by the project to the farmers to increase the irrigated area under vegetable cultivation.

## Conclusion and Suggestions

The study analyzed the agro-climatic zone of Chhattisgarh plains, and the implements/ hand tools being used by farmers are of traditional type such as *desi* plough, *patela*, *koper*, and *belan* (wooden roller). The hand tools such as pick-axe, spade, crow bar, and mallet are popular among the farmers. The contribution of tractive farm power was highest in Chhattisgarh plains, and sufficient draught animal power was found. The existing implements/ equipment of sample villages were studied to locate the area where improvements are possible to remove the drudgery of the farmers in different farm operations to save their time and to increase the crop yields by using proper operations. Some of the areas where improvements can be brought about are as follows:

- (1) Proper constructional material can be used for increased life of plough share.
- (2) Good quality sickles should be introduced, which have similar dimensions as traditional ones.
- (3) The study indicated a dire need of increasing the farm power availability and farm mechanization in this particular area to increase the productivity of land.

In order to promote mechanization of farms in Chhattisgarh plains, the following aspects should be taken care of:

- (1) Availability of adequate farm power should be ensured.
- (2) Establishment of custom hiring facility through govt. and private entrepreneurs.
- (3) Tractors and power tillers with attachments may be provided on a massive scale to increase farm power availability.
- (4) Establishment of manufacturing units may be promoted among the entrepreneurs in this region.
- (5) Horticultural tools for vegetables, fruits, and flower cultivation should be promoted.
- (6) Self propelled transplanters should be promoted among farmers.
- (7) The State government may subsidize inputs for raising of mat type rice seedlings at the village level, which promotes nursery enterprises in villages.
- (8) Identification, development, and popularization of machineries for mechanization of orchards.
- (9) Development and promotion of gender friendly agricultural tools and equipments.
- (10) The water management programme should be strengthened for proper utilization of ground water.

- (11) Drip irrigation system should be promoted for plantation and horticultural crops.
- (12) Protected cultivation of ornamental flowers, herbs, and medicines should be promoted.
- (13) Green house cultivation for high value seasonal vegetables may be promoted.
- (14) Banks can liberalize credit policies to attract more farmers to avail loans.
- (15) Special insurance schemes for agricultural machinery and equipments need to be provided.
- (16) Skill development training programmes should be organized on repair/maintenance of farm machineries, irrigation systems, agricultural processing, and so forth.

## Limitations of the Study and Directions for Future Research

The study was carried out in coordination with the interviewers in the villages. We found it difficult to extract the full information as the villagers tried to hide the actual problems and their strengths. This might be due to the fear of getting deprived of some government facilities if the authorities found out that they already have those assets. In order to get a good data set, the sampling has to be increased, which definitely requires more time and extra funding to do the same.

The data set is quite essential for the management of the policy plan of the government, and this will help to formulate further policies in order to increase farm mechanization to get better crop productivity through farm mechanization interventions. The socioeconomic survey needs to be carried out before and after the implementation of any project to evaluate the plans and policies on a real-time basis.

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