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Mechanization in Indian Agriculture

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The mechanization of Indian farms is imperative to enhance input use efficiency, reduce human drudgery, increase production and productivity of food-grains, reduce cost of production and to address issues of labour scarcity and timeliness of farm operations. The status of farm mechanization for different crops, farm power availability, farm machinery manufacturing and sale, standardization and testing, and Government initiatives to ensure mechanization of Indian agriculture are assessed in this study. The total farm power availability in Indian agriculture was 2.24 kW/ha in 2016-17. It had a share of 1.324, 0.018, 0.021, 0.460, 0.193, 0.091 and 0.130 kW/ha from tractors, power tillers, combine harvesters, diesel engines, electric motors, humans and draught animals, respectively. The overall mechanization levels for rice, wheat, maize, sorghum, pulses, oilseeds, cotton and sugarcane crops were 45, 63, 40, 26, 34, 34, 26 and 24%, respectively. The increasing trend in establishment of custom hiring centres and hi-tech hubs along with farm machinery banks at village level has ensured availability of modern agricultural machinery for different field operations to small and marginal farmers. The quality of farm equipment is ensured by testing involving laboratory and field performance evaluation and followed by certification at designated testing centres. There is a need to innovate custom service or a rental model by institutionalization for high cost farm machinery to reduce the cost of operation.

Key words: Agricultural machinery, Custom hiring, Farm power availability, Mechanization level, Test code

Introduction

Indian agriculture employs about 52% of total work force with a GDP (at constant price 2011-12) contribution of 15% (2016-17). It contributes to 25, 22, 13 and 25% of the global production of pulses, rice, wheat and cotton, respectively. Indian economy is also influenced by agriculture and allied sectors besides its volatile nature of production. In recent past, India has witnessed a major shift in economy from agriculture to service sector with a GDP contribution of 54% (2016-17). Over the years, Indian farming system has not given an expected remuneration to farmers besides its remarkable growth in food-grain production and processing sectors. However, agriculture remains as principal means of livelihood for over 58% of the rural households. It is the prodigy of soil of India that it provides food to 1.3 billion population with just an average farm size of less than 1.08 ha. Small and marginal land holdings (< 2.0 ha) contribute to 86% of total operational land holdings and cover 47% of total operated area (Anonymous, 2018).

The varied soil, climatic condition, topography, flora and fauna throughout country increase the challenges of timeliness in farm operations, uniformity in technology adoption and availability of location specific farm implements and machinery (Mehta et al., 2014a). Hence, agricultural mechanization plays a complementary role to address the above situations and to contribute in increasing production, productivity and profitability in agriculture by achieving timeliness in farm operations, enhancing input use efficiency, reducing unit cost of production with increasing competitiveness. In addition to timeliness in farm operations, it

also reduces labour requirement and human drudgery. This subsequently balances the labour requirement between agriculture and agro-based industries. The agricultural mechanization is at an early stage in India and growing at 7.5% per annum inspite of challenges of small land holdings, cropping pattern, market prices of crops, minimum support price (MSP) and government policies and legislations. The ignorance of these challenges will exaggerate the redundant labour force, low return against inputs for yield and ultimately decrease the enthusiasm in agriculture. Further, in the near future Indian agriculture may require energy intensive agriculture with higher input use efficiency, better soil health management practices and value addition to produce in production catchments. This may be due to low probability of increase in net cultivated area and scarcity of agriculture labour. Therefore, an attempt has been made in this paper to study the present scenario of farm power availability, farm mechanization levels for major crops, and Government initiatives to assure the availability of farm machinery at village level and to ensure quality manufacturing along with promotion of the farm mechanization on a large scale.

Farm Power Availability

The production and productivity of food-grains are considered as factors of available mobile farm power sources like tractors, draught animals, power tillers, combine harvesters, agricultural workers and stationary power sources like diesel engines and electric pump sets/motors. The time-series data on farm power sources and agricultural production of India were compiled and used in the study.

The secondary data related to food-grain productivity, net sown area, and other relevant agriculture statistics were collected and compiled from various sources such as Agricultural Statistics and Agriculture Census published by the Directorate of Agriculture, and Basic Agricultural Statistics and Livestock Census published by Government of India. The data on population of agricultural workers (men and women) and draught animals (exotic cattle/cross breeds, indigenous cattle and buffaloes) were collected and compiled from the Population Census 2011 and Livestock Census 2012 (Anonymous, 2014a), respectively published by the Government of India. The data on population of tractors and power tillers were collected and compiled from Tractor Manufacturers Association (TMA) and Power Tiller Manufacturers Association (PMA), respectively.

The data on population of diesel engines and electric pump sets/motors were collected from Report of study on “Pilot project to ascertain the use of diesel for irrigation” and Agricultural Research Data Book 2017, respectively (Ranganathan et al., 2016; Anonymous, 2017a). The power availability from different farm power sources was calculated by taking an average power of 0.05, 0.38, 5.60, 3.70 and 5.60 kW for an agricultural worker, draught animal, power tiller, electric motor and diesel engine, respectively (Anonymous, 2014b). However, power availability from tractor was estimated by taking an average power of 13.4, 18.7, 26.1, 33.6 and 41.0 kW for the power range of 38.0 kW, respectively. The life of tractor, power tiller, combine harvester, electric motor and diesel engine was considered as 15, 10, 6, 15 and 15 years, respectively. Total power availability on Indian farm was calculated by dividing sum of total power by total cultivated land of 140 million ha (Goering, 1992; Bector et al., 2008; Mehta et al., 2014b). It was observed that the percentage of agricultural workers to total workers decreased from 59.1 in 1991 to 54.6% in 2011 and projected to be 40.6% in 2020 of which 45% will be women workers.

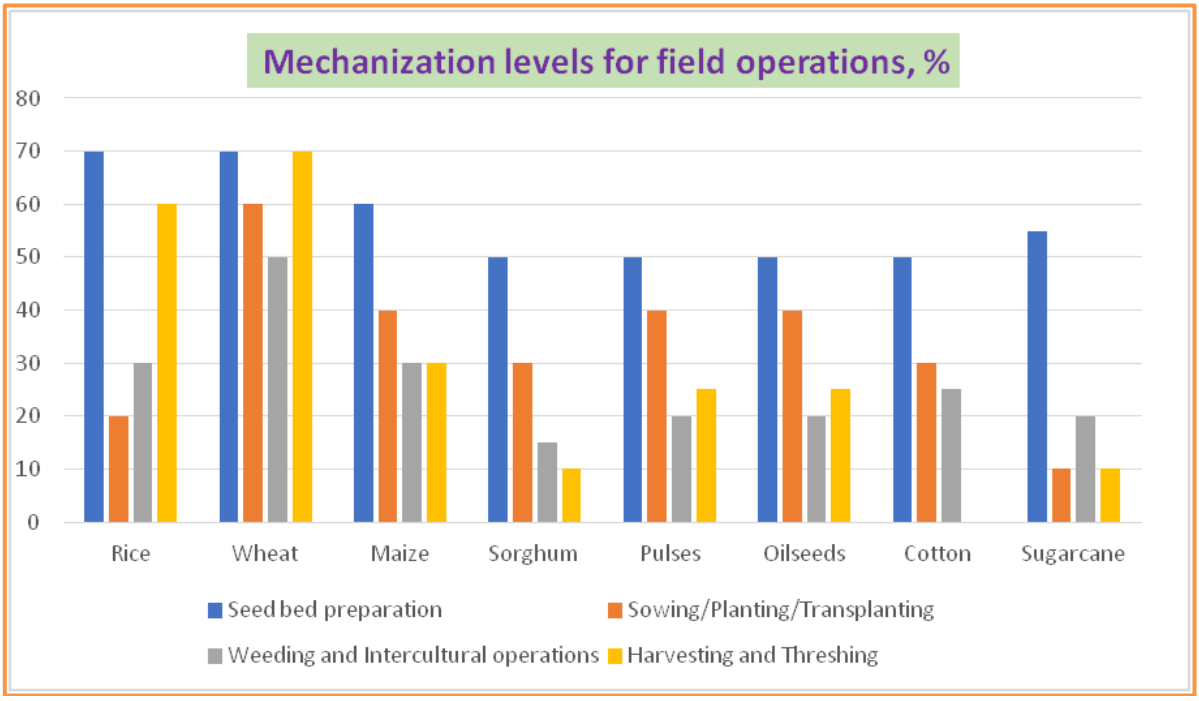
This is undoubtedly due to much lower wages in agriculture as compared to industry and the disguised unemployment leading to extensive labour migration. The farm power availability from human was 0.091 kW/ha in 2016-17. The population of draught animals in the country reduced from 78.42 in 1971-72 to 47.46 million in 2016- 17. The power availability from this source has come down from 0.221 kW/ha in 1971-72 to 0.130 kW/ha in 2016-17. During the year 2016- 17, the population of tractors, power tillers, combine harvesters, diesel engines and electric motors was 6.35, 0.46, 0.04, 11.48 and 7.50 million, respectively. The corresponding farm power availability from tractors, power tillers, combine harvesters, diesel engines and electric motors was calculated as 1.324, 0.018, 0.021, 0.460

and 0.193 kW/ha, respectively. The total farm power availability was 2.24 kW/ha during 2016-17. During the same period, the farm power availability from mobile (human, draught animal, tractor, power tiller and combine harvester) and stationary (diesel engine and electric motor) sources was 1.585 and 0.650 kW/ha, respectively.

In the mobile power sources category, power availability from tractor was the highest (1.324 kW/ ha) whereas in the stationary power availability, diesel engine had the highest share of 0.460 kW/ha. This indicated growing trend towards use of mechanically operated farm equipment over traditional human and animal powered equipment implying adoption of mechanization on Indian farms.

Farm Mechanization Levels

The farm mechanization has an inbuilt advantage to make farmer's daily life more comfortable by reducing labour requirement and drudgery associated especially of women workers. Hence, mechanized farming will be an indicator of high standard and good management systems during agricultural operations along with upgrading the standard of living of farmers and agricultural workers. The mechanization levels in different farm operations such as seedbed preparation, sowing/ planting/transplanting, weeding/ interculture, plant protection, and harvesting and threshing for major crops (rice, wheat, maize, sorghum, millets, pulses, oilseed, cotton and sugarcane) production systems were assessed. The crop wise and overall mechanization levels were calculated by taking an average of operation wise and weighted mechanization levels. The farm mechanization levels assessed for major cereals, pulses, oil-seeds, millets and cash crops are given in Table.



It indicates that the seedbed preparation operation is highly mechanized (more than 50%) for major crops whereas harvesting and threshing operation is the least mechanized (lower than 30%) for major crops except for rice and wheat crops. In seedbed preparation, mechanization level is higher in rice and wheat crops as compared to other crops. However, mechanization level for sowing operation is the highest for wheat crop (60%). The mechanization levels in planting/transplanting operation for sugarcane and rice crops are only 10 and 20%, respectively. In case of harvesting and threshing, the mechanization levels in rice and wheat crops are more than 60% and there is no mechanization in cotton crop.

Government Initiatives on Farm Mechanization

The Government of India has also taken initiatives and programmes like Rashtriya Krishi Vikas Yojana (RKVY), National Food Security Mission (NFSM), National Horticulture

Mission (NHM), Gramin Bhandaran Yojana (GBY), Submission on Agricultural Mechanization (SMAM), scheme on Promotion of Agricultural Mechanization and Machinery for In-situ Management of Crop Residue in the States of Punjab, Haryana, Uttar Pradesh and NCT of Delhi, etc. The major objectives of SMAM are to demonstrate the agricultural machinery on the farmers' fields to increase farm mechanization and productivity, test and evaluate machines through identified testing centres to ensure quality and performance, support the custom hiring centres of agricultural machinery and hi-tech hubs to ensure the availability of agricultural machinery, increase trained and skilled personnel, etc.

In consequence, the concept of 'Custom Hiring' assures the distribution of mechanical power beyond large holding to small/marginal land holdings. It also facilitates availability of farm machinery/equipment on hire and assists in enhancing mechanization status. The estimated budget proposed for the scheme for three years (2017-20) is USD 1.05 billion. This includes a share of 60 and 40% by Central Government and State Governments, respectively. However, a share of 90 and 10% will be borne by Central Government and State Governments, respectively for North Eastern and Himalayan states. During the period from 2014- 15 to 2016-17, 38074 persons have been trained in different parts of country by testing centres under SMAM. During last three years, 4335 farm machinery were tested at recognized testing centres and 376,852 were distributed through subsidy under SMAM. The number of custom hiring centres, Hi-tech hubs, farm machinery banks at village level and custom hiring centres in NE states established during the period were 4108, 41, 1710 and 2173, respectively (Anonymous, 2017b). The target under SMAM is to establish 19883, 613 and 22338 numbers of custom hiring centres, Hi-tech hubs for management of high value crops and farm machinery banks at village level, respectively by 2019- 20.

This is expected to increase farm power availability and average level of mechanization for different farm operations to 2.45 kW/ha and 50%, respectively by 2020. The objectives of the new scheme on Promotion of Agricultural Mechanization and Machinery for Insitu Management of Crop Residue in the states of Punjab, Haryana, Uttar Pradesh and NCT of Delhi are to provide financial assistance to establish Farm Machinery Banks or Custom Hiring Centres of in-situ crop residue management machinery, to procure agriculture machinery and equipment for in-situ crop residue management and to execute Information, Education and Communication strategies to create awareness on in-situ crop residue management among farmers, users and stakeholders. Under Central Sector component of the scheme, 100% cost of USD 168 million will be met by the Central Government.

Conclusion

India has achieved considerable progress in farm mechanization during last one and half decades. The use of mechanically operatedfarm equipment increased on Indian farms over traditional human and animal power equipment. The farm power sources such as tractors, power tillers, combine harvesters, diesel engines and electric motors contributed to 1.324, 0.018, 0.021, 0.460 and 0.193 kW/ha, respectively in total farm power availability of 2.24 kW/ha during 2016-17. The overall farm mechanization levels for rice, wheat, maize, sorghum and millets, pulses, oil-seeds, cotton and sugarcane crops are 45, 63, 40, 26, 34, 34, 26 and 24%, respectively. The farm machinery industry has grown at Compound Annual Growth Rate (CAGR) of 7.5% and reached a capital value of USD 7.30 billion. The sale of tractors increased at a CAGR of 9.75% during last 56 years and reached a level of 711,478 units in 2017-18. The present trend is towards the use of high capacity and energy efficiency farm machinery on custom hiring basis. The testing network of farm machinery was strengthened by establishment of 32 specialized farm machinery testing centres in SAUs, ICAR institutes, state Govt. institutes etc. in addition to four farm machinery testing stations under Government of India to enhance quality of farm machinery manufacturing in country.

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