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Status of Mechanization Power in Indian Agricultural Sector

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Abstract

Indian agriculture has witnessed significant changes in production technology through the introduction of high yielding varieties of crops, especially wheat, rice and intensive application of complementary modern inputs in farming. The new momentum created by modern seeds and fertilizers was considered the initiation of Green Revolution. Consequently, the consumption of several agro-inputs like pesticides, growths regulating compounds and weedicides have increased, besides the fertilizers all over the country. Technological change in agriculture can be classified into two ways: (i) land-augmenting technical change (ii) labour-augmenting technical change. Land-augmenting technical change involves change in biological techniques in crop production. It includes mainly HYV of seeds fertilizers, irrigation and plant protection measures. Labour-augmenting technical change includes mechanical changes, namely, rapid mechanization of agricultural operations, such as introduction of traders combine harvesters. Hence, this study examines the adaptation status and economic advantages of farm mechanization in Indian Agriculture.

Keywords: *Farm Mechanization, Green Revolution, Technological change and Fertilizers.*

I. Introduction

India accounts for only about 2.4% of the world's geographical area and 4% of its water resources, but has to support about 17% of the world's human population and 15% of the livestock. Agriculture is an important sector of the Indian economy, accounting for 14% of the nation's GDP and about 11% of its exports. Agriculture in India is currently growing at an average compound annual growth rate (CARG) of 2.8%. About half of the population still relies on agriculture as its principal source of income and it is a source of raw material for a large number of industries. Accelerating the growth of agriculture production is therefore necessary not only to achieve an overall GDP target of 8% and meet the rising demand for food, but also to increase incomes of those dependent on agriculture and thereby ensure inclusiveness in our society (Anonymous, 2013).

There was a record food grains production of 259.32 million tonne during 2011-12, of which 131.27 million tonne was during kharif season and 128.05 million tonne during the Rabi season. The increases in production of wheat, bajra, maize, groundnut and total oilseeds can mainly be attributed to

increase in yields, whereas the growth in production of gram, tur, pulses, soybean and cotton is driven by a combination of both expansion in area and increase in productivity. This situation necessitates the role of mechanization in terms of minimal use of inputs, time saving and labour saving increasing demand for industrialization, urbanization, housing and infrastructure is forcing conversion of agricultural land to non-agricultural uses. The scope for expansion of the area available for cultivation is limited. As per agriculture census 2010-11, small and marginal holdings of less than 2 hectare account for 85% of the total operational holdings and 44% of the total operated area. The average size of holding for all operational classes (small and marginal, medium and large) have declined over the years and has come down to 1.16 hectare in 2010-11 from 2.82 hectare in 1970-71 (Anonymous, 2013)

Agricultural mechanization can be defined as the economic application of tools, animals, or machines to aid human effort, increase productivity, and eliminate drudgery in farming. Agricultural mechanization aims at reducing human drudgery, increasing yields through better timeliness of operations, bringing more land under cultivation, providing agriculture-led industrialization and markets for rural economic growth. Mechanization is needed to raise productivity in rainfed upland and rainfed lowland and to increase cropping intensity in irrigated farms. Improved tillage implements reduce cost of tillage and prepare better seed bed. Seed drills give better plant population, reduce cost and give higher yield. Use of peregrinated seeders in puddle wetland give similar yield like manual transplanting but reduce labour requirement by 75-80%. The manual and self propelled transplanter reduces cost of transplanting by 45-50% and labour requirement by 75-80%. Uses of improved weeders reduce weeding cost by 79-90%. Walking type vertical conveyer reaper, power tiller and tractor front mounted reaper save 50-60% labour and harvesting cost by 60-70% as compared to manual harvesting. Use of pedal operated thresher, motorized hold on thresher reduce time, labour, cost of threshing to a great extent. Combine harvesting save 40-50% cost as compared to manual harvesting and threshing by power thresher.

II. Agricultural Mechanization Scenario And Farm Power

Agricultural workers, draught animals, tractors, power tillers, diesel engines, electric motors are used as sources of farm power in Indian agriculture. Table 1 shows the available farm power (kW/ha) in Indian agriculture from these sources and total farm power. It indicates that the composition and relative share of different sources of power for farming operations has undergone significant change during the last four decades. The availability of draught animals power has come down from 0.133 kw/ha in 1971-72 to 0.094 kw/ha in 2012-13, whereas the share of tractors, power tillers, diesel engines and electric motors has increased from 0.020 to 0.844, 0.001 to 0.015, 0.053 to 0.300 and 0.041 to 0.494 kw/ha, respectively during the same period. The total power availability on Indian farms has increased from 0.293 to 1.841 kW/ha at a percentage of 4.58% during the last forty one years.

Table 1: Sources of Farm Power Available in Indian Agriculture

Year	Farm power, kW/ha						Total power, kW/ha
	Agriculture Labour	Draught animals	Tractors	Power Tillers	Diesel Engines	Electric Motors	
1971-72	0.045	0.133	0.020	0.001	0.053	0.041	0.293
1975-76	0.048	0.135	0.040	0.001	0.078	0.056	0.358
1981-82	0.051	0.128	0.090	0.002	0.112	0.084	0.467
1985-86	0.057	0.129	0.140	0.002	0.139	0.111	0.578
1991-92	0.065	0.126	0.230	0.003	0.177	0.159	0.760
1995-96	0.071	0.124	0.320	0.004	0.203	0.196	0.918
2001-02	0.079	0.122	0.480	0.006	0.238	0.250	1.175
2005-06	0.087	0.120	0.700	0.009	0.273	0.311	1.500
2011-12	0.100	0.119	0.804	0.014	0.295	0.366	1.698
2012-13	0.093	0.094	0.844	0.015	0.300	0.494	1.841

Source: Vision 2050 document of Central Institute of Agricultural Engineering, Bhopal, India

III. Status of Farm Mechanization in India:

Presents the market overview of the major agricultural machinery used in India. From the table it is estimated that the highest annual requirement is 100,000 for threshers and followed by 60,000-80,000 for rotavator, and 25,000 for power weeder. Light weight power weeders are also required for hilly terrains. In case of market growth per annum, the highest growth of 50% was for rice transplanter. It has been observed that the sale of machinery like combine, laser guided land leveler and rice transplanter are growing fast on custom hiring mode even though cost is higher, since the demand is more.

The zero till drill is preferred by farmers from Indo Gangetic plains particularly in northern states of India viz Punjab, Haryana and Uttar Pradesh. The sale of zero till drill in India is around 25,000-30,000 per annum in rice-wheat cropping system due to limited time available for sowing of wheat after rice harvesting.

The overall mechanization level in India is only 40-45% even though 90% of the total farm power is contributed by mechanical and electrical power sources. However, all operations are not uniformly mechanized. Operation-wise level of mechanization varies from 42% for soil working and seed bed preparation, 29% for seeding and planting, 34% for plant protection and 37% for irrigation. In case of harvesting

and threshing, the level of mechanization is 60-70% for wheat and rice and less than five per cent for others crops. The operation wise mechanization for harvesting, crop care and seeding are top priority for the farmers in India for cereals and horticultural crops. But mechanization of above operations is not up to the level of farmers expectations till date. Farmers need complete mechanization package for major crop

Table 2 Market Overview of the major farm machinery used in India

Name of machinery	Market size annually	Approximate cost, US $ Tractor
Tractor	600000	7000-12000
Power tiller	56000	2100
Combine harvester	4000-5000	22000 – 35000
Thresher	100000	1600 – 2500
Rotavator	60000-80000	1300-2000
Rice transplanter Walking type Riding type	1500-1600	2500-4200 3300-16600
Self-propelled vertical conveyor reaper	4000-5000	1300-2000
Zero till seed drill	25000-30000	750-850
Multi -crop planter	1000-2000	850-1000
Laser land leveler	3000-4000	5800-6500
Power weeder	25000	8500

Source: Vision 2050 document of Central Institute of Agricultural Engineering, Bhopal, India

IV. Impact of farm mechanization in agriculture sector

Efficient machinery helps in increasing productivity by about 30 %(table-3) besides, enabling the farmers to raise a second crop making the agriculture attractive. Raising more crops with high productivity is a path for meeting the future food requirement of population. Development and introduction of high capacity, precision, reliable and energy efficient equipment is the need for judicious use inputs. For crop production human, animal and mechanical energy is extensively used. In small and marginal farms, except for tillage, other operations such as sowing/ transplanting, weeding, cotton picking harvesting and threshing (paddy) are normally manually perform.

Table 3: Economic Advantage of Mechanization

Increase in Productivity	Up to 12-34 %
Seed-Cum-Fertilizer Drill Facilitates Saving in Seeds Saving in Fertilizer	 Up to 20 % Up to 15-20 %
Enhancement in Cropping Intensity	Up to 5-22 %
Increase in Gross Income of the Farmers Source	Up to 29-49 %

Source: Report of the sub-group on agricultural implements and machinery for formulation of 9th five year plan, Govt. of India.

Mechanization also imparts capacity to the farmers to carry out farm operations, with ease and freedom from drudgery, making the farming agreeable vocation for educated youth as well. It helps the farmers to achieve appropriateness and specifically meter and apply costly input for better efficacy and efficiency.

In India, the promotion of agricultural mechanization has brought about a rapid change in the agricultural sector. Many small and medium sized agricultural machines have been produced and are widely used in the region. Agricultural mechanization plays an increasingly important role in agricultural production in the India. It reduces drudgery, increases the safety and comfort of the working environment; it enhances productivity, cropping intensity and production. It increases income for agricultural workers and then improves social equality and overall living standards. If properly used, it also conserves and properly utilizes natural resources and reduces the cost of production.

It allows for timelier farm operations, effectively deals with climate change, produces better quality agricultural commodities, etc. It is necessary, therefore, to use modern equipment in agriculture and to use modern science and technology to re-invent agriculture. The region needs, inevitably, to accelerate the development of agricultural mechanization.

Mechanization has had a revolutionary impact on the development of agriculture and the improvement of farmer's livelihood in India. At the same time, there is a huge gap in the mechanization of agriculture due to different levels of development, lack of technology transfer and various testing standards and procedures. Promoting agricultural mechanization and enhancing its safety standards are key to the development of sustainable agriculture, a challenge that most developing countries in the region need to address.

V. Conclusion:

In Indian conditions selective mechanization for utilization of abundant human and animal power sources with supplementary mechanical and electrical

power will be beneficial. As irrigation is available to less than 50% cultivable area, improved technology for upland and lowland crop will surely increase crop production and productivity. Mechanization of small holding will play an important role in increasing crop production. Vigorous efforts should be made by scientists, extension workers and government machinery along with strong political will to achieve this goal. Massive programmes are required to extend the improved production technology to the farmers and to provide irrigation which is key to agricultural development. Steps have to be taken for availability of high yielding variety seeds, fertilizers, pesticides and agricultural implements at Block and Panchayat level. Adequate farm power is needed for increasing production by timely completion of farm operations. Custom hiring of costly farm implements and easy availability of credit are required for small and marginal farmers to accept the improved production technology. Proper procurement policy, value addition by processing and improved marketing infrastructure will improve the economic conditions of the farmers.

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