



MACHINES DRIVE OF POWER IN FARMING IN LABOUR INTENSIVE STATE HARYANA

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ABSTRACT

Farm mechanization helps in effective utilization of inputs to increase the productivity of land and labour. Besides it helps in reducing the drudgery in farm operations. The early agricultural mechanization in India was greatly influenced by the technological development in England. Irrigation pumps, tillage equipment, chaff cutters, tractors and threshers were gradually introduced for farm mechanization. These threshers were widely adopted by the farmers. Gradually demand for other farm machinery such as reapers and combine harvesters also increased. Equipment for tillage, sowing, irrigation, plant protection and threshing has been widely accepted by the farmers. Even farmers with small holdings utilize many improved farm equipment through custom hiring to ensure timeliness of farming operations. The present trend in agricultural mechanization is for high capacity machines through custom hiring and for contractual field operations. However, mechanization of horticulture, plantation crops and commercial agriculture is yet to be introduced in the country.

Haryana is a small state which is relatively backward area of the farmers in comparison to well develop state of Punjab. It made rapid progress in the field of agriculture development since its existence in 1966 and after it has achieved a prestigious position in comparison to other advanced states of the Indian with 1.4% of the total geographical areas of the country. It contributes more than 5% of the total food grains produced in the country.

Haryana is one of those states which has repeated the benefit of “Green Revolution” and has attained a very high rate of agricultural production. Since 1947 the scope for bringing more area under cultivation that was limited before green revolution. Efforts were intensified towards increasing the yields per unit of area, through an increase in irrigation facilities and cropping

intensity. Due to use of farm machinery, chemical fertilizers and high yielding varieties of seeds need of credit in agriculture sector is increasing day by day. All these efforts resulted in boosting agricultural production. As a result the production of food-grain of the state has increased from 25.92 lakh tones in 1966-67 to 161.50 lakh tones in 2013-14 i.e. more than six time increased over the year 1966-67. This paper's aim is to analyzing the growth and development of the use of machinery in farming in the state Haryana during the study period.

Keywords: Agriculture, growth rate, tones, agricultural machinery, Draught Animals, Agriculture Worker etc.

INTRODUCTION

The country witnessed unprecedented growth in agriculture which has helped India to graduate from hunger to self sufficiency in food grains by increasing the food grain production from 51 million tones to 248 million tones, with surplus for export. The technology back-up by agricultural scientists, in the form of “*Green Revolution*” combined with industrial growth, positive policy support, liberal public funding for agricultural research and development and dedicated work of farmers contributed to the phenomenal increase in agricultural, animal and fish production. Application of engineering in agriculture was equally appreciated by the farmers and today they feel proud to have improved machinery from *Bakhars* to rotavators, *Persian wheel* to drip and micro-sprinkler systems, cone-dibblers to pneumatic planters, sickles to combine harvesters, sieve to colour sorters, and, *kolhus* to solvent extraction plants, and hand mills to roller flour mills, etc. The farmers are not afraid of hot/cold desert and vagaries of weather as they have green houses and low tunnel plastic houses technology to grow crops in any place at any time of the year.

The growth in adoption of agricultural machinery in the country has been possible due to their local manufacture. The manufacture of agricultural machinery in India is under taken by village artisans, tiny units, small scale industries, organized medium and large scale sector. Organized sectors manufacture sophisticated machinery such as tractors, engines, milling and dairying equipment. Traditional hand tools and bullock drawn implements are largely fabricated by village craftsmen (blacksmith and carpenters) and power operated machinery by small-scale industries.

Objectives of the Study:

To analysis the intensity of machinery and growth rate of machinery use in farming in Haryana.
To analysis the role of machinery in the production of agriculture sector in Haryana.

The present study is based only on the secondary data that has been collected through various sources as like: Economic survey, CMIE of money and banking, Statistical abstract, Agriculture reports, NABARD, RBI publications etc.

Various statistical tools such as tabulation, mean, percentage, ratio analysis, average growth rate, graphs and diagrams have been used for the purpose of analyzing the financial data in present study.

MACHINES DRIVE IN FARMING IN INDIA

Silently, agriculture in India has gone through a far-reaching change in the past few decades. The share of human power available for carrying out the myriad operations in farming has shrunk to a mere 5% as has that of draught animals, the iconic oxen pulling the plough. More than 90% of the power is now drawn from mechanical sources: tractors and power tillers provide the bulk, 47%; Electric motors 27% and diesel engines 16%. These are the latest estimates thrown up by a study of farm mechanization done by C R Mehta, principal scientist, and his colleagues at the Central Institute of Agricultural Engineering, Bhopal. Four decades ago, in 1971-72, 60% of the power was provided by humans and animals 15% by farm labourers and 45% by animals. In 1991-92, this collective share had dropped to 26% (labour accounted for 9%). Tractors have made the biggest stride, from a mere 7% to 47%.

These shares are calculated using an average value of power that a human or a draught animal or any of the machines generate per unit of land. An average human being, for instance, can yield 0.15 kilowatt power per hectare of land worked while a tractor can give 30.21kW. Mehta also pointed out that these are figures for power availability while actual consumption may be less.

Table no-1: Share of Machine in Indian Farms in % age

Equipment	1972-72	1991-92	2012-13
Agriculture Worker	15	09	05
Draught Animals	44	17	05
Machines	39	74	90
Tractors, Power Tillers	07	31	47
Diesel Engines	18	23	16
Electric Motor	14	20	27

Source: Census 2011 and economic survey of India 2013-14 .

But before you begin to celebrate this decline in backbreaking drudgery, Mehta also points out that overall farm mechanization in India has reached only about 40%, compared to 95% levels in advanced countries. "This means that 40% of farm operations for major crops are done by

mechanical power sources and 60% is still being done by animate power sources (human + draught animal) that generate only 10% of the total power available in farming. This shows that the timeliness and quality of farm operations with animate sources of power are poor," Mehta said. In most crops, tractors are used for initial land preparation, even by small land holders. Similarly, threshing is mostly mechanical now a day as is drawing of water. But many other operations, including paddy transplanting, are still done by agricultural workers.

Table no-2: Share of Human Power in Indian Farms (in Millions)

	1991	2011	Change in % age
Total Population	846	1211	43
Cultivators	111	119	07
Agri. Labour	75	144	93

Source: Census 2011.

It would be logical to assume that as machines take over agricultural operations, people are freed up from this onerous work. But this is not happening. There were 111 million cultivators and 75 million agricultural labourers in 1991 as per the Census. That's a total of 185 million people working on the land. But, in Census 2011, there were 119 million cultivators and a jaw dropping 144 million agricultural labourers, making a total of 263 million people working on land. Population increased by 43% in these 20 years but the number of landless agricultural laborers shot up by an astonishing 93%. The primary reason for this is that there is nowhere else where this army of underemployed people can find work, forcing them to crowd into agriculture or related rural work. It also pushes up migration to cities in search of jobs.

MACHINES DRIVE IN FARMING IN HARYANA

The structural composition of State economy has witnessed significant changes since the formation of Haryana State. Agriculture Sector still continues to occupy a significant position in State economy, although, the share of this sector in the Gross State Domestic Product is continuously declining. The predominance of Agriculture Sector is also responsible for instability in the growth rate of economy due to fluctuations in agricultural production. Natural calamities and fluctuation in rainfall often cause substantial loss in crop production which eventually results in fluctuation and instability in growth rate of State economy. Moreover, rapidly increasing share of Services Sector is also responsible for decline in the share of Agriculture Sector. The composition of Gross State Domestic Product at constant (1999-2000)

prices reveals that the share of Primary Sector which includes Agriculture and Allied Sectors has declined from 32.0 percent during 1999-2000 to 20.5 percent during 2007 -08.

Agriculture continues to occupy a prominent position in State economy. Despite the decline in the share of Agriculture Sector in the Gross State Domestic Product to 19.6 percent in 2007-08 from 21.2 percent in 2006-07, about two third population of the State still depends upon agriculture for their livelihood. The total area of the State under cultivation has already reached at a saturation level and thus there is hardly any scope to bring more area under cultivation. The agriculture production can only be increased through enhanced cropping intensity, change in cropping pattern, improvement in seeds of high yielding varieties, better cultivation practices and development of post-harvest technology, new and low cost machine etc.

The Per Capita Income on current prices, has been estimated at Rs. 147076 and on constant prices Rs 71493 during 2014-15 as against Rs. 56917 & 47046 during 2007-08 showing an increase of 2.58 & 1.52 times respectively.

In Haryana percentage share of total population depends on agriculture is about 58 percent. Thus, it may be said that agriculture is the backbone of economy. So the prosperity of agriculture is the prosperity of entire economy. The Rostow stages theory of growth has observed that, agriculture plays a distinct but multiple and converging role in the transitional process of the “take off” into self-sustained growth.

Haryana is a small state which is relatively backward area of the farmers in comparison to well develop state of Punjab. It made rapid progress in the field of agriculture development since its existence in 1966 and after it has achieved a prestigious position in comparison to other advanced states of the Indian with 1.4% of the total geographical areas of the country. It contributes more than 5% of the total food grains produced in the country.

Haryana is one of those states which has repeated the benefit of “Green Revolution” and has attained a very high rate of agricultural production. Since 1947 the scope for bringing more area under cultivation that was limited before green revolution. Efforts were intensified towards increasing the yields per unit of area, through an increase in irrigation facilities and cropping intensity. Due to use of farm machinery, chemical fertilizers and high yielding varieties of seeds need of credit in agriculture sector that is increasing day by day. All these efforts resulted in boosting agricultural production. As a result the production of food-grain of the state has increased from 25.92 lakh tones in 1966-67 to 129.94 lakh tones in 2005-06 and 161.50 lakh tones in 2013-14 i.e. more than six time increase over the year 1966-67.

Land Utilisation

The present table 3 shows that total cropped area in Haryana has increased from 45.99 lakh hectares in 1966-67 to 63.76 lakh hectares in 2012-13. Area sown more than once also has increased from 11.76 lakh hectares to 28.63 lakh hectares in the same time period.

Table 3- Land Utilisation in Haryana (Lakh hectares)

Classification	1966-67	1989-90	2004-05	2009-10	2012-13
Aria under forest	0.91	0.68	0.44	0.40	0.40
Land not available for cultivation	4.89	4.17	5.25	5.79	5.42
Follow Land	2.59	1.75	2.12	1.42	1.03
Other uncultivable land	1.37	0.83	0.66	0.71	1.01
Cultivable land	38.19	38.21	38.26	38.08	36.64
Net Area sown	34.23	35.93	35.98	35.90	35.13
Area sown more than once	11.76	20.58	28.97	28.01	28.63
Total cropped area	45.99	56.51	64.25	63.51	63.76

Source: - Statistical Abstract of Haryana 2000 to 2014-15

The area classified other uncultivable land i.e. the area not properly utilised, has been gradually declining whereas the area under forests, that land not available for cultivation (utilized for habitation and industrial purposes) and cultivable area had been continuously increasing. Non cultivable land was 4.89 lakh hectares in 1966-67 that has increased 5.42 lakh hectares in 2012-13. Similarly, the area under other uncultivable land has decreased from 1.37 lakh hectares in 1966-67 to 0.71 lakh hectares in 2009-10. Thus, uncultivable area has decreased and that of cultivable area has increased. The net area sown has increased from 34.23 lakh hectares in 1966-67 to 35.90 lakh hectares in 2009-10. The net area shown has increased about 5 percent over the year 1967 due to increase in the cultivable area. Along with this increase multiple cropping as depicted by the area has shown more than once has also been increased. The results increase in gross cropped area during the study period, it is calculated 39.70 percent. While area under forest has decreased from 0.91 lakh hectares to 0.40 lakh hectares in the same time period. It is an alarming bell for the environment in Haryana and it is below than national level.

Mechanization of Farming and Farm Equipment's

In the strategy of agricultural development mechanization of farm operation is an essential aspect along with the high yielding varieties of seeds, use of these in organic manures and pesticides

etc. Double or triple cropping on a large scale is not possible without the use of modern technology on farms. Mechanization of farming involves in use of tractors, threshers and tube-wells. Full mechanization of equipment in Haryana has not been attained and it is not possible due to decreasing landholding and lack of farm mechanization policy. Detail regarding farm equipment's of the state is presented in table 4.

Table 4- Agricultural Machinery and Equipment's used in Haryana

Sr. no.	Name of equipment	1989-90	2003-04	% change 1990 to 2003	2007	% change 2003 to 2007
1	Plough (total)	624333 (91)	274250 (40)	-56.07	202896 (30)	-26.02
	(a) wooden	450991 (66)	121377 (18)	-73.00	93,731 (14)	-22.78
	(b) Iran	173362 (25)	152873 (22)	-11.80	1,09,165 (16)	-28.59
2	Tractors	165648 (24)	254020 (37)	53.34	259030 (38)	1.97
3	Tube-wells & pumps	418622 (61)	548233 (80)	30.96	6,18,023 (90)	12.73
4	Thresher /combine harvesters	2383 (0.35)	9181 (1.34)	285.27	--	--
5	Sugar can crusher	6019 (0.88)	2777 (0.41)	-53.86	834 (0.12)	-69.97

Source: Statistical Abstract of Haryana 2006-07 & 2011-12.

Note: in brackets we show the no of equipment per village in absolute number.

Table 4 shows that the biggest increase is noticed in thresher/combine harvesters machines that have increased from 2383 in 1989-90 to 9181 in 2003-04. It is counted about 285 percent hike in the use of above said equipment. Similarly number of tractors along with tube-wells and pump-sets has also increased tremendously to about 53.34 percent and 30.96 percent over the entire period respectively. The decline is noticed in case of wooden plough and sugar cane crushers. The sugar cane crushers have declined by 53.86 percent and wooden plough decreased from 56.07 percent. Increased the demand of thresher/ combine harvester machines, tractors, tube – wells and pump sets in the market showed a definite trend towards mechanization of agriculture and using modern technology in Haryana.

The table 5 clearly shows that the use of tractor in Haryana has increased from 4803 in 1966-67 to 271729 in 2013-14. Use of tractor has increased more than 56.57 times after green revaluation. It shows the advancement in Haryana agriculture. During the study period growth rate of use of tractors have remained 1.47 percent.

Table 5-Number of Tractor in Haryana

Year	Number of Tractor	% age change
1966-67	4803	-
1970-71	12312	2.56
1975-76	25451	2.07
1980-81	52689	2.07
1985-86	83120	1.58
1990-91	130246	1.57
1995-96	162030	1.24
2000-01	209613	1.29
2005-06	246914	1.18
2009-10	259030	1.05
2010-11	262236	1.01
2012-13	270230	1.03
2013-14	271729	1.01
Mean	153108	1.47

Source: Statistical abstract of Haryana 2000 to 2013-14.

Table 6-District wise Number of Tractor in Haryana in 2013-14.

Distract	Number of Tractor	No of Villages	Tractor per Village
Ambala	8822	470	19
Panchkula	11476	219	52
Yamunanagar	12560	636	20
Kurukshetra	14483	415	35
Kaithal	12760	269	47
Karnal	19327	434	45
Panipat	2232	186	12
Sonipat	17140	332	52
Rohtak	13023	143	91
Jhajjar	16867	260	65
Faridabad	3916	149	26
Palwal	15020	280	54

Gurgaon	5444	242	22
Mewat	4577	439	10
Rewari	8874	403	22
Mahendragarh	5855	370	16
Bhiwani	22233	444	50
Jind	14349	306	47
Hisar	21791	269	81
Fatehabad	16737	245	68
Sirsa	24243	330	73
Haryana	271729	6841	40

Source: Statistical abstract of Haryana 2013-14.

Note: Tractor per Village is in round figure.

The table 6 shows the use of tractor in Haryana District wise. In Haryana per village 40 tractors are used in 2013-14. Distract Rohtak is leading in using the tractor per village (91) and followed by Hisar (81). Mewat is on the lowest position in the using tractor per village (10) followed by Panipat (12) in Haryana.

Table 7-Number of Diesel Sets & Electric Sets in Haryana

Year	Diesel Sets	Electric Sets	Total
1966-67	-	-	25,311
1970-71	17,903	86,455	1,04,358 (4.12)
1975-76	65,092	1,39,644	2,04,736 (1.96)
1980-81	1,09,353	2,22,674	3,32,027 (1.62)
1985-86	1,34,136	2,72,282	4,06,418 (1.22)
1990-91	1,55,842	3,41,729	4,97,571 (1.22)
1995-96	2,25,848	3,23,448	5,49,296 (1.10)
2000-01	2,55,302	3,34,171	5,89,473 (1.07)
2005-06	2,31,821	3,86,202	6,18,023 (1.05)

2009-10	2,36,146	4,67,311	7,03,457 (1.14)
2010-11	2,31,146	4,92,311	7,23,457 (1.03)
2012-13	220046	532311	752357 (1.04)
2013-14	215646	556664	772310 (1.03)
Mean	174857	346267	521124

Source: Statistical abstract of Haryana 2000 to 2013-14.

Note: In the brackets data shows the % age change.

The table 7 shows the use of Diesel Sets & Electric Sets in Haryana. During the study period from 1970-71 to 2013-14 use of Diesel sets has increased 12.05 times and Electric Sets has increased 6.44 times. Total sets have increased 7.4 times during the same time period.

Table 8: District wise Number of Diesel Sets & Electric Sets in Haryana

District	Diesel Sets	Electric Sets	Total
Ambala	5,119 (11)	21,197 (45)	26,316 (56)
Panchkula	1,287 (06)	3,365 (15)	4,652 (21)
Yamunanagar	6,095 (10)	24,770 (39)	30,865 (49)
Kurukshetra	9,365 (23)	62,545 (151)	71,910 (173)
Kaithal	19,890 (74)	40,882 (152)	60,772 (226)
Karnal	193 (0.44)	40,154 (93)	40,347 (93)
Panipat	3,033 (16)	28,896 (155)	31,929 (172)
Sonapat	21,860 (66)	22,405 (67)	44,265 (133)
Rohtak	16,580 (116)	3,409 (24)	19,989 (140)
Jhajjar	22,288	7,024	29,312

	(86)	(27)	(113)
Faridabad	2,435 (16)	7,626 (51)	10,061 (68)
Palwal	15,608 (56)	9,542 (34)	25,150 (90)
Gurgaon	623 (03)	23,953 (99)	24,576 (102)
Mewat	8,022 (18)	7,635 (17)	15,657 (36)
Rewari	5,502 (14)	28,029 (70)	33,531 (83)
Mahendragarh	142 (0.38)	27,266 (74)	27,408 (74)
Bhiwani	23,560 (53)	27,614 (62)	51,174 (115)
Jind	19787 (65)	30,414 (99)	50,201 (164)
Hisar	20,543 (76)	10,558 (39)	31,101 (116)
Fatehabad	9,191 (38)	28,821 (118)	38,012 (155)
Sirsa	20,023 (61)	36,206 (110)	56,229 (170)
Haryana	231146 (34)	483723 (71)	723457 (106)

Source: Statistical abstract of Haryana 2013-14.

Note: Tractor per Village is in round figure.

The table 8 shows the District wise use of Diesel pump sets & Electric pump sets in Haryana. In Haryana per village 106 pump sets are used in 2013-14. Out of total pump sets per village 34 pump sets are Diesel and 71 pump sets are Electric. District Kaithal is leading in using the total pump sets per village (226) and followed by Kurukshetra (173). Panchkula is on the lowest position in the using total pump sets per village (21) followed by Mewat (36) in Haryana.

FINDINGS: The agriculture and rural development are highly inter-related to use of machinery in farming in Haryana. Agriculture has been considered as crucial sector to generate major proportion of employment. Productive job opportunities are to be created in rural areas through development of agriculture, irrigation facilities, rural infrastructure and promotion of

village and cottage industries for rural development by providing cheaper bank loan.

Study found that use of Diesel pump sets and Electric pump sets shows the increasing trends during the study period in Haryana. We also found that those districts are rich in per capita income and resources are using more Diesel pump sets and Electric pump sets in comparison of poor districts. During the study period from 1970-71 to 2013-14 use of Diesel pump sets has increased 12.05 times and Electric pump sets has increased 6.44 times. Total pump sets have increased 7.4 times during the same time period.

Study found that use of tractor in Haryana has increased more than 56.57 times after green revaluation. It shows the advancement in Haryana agriculture. During the study period growth rate of use of tractors have remained 1.47 percent. In Haryana per village 40 tractors are used in 2013-14. District Rohtak is leading in using the tractor per village (91) and followed by Hisar (81). Mewat is on the lowest position in the using tractor per village (10) followed by Panipat (12) in Haryana.

Study also shows that the biggest increase is noticed in thresher/combine harvester's machines that have increased from 2383 in 1989-90 to 9181 in 2003-04. It is counted about 285 percent hike in the use of above said equipment. Similarly number of tractors along with tube-wells and pump-sets has also increased tremendously to about 53.34 percent and 30.96 percent over the entire period respectively. The decline is noticed in case of wooden plough and sugar cane crushers. The sugar cane crushers have declined by 53.86 percent and wooden plough decreased from 56.07 percent. Increased the demand of thresher/ combine harvester machines, tractors, tube –wells and pump sets in the market showed a definite trend towards mechanization of agriculture and using modern technology in Haryana.

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