Custom Hiring Services of Farm Machinery in Punjab: Impact and Policies

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ABSTRACT

Punjab agriculture, as in India, is characterised by abundance of small holdings but it is highly mechanised. However, the ownership of machinery is mainly determined by the economic viability. This led to the development of custom-hiring services. About 40 per cent farm households own the tractor, but every farm household uses the tractor. Human labour employment is higher on tractor owning farms. However, custom hiring system is better for the smaller farmers for availing non-farm employment opportunities. The productivity of major crops is higher on the tractor owning farms due to timely and sufficient availability of tractor services. The net farm income is higher on tractor owning farms but input costs are low on custom hiring farms. It may be due to the high fixed costs as well as repair and maintenance costs on tractor owning farms. The custom hiring farmers reported the problems of costly, inadequate and lack of timely availability of custom hiring services. The government should develop the Primary Agricultural Cooperative Societies as Agro-Service Centres for such services and take steps like fixing the custom hiring rates, reducing fuel costs and creating more awareness about custom hiring of farm machinery. This would particularly be beneficial to the small farmers to cut down their cost of production, enhance productivity and increase their net farm income.

Key words: *Custom hiring; Employment; Productivity; Income; Constraints; Policy;*

The trend towards over-capitalisation in agriculture and the increasing cost of production are becoming the new challenges for competitive production. The basic requirement to meet this competition is to reduce the unit cost of production and maximize resource productivity which depends greatly on the availability and judicious use of farm power by the farmers. The green revolution model initiated during mid-1960s made a progressive shift from draft animal power to mechanical power in Punjab agriculture. The use of mechanical power has become indispensable for timely completion of various farm operations under intensive agriculture. The mechanical process of farming enabled efficient utilisation of inputs such as seeds, fertilisers and irrigation water along with contribution to increasing cropping intensity through multiple cropping systems.

Indian agriculture is characterised by over-abundance of small holdings. Due to law of inheritance and differences in soil fertility, fragmentation and sub-division of land became general feature of Indian agriculture which now has 83 per cent small farms with operational land holding of less than two hectares. Similarly, in Punjab, out of 10 lakh land holdings, about three lakh are small and marginal holdings. Interestingly, the number of these holdings has declined during last one and half decade. It was five lakh in 1991 which declined to three lakh in 2005-06. This shows that two lakh small farmers have left farming, majority of them have left agriculture due to uneconomical size of holdings (*Singh and Kingra, 2007; 2010*). Large number of old tractor markets is a common site in the state. Some small farmers even buy a new tractor from the agency to sell them in these tractor markets, to repay some other debt (*Singh and Rangi, 2006*). The annual hours of tractor/machinery used in small holding do not justify the ownership of tractors and tractor-based machines by most of the farmers. It is always argued that tractor and other implements are the major reason of farmers' distress. The small farmers who have owned their tractor are more indebted than the other farmers who

hire-in tractor and other machinery. Through custom hiring of agricultural machinery even small farmers have been able to get the benefit of agricultural mechanisation. About 40 per cent farm households own the tractor, but every farm household uses the tractor.

Though custom hiring has been practised in Punjab since long, the attempts to evaluate economics of tractor ownership in contrast to custom hiring are limited. Our study documents the practice of custom-hiring of tractor in agriculture and its impact on productivity, income and employment of the farmers of the Punjab state.

METHODOLOGY

Multi-stage random sampling technique was used. Of the twenty districts of Punjab, four districts namely Ludhiana, Jalandhar, Bathinda and Patiala were selected for the study. One block from each selected district and one village from each block was chosen. From each of the four selected villages, 20 tractor owning farms and 10 custom-hiring farms (not owning tractor) were selected. In total, 120 holdings were selected for the study (Table 1).

On the basis of probability proportion of tractor operated farms, in relation to farm size, 8 small, 32 semi-medium, 25 medium and 15 large farms were selected (Table 2). None of the marginal farms in the selected villages owned tractor. Among custom hiring farms, 17 marginal farms, 15 small farms, 7 semi-medium and one medium farm was selected. None of the large farms in the selected villages was practising custom hiring farming. The reference period of the study is 2011-12.

Table 1. Sampling design of the study

District	Block	Village	Sample		
			Owning tractor	Custom hiring	Total
Ludhiana	Ludhiana-I	Bihla	20	10	30
Bathinda	Rampuraphul	Gill Kalan	20	10	30
Patiala	Patiala	Assarpur	20	10	30
Jalandhar	Dhilwan	Ibban	20	10	30
Total			80	40	120

Table 2. Distribution of selected farms according to size groups

Farm category (Operational land)	No. of farmers owning tractor	No. of farmers custom-hiring tractor	Total selected farmers
Marginal (< 1 ha)	-	17	17
Small (1-2 ha)	8	15	23
Semi-medium (2-4 ha)	32	7	39
Medium (4-10 ha)	25	1	26
Large (> 10 ha)	15	-	15
Total	80	40	120

RESULTS AND DISCUSSION

Mechanization of Punjab agriculture : Mechanisation in Indian agriculture started with the introduction of green revolution model, in which establishment of the Central Tractor Organisation was established mainly for land reclamation and mechanical cultivation. Since then by the virtue of its inherent edge over the conventional means of farming, agricultural mechanisation gained popularity. The increased use of farm machines found expression in the expansion of cropped area through increase in cropping intensity.

The pattern of farm size distribution in Punjab has been changing differently than in India mainly because of the differences in the mechanisation of agriculture and the development of custom hiring services (Table 3). In India, the number of land holdings increased from 1066 lakh in 1990-91 to 1292 lakhs in 2005-06. On the other hand in Punjab, the number of land holdings declined from 11.17 lakh to 10.04 lakh during the same period. The number of small and marginal farmers declined from 5 lakh in 1990-91 to about 3 lakh

Table 3. Number of operational holdings by size group ('000 Number)

Farm category	1990-91				2005-06			
	India		Punjab		India		Punjab	
Marginal	63389	59.44	297	26.48	83694	64.77	135	13.45
Small	20092	18.84	204	18.25	23929	18.52	184	18.33
Semi-Medium	13923	13.06	288	25.85	14127	10.93	319	31.77
Medium	7580	7.11	261	23.41	6375	4.93	295	29.38
Large	1654	1.55	67	6.01	1095	0.85	71	7.07
All Holdings	106637	100.0	1117	100.0	129222	100.0	1004	100.0

Source: Department of Agriculture and Cooperation, Agricultural Census Division.

in 2005-06. The over mechanisation is one of the reasons for de-peasantisation in the Punjab state as the over capitalisation reduced net income of the farmers by increasing per unit cost of cultivation and displacing labour and bullock power.

Agriculture in Punjab, which is the most mechanised in India, has undergone a remarkable change since early 1970s. It has been transformed from subsistence farming to mechanised farming using mainly inanimate power sources like tractors, diesel engines, electric motors, etc. The adoption of mechanisation has taken place on a very large scale (Table 4).

The number of all types of farm machinery brought structural changes in the state. In terms of gross cropped area, Punjab state has the highest density of tractors in Indian union. As much as 4.25 lakh tractors are being used in the cultivable land of 41.58 lakh hectare in the state. The tractor power is widely used in Punjab agriculture so much so that all the bullock power even on small farms has been replaced by tractor power (Singh *et al*., 2008). The number of tubewells increased from 10.73 lakh in 1999-00 to 13.75 lakh in 2009-10, the major share (80.36 %) of these tubewells is electric operated. The harvesting of the crops, particularly, paddy and wheat is being done mechanically. Thus, the number of combine harvesters increased from 8,050 in 1999-00 to 14,670 in 2009-10. Similarly, the number of other machines and implements has increased during the last two-three decades. As a result, the Punjab agriculture become intensively mechanised which has its own limitations and problems.

Table 4. Agricultural machinery in Punjab state (No.)

Category	1999-00	2009-10
Tractors	3,95,000	4,25,200
Disc-harrows	2,95,000	2,24,300
Seed cum fertiliser drill	1,95,000	1,83,400
Spray pumps (knapsack)	5,55,000	6,55,000
Combines	8,050	14,670
Threshers	3,50,000	8,02,000
Straw reapers	4,100	32,900
Tubewells	10,73,000	13,75,517
(a) Electric	7,88,000	11,05,517
(b) Diesel	2,85,000	2,70,000

Custom hiring system in Punjab agriculture : The agriculture of Punjab is highly mechanised. However, the ownership is mainly determined by the economic viability. This led to development of the custom-hiring services, which helped in containing the per unit input costs on majority of the small holdings.

From our field survey, average operational holdings and intensity of tractor ownership among tractor owning farms revealed that all the farm size categories except the marginal farmers continue to operate their holdings with owned tractors and implements (Table 5). It was found that average size of operational holding was 3.67 times for farmers having their own tractor (13.68 acres) than for those who hire tractor (3.73 acres). The average number of tractors increased with the farm size and the area served per tractor also increased with farm size. The intensity of owning tractor is higher on smaller farms as compared to larger farms. However, the small farmers might have done hiring out of tractor services to large extent.

Further for farms owning tractors, it was observed the size of tractor owned varied from 35 to 60 hp (Table 6). Though majority of tractors owners had tractor of 35 horse power (about 61 %) yet 9.18 per cent had tractors of power varying from 36 to 40 hp and 45 hp each, 7.14 per cent had 50 hp and 55 hp each, and 6.12 per cent had 60 hp. It was also found that these large sized tractors were mainly owned by large farmers only. Total tractor power available per farm varied from 37 hp on small farms to about 70 hp on large farms.

It was also found that ownership of tractor power was 3.60 hp per acre on an average tractor owning farm. However, it varied inversely with farm size as it declined from about 8 hp per acre on small farms to just 2.56 hp per acre on large farms.

Table 6. Horse power of tractors on tractor owning farms

Farm category	Tractor horse power range						Total no.	Average	Average
	35	36-40	45	50	55	60	of tractors	hp/farm	hp/acre
Marginal	-	-	-	-	-	-	-	-	-
Small	5	2	1				8	37.00	7.99
Semi-medium	22	4	1	2	1	2	32	38.81	5.16
Medium	21	3	4	3	2	1	34	53.96	3.34
Large	12		3	2	4	3	24	70.33	2.56
Total	60	9	9	7	7	6	98	49.28	3.60
% of total	61.22	9.18	9.18	7.14	7.14	6.12	-	-	-

Table 5. Intensity of tractor ownership among tractor owning farms (Area in acres)

Farm category	With owned tractor			Hired tractor
	AOH	TR	AT	AOH
Marginal	NA	NA	NA	1.86
Small	4.63	1.00	4.63	4.41
Semi-medium	7.52	1.00	7.52	5.63
Medium	16.17	1.36	11.89	12.00
Large	27.50	1.60	17.19	NA
Sub-total	13.68	1.23	11.12	3.73

AOH = Average operational holding
TR = Average no. of tractors
AT = Area per tractor

Impact of custom hiring services on employment : The analysis of data pertaining to human labour employment in agriculture and non-farm sectors indicated that in farm category owning tractor, about 93 per cent (2.18 persons per farm) were employed in agriculture (Table 7). On the other hand, on an average farm hiring tractor 81.25 per cent (1.43 persons) were employed in agriculture.

On the contrast more labour was working in non-farm sector in tractor hiring farms 19.54 per cent as compared to tractor owning farms 7.23 per cent. All this indicates that for tractor owning farms, more employment opportunities exist in agriculture as the farmers owning tractor also provide hiring facilities themselves to farmers not owning it.

Table 7. Average earners on selected farm families: tractor owners vs custom hiring farms (per farm)

Farm category	Farm Earners	Non-farm earners	Total
With owned tractor			
Marginal	NA		
Small	2.25	0.08	2.33
Semi-medium	2.00	0.05	2.05
Medium	2.31	0.46	2.77
Large	2.31	0.15	2.46
Sub-total	2.18	0.20	2.38
	(92.77)	(7.23)	(100.00)
With custom hired tractor			
Marginal	1.30	0.50	1.80
Small	1.50	0.25	1.75
Semi-medium	1.50	0.17	1.67
Medium	1.00	0.12	1.12
Large	NA		
Sub-total	1.40	0.34	1.74
	(80.46)	(19.54)	(100.00)

The impact of farm mechanisation on labour employment, particularly in labour surplus country like India, has been a matter of concern and debate. As tractors save the resources allocated for maintaining draft animals and enabled an increase in output by raising cropping intensity and productivity, thus proving socially beneficial in the context of shortage and high prices of agricultural commodities.

In case of our field survey, the pattern and magnitude of total human labour employed in crop farming revealed that farms owing tractors employed more human labour (about 235 hours per acre) than for farms hiring tractors (about 219 hours per acre) (Table 8). Of the total human employment in cropping on tractor farms, about 110 hours were of family labour and rest about 125 hours were of hired labour comprising 29 hours/acre for permanent labour and 96 hours for casual labour. However, for tractor hiring farms, about 112 hours/acre came from family labour and the rest 106 hours from hired labour including 12 hours/acre from permanent labour and 94 hours/acre from casual labour. Comparison of employment figures for two farm categories indicates that only the family labour employed in crop farming was lower on tractor owing farms than on tractor hiring farms while permanent as well as casual labour employment was lower on tractor hiring farms. The size wise analysis relating to employment revealed no definite relationship with farm size for both the farm categories.

Impact of custom hiring on productivity: It is well known fact that farm mechanisation enhances

Table 8. Employment on selected farms in crop production in Punjab (Hours/annum/acre)

Farm category	FL	PL	CL	TE
With owned tractor				
Marginal	NA			
Small	211.30	0.00	119.30	330.6
Semi-medium	145.76	20.36	64.98	231.1
Medium	111.20	26.60	97.41	235.21
Large	79.86	37.16	112.42	229.44
Sub-total	109.87	28.66	96.31	234.84
With custom hired tractor				
Marginal	182.29	0.00	104.88	287.17
Small	137.80	0.00	79.74	217.54
Semi-medium	79.38	28.36	116.50	224.24
Medium	58.75	0.00	41.25	100
Large	NA			
Sub-total	112.29	11.67	94.95	218.91

Note: FL, PL CL & TE indicates family labour, permanent labour, causal labour and Total employment respectively

agricultural productivity but sometimes due to heavy fixed cost of farm machinery, net income of farmers gets reduced. In a survey by National Council of Applied Economic Research, for seven states belonging to three major agro-climatic zones of India. The increase in timely sown area of wheat during 1990s due to tractors alone justifies about 16 per cent tractors in Punjab (*Singh K et al., 2004*). Similar findings were obtained in our present study, in which the yield of major crops of Punjab was higher on tractor owning farms (Table 9). For paddy, average yield per acre was 26.82 on tractor owning farms and 26.38 for tractor hiring farms. Statistically the yield of paddy was significantly higher on farms owning tractors as compared to those farming with custom hiring tractor. Similarly, for wheat for tractor farms higher yield of 21.45 qtls/acre was there than for custom-hiring farms i.e. 20.87 qtls/acre. The yield of wheat came to be significantly higher on farms owning tractors than on farms custom hiring tractors. Thus, in a rice-wheat system, which covers about two-third of the state area (*Singh K et al., 2002*), the tractor owners had almost one quintal higher production than the custom hiring farms.

Impact of custom hiring on farm income : Size wise analysis for both the farm categories indicates almost an inverse relationship between gross farm income per acre and farm size. Gross farm income per acre varied from Rs 54,194 per acre on large farms to Rs 69,305 per acre for small farms on tractor owning farms while it varied from Rs 51,679 per acre on medium farms to Rs 89,488 per acre on marginal farms in tractor hiring farms. Similar kind of pattern existed for net farm income per acre. Net farm income increased from Rs 33,982 per acre on large to Rs 46,006 per acre on semi-medium tractor farms and from Rs 68,195 per acre to Rs 43,031 per acre on medium farms of tractor hiring category. Thus, it was observed that small and semi-medium tractor hiring farms earned more net income than tractor owned farms of respective categories (Table 10). This shows that it is better for smaller farms to hire tractor services rather to have their own tractor. On the other hand owning a tractor is economically beneficial for larger farmers.

Constraints and policy suggestions : Although custom hiring services in Punjab Agriculture have been becoming popular among smaller farmers but these farmers were facing some constraints which were hampering the practical applicability of the custom hiring system. High cost of hiring a tractor appeared to be the major constraint outlined by 95 per cent of the custom hiring farmers (Table 11). Timely and adequate availability of tractor services were reported another major constraint by 72.50 per cent and 55 per cent of the respondents respectively. They felt that sometimes the sowing of their crop get delayed due to lack of timely and adequate availability of tractor services. Another interesting issue highlighted by 47.5 per cent of custom hiring farmers that ownership of the tractor is a social status. In such situation, even small farms owned tractor which becomes hindrances in custom hiring services.

About 98 per cent of the respondents felt that there is a need to expand and develop the cooperative custom hiring service centres in Punjab as these can contribute to solve the problem of timely availability of machinery to farmers. 95 per cent farmers said that custom hiring rates should be reduced. Also about 38 per cent of the respondents suggested that the Government should take

Table 9. Area and productivity for wheat and paddy for selected farms (Area in acres and yield in qtls/acre)

Farm category	Operational area	Area under Paddy	Yield	Area under Wheat	Yield
With owned tractor					
Marginal	NA	-	-	-	-
Small	4.63	3.88 (83.60)	26.35	3.91 (84.45)	20.61
Semi-medium	7.52	6.36 (84.57)	26.64	6.78 (90.16)	21.21
Medium	16.17	9.19 (56.83)	27.01	10.92 (67.53)	21.4
Large	27.50	12.49 (45.42)	26.86	16.93 (61.56)	21.8
Sub-total	13.68	8.15 (59.58)	26.82	10.33 (70.83)	21.45
With custom hired tractor					
Marginal	1.86	0.98 (52.69)	25.95	1.56 (83.87)	20.49
Small	4.41	3.47 (78.67)	26.44	3.90 (88.44)	20.46
Semi-medium	5.63	3.48 (61.81)	26.35	5.00 (88.81)	21
Medium	12.00	9.5 (79.17)	26.69	10.50 (87.50)	21.59
Large	NA	-	-	-	-
Sub-total	2.94	2.15 (57.64)	26.38	2.60 (88.44)	20.87
t-value (Av. Yield)	-	-	2.34*	-	2.46*

Note: (i) Figures in parentheses are percentages to total area in season, (ii) *-Significant at 5% level of significance

Table 10. Income comparison of owner v/s custom hiring farms (Rs. per acre/annum)

Farm category	Crops	Dairy	Gross farm income	Gross farm expen	Net farm income
With owned tractor					
Marginal	NA	-	-	-	-
Small	52332	16973	69305	24549	44756
Semi-medium	49460	14073	63533	17527	46006
Medium	42565	12280	54845	16596	38249
Large	46789	7405	54194	20212	33982
Sub-total	47092	12552	59644	18442	41202
With custom hiring tractor					
Marginal	39996	49492	89488	21292	68195
Small	46201	18501	63001	16608	46393
Semi-medium	53060	10526	73019	18589	54430
Medium	47617	4063	51679	8648	43031
Large	NA	-	-	-	-
Sub-total	47821	19781	57637	17323	40314

steps like fixing custom hiring rates for farm machinery, making fuel available at subsidised rates. About half of the respondents (45%) felt need for creating more awareness about custom hiring of machinery which will help to reduce the fixed costs of farm operations and lessen the burden of heavy capital investments.

CONCLUSION

The agriculture in Punjab is highly mechanised. However, the ownership of machinery is mainly determined by the economic viability. This led to the development of custom-hiring services, which helped the majority of the small holdings to take up the farm operation with farm machinery without going in for investment in high cost machinery. About 40 per cent farm households own the tractor, but every farm household uses the tractor. Human labour employment is higher on tractor owning farms. However, custom hiring system is better for the smaller farmers for availing non-farm employment opportunities. The productivity of major crops is higher on the tractor owning farms due to timely and sufficient availability of tractor services as compared to custom hiring farms.

Table 11. Constraints and suggestions regarding custom hiring farmers (N = 40)

Particulars	No.	%
High cost of custom hiring services	38	95.00
Lack of timely availability of tractor services	29	72.50
Inadequate availability of tractor services	22	55.00
Owning tractor- a social status	19	47.50
Develop cooperative custom hiring machinery service centres	39	97.50
Reduce costs of custom hiring services	38	95.00
Timely availability of machinery	30	75.00
More awareness for hiring in machinery	18	45.00
Govt. support for fixing hiring rates, subsidising fuels and lubricants etc.	15	37.50

Undoubtedly, net farm income is higher on tractor owning farms than that of custom hiring farms, but input costs are low on custom hiring farms. It may be due to the high fixed costs as well as repair and maintenance costs on tractor owning farms. The custom hiring farmers reported the problems of costly custom hiring services and lack of timely and adequate availability of tractor services. Therefore, the government should support the efficient delivery of custom hiring services for costly machinery especially by developing the Primary Agricultural Cooperative Societies as Agro-Service Centres and fixing custom hiring rates for farm machinery. This would particularly be beneficial to the small farmers to cut down their cost of production, enhance productivity and increase their net margins.

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