Investigating the cost of wheat production in Iran and the effect of combine availability on harvesting cost

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ABSTRACT

The aim of this study was investigated the cost of wheat production in Iran and the effect of combine availability on harvesting cost. Information of combine number and cost of wheat production in each province, for this period (2000 – 2006), attained from Ministry of Jihad-e-Agriculture of Iran statistics. Data from variable costs such as land preparing, planting, cultivating, harvesting and land price in each province in each year was entered into computer. Comparisons between means of producing cost, specially harvesting cost, were carried out with use of SPSS15. To compare the mean of costs in each province Duncan test was used. The result showed that the cost of wheat harvesting in provinces has decreased with increasing the number of combine harvester in provinces. Therefore for decreasing the harvesting cost in Iran provinces it is necessary to distribute more combine harvester in provinces.

Keywords: Wheat, Combine harvester, Harvesting cost, Iran

1. INTRODUCTION

Wheat (*Triticum aestivum* L.) is among the oldest and most extensively grown of all crops. It is a main cereal cultivated throughout the world along with rice, barley, maize, rye, sorghum, oats and millet. Nowadays, wheat cultivars have been developed for different qualities in accordance with the development of genetic recombination (Hung *et al*., 2008).Wheat is grown under irrigated as well as rain-fed conditions worldwide. Under rain-fed conditions the developing grains are frequently exposed to mild to severe stress at different stages of grain development (Singh *et al*., 2008).

The widespread production of wheat is the result of farmers and scientists adapting the crop to different soils, climates and management systems. Thus, wheat production cannot be analyzed without proper consideration of the large variation in these factors among wheat-producing regions. Integrating these factors into a comprehensive cropping systems approach is necessary to develop management practices which best suit a particular climate and soil (Pannkuk *et. al* 1998). Wheat production has increased through changing the traditional patterns of production structure and cultivation, and by increasing the use of machinery, high-yielding varieties and pumped groundwater (Iranian Ministry of Agriculture, 1992). Based on Ministry of Jihad-e-Agriculture of Iran (Anonymous, 2006) statistics, Iran wheat's production was about 14663745 t in 2006, from which 10137769 t was from irrigated and 4525976 t was from rain-fed lands, respectively. Wheat

is the single most important agricultural commodity in Iran. In 2006, for example, total crops were planted in 6878918 ha, more than 55% of which was planted by wheat.
In light of its general objective of attaining national self-sufficiency in agricultural products, the Iranian government has sought strategies that would lead to higher levels of production given current inputs particularly of land and water, and has paid considerably more attention to the production of wheat than to other crops. Therefore, the production of wheat has been increased during recent years (Bakhshoodeh and Thomson, 2001). In terms of economic efficiency, inputs such as seeds, fertilizers and machines seem not to be economically used in wheat production in Iran (Bakhshoodeh, 1995).
The availability of power is a pre-requisite for any agricultural activity whether the source is human, animal or motorized. In developed countries' agriculture, the general availability of virtually unlimited amounts of farm power in its different forms is almost taken for granted and comes almost exclusively from internal combustion engines or electric motors. The human is just the “brain” and control of the system. However, in most developing countries, the human is also a major source of farm power. It is a matter of how significant is this and to what extent is human power used (Clarke and Bishop, 2002).
Successful transformation of agriculture into a modern industry and the remarkable increases in factor productivity has contributed to improvement in human wellbeing. From an engineering perspective, agricultural mechanisation (as symbolised by the farm tractor) represents both a technology-push and technology-pull factor in the successful transformation of subsistence agriculture into market-oriented agribusiness. The availability of huge power units and related electromechanical systems for land preparation, cultivation, crop and livestock protection, harvesting and post harvest handling enabled humans to expand cultivated areas, convert otherwise marginal lands into productive units, and free up surplus farm labor to engage in non-farm service sectors that are equally rewarding (Linus U. Opara, 2004)
Wheat price in Iran is determined by government, and this is approximately constant throughout the country. Therefore, to increase the economical performance of wheat producing in Iran the expenses should be decreased. Availability of combine harvesters in harvesting period is one of the most important terms that has significant effect on harvesting costs. In this study, the effect of combine availability in Iran provinces is investigated.

2. MATERIALS AND METHODS

Iran is subdivided into 29 provinces as shown in Fig. 1. Information of combine number and cost of wheat production in each province, for the period from 2000 to 2006, were attained from Ministry of Jihad-e-Agriculture of Iran. Since Razavi Khorasan, North Khorasan and West Khorasan have recently been considered by the government to be provinces, data of these provinces were lumped into Khorasan. Also, due to incomplete data available for Gilan province, this province was not considered in the study.
Data from variable costs such as land preparation, planting, cultivation, harvesting and land price in each province, in each year, were collected. Comparisons between means of producing costs, specially harvesting costs, were carried out using SPSS 15. To compare mean of costs in each province Duncan test was used.

Fig. 1. The map of Iran provinces.

The experimental design was a randomized complete block with seven replications (each year in this study assumed as a replication). The treatment in the study was wheat harvesting cost for different provinces from 2000 to 2006.

A mechanization index based on combine availability in different provinces is presented as Eq. (1):

$$\mathrm{Im}i = \frac{Ci}{Si} \quad (1)$$

Where I_{mi} is the mechanization index of the ith province (1/ha); C_i is the number of combine in the ith province (the average of the number of combines from 2000 to 2006); s_i is the wheat cultivation area in ith province (ha).

Graph of I_{mi} is presented in Fig 2. Also, the graph of cultivated area under wheat (irrigated, rain-fed and total) in each province is shown in Fig. 3.

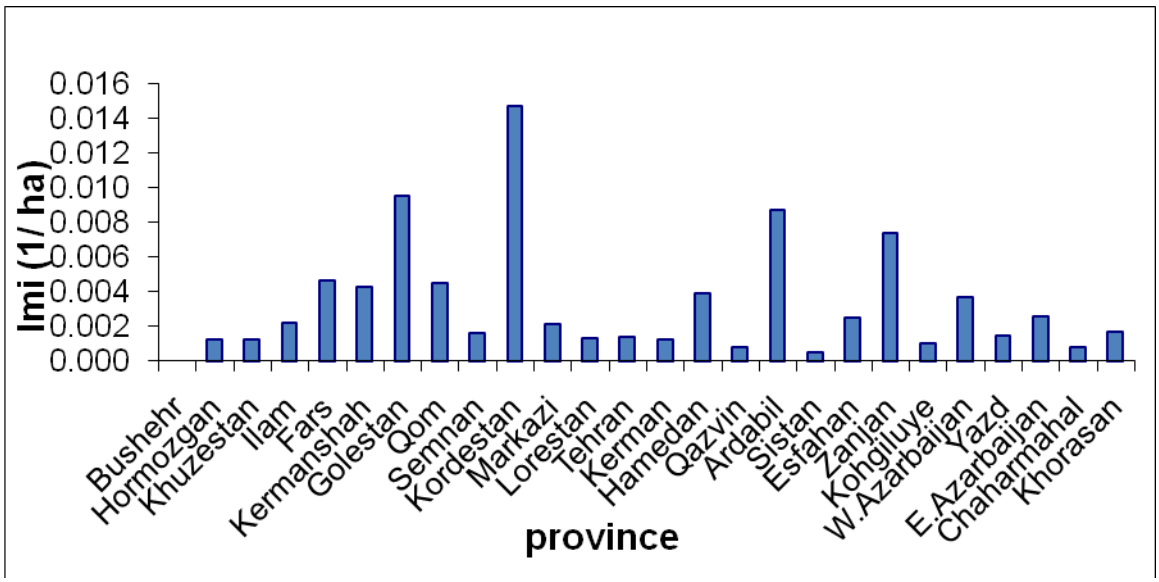

Fig. 2. Graph of the average number of combines per hectare from 2000 to 2006 in different provinces in Iran.

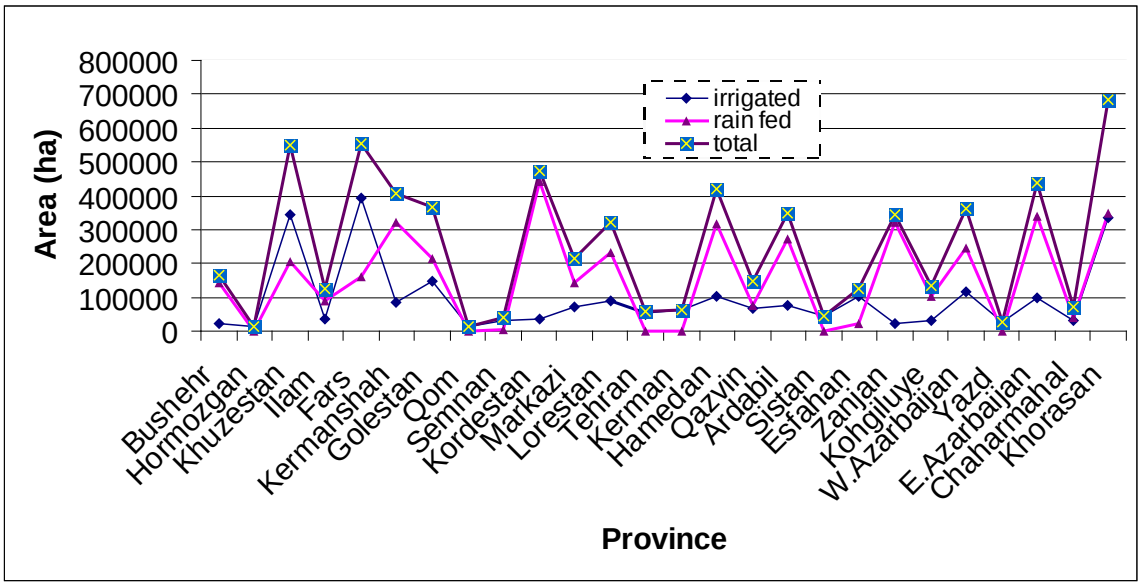

Fig. 3. Graph of average cultivated area under wheat (irrigated, rain-fed and total) in each province.

3. RESULTS AND DISCUSION

3.1. Total cost of wheat production in Iran

Results of compared means of production cost of irrigated and rain-fed wheat in Iran from 2000 to 2006 are presented in Table 1. According to this table, the cost in studied period is significantly increased. Regarding the high inflation rate in Iran, this increase is expectable. But

according to the results, the rate of this increase is significantly rapid in the ending years of study. It is due to national and international economical problems (such as war and sanctions).

Table 1. Results of Duncan test for the cost of production of wheat in Iran from 2000 to 2006

year	Cost (thousand Rials per hectare)			
	irrigated wheat		rain-fed wheat	
2000	a*	172204	a	56509
2001	a	216162	a	72505
2002	bc	266914	ab	87869
2003	c	292544	bc	105710
2004	d	400515	c	132353
2005	e	475819	cd	149165
2006	f	539487	e	180611

*values with the same letters in each column are not significantly different (P<0.05)

3.2. Total cost of wheat production in Iran provinces

Results of compared means of production costs of irrigated and rain-fed wheat in Iran provinces from 2000 to 2006 is presented in Table 2. According to this Table, the total cost of irrigated wheat producing in provinces is significantly different and provinces such as Khuzestan, Sistan & Balochistan, Kohgiluyeh & Boirahmad, Ilam, Bushehr, Kurdistan and Lorestan have the least cost among of all provinces. Fars and Khorasan provinces that stand high in wheat production in Iran (Figs. 2 & 3) presented high levels of production costs which is an indication of weak management in these provinces.

Also, according to Table 2 the total costs of rain-fed wheat producing in provinces are significantly different and provinces such as Bushehr, Khuzestan, Markazi and Zanjan have the least cost among all provinces. The high cost level for Golestan province, important for wheat production, indicated weak management in this province.

Table 2. Results of Duncan test for the average production cost of wheat in Iran provinces from 2000 to 2006

province	Cost (thousand Rials per hectare)		Cost (thousand Rials per hectare)	
	irrigated wheat		rain-fed wheat	
Khuzestan	a*	218831	ab	71761
Sistan&	a			-
Balochistan		221579		
Kohgiluye	a	226795	bc	136279
Ilam	ab	246482	abc	103052
Bushehr	ab	250598	a	45121
Kordestan	ab	256538	abc	100472
W.Azarbaijan	ab	290684	abc	108382
Lorestan	ab	294888	abc	109104
Kermanshah	ab	296504	bc	122210
Hormozgan	ab	302809		-
Kerman	abc	309768		-
E.Azarbayjan	abc	320056	abc	95056
Zanjan	abc	320446	ab	79697
Markazi	abcd	332995	ab	77156
Semnan	abcd	345354	c	151580
Qom	abcd	348426		-
Qazvin	abcd	354587	abc	87217
Golestan	abcd	367849	d	258758
Chaharmahal	abcd	398031	bc	135576
Hamedan	abcd	409010	abc	109025
Ardabil	abcd	414343	abc	98847
Yazd	abcd	432413		-
Tehran	bcd	446523	abc	104173
Fars	bcd	447805	abc	95386
Esfahan	cd	520434	abc	84697
Khorasan	d	537953	bc	115846

*values with the same letters in each column are not significantly different (P<0.05)

3.3. Harvesting cost of wheat in Iran provinces

Results of compared means of harvesting cost of irrigated and rain-fed wheat in Iran provinces is presented in Tables 3. According to this Table the total harvesting cost of irrigated wheat producing in provinces is significantly different and harvesting cost in provinces such as Bushehr, Hormozgan, Khuzestan, Ilam, Fars, Kermanshah, Golestan and Qom is less than that of other provinces. These results are logical for provinces such as Khuzestan, Fars, Kermanshah and Golestan because of high level of I_{mi} (Fig.1). The lower harvesting cost in provinces such as Bushehr, Hormozgan and Ilam is due to the fact that they are in the vicinity of Khuzestan, Fars and Kermanshah, respectively. In spite of high level of I_{mi} in Kordestan province (Fig. 2), the

harvesting cost in this province is rather high. The most probable explanation is that the amount of irrigated wheat level in this province is relatively lower than that of the rain-fed wheat. It seems that all efforts in this province are directed towards the rain-fed wheat production. The proof of this is the low harvesting costs of the rain-fed wheat in the province.

According to Table 3 the harvesting cost of rain-fed wheat is less fluctuated than that of irrigated wheat. Lower fluctuation in the harvesting cost of rain-fed wheat is due to lower yield compared with irrigated wheat (Table 4). Similar to harvesting costs of irrigated wheat, provinces that have the higher level of I_{mi} such as Khozestan, Markazi, Kermanshah, Fars, Kordestan and Ardabil, have the lower harvesting costs compared to that of other provinces (Table 3, Figs. 2 and 3). Table 4 also contains the results of Duncan test for the yield of wheat in Iran provinces.

According to table 4, Bushehr province has the lowest yield of wheat amongst the provinces, which could explain lower harvesting cost. From table 4, it is conceivable that provinces having higher I_{mi} also exhibit higher yield.

Table 3. Results of Duncan test for the average harvesting cost of wheat in Iran provinces

province	Cost (thousand Rials per hectare)			
	Irrigated wheat		Rain-fed wheat	
Bushehr	a*	18412	a	7347
Hormozgan	ab	21501	-	-
Khuzestan	abc	24748	ab	16631
Ilam	abcd	28775	abcd	21695
Fars	abcde	33737	abc	18812
Kermanshah	abcde	35890	abc	17995
Golestan	abcde	37534	bcdef	31687
Qom	abcde	39857	-	-
Semnan	abcdef	44019	bcde	28605
Kordestan	abcdef	45228	abc	19158
Markazi	abcdefg	46534	ab	17495
Lorestan	abcdefg	47196	bcde	27861
Tehran	abcdefg	47986	bcdef	33347
Kerman	abcdefg	51253	-	-
Hamedan	bcdefg	54501	abcd	22847
Qazvin	bcdefg	55658	bcdef	32729
Ardabil	cdefg	59412	abc	20588[abc]
Sistan& Balochistan	defg	61909	-	-
Esfahan	defg	64030	cdef	38158
Zanjan	efgh	67183	abcd	22352
Kohgiluye	efgh	68442	ef	47199
W.Aazarbayjan	efgh	78859	bcdef	33183
Yazd	fgh	81196	-	-
E.azarbayjan	gh	83320	bcdef	30160
Chaharmahal	gh	85467	f	50043
Khorasan	h	98561	ef	43975

*values with the same letters in each column are not significantly different (P<0.05)

Table 4. Results of Duncan test for the yield of wheat in Iran provinces

Province	Yield ($kg.ha^{-1}$)			
	Irrigated		Rain-fed	
Bushehr	a*	1854	a	306
Kordestan	b	2570	fg	993
Kerman	bc	2772	-	-
Khorasan	bcd	2815	abc	542
E.Azarbayjan	bcd	2833	bcdefg	753
Ilam	bcde	2941	bcdefg	768
Lorestan	bcdef	2978	defg	932
Markazi	bcdef	2988	bcdefg	690
W.Azarbaijan	bcdefg	3035	cdefg	893[c]
Chaharmahal	cdefg	3075	fg	1013
Qazvin	cdefgh	3190	ab	515
Kohgiluye	cdefgh	3231	efg	965
Khuzestan	defgh	3279	bcdef	666
Hamedan	defgh	3288	bcdefg	781
Ardabil	efgh	3356	fg	1014
Kermanshah	efgh	3381	g	1035
Zanjan	fgh	3640	efg	971
Golestan	ghi	3521	h	2066
Esfahan	ghi	3608	abcde	628
Fars	i	3933	bcdefg	706

*values with the same letters in each column are not significantly different (P<0.05)

4. CONCLUSIONS

Generally, the cost of wheat harvesting in provinces is decreased with increasing the number of combine harvester (I_{mi}) in provinces. Therefore, for decreasing the harvesting cost in Iran provinces, it is necessary to distribute more combine harvesters in provinces.

It was found that the number of combine harvesters in provinces with high level of irrigated wheat is higher than that of other provinces. Therefore, the cost of wheat harvesting in these provinces is lower. For decreasing the cost of harvesting of rain-fed wheat, it is necessary to allocate more combine harvesters for provinces such as Chaharmahal & Bakhtiari, West Azerbaijan, East Azerbaijan and Zanjan that have the high level of rain-fed wheat production (Fig. 3). It is clear that for Khorasan province with maximum level of irrigated and rain-fed wheat production in Iran (Fig. 3) High level of harvesting costs corresponds to low level of I_{mi}. This means that the number of combines available in this province is not sufficient. Also provinces like Bushehr which have lower yield will also have lower harvesting cost. In addition, provinces with higher I_{mi} have higher yield.

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