

Estimation of Wheat Cultivation Mechanization Status in Iran

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Abstract: Agricultural Mechanization (AM) was obtained from contribution of agriculture and 20th century technology for providing the world highly increasing population needs for food and fiber. In this study, Iran wheat cultivation mechanization status and obstacles were considered and by comparing with other countries experiences, some remedies presented. However, AM in Iran has aged for more than 80 years, it has not achieved to its desired position. From this study, wheat cultivation Mechanization Level (ML) and available power per hectare estimated 84% and 1.17 (hp/ha), respectively. For full mechanized wheat cultivation (ML = 100%), by assuming available power per hectare of 1.17 (hp/ha), more 1244387 (hp) power is needed.

Key words: Needed power, mechanization indices, obstacles and remedies, wheat cultivation

INTRODUCTION

AM purposes are: increasing land and labor efficiency by reducing the difficulty in farming operations, bring in more land under cultivation, save energy and resources (seed, fertilizer and water), sustainable agricultural production, improving operators' comfort, safety and convenience, protect the environment by allowing precision operations, and increasing the overall income (Salokhe and Ramalingam, 1998).

Enhancement of production in developed agriculture uses many types of machinery and there are many factors that need to be taken into account when specifying a new mechanization system (Blackmore *et al.*, 2007).

AM has made a significant contribution to agricultural and rural development in many parts of the world and its purpose is to create a policy, institutional and market environment in which farmers and other end-users have the choice of farm power and equipment suited to their needs within a sustainable delivery and support system (Bishop, 1997).

Although, it is more than 80 years after when the first tractor has been imported to Iran, AM have not be able to provide increasing needs for food and fiber, sufficiently.

Wear/unsatisfied machinery and equipments application, untimely operations, unadjusted machines and unsuitable farm capacities, and etc. are factors affect crops waste in Iran farmlands.

Still, in spite of manufacturing tractors, combines and different machinery, AM has not been improved. About 60% of tractors and 47% of combines are more than 13 years old that make undeveloped AM (Hashemi, 2002).

Countries experiences: In choosing how to mechanize, different countries should expect different results from mechanization (Binswanger, 1986). AM status in some countries is reviewed as follow:

Developing countries: African countries have an economy strongly dominated by the agriculture sector which generates up to 50% of gross domestic product, contributing more than 80% of trade in value and more than 50% of raw materials to industries (FAO, 2008).

The economies of most sub-Saharan Africa countries are agriculture based, which includes 15 to 60% of their gross domestic product and provides employment for more than two-third of the population (Shetto, 2006).

Egyptian farmers responded to migration-induced labor shortages in the 1970s and 1980s by mechanizing many agricultural operations (Kerr, 2003).

The fragmented approach to mechanization issues has been one of the major reasons for the disappointing performance and low contribution of mechanization to agricultural development in Africa but mechanization schemes have been successful in many countries in Africa, particularly when coupled with irrigation (FAO, 2008).

In general, mechanization will contribute little to growth in countries without a land frontier and with densely populated farmland-such as Bangladesh, most of India, and China (Binswanger, 1986).

Focus points of AM between 2006 and 2010 in China were (Wang, 2005):

- Soil conservation in Northern arid farming areas
- Achieving full mechanization for rice production in the south area
- A national high-quality grain project "Modern Agricultural Equipment Promotion" needs for Sustainable improvement of mechanization level for grain maize harvesting
- Removing the "Bottleneck" restricting rapeseed production

Table 1: Iran farms area distribution (source: Iran statistical Yearbook, 2005)

Farmlands area (ha)	Annual cultivated lands		Fallow		Orchard		Total	
	No.	Area (ha)	No.	Area (ha)	No.	Area (ha)	No.	Area (ha)
Less than 0.1	65073	2145	15621	665	163492	7079	226385	9889
0.1 to 0.2	71903	7755	15907	1378	124046	14266	183226	23398
0.2 to 0.5	232139	60170	41968	7578	230419	54097	402383	121845
0.5 to 1	271592	145057	53167	18804	211285	88077	393039	251938
Less than 1	640707	215127	126663	28425	729242	163519	1205032	407070
2 to 3	298617	535538	95209	109863	143436	135606	355372	781006
3 to 4	218447	552111	83916	129313	97051	105979	247480	787403
4 to 5	176497	571179	77212	152659	71182	84844	194153	808682
5 to 7.5	324815	1448295	158624	426577	127178	170033	349641	2044905
7.5 to 10	134524	823396	75658	275646	58335	86948	141515	1185987
10 to 15	198636	1625566	118493	610697	77216	136947	208602	2373210
15 to 20	83264	950591	53822	393832	34390	70642	86577	1415065
20 to 25	58649	860538	38323	376598	22271	56146	61112	1293279
25 to 35	46749	907338	32122	428943	19210	59231	48499	1395512
Total	2639486	11647027	998312	4550142	1651046	1468034	3480729	17665198

Table 2: Available power recourses (source: Iranian Ministry of Jihad-e-Agriculture, 2008)

Tractor Power (hp)	John deere	Massy ferguson	Universal	Others	Total
Less than 45	214	1751	2082	17595	21642
Between 45 and 80	6036	162206	135560	8992	312794
Between 80 and 110	4453	15570	15	1479	21517
more than 110	545	2778	234	2281	5838

- Emergence of new manufacturing and processing machines for economically important crops

Mechanization was accelerated by providing long-term loans to Pakistan farmers to purchase tractors and other farm machinery. On the other hand, the level of agricultural employment in 1990 was marginally higher than that of 1985, in Malaysia, reflecting a limited headway in the mechanization and automation of important production activities (Salokhe and Ramalingam, 1998).

Developed Countries: In industrialized countries of Europe and the Americas, less than 10% of the people are working in agriculture and many countries are suffering from agricultural overproduction (Salokhe and Ramalingam, 1998).

After the First World War, high prices for a number of products, especially cereals, encouraged investments in mechanization of Dutch and its agriculture prospered (Coolman, 2002).

In United States, in the second half of the century an impressive horse-based mechanization led to massive agricultural growth because land was rapidly opened up and export markets in Europe provided a highly elastic demand for agricultural products (Binswanger, 1986).

More than half of U.S.A populations were farmers in 1870. Because of mechanization in agriculture, this ratio decreased to 1 of 12 in 1960 and 1 of 26 in 1976. Nowadays, an American farmer can provide food of 60 people and one rural family can manage a 1200 ha farm. Agricultural production is second U.S.A. exporting goods (Behroozi-Lar, 1999).

Iran agriculture is in parallel with its civilization. There are many historical evidences which testify that agriculture in Iran has the age of more than 10000 years, and Iranian are of the first nations cultivated crops by some manual tools.

Iran is a country by specific climate and topographical variations. In each region of Iran, some crops can be grown which can not be grown in other places (e.g., tobacco, rice, sugar cane). There are also lots of crops which can be grown in most of Iran farmlands (e.g., wheat and barely).

This study considers the current AM status of wheat cultivation in Iran and its obstacles. Other countries experiences were considered to suggest the remedies to improve the wheat production mechanization.

METHODOLOGY

AM in Iran began by motorizing farm operations in 1920s; and in 1960s AM revolution of Iran occurred by manufacturing some tractors.

As shown in Table 1, most of Iran farmlands are less than 1 (ha) that by considering these smallness, specific AM strategy is needed.

Iranian farmers use various power resources include labors forces, animal draft, different tillers and tractors. Tractor, as prime power resource in Iran farms, has main participation in crop production. Iran farmlands tractor resources are shown in Table 2.

According to Table 2 and multiplying means of tractor power ranges by 0.6 (as a coefficient), total tractor resource power is estimated about 13650000 (hp). From

Table 3: Iran wheat mechanization level (source: Iranian Ministry of Jihad-e-Agriculture, 2003)

Operation	Irrigated wheat (%)	Dry wheat (%)
Primary tillage	99	96
Secondary tillage	84	58
Combine/Reaper harvest	89	77

Table 1 and 2 data, Iran available power per hectare obtained from dividing 13650000 (hp) (total tractor resource power) on 11647027 (ha) (cultivated area) is equal to 1.17 (hp/ha).

AM level for irrigated and dry wheat farmlands was estimated by considering Iran Center of Mechanization Extension data in Table 3.

According to Table 3, wheat cultivation mechanization level is 0.84. Iran wheat cultivation area in 2009 was 6647367 (ha) (FAO official website). So, 57% of Iran annual cultivated area is under wheat cultivation. Then, needed power resources are calculated as below:

$$A_{T-M} = A_T \times (1-ML)$$

$$APPH = P_N / A_{T-M}$$

$$ML = A_M / A_T$$

$$P_N = APPH \times A_{T-M}$$

where,

- A_{T-M} : Not mechanized cultivation area
- A_T : Total wheat cultivation area
- APPH : Available Power Per Hectare
- A_M : Mechanized cultivation area
- P_N : Needed Power for full mechanized (100%) cultivation
- ML : Mechanization Level

So:

$$A_{T-M} = 6647367 \times (1-0.84) = 1063579 \text{ (ha)}$$

$$P_N = 1.17 \times 1063579 = 1244387 \text{ (hp)}$$

$$A_T = 6647367$$

$$ML = 0.84$$

$$APPH = 1.17$$

For full mechanized wheat cultivation (ML = 100%) with fix APPH of 1.17 (hp/ha) there is more 1244387 (hp) needed. However, there is no guaranty for full mechanized other crops cultivation.

RESULTS AND DISCUSSION

Available power per hectare for Iran agricultural operations is 1.17 (hp/ha) and wheat cultivation mechanization level is 84%. For full mechanized cultivation operations with fixed APPH of 1.17 (hp/ha), more 1244387 (hp) is needed.

According to Table 1 most of Iran farms (about 53%) are less than 1 (ha) and machinery by high field capacity

are not sufficient, however, cheaper and smaller tractors and machinery should be provided.

Utilization systems are not the same for most of the farms. Each region best utilization system should be considered.

Obstacles for Iran self-sufficient agriculture and improvement in agriculture are as follow:

- Most of Iran farmlands are less than 1 (ha) and application of some tractors and machines with high capacities is not recommended. So it is suggested to:
 - More attention be paid to land consolidation
 - Governmental and private AM service centers should be extended to provide the farmers appropriate services
 - Soft loans for farmers ought to be available by governmental organizations
 - Inheritance laws should be made to prevent small landownership

Competent organizations should control the application of modern machines by farmers to prevent the decline of agricultural utilization caused by unsuitable technologies, while, increasing the utility by appropriate one.

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