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Agricultural Wheat Waste Management in Iran

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Abstract: In the basis of existing statistics in Iran, in average 35 percents of agricultural crops from product to consumption process converted to wastes which it can be guaranteed 15- 20 million people nutrition of peoples. Agricultural wastes occurred in cultivation, pre-harvesting, harvesting and post harvesting process but the majority of wastes was related to both stages of harvesting and post harvesting. In agricultural products, wheat has a high importance because it's a strategic and food staple. But the results showed that waste quantity in this food staple is notable. the wastes in cultivation stage consists of extra seed consumption that it's estimated 20 percents and results of technical problem and using of abrogate cultivation methods. In harvesting stage the wastes has estimated (0.5-2 percent) for cutter plane loss (0.5- 1 percent), for masher unit loss, (0.2- 0.4 percent) for separator loss, (0.04- 0.2 percent) for cleaner loss and other factors. Finally in post harvesting stage, wastes classification in 4 category include of transportation (5.5 percent), winnowing (0.2 percent), storing (4 percent) and converting wastes (5 percent) respectively. These static warn that waste management is indispensable. With regard to the results of the study, appropriate storage and processing of products after harvesting along with development of agricultural converting industries can be effective in wheat waste management. In addition, health observation before of harvesting will postpone product spoilage created by external and internal factors, so product can be useable for more time. Finally, it's important that wheat waste management needs to regularly and long time programming with attention to farmer and people educations.

Key words: Wheat, Waste Management, Harvesting, Iran country

INTRODUCTION

The Iran is mainly an agricultural country. Agriculture is a major industry that contributes to the growth of the Iran economy. In Iran, like other developing countries, agriculture is one of the most important economic sectors and comprises a considerably high percentage of production and employment. It accounts for over 1/4 of the Gross National Product (GNP), 1/4 of employment, over 4/5 of the domestic food supply, 1/3 of non-oil exports (excluding carpet exports), and 9/10 of the raw material demand of national industries. Agronomy and horticulture are of great importance in Iranian agriculture. These two sub-sectors account for more than half of the total added value of Iranian agriculture (excluding fodder crops). Its share in Iranian GDP has risen from 14.5% in 1978 to 25.7% in 1997 (Karbasioun, 2007).

About 11 percents of the country's total land area of 1,636,000 km² are cultivated. Which about one-third of total surface area are suited for farmland. Still, 63% of the cultivable lands have not been used, and 185,000 km² of the present farms are being used with 50 to 60% capacity.

During the last decade, agricultural sector has been one of the main priorities in the national, development plans. The most recent statistics on the annual cultivated area (Iranian Ag Statistic, 1996-97) revealed that this area were about 14 M ha. Annual crops occupied nearly 12 Mha of land and the other 2.0 Mha is under orchards. Cereal crops (i.e. wheat, barley, and rice) cover almost 70% of the cultivated land areas, while wheat alone covers nearly 52%.

Wheat is the core commodity of the Iranian food and agriculture systems, grown on nearly half of the country's rain-fed areas and one-third of the irrigated area. As such, the rain-fed wheat crop covers nearly 4.5 million hectares, while the irrigated wheat crop covers approximately 2.2 million hectares. The average yield for irrigated wheat is approximately 3.0 ton/ha, compare to 0.95 ton/ha for rain-fed wheat. Most of the rain-fed wheat crop is located in the western provinces of Kermanshah, Kurdistan, and Azerbaijan, with a larger share of the irrigated wheat crop located in the east.

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The results revealed that Iran was largely self-sufficient in wheat, but, at the recent years, drought and heat stress significant losses to the nation's winter grain crops. Wheat production is expected to decline 20 percent compared to last year, to the lowest level in the past six years. Most of Iran's non-irrigated wheat area is concentrated in the northwest sector of the country where drought and extreme temperatures have been especially prevalent. This year's projected shortfall in winter grain production could lead to a significant increase in grain imports, with the government already reported to have sanctioned the importation of 2.0 million ton of wheat, and for the past three years, Iran has been a large wheat importer, with major suppliers typically being Kazakhstan, Canada, Argentina, and Australia.

In addition in average, any year 35% of agricultural crop products were converted to wastes (Bayat, 2003) have been imposed irrecoverable costs. There were different causes can convert crops to wastes; therefore it is difficult to predict waste quantities.

Wheat is a main crop in Iran which allocated high capacities of land areas (Statistic Center, 1999), but of them were product over 2.0 million ton to wastes. It is estimated that if 25% of wheat convert to wastes, it will miss use emulate 1.3 million ha of land areas.

The results revealed that, for example, wheat grain wastes were 3048×10^6 from 1996 to1999; whereas 2675×10^6 was used for cultivation wheat seed quantity totally (Haydari, Cheragi, 2001).

There were different causes for converting product crops such as wheat into the wastes. Karshenas (1994) claimed that the difficulties within Iranian agriculture were caused by the mismanagement by actors within the sector. Keshavarz and Naderi (2003) also claim that mismanagement is the major reason for the partly drought-related water crises in previous years. In the same way, it was reported that about 60% of the 83 billion cubic meters of water used in the agricultural sector failed to reach crops which 40% failed in silks and 30% in lands and inaccessible for plants. Many specialists also confirm this (see Khatoonabadi, 1999; Afkhami, 1998; Karami and Rezaei-Moghaddam, 2005).

Bageri and Shahbazi (2003) discovered that a great number of Iranian farmers lack technical competencies at many stages of farming activity such as planting, harvesting, plant protection and using of agricultural machinery. These studies disclosed that 75-82% of young farmers need to be trained in all the above listed aspects of farming. The Ministry of Agriculture knows this status and has established a consultation committee composed of 17 Iranian and 15 international consultants. The major function of this committee is to try to address the indicated barriers in the agricultural sector (Lotfi, 2004).

MATERIAL AND METHODS

The main purpose of this study was to investigate wheat grain wastes and causes in Iran. This research employed an applied-descriptive research design due to the application of the findings to the interested policy-makers and researcher. Literature review and content analysis were used to conduct the research.

RESULT AND DISCUSSION

Wheat's Grain Wastes in Process of Wheat Production:

At this section we classified wheat waste causes into four classes; cultivation wastes, pre harvesting wastes, harvesting wastes, and post harvesting wastes (Mahdavi and Zanjirian, 2003).

Cultivation Wastes:

At the first step, wastes consisted of additional seeds use as 20%. There were different causes, mainly lack of appropriate technology and because of land structure many farmers to have used additional seeds and planting with no automatic drill which irregular deep as a result of sowing delays emergence and many of seeds not to receive earring (Najafi, 1997). In Iran, the land area used by more than 80 percent of the farmers is under 5.0 ha in size and more than 50 percent of the farmers have less than 2.0 ha and these lands are fragmented into more than 10 plots (Akbari, 2007). It is equal to 2% of produced wheat in Iran totally.

Seedbed preparation is the same as for grain crops. Wheat does not suppress weeds sufficiently and needs a clean, weed-free seed-bed for planting (Doerfler, 1976). Weed competition studies on wheat showed that if weeding is not carried out between two and four weeks after sowing the yield is reduced by 20 percent (Mohamed, 1996).

Planting with an automatic drill is recommended but not essential. However, row-planting has an advantage over broad-casting, as it requires less seed and facilitates mechanized weed control, rouging and field inspection (Galanopoulou *et al*., 1996). Rouging lanes (empty rows at intervals) should be left, which could be used by the seed grower to walk through the field when rouging and inspecting the crop, as well as for spraying the crop.

Table 1: Estimation Iran wheat supply, consumption, smuggle and wastes (1996-1999) (Thousand Tones)

Describe year	*supply*	*consumption*	*smuggle*	*wastes*	*Used seeds for seedling*
1996	15188	13415	1773	799	766
1997	14422	12863	1559	775	588
1998	14824	13573	1252	741	632
1999	15063	13429	1634	733	689

Haydari and Cheragi, 2001

Table 2: Estimation of post harvesting waste values

	Transport	Winnowing	Storage	Transformation	Baker's	Consumption	Total
Waste average	2	5	4	5	0.35	16.3	32.65
Waste quantity (thousand Tone)	111	277.5	222	277.5	19.4	904.65	1812.05
Waste value (million $)	20.8	52	41.6	52	3.6	169.6	339.6

Asadi *et al*, 2005.

Table 3: Economy of solution effectiveness (million $) in reduction or prevention of wheat wastes

Waste stage	*Effectiveness percentage of solutions*	*Economy of solution effectiveness (million $)*
Natural	90	39.78
Cultivation	80	32.51
Pre harvesting	90	51.66
Time delaying in harvesting	30	28.6
Harvesting method	60	66.48
Transport	90	18.72
Winnowing	80	41.6
Store	90	37.44
Transformation	90	46.8
Baking breads	95	3.42
Consumption	95	161.12
Total		518.13

Asadi *et al*, 2005

Deep sowing delays emergence, resulting in weaker seedlings, reduced emergence and poor tillering and yield. Varieties with short coleoptiles length, particularly semi dwarf varieties, suffer most compared to varieties with longer coleoptiles length (Perry and Hillman, 1991).

The optimum seed rates for wheat vary with variety, location and method of planting. For seed production fields, a lower seed rate may be recommended because lower seed rates lead to higher multiplication factors (Nelson, 1986) but to lower yield per unit area. Higher multiplication factors lead to rapid seed increase (more seed harvested per kilogram of seed planted), and farmers will benefit from the improved variety earlier. Low seed rates do not only increase the multiplication factor, but also often improve seed quality because a lower number of plants per unit of land receive better nutrition, thus producing better quality seed.

In addition in wheat, seed size is positively correlated with seed vigor: larger seeds tend to produce more vigorous seedlings (Ries and Everson, 1973). Larger seeds of spring wheat produced higher yields than smaller seeds under late-sown conditions (Singh and Kailasanathan, 1976), but not under optimum management conditions (Kalita and Choudhury, 1984). Similarly, Khah *et al*., (1989) found that low-vigor spring wheat seed produced lower yields only when it resulted in low plant populations or when planting was later than normal. However, Mian and Nafziger (1992) have found that seed size has little effect on emergence of soft red winter wheat.

Pre Harvesting Wastes:

At this stage wastes consisted of timing and date of harvesting on wheat grain losses in violent weather with rainfall which emergence chlorophyll on clusters or wastage in the rain severity. Also, maturity of seeds is very important. It is estimated that wastes in this stage are equal to 54.9kg/ ha (Behrozi Lar, 1994).

Cereal seed reaches physiological maturity between 35 to 45 percent moisture content, but it needs to dry down to safer moisture content for harvesting and storage (Boyd *et al*., 1975). The seed moisture content can be used as an indicator of when the crop is ready for harvest. Electric moisture meters or the crop characteristics can be used to decide when to harvest. For wheat, threshing or combine harvesting at 16 to 19 percent moisture content reduces mechanical damage (Thompson, 1979).

Harvesting Wastes:

Mechanical harvesting is a common practice for seed production fields. Breeder and pre-basic seed are harvested by plot combine and do not constitute many problems. Basic and certified seed, however, have to be harvested with commercial combine harvesters.

The most critical factors to be considered are seed moisture content, mechanical damage and cleanliness of equipment. For seed crops, dry weather during ripening and harvesting is essential.

Proper adjustment of the concave clearance and drum speed of a combine is essential to avoid damage to the seed crop. Mechanical damage becomes a serious problem for durum wheat seed production (Lakhdar *et al*., 1998; Grass and Tourkmani, 1999).

The results of Rahimi and Khosravani (2005) revealed that factors such as cultivation time, number of land plots, combine type, cultivation type (traditional or serial) farmer's education and farmer's familiarity with combine were important in wheat harvesting.

In Iran, at the harvesting stage wastes included different areas such as cutter stage (0.5-2%), thresher grain stage (0.5 -1%), separator process (0.2- 0.4%), cleaner process (0.04- 0.2%) and other factors (Behrozi Lar, 1994).

Post Harvesting Wastes:

Losses of wheat due to inadequate storage and other post-harvest factors at the farm, village and commercial levels of up to 4 percent have been observed (McFarlane, 1989; Abdullahi and Haile, 1991), though losses in excess of 40 percent for other cereals are not uncommon (NRC, 1996). Deterioration of stored grain is influenced by physical (temperature, humidity), biological (microflora, arthropod, vertebrate) and technical (storage conditions, methods and duration) factors. Experience has shown that such losses are not easily reduced in the absence of well-integrated policies and plans to develop the total system of production, marketing, storage and distribution (Tyler and Boxall, 1984).

After a seed crop has been harvested, the seed, if necessary, has to be dried and cleaned, i.e. removal of inert matter, seed of weeds, other crops and other varieties, and seeds that are diseased, damaged and deteriorated. Cleaning can be done because wheat seeds differ in length, width, thickness, density, weight and shape. But in Iran in winnow stage because of inappropriate technology many of seeds damaged and are not appropriate places to storage in addition many of the seeds because of inappropriate place deteriorated and many of funnies (*Fusarium* spp., *Tilletia* spp., *Drechslera* spp., *Septoria* spp. and *Ustilago* spp.), bacterias (*Corynebacterium*, *Pseudomonas* and *Xanthomonas*) and nematodes (*Anguina tritici*) which are the most important seed-borne diseases losses the wheat. Also mechanical injury to seed during harvest or handling makes it more susceptible to deterioration in storage.

Wheat seed is storable for medium to long periods if kept under safe storage conditions. For wheat, high seed moisture (above 11 to 12 percent) is the most damaging, and seed must be kept as dry as possible in storage (Clements, 1987).

It is estimated that at this stage produced wastes over three stages ago. These are classified transportation wastes (5.5%), winnowing wastes (0.2%), silo (store) wastes (4%), and 5% transformation wastes (Najafi, 1997). It was shown waste grain wastes process in traditional and modern agricultural in figure1 and 2.

At the study the results of Asadi *et al*, (2005) revealed that in Iran post harvesting wastes was 1812.05×10^{6} kg from 1995 to 2001. Also it was estimated which waste value in these years were 339.6 million$.

There were other factors (moreover four factors) such as policy making, lack of information and weak planning, lack of economical and human resources, and ineffective organizations.

Flour and Bread Wastes:

We described in the separated section, because of important of this section. Almost in this stage converted over a 1/6 of wheat grain into wastes which there have been produced 9×10^{3} kg wastes, based on 65 million Iran populations (Irani, 2003). The results showed that low quality and being paste were the most important of waste causes (Mirfakhraee *et al*., 1990). There were other causes which produced wastes such as: Lack of facilities in low income households to preserve bread and flour; using of additives in baking breads; inappropriateness conditions of baking breads; and lack of familiarity of bread consumption in restaurants and public organizations (Irani, 2003). In addition there were other causes such as uneducated personals in baking breads, low prices of breads, lack of monitoring in distribution of bread, and inappropriateness nutrition customs which were produced many wastes in Iran.

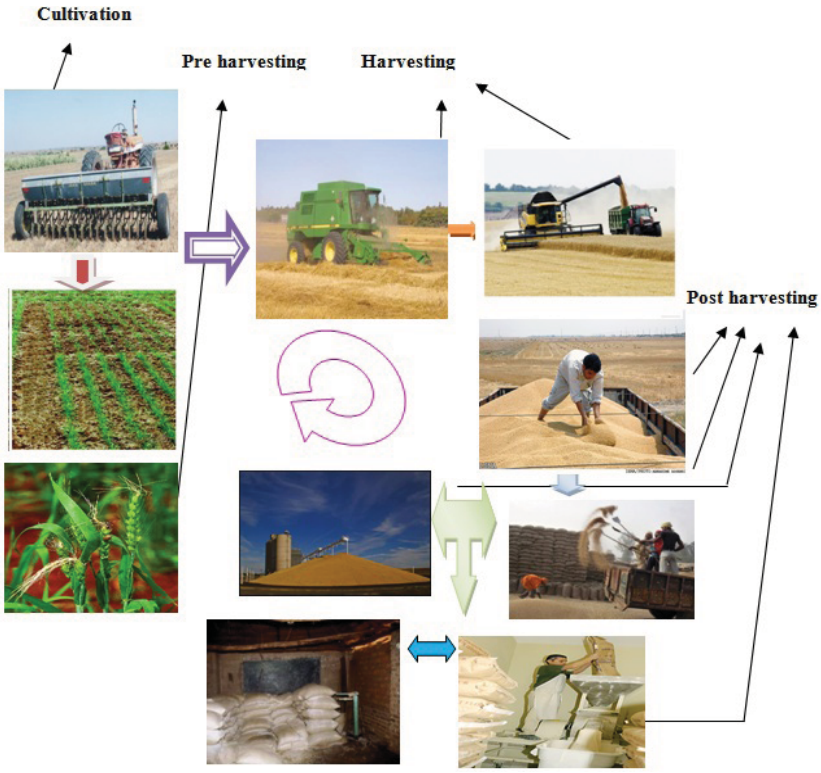

Fig. 1: Wheat grain waste in modern agriculture process.

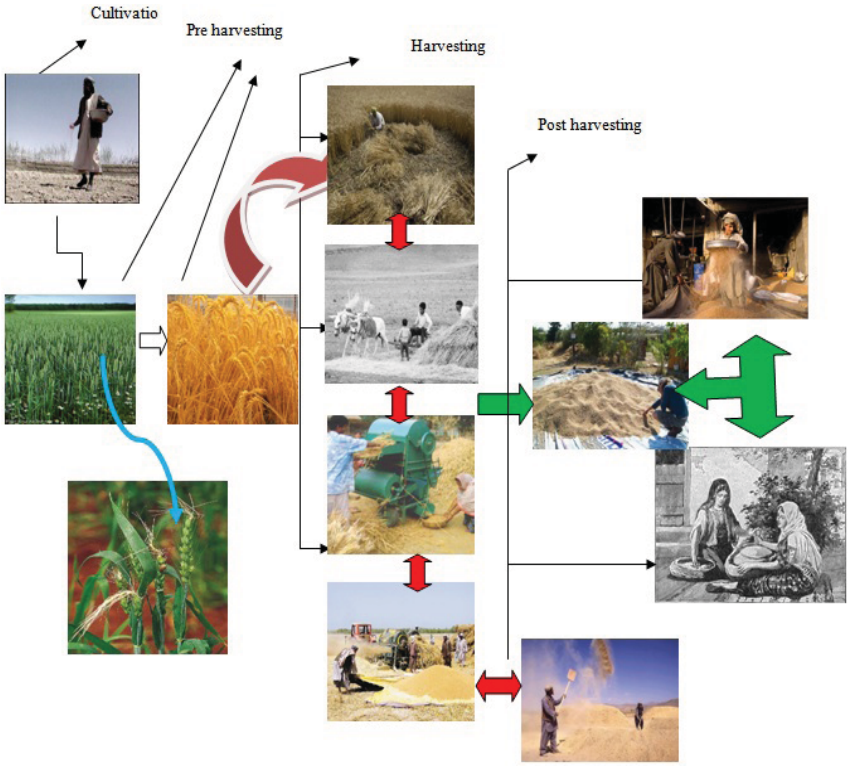

Fig. 2: Wheat grain waste in traditional agriculture process.

Solutions:

Evidently, Agricultural wheat grain waste is a vital issue that, unfortunately, does not get enough media coverage, even though it directly relates to the level of understandings and attitudes of all of us. The hectic pace of development in the last 20 years has so commercialized our society that people have forgotten the proper, ethical way of conserving food. Although, people are living comfortably in many countries around the world and food is readily available at reasonably prices, but that does not mean we should waste it (Malek mohammadi, 2006). Consequently, there are many reasons for implementing Agricultural Waste Management Iran wide and consumer education to conserve wheat. So it seems wheat grain waste management in order to decreasing of wastes is indisputable and can be implementing through:

A: Education as a Missing Link:

As mentioned above the main crops produced in Iran are wheat, rice, and barley. Due to special programs initiated in the agricultural sector, Iran has become more self-sufficient in the production of several farm products, including certain fruits, vegetables, livestock and wheat. Iranian wheat production has increased from 10 million tonnes to 12.5 million tonnes between 1995 and 2005, but with this situation, the Agricultural sector has been faced with many challenges. While, in total, there are 3.5 million producers in the agricultural sector, about 48 percent are literate, but mainly at the primary school level (Akbari, 2007). Although there were over 100,000 extension personnel in agricultural sector but there were only about 10000 extension personnel in farms and extension centers and the past experience has revealed that farmers have had no appropriate access to extension and education centers, as the centers have been very diverse and unequally distributed across the country.

In this scenario, the Ministry of Agricultural Jihad initiated the utilization of agricultural graduate students for consulting farmers (Ministry of Agricultural Jihad, 2003). With attention to not sufficient educations and not access of many farmers to this education, therefore it is necessary to support farmers through extension and education centers.

Also the results showed that in spite of developed counties in baking breads many of personnel's are inexperienced and there were not sufficient education (Irani, 2003). In addition the results revealed that many of the wastes (over a half) produced in households with low level literate and illiterate and high income (Arsalanbod and Mehrnia, 2000). Therefore it is appearing that education is a basic solution in preventing wheat wastes.

B: Policy Making:

It is estimated that through decision making and applying appropriate approaches in the cultivation stage can be prevented 1158.24×10^6 kg of wheat wastes and 1869.8×10^6 kg in the post harvesting stage (Asadi *et al*, 2005) and using of effective solutions.

Public organizations such as agricultural ministry and grain organization can be preventing of wastes with appropriate policy making and legislating.

C: Establishing Infrastructures:

Effective grain storage systems maintain grain quality and prevent grain losses. In order to prevent spoilage, storage structures must be designed and maintained to protect the grain from weather, bird, animal, insect, and mold damage. Grain that is to be stored for any length of time must be kept under conditions that are uniformly cool and dry. There are a number of grain storage management practices that should be followed in order to minimize grain losses due to spoilage.

- Bins, air ducts, perforated floors, etc. should be swept clean or vacuumed and spoiled grain in and around storage and harvest facilities should be cleaned-up and buried or burned. Holes and leaks in bins should be patched to prevent grain loss, keep out the rain, and limit the access of rodents.
- Cleaned bins should be sprayed for insects well before harvest starts, especially if there is a history of insect problems in the storage facility.
- Properly sample the grain as it goes into the bin. This will provide a clear picture of the grain condition at the start of storage and help to identify potential problems that should be monitored and/or corrected.
- Avoid mixing newly harvested grain with grain that has been in storage.
- Grain that has been in storage may contain insects. Freshly harvested grain may also heat if it is placed on top of grain that has been in storage.
- Regularly monitor grain temperature and moisture.
- Keep detailed records on the condition of the grain in storage. Accurate records can help in identifying potential storage problems and in planning preventative action.

D: Effective Marketing Systems

Perhaps, the first step in developing an agricultural wheat waste management system is to establish an effective marketing system. A marketing plan is essential for every agricultural sector and for efficient and effective marketing of any agricultural product or service. A marketing plan serves as a road map. It establishes objectives, recommended actions, and timing for achieving the objectives.

There are different causes to establish effective marketing system such as qualitative and quantity diversity of wheat, being seasonal of wheat and etc and from the way can be to reduce wastes.

The role of experts is to identify type, location, and connection of market systems because process marketing system including transportation, transforming, and commercial activities and correlated with type and volume of waste produced (Shadan and Mihankhah, 2003).

Conclusion:

With attention to above mentioned, wheat product is one of the strategic products and food staple in Iran and play an important role in food security in Iran but statistic results showed that this product has a many wastes in different stages of process from cultivation to consumption. So it seems wheat wastes management is the best solution to reduce these wastes and to provide food security in Iran. Wheat wastes management includes of some components such as; education, policy making, establishing infrastructures and effective marketing system that explained in above paragraph. In order to achievement a self-sufficient and food security we must pay attention to component of wheat wastes management.

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