

## ECONOMIC STUDY TO ESTIMATE POST-HARVEST LOSSES FOR YELLOW CORN IN IRAQ (BABYLON PROVINCE IS AN APPLIED MODEL FOR RESEARCH)

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### Abstract

Agriculture in Iraq suffers from the phenomenon of increasing the percentages of loss in agricultural products and a decrease in the percentage of manufactured ones, where the areas cultivated with this crop in Iraq for the period (2000/2018) amounted to (8720271 thousand dunums) and the total production amounted to (6259970 thousand tons), with an average amount to (329,472 thousand tons), with an average loss of 913.3819 tons from this quantity. In Babylon province, data indicate that the total area for the same period amounted to (2192315 thousand dunums), with productivity of (1620 685 thousand tons), an average amount to (85299 thousand tons), and an average of loss from the original quantity amounted to (126.68 tons). The results indicated that the percentage of post-harvest loss constituted 11.75% at the level of farms and receiving centers (1.5%, which their percentage constituted 12.76% from the percentage of total loss and 10.75%, which their percentage constituted 87.21% from the percentage of total loss), respectively for each of them. Thus the economic importance of losses after harvest becomes evident from one of the priorities of the study when it is linked to the loss of economic resources, which is a waste of the resources that were used in their production as well as the losses achieved for both farms and factories, The importance and seriousness of this problem can be realized, whenever we know that the rate of production growth in the agricultural sector did not reach (2%), and with estimating the economic impact of the loss at the level of farms and receiving centers, it was found that the total lost quantity amounted to (1,492 thousand tons), which its financial values amounted to ( 2.663.780,000 dinars), depending on the official purchase and sale prices of the crop from farmers specified by the state for the season (2019/2020).

Key words: Yellow corn , Post-harvest losses, characterization of losses, post-harvest stages.

### Introduction

The World Food and Agriculture Organization studies indicate that nearly a third of the human food produced is lost or wasted globally, and amounts to about 1.3 billion tons annually (FAO, 2011). Agriculture in Iraq suffers from the phenomenon of increasing losses in agricultural products and a decrease in the proportion of the factory, compared to many other countries. This is due to the stagnation in the marketing systems applied with its traditionalists , and the lack of interest in post-harvest treatments as much as interest in agricultural treatments, The yellow corn crop is considered one of the feed crops that top the list of feed grains in the world where it is preferred on all other grains because of its high production, especially hybrid cultivars, where the

dunum yield reaches more than 3 tons, and its preference as a feed crop is due to the low content of fiber compared to the rest of the grain (Al-Aqeedi, 2009), The waste of these foods constitutes a major agricultural obstacle, so limiting pre- and post-harvest losses has become a common food strategy worldwide (Agoda Samuel \*, 2011), The problem of grain loss is an economic problem, although the problem of wastage in agricultural products is a problem that all countries of the world suffer from, but it is clearly visible in countries whose agricultural sector is characterized as a developing sector, including Iraq, due to the lack of the necessary technical and technological means that can be during which the wastage is minimized and because there is not enough information and data on the losses of agricultural products ,In a methods that enable it to take the necessary measures to reduce it in the stages of production and marketing operations, the increasing demand for food confirms the need to reduce the size of losses in crop production in the post-harvest stage by (5-20)% of production in countries developed countries (20-50%) in developing countries (Kader. 1991), There is no doubt that reducing this loss means an increase in production, and it is reported that the percentage of loss 25% after harvest in developing countries is due to poor handling and damage resulting from crop exposure to different conditions (Liza and Kader. 2002).The corn crop is considered one of the most important crops in the province, and the percentage of grains from this crop constitutes about 40% of the concentrated diet of poultry and livestock. Therefore, the increased cultivated area and increased productivity may not have a significant effect without working to reduce the percentage of losses .In addition to the increase in wastage and damage from the total production, which represents a waste of agricultural economic resources, its effects are negatively reflected on farm income and being a primary source of farm income, which constitutes 25-30% of the farmers' budget (Khalil et al, 2017) The problem of the study shows that the percentage of losses of the corn crop may reach 11.75% at the level of both farms and post-harvest receiving centers, marketing and manufacturing operations in the corn factories, which leads to a decrease in farmers 'incomes and represents a waste of economic resources used in the production of this crop as a result of poor manufacturing and functional processes, and despite the development of different agricultural methods in production, it is still below the required level, which causes a great loss of these products in different marketing stages, and reducing the size of the loss or avoiding its occurrence will benefit all from the producer and the consumer, and due to Iraq's lack of studies and information on post-harvest losses, which necessitates studying the causes of loss and the possibility of reducing it at all levels as one of the axes of the vertical development of agricultural production, Explaining its effect on farmers 'incomes and the most important factors affecting it, identifying weaknesses, estimating the economic losses resulting from it, identifying the methods that lead to it, and developing appropriate solutions to reduce the loss rate to the lowest possible level.

In light of this research problem, the study mainly targeted the following:

- 1.. The productive and economic indicators of the corn crop in the province for the study sample.
2. Estimate the percentage of post-harvest losses for the corn crop in Babylon province, at the level of farms and receiving factories.
3. Determine the causes of post-harvest losses and develop appropriate solutions to reduce it.

4. Measuring the economic impact of the post-harvest losses of the study crops.

### **Materials and methods**

Post-harvest treatments ( Post-harvest Food Loss ) is an important link in the value chain of agricultural products of all kinds, and that importance increases in the agricultural horticultural crops of vegetables and fruits. Given the obvious positive or negative effects that good or bad application of post-harvest treatments leads to these products, they are defined as the processes that apply to the agricultural product, starting from the date of harvest and ending with its offer for sale and consumption. As there are some research and studies, it showed that the percentage of waste due to lack of interest in collection, preparation and storage operations amounts to 20 - 35% of the actual production amount (Zaki, 2015). It is defined as a qualitative and quantitative measure of food loss along the supplying chain. Agricultural production is exposed to the loss of a large part of various crops, whether field or horticultural, during its marketing course from production sites to consumption areas, representing a decrease in national agricultural income and per capita income. . AST

Generally, the loss is divided into: (1) Quantitative food losses (2) indirect qualitative loss ,Quantitative food losses occur through weight or volume loss, which occurs due to insect infestation, rodents and birds, or through circulation, natural changes or chemical changes, or as a result of contamination with toxic substances, pesticide residues or insects and birds, and when the food becomes invalid for consumption, it contributes to the process of nutritional loss.

Either qualitative loss: it is represented in a lack of nutritional content, or unwanted changes in taste, color, consistency, or formal nutritional characteristics. Given that the issue of post-harvest losses is an important issue, many researchers have submitted studies on the most important causes of the cause of post-harvest losses and its estimates and how to overcome it, These studies are limited, but they are important, as they helped to develop a perception of the most important causes of post-harvest loss in crops, and thus the possibility to measure it more accurately and measure the impact of these causes on total loss. Previous studies in this field have shown that the most important problems facing farmers in the production of maize crop that is due to post-harvest losses can be summarized as follows: (Sayed, 2015) .

1. Weak technical information directly linked to the production process itself or linked to harvesting and post-harvest treatments, leading to marketing information.
2. Higher production costs due to higher prices for inputs from pesticides, fertilizers and others, as well as high labor wages, and this causes a material burden on farmers, which generates and results in the inability to carry out post-harvest transactions as required.
3. The low quality of products due to insect injuries during the production phase results in post-harvest losses.
4. Fluctuations in production, which results in a surplus in production from the needs of the markets in some years, and this surplus is destroyed due to insufficient storage operations.
5. Wrong placement technique, which contributes significantly to causing mechanical damage, causing a large percentage of waste.

6. Failure to properly conduct post-harvest treatments, especially the sorting and grading processes, as they have a significant impact on changing the percentage of losses, and this is largely due to the lack of trained workers and high wages.

7. High costs of packing and storing operations.

Post-harvest losses occur during the period between the end of the harvest process and the final crop consumption. There are three forms of post-harvest losses, each with an economic content, which is (Saleh, 2015):

(A) natural loss. (B) lost in quality. (C) Nutrition value loss.

(A) Natural loss: It results from the use of primitive methods in the operations conducted on the crop after harvest, in addition to attacking rodents and birds, in addition to the loss in the water content of the gain. This loss appears as a deficit in the store which can be measured.

(B) Quality loss: This loss occurs in the components of the gain, which loses its natural characteristics that are distinguished by it, and it occurs from the exposure of the gain to conditions contrary to its natural state, or by its exposure to infection by bacteria, fungi and insects.

(C) Nutritional value loss: It occurs as a result of the grain's lack of nutritional value due to natural and quality loss.

Post-harvest problems can be overcome through extension and training programs for producers and traders, and there is often post-harvest loss, and therefore it is difficult to estimate the expected return from trading techniques that reduce that losses (Agricultural Research Center, 2010) Reducing the percentage of losses in agricultural crops, especially the horticultural ones after harvest, at an average of (5-10)% is considered an important factor as it drains a lot of resources and represents a loss of agricultural economic resources, which is reflected negatively on the income of farmers. This is due to the high percentage of damaged, because it is considered perishable and has a limited marketing or storage life, if it was stored safely, and to reduce the percentage of this loss in post-harvest crops while maintaining quality for the longest possible period, it is necessary to first fully understand the factors of deterioration after harvest and know the ways and means and techniques of control and control On it (Saleh, 2015)., The losses of agricultural crops of all kinds are a common factor between the two types of development referred to since maintaining the quality and quantity of production contributes to achieving the achievement of agricultural development aims of both kinds. It is just as important using modern technologies and expanding the cultivated area in terms of its contribution to the development process, It can be said that reducing the percentage of losses from agricultural crops in general and horticulture in particular, whether during the production stage or what follows from post-harvest and marketing treatments may be equivalent in economic feasibility to reclamation and cultivation of large areas that drain a lot of economic and water resources. However, this aspect has not yet received adequate attention from those involved in agricultural policy or agricultural development projects (Siddakhron, 2015), The problem of grain loss is an economic problem, although the problem of Waste in agricultural products is a problem that all countries of the world suffer from, it is clearly visible in countries whose agricultural sector is characterized as a developing sector, including Iraq, The reason for this is due to the lack of the necessary technical and technological

means through which this loss can be reduced to a minimum, in addition to the lack of sufficient information among those concerned with agricultural affairs to estimate the loss of agricultural products and the reasons for its occurrence, In a methods that enables it to take the necessary measures to reduce it in the stages of production and marketing operations (Abdel Qader, 2002). Either at the level of Iraq, the importance of this crop is represented by its acquisition of the third-place after wheat and rice in terms of area and production, and it is one of the summer crops that are widely cultivated in all of Iraq as green feed and grains, in addition to being food for the human being and is used in the manufacture of various other agricultural products, especially Vegetable oil (Dahla, 2008). Agriculture suffers from the phenomenon of increasing loss rates in agricultural products and the decrease in the percentage of the factory from them, because the harvesting of the crop is done in a primitive way, as well as being damaged as a result of collection and storage, and for multiple transfers of the crop more than once and exposed to various weather factors for a long time until marketing, which leads to increased loss From them (Jamila and Al-Omari, 2015). Food losses in developed countries are generally low in the middle stages of the supply chain. This can be due to more efficient agricultural systems, improved transportation, improved management, storage and processing of facilities that ensure a greater proportion of harvested production is delivered to the market (Hodges et al, 2011). Post-harvest loss stages are formed during a series of stages that start from the harvest to the consumer and there is food loss at each stage for many reasons (ACF, 2014), Result (1) defect in the mechanization of operations from harvest to circulation (2) defect in manufacturing processes (3) Unfavorable weather conditions (4) Weakness in production processes and organizational and administrative decisions (5) Presence problems with transport operations (6) Violent handling and inefficiency of cooling and temperature preservation operations (7) Presence of problems with sorting and grading operations and using inappropriate packaging materials(8) Poor infrastructure (8) Decreased consumer taste and requirements (9) Low market availability and poor physical condition of the consumer.

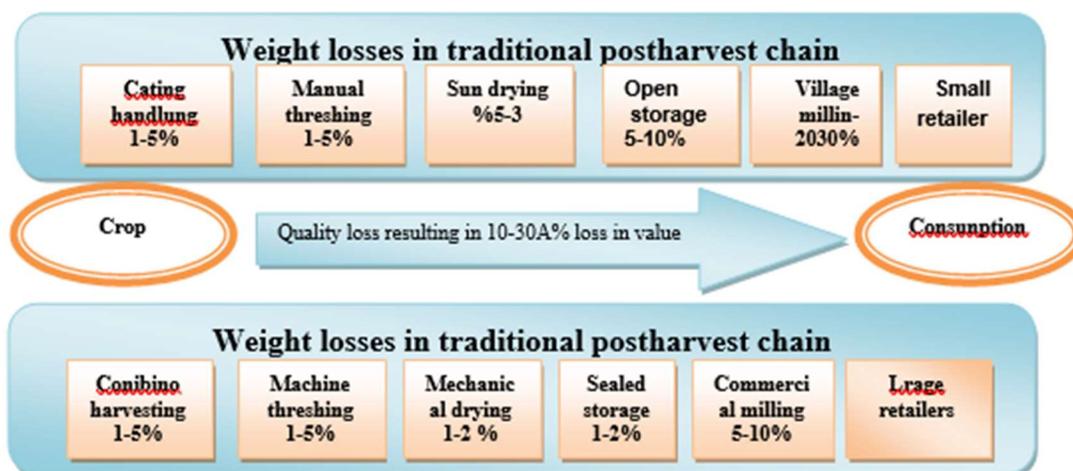


Figure (1) Post-harvest chain by traditional method versus mechanization method

## Data sources and methods of analysis

### The research is based on major sources for data:

1. Results of previous relevant research and studies and correlation with post-harvest grain crops losses.
2. Secondary data published from the Ministry of Agriculture, the Planning and Follow-up Department, the Babylon Agriculture Directorate and the laboratories of the Mesopotamian Company in Babylon.
3. Primary data for a field study through a questionnaire designed to fulfill the purposes of the research, in addition to using the descriptive and quantitative economic analysis method when estimating some percentages and mathematical averages using the SPSS statistical program in the data analysis process to obtain statistical indicators and measures.

### The research sample

To conduct the research, it is necessary to take a research sample at the level of farms and receiving centers for the corn crop from farmers in Babylon province, the number of farmers who cultivated the corn crop in Babylon province for the agricultural season 2019/2020 is about (11803) farmers. 372 farmers were selected as indicated in the table (1), The Babylon province is considered first among the provinces 'of the country that are famous for yellow corn cultivation in terms of area and production, where the total area of the province is (2047600) dunum , and the arable area in the province is 1612052 dunam and constitutes 70% of the total area of the province and the area is estimated Cultivated and implemented with yellow corn crop (116,100) dunam for the year 2019/2020

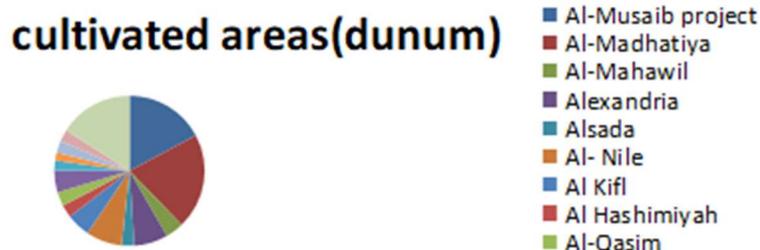
Four laboratories were selected to receive the yellow corn crop in the province (Al-Madhatiya, Babylon, Al-Musaib, and Al-Haidari), and a questionnaire was designed for each level in the form that fulfills the purposes of the research.

**Table 1. The agricultural divisions covered by the field survey, the number of farmers and the cultivated areas, and the relative importance of the 2019-2020 agricultural season**

The relative importance %	The number of farmers	The relative importance %	cultivated areas(dunum)	The agricultural divisions	No.
3.38	400	1.55	1800	Center city	1
2.65	313	2.11	2450	Abi Gharaq	2
7.59	897	5.16	6000	Al Kifl	3
3.49	412	3.87	4500	Al-Mahawil	4
4.83	571	7.75	9000	Al- Nile	5
21.27	2511	17.22	20000	Al-Musaib project	6
2.16	256	2.71	3150	Alsada	7
5.01	592	7.32	8500	Alexandria	8
4.38	517	2.75	3200	Al Hashimiyah	9
14.45	1706	20.67	24000	Al-Madhatiya	10
16.30	1925	15.93	18500	Alshuwmlia	11
0.05	601	2.58	3000	Altalica	12
3.35	396	3.014	3500	Al-Qasim	13
3.41	403	4.73	5500	Al-Imam	14

2.56	303	2.58	3000	Al-Musaib	15
99.99	11803	99.99	116100	Total	

Reference: Babylon Agriculture Directorate: Planning and Follow-up Department, Statistics Department.



Reference: Drawing based on data from Table (1).

Figure (1) The relative distribution of the agricultural areas of the in Babylon province for the agricultural season 2019-2020

## Results and discussion

### First: the productive and economic indicators of post-harvest losses from the corn crop with the sample of the study:

By studying the development of both the cultivated area and the production of the yellow corn crop in Babylon province during the period (2000-2018), the following was found ,Table No. (2) data indicates that the total area of the yellow corn for the period (2000-2018) amounted to about 2192315 thousand dunam with an average of 115,385 dunam, ranged between a minimum of 103 thousand dunam and an average of 4.69% in 2018, and a maximum of 192689 thousand dunam, with an average of 8.78% in 2004.As for the total productivity, it reached about 1620,685 thousand tons for the period from 2000-2018, with average productivity reaching about 85,299 thousand tons at the level of Babylon province, between two minimum limits of 63 thousand tons and an average of 3.8% in 2018, and a maximum of 164540 thousand tons, with an average of 10.15 % year 2014. Where we notice a clear fluctuation with respect to the area cultivated with the corn crop, which negatively affected the productivity of one dunum of the crop, due mainly to the water scarcity in the country, and the agricultural lands costumed to agriculture as a result of urban encroachment and establishment of industrial distributions and lack of adoption of scientific methods in agriculture in the agricultural process and the use of seeds of non-good cultivars and we note the loss of area clearly in 2014 due to the low water shares and at the level of Iraq and also in 2018 at the level of Babylon province due to the failure of the province to include the water share costumed to agriculture due to water scarcity in this year and the dependence of farmers on Irrigation using Artesian aquifer, which affected production, And by studying the general trend equation for area development and productivity at Babylon level in Table (3).The trend formula for the area showed a decreasing trend with the limits (-3311.41403509) with a treatment of 0.128121 and a value of F amounted to 2.498111.

**Table 2. Area and production of the yellow corn crop at the level of Babylon province for the period (2000-2018)**

Production / thousand tons	The average of yield/kg/dunum	Area / thousand dunam	Years
47440	677	70069	2000
44702	710	62967	2001
148452	951	156189	2002
68551	692	99034	2003
110473	573	192689	2004
90356	507	178109	2005
95532	562	169958	2006
108808	670	162333	2007
82879	678	122172	2008
61135	599	101918	2009
67495	647	104180	2010
80835	688	117422	2011
103088	725	142130	2012
152073	930	163421	2013
164540	1039	158319	2014
47197	976	48341	2015
80690	1029	78383	2016
66376	1027	64578	2017
63	611	103	2018
1620685	14291	2192315	Total
85299	752.15	115385	average

Ministry of Planning / Central Statistical Organization, Agricultural Statistics Directorate  
 Ministry of Agriculture / Agricultural Statistics Department / Department of Planning and Follow-up

**Table 3. General time trend equations for area development and production for corn crop at the level of Iraq and Babylon province during the period (2000-2018).**

F value	R ^ value	Time trend equation	indicters	Number
2.498111	0.128121	$Y = 148499.140351 - 3311.41403509 * T$	Area (thousand dunum ) in Babylon province	3
0.151447	0.008830	$Y = 92087.245614 - 678.803508772 * T$	Productivity (thousand tons) in Babylon province	4

( $Y = a + bt$ ), Y represents the estimated value of the dependent variable, t represents time. b represents the slope of the regression curve and represents Annual growth rate

And by studying the general trend of productivity, the equation showed a decreasing trend of about - 678.803508772) and by a coefficient of determination of (0.008830) and a value of F of 0.151447. and by studying the economic impact on the loss of yellow corn production for the study sample, To demonstrate the economic impact of yellow corn loss during its production stages per dunum of the study sample and the agricultural season (20/20/2019) and as shown in Table No. (4), the study questionnaires were classified and sorted into two main parts, The first section was represented by the questionnaires of the farmers who applied the correct and recommended

agricultural operations by the official authorities in the crop cultivation, and the number of these forms reached 99 forms out of a total of 372 forms. While the second section was represented by questionnaires of farmers who did not follow the correct agricultural methods and guidelines recommended by the agricultural departments, and the number of these forms reached 273 forms. After that, a comparative analysis was conducted between the two sections of the questionnaires using some important economic measures and indicators. Table (4) shows:

1. Average productivity per dunum: The high efficiency of using the land component for the followers of the agricultural operations recommended by the relevant extension authorities, with an average productivity of 47.59 tons per dunum compared to 13.73 tons for non-followers of those agricultural operations, with a difference of about 34 tons per dunum.
2. The cost of the unit produced Scale: The cost of producing one ton of the yellow corn crop was low for farmers following correct agricultural operations compared to those not following those processes, where it amounted to about 243 thousand dinars compared to 290 thousand dinars, a difference of about 47 thousand dinars per ton.
3. The Scale of the total costs of producing one dunum: Table (4) showed that the decrease in the total costs of one dunum of yellow corn for producers following the correct agricultural operations, where they amounted to about 39 million dinars, compared to 103 million dinars for non-followers of those agricultural operations, with a difference of about 63 million dinars per acre . Costs express the monetary values spent on the production of one dunum, of which are fixed and variable and are calculated on the basis of one dunum. Therefore, the changes that occur to any of them will have an impact on the total revenue.
4. Total revenue Scale: The results in Table (4) indicate an increase in the total revenue per dunum of yellow corn for farmers following correct agricultural operations, with a difference of about 250 million dinars, where it was found that the efficiency of producers following agricultural operations increased with a total revenue of 1.425 billion dinars compared to 1.175 One billion dinars for non-followers of those agricultural operations.
5. The Scale of the net dunum yield depends on the prices of the production process requirements and the prices of the final and secondary products of the crop.

In addition to the average productivity per unit area. It reflects the use of improved seeds or new technology, the provision of production inputs, or improved farm management. This standard represents the difference between total revenue and total costs,

6. The Scale of profitability of the spent dinar: The results show in table (4) an increase in the net revenue per dunum of yellow corn producers to reflect the high efficiency of farmers who follow the correct agricultural operations with a net dunum revenue of about 1.386 billion dinars compared to 1.072 billion dinars for those who do not follow those agricultural operations by a difference Its amount is about 314 million dinars.

This scale indicates the economic efficiency of the variable production elements only, and it shows the amount of revenue achieved from the use of farm assets in the production process, and the higher the value of this indicator, the greater the net revenue achieved in relation to the costs spent. Noting the results in Table (4), the increase in the net revenue to costs for the corn crop is

evident, thus increasing the efficiency of farmers who follow the right processes with profits of about 35 dinars, compared to 10 dinars for non-followers of those agricultural operations, and with an accounting difference of about 25 dinars

**Table 4. Indicators of the economic efficiency of those who followed and do not follow the correct agricultural processes in cultivating the yellow corn crop for the study sample**

The index difference between the two categories	do not follow the correct agricultural processes (273 farmers)	Followers of the correct agricultural processes (99 farmers)	Economic indicators	No.
33.86	13.73	47.59	Average dunum productivity/ton	1
47305 -	290092	242787	The average cost of the unit produced / dinars ton	2
63810000 -	103100000	39290000	Total costs per dunum /dinar	3
250292000	1175192000	1425484000	Total revenue per dunum/dinar	4
314102000	1072092000	1386194000	Net revenue per dunum/dinar	5
24.883	10.398	35.281	Profit of the spent dinar/dinar	6

Reference // was calculated and compiled by the researcher based on the data of the questionnaires

Second: Estimating the percentage of post-harvest losses and the relative importance of the causes of yellow corn yield related to post-harvest treatments in the study sample in Babylon province for the agricultural season (20/20/2019)

The data presented in Table (5) indicate that the total cultivated area of the yellow corn crop in Babylon province was (116,100) thousand dunam, and the area constituted (5738) thousand dunam in the study sample and the expected amount of production reached 8682 tons while the quantity actually marketed to the receiving factor was 8463 tons Of the expected amount to be produced and thus the lost percentage of them amounted to 219 tons, and the results showed that the farmers of the research sample had lost, according to their estimates, approximately 10.25% as a loss of the actual marketed production, and the ratio of the lost area to the net cultivated area (2.6%) from the original cultivated area

**Table 5. Shows the area, quantity expected to be produced, marketed, and the amount of production loss in the study sample for the marketing season (2019/2020)**

The percentage of the area lost to the net cultivated area	The lost cultivated area/dunum	Production loss rate%	Amount of loss/ ton	virtually marketed quantity/ton	The total quantity expected to be produced / ton	Total area/dunum	Crop
%2.6	151	%10.25	219	8463	8682	5738	Yellow corn

Ministry of Agriculture / Babylon Agriculture Directorate, Agricultural Statistics Department, Planning and Follow-up Department  
Calculate according to the questionnaire.

The lost cultivated area was calculated by dividing the lost quantity from production by the average productivity per dunum of the study sample.

Third: the determination of the causes of crop loss in the study sample and the relative importance according to the opinions of farmers in post-harvest treatments in the study sample in Babylon province for the agricultural season (20/20/2019)

The results in Table (6) indicate that there are twelve reasons for the marketing loss of the yellow corn crop after its harvest and according to the opinion of the farmers included in the research that were included in the questionnaire form, the most important of which were the following and according to the order (1) Lack of interest in marketing operations as a result of low purchase prices by The state reached 219 farmers with a percentage of 8.87%, (2) the crop refused to not conform to the conditions of receipt and the number of respondents was 186 farmers and accounted for 50%, (3) the inability to reduce the percentage of moisture to the yield and the number of respondents 180 farmers and formed 48.38%, ( 4) Poor collection and storage operations, the number of which reached 166, and accounted for 44.62%, (5) The lack of training and extension courses, the number of respondents was 129 farmers, and it accounted for 34.67%, (6) climatic factors such as high temperature and rain. (7) Poor level of preparation and preparation for the crop, the number reached 115 farmers, and the percentage constituted 30.91%.(8) Insufficient workers during the collection of the crop, and the number of respondents reached 69 farmers and accounted for 18.54%, (9) Poor level of preparation, preparation for the crop, the number reached 64 farmers and accounted for 17.20%, (10) Insufficient workers during collection of the crop and the number of respondents reached 53 Farmers accounted for 14.24%, (11) the crop was rejected due to infection by rot. The number of respondents was 12 farmers, and the figure accounted for 3.22%, (12) poor transportation, and the number was 11 farmers, and the rate accounted for 2.92%.

**Table 6. What do you think are the reasons for losing the marketing of the crop before its transfer to the receiving factories?**

percentage%	Number	Indicators	No.
58.87	219	Lack of interest in marketing operations as a result of the low purchase prices by the state	1
50	186	The crop was rejected for not meeting the terms of receipt	2
48.38	180	The impossible to reduce the moisture content of the yield	3
44.62	166	Poor collection and storage operations	4
34.67	129	Unavailability of training and Extension courses	5
32.52	121	Climatic factors such as high temperature and rain	6
30.91	115	Poor level of preparation and processing of the crop	7
18.54	69	Insufficient workers during harvest collection	8
17.20	64	Poor level of preparation, preparation and preparation of the crop	9
14.24	53	Insufficient workers during harvest collection	10
3.22	12	Crop rejected because of infection with rot	11
2.92	11	insufficient transport process	12

reference: collected and calculated from the results of the research sample (according to the questionnaire)

The results in Table (7) also indicated that there are ten reasons that express the opinions of the respondents in taking appropriate methods in the mechanism of reducing the percentage of loss in the production of the yellow corn crop and according to the study sample according to the opinion of the 372 farmers included in the research that were included in the questionnaire, the most important of which were the following According to the arrangement (1) improvement of the cultivated cultivars of the crop, the number of respondents reached 317 farmers and a rate of 85.21%, (2) payment of dues early to farmers and the number of farmers reached 248 and the average of 66.66%, (3) Increase the purchase price determined by the state and the number of respondents 244 farmers, at a rate of 65.59%, (4) expediting the marketing of the product to receiving laboratories, and the number of respondents reached 240 farmers, at a average of 64.51%, (5) interest in cultivated and harvest dates, and the number of respondents reached 231 farmers, at an average of 62.09%, (6) interest in storage, sorting and other operations, and the number reached 194 farmers, at an average of 52.15%, (7) interest in contracting diseases and pests, and the number reached 192 farmers, at an average that formed 51.61% (8) Intensification of courses, extension seminars and workshops related to the crop, with a number of 155 farmers, at a rate of 41.66%, (9) providing manpower and the number of respondents of 113 farmers, accounting for 35.75%, (10) providing advanced and appropriate drying devices in the field, and the number of respondents reached 102 farmers. And by 27.41%

**Table 7. What do you think are the appropriate methods to reduce the amount of loss in the crop**

%percentage	Number	Indicators	NO
85.21	317	Improving cultivated cultivars	1
66.66	248	Paying farmers' dues early	2
65.59	244	Increase the purchase price determined by the state	3
64.51	240	Accelerating the marketing of the product to the receiving factories	4
62.09	231	attention to the cultivating dates and harvesting	5
52.15	194	Attention to storage, sorting and other operations	6
51.61	192	Attention to disease and pest resistance	7
41.66	155	Intensification of extension courses, seminars and workshops	8
35.75	113	Provide workers	9
27.41	102	Providing advanced and appropriate drying devices in the field	10

Reference: collected and calculated from the results of the research sample (according to the questionnaire form)

Fourth: Measuring the economic impact on the post-harvest marketing level at the level of both farms and receiving factories for the corn crop in the 2019/2020 season:

The percentage of losses in post-harvest marketing operations is low compared to losses at the production level, due to this being the link between the product and the marketing center,

The fact that the exchange process takes place in a short period of time, because it is a result of the nature of the crop and the fact that its marketing period coincides in the winter periods and thus its exposure to various weather conditions and avoid damage to rot that may afflict it and thus the

crop is rejected by the receiving centers because there are no Allow percentage for rot within the receiving specifications. The total quantity marketed to the factories and receiving centers by farmers belonging to the agricultural people in the province covered by the agricultural plan drawn up by the Agriculture Department in Babylon amounted to (84,500) thousand tons and the percentage of loss was about (11.75%) at the level of each of the farms and receiving centers. By calculating the value of the financial loss resulting from this loss, it amounted to (2.663.780,000) billion Iraqi dinars, depending on the official prices for the purchase and sale of the crop by the state for the marketing season 2019/2020, where the purchase price of the yellow corn crop from farmers reached (350000) thousand dinars per ton and the selling price of dried cereals (280000) thousand dinars per ton to poultry and fish projects, which is a subsidized price, and by surveying the opinions of each of the farmers and the views of workers in the receiving centers for the corn crop in the province, the results showed that there are multiple reasons and we will highlight the causes of this loss during the assembly operations And manufacturing, storage and transportation from the field until it reaches the final consumption through a questionnaire that was designed for this purpose and as follows, which can be reviewed according to the tables below:

**First: Loss with the collection function:**

The data in Tables(8) and (9) indicated that the percentage of loss during the collection process for the crop received from farmers and conforming to the specifications of receipt was estimated at (3%) according to the crop receipt instructions issued by the General Mesopotamia Company for Seeds for the marketing season 2019/2020, and they were as following:

- Loss (ear) Because of damage to the quantities received due to different weather conditions 2%
- Loss (ear ) Because of the birds and storage with roofs 1%
- Loss (ear) By the mechanisms 1%.

However, through research and field observations, we see that the true rate of loss may reach more than these percentages set in official instructions and may reach (6%), which was estimated through the questionnaire form prepared for this purpose and the opinions of managers, laboratories, and technical workers in the yellow corn factories in This field, as shown in Tables (8) and (9).

- Post-harvest farm loss for 1%
- Post-marketing loss in the factory because of rot due to different weather conditions 2%.
- Loss of the factory after marketing due to birds and storage in Stores 1.75%.
- Loss of factory after marketing due to machinery 1.25%.

This percentage of loss during the assembly process in the receiving factory constituted about (51.05%) of the total loss during the marketing process of the crop for the yellow corn factories in Babylon, which is equivalent to about (5,070) thousand tons of the total loss shown according to Table No. (10) and thus the loss was estimated. The result of this loss is about (1.774.500.0000) billion Iraqi dinars out of the quantity received from farmers (84500) thousand tons (ears), and according to the purchase price of the crop of farmers amounting to 350,000 thousand dinars per ton for the marketing season 2019/2020.

**Second: Loss during the manufacturing process:**

The percentage of loss during the manufacturing process to perform the drying and threshing of the corn crop after receiving it from farmers in the receiving factory was estimated at (1%) based on the receiving instructions prescribed by the company and as shown in tables (8) and (9), and through field monitoring and based on a form The questionnaire prepared for this purpose and to see the opinions of workers in this field, the estimated loss average(1.5%). This loss in the manufacturing process constituted about (12.76%) of the total loss during the marketing process of the corn factories, and the amount of loss due to this loss was estimated at about (1,267.5) tons of the total amount of the total quantity, and its financial value was estimated at (443,625,000) million Iraqi dinars, according to the official prices paid by the state in purchasing the crop from farmers.

### **Third: Loss in the storage function:**

The percentage of loss during the storage process in the corn factories after receiving the crop from farmers was estimated at about 1% based on the instructions for receiving the corn crop, but through field monitoring and based on the questionnaire form prepared for this purpose and taking the opinions of workers and specialists in this field has been estimated at ( 1.5%), as shown in tables (8) and (9). This loss average constituted (12.76%) of the total dried and stored quantity, which was estimated at (48800) thousand tons for the total quantity manufactured from threshing the ears corn, which amounted to (84500) thousand tons, and thus the volume of the lost quantity reached about (732) tons, its financial value was estimated according to the selling prices of dried grains to poultry farmers at about (204.960,000) million Iraqi dinars, and based on the selling price one ton of dried cereals to poultry farmers at (280000) as a price supported by the state for poultry raising projects

### **Fourth: Loss of transfer function:**

The yellow corn crop is exposed to loss as a result of the transfer process. This loss rate can be divided according to the stages of transportation and as shown in tables (8), (9), (10):

#### **The first stage :**

#### **- Loss resulting from transferring the crop from the farm to the receiving and selling centers:**

Through field monitoring and a questionnaire prepared for this purpose, the percentage of loss due to the transfer of the crop from the field to the receiving center was estimated at (0.5%), which was estimated by the researcher and of course, it is a small percentage, This is because the fields producing the crop are close to receiving factories, in addition to the product's eagerness to keep the crop from being lost during transport operations and the small quantity marketed. As the quantity transferred from farmers to receiving factory reached (84500) thousand tons of yellow ear corn ,

Accordingly, the missing amount according to this percentage was up to (422.5) tons, and its financial value, according to the purchase prices allocated by the state, amounted to about (147.875,000) million Iraqi dinars, and this percentage of the loss at this stage constituted about (4.25%) of Total loss during the marketing process of the crop.

#### **The second phase :**

**- The loss of transferring the yellow corn crop between the company's own factories or from the external arenas for receiving :**

This loss occurs as a result of receiving the crop in external arenas that are leased by the factories as a result of insufficient treasury energy for receiving .

From which external storage arenas are leased in some seasons, which exposes them to loss due to exposure to weather conditions and attack of rodents and birds and the delay in the process of transporting them to factories for the purpose of threshing and drying, as well as the occurrence of the transfer of the quantities received from the crop between the receiving factories for the purpose of threshing and drying them, and avoiding delays in manufacturing processes and thus is distributed quantities received to other receiving factories or the rental of additional storage arenas. The quantities transferred to the corn factories from the dried grains reached (5000) thousand tons from the company's factory to Babylon factories for this season, The loss rate for this quantity was estimated at about (1.75%), and accordingly the lost quantity formed according to this percentage up to (87.5) tons and its financial values, according to the selling prices of poultry breeder's, reached about (24500000) million, and this percentage of loss during this phase was about (14.89%) of the total loss during the crop marketing process.

**third phase:**

- Loss of transferring dried beans from receiving factories to poultry farmers

This percentage of losses was estimated at about (0.5%), and the quantity marketed to poultry breeders for this marketing season amounted to (48800) thousand tons, and the loss percentage was about (244) tons and its financial values reached (68.320,000) million dinars, according to the sale prices established by the state, amounting to (280000) thousand dinars, as a price supported by the state to poultry breeders and chicken and fish breeding projects, and this percentage of loss at this stage was about (4.25%) of Total loss during the marketing process of the crop.

**Table 8. Percentage of loss in the yellow corn crop in Iraq for the marketing season 2019/2020 and according to the instructions for Receiving of the company Mabaen Al-Nhreen Company for seeds**

Ratios according to the questionnaire	Loss percentage according to previous research	Percentage according to receiving instructions	Statement	Function	No.
1%	Not mentioned in the instructions	Not mentioned in the instructions	Losses as a result in ware field storage, loading and unloading operations, exposure to rodents and birds, and weather conditions	-Collection of the ears on the farm	1
2% 2% 1%	2% 2.5% 1%	1% 1% 1%	-Damage as a result of weather conditions after receiving the crop -Percentage of loss because of birds and	-Collecting ears in the factory	2

			storage of farms in the roof -The loss because of the mechanisms		
1.5%	2%	1%	Threshing and drying yellow corn grains	Manufacturing function in the factory	3
1.5%	1%	Not mentioned in the instructions	Store yellow corn grains	Storage function in the factory	4
0.5%	0.5%	Not mentioned in the instructions	Transferring ears from the field to the factory	Transfer function	5
1.75%	2.5%	Not mentioned in the instructions	Transferring ears from one factory to another or from the Outdoor Spaces		
0.5%	1%	Not mentioned in the instructions	Transfer of dried grains from the laboratory to the breeders		
11.75%	12.5%	Total			

References: Calculated by the researcher based on the questionnaire form

**Table 9. The loss percentage of the yellow corn crop in Iraq during the marketing function at the farmer level and the receiving factory according to the researcher's vision for the 2019-2020 marketing season**

Percentage of what it constitutes of the total loss%	Loss percentage %	Statement	function	No.
8.51%	1%	Primitive harvest, open storage, moving more than once, exposure to different weather conditions, attacking pests and birds, delayed marketing and bad operations for packing and emptying	the function of the assembly in farm	1
% 17.02 % 14.89 % 10.63	% 2 % 1.75 % 1.25	-Damage and assembly in the squares due to weather conditions after receiving the crop Birds and storage in the Stores Loss because of mechanisms	the function of the assembly in factory	2
51.05%	% 6	Total functions		
% 12.76	1.5%	The work of threshing and drying of the yellow corn crop	Manufacturing function	3
12.76%	1.5%	Store the dried grain of the yellow corn crop	Storage function	4
4.25% 14.89% 4.25%	0.5% 1.75% % 0.5	-Transferring ears from the field to the receiving factories Transfer quantities of dried grains from the company's factories to Babylon factories Transfer of dried grains from the factory to the poultry fields	Transfer function	5
23.39%	2.75%	Total transport		

99.97%	%.11.75	Total
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Reference: Calculated by the researcher based on the questionnaire form

**Table 10. The percentage and value of loss of the yellow corn crop in Iraq for the 2019/2020 marketing season.**

The marketing function	Loss percentage %	The amount of loss (ears, dried grains) tons	The loss value at the function level / thousand dinars
Assembly	6 %	5.070 ears	1.774.500.000
Manufacturing	1.5 %	1.267 ears	443.625.000
The total functions	7.5 %	6.337.ears	2.218.125.000
Storage	1.5%	732 dried grains	204.960.000
Transportation / 1	0.5%	422.5 ears	147.875.000
Transportation / 2	1.75%	87.5 dried grains	24.500.000
Transportation / 3	0.5%	244 dried grains	68.320.000
Total transport	2.75%	754	240695000
total	11.75%	1.492.337	2.663.780.000

Reference: Calculated by the researcher based on the questionnaire form

### Conclusions:

We conclude from the research results that the research has reached that it can be said that working to reduce the volume of the loss in the grain during the marketing process means providing supply without the need for a large volume of investment, whether it is in projects to increase production or in importing the equivalent of loss from abroad to fill the local shortage in production, These results reflect the absence of the role of agricultural extension specialized in disseminating the special knowledge associated with post-harvest transactions for the corn crop as one of the important crops of marketing and nutritional value, which confirms the importance and necessity of extension the efforts to publish technical recommendations and find the most appropriate solutions and measures for improving the productivity of the maize crop Achieving a rewarding economic return with a high comparative advantage. And showing the extent of the effect of the amount of loss on the crop in the Iraqi economy by indicating the amount of loss that reached (219) tons out of the marketed quantity for receiving centers, As the total costs of producing the lost quantity amounted to (76650000) million dinars, which is part of that damage to the national economy of (2.663.780,000) billion Iraqi dinars, according to the prices of buying and selling the crop from the state for the marketing season 2019/2020, Which guarantees production costs plus the costs of all marketing services that were spent in the service of producing the crop. In addition to the waste and loss of economic resources through the total lost cultivated area of 151 dunam, which constituted 2.6% of the net cultivated area

### Recommendations:

1. Commitment to the recommendations issued by the relevant agricultural authorities, and the need to pay attention to factors affecting field losses, which requires the adoption of the Agricultural Extension Service for the results of agricultural research and scientific recommendations that are reached by scientific research for researchers.

2. Make farmers and marketers aware of the need to pay attention to cleaning yield, sorting and grading. Receiving the crop from farmers early, as delaying receiving causes the crop to be lost and damaged where a result of its exposure to different weather conditions.
3. The research recommends the necessity to activate the extension role and intensify efforts through the work of seminars and explanatory fields, to compensate for the knowledge deficiency of farmers in this important field.
4. Working to raise the efficiency of the performance of the various agricultural marketing workers in terms of administration, technical and marketing, and preparing programs to train and qualify those involved in this subject.
5. Working to increase the adequacy and efficiency of modern marketing supplies and equipment, such as those related to buildings, marketing centers, stores , transportation means, etc., and provide advanced supplies that complement marketing operations.
6. Working to reduce the loss of the yellow corn crop because of its positive impact on many economic variables, the most important of which is the gap and imports from this crop.

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