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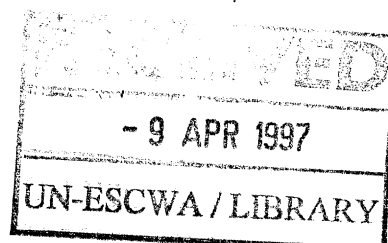
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Preleminary Economic Assessments of
Post-Harvest Losses of Wheat in Iraq

85-1247



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FOREWORD

This study presents the results of a short field investigation into the assessment of wheat losses in Iraq. This study forms a part of Joint ESCWA/FAO Agriculture Division's work programme in the field of food security, more specifically on critical factors affecting food production and distribution.

The study is divided into four chapters. The first chapter explains the objectives of the study. The second chapter presents the scope of study and methodology adopted. Current harvesting practices of wheat are described in the third chapter. In the fourth chapter the results of post-harvest losses of wheat are analysed and their preliminary economic assessment made. Finally, suggestions and recommendations on a future plan are presented.

The Joint ESCWA/FAO Agriculture Division would like to express its appreciation for the considerable help and cooperation afforded by the officials in the Ministry of Agriculture and Agrarian Reform, Government of Iraq, in preparation of this study. Special thanks are due to the Director General of Planning and Follow-up, Mr. M. Al-Shamma, and to his various deputies, and to all Directors General of the Ministry of Agriculture's offices in the Governorates of Thi-Qar, Diyala and Nineveh. With their cooperation, our staff was able to meet many officials and visited several farms and concerned offices. The Division would also like to thank the Chief of the State Organization of Grains, Mr. G.A. Khadory and his deputy, Dr. S. M. Hussain for their interest in the study.

The study was prepared by Dr. Mahmoud S. El Adeemy, an economic expert of the Joint ESCWA/FAO Agriculture Division.


M.M. Sherif
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CHAPTER I

INTRODUCTION

It is tragic and intolerable that enormous amount of food are lost to pests, rodents, birds, diseases and waste of all kinds when millions of human beings in developing countries suffer from malnutrition. At a most conservative estimate there is a loss of 10 per cent in cereals harvested in developing countries. Saving half of that loss would provide some 40 million more tons of cereals and save around \$7500 million in foreign currency per year. (1)

Great efforts and resources have been spent to increase agricultural production and in particular that of so called staple food. It is no good growing more food if we allow it to go waste in various avoidable ways. The increasing need of more food and better diet requires a continuous effort for both increasing food production and eliminating avoidable waste.

The magnitude of wheat grain losses in Iraq is not exactly known, but it is acknowledged that such losses exist and are significant through the chain of the post-harvest system. Officials in the State Organization of Grain, the Ministry of Agriculture and Agrarian Reform and others are aware of the problem. The question is how to assess these losses and consequently how to reduce or prevent them.

OBJECTIVES

It is generally acknowledged that wheat post-harvest losses in Iraq are substantial though the magnitude of these losses is not known. The main objectives of this study are to expose the position of wheat post-harvest system in Iraq, to examine various stages in the flow of grains from the producer to the consumer, and to determine for each stage what losses may be considered for measurement.

Specifically, the report sheds some light on the quantity of wheat losses, identifies their causes and makes some recommendations as to how these

(1) The lost harvest, PEL, FAO, Rome

losses could be reduced. The report also concludes with some suggestions for future plans.

Importance of Wheat

Wheat is the most important crop in Iraq not only because it occupies the largest area, about half the total cultivated area, but also because it is the main traditional staple food in the country. Wheat is a winter crop and is mainly grown under rainfed conditions. Area of 4.8 million donums of wheat were cropped in 1981, out of which only 0.6 million donums, or 12 per cent of total area, were under irrigation*. Wheat production therefore depends on weather and amount of rains which fluctuate from one year to another. Total wheat production amounted to 907 thousand tons in 1981, of which 20 per cent came from irrigated area and the rest from rainfed area.

Table (1) shows the importance of wheat crop among other cereal crops. In 1973, about three-quarter of cereals area was of wheat; this share has dropped in 1982 to about half the cereal area and to 46% in 1983. The table indicates that the drop of percentage contribution of wheat area was in the irrigated as well as in the rainfed area.

As stated earlier, the main wheat area is rainfed. It is expected therefore to find that wheat is mainly produced in the north where the rate of precepitation is higher than in other part of the country. Table (4) in the appendix shows that 44 per cent of total wheat in Iraq grown in the northern governorate of Nineveh and that the three governorates of the north, Nineveh, Arbil and Sulaimania cultivate together about two-third of total wheat in the country. Wheat crop is less tolerant to salt than barley, and for this it has been allocated to good land with no or low salinity problems.

* Donum = 2500 sq.m.

Table (1) : Percentage of wheat area to total cereal area
in Iraq, 1973 - 1982

Year	Percentage of Area		
	Irrigated	Rainfed	Total
1973	41	82	72.4
1974	44	82	73.6
1975	38	79	69
1976	37.5	79.8	68.9
1977	29	73.5	60.7
1978	32	76	64
1979	28	66	55.7
1980	27	69	59
1981	25	61	52
1982	n	n	49
1983	"	"	46

n = Not available

Source Based on:

- 1) Ministry of Agriculture and Agrarian Reform, Department of Planning and Follow-up, for 1973-1981
- 2) Ministry of Planning, Central Statistical Organization, Annual Abstract of Statistics, 1982, 1983

CHAPTER II

SCOPE AND METHODOLOGY

The present chapter explains the procedure followed in this study to assess wheat losses in Iraq in a more empirical way. The scope and areas surveyed are defined, the methodology adopted is outlined and finally some limitations are stated.

Scope of the study

The present study is concerned with the economic assessment of post-harvest losses of wheat in Iraq.

In order to have a representative picture of wheat post-harvest system and losses in Iraq, three governorates representing the northern, central and southern regions were selected for field visits; these are Nineveh, Diyala and Thi Qar respectively. In fact, there are some justification behind the selection of these governorates. They represent:

- (1) Varied climatic and ecological conditions.
- (2) Areas where wheat farming is rainfed and those where farming depends on irrigation.
- (3) Areas where wheat harvesting is mechanized and others where wheat is hand (manual) harvested.
- (4) Areas where different wheat varieties are grown.
- (5) Areas where varied types of farm tenure are found; privately owned, cooperative, rented and state farms.

Nineveh governorate in the north represents the rainfarming type with relatively low temperature and a combine harvested wheat. Wheat varieties in this region are Mexipak, Saber Bak, Erass and an Italian variety. All types of farm tenure are found in this governorate.

Diyala governorate in the central region represents wheat farming grown mostly under irrigation. The temperature is relatively moderate. Both

mechanized and hand harvesting methods of wheat are found in the area; about half of total wheat area is combined harvested and the remaining area is hand harvested. Varieties grown are Mexipak, Abughraib 5 and Kokerts.

In the south, in Thi Qar governorate, we find irrigated wheat with a weather of warm temperature. Hand-harvesting is predominant in the region; about 80 per cent of the total wheat area is manually harvested; mainly small farms. Wheat varieties grown are Mexipak, Kokerts 71 and Abughraib 5.

Study methodology

It must be borne in mind that the purpose of loss assessment is to achieve efficient loss reduction. It may also be very expensive to take up loss reduction efforts in the whole post-harvest system. It is thus necessary to identify the most serious grain loss points where improvement can be effective and losses can be avoided.

It is advisable to follow statistical methodology in such assessment in order to have standard results. This will enable grain loss reduction efforts and priority programmes to be effectively implemented. For the assessment of losses at any stage, it is necessary to define the population for which it is desired to estimate the loss. Sampling procedure and a measurement technique appropriate to the situation are to be designed. Data required are to be specified, and when collected, should be scrutinised and analysed to obtain estimates of losses. The reliability of information obtained should also be judged for possible errors.

A recognized procedure for assessment and collection of data on post-harvest food grain losses is detailed in the FAO Economic and Social Development paper 13⁽¹⁾: It is inappropriate to reiterate this methodology here. But it is important to state that due to time and resource limitations, it was found that various methods of random sample of farms were impracticable. A loss survey would require at least a year and a team of enumerators and specialists to cover harvesting and storage stages.

(1) Statistic Division, Assessment and collection of data on post-harvest food grain losses, FAO economic & social development paper 13, Rome, 1980

Selection of farms in this study was therefore made on an area basis, i.e. the investigator visited the selected governorates and, with the assistance of Agricultural and Agrarian Reform Directorate, some villages were selected and visited. In these villages some farmers, available in the field during the visit, were interviewed on wheat losses.

The procedure followed in this study to make preliminary reasonable assessment of wheat post-harvest losses in Iraq was as follows:

(1) Areas visited were selected on the basis outlined earlier; that is three governorates representing the three main geographical regions of Iraq were visited.

(2) In each governorate a number of farms were selected to represent various aspects of farming and harvesting methods. These aspects are: (a) Privately owned farms, cooperative farms, rented farms and state farms. (b) Farms where wheat is manually harvested, and those use combine harvesters. (c) in addition to that, in Nineveh governorate farms were selected so as to represent the levels of rainfall and consequently the level of yield. In this governorate, land is classified into three classes; assured, semi-assured and non-assured zones according to the amount of rainfall; being 400mm and above, 250-400mm and less than 250mm respectively.

The number of farms visited in each governorate depends on the number of variables in each region, the time available, and the availability of farmers during the visit which lasted for four days in each region. This number was 9 - 12 farmers.

(3) During the visits, the interviewer observed and interviewed farmers, machine drivers and workers on their estimates of wheat losses, their causes and their views and suggestion to prevent or reduce them. In some cases, the interviewer heard some conflicting views from different farmers about their estimate of wheat losses. In such cases the interviewer used his own judgment to decide on the most reasonable estimate of losses, through visual observation and indirect questions.

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(4) Threshing floors in the field or the village, in hand harvesting, were inspected for possible wheat losses and their causes.

(5) After threshing or combine harvesting, wheat grain was followed till it reached stores in the village or the marketing centres. Means of transportation were surveyed, drivers and farmers were asked about the quantity of losses which may occur for each mean of transport.

(6) Stores at village, marketing centres, cooperatives and at silos were inspected and observations made with the help of store keepers for the possible causes of losses during storage.

(7) At the end of the chain of wheat post-harvest system some silos and flour mills in the region were visited, handling and storage facilities were also inspected.

Some limitations

It should be stated here that the present study has some limitations, the most important of which are:

(1) Time limitation; as stated earlier a comprehensive loss survey would require at least a year and a team of investigators to cover various stages, or even one stage of post-harvest system. Time and enumerators were not available to the present study. The investigator tried in few weeks the best of his effort and knowledge to collect loss information from farmers, workers, combine drivers, etc. included in this report.

(2) Financial restriction has also limited the number of farms visited in each region. This number ranges between 9 - 12 farms depending on the availability of farmers during the visit, time spent with each farmer, etc.

Nevertheless, the framework designed and procedure outlined for the study is believed to be satisfactory. If resources are made available, this framework can serve as good guide for a large scale exercise of this nature.

CHAPTER III

CURRENT HARVESTING PRACTICE

Sowing of wheat is done in October-November depending on rainfall in the north and availability of irrigation water in other areas. Harvest generally starts late May in the south and extends to late June-early July in the north; thus there are some weeks difference between various regions.

Combine harvesting

The use of combine harvester varies from one area to another. In the north, where large area of wheat and barley is grown, mechanized harvesting accounts for 80-90 per cent of wheat and barley production. The encouragement of the government to the importation of new combine harvesters by individuals has recently greatly increased machine availability, particularly in the Nineveh governorate where about 44 per cent of total wheat area is grown. In other regions combine harvesting is used on a smaller scale; it ranges from 50-60 per cent in the central region to about 10-20 per cent in the southern region.

Hire rates for combine harvesters vary from one area to another, depending on harvesting time, availability of machines and drivers, area cultivated, etc. On the average this rate was I.D.10 a donum in 1984 harvesting season (1). Additional charge may be added for sack stiching and transportation to farmer's house. In some cases farmers have to provide combine drivers with food, drinks and the like in addition to the stated charge.

Straw recovery in the combine harvested areas is normally secured; piling straw after harvest is transported by a tractor-trailer to farmer's house where it could be fed to animals or sold to animal breeders. Moreover, grazing of the land by local nomadic animals is quite common in most areas, particularly those with high number of sheep and goats like Nineveh, Thi Qar and Diyala. The grazing crop is sold to livestock owner for about I.D.15-20 per donum. In extereme poor production years, this rate may go up to I.D.25 per donum.

(1) 1 Dinar = \$3.2

Harvest by hand

This method of harvesting is commonly practiced in the southern region. In fact many farmers would prefer to utilize combine harvester to harvest their wheat but are unable to do so for many reasons - (a) Physical considerations such as land slope, existence of large amount of rocks and stones in the field, access to field, size of wheat area, and remotness of the production areas, (b) unavailability of combine harvesters.

In some cases, where wheat area is small and the family labour is sufficient, farmers prefer hand harvesting. In such cases loss during harvesting is at minimum due to the utmost care taken by the family labour. Although hand-harvesting is slow and labourious, farmer feels that labour is free of charge, particularly when alternative employment opportunities are not available. Farmers who have insufficient family labour for harvesting and do not have access to combine harvester usually hire local migrant labour for the work. This is very expensive option; the cost of using a labourer is about I.D.6 a day.

After cutting the crop, normally by sickles, it may be left in the field for few days or moved at the end of the day. Sometimes plants are left on the ground until harvesting of the whole field is completed. Bundles of wheat are heaped in a corner of the field and reheaped in a bigger quantity and then transported to the threshing floor. Tractors and trailers may be hired to transport the crop to the traditional threshing ground which could be in a nearby area or in the village. On some farms, farmers use donkeys or carry the crop on their heads (particularly women and children) to transport the crop to the threshing ground.

Previous assessment of wheat post-harvest losses in Iraq

Few attempts have been made to assess wheat losses during harvesting or at any other stage of the post-harvest system have been made by governmental institutions in the past. In 1971, a study by Iraq Consult and SCICON International put wheat losses at 7 per cent due to insects and rodents at storage stage

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only.⁽¹⁾ After an unsuccessful attempt made by the Grain Board to collect 100 samples from grain stored on farms and "alalwis"* throughout Iraq to assess losses, the study used the above estimate. This estimate was arbitrary and conservative and was used to estimate the present and programmed storage capacity in Iraq and consequently suggest the required silo storage capacity in the future. It was estimated that these losses should be reduced to 3.75 per cent after the completion of silos and warehouse complexes plan.

Officials in the State Organization of Grain suggest that losses have decreased as bag storage is confined to rice. Losses in bulk storage are still appreciable. However, there are no evidence of estimates to support this view. Nevertheless, it is known that significant losses occur during wheat transportation from port or farms to silos and mills due to badly covered trucks, birds, insect pests, etc. It should be stated, however, that due to the lack of basic information, the exact size of the problem is not known and thus how to tackle it is not clear.

In June 1983 a mission from FAO was sent to Iraq at the request of the State Organization of Grain to assist in some technical problems of wheat losses in Iraq.⁽²⁾ The mission concluded that technical assistance be provided to the (SOG) on post-harvest methodology to reduce food losses and also to provide training in proper and efficient utilization of equipment and facilities, i.e. handling, storage, processing and laboratory equipment. The mission suggested, to implement these recommendations, that a consultancy of one month may be launched to Iraq.

In September 1983, FAO consultant arrived to Iraq to follow-up and implement the recommendations made by previous mission.⁽³⁾ The major requirements envisaged by the consultant were the establishment of a regular methodical procedure and appropriate technology, for assessment of losses in the SOG system.

(1) Iraq Consultant SCICON International, Iraq grain storage programme, final report for the Grain Board, State Organization of Grains, Republic of Iraq, 1971.

(2) Consultant report on a post-harvest loss assessment mission to Iraq, PFL Programme, FAO, June 1983.

(3) Andrews W.H. report on a loss assessment consultancy to Iraq, PFL Programme AGS/PFL, FAO November 1983.

* Sief system; courtyards where grain is stored in bags.

For this, it was decided to conduct a seminar on the principles and practice of inspection of bag and bulk grain, its sampling, assessment of losses by the count-and weigh method. At the end of the seminar, discussions and recommendations were made.

The main recommendations made by the consultant were:

(1) A system of inspection and sampling to be adopted at each point in the chain from port entry to consumers. This system should be reviewed after 6-9 month after the system has been instituted adequately and data properly recorded.

(2) Pest control teams to be trained to relieve inspectors of pest control work.

(3) Overseas training for laboratory staff and SOG inspectors to have a basic training in general storage principles and practices. Moreover, another seminar was recommended to be held for silo managers to concentrate on storage management problems, including losses and pest control.

CHAPTER IV

Assessment of post-harvest losses of wheat in Iraq

Having examined various stages in the flow of wheat from the producer to the flour mill during the field visits, one could identify harvesting, transporting and storage as the stages where wheat losses are most serious.

The important features of wheat handling system are summarized in chart I.

Though the study is concerned with post-harvest losses of wheat, it is important to note that losses during harvesting are greatly affected by the condition of plant prior to harvesting process. The amount of loss depending on the time of harvesting, if the operation is done before complete ripening, losses in grain weight occur afterwards when grain gets dry. It is recommended that moisture contents of grain during harvesting should be in the range of 15 % to 18 % , this ratio will decrease during transportation, threshing and storage to reach about 10 - 12 % at marketing stage. Early harvesting do not only mean loss in grain weight as a result of dryness, but it also makes the separation of grain during threshing more difficult specially when combine harvester is used. On the other hand, if harvesting was late, panicles shed their grain before and during harvesting.

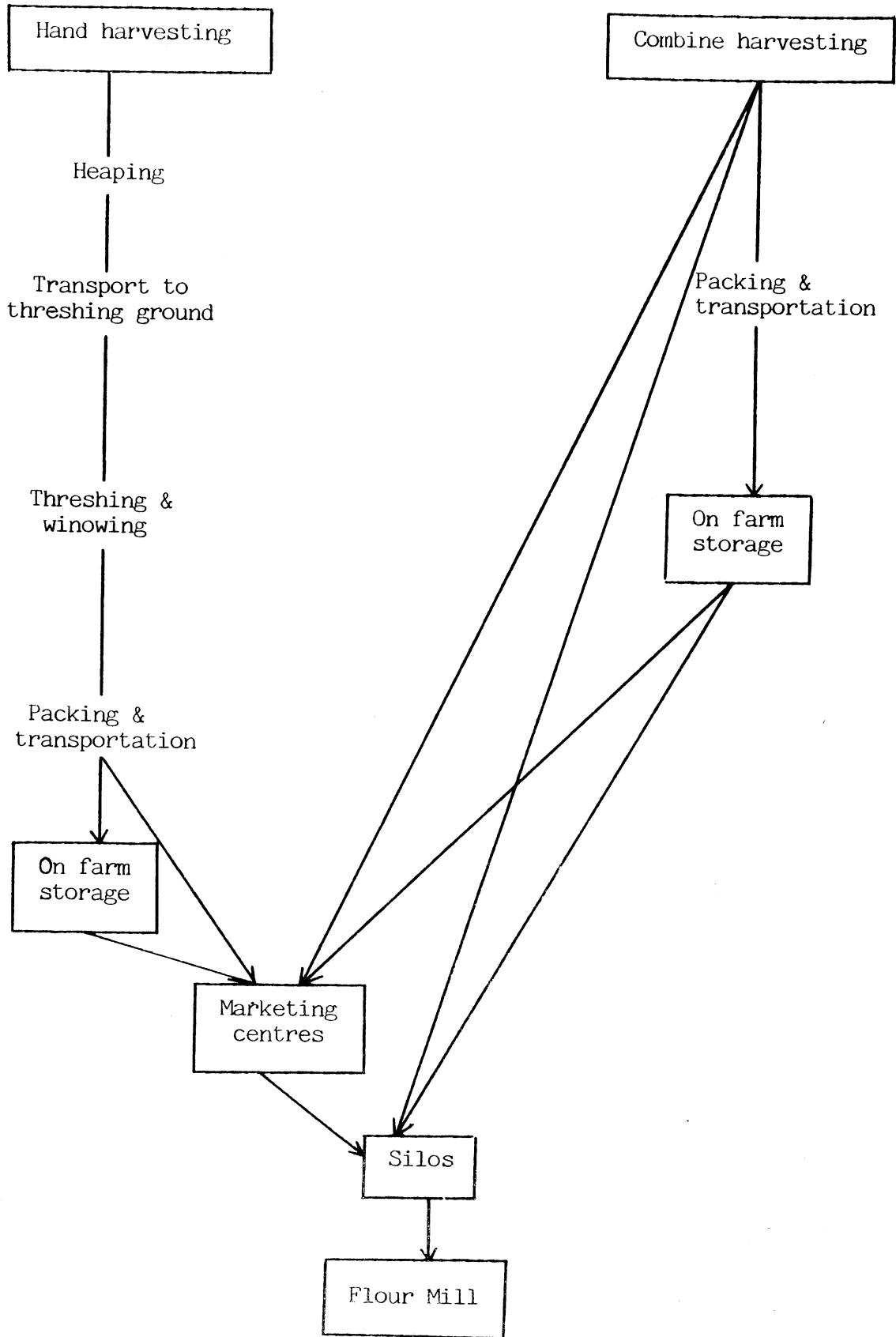
Causes and assessment of losses during manual harvesting

1 - As stated earlier, it was noticed during the field visits that about 80 per cent of total wheat grown in the southern region, 50 percent in the central region and 10 percent in the northern region is manually harvested. Generally speaking, it was also noticed that wheat losses on small farms, where the work is done by the family, are proportionately less than those on big farms.

During cutting the stems with a sickle, some of the grain will shake down particularly if the ears began to shed. Plants are also missed by the harvester, particularly when the crop was sparse and dropped during the handling stage. The quantity of loss in this case depends on the degree of care taken by harvester. Losses will be greater if the harvester is hired on an area harvested basis, in this case harvesting is done so quickly in order to harvest as much

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CHART (1)
Wheat handling System in I r a q



possible a larger area in a limited time. The quantity of sheded grain will be probably higher if weather is hot or harvesting is carried out during hot hours of the day. Losses at this stage were put as between 2 to 3 per cent. This percentage could be higher had not women and children gleaned the grains after harvest as it is **Practised on many farms in the south.**

2 After harvesting, bundles of wheat are heaped and reheaped in bigger heaps before it is carried to the threshing ground. Losses occur during the movement of bundles; the magnitude of these losses depend on (a) the degree of crop dryness, (b) heat of weather, and (c) the degree of care taken during handling the crop. **The estimated loss for this stage was put in the range of 1 % to 2 %.**

Bundles of wheat are then carried to the threshing ground by tractor trailor, donkey cart or on women's heads. Losses in this process occur at different degree depending on: (a) means of transport, (b) distance of threshing ground from the field, and (c) care taken during handling and transportation. Losses during this process are estimated to be 1 % to 3 %. These percentage could be reduced when farmers cover the bundles with cloth to prevent the dripping of grain.

3 - Threshing ground is usually located in an elevated site to facilitate grain seperation during winowing, or it can be an area of flat bare earth normally swept clean by farmers. In some cases old sacks, sheets or cloth are laid on the ground to minimize loss.

In the threshing and winowing process, the grains are seperated from husk using small machine driven by tractor. The grain straw mixture is then raken clear and heaped into a pile for subsequent hand winowing to clean the grain by blowing away the chaff (straw) from it. In few cases manual threshing is the only method employed.

Losses occur during this stage are caused by spillage, by in-complete removal of grains from stalks or by damage of grain during threshing. Losses may also occur due to the change of the location of threshing ground from year to year, specially when the earth is cracked or not flat. Losses during this process are estimated to be 5 % to 7 %.

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Causes and assessment of losses during combine harvesting

There are several factors affecting combine harvesting losses, viz field size, crop variety, yield, cultivating methods, soil profile, crop height, rocks and stones, working speed, crop maturity, operators skill, etc.

The presence of large rocks and stones on many farms force the combine drivers to raise their tables well clear off the ground to avoid cutter bar breakage and the possibility of stone entry to the threshing cylinder. It was noticed that most combines drivers are seasonal employees and therefore they are reluctant to risk the possibility of machine breakdown during the restricted harvesting season. Several breakdowns were observed during field visits, the cause of the majority of it, was when the operators tried to minimize the harvesting loss, at farmers direction, by cutting near to the ground.

The rough soil surface profile is caused by the existing cultivation practices. The combine operator usually follows the ploughing line to avoid the bouncing caused when crossing ploughing ridges. The operator has to raise his cutter bar clear of the peaks to avoid taking in earth and hitting rocks and stones. The main concern of the operator should be to achieve the correct relationship between reel position, reel speed, ground speed and cutter bar height in addition to the correct set of threshing drum and sieve size. The adjustments will reduce lodged grain heads and partially threshed heads.

Grain moisture content at harvest is very important, if that content is rather high, some grain heads are difficult to be threshed or partly threshed. On the other hand, if moisture content is low shedding of grain may occur. In both cases losses are higher.

The study examined the performance of new and old combine harvesters to find out if they have any effect on wheat losses. The majority of combines are of Claas and John Deere manufacturers. It was noticed that losses occurred using old machines were greater than those found in new ones. This was mainly explained by the frequent breakdown and difficulty to adjust the old machines during harvesting. To conclude the overall estimate of losses during combine harvesting were 4 - 6 %.

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It should be stated, however, that a number of visual observations were made during the field visits with regard to causes of losses while wheat was in the field or on the threshing ground. Apart from losses caused by shedding, birds and rodents, wild beavers were one of the main causes of losses in the south. The attack of birds to the crop in the field or in the threshing ground was rather severe this year due to the decrease of harvested area particularly in the rainfed area of the north. It was reported that some farmers had to chase birds in the field by making loud noise through hitting empty tins. Losses caused by birds were estimated to be 3% - 5%. Another cause of losses was seen in the wheat area adjacent to marches in the southern region; that is the attack of wild pigs to wheat field particularly during the night. Some farmers reported that they had to shoot these animals to protect their fields. Losses caused by wild pigs were put as 2% - 4%.

Assessment and causes of losses in storage

The most important losses during wheat handling in the storage stages for two main reasons; firstly they are of a relatively sizable magnitude, secondly, they are relatively easier to reduce/prevent by better methods of storage. The possible storage facilities available in Iraq can be described as follows:

(a) On-farm storage

There are several ways of wheat storage noticed during field visits on Iraqi farms and villages.

i) the grain may be simply tipped in a heap outside the farmer's house or even left in the field for the duration of short period until a means of transport is available to take it to marketing centres. In some cases, grains are kept in bags in an open space or the village courtyard. Losses occur at this stage caused by birds, rodents and some farm animals (poultry, sheep and goats). A risk of insect infestation of the grain during this period of retention is also expected.

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ii) Another form of on-farm storage is a roofed or semi-roofed ordinary room made of bricks and mud. Grains are stored in these rooms in bags or in bulk. Losses occurring at this point are probably less than those which occur at the previous form of storage.

iii) Some of the storage facilities on the farm or village are flask shaped underground or overground pits covered with earth and straw. The condition of these storage facilities fall far below basic requirements. Lack of ventilation often leads to the increase of grain moisture contents and infestation by insects. Moreover, covering pits with straw and mud mixes grain with dirt and consequently reduces the quality of grain.

Generally speaking, losses during on-farm storage under these conditions are reckoned to be between 6% to 10%.

(b) Storage at marketing centres

Farmers sell their wheat grain to the State Organization of Grains through the marketing centres belonging to the Ministry of Agriculture and Agrarian Reform. These affiliated centres are found in the main wheat producing areas all over the country. Each marketing centre is managed by a committee composed of representatives of farmers, cooperatives, Ministry of Agriculture and the State Organization of Grains. The number of these centres is increasing from year to year in order to increase the quantity of wheat marketed and received by the State. The number of these centres in the country is now about 90.

Marketing centres usually use the storage facilities of the cooperative societies and the Ministry of Agriculture branches. These facilities are ordinary roofed, partly roofed rooms or sometimes an open space to retain grain for short period before sending it to the central stores or silos. Storage conditions in these warehouses are usually insufficient. Poor ventilation which results in high temperature inside the stores, broken windows and roofs, improper stock layout, spillage from teared bags, birds and rodents excrement are all causes of losses noticed during field visits. Moreover,

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the store may be used for other purposes, such as storing other crops, fertilizer, seeds, etc.

It was noticed during the field visits that only when a reasonable quantity of grain, 60-80 bags, are accumulated in the warehouse, the grain is transported to the central storage or to the silo. In some cases, farmers take their grain directly, using available mean of transport, to the silo or to the central storage.

Losses caused by the above mentioned factors vary from one area to another depending on conditions of stores, the length of the storage period and the care taken when handling grain. Approximate losses in this stage were put as 5% to 7%.

(c) Central storage and storage at silos

After a period of temporary on-farm storage, the grain is normally moved to the warehouses of the marketing centres. The grain then is received into central stores which are normally adjacent to silo or in the silo premises. These facilities are normally large roofed area where grain is left for few days before it is moved for processing in the silo.

Big farmers and state farms deliver the grain directly to the silo. This often happens when combine harvester is used. In some cases grains are transported directly in bulk or bagged on a truck from the combine in the field to the silo.

Losses during this stage may be due to spillage, dripping from bags and of birds; the estimate of these losses was put as 2% - 3% depending on the length of period grain is left before processing , the conditions of bags and the way they are handled.

Losses in wheat transportation

In the post-harvest operations transport such as bullock-cart with wooden or pneumatic wheels, tractor trailers, trucks, etc. is involved at several points. In manual harvesting the produce is transported in the first instance from the field to the threshing floor. From threshing floor it is

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transported to the farmer's storage, and from there to the marketing centres. From the marketing centres it is transported to central storage or silos by trucks. In all these operations, including loading and unloading, losses occur due to spillage or dripping. Losses during transport in manual harvesting are expected to be greater than those in combine harvested because of the many operation and stages involved.

Generally speaking, losses occurring during transportation depend on means of transport, conditions of roads, distances of transport and the degree of care taken during transportation. Estimates of losses during transport in manual harvesting are put as 3% - 5%, this estimate could be reduced to 1% - 3% in combine harvested wheat.

Overall assessment of wheat post-harvest losses

The previous part of this chapter discusses the causes of wheat losses in the chain of post-harvest system from the producer to the silos. Visual observations and field interviews with farmers, combine operators and others concerned have helped to put a preliminary assessments of wheat losses in various stages of post-harvest system.

Table (2) shows a summary of these assessments which indicates that total losses of manually harvested wheat are in the range of 24-37 percent. These losses are 18-29 percent for combine harvested wheat. On the whole, the results contained in this table can be summerized as follows:

1 - Losses during manual harvesting are relatively less than those of combine harvested wheat; 3 - 5% and 4-6% respectively. This can be explained by the great care taken by family labour during manual harvesting where they usually glean shedded grains and plants. This is hardly done when using combine and some plants are too short which caused panicles to lodge below the average combine cutting height. Moreover, plants at the edge and corner of the field are sometime difficult to be combine harvested.

2 - After manual harvesting, threshing and winowing process has to be

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carried out, wheat losses during this stage was 5-7 per cent. In combine harvester, harvesting and threshing are done in one operation.

3 - Losses in storage for wheat manually harvested are similar to those in combine harvested one if the same storage facilities are used. But it should be stated that in many cases, wheat grains harvested by combine are transported in bulk or in bags from the field or farmer's house directly to the central stores or the silo, thus reducing storage losses to about 5-7 per cent instead of 13-21 per cent. For this possibility of direct transportation of grain from the farm to central stores or silos, losses during this stages are estimated to be 1-3 per cent compared with 3-5 per cent in manual harvesting.

4 - The wide range of loss assessment of wheat in the table for harvesting and during storage is mainly due to the variability of local conditions in the regions visited and the number and degree of factors behind these losses.

5 - It should be noted that there are some causes of wheat losses which are limited to an area and not found in other areas. Wild pigs, for example, were seen in the southern region where these animals come out of the the marches during night and attack wheat fields. Such losses were included as harvesting loss.

Some Economic Conclusions

The potential importance of wheat loss in Iraq can be illustrated by the estimates stated in table 2. Taking the lower limit of loss range, it is estimated that in the manual harvested wheat, 24 per cent of total production is wasted. Taking 1983 production of 841 thousand tons, wheat losses will be about 202 thousand tons of grain with a local value of about I.D.18.2 million⁽¹⁾. This value is reduced to about I.D.13.6 million when assuming that all wheat is combine harvested. The value of wheat losses could be further reduced to I.D.7.6 million if proper or immediate moving of combine harvested wheat grain to the main storage or silos is secured.

It is more logic, however, to estimate national losses of wheat according to the percentage of area hand harvested and combine harvested

(1) Wheat price paid to farmers in 1984 was I.D.90/ton.

in each region. Table (3) illustrates this situation. Total wheat losses in the hand harvested areas amounts to 62 thousand tons or about 37 per cent of total losses, valued at I.D.5.6 million. Wheat losses in the combine harvested area are estimated as 107 thousand tons with a value of I.D.9.6 million. The total loss of hand harvested and combine harvested wheat will be therefore about 169 thousand tons with a value of 15.2 million. It should be stated, however, that the increase of the combine harvested wheat losses was mainly due to the increase of wheat area grown in the northern region which is usually combine harvested and represents about three-quarter of total wheat production in the country.

The importance of wheat loss magnitude looks more alarming if we know that the estimated quantity lost is equal to the production of about one million donum ⁽¹⁾. Table (4) emphasizes the urgent need to reduce wheat losses. The table shows that self sufficiency ratio of wheat is declining, from 45 per cent in 1979 to 27.6 per cent in 1983. Using the figures of total wheat loss in Table (3), its ratio to total consumption, imports and production will be 4.7 per cent, 6.4 per cent and 16.9 per cent respectively. Reducing wheat losses will not only increase home production, but also will release the burden on the balance of payment by reducing wheat imports.

Using production figures published by the Central Organization of Statistics and FAO figures for imports, selfsufficiency ratios will be 27.5, 36.0, 32.0, 30.0 and 24.4 per cent for the years 1979, 1980, 1981, 1982 and 1983 respectively. That is to say that selfsufficiency ratio has increased in 1980 compared with that of 1979, thus it decreased in the following years.

The above results indicate the great physical and economic losses in wheat production in Iraq. This also indicates the great efforts which should be taken to reduce or prevent them. Some suggestions for future plan are outlined in the following pages.

(1) Taking average yield of 164 kgs /don. in 1983

Table (2) Average assessments of wheat post-harvest loss, field visits, Iraq, 1984⁽¹⁾.

<u>Manual harvesting wheat</u>		<u>Combine harvesting wheat</u>	
<u>Stage</u>	<u>Loss%</u>	<u>Loss%</u>	
Harvesting	3-5	4-6	
Threshing & Winowing	5-7	-	
Transportation	3-5	1-3	
Storage- on farm	6-10	6-10)	
- marketing centres	5-7	5-7)	
- central & silo storage	2-3	2-3)	5-7 ⁽²⁾
	<hr/>	<hr/>	<hr/>
Total	24-37	18-29	10-16

(1) It should be stated, however, that these losses could be greater if we assume that total production estimated by the Ministry of Agriculture does not include losses, i.e. net production received at silos.

(2) If grains are carried directly from field or a farm stores to the silo, storage losses will be reduced to 5-7% and the total loss of combine harvested wheat will be 10-16%.

Remarks: Loss percentage represents losses in the quantity of grain at each stage of the post-harvest system.

Table (3) Assessment of quantity and value of wheat losses in Iraqi regions (Average 1977 -1983)

Region	North	Central	South	Total
Production, 000' ton	638.0	157.6	57.9	853.5
H. harvested, " (1)	127.6	78.8	52.7	259.5
C. harvested, " (2)	510.4	78.8	5.8	595.0
Total loss, "	122.5	33.1	13.5	169.1
H. harvested Loss "	30.6	18.9	12.5	62.0
C. harvested loss "	91.9	14.2	1.0	107.1
Value of T. loss (3) I.D. million	11.0	3.0	1.2	15.2

- (1) Hand harvested wheat, 20%, 50% and 90% in the northern, central and Southern regions respectively.
 (2) Combin harvested wheat, 80%, 50% and 10% in the northern, central and southern regions respectively.

(3) Value of wheat I.D.90/ton.

Source: Table 5 in the Appendix, production is the average of 1977-1983.

Table (4) Production, imports, consumption and Self-Sufficiency ratio of wheat in Iraq, 1979 - 1983 (1)

Years	Production (ton)	Imports (ton)	Consumption	Sufficiency Ratio
1979	1 492 000	1 805 780	3 297 780	45.2
1980	1 300 000	1 698 391	3 998 391	43.4
1981	902 000	1 912 690	2 814 690	32.0
1982	965 000	2 247 360	3 212 360	30.0
1983	1 000 000	2 626 700	3 626 700	27.6

- (1) There are some discrepancy between FAO and Central Statistical Organization production figures for the year 1979, 1980 and 1983. Nevertheless FAO figures were used to be compared with imports and consumption figures which are available only in the FAO publication.

Sources: 1- FAO production yearbook (Vol 35 . 37 for 1981 .1983)

2- FAO Trade yearbook (Vol 34 . 37 for 1980 . 1983)

Proposed Future Plan

1 - The main objective of national plan is to increase food production by all possible means, one of these is the reduction of wheat grain lost in the post-harvest system. The results of this study indicate that losses of wheat reached about I.D.18.2 million. A great percentage of this value could be saved, had appropriate measures been taken to reduce wheat losses.

2 - It is true that the present report put preliminary assessment of wheat losses in Iraq, based on visual observations and field visits made to different regions and covered all stages of the post-harvest channel from the producer to the silo. But we feel that these results are a challenge to a more comprehensive assessment of these losses. It is therefore a pilot exercise to define the strategy for a sound losses assessment study.

3 - It is necessary to launch a national control programme of wheat losses. This is usually handicapped by the lack of basic data. These data must be based on accurate, regular and methodical recording system of losses.

4 - A complete system of loss assessment should therefore be established with the technical assistance of FAO. This should be done in the context of a pilot project for the prevention of wheat losses in Iraq.

5 - The project should depend on practical aids, both technical and economical in showing how losses can be reduced by improved techniques in harvesting, threshing, handling and storage.

6 - To conduct wheat loss surveys a team comprising storage technologist and economist is necessary.

7 - A planned programme of training and demonstration covering various aspects of harvesting, handling and storage and their management, pest control operations, etc. to store-keepers, farm managers and other concerned personnels should be envisaged. Mr. Andrews, FAO consultant, has started on this direction in his mission, october 1983, when he supervised a seminar on grain inspection, sampling and loss assessment at the request of State Organization of Grains. (1)

(1) Andrews, W.H., OP. Cit.

8 - Cooperation between the suggested project and the extension service should be envisaged to speed-up and maintain project activities.

9 - To launch such project an official request should be made to FAO for technical assistance and other organizations for possible funding. A complete programme of pilot project should be prepared by State Organization of grains and the Ministry of Agriculture and Agrarian Reform with the assistance of Joint ESCWA/FAO Agriculture Division. discussed with those concerned.

SUMMARY

The magnitude of wheat losses in the Republic of Iraq is not exactly known, but it is acknowledged that such losses exist in high percentage in the post-harvest system. The general objective of the present study was to shed some light on wheat losses during the post-harvest stage by assessing these losses using visual observations and field interviews with farmers, combine operators, store-keepers and others. Causes of these losses at all points in the chain of post-harvest were also examined.

Three regions representing different ecological and agricultural conditions were selected and visited. Nineveh Governorate in the north represents the rainfarming type where the majority of wheat farms are combine harvested. Diyala Governorate represents the central region where agriculture depends on irrigation and about half of the wheat farms are combine harvested, the other half are hand harvested. In the south, Thi Qar Governorate was visited where the majority of wheat farms are hand harvested.

In each region, a number of farms were selected to represent the various tenure systems, privately owned farms, cooperative farms, rented farms and state farms. It was also planned that farms selected should represent those where wheat is manually harvested and those use combine harvesters.

During the visits, the interviewer observed, inspected and interviewed farmers, combine operators, store keepers etc..... on their estimates of wheat losses and their causes at various stages of post-harvest system. Their suggestions to reduce losses were also recorded.

A wide range of loss assessment were reported for each stage in the chain of post-harvest system. This was expected because of the wide variations of local and farm conditions in addition to the numerous factors causing wheat losses. The study showed that losses during manual harvesting were relatively less than those of wheat combine harvested; being 3-5% and 4-6% respectively. This was mainly due to the great care taken by family labour during manual harvesting and handling.

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On the whole, the study showed that in the manual harvested wheat 24% of total production or about 202 thousand tons valued at I.D. 18.2 million are wasted. The loss estimates for combine harvested wheat were 18% or about 151 thousand tons at a value of I.D. 13.6 million. This last value estimate could be reduced to I.D. 7.6 million had wheat grain transported directly from the farm or village to the silo, thus reducing losses of storage to more than half.

The study concludes that a great percentage of wheat losses could be saved had appropriate measures been taken to reduce/prevent them. The study therefore suggests a national control programme of wheat losses. This programme should be implemented through a pilot project for the prevention of wheat losses in Iraq. A proposal of this project should be prepared by the Ministry of Agriculture and Agrarian Reform, and the State Organization of Grain with the assistance of ECWA/FAO Agriculture Division. This proposal should then be presented to FAO and other organization donors to finance the project.



A P P E N D I X



Table (1) Area of Wheat in Iraq 1973-1983

(Area/000 donums)

Year	Irrigated	Rainfed	Total
1973	940	5775	6715
1974	927	5697	6624
1975	810	4980	5798
1976	850	8220	6070
1977	753	4623	5375
1978	868	5493	6361
1979	691	4239	4930
1980	645	5002	5647
1981	572	4275	4847
1982	n	n	4729
1983	n	n	5126

n : Not available

Source 1 - Ministry of Agriculture and Agrarian Reform, Department of Planning and follow-up, for 1973-1981

2 - Ministry of Planning, Central Statistical Organization , Annual Abstract of Statistics for 1982 and 1983.

Table (2) Production of wheat in Iraq 1973-1983
(000' tons)

Year	Irrigated	Rainfed	Total
1973	297	660	957
1974	415	924	1339
1975	262	583	845
1976	407	906	1313
1977	216	480	696
1978	782	628	1410
1979	233	452	685
1980	211	765	976
1981	182	725	907
1982	n	n	965
1983	n	n	841

n : Not available

Source: 1 - Ministry of Agriculture and Agrarian Reform, Department of Planning and follow-up, for 1973-1981.

2 - Ministry of Planning, Central Statistical Organization , Annual Abstract of Statistics for 1982 and 1983.

Table (3) Yields of wheat in Iraq 1973 - 1983
(Kgm/Donum)

Year	Irrigated	Rainfed	Total
1973	316	114	143
1974	448	162	202
1975	323	117	146
1976	479	173	216
1977	287	104	129
1978	325	114	143
1979	337	107	139
1980	327	153	173
1981	318	168	186
1982	n	n	204.1
1983	n	n	164.1

n : Not available

Source: 1 - Ministry of Agriculture and Agrarian Reform, Department of Planning and follow-up, for 1973-1981.

2 - Ministry of Planning, Central Statistical Organization , Annual Abstract of Statistics for 1982 and 1983.

Table (4) Area cultivated of wheat by Governorate in Iraq 1977 - 1983
(1000* Donum)

Governorates	1977	1978	1979	1980	1981	1982	1983	Total	Average	Per-centage
Nineveh	972	3042	1695.8	2909	2150	2006	2066.6	14841.4	2120.2	43.6
Salah.AI.Deen	231	321	279	262	226	211	308.4	1838.4	262.6	5.4
Al.Taimem	408	636	536	486	487	557	587.1	3697.1	528.2	10.9
Diala	175	229	272.1	233	325	234	304.1	1172.2	253.2	5.21
Baghdad	64	45	32.8	23	21	25	27.4	238.2	34	0.70
Al.Anbar	59	57	34.4	34	31	35	30.6	281	40	0.82
Babylon	146	103	73.7	63	52	41	68.9	547.6	78.2	1.61
Karbela	3	8	1.1	-	1	1	0.7	14.8	2.1	0.04
Al.Najef	2	1	0.3	1	4	2	2.9	13.2	1.9	0.03
Al.Qadisiay	64	59	47.9	61	71	63	60.4	426.3	60.9	1.25
Al.Muthana	32	30	24.7	20	18	22	27.9	174.6	24.9	0.51
Thi Qar	90	77	54.3	56	59	49	42.9	428.2	61.2	1.26
Wasit	233	175	152.2	150	130	118	149.7	1107.9	158.3	3.26
Maysan	47	47	38.9	40	32	49	53.3	307.2	43.9	0.90
Basra	9	7	6.5	5	3	4	5.3	39.8	5.7	0.12
D'hok	147	111	128.2	116	137	144	201.8	985	140.7	2.89
Arbil	361	661	613.8	684	653	603	723.2	4299	614	12.63
Al.Sulaimania	389	374	319.5	353	522	565	464.9	2987.4	426.8	8.78
Total	3432	5983	4311.2	5496	4922	4729	5126.1	33999.3	4856.8	100

Source: Ministry of Planning, Central Statistical Organization, Annual Abstract of Statistics.

Table (5) : Total production of wheat in the Governorates of Iraq 1977-1983 (000' tons)

Governorates	1977	1978	1979	1980	1981	1982	1983	Total	Average	Per-centage
1 - Nineveh	133.0	343.9	177.4	463.7	366.1	363.2	307.2	2154.5	307.8	36.1
1 - Salah.Al.Deen	36.9	51.2	46.7	30.9	30.2	39.3	41.9	277.1	39.6	4.6
1 - Al. Tameem	49.9	55.9	54.1	45.1	55.5	103.2	49.4	413.1	59.0	6.9
2 - DIALA	39.7	42.3	46.7	37.2	46.2	37.0	42.8	291.9	41.7	4.9
2 - Baghdad	24.7	16.5	11.5	8.0	7.1	7.6	8.4	83.8	12.0	1.4
2 - Al. Anbar	25.1	22.7	13.3	15.3	11.0	12.0	10.1	109.5	15.6	1.8
2 - Babylon	62.4	39.6	30.6	28.3	19.6	18.6	21.0	220.1	31.4	3.7
2 - Kerbela	0.5	1.5	0.2	0.2	0.1	0.1	-	2.6	0.4	-
3 - Al. Najaf	0.6	0.3	0.1	0.2	0.1	0.1	1.4	2.8	0.4	-
3 - Al. Qadisiaya	22.6	21.1	17.8	20.6	23.2	15.4	13.1	133.8	19.1	2.2
3 - Al. Muthanna	10.5	5.9	7.2	5.9	1.9	3.3	4.9	39.6	5.6	0.7
3 - Thi. Qar	24.3	23.8	17.8	22.3	23.5	22.7	9.6	144.0	20.6	2.4
2 - Wasit	79.7	63.9	59.3	58.8	44.1	48.2	41.6	395.6	56.5	6.6
3 - Maysan	12.1	13.5	9.5	9.4	6.4	9.9	14.7	75.5	10.8	1.3
3 - Basrah	2.2	1.5	1.6	0.8	0.7	1.2	1.9	9.9	1.4	0.2
1 - D'hok	33.3	23.4	37.6	50.7	62.4	54.3	63.7	325.4	46.5	5.4
1 - Arbil	47.9	80.2	75.9	107.5	88.1	99.6	91.1	590.3	84.3	9.9
1 - Al. Sulaimaniya	90.8	102.6	77.5	70.7	116.8	129.4	118.2	706.0	100.8	11.9
Total	695.7	909.8	684.8	975.6	902.2	965.1	841.0	5974.2	853.3	100.0

Source: Ministry of Planning, Central Statistical Organization, Annual Abstract of Statistics, 1977-1983

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