J. Agric. Sci. Mansoura Univ., 34 (5): 5823 - 5835, 2009

DETERMINE OF WHEAT HARVEST SYSTEMS REQUIREMENTS

Abo-El-Naga M.H.M.; H. A. El-Gendy and G.G. Radwan
Agric. Eng. Res. Inst., ARC, Egypt

ABSTRACT

To upgrade a harvest system of wheat crop, required that, minimized all losses, cost and energy consumed, fulfill that by determine and completeness all losses, cost and energy consumed for all different operations and systems traditional and available of harvest wheat crop. The field experiments were carried out in Dakahlia Governorate during two seasons (2007 – 2008) with all available and traditional harvest systems for wheat crop on a variety of wheat crop Sakha 9 and determine all losses, cost and energy consumed. The results obtained from all available and traditional harvest operations for wheat crop indicated that the optimum system of harvest wheat crop obtained by (A2+C2+D1) [Reaping by self-propelled mower with bundling device + Transport by animal and wooden cart + Threshing by Turkish machine] at grain losses about 4.5%, straw losses about 14.5%, energy requirement of 1000.24 MJ/fed and criterion cost of 1195.73 L.E/fed.

INTRODUCTION

In Egypt wheat is the first important cereal crop than others, it is occupies about 2.75 millions feddan with a national average of about 2.28 tons, producing nearly about 6.27 millions tons of grain, Ministry of agriculture (2007) A.R.E. The wheat harvesting include reaping, bundling transport and threshing operations. Up till now, the problem of labor shortage can be solved with the use of farm machinery which helps to bring more area under cultivation, increase cropping intensity and timely harvest crops. Most of wheat harvesting systems still doing manually and mechanically. These systems increased total losses, cost and energy consumed. Bukahri *et al.* (1983) found losses to the tone of 16% for manual harvesting and threshing as compared to about 12% for manual harvesting plus mechanical threshing and only 3.4% for combine. Embaby (1985) stated that, wheat grain losses resulting from harvesting and threshing methods by stationary machine were as following: 2.7% for manual cutting, 5.3% for self-propelled mower and 3.8% for tractor mounted mower. He also found that, the consumed energy per fed., for wheat production under Egyptian conditions by using self-propelled mower and tractor mounted mower were 10.21 and 35.81 kW.h/fed. AMRI (1987) found 2.2% wheat losses for combine as compared to 4.65% for reapers and about 7.5% for manual harvesting. GOP (2001) indicated that combine harvester is an efficient, economical, and less labour demanding machine. It increases grain recovery by minimizing harvesting and threshing losses. McNeill and Overhults (2001) measured field losses by counting loose kernels on the ground. Look in front of the combine in standing wheat to measure preharvest losses. Wheat kernels found under the combine are both preharvest losses and header losses. Count kernels behind the combine to measure total losses (preharvest, header, threshing, and separating losses). Every 20 kernels found in a square-foot area represent losses of about 1 bushel per acre. A good goal is to limit harvest losses to no more than 5 % of the crop yield. Adjust ground speed, header height, and reel speed, and position to control harvest losses. Tahir *et al.* (2003) recommended that the combine increases wheat grain recovery by reducing post-harvest losses and saves time and labor. Therefore, it should be adopted without further delay. A chaff-making unit should be designed as an attachment to the combine so that the farmers who want chaff for their animals may be able to use it. The cab of the combine should be modified to minimize noise and dust pollution. A small electric fan should be arranged within the cab to facilitate combine operator.

Moussa (1987) mentioned that the maximum grain losses observed under the different combines were 16.3, 5.61 and 6.19% at forward speed of 3.5 km/h with Yannmar, Deutz and Fortshritt combines respectively. El-Zemeity (1997) indicated that, the highest values of straw losses 11.2 % was obtained at drum speed of 1000 rpm, feed rate of 15 kg/min and moisture content of wheat straw 8.1%, while the lowest values of straw losses 3.2% was obtained at drum speed of 600 rpm, feed rate of 25 kg/min and moisture content of wheat straw 22.3%. Khan *et al.* (1989) reported that, the total losses ranged from zero to 7.0% in the axial flow machines threshed. Hassan *et al.* (1994) found that, increasing of forward speed from 2.1 to 3.9 km/h at constant cutter bar speed of 1.2 m/s and grain moisture content of 19.2% increased header losses from 0.82% to 1.38% from 0.72% to 1.09% and from 0.22% to 0.87% by using Yanmer, Deatz and Fortshirt combines from wheat crop. Singh *et al.* (1988) studied harvesting wheat by reaper. They found that, average field capacity was about 0.4 ha/h with 4% grain losses, labour input in mechanical reaping was about 5 man-h/ha compared to 84 man-h/ha in manual operation. Danasory and Imbabi (1998) studied on mechanical and manual pickup and baling of wheat straw after harvesting with combine. They indicated that, the time requirement for manual picking and packing per feddan straw after harvesting with combine was 54 man.h. The baler losses of straw increased by increasing the forward speed and straw yield, the straw losses ranged from 11.8% to 20.7% of harvest straw. Mohamad (1994) found that, the optimum machine power for threshing operation of wheat crop is 9.15 hp and rice crop is 4.00 hp. The machine investment cost is 4.59 L.E/h and total cost for threshing operation is 16.84 L.E/h. Arnaout *et al.* (1998) found that, the minimum grain losses of 1.66% obtained under wheat combine machine and minimum energy consumed of 25.38 kW.h/fed., by using self-propelled mower and thresher machine, too, the minimum total cost of 173.03 L.E/fed., by combine machine for wheat crop. El-Nakib *et al.* (2003) found that, the total losses increased from 2.07 to 2.73% and from 4.37 to 5.24% at forward speed of 2.00 and 5.14 km/h, and grain moisture content of 22.5 and 14.0% respectively. Ebaid *et al.* (2004) found that, the fan losses were 0.11%, losses behind sieve zero %, unthreashed grain 0.05 % and total damage grain zero % and machine productivity 800 kg/h too, found that the operation cost of the machine is 15.55 L.E/h. Unit cost 19.445 L.E/ton, seed losses equivalent 0.27 L.E/ton, and criterion cost (operating cost + losses) 19.72 L.E/ton. Ali *et al.* (2007) developed a feeding device in Turkish threshing machine they found that, minimum total grain losses of 5.48 and 3.57% before and after development were obtained at material feed rate of 1100 kg/h, drum speed of 27 m/s and grain moisture content of 19%. The main objective of this research is to determine the wheat harvesting requirements such as losses, cost and energy consumed for different harvesting systems traditional and available.

MATERIALS AND METHODS

The field experiments were achieved in Dakahlia Governorate during two seasons (2008 – 2009) with available and traditional harvest systems for wheat crop on a variety of wheat crop Sakha 9, to determine total losses, cost and energy requirements. Some characteristic of a variety wheat crop Sakha 9 shown in Table (1). Also, the machines used specifications and laborers shown in Tables (2) and (3) respectively.

Table 1: Mean values of some characteristic of wheat crop (Variety of Sakha 9).

Some characteristics of wheat crop	Mean values
Plant height (cm)	106.3
Thousand grain mass (g)	48.15
No of stems / m^2	322.51
Grain moisture content (%)	

Table (2): Specifications of machines used.

Type of machine	Working width, m	Expected life, h	Mass, kg	Power, kW
Tractor		24000	2265	55.93
Self-propelled mower with banding device	1.6	5000	385	9.55
Self-propelled mower without banding	1.6	5000	375	9.55
Mounted mower BM-1102	1.6	2500	183	---
Small reaper, AMRI	1.2	2500	180	---
Big reaper, AMRI	2.2	2500	1250	---
Turkish threshing machine	----	2500	1250	---
Wooden cart	---	2500	250	---
A small trailer	---	5000	550	---
A big trailer	---	5000	1500	---
Combine (Kubota)	1.5	3000	2375	24.56
Combine (Deutz)	4.5	5000	5100	54.44
The baler (Class) model, Markant 55	1.6	3000	1260	---

Table (3): Requirements of laborers for different harvest operations.

Type of harvest operation	Number of laborers
Reaping by sickle.	8
Reaping by mounted mower.	4
Bundling and gathering.	4
Transport and collecting by hands (manual).	6
Transport and collecting by wooden cart.	3
Transport and collecting by small trailer.	3
Transport and collecting by a big trailer.	4
Threshing wheat crop by threshing machine.	4
Threshing straw yield after combine harvest.	3

The studied harvesting wheat crop systems (reaping (A, D2 and D3), bundling (B) or gathering and collecting (E), transport (C, F) and threshing (D1)) can summarized as shown in Table (4)

Table (4): The systems for harvest wheat crop used in this work.

Systems	Description the treatments
A1+B1+C1+D1	**Manual reaping (sickle)** + Manual bundling + Transport by hands + Threshing by Turkish machine.
A1+B1+C 2+D1	Manual reaping (sickle) + Manual bundling +Transport by animal and wooden cart + Threshing by Turkish machine.
A1+B1+C3+D1	Manual reaping (sickle) + Manual bundling + Transport by small trailer + Threshing by Turkish machine.
A1+B1+C4+D1	Manual reaping (sickle) + Manual bundling + Transport by big trailer + Threshing by Turkish machine.
A2+C1+D1	**Reaping by self-propelled mower with bundling device** + Transport by hands + Threshing by Turkish machine.
A2+C2+D1	Reaping by self-propelled mower with bundling device + Transport by animal and wooden cart + Threshing by Turkish machine.
A2+C3+D1	Reaping by self-propelled mower with bundling device + Transport by small trailer + Threshing by Turkish machine.
A2+C4+D1	Reaping by self-propelled mower with bundling device + Transport by big trailer + Threshing by Turkish machine.
A3+B1+C1+D1	**Reaping by self-propelled mower without bundling device** + Manual bundling + Transport by hands + Threshing by Turkish machine.
A3+B1+C2+D1	Reaping by self-propelled mower without bundling device + Manual bundling + Transport by animal and wooden cart + Threshing by Turkish machine.
A3+B1+C3+D1	Reaping by self-propelled mower without bundling device + Manual bundling + Transport by small trailer + Threshing by Turkish machine.
A3+B1+C4+D1	Reaping by self-propelled mower without bundling device + Manual bundling + Transport by big trailer + Threshing by Turkish machine.
A4+B1+C1+D1	**Reaping by mounted mower** + Manual bundling + Transport by hands + Threshing by Turkish machine.
A4+B1+C2+D1	Reaping by mounted mower + Transport by animal and wooden cart + Transport by hands + Threshing by Turkish machine.
A4+B1+C3+D1	Reaping by mounted mower + Manual bundling + Transport by small trailer + Threshing by Turkish machine.
A4+B1+C4+D1	Reaping by mounted mower + Manual bundling + Transport by big trailer + Threshing by Turkish machine.
A5+B1+C1+D1	**Reaping by small reaper** + Manual bundling + Transport by hands + Threshing by Turkish machine.
A5+B1+C2+D1	Reaping by small reaper + Manual bundling + Transport by animal and wooden cart + Threshing by Turkish machine.
A5+B1+C3+D1	Reaping by small reaper + Manual bundling + Transport by small trailer + Threshing by Turkish machine.
A5+B1+C4+D1	Reaping by small reaper + Manual bundling + Transport by big trailer + Threshing by Turkish machine.
A6+B1+C1+D1	**Reaping by big reaper** + Manual bundling + Transport by hands + Threshing by Turkish machine.
A6+B1+C2+D1	Reaping by big reaper + Manual bundling + Transport by animal and wooden cart + Threshing by Turkish machine.
A6+B1+C3+D1	Reaping by big reaper + Manual bundling + Transport by small trailer + Threshing by Turkish machine.
A6+B1+C4+D1	Reaping by big reaper + Manual bundling + Transport by big trailer + Threshing by Turkish machine.
D2+E1+F6	**Harvest by combine (Kubota)** + Gathering by hands and Transport straw yield by hands + Cutting by Turkish machine.

D2+E2+F6	Harvest by combine (Kubota) + Gathering by hands and Transport straw yield by animal and wooden cart + Cutting by Turkish machine.
D2+E3+F6	Harvest by combine (Kubota) + Gathering by hands and Transport straw yield by small trailer + Threshing by Turkish machine.
D2+E4+F6	Harvest by combine (Kubota) + Gathering by hands and Transport straw yield by big trailer + Cutting by Turkish machine.
D2+E5+F6	Harvest by combine (Kubota)+ Collect by the baler and Transport by a big tractor and trailer + Cutting by Turkish machine.
D3+E1+F6	**Harvest by combine (Deutz)** + Gathering and Transport straw yield by hands + Cutting by Turkish machine.
D3+E2+F6	Harvest by combine (Deutz) + Gathering and Transport straw yield by animal and wooden cart + Cutting by Turkish machine.
D3+E3+F6	Harvest by combine (Deutz) + Gathering and Transport straw yield by small trailer + Cutting by Turkish machine.
D3+E4+F6	Harvest by combine (Deutz) + Gathering and Transport straw yield by big trailer + Cutting by Turkish machine.
D3+E5+F6	Harvest by combine (Deutz) + Collect by the baler and Transport by a big tractor and trailer + Cutting by Turkish machine.

To evaluate the previous harvesting systems the harvesting losses are determined as follow:

a) Pre-harvest losses:

The percentage of pre-harvest losses was calculated by using the following equation;

$$\text{Pre-}harvest\ \ losses = \frac{\text{Pre-}harvest\ \ losses/\ fed}{Total\ \ yield/\ fed} \times 100 \qquad (\%)$$ -------- (1)

b) Header grain losses:

The percentage of header loss was calculated by using the following equation;

$$Header\ \ losses = \frac{Header\ \ losses/\ fed}{Total\ \ yield/\ fed} \times 100 \qquad (\%)$$ ------------------ (2)

c) Threshing grain losses:

Threshing grain losses consists of many types of losses such as grain loss, grain damage and unthreshed grain. It can be calculated by using the following equation;

$$Grain\ \ losses = \frac{Weight\ \ of\ \ grain\ \ losses\ \ with\ \ the\ \ straw/\ fed}{Total\ \ Weight\ \ of\ \ grain/\ fed} \times 100 \qquad (\%)$$ ------(3)

$$Grain\ \ damage = \frac{Weight\ \ of\ \ grain\ \ damage/\ fed}{Total\ \ Weight\ \ of\ \ grain/\ fed} \times 100 \qquad (\%)$$ ---------- (4)

$$Unthreshed\ \ grain\ \ losses = \frac{Weight\ \ of\ \ unthreshed\ \ grain/\ fed}{Total\ \ Weight\ \ of\ \ grain/\ fed} \times 100 \qquad (\%)$$ ---(5)

d) Threshing straw losses:

$$Straw\ \ losses = \frac{Weight\ \ of\ \ straw\ \ losses/\ fed}{Total\ \ straw\ \ yield/\ fed} \times 100 \qquad (\%)$$ ----------- (6)

e) Reaping or cutting straw losses:

The height of cut was measured above ground to the cut surface before and after cutting operation. Them the percent of residual straw was calculated by using the following equation;

$$Ec = \frac{Ha - Hb}{Ha} \times 100 \quad (\%)$$ --------- (7)

Where;

Ec = the percent of cutting straw losses, %

Ha = height of stand plant above the soil surface before cutting, cm

Hb = height of the stubble after cutting, cm

Criterion cost:

The criterion cost of harvesting operation was estimated by using the following equation:

$$\frac{Criterion\ cost}{fed} = \frac{Operation\ cost}{fed} + \frac{Grain\ losses\ cost}{fed} + \frac{Straw\ losses\ cost}{fed}$$ -----(8)

$$Operating\ cost/fed = \frac{Machine\ cost\ (LE/h)}{Effective\ field\ capacity\ (fed/h)} \quad LE/fed$$ ----- (9)

$$Criterion = \frac{Criterion\ cost}{Value\ of\ product} \times 100 \quad \%$$ ------- (10)

Where:

Value of product = value of grain yield + value of straw yield

A mathematical model modified by Kassem (1986) and applied by EL-Shazly (1989) was used for predicting the consumed energy. Through the model, the energy could be computed by using the following equations;

A. Machinery energy requirements "E_n"

This includes the energy required to manufacture, transport and repair machinery.

$$E_n = \frac{C_n}{Fc}\left(\frac{W}{TDL} + \frac{W_m}{MDL}\right) \quad MJ/fed$$ ------------ (11)

Where:

C_n= Energy input coefficient used to represent the embodied energy in a piece of equipment or tractor =101 MJ/kg. (Pemmental *et al.*, 1973 and Lower *et al.*, 1977).

Fc = Field capacity, fed/h

W_T = Mass of tractor, kg

Wm = Mass of machine, kg

TDL = Tractor – design life, h

MDL = Machine – design life, h

B. Fuel energy requirement "E_F"

$$E_F = \frac{C_F}{Fc} P \times F_E \quad MJ/fed$$ ------------ (12)

$$F_E = 2.64\ x + 3.91 - 0.2\sqrt{788\ x + 173} \quad L.kW/h$$ ------- (13)

Where:

E_F = Energy used as fuel, MJ/fed.

C_F = Energy input coefficient used to represent the energy values of the fuel = 47.2 MJ/L.(Lower,*et al.*, 1977)

P = Power used, kW

F_E = Fuel efficiency, L/kW.h.

X = Load factor = 0.2 to 0.8 for transportation and agricultural operations (Shaibon, 1985)

C. ***Human labore energy "****E_{HL}"*

$$E_{HL} = \frac{C_{HL}}{Fc} \times N_L \qquad MJ/fed \qquad \text{---------- (14)}$$

Where:

C_{HL} = Energy input coefficient representing the human Labor energy = 2.3 MJ/man.h. (Pimmental *et al.*, 1977).

N_L = Number of laborers required to perform any operation.

RESULTS AND DISCUSSION

The results were concerned with available and traditional harvesting systems for wheat crop to estimate the total losses of grain and straw wheat crop, the different operations costs and energy requirement for the previous systems of harvesting wheat crop.

The total losses (Grain losses + Straw losses);

For wheat crop harvesting systems, the data of grain and straw losses were calculated and illustrated in (Figs.1-A and 1-B). The figures show that, the highest grain losses values of 6.36% obtained by (A4+B1+C3+D1) [Reaping by mounted mower + Manual bundling + Transport by small trailer + Threshing by Turkish machine] system. While the lowest grain losses values of 3.35% obtained by (D2+E1+F6), (D2+E2+F6), (D2+E3+F6), (D2+E4+F6) and (D2+E5+F6) [(Harvest by combine Kubota + gathering and transport straw yield by hands + Cutting by Turkish machine),(Harvest by combine Kubota + gathering and transport straw yield by animal and wooden cart + Cutting by Turkish machine),(Harvest by combine Kubota + gathering and transport straw yield by small trailer + Cutting by Turkish machine),(Harvest by combine Kubota + gathering and transport straw yield by big trailer + Cutting by Turkish machine) and (Harvest by combine Kubota + Collect by the baler and transport by a big tractor and trailer + Cutting by Turkish machine) systems. However, the data were represented in Figs. 2-A and 2-B show that the highest straw losses values of 52.00% obtained by (D3+F1+F6), (D3+F2+F6), (D3+F3+F6), (D3+F4+F6) and (D3+F5+F6) [(Harvest by combine Deutz + gathering and transport straw yield by hands + Cutting by Turkish machine), (Harvest by combine Deutz + gathering and transport straw yield by animal and wooden cart + Cutting by Turkish machine), (Harvest by combine Deutz + gathering and transport straw yield by small trailer + Cutting by Turkish machine), (Harvest by combine Deutz + gathering and transport straw yield by big trailer + Cutting by Turkish machine) and (Harvest by combine Deutz + Collect by the baler and transport by a big tractor and trailer + Cutting by Turkish machine)] systems. While the lowest straw losses values of 12.00% obtained by (A1+B1+C1+D1), (A1+B1+C 2+D1), (A1+B1+C3+D1) and (A1+B1+C4+D1) [(Manual reaping + Manual bundling + Transport by hands + Threshing by Turkish machine), (Manual reaping + Manual bundling +Transport by animal and wooden cart + Threshing by Turkish machine), (Manual reaping + Manual bundling + transport by small trailer + Threshing by Turkish machine)and (Manual reaping + Manual bundling + transport by big trailer + Threshing by Turkish machine)] systems.

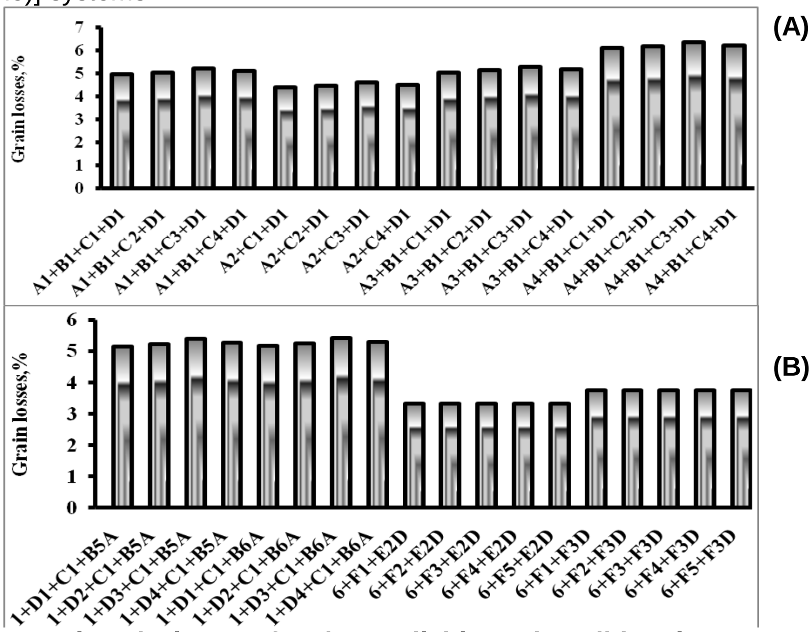

Fig. 1: Total grain losses for the available and traditional systems to harvest wheat crop.

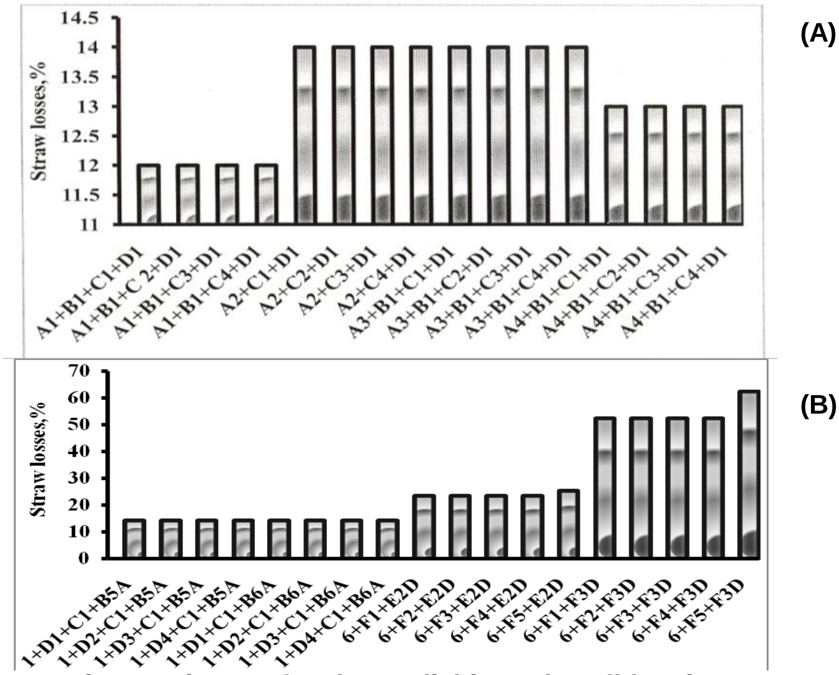

Fig. 2: Total straw losses for the available and traditional systems to harvest wheat crop.

The energy requirement:

The data were represented in (Figs. 3-A and 3-B) indicated that, the highest values of energy requirement (6424.88 MJ/fed) were obtained by using these system (D3+F5+F6). [Harvest by combine Deutz + Collect by the baler and transport by a big tractor and trailer + Cutting by Turkish machine]. While the lowest values (1000.24 MJ/fed) were obtained by these system (A2+C2+D1). [Reaping by self-propelled mower with bundling device + Transport by animal and wooden cart + Threshing by Turkish machine].

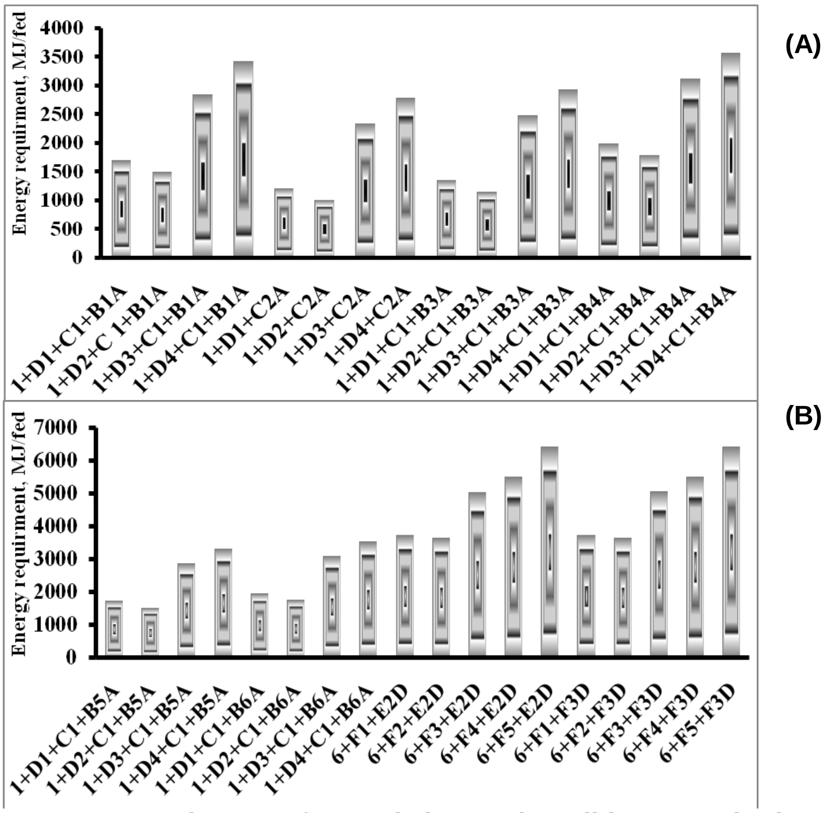

Fig. 3: Energy requirement for available and traditional methods to harvest wheat crop.

The total cost:

The data were represented in Figs. (4-A and 4-B). The figures indicate that, the highest values of total cost (885.00 L.E/fed) were obtained by using this system (D3+F5+F6) [Harvesting by a combine Deutz + Collect by the baler and transport by a big tractor and trailer + Cutting by Turkish machine].While the lowest values (550.00 L.E/fed) were obtained by using the following systems (D2+E1+F6) and (D2+E2+F6). [(Harvest by combine Kubota + gathering and transport straw yield by hands + Cutting by Turkish machine) and (Harvest by combine Kubota + gathering and transport straw yield by animal and wooden cart + Cutting by Turkish machine)]. However, the data were represented in Figs. (5-A and 5-B). These show that the highest values of criterion costs (2239.13 L.E/fed) were obtained by using this system (D3+F5+F6) [Harvest by combine Deutz + Collect by the baler and transport by a big tractor and trailer + Cutting by Turkish machine]. While the lowest values (1178.5 L.E/fed) were obtained by using the following systems (D2+E1+F6) and (D2+E2+F6) [(Harvest by combine Kubota + gathering and transport straw yield by hands + Cutting by Turkish machine) and (Harvest by combine Kubota + gathering and transport straw yield by animal and wooden cart + Cutting by Turkish machine)]. At the other hand, the data were represented in Figs. (6-A and 6-B). The figures clear that the highest values of criterion cost percentage (27.50%) were obtained by using this system (D3+F5+F6) [(Harvest by combine Deutz + Collect by the baler and transport by a big tractor and trailer + Cutting by Turkish machine)].While the lowest values (14.50%) were obtained by using the following systems (D2+E1+F6) and (D2+E2+F6) [(Harvest by combine Kubota + gathering and transport straw yield by hands + Cutting by Turkish machine) and (Harvest by combine Kubota + gathering and transport straw yield by animal and wooden cart + Cutting by Turkish machine)].

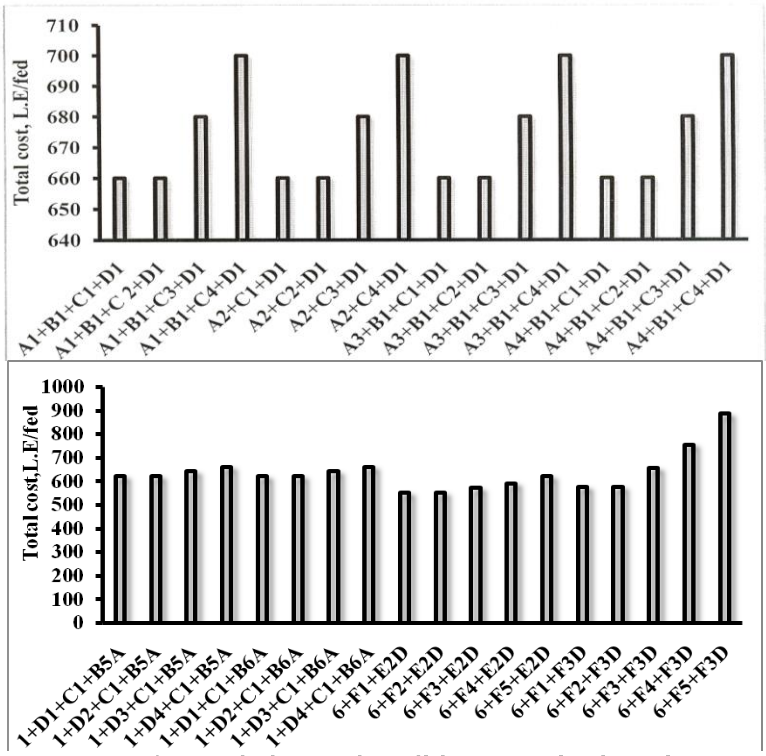

Fig. 4: Total cost for available and traditional methods to harvest wheat crop.

SUMMARY AND CONCLUSION

The main objective of this investigation is to determine the losses, cost and energy requirement for using available and traditional harvest systems of wheat crop under Egyptian conditions. The results of available and traditional harvest operations for wheat crop indicated that the optimum system of harvest wheat crop obtained by (A2+C2+D1) [Reaping by self-propelled mower with bundling device + Transport by animal and wooden cart + Threshing by Turkish machine] at grain losses about 4.5%, straw losses about 14.5%, energy requirement of 1000.24 MJ/fed and criterion cost of 1195.73 L.E/fed.

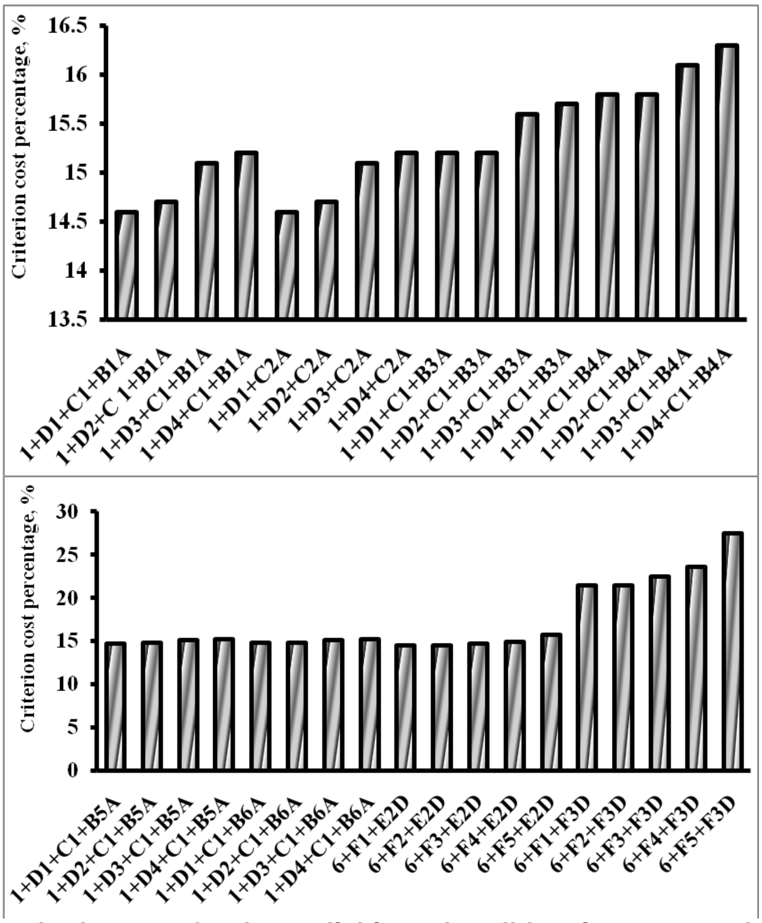

Fig. 5: Criterion cost for the available and traditional systems to harvest wheat crop.

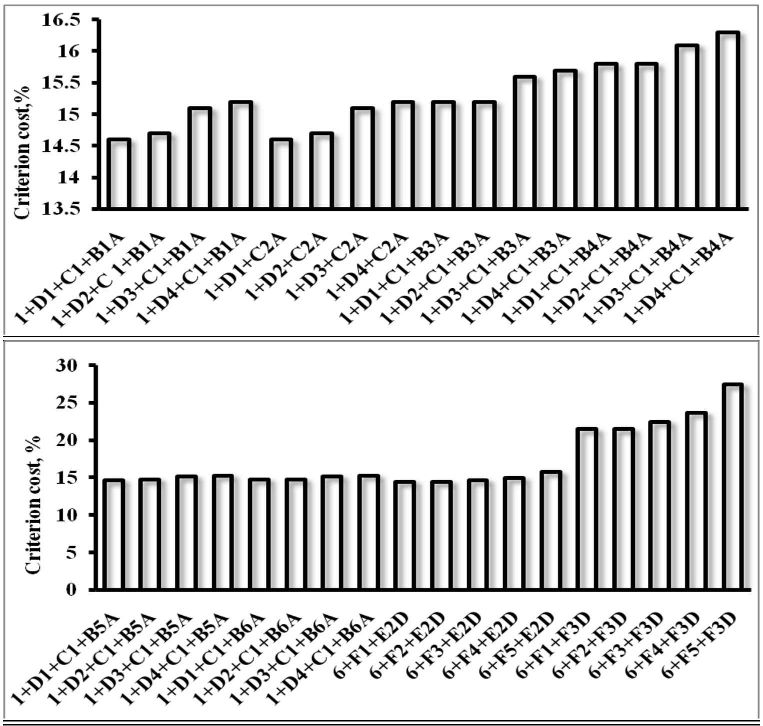

Fig. 6: Criterion cost for the available and traditional systems to harvest wheat crop.

REFERENCES

Ali, M.M; M.M. El-Sharabasy and M.A. Khattab (2007). Development of feeding device in a turkish threshing machine. Misr J. Ag. Eng., 24(2): 235 - 258.

Arif, A.M. (1994). Studying concave-drum factors and operation of a locally manufacturated thresher and their effect on threshing efficiency. M. Sc. Th., Agric. Mech. Dep., fac. Of Agric. Ain Shams Univ.

Arnaout, M.A.I; M.K. Abdel-Wahab and M.M.EL-Sharabasy (1998). Selecting the proper system for mechanizing grain crops harvesting in the small holding. Misr. J. Ag. EWng., 15(1):133-144.

Ebaid M.T.; A.A. Abd El-Rahman; G.G. Radwan H.E. Osman (2004). Development a thresher for wheat crop of beater type for maximum productivity Misr J. Agr. Eng., 21(1): 14-28.

EL-Nakib, A.A.; Z.Y. Abdel-Lateef; A.A. EL-Meseery and A.A. Khattab (2003). Minimizing the harvesting losses of the wheat.the 11th Annual Conference of Misr Society of Agric. Eng. Oct.: 908-922.

EL-Danasory and Imbabi (1998). Study on mechanical and manual pickup and baling of wheat straw after harvesting with combine. Misr J. Ag. Eng. 15(2): 246-260.

EL-Shazly, M.A. (1989). The energy requirements for producing main crops under Egyptian conditions. Egypt. App. Sci., 4(2): 268-281.

Embaby, A.T. (1985). A comparison of the different mechanization system forcereal crop production. M. Sc. Thesis agric. Eng. Dep., faculty of Agric., Cairo, Univ., Egypt.

Hassan, M.A.; M.M. Morad; M.A. El-Shazly and A. Farag (1994). Study on some operating parameters affecting the performance of combine devices with reference to grain losses. Misr J. Agric. Eng., 11(3): 767 - 780.

Kassem, A.S. (1986). A mathematical model for determining total energy consumption for agricultural systems. Misr J. Agric. Eng., 3(1): 39 - 57.

Khan, A.U.; A.H.A. Mohamad; A. Kamal and M. Amin (1989). Improvement of AMRI-Th2 all crop thresher Ann. Rep. Mach. Develop. Prog. Ag. Mech. Res. Inst., Egypt: 6 - 18.

Lower, O.J; E.M. Smith; S. Burgress, L.G. Welles, and D. Bebertins (1970). Beeg: Production of beef with minimum grain and fossil energy inputs. Volumes I, II and III. Report to NSF. Oct.

Moussa, A.I.M. (1987). Study the usability of different combine machine in wheat and rice fields. M. Sc. Thesis, Agric. Eng. Dept., Fac. of Agric., Zagazig Univ.

Pimental, D.; B. Hurv; C. Pellotte; H.J. Forfter; I.N. Oks; O.B. Sholel and B.G. Whitman (1973). Food production and the energy crisis. Sci,Vol. 1, Nov., P:443-449.

Shaibon, H.A. (1985). Effect of size and scattering of land holding on costs of mechanized service and Egyptian conditions. Misr. J. Agr. Eng. 2(2): 15-28.

Singh, G.; A. P. Chaudhary and D.G. Clough (1988) performance evaluation of machine reaper in Pakistan A.M.A. 19(3): 47-52.

Tahir, A.R.; F.U. Khan and K. Ejaz (2003). Techno-Economic Feasibility of Combine Harvester (Class Denominator) – A Case Study: International journal of agriculture & biology, 1560–8530/2003/05–1–57–60, http:// www. ijab. org.

Clarke, J. M. (1985). Harvesting losses of spring wheat in windrower/combine and direct combine harvesting systems. Agric. Canada Res. Sta., Swift Current, Sask. S9H 3X2, Canada. Agronomy J., Vol. 77, No. 1, 13-17.

Tahir, A.R.; F.U. HAQ KHAN and K. EJAZ (2003). Techno-Economic Feasibility of Combine Harvester (Class Denominator) – A Case Study. Int. J. Agri. Biol., Vol. 5, No. 1, 1560–8530/2003/05–1–57–60, http:// www. ijab. org.

تحديد متطلبات نظم حصاد القمح

محمد حمزه مخيمر أبو النجا، هانى عبد العزيز الجندى و جابر غمرى على رضوان
معهد بحوث الهندسة الزراعية – مركز البحوث الزراعية

نظراً للأهمية الإستراتيجية والإقتصادية لمحصول القمح خاصة فى الدول النامية فإن النهوض بنظام الحصاد لمحصول القمح بهدف تدنية الفواقد الكلية والتكاليف والطاقة المستهلكة يعد من الأهمية بمكان. لذا يلزم دراسة النظم الشائعة الإستخدام فى عمليات الحصاد للوقوف على أفضل هذه النظم بهدف معظمة إنتاج محصول القمح وتقليل الفاقد. ولتحقيق هذا الهدف إشتملت هذه الدراسة على تقدير الفواقد الكلية والتكاليف والطاقة المستهلكة لـ ٣٤ نظام حصاد وهى النظم الشائعة فى جمهورية مصر العربية. وتضمنت عمليات الضم والتربيط النقل والتجميع والدراس. وقد أجريت التجارب والإختبارات المطلوبة بمحافظة الدقهلية خلال موسمين متتاليين (٢٠٠٧، ٢٠٠٨ م) على صنف القمح سخا ٩. وقد تم تقدير الفوقد الكلية والتكاليف والطاقة المستهلكة خلال كل مرحلة من مراحل الحصاد وأوضحت النتائج أن الظروف المثلى لحصاد محصول القمح مع عمليات {الضم بالمحشة الذاتية بجهاز التربيط + النقل والتجميع بالعربة الكارو + الدراس بالآلة الثابتة} حيث بلغت فواقد المحصول حوالى ٤,٥%، وفواقد التبن حوالى ١٤,٥% كما بلغ مقدار الطاقة المستهلكة ١٠٠٠,٢٤ ميجاجول/فدان ومقدار التكاليف القياسية ١١٩٥,٧٣ جنيهاً/فدان.