Zagazig J. Agric. Res., Vol. 36 No. (4) 2009 853-875

STUDY ON SOME MECHANICAL AND PHYSICAL PARAMETERS AFFECTING THRESHING PROCESS OF WHEAT CROP

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Accepted 30 /7/2009

ABSTRACT: The experimental studies were carried out mainly for threshing wheat crop (Sakha 69 variety) to determine the effect of drum rotating speed, feed rate, and crop moisture content on machine performance, threshing efficiency, total grain losses, consumed energy and total cost requirements. The obtained data revealed that the minimum grain losses and threshing efficiency were 1.83% and 99.87% respectively at drum speed of 26.75 m/s (700 rpm), grain moisture content of 11.7% and feed rate of 1.08 Mg/h. The minimum consumed energy rate was 10.23 kW.h/Mg at drum speed of 17.20 m/s (450 rpm), grain moisture content of 11.7% and feed rate of 1.68 Mg/h. The minimum threshing cost was 37.29 L.E./Mg at drum speed of 26.75 m/s (700 rpm), grain moisture content of 11.7% and feed rate of 1.68 Mg/h.

Key words: Moisture content, drum rotating speed, feed rate, threshing cost, consumed energy rate.

INTRODUCTION

Wheat crop is an important crop in the world, and the most economical crop in the international income. Wheat is considered the primary strategically food crop for human and animals in Egypt. About 1.8 million feddans of wheat crop are cultivated annually. In Egypt, most farmers obliged to harvest wheat crop using hand method and using stationary thresher for threshing due to high cost of combine harvester and high straw remaining in field. Therefore, increasing the wheat yield is important to increasing national income. Also, reducing grain losses during harvesting and threshing operations is very important to increase total grain yield. There are many factors affecting the threshing machines performance such as drum speed, feeding rate and grain moisture content. So, the optimum conditions for operating stationary thresher are necessary to maximize machine efficiency and minimize total grain losses, energy consumed and total cost requirements for threshing operation. Ghaly (1973) found that the un threshed wheat grain losses and the grain loss in tailings decreased with the increase of cylinder speed and decrease of whole diameter. He noticed that the visible and invisible grain damage increased exponentially with the increase of cylinder speed. On the other hand visible damage increased slightly with the decrease of whole diameter. El-Banna (1979) showed that increasing the cylinder speed decreased the un-threshed wheat grain losses exponentially and increased the visible and invisible grain damage. The results indicated that un threshed heads was under 10% and visible grain damage was 11.5% at cylinder speed 1020 rpm. Tandon *et al.* (1988) indicated that the moisture content has a significant effect on threshing efficiency and invisible grain damage. The effect of concave clearance and cylinder peripheral speed, though numerically, was significant at 5% level. Mishra and Desta (1990) reported that the threshing efficiency increases with an increase in cylinder speed for all feed rates and cylinder-concave clearances. The maximum threshing efficiency of 99.9 % was obtained at the lowest feed rate of 6 kg/min, and cylinder speed of 500 rpm (12.6 m/s), minimum threshing efficiency of 98.3% was found at lowest cylinder speed of 300 rpm (7.5 m/s), and feed rate of 10 kg/min. This is because at a higher speed the energy imparted to the ear head and grain increases causing higher threshing efficiency. The reason for lower threshing efficiency at higher feed rate, cylinder-concave clearance and at lower speed is because of the cautioning effect between the cylinder-concave clearance and the low impact force at low cylinder speed. Alaa (1994) found that the relation between consumed power and moisture content for wheat grain was direct relationship, where by increasing the moisture content from 14 % to 18 %. The power increased from 7.552 hp (5.5 kW) to 8.16 hp (6 kW) when feed rates 600 kg/h and cylinder speed of 750 rev/min (25 m/s). El-Behiry *et al.* (1997) found that the optimum conditions for threshing the wheat were. Drum speed ranged from 700 to 800, to increase the machine productivity and avoid high ratio of losses. Percentage of grain moisture content ranged from 10 to 12 %. Lotfy (1998) studied the effect of moisture contents in wheat grain at three levels of (14.8, 12.4 and 11.2 %) and also three levels for straw, (10.5, 9.1 and 7.3 %). They named M1, M2 and M3 respectively. The decreasing the moisture content from M1 to M3 at drum speed of 36.11 m/sec, un threshed grain ratio decreased from 1.3 to 0.64 % and the threshing efficiency increased from 98.7 to 99.36 %. The best results were at M3. The grain damage ratio increased from 1.23 to 1.56 %. El- Sahrigi *et al.* (2000) found that the experimental results showed that performance of AMRI Th2 thresher after modification is better than before modification and gave a threshing capacity of 1542 kg/h, cleaning efficiency of 98.31%,total losses of 1.89% and criterion cost of 17.09 L.E/ton at feed rate of 5400 kg/h. Before modification, it had a threshing capacity of 950kg/h, a cleaning efficiency of 91.7%, total losses of 1.06% and criterion cost of 210 L.E/ton. Mahmoud *et al.* (2007) found that the energy requirements of 18.26 and 18.92 kW.h/ton before and after development was obtained at material feed rate of 1100 kg/h, drum speed of 27 m/s and grain moisture content of 19%.

So, the Objectives of this study are:

- Selecting the proper physical conditions of threshing wheat crop such as, grain moisture content.
- Selecting the proper operating parameters such as drum rotating speed and feed rate.
- Determination physical and operational parameters affecting threshing process in respect to grain damage, grain losses, un threshed losses, threshing efficiency, power and consumed energy rate and total cost for threshing operation.

MATERIALS AND METHODS

Materials

The main experiments were carried out through two successful agricultural seasons of 2007 and 2008 in a private farm at Diarb

Negm, Sharkia governorate for threshing wheat crop to determine the physical and mechanical parameters affecting thrashing process such as grain moisture content, drum speed and feed rates.

The wheat crop

The threshing operation was carried out on wheat crop variety Sakha-69. The following specifications were taken under five groups, each group contains ten wheat plants. Some of physical specifications for wheat variety Sakha-69 are shown in Table (1).

Threshing machine

The specifications of wheat threshing machine are as following:

Made in	Turkish
Prime mover	Belt
Crop feeding	
Method of feeding	Manual
Height of feeding (cm)	165
Threshing drum	
Type of drum	Spike tooth
Diameter, (cm)	73
Length, (cm)	120
No. of fingers	44
No. fingers/row	11
Distance between tow fingers (cm)	11

Table 1. Some of physical specifications for wheat variety Sakha-69

Sample No.	Plant length, (cm)	Weight of straw in sample, (g)	Weight of seed in sample, (g)	Percent of straw, (%)	Percent of seed, (%)	Grain/ Straw ratio, (%)
Group(1)	99	190	225	0.457	0.542	1.186:1
Group(2)	91	187	208	0.473	0.526	1.120:1
Group(3)	93	185	218	0.462	0.537	1.162:1
Group(4)	96	182	223	0.449	0.550	1.225:1
Group(5)	98	185	235	0.440	0.559	1.272:1
Total	477	929	1106	2.278	2.714	5.965:1
Mean	95.4	185.8	221.2	0.455	0.542	1.192:1

Tractor

The specifications of tractor transmitted the power to the threshing machine through pulleys and flat belt are as following:

Model	Universal 650 M
Made in	Romania
Engine cycle	Four cylinder, four strokes
Engine fuel	Diesel engine, hydraulic system
Engine (hp-kW)	77 hp (56.6 kW)
PTO Revolution (rpm)	540 – 1500
Mass (kg)	2700 -3000

Methods

The experimental studies were carried out mainly to determine the effect of drum rotating speed, feed rate, and crop moisture content on machine productivity, threshing efficiency, total grain losses, consumed energy and total cost requirements. The following variables were investigated:

Drum speed

Three rotating speeds were adjusted 17.20, 21.02 and 26.75 m/s (450, 550 and 700 rpm).

Feed rates

Four levels of feed rate 18, 22, 25 and 28 kg/min.

Grain moisture content of the crop

Three levels of grain moisture contents 11.7, 14.2 and 17.6% for grain. The grain moisture content was determined on dry basis using the oven method at 105 C° for 24 hours according to ASAE (2003).

Measurements

Total grain losses

$$\text{Total grain losses} = \frac{W_l}{W_t} \times 100 \quad \dots (3.1)$$

Where:

W_l = Weight of grain losses with the straw, gm.

W_t = Total weight of grain, gm.

Un threshed losses

$$\text{Un threshed losses} = \frac{Un.G}{T.G} \times 100 \quad .(3.2)$$

Where:

Un.G = Weight of un-threshed grain, gm.

T.G = Total weight of grain, gm.

Grain damage

$$\text{Grain damage} = \frac{W_d}{W} \times 100 \quad (3.3)$$

Where:

W_d = Weight of grain damage, gm.

W = Weight of threshed grain in sample (grain out put), gm.

Machine productivity

$$\text{Machine productivity} = \frac{Q}{T} \times 100 \quad (3.4)$$

Where:

Q = Weight of threshed materials, gm.

T = Time of threshed, h.

Threshing efficiency

$$\text{Threshing efficiency} = \frac{W}{W_t} \times 100 \quad ..(3.5)$$

(Desta and Mishra, 1990)

Where:

W = Weight of threshed grain (grain output),gm.

W_t = Total weight of grain,gm.

Power

To estimate the engine power during threshing process, the decrease in fuel level is accurately measured immediately after each treatment. The following formula was used to estimate the corresponding used engine power (*EP*) according to (Hunt, 1983).

$$\left[EP = \left[\begin{array}{l} f.c\left(\frac{1}{3600}\right) P.E \times L.C.V \times 427 \times \eta_{thb} \\ \times \eta_m \times \frac{1}{75} \times \frac{1}{7} \times \frac{1}{1.36} \end{array} \right], kW \right] .(3.6)$$

Where:

f.c.= Fuel consumption, L/h.

P.E = Density of fuel, kg/L (for diesel =0.85)

L.V.C = Lower calorific value of foul (kcal/kg).

(average L.C.V. of diesel is 10000 kcal/kg)

η_{thb} = Thermal efficiency of the engine.

(considered to be about 35% for diesel engine)

427=Thermo-mechanical equivalent, (kg.m/kcal).

η_m = Mechanical efficiency of the engine.

(considered to be about 80% for diesel engine)

Consumed energy rate

$$\text{Consumed energy rate} = \frac{\text{Engine power kW}}{\text{Machine productivity ton/h}}, \text{kW.h/ton} \quad ..(3.7)$$

Threshing cost

The total cost of threshing operation was estimated using the following equation, (Awady *et al.* 1982):

Threshing cost, (L.E/ton) = Operating cost + Grain losses cost..................(3.8)

Operating cost was determined using the following equation:

$$\text{Operating cost} = \frac{\text{Machine cost, L.E./h}}{\text{Machine productivity, Mg/h}}, \text{L.E./Mg} \quad (3.9)$$

Machine cost could be determined using the following equation (Awady 1978):

Machine cost

$$C = \frac{P}{h}\left(\frac{1}{a} + \frac{i}{2} + t + r\right) + (0.9 w.s.f) + \frac{m}{144}, \quad \text{L.E/h} \quad \text{..........(3.10)}$$

Where:

C = Hourly cost, L.E/h.

P = Price of machine, L.E.

h = Yearly working hours, h/year.

a = Life expectancy of the machine, h.

i = Interest rate/year.

F = Fuel price, L.E/*l*.

t = Taxes, over heads ratio.

r = Repairs and maintenance ratio.

m = The monthly average wage, L.E

0.9 = Factor accounting for lubrications.

W = Engine power, hp.

S = Specific fuel consumption, *l*/hp.h.

144 = Reasonable estimation of monthly working hours.

RESULTS AND DISCUSSION

Total Grain Losses

The total grain losses affected with many parameters such as material feed rate, threshing drum speed, grain moisture content,..etc.

The total grain losses are the sum of chaff losses, un-threshed and broken grains during the threshing operation.

Effect of material feed rate on total grain losses

Concerning the effect of material feed rate on the percentage of total grain losses, results obtained in Fig. 1 shows that increasing feed rate from 1.08 to 1.68 Mg/h under constants drum speed 17.20 m/s (450 rpm) and various grain moisture contents of 11.7, 14.2 and 17.6 % increased the percentage of total grain losses by 26.57, 32.04 and 33.33 % respectively. Also results obtained

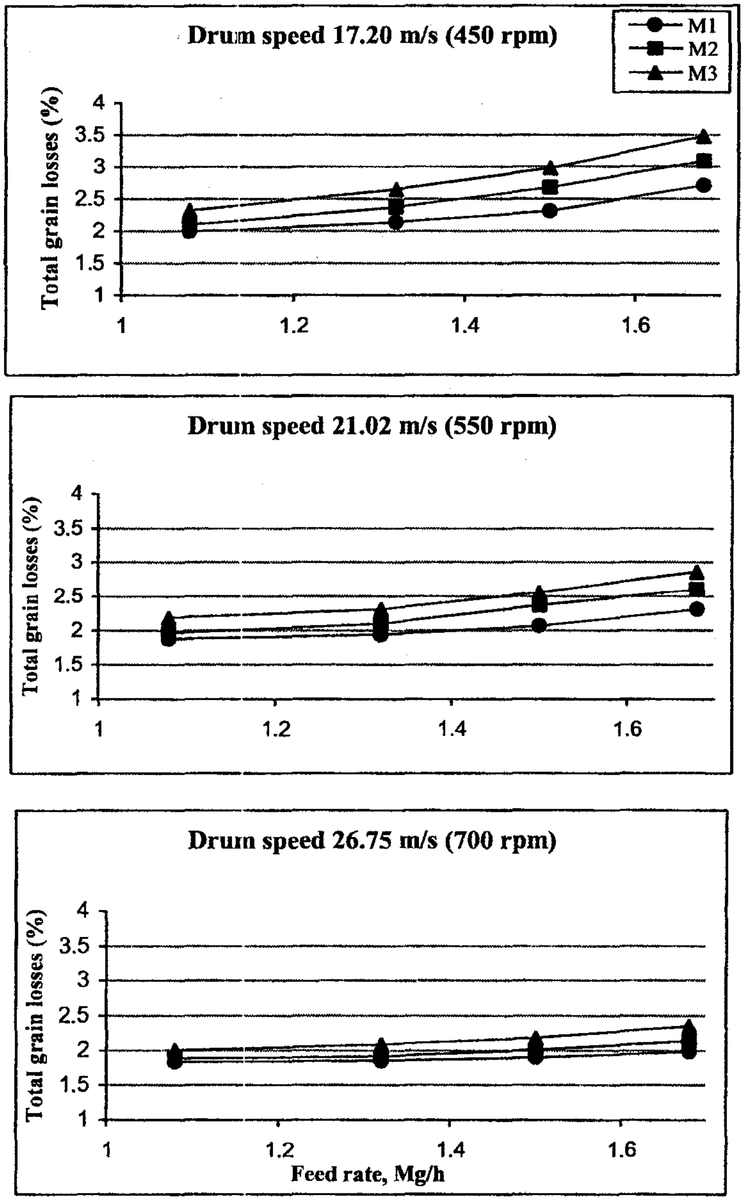

Fig. 1. Effect of feed rate on total losses % under different grain moisture contents and different drum speeds

in Fig. 1 shows that increasing feed rate from 1.08 to 1.68 Mg/h under constants drum speed 21.02 m/s (550 rpm) and various grain moisture contents of 11.7, 14.2 and 17.6 % increased the percentage of total grain losses by 18.61, 24.62 and 23.43 %, respectively.

Also results obtained in Fig. 1 shows that increasing feed rate from 1.08 to 1.68 Mg/h under constant drum speed 26.75 m/s (700 rpm) and various grain moisture contents of 11.7, 14.2 and 17.6 % increased the percentage of total grain losses by 7.57, 12.15 and 14.89 %, respectively. The increasing in the percentage of total grain losses by increasing material feed rate are attributed to the excessive wheat plants in the threshing chamber. Consequently, wheat plants leave device with out complete threshing that tends increase total grain losses.

Effect of grain moisture content on total grain losses

As to the effect of grain moisture content on the percentage of total grain losses, results obtained in Fig. 2 shows that increasing grains moisture contents from 11.7 to 17.6 % under constant material feed rate of 1.08 Mg/h and various drum speed of 17.20, 21.02 and 26.75 m/s (450, 550 and 700 rpm) increasing the percentage of total grain losses by 14.22, 14.15 and 8.50 %, respectively. Also results obtained in Fig. 2 shows that increasing grains moisture contents from 11.7 to 17.6 % under constant material feed rate of 1.32 Mg/h and various drum speed of 17.20, 21.02 and 26.75 m/s (450, 550 and 700 rpm) increasing the percentage of total grain losses by 19.24, 16.01 and 11.48 %, respectively.

Also results obtained in Fig. 2 shows that increasing grains moisture content from 11.7 to 17.6 % under constant material feed rate of 1.50 Mg/h and various drum speed of 17.20, 21.02 and 26.75 m/s (450, 550 and 700 rpm) increasing the percentage of total grain losses by 22.48, 18.14 and 12.84 %, respectively. Also results obtained in Fig. 2 shows that increasing grains moisture contents from 11.7 to 17.6 % under constant material feed rate of 1.68 Mg/h and various drum speed of 17.20, 21.02 and 26.75 m/s (450, 550 and 700 rpm) increasing the percentage of total grain losses by 22.12, 19.23 and 15.7 %, respectively. The increasing in the percentage of total grain losses by increasing grain moisture contents due to the elastic conditions of high moisture content of grains resulting in a little impacting force on the wheat materials.

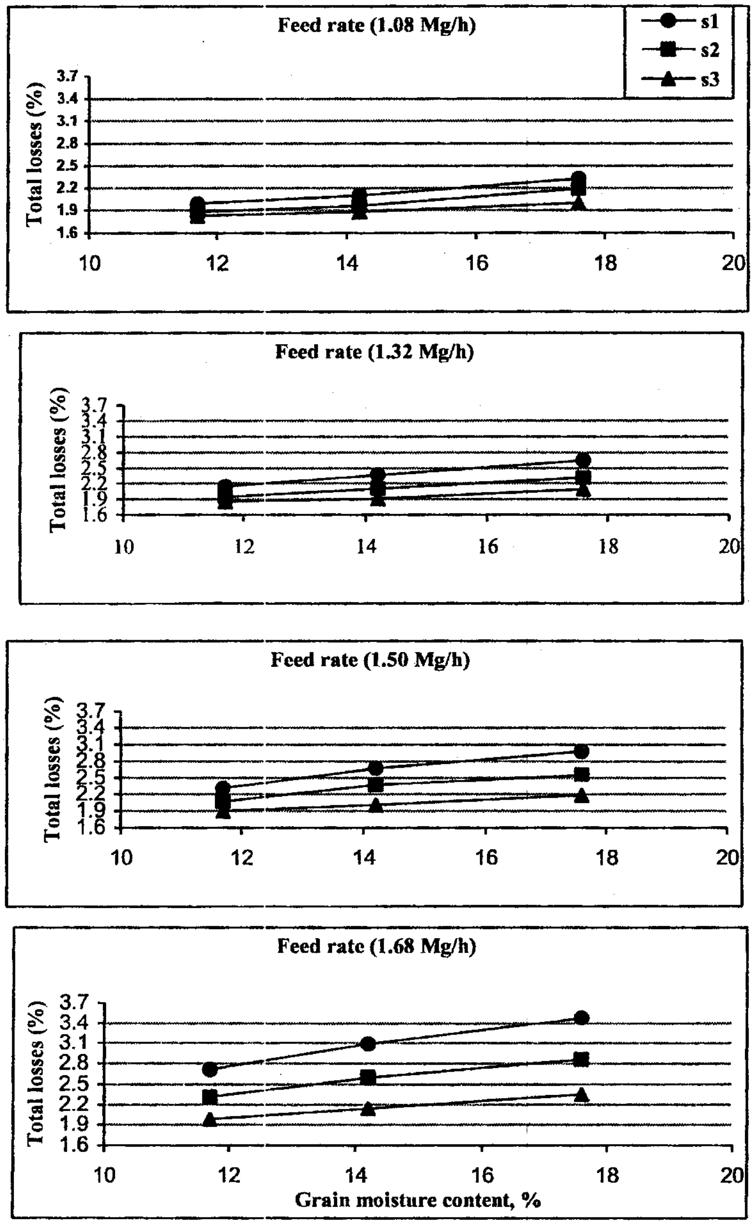

Fig. 2. Effect of grain moisture content on total losses % under different drum speeds and feed rates

Threshing efficiencies

The threshing efficiency is a function to the un-threshed grain losses. It decreased as increasing both material feed rate and grain moisture content and decreased drum speed.

Effect of material feed rate on threshing efficiencies

Concerning the effect of material feed rate on the percentage of threshing efficiencies, results obtained in Fig. 3 shows that increasing feed rate from 1.08 to 1.68 Mg/h under constant drum speed 17.20 m/s (450 rpm) and various grain moisture contents of 11.7, 14.2 and 17.6 % decreased the percentage of threshing efficiencies by 1.14, 1.26 and 1.32 %, respectively. Also results obtained in Fig. 3 shows that increasing feed rate from 1.08 to 1.68 Mg/h under constant drum speed 21.02 m/s (550 rpm) and various grain moisture contents of 11.7, 14.2 and 17.6 % decreased the percentage of threshing efficiencies by 0.80, 0.88 and 0.96 %, respectively.

Also results obtained in Fig. 3 shows that increasing feed rate from 1.08 to 1.68 Mg/h under constant drum speed 26.75 m/s (700 rpm) and various grain moisture contents of 11.7, 14.2 and 17.6 % increased the percentage of threshing efficiencies by 0.53, 0.58 and 0.62 %, respectively. The decreasing in the percentage of threshing efficiencies by increasing material feed rate are attributed to the excessive wheat plants in the threshing chamber. Consequently, wheat plants leave device with out complete threshing that tends decrease threshing efficiencies.

Effect of grain moisture content on threshing efficiencies

As to the effect of grain moisture content on the percentage of threshing efficiencies, results obtained in Fig. 4 shows that increasing grains moisture contents from 11.7 to 17.6 % under constant material feed rate of 1.08 Mg/h and various drum speed of 17.20, 21.02 and 26.75 m/s (450, 550 and 700 rpm) decreasing the percentage of threshing efficiencies by 0.33, 0.27 and 0.18 %, respectively. Also results obtained in Fig. 4 shows that increasing grains moisture contents

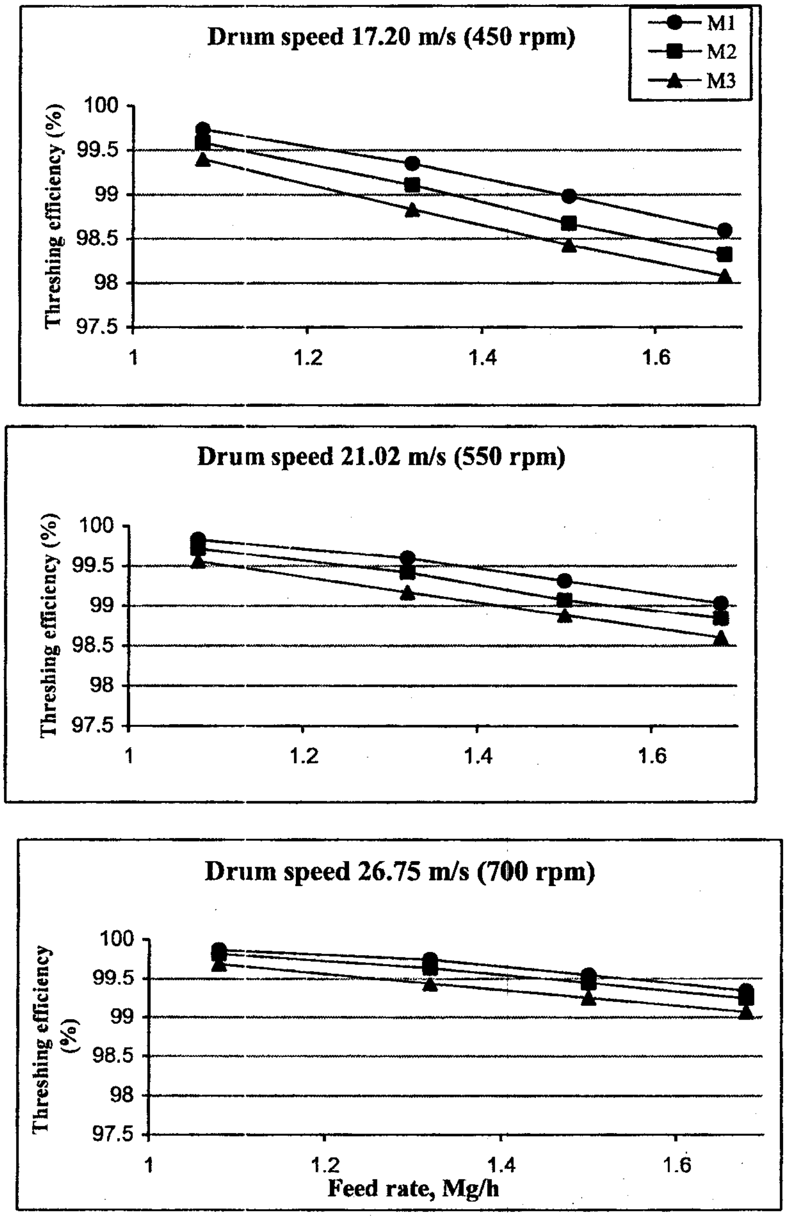

Fig. 3. Effect of feed rate on threshing efficiency different grain moisture contents at different drum speeds

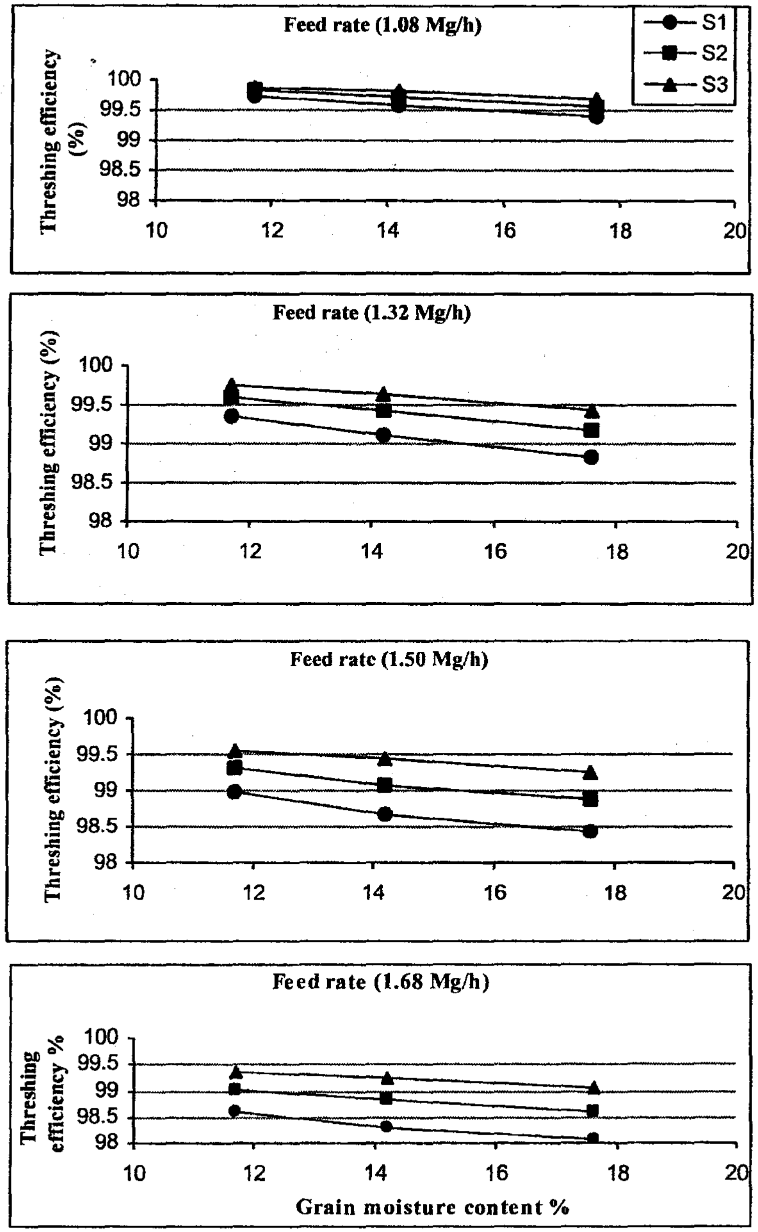

Fig. 4. Effect of grain moisture content on threshing efficiency (%) under different drum speeds and feed rates

from 11.7 to 17.6 % under constant material feed rate of 1.32 Mg/h and various drum speed of 17.20, 21.02 and 26.75 m/s (450, 550 and 700 rpm) decreasing the percentage of threshing efficiencies by 0.52, 0.43 and 0.32 %, respectively. Also results obtained in Fig. 4 shows that increasing grains moisture contents from 11.7 to 17.6 % under constant material feed rate of 1.50 Mg/h and various drum speed of 17.20, 21.02 and 26.75 m/s (450, 550 and 700 rpm) decreasing the percentage of threshing efficiencies by 0.55, 0.43 and 0.30 %, respectively.

Also results obtained in Fig. 4 shows that increasing grains moisture content from 11.7 to 17.6 % under constant material feed rate of 1.68 Mg/h and various drum speed of 17.20, 21.02 and 26.75 m/s (450, 550 and 700 rpm) decreasing the percentage of threshing efficiencies by 0.52, 0.43 and 0.27 %, respectively. The decreasing in the percentage of threshing efficiencies by increasing material feed rate are attributed to the excessive wheat plants in the threshing chamber Consequently, wheat plants leave device with out complete threshing that tends decrease threshing efficiencies.

Consumed energy rate

The consumed energy rate are a measure for all parameters affecting the threshing operation. Feed rate, threshing drum speed, and grain moisture content.

Effect of material feed rate on Consumed energy rate

Results obtained in Fig. 5 shows that increasing material feed rate from 1.08 to 1.68 Mg/h under constant drum speed 17.20 m/s (450 rpm) and various grain moisture contents of 11.7, 14.2 and 17.6 % decreased the percentage of consumed energy rate by 33.05, 31.24 and 28.76 %, respectively. Also results obtained in Fig. 5 shows that increasing feed rate from 1.08 to 1.68 Mg/h under constant drum speed 21.02 m/s (550 rpm) and various grain moisture contents of 11.7, 14.2 and 17.6 % decreased the percentage of consumed energy rate by 31.24, 31.34 and 28.92 %, respectively. Also results obtained

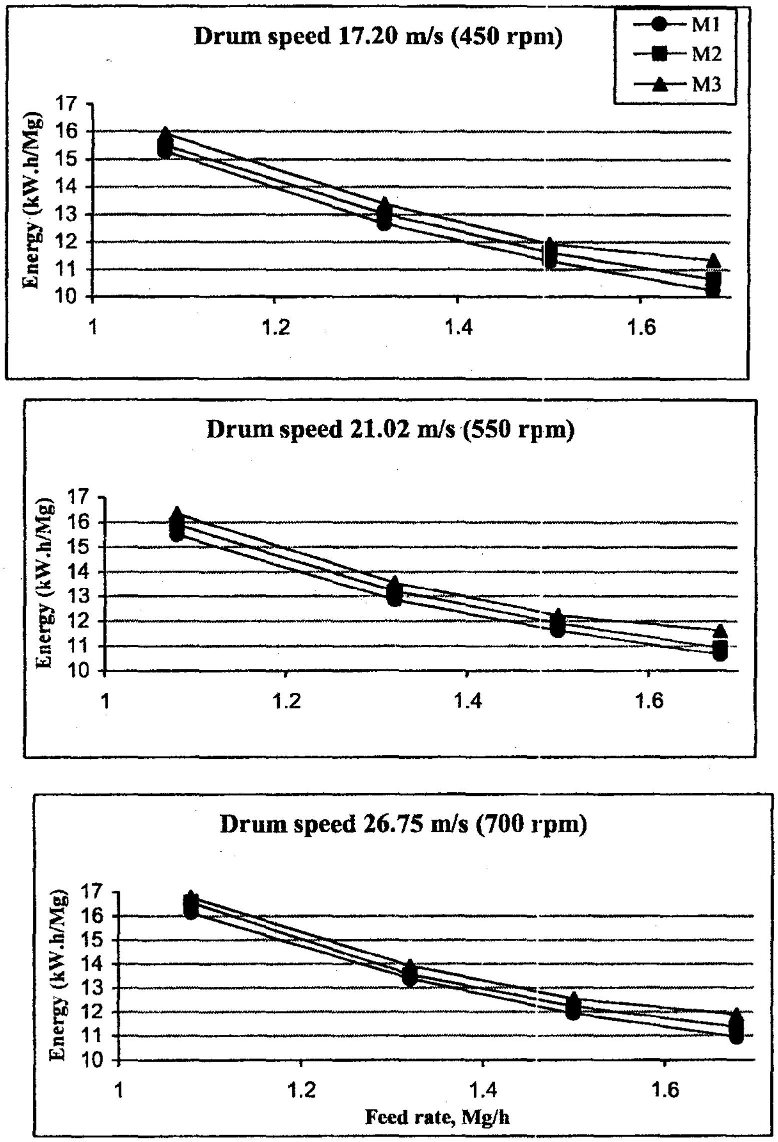

Fig. 5. Effect of feed rate on consumed energy rate under different grain moisture contents at different drum speeds

in Fig. 5 shows that increasing feed rate from 1.08 to 1.68 Mg/h under constant drum speed 26.75 m/s (700 rpm) and various grain moisture contents of 11.7, 14.2 and 17.6 % decreased the percentage of consumed energy rate by 32.28, 31.56 and 29.14 %, respectively.

The decreasing in the percentage of energy requirement by increasing material feed rate are attributed to the excessive wheat material in the threshing chamber, that increasing the load on the threshing drum caused more fuel consumed.

Effect of grain moisture content on consumed energy rate

Data in Fig. 6 shows that increasing grains moisture contents from 11.7 to 17.6 % under constant material feed rate of 1.08 Mg/h and various drum speed of 17.20, 21.02 and 26.75 m/s (450, 550 and 700 rpm) increasing the percentage of consumed energy rate by 4.02, 5.25 and 3.81 %, respectively. Also results obtained in Fig. 6 shows that increasing grains moisture contents from 11.7 to 17.6 % under constant material feed rate of 1.32 Mg/h and various drum speed of 17.20, 21.02 and 26.75 m/s (450, 550 and 700 rpm) increasing the percentage of consumed energy rate by 5.30, 3.69 and 3.81%, respectively.

Also results obtained in Fig. 6 shows that increasing grains moisture contents from 11.7 to 17.6 % under constant material feed rate of 1.50 Mg/h and various drum speed of 17.20, 21.02 and 26.75 m/s (450, 550 and 700 rpm) increasing the percentage of consumed energy rate by 5.27, 5.06 and 4.94 %, respectively. Results obtained in Fig. 6 shows that increasing grains moisture contents from 11.7 to 17.6 % under constant material feed rate of 1.68 Mg/h and various drum speed of 17.20, 21.02 and 26.75 m/s (450, 550 and 700 rpm) increasing percentage of consumed energy rate by 9.78, 8.34 and 8.07 %, respectively. The increasing in the percentage of consumed energy rate by increasing material feed rate are attributed to the excessive wheat material in the threshing chamber, that increasing the load on the threshing drum caused more fuel consumed.

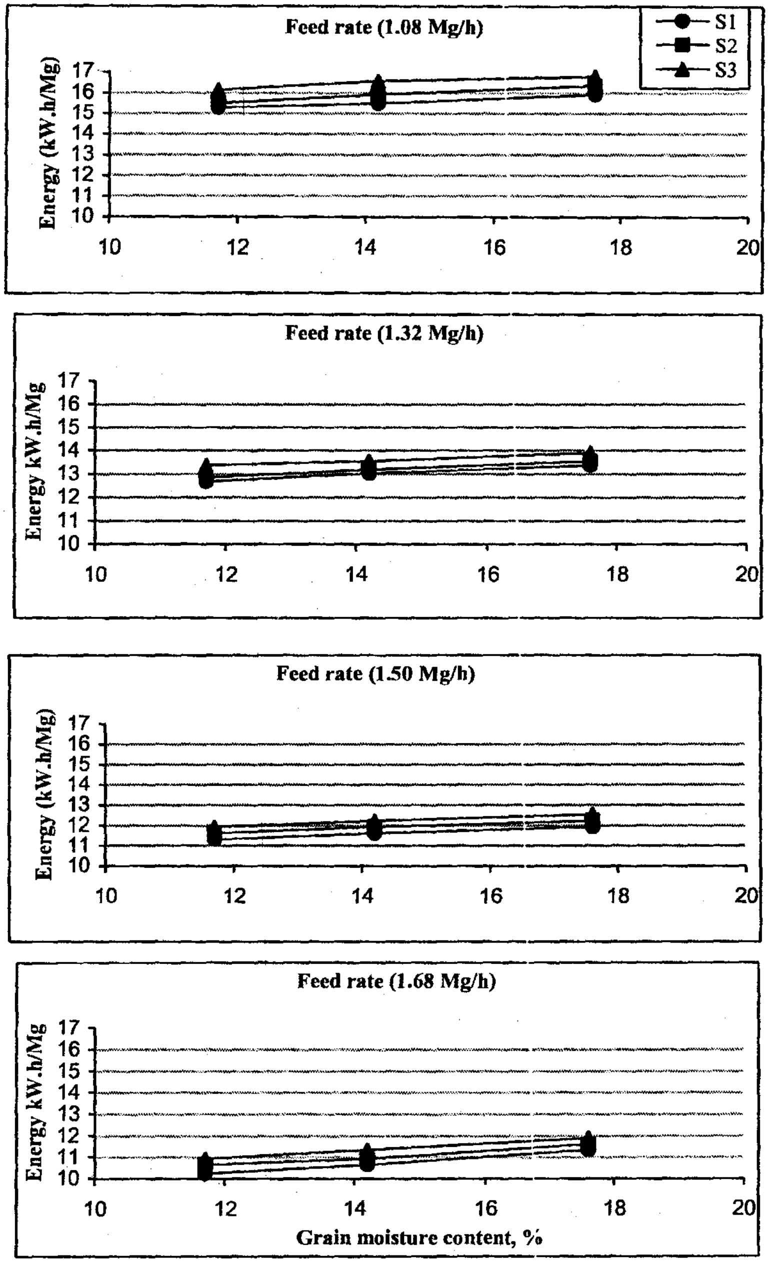

Fig. 6. Effect of grain moisture content on consumed energy rate under different drum speeds and feed rates

Threshing Cost

The threshing cost is affected with by many parameters such as material feed rate, threshing drum speed, grain moisture content, operating cost and losses cost.

Effect of material feed rate on threshing cost

Concerning the effect of material feed rate on the percentage of threshing cost, results obtained in Fig. 7 shows that increasing feed rate from 1.08 to 1.68 Mg/h under constant drum speed 17.20 m/s (450 rpm) and various grain moisture contents of 11.7, 14.2 and 17.6 % decreased the percentage of threshing cost by 9.82, 4.82 and 1.73 %, respectively. Also results obtained in Fig. 7 shows that increasing feed rate from 1.08 to 1.68 Mg/h under constant drum speed 21.02 m/s (550 rpm) and various grain moisture contents of 11.7, 14.2 and 17.6 % decreased the percentage of threshing cost by 15.34, 11.29 and 10.29 %, respectively.

Results obtained in Fig. 7 shows that increasing feed rate from 1.08 to 1.68 Mg/h under constant drum speed 26.75 m/s (700 rpm) and various grain moisture contents of 11.7, 14.2 and 17.6 % increased the percentage of threshing cost by 20.72, 18.47 and 16.46 %, respectively. The decreasing in the percentage of threshing cost by increasing material feed rate are attributed to the excessive wheat plants in the threshing chamber. Consequently, wheat plants leave device with out complete threshing that tends decrease cleaning efficiencies.

Effect of grain moisture content on threshing cost

As to the effect of grain moisture content on the percentage of threshing cost, results obtained in Fig. 8 shows that increasing grains moisture contents from 11.7 to 17.6 % under constant material feed rate of 1.08 Mg/h and various drum speed of 17.20, 21.02 and 26.75 m/s (450, 550 and 700 rpm) increasing the percentage of threshing cost by 5.61, 5.39 and 3.06 %, respectively.

Also results obtained in Fig. 8 shows that increasing grains moisture contents from 11.7 to 17.6 % under constant material feed rate of 1.32 Mg/h and various drum speed of 17.20, 21.02 and 26.75 m/s (450, 550 and 700 rpm) decreasing the percentage of threshing cost by 9.18, 7.09 and 4.81 %, respectively.

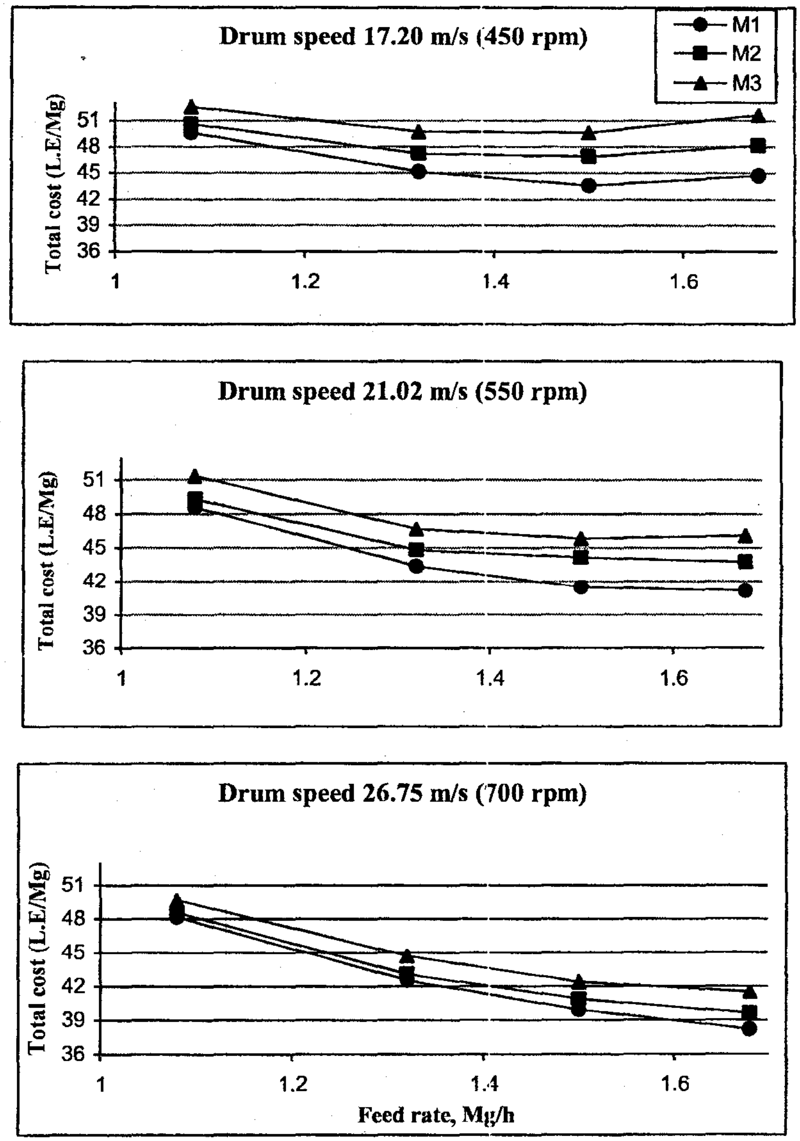

Fig. 7. Effect of feed rate on total cost different grain moisture contents at different drum speeds

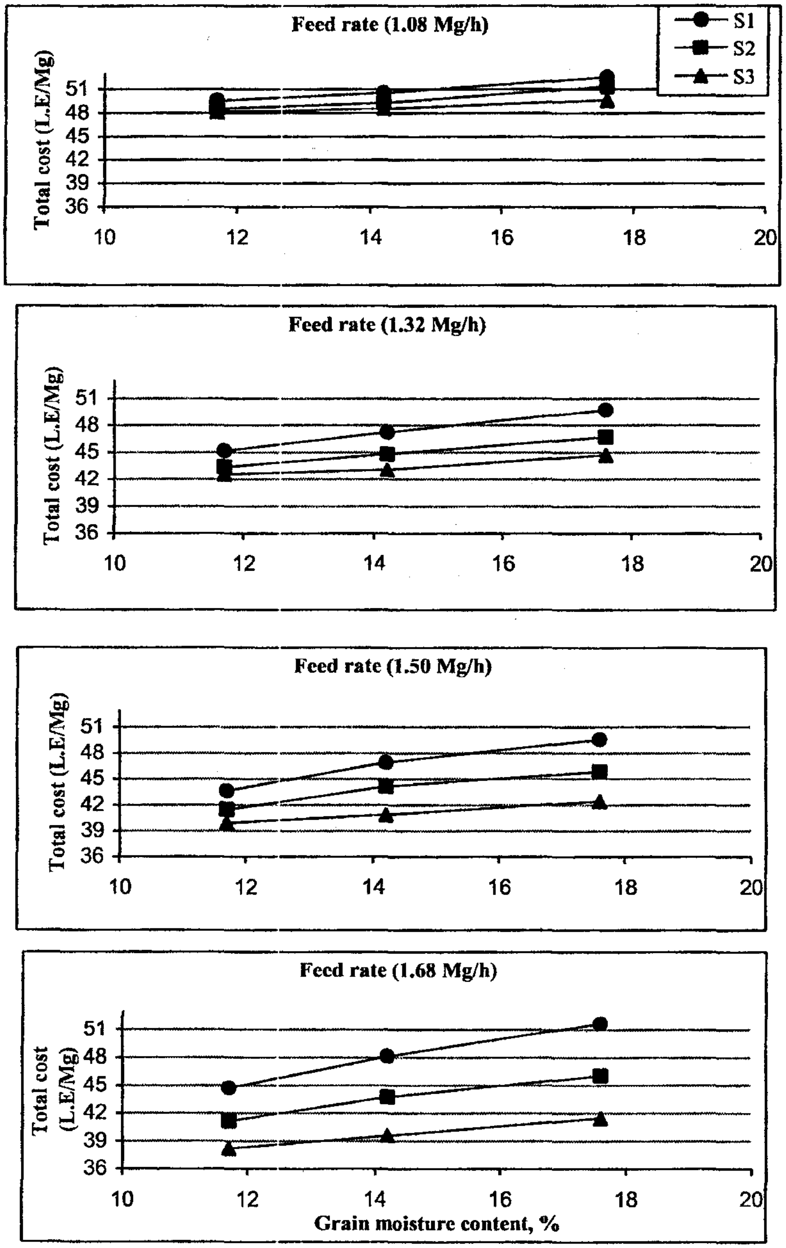

Fig. 8. Effect of grain moisture content on total cost (L.E/Mg) under different drum speeds and feed rates

Also results obtained in Fig. 8 shows that, increasing grains moisture contents from 11.7 to 17.6 % under constant material feed rate of 1.50 Mg/h and various drum speed of 17.20, 21.02 and 26.75 m/s (450, 550 and 700 rpm) increasing the percentage of threshing cost by 12.11, 9.57 and 5.89 %, respectively. Also results obtained in Fig. 8 shows that increasing grains moisture contents from 11.7 to 17.6 % under constant material feed rate of 1.68 Mg/h and various drum speed of 17.20, 21.02 and 26.75 m/s (450, 550 and 700 rpm) increasing the percentage of threshing cost by 13.38, 10.72 and 8.00 %, respectively. The increasing in the percentage of threshing cost by increasing grain moisture contents due to the elastic conditions of high moisture content of grains resulting in a little impacting force on the wheat materials.

Conclusion

Data from this study led to the following conclusions:

- The obtained data revealed that the minimum grain losses and threshing efficiency were1.83% and 99.87%, respectively at drum speed of 26.75 m/s (700 rpm), grain moisture content of 11.7% and feed rate of 1.08 Mg/h.
- The minimum consumed energy rate was 10.23 kW.h/Mg at drum speed of 17.20 m/s (450 rpm), grain moisture content of 11.7% and feed rate of 1.68 Mg/h.
- The minimum threshing cost was 37.29 L.E./Mg at drum speed of 26.75 m/s (700 rpm), grain moisture content of 11.7% and feed rate of 1.68 Mg/h.

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دراسة بعض العوامل الميكانيكية و الطبيعية المؤثرة على عملية دراس محصول القمح

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أجري هذا البحث في محافظة الشرقية بديرب نجم - الموسم الزراعي ٢٠٠٧- ٢٠٠٨م بغرض دراسة بعض العوامل الميكانيكية والطبيعية المؤثرة على عملية دراس محصول القمح.

الهدف من الدراسة:

١- لختيار أفضل عوامل التشغيل مثل السرعة الدورانية للدرفيل ومعدل التلقيم ورطوبة النبات لألة الدراس.

٢- تحديد العوامل الطبيعية والميكانيكية المؤثرة على عمليه الدراس مع الأخذ في الاعتبار نسبة الفقد ونسبة الكسر والحبوب الغير مدروسة (الفواقد الكلية) وحساب استهلاك الوقود والقدرة والطاقة المستهلكة وكفاءة الدراس وحساب التكاليف الكلية اللازمة لعملية الدراس.

وقد تم تقييم أداء الآلة أخذاً في الاعتبار كلاً من المؤشرات الآتية:

١- الفقد الكلي في الحبوب و كفاءة الدراس.

٢- استهلاك الوقود ومتطلبات القدرة والطاقة اللازمة لعملية الدراس.

٣- التكاليف الكلية لعملية الدراس والتذرية.

وقد تم تسجيل النتائج للمؤشرات السابقة تحت عوامل تشغيل مختلفة هي: ثلاث سرعات دورانية للدرفيل هي١٧,٢٠، ٢١,٠٢ و٢٦,٧٥ م/ث (٤٥٠، ٥٥٠ و٧٠٠ لفة/دقيقة) وثلاث نسب لرطوبة الحبوب هي (١١,٧ ، ١٤,٢ و١٧,٦ %) وأربع معدلات تلقيم هي (١,٠٨ ، ١,٣٢ ، ١,٥٠ و ١,٦٨ ميجا جرام/ساعة).

وقد أظهرت النتائج المتحصل عليها ما يلي ويوص باستخدام الألة تحت هذه الظروف:

١- أن أقل فاقد في المحصول وأقصى كفاءة دراس كانت ١,٨٣% و٩٩,٨٧% ، على الترتيب عند سرعة دورانية لدرفيل الدراس ٢٦,٧٥ م/ث (٧٠٠ لفة/دقيقة) ونسبة رطوبة للحبوب ١١,٧% ومعدل تلقيم ١,٠٨ ميجا جرام/ساعة.

٢- أن أقل قيمة للطاقة المستهلكة ١٠,٢٣ كيلوات.س/ميجاجرام كانت عند سرعة دورانية لدرفيل الدراس ١٧,٢٠ م/ث (٤٥٠ لفة/الدقيقة) ونسبة رطوبة للحبوب ١١,٧ % ومعدل تلقيم ١,٦٨ ميجا جرام/ساعة.

٣- أن أقل قيمة لتكاليف عملية الدراس كانت ٣٧,٢٩ جنيه/ميجا جرام عند سرعة دورانية لدرفيل الدراس ٢٦,٧٥ م/ث (٧٠٠ لفة/الدقيقة) ونسبة رطوبة الحبوب ١١,٧ % ومعدل التلقيم ١,٦٨ ميجا جرام/ساعة.