PERFORMANCE EVALUATION OF SOME MACHINES USED FOR HARVESTING AND THRESHING LENTIL CROP UNDER EGYPTIAN CONDITIONS

By

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ABSTRACT

Performances of some harvesting machines (Self propelled mower- Rear mounted mower- Reaper) were evaluated during harvesting operation of lentil crop in terms of harvesting losses, fuel consumption, energy requirements and operation costs as a function of changing in forward speeds (1.9 - 3.0 – 3.9- 5.2) km/h and seed moisture contents (10.05 – 14.52 – 27.11) %. Also, performance of threshing machine was evaluated in terms of unthreshed seeds, mechanical seed damage, total seed losses, fuel consumption, specific energy and operation costs as a function of changing in drum speeds (11.47 – 15.29 – 19.12 – 22.94 m/s) with previous seed moisture contents.

The obtained results revealed the following points:

1- Mechanical harvesting by reaper always gave the lowest values of the seed losses followed by self- propelled mower and rear-mounted mower for harvesting lentil crop.

2- Optimum forward speed of harvesting machines ranged from 3.0 to 3.9 km/h, with seed moisture content of 14.52 %. These conditions are considered the proper for harvesting lentil crop.

3- Optimum drum speed of threshing machine ranged from 15.29 to 19.12 m/s (400 – 500 r.p.m.) with seed moisture content of 10.05 %. These conditions are considered the proper for threshing lentil crop.

Keywords: - lentil; harvesting machines; threshing machines; drum speeds; threshing losses.

1- INTRODUCTION

Lentil (Lens Esulenta) is one of the most important food crops in Egypt. It has the second rank in importance after Faba

Been (Vicia Faba L.). It is well known that protein content in lentil is nearly three times higher than that of the cereals. Also, Lentil crop plays an important role in an improvement of soil properties, whereas lentil roots fix the nitrogen in the soil to rich the next crop. Moreover, the plant residues may be used as fodder for animal. In Egypt the total cultivated area of lentil is about 25000 fed. (10416.7 ha) producing about 14000 megagrams whereas the major planting area is in Upper Egypt (Anon, 2002).

In Egypt lentil crop is still harvested and threshed by using conventional manual method which is considered tedious work and consuming more labor and time with high losses and costs.

Mehmet and Zeren (1987) compared among conventional, mechanical harvesting and threshing methods of lentil crop. The results showed that conventional harvesting and threshing methods were found to have low field efficiency and high cost. The aspirated lentil harvester could be used on small and medium-sized farms. They also added that for successful lentil harvesting the surface of the field should be as level as possible. The harvesting machine should have a high efficiency and should perform at a low cutting height.

Abo El- Khair (1991) reported that the unthreshed seed losses of soybean decreased with an increase in both cylinder speed and seed moisture content. Mahrous (1995) stated that improving the rear-mounted mowers widely used in Egyptian agricultural. A conveying belt for improving the performance was designed and tested comparing with the rear-mounted mower with out modification under actual field conditions. He showed that the average field capacity was about 1.025 fed. / h. for rear mounted mower without modification while it increased to 1.18 fed./h. for the same mower after modification.

Kepner et al. (1982) showed that the typical operating speed of harvesting implements ranged from 5.6 to 8.9 km/h for self – propelled mower. Helmy et al. (1995) noticed that increasing combine harvesting forward speed and grain moisture content tends to increase the total grain losses and effective field capacity. Singh and Singh (1981) studied the effect of moisture content and threshing speed on threshing performance of two soybean varieties. They showed that unthreshed grain increased by increasing moisture content and decreased by increasing drum speed. However, grain damage decreased by increasing moisture content and increased by increasing drum speed. Awady et al. (1982) stated that the high percentage of damaged seed resulted from such factors as high moisture content, high threshing cylinder speeds and little clearance. Abdel-Mageed et al. (1994) evaluated the performance of the IRRI-PAK locally designed threshing machine in threshing and separation sunflower seeds. They showed that the optimum threshing drum speed and concave clearance were about 350 r.p.m. and 45 mm, respectively, at moisture content of 14 %. Under the previous conditions, the total loss was 5.8 % and seed damage was 3.68 %.

The present work aims to measure the total harvest losses of lentil crop and select the proper conditions for harvesting and threshing lentil crop under local conditions.

2- MATERIALS AND METHODS

The main experiments were carried out at the experimental Farm of Sakha Agric. Res. Station, Kafer El – Shiekh Governorate during 2003-2004 season to evaluate the performance of different harvesting and threshing machines of lentil crop (Giza 370) variety under Egyptian conditions. Lentil was planted mechanically by using seed drill, Sulky type.

Mechanical harvesting and threshing were carried out by using the following machines:

2-1- Harvesting Machines:-

2-1-1- Self – propelled mower:

A self – propelled single knife mower, model Ferrari – 703 made in Italy. It has Lamardini diesel engine, (9.6 kW, air cooled, one cylinder) with 140 cm cutting width was used to cut lentil crop.

2-1-2- Rear –mounted mower:-

Amounted double knife mower (Busatis 1102, German manufactured) with 150 cutting width was used to cut lentil crop.

2-1-3- Reaper:-

The 1.6 m wide reaper was driven by using a 44.16 kW tractor to cut lentil crop.

2-2- Threshing Machine:-

The threshing operation of lentil crop was carried out by using threshing machine (Turkish type). The threshing drum (120 cm length and 73 cm diameter), No. of fingers 40 and the concave clearance 30 mm.
The harvesting and threshing machines were operated by the P.T.O. of a 47.8 kW, Nasr tractor.

2-3-Field tests:-

The field tests were carried through two steps as follows:

The first step: was harvesting lentil crop by the different harvesting machines (self - propelled mower, rear - mounted mower and reaper) which were tested at four different levels of forward speeds of about 1.9, 3.0, 3.9 and 5.2 km /h and three different levels of lentil seed moisture contents of 10.05, 14.52 and 27.11 % (db).

The second step: was to thresh lentil crop by using the threshing machine that was tested at four drum speeds of 11.47, 15.29,19.12 and 22.94 m/s (300, 400, 500 and 600 r.p.m.) at the same above mentioned lentil seeds moisture contents.

2-4-Instruments and Measuring:-

A stopwatch and measuring tape were used to measure the distance of travel and elapsed time. An oven drying method was used to determine seed moisture content. A tachometer that engaged to the drum pulley was used to measure the threshing drum speed of the threshing machine. The performances of harvesting and threshing machines were evaluated according to the following indicators:-

2-4-1- Harvesting losses:-

Harvesting losses percentage was determined according to the following equation:

$$\text{Harvesting losses} = \frac{H}{M_T} \times 100, \% \quad \ldots\ldots 1$$

Where:

H =self-propelled mower, rear mounted mower and reaper losses mass in, Mg/m^2 and

M_T =total mass of seed in, Mg/m^2.

2-4-2- Threshing losses:-

Unthreshed seeds and seed damage percentages were calculated by using the following equations:

$$\text{Unthreshed seeds} = \frac{M_1}{M_T} \times 100 \text{ , \%} \quad \ldots\ldots\ldots\ldots\ldots\ldots 2$$

Where:

M_1 = mass of unthreshed seeds, Mg/m^2 and
M_T =total mass of seeds, Mg/m^2

$$\text{Mechanical seed damage} = \frac{M_2}{M_T} \times 100 \text{ , \%} \ldots\ldots\ldots\ldots 3$$

Where:

M_2 = mass of damaged seeds, Mg/m^2

2-4-3- Total seed losses:

Total seed losses percentage is summation of both unthreshed seed percentage and mechanical seed damage percentage.

2-4-4- Machine productivity (M_p):-

Machine productivity (Mg/h) was calculated by using the following equation:

$$M_P = \frac{M_T}{T} \times 100 \qquad \text{, Mg/h} \quad \ldots\ldots\ldots\ldots\ldots\ldots 4$$

Where:

T = the time consumed during threshing operation, h.

2-4-5- Power consumption (E.P):

Power consumption, (kW) was approximated by measuring fuel consumption for each treatment by using the following standard equation:

$$E.P = \frac{F.C.}{60 \times 60} \times \rho_f \times L.C.V. \times 427 \times \tau_{th} \times \tau_m \times \frac{1}{75} \times \frac{1}{1.36}, \ldots\ldots\ldots 5$$

Where:

F.C.	=	fuel consumption, *l*/h;
ρ_f	=	density of the fuel (0.85 kg/*l* for diesel fuel),
L.C.V.	=	lower calorific value of fuel (10^4 kcal/kg),
427	=	thermo-mechanical equivalent, kg.m/kCal;
τ_{th}	=	thermal efficiency of engine (40% for diesel engine) and

τ_m = mechanical efficiency of engine (80% for diesel engine).

2-4-6- Specific energy requirements:-

Specific energy for harvesting operation was calculated by using the following equation:

$$\text{Specific energy} = \frac{\text{Engine power, kW}}{\text{Effective field capacity, Fed./h}} \text{ kW.h/Fed} \ldots\ldots\ldots\ldots 6$$

While, specific energy requirements for threshing operation was calculated by using the following equation:

$$\text{Threshing specific energy} = \frac{EP}{M_p}, \text{ kW.h/Mg} \ldots\ldots\ldots\ldots 7$$

2-4-7- Operating cost analysis:-

Cost estimation of machines used in the present study was performed considering the conventional method of estimating both fixed and variable costs (Hunt, 1983).

Calculation of fixed costs:

1- Depreciation (D) and interest (I) costs have been calculated by using the following equations:

$$D = (L\text{-}n/YD) \times (p\text{-}s) \ldots\ldots\ldots\ldots 8$$

$$I = \frac{p+s}{2} xr \ldots\ldots\ldots\ldots 9$$

Where:

L= machine life in years,

n= number representing age of the machine from a beginning year,

YD=sum of the year digits,

P=purchase price, LE;

S=salvage price, % of p and

r=interest rate = 12 %

2- Taxes, insurance and housing were considered to be 2% of purchase price.

Calculation of variable costs:

1- Fuel cost calculated by multiply mean fuel consumption rate *l*/fed fuel price LE/*l*.

2- Grease and lubricant consumption per fed was calculated as 15% of the fuel cost per Fed., LE/fed.

3- Repair and maintenance was calculated as a percentage of 80 to 100% of depreciation. The percentage of 90 % was used in the present study.

4- The cost of labors was calculated according to the frequent wage rate for local labors which was found to be 2.5 LE/h.

5- The inflation rate (I_f= 6%) take account, where the price of any machine in current time was calculated according to the following equation:

$$P \times (1 + I_f)^n ,\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 10$$

2-4-8-Threshing cost:

Threshing cost was determined by using the following equations (Awady et al., 1982).

Operating costs LE/Mg=Machine costs/Machine productivity…11

3 - RESULTS AND DISCUTION

3-1-Harvesting Losses:

The effect of different harvesting machines, forward speed and seed moisture contents on total losses percentage of lentil crop is shown in Fig. 1. The results showed that the increase of machine forward speeds tends to increase the total seed losses percentage with different harvesting machines and different seed moisture contents during harvesting lentil crop. On the other hand, harvesting lentil crop using self – propelled mower, increasing forward speed from 1.9 to 5.2 km/h. cause a corresponding increase in the total seed losses percentage from 8.2 to 14.0 %, 4.9 to 10.6 % and from 7.3 to15.4 % at seed moisture content of 10.05, 14.52 and 27.11 % respectively. At the same time, increasing forward speed from1.9 to 5.2 km/h with the rear mounted mower cause a corresponding increase in the total lentil seed losses percentage from 11.9 to 19.0%, 6.9 to 12.8% and from 8.6 to 19.4% at seed moisture contents of 10.05, 14.52 and 27.11%, respectively. Also, it is clear that increasing reaper forward speed from1.9 to 5.2 km/h increases the total seed losses percentage from 7.6 to 13.0%, 3.3 to 8.2 % and from 4.5 to 12.4 % at the three above mentioned seed moisture contents, respectively.

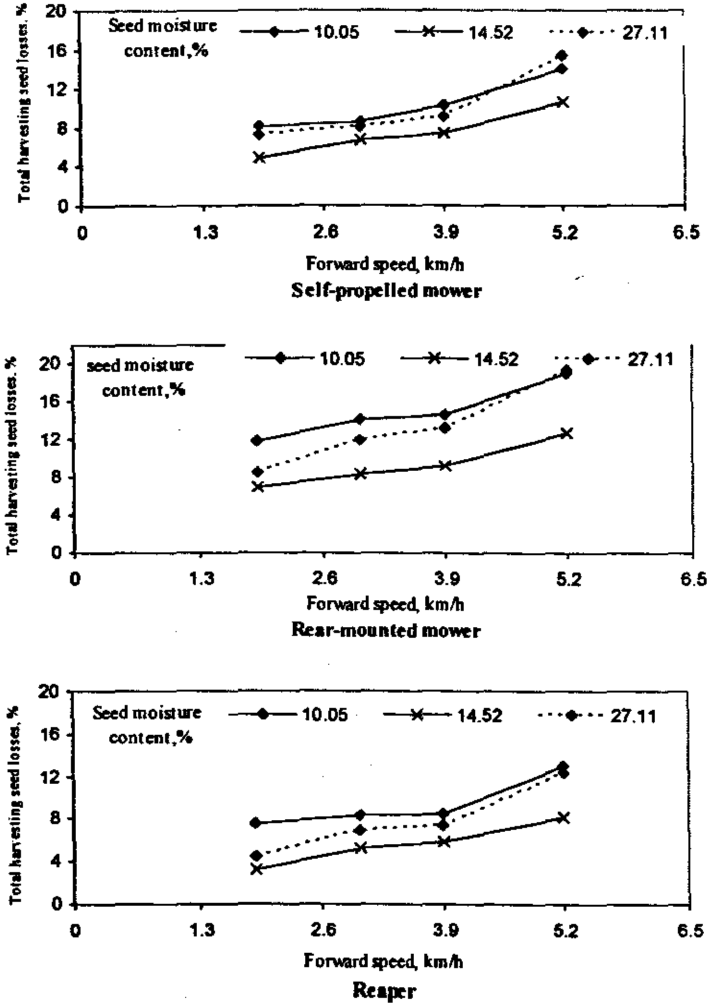

Fig. 1: Effect of different harvesting machines, forward speed and seed moisture content on the harvesting losses percentage of lentil crop.

The increase of seed losses by increasing forward speed was attributed to the excessive load of plants on the cutter bar and the high impact of bar with the plants. The results showed that the forward speed of harvesting machines ranging from 1.9 to 3.9 km / h. is considered the proper result of the seed losses percentage of lentil crop while the seed moisture content of 14.52 % always gave the minimum values of the total losses percentage compared with other various seed moisture contents followed by 27.11 and 10.05 %, respectively, for different harvesting machines and different forward speeds. At the same time, the reaper always recorded the minimum values of the total losses compared with other harvesting machines followed by self – propelled mower and rear – mounted mower respectively, for all treatments.

3-2-Threshing Losses:-

3-2-1- Unthreshed seed and seed damage losses:

The effects of drum speeds and seed moisture contents on the unthreshed seeds and mechanical seed damage percentages of lentil crop using threshing machine are shown in Fig. 2.

The results indicated that increasing drum speeds decreased the unthreshed seeds percentage while the total mechanical seed damage percentage is increased with all levels of lentil seed moisture contents used. Whereas increasing drum speed from 11.47 to 15.29, 19.12 and 22.24 m/s decreased unthreshed seeds percentages from 9.2 to 6.2, 5.1 and 3.1 % at seed moisture content of 10.05 %, while unthreshed seed percentages decreased from 13.1 to 11.45, 8.4 and 7 %, respectively, with previous drum speeds at seed moisture content of to 27.11 %. On the other hand, the percentage of mechanical seed damage increased from 3.7 to 4.8 % and from 5.6 to 7 % as drum speed increased from 11.47 to 15.29 m/s and from 19.12 to 22.24 m/s, respectively, at seed moisture content of 10.05 %. Also, mechanical seed damage percentages increased from 2.1 to 3.0 % and increased from 4.15 to 5.1 %, respectively, as previous drum speed increased at lentil seed moisture content of 27.11%.

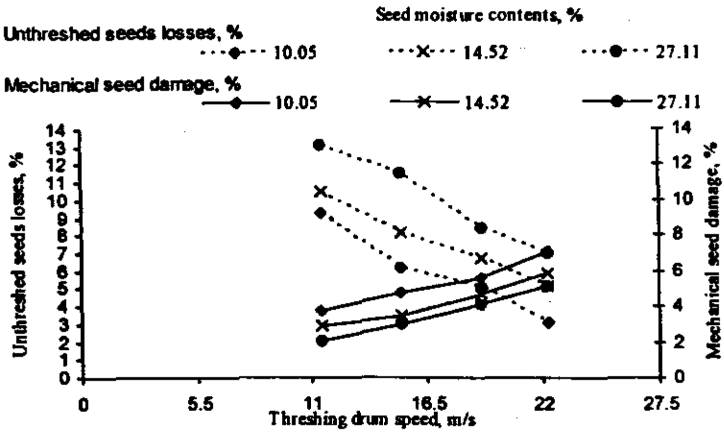

Fig. 2: Effect of threshing drum speed and seed moisture content on the unthreshed seed losses and mechanical seed damage losses during threshing operation of lentil crop.

In general, increasing seed moisture contents lead to increase unthreashed seeds because the attachment strength of the high moisture content seeds is higher than for low moisture content seeds, thus the seeds did not thresh easily resulting in more unthreashed seeds. From data presented in the previous figure, it can mentioned that the seed moisture content of 10.05 % gave the lowest values of unthreshed seeds comparing with other levels of seed moisture contents but gave the highest values of mechanical seed damage with all drum rotating speeds.

3-2-2-Total seed losses:-

The illustrated data in Fig. 3 show the relation among drum rotating speeds, seed moisture contents and total seed losses including unthreshed seeds and mechanical seed damage. Regarding to Fig. 3, increasing drum speed from 11.47 to 15.29 m/s tends to decrease the total losses by about 14.73 % while decreased by about 5.61 % when drum speed increased from 19.12

to 22.24 m/s at seed moisture content of 10.05 %. Also, the results take the same trend at seed moisture content of 27.11 % whereas the total seed losses decreased by about 4.93 and 3.58 %, respectively, as drum speed increased from 11.47 to 15.29 m/s and from 19.12 to 22.24 m/s. In general, results indicated that increasing drum rotating speeds tend to decrease the total seed losses percentages with all different levels of lentil seed moisture contents under study. This is attributed to the high stripping and impacting forces applied to the lentil plants, which tended to improve threshing operation and decreased unthreshed seeds. Therefore the suitable conditions to reduce the total seed losses were drum speed of 11.47 m/s with seed moisture content of 10.05 %.

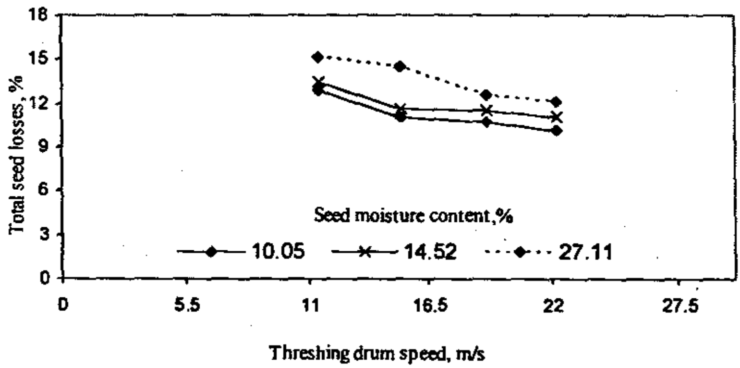

Fig. 3: Effect of threshing drum speed and seed moisture content on the total lentil seed losses during threshing operation of lentil crop.

3-3-Fuel Consumption Rates: -
3-3-1- Harvesting machines:-

Fig.4 shows the effect of different types of harvesting machines, different levels of forward speeds and different levels of seed moisture contents on the fuel consumption (l/h) during harvesting

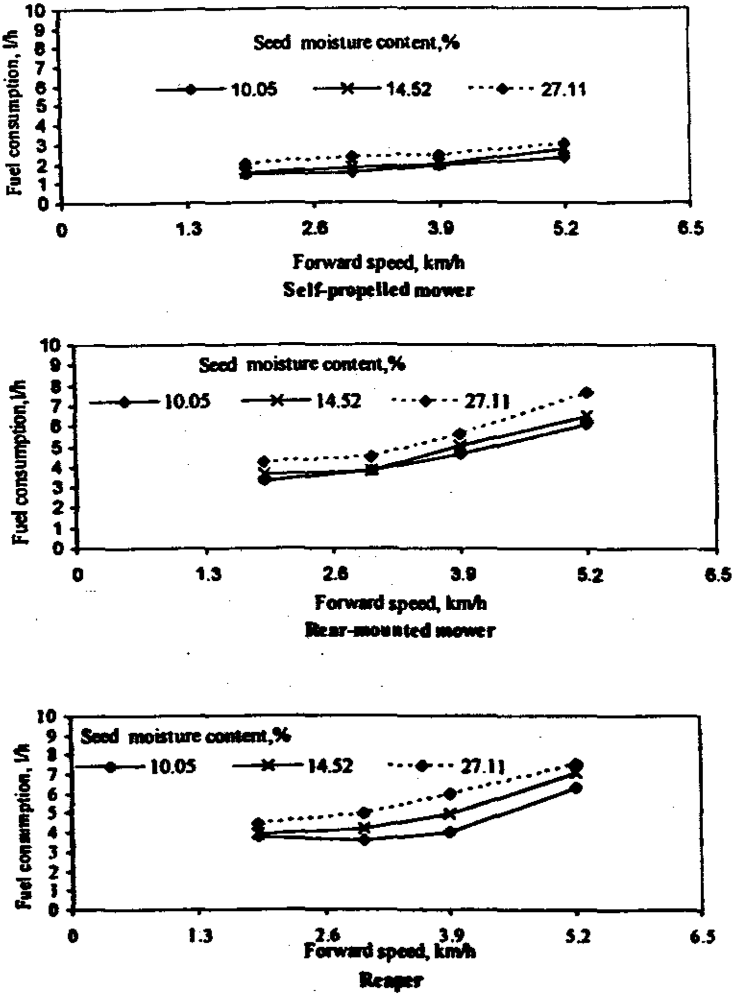

Fig.4: Effect of different harvesting machines, forward speed and seed moisture content on the fuel consumption, l/h during harvesting operation of lentil crop.

operation of lentil crop. Commonly the fuel consumption increased by increasing forward speed and seed moisture content for various types of harvesting machines under study. The results showed that increasing of forward speed from 1.9 to 5.2 km/h at the seed moisture content of 14.52 % lead to increase the fuel consumption rates from 1.5 to 2.71, 3.64 to 6.49 and from 3.89 to 7.12 *l*/h for self – propelled mower, rear – mounted mower and reaper, respectively. From the presented results in previous figure, it can observed that the seed moisture content of 27.11 % always gave the highest values of fuel consumption rates compared with other seed moisture contents followed by 14.52 and 10.05 %, respectively, with all types of harvesting machines used.

3-3-2-Threshing machine:-

Fig. 5 shows the effect of different levels of threshing machine drum speeds and different levels of lentil seed moisture contents on the fuel consumption rate *l*/h during lentil threshing operation. The results declared that the fuel consumption rate increased by increasing both drum speed and seed moisture content during threshing lentil crop. The increase of drum speed from 11.47 to 22.24 m/s increased the fuel consumption rate by 33.33, 36.17 and 32.76 % at seed moisture content of 10.05, 14.52 and 27.11 % respectively.

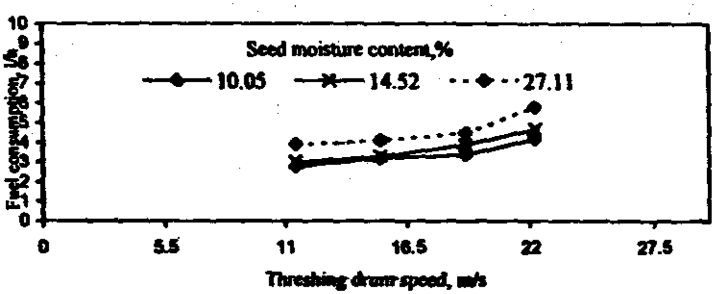

Fig. 5: Effect of threshing drum speed and seed moisture content on the fuel consumption during threshing operation of lentil crop.

3-4-Energy Requirements:-

3-4-1- Energy requirements for harvesting machines:-

Results in Fig. 6 show the effect of different types of harvesting machines, different levels of forward speeds and different levels of lentil seed moisture contents on specific energy requirement (kW.h/fed.) during lentil harvesting operation. The results indicated that increasing forward speed from 1.9 to 5.2 km/h cause a corresponding increase in the specific energy from 9.15 to 12.80, 13.61 to 20.98 and from 14.06 to 22.68 kW.h/fed with self – propelled mower, rear – mounted mower and reaper, respectively at seed moisture content 14.52 %. Meanwhile, rear – mounted mower always recorded the highest values of energy requirement (kW.h/fed) compared with reaper and self – propelled mower during harvesting lentil crop.

3-4-2- Energy requirements for threshing machine:-

The relation between threshing drum speeds and seed moisture contents on specific energy requirements (kW.h/Mg) during threshing operation of lentil crop are shown in Fig. 7. The results reveled that the specific energy requirements (kW.h/Mg) increased by increasing drum speed and seed moisture content for threshing lentil crop. This may be due to the increase in drum speed and the attachment strength of the high moisture content seeds is highest which are frequently accompanied by appreciable increase in fuel consumption, which in turn tends to increase energy.

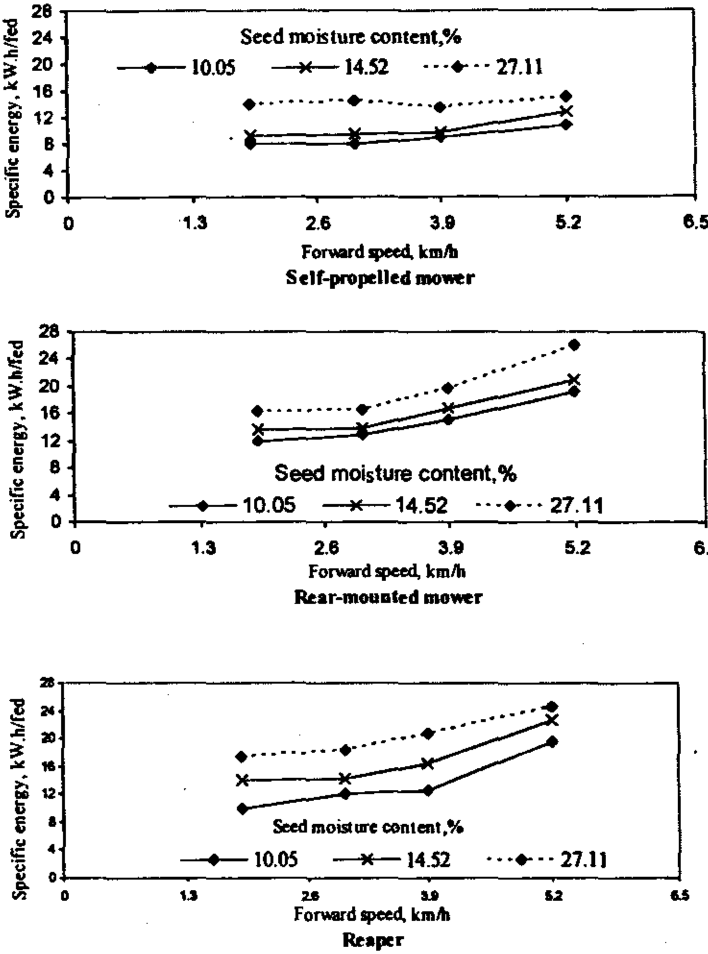

Fig. 6: Effect of different harvesting machines, forward speed and seed moisture content on specific energy requirements during harvesting operation of lentil crop.

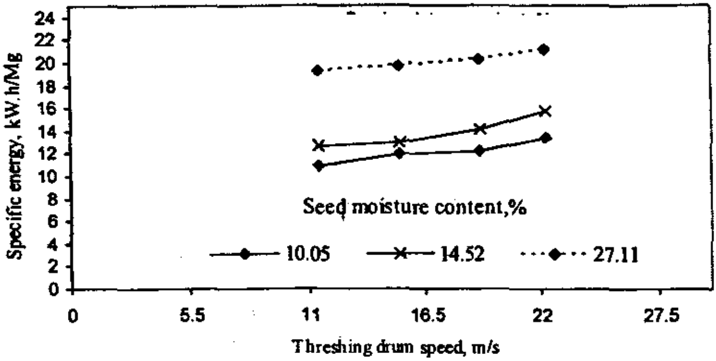

Fig. 7: Effect of threshing drum speed and seed moisture content on the specific energy requirements during threshing operation of lentil crop.

3-5- Cost Analysis:-

3-5-1- Cost analysis of harvesting machines:-

Fig. 8 shows the relation among type of harvesting machines, forward speed and seed moisture contents during harvesting operation of lentil crop. The results showed that harvesting operation costs (LE/h) increased as forward speed of harvesting machines increased and seed moisture content increased for all harvesting machines under study, since it increased from 15.51 to 16.1, 20.76 to 22.7 and from 20.41 to 22.85 LE/h as forward speed increased from 1.9 to 5.2 km/h at seed moisture content of 10.05 % with self propelled mower, rear mounted mower and reaper, respectively. On the other hand, increasing seed moisture content to 27.11 % led to increase harvesting cost from 15.9 to 16.58, 21.38 to 23.75 and from 21.54 to 23.68 LE/h as forward speed increased from 1.9 to 5.2 km/h, respectively, with previous harvesting machines. The comparing the three different harvesting machines used, it is clear that the self +propelled mower always gave the lowest values of harvesting cost followed by rear-mounted mower and reaper, respectively, at all levels of different forward speeds and all levels of different seed moisture contents under study.

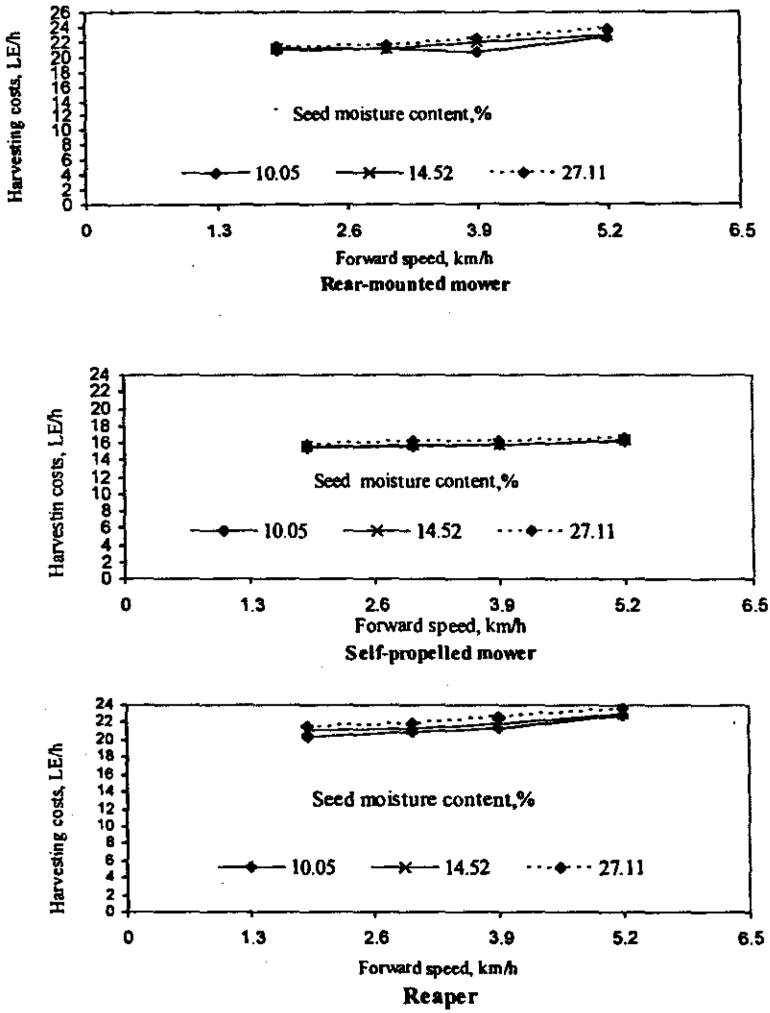

Fig. 8: Effect of different harvesting machines, forward speed and seed moisture content on harvesting costs during harvesting operation of lentil crop.

3-5-2- Cost analysis of threshing machine:-

According to results presented in Fig. 9 it can observed that increasing threshing drum speed m/s led to decrease the operating costs LE/Mg, while increasing seed moisture contents led to increase operating costs of threshing machine. Increasing drum speed of threshing machine from 11.47, 15.29 and 19.12 to 22.24 m/s tended to decrease the operating costs from 27.79, 26.97 and 25.99 to 23.67 LE/Mg at seed moisture content of 10.05 %. Meanwhile, increasing seed moisture content to 27.11 % led to increase the operating costs from 36.3, 35.58 and 33.83 to 29.37 LE/Mg as previous threshing drum speeds increased, respectively.

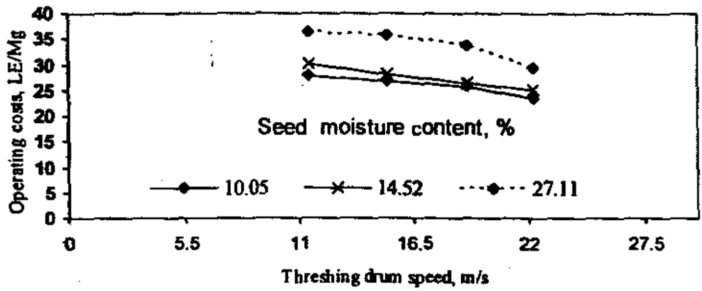

Fig. 9: Effect of threshing drum speed and seed moisture content on the operating costs of threshing operation of lentil crop.

4- CONCULTION

The main conclusion can be summarized as follows:

1- Mechanical harvesting by using reaper always gave the lowest values of the seed losses percentage compared with other harvesting machines followed by self – propelled mower and rear – mounted mower for harvesting lentil crop.

2- Forward speed of harvesting machines range of 3.0 to 3.9 km/h and seed moisture content 14.52 % for lentil crop gave the best values of the total seed losses, fuel consumption and specific energy requirements.

3- Drum speed of threshing machine range of 15.29 to 19.12 m/s (400-500 r.p.m.) and seed moisture content 10.05 % for lentil crop gave the best values of total seed losses, damage, fuel consumption and specific energy requirements.

Applied recommendation:-

It is recommended to use the reaper for harvesting lentil crop under local conditions at range of forward speed of 1.9 to 3.0 km/h at seed moisture content of 14.52 % and also, it is recommended to use threshing machine under range of drum speed of 15.29 to 19.12 m/s with seed moisture content of 10.05 % to obtain the lowest values of losses with an appropriate level of operating cost.

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الملخص العربي

تقييم أداء بعض الآلات المستخدمة في حصاد ودراس محصول العدس تحت الظروف المصرية

إبراهيم صلاح الدين يوسف - محمد الشحات بدوى – إبراهيم عبد المنعم قاسم

معهد بحوث الهندسة الزراعية – الدقي – الجيزة – مصر

الغرض من هذا البحث هو دراسة وتقييم أفضل طريقة لحصاد محصول العدس وهو المحصول الشعبى في مصر والذي مازال حتى الآن يتم حصاده بطرق بدائية تحتاج لعماله كثيرة وتكاليف عالية ووقت كبير مع زيادة نسبة الفقد والكسر في الحبوب الناتجة.

وفى هذه الدراسة تم تقييم ثلاث معدات تستخدم أساسا في حصاد محاصيل الحبوب لحصاد العدس وهى المحشة الترددية الذاتية الحركة والمحشة الترددية المعلقة خلف الجرار والريبر المعلق أمام الجرار وذلك عند أربع سرعات تقدم مختلفة أثناء الحصاد (١,٩ ــ ٣,٠ ــ ٣,٩ ــ ٥,٢) كم/س مع ثلاثة مستويات مختلفات لمحتوى الحبوب من الرطوبة أثناء الحصاد (١٠,٠٥ – ١٤,٥٢ – ٢٧,١١) % علي أساس جاف.

كذلك تم تقييم آله الدراس الثابتة التي تدار بالجرار وذلك عند أربعة مستويات مختلفة لسرعة درفيل الدراس هي ١١,٤٧ – ١٥,٢٩ – ١٩,١٢– ٢٢,٩٤ متر / ثانية (٣٠٠ – ٤٠٠– ٥٠٠ – ٦٠٠ لفة /دقيقة) وعند نفس المحتوى الرطوبى في الحبوب أثناء الحصاد حيث كان يتم الدراس في نفس توقيت الحصاد.

وقد تم تحديد نسبة الفقد الكلى لآلات الحصاد وكذلك نسبتي الفقد الكلى والكسر لآلة الدراس مع قياس استهلاك الوقود والاستهلاك النوعي للطاقة وكذلك تم حساب تكاليف تشغيل الآلات الأنفة الذكر.

وقد تم الحصول على النتائج آلاتية:

الحصاد الالى باستخدام الريبر دائما يعطى اقل نسبة فقد في الحبوب مقارنة بالمحشة الذاتية والمحشة الترددية المعلقة خلف الجرار على التوالي.

أفضل سرعة للحصاد الالى بجميع المعدات قيد الدراسة كانت تتراوح بين ٣,٠ – ٣,٩ كم / ساعة وكذلك كان أفضل محتوى رطوبى للحبوب في نفس توقيت الحصاد هو ١٤,٥٢ % حيث أعطى أفضل النتائج من نسبة فقد للحبوب واستهلاك الوقود.

أفضل سرعة لدرفيل الدراس لآلة الدراس تراوحت بين ١٥,٢٩ – ١٩,١٢ متر / ثانية (٤٠٠ – ٥٠٠ لفة /دقيقة) وكذلك كان أفضل محتوى رطوبى للحبوب أثناء عملية الدراس هو ١٠,٠٥ % حيث أعطيا أفضل النتائج في نسبتي الكسر والفقد في الحبوب واستهلاك الوقود والاستهلاك النوعي للطاقة أثناء عملية دراس محصول العدس في نفس وقت الحصاد.

زادت تكاليف عملية الحصاد الآلي بواسطة الريبر من ٢١,٦ إلي ٢٣,١ جنيها / س بزيادة سرعة التقدم من ١,٩ إلي ٥,٢ كم/س عند محتوي رطوبي للحبوب مقداره ١٤,٥٢ % ، بينما انخفضت تكاليف التشغيل لآلة الدراس بزيادة سرعة درفيل الدراس من ١٥,٢٩ إلي ١٩,١٢ م/ث من ٢٦,٩٧ إلي ٢٥,٩٩ جنيها / ميجا جرام وذلك عند محتوى رطوبى مقداره ١٠,٠٥ %.