STUDY ON THE MECHANIZATION OF COWPEA CROP PRODUCTION UNDER EGYPTIAN CONDITIONS

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ABSTRACT

Field experiments were carried out to investigate some different mechanization systems for producing cowpea crop under Egyptian conditions. Planting was carried out using both pneumatic planter and seed drill comparing with the manual method. Harvesting was carried out using both tractor mounted mower and self-propelled harvester at different forward speeds and different moisture contents comparing with the manual method. Threshing operation was carried out using threshing machine at different drum speeds, and different seed moisture contents. The obtained data reveal the following:

Mechanical planting by pneumatic planter + mechanical harvesting by self-propelled harvester + threshing by threshing machine is considered the proper system for producing cowpea crop under Egyptian conditions as it requires minimum cost. Seed moisture content of 12.22% and forward speed of 2.7 Km/h are considered the proper conditions for harvesting cowpea crop as they recorded minimum seed losses. Drum speed of 19.10 m/s (500 r.p.m) and seed moisture content of 9.52 % are considered the proper values for threshing cowpea crop as they recorded maximum efficiency and minimum energy.

INTRODUCTION

Cowpea is considered one of the most important legume crops all over the world. It can be used as green pods for fresh market or dry seeds. The grains of cowpea contains high percent of protein reached up to 24.8%, added to carbohydrates reached up to 63.6% It considered one of the crops which plays an important role in the improvement of soil properties especially in new lands (sandy and light soils). Cowpea is currently used in human feeding.

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More over, cowpea residues serve as a filling material for animal feed. The total planted area in Egypt devoted for dry seeds at 2003 was 8574 feddan with production of about 9238 tons with (an average yield of 1.077 tons/feddan). Also the production was 26794 feddan for green pods with total production of about 90651 tons (an average yield of 3.387 ton/feddan). According to agricultural economics bulletin (2003).
The cowpea procedures face many problems such as: Labour shortage as well as high wages in new lands. Concerning the effect of planting method on the crop yield, **Moustafa (1993)** mentioned that the highest number of vegetative branches and highest yield of soybean were obtained under pneumatic planter. Mechanical planting (pneumatic planter and seed drill) saved about 67.6 and 31.6 %, respectively of seeds per feddan compared by manual planting. He also added that the mechanical planting treatment produced heavy grains. **Gomaa (2003)** compared the performance of two types of planters (pneumatic and mechanical) in cowpea planting. He found that the best seed germination, seed scrattering, planting depth and total yield were obtained under planting forward speed of 3.16 Km/h. Also he said that the best results of planting uniformity and total yield were obtained with pneumatic planter compared to mechanical planter. **Yehia *et al,.* (2005)** reported that the grain emergence percentage of cowpea using pneumatic planter was higher than using manual planting, seed drill and mechanical planter in flat and furrow soil. They added that the optimum grain emergence of 99.1 % was obtained by using pneumatic planter in furrow and minimum of 62.44 % was obtained by using manual planting in flat soil. Also they reported that the highest seed productivity (1313 kg/fed) was obtained by using pneumatic planter in furrow soil. Relating to the effect of harvesting method on cowpea losses, **Baryeh (1987)** studied and compared three types of manual harvesting of cowpeas with 2 types of mechanical harvesting of upright, semi-upright and spreading cowpea varieties. Results indicated that losses for manual harvesting varied from 0.5 to 16.9%, depending on cowpea variety and type of manual harvesting. Losses from a cutter conveyor varied from 4.0 to 39.8% according to cowpea variety, moisture content (M.C.) and forward speed. Losses from rotary cutter were between 11.6 and 41.5% for similar

reasons. The av. harvesting times for crop at 12% M.C. wet basis (w.b.) for manual harvesting cutter conveyor and rotary cutter were 0.05, 0.17 and 0.10 ha/h resp . For the semi-upright variety. An economic appraisal of all the harvesting methods showed that manual shearing gave high crop losses and was slow compared with pod picking and uprooting. While both mechanized methods were quicker than manual harvesting, crop losses were excessive at crop moisture levels of 12% w.b. At M.C. of 28% w.b. crop losses were considerably reduced.

As to the effect of some operating parameters on cowpea threshing losses, **Sharma and Devnani (1980)** studied the threshing of cowpea. Threshing efficiency increased with the increase of cylinder speed but decreased with the increase of feed rate and concave clearance. Energy consumption was directly proportional to cylinder speed and feed rate and remained constant at selected concave clearance. At higher speeds the visible grain damage was 5 % and the germination percentage was low. Also they said that when cowpea at 6.5 % moisture content is to be threshed for consumption, the thresher should be operated at 496.0 m/min cylinder tip speed with 8.0 mm concave clearance. For seed purpose it should be threshed at 288.5 m/min cylinder tip speed and 8.0 mm concave clearance. **Herbek and Bitzer (2004)** indicated that cylinder speeds ranging from 400 to 800 rpm were normally adequate and that higher cylinder speeds of 700 to 800 rpm caused greater seed damages than slower speeds. They added that it may be necessary to use a cylinder speed lower than 500 r.p.m if excessive seed damage occurs and suggested using as much air as possible to remove material without blowing seeds out.

As mentioned before, cowpea production still depends mainly on manual methods especially in small holdings, consuming time and cost. For this reason, this work has turned toward concept of mechanizing cowpea production. The objective of this work are:

1-Selecting the proper method of planting, harvesting and threshing cowpea crop to optimize crop yield and minimize cost of production.

2-Optimizing both seed moisture content and machine forward speed for harvesting cowpea to minimize grain losses.

3-Optimizing both seed moisture content and drum speed for threshing cowpea to maximize threshing efficiency.

MATERIALS AND METHODS

The main experiments were carried out during the agricultural season of 2005/2006 at EL-Khatara Farm, Sharkia Governorate to investigate some different mechanization systems for producing cowpea (Qaha1) variety under Egyptian conditions.

The experimental area was about 1.5 fed. Divided into 27 equal plots having dimensions of [3.5x 67] m per each. Mechanical analyses of the experimental soil was classified as sandy soil as shown in table (1).

Table (1): Soil mechanical analysis:

Clay %	Silt %	Sand %	Textural class
2.8	4.9	92.3	Sandy

The following equipment were used in the research:

(1) Tractors:

1- Roman "Universal 650-M" of 75 hP (55.93 k.W) engine power.

2- Kubota "L 285" of 30 hp (22.37 k.W) engine power.

3- Naser " M34/T diesel water cooled" of 60 hp (44.1 k.W) engine power.

(2) Planting machines:

1- Pneumatic planter four rows, model GAMMA 90 with working width of 240 cm.

2- Seed drill 20 rows, model TYE and working width of 240 cm.

(3) Harvesting machines:

1- Tractor mounted mower model B.M.1102 with cutting width of 150 cm.

2- Self-propelled harvester model Lombardini with cutting width of 120 cm and 3.4 hp (2.5 k.W) engine power.

(4) Thresher, Turkish machine. The machine consists of two components; threshing and winnowing units. The threshing drum is 120 cm length, 73 cm diameter and No of fingers is 40. The winnowing unit consists of a fan, vibrating screen and air elevator.

Treatments:

Nine treatments, namely A, B, C, D, E, F, G, H and I were carried out and replicated three times in a completely randomized block design.

A: Manual planting + manual harvesting + threshing by threshing machine.
B: Manual planting + mechanical harvesting by tractor mounted mower + threshing by threshing machine.
C: Manual planting + mechanical harvesting by self-propelled harvester + threshing by threshing machine.
D: Mechanical planting by pneumatic planter + manual harvesting + threshing by threshing machine.
E: Mechanical planting by pneumatic planter + mechanical harvesting by tractor mounted mower + threshing by threshing machine.
F: Mechanical planting by pneumatic planter + mechanical harvesting by self-propelled harvester + threshing by threshing machine.
G: Mechanical planting by seed drill + manual harvesting + threshing by threshing machine.
H: Mechanical planting by seed drill + mechanical harvesting by tractor mounted mower + threshing by threshing machine.
I: Mechanical planting by seed drill + mechanical harvesting by self-propelled harvester + threshing by threshing machine.
The treatment A is considered as conventional method. All the experimental plots were treated by two chiseling and levelled by land leveller before planting operations.

Planting methods:

In both manual and mechanical methods, the rows spacing and hills in the same row were almost adjusted to be [60 cm] and [15 cm], respectively. Both manual and mechanical methods require about [25 kg / fed] of seeds. The average number of seeds was 3-5 seed per hill.
The manual and mechanical planting plots were thinned to one plant per hill after three weeks from planting. The planting depth was adjusted to be [4 cm] at forward speed of 4 km/h.
Fertilizing, irrigation and weed control were the same in all treatments according to the technical recommendations.

Harvesting methods:

The harvesting operation was carried out through four different levels of seed moisture contents of 19.63, 15.18, 12.22 and 9.5 % at different workable speeds of 1.5, 2.7, 4.5 and 6 km/h.

Threshing:

The threshing operation was conducted under three different drum speeds of 400, 500 and 600 r.p.m. [15.28, 19.10 and 22.92 m/s] at four moisture contents of [16.23, 13.60, 9.52 and 7.14 %]. During the threshing operation, the feed rate was kept constant at 185 kg/h.

Measurements:

- Some plant characteristics as well as crop yield were measured as indicators for the planting operation.
- Harvesting losses were considered as an indicator for the harvesting operation.
- Unthreshed pods, mechanical seed damage, threshing losses, threshing efficiency and cleaning efficiency were recorded as indicators for the threshing operation.

- Field capacity and field efficiency:

Field efficiency (ηf) is the ratio of actual field capacity to theoretical field capacity expressed as percent.

$$\eta f = \frac{Actual\ field\ capacity}{Theoretical\ field\ capacity} \times 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where: Actual field capacity is the actual working rate of area and theoretical field capacity is calculated by multiplying machine forward speed by the effective working width of the machine.

- Power required:

Estimation of the required power to operate each machine was carried out by accurately measuring the decrease in fuel level in the fuel tank immediately after executing each operation.

The required power was calculated by using the following formula:

$$p\ (\text{k.W}) = \text{w}f \times \text{c.}v. \times \eta \text{th} \times \frac{427}{75} \times \frac{1}{1.36}$$ (Barger, *et al.,* 1963)……..(2)

w*f* = Rate of fuel consumption (kg/sec)

c.*v.* = Calorific value of fuel in Kcal/kg of fuel.

(Average c.*v.* of solar fuel is 10000 Kcal/kg)

(Average c.*v.* of benzene is 11000 Kcal/kg)

427 = Thermo – mechanical equivalent, Kg.m/Kcal.

η **th =** Thermal efficiency of the engine

(Considered to be 30% for diesel engines)

(Considered to be 20% for benzene engines)

- Energy requirements:

Energy requirements can be calculated by the following equation:

Energy requirements (kW.h/fed) = $\frac{Power\ required\ (k.W)}{Effective\ \ field\ capacity\ \ (fed./h.)}$ .....(3)

- Cost analysis:

The cost of mechanized process was based on the initial cost of machine, interest on capital, cost of fuel and oil consumed, cost of maintenance, and wage of operator according to the following formula:

c = $\frac{p}{h}\left(\frac{1}{e}+\frac{i}{2}+t+r\right)+(0.9\ hp\times f\times s\ )+\frac{W}{144}$ (Awady, 1978).... (4)

C : Hourly cost.

P : Capital investment.

h : Yearly operating hours.

e : Life expectancy of equipment in year.

i : Interest rate.

t : Taxes and over head.

r : Repairs ratio of total investment.

0.9: A factor including reasonable estimation of the oil consumption in addition to fuel.

hp : Horse power of engine.

f : Brake specific fuel consumption in liter/hp.

S : Price of fuel per liter.

W : labor wage rate per month in L.E.

144 : Reasonable estimation of monthly working hours.

The operational cost can be determined using the following formula:

Operating cost / fed. = $\frac{Machine\cos t/h.}{Effective\ field\ capacity\,(fed./h.)}\ L.E./fed.$ ...... (5)

The criterion cost can be determined using the following formula:

Criterion cost (L.E/fed) = operating cost + seed losses cost. ……... (6)

RESULTS AND DISCUSSION

Results and discussion will present under the following items:

(1) RESULTS OF COWPEA PLANTING:

1-1- Effect of different planting methods on some plant characteristics:

Results in table (2) show that uniformity of distribution values were 18.23, 23.54 and 29.45 % using pneumatic planter, seed drill and manual planting, respectively. That is due to the control in the seeds spacing under pneumatic planter over seed drill and manual planting.

The complete emergence of plants was noticed after 9 days using seed drill, while the period increased to 11 and 12 days using manual planting and pneumatic planter, respectively. This is due to the fact that the depth of planting could not be thoroughly adjusted.

The maximum germination ratio of 96 % was remarked under the manual method. The germination ratio decreased to 93.5 and 89 % under pneumatic planter and seed drill respectively. That is due to the fracture between the seeds and the feeder under seed drill machine, resulting in cracked seeds.

The highest plant population of 16.1 plant/m² was noticed under manual planting. While it decreased to 11.9 and 13.2 plant/m² under pneumatic planter and seed drill respectively. This is due to the high germination ratio of manual planting comparing with pneumatic planter and seed drill.

Table (2) Effect of different planting methods on some plant characteristics:

Planting methods	distribution Uniformity %	Emergence period/day	Germination ratio %	Plant population plant / m²
Manual	29.45	11	96	16.1
Pneumatic planter	18.23	12	93.5	11.9
Seed drill	23.54	9	90	13.2

1-2- Effect of different planting methods on some plant features and total yield:

Planting method has a great effect on the plant features such as stem length, number of branches per plant, number of pods per plant, number of seeds per plant and weight of seeds per plant.

It was observed from Table (3) that the maximum stem length of 52.7 cm was noticed under manual planting. While it decreased to 45.2 and 38.9 cm under seed drill and pneumatic planter, respectively. Crowded cowpea plants under the manual planting lead to increase plant length. The same table show that manual planting decreased number of branches by 22.03 and 9.80 % comparing with pneumatic planter and seed drill, respectively. The same trend was noticed with number of pods per plant, which decreased under manual planting by 33.64, and 22.16 % comparing with pneumatic planter and seed drill, respectively. This is due to the plant density, plants growing in high densities are taller, little branches, and little pods than those in low densities. Also manual planting decreased number of seeds per plant by 34.15, 22.71 % comparing with pneumatic planter and seed drill, respectively. The same trend was noticed also with weight of seeds per plant, which decreased under manual planting by 42.01 and 26.82 % comparing with pneumatic planter and seed drill, respectively. The number of seeds per plant for the mechanical planting is more than for the manual planting because of the large number of pods per plant for the mechanical planting comparing with the manual planting. The same trend was noticed with the weight of seeds per plant.

Fig. (1) Show that the average weight of 1000 grains were 164.2, 183.4, and 174.5 gm. under manual planting, pneumatic planter, and seed drill, respectively. Also Fig.(2) show that the average values of yield obtained were 408.7, 567.3, and 472.5 kg/fed. under manual planting, pneumatic planter, and seed drill, respectively. So, mechanical planting using pneumatic planter is the advisable method for planting cowpea because of its high resulting yield.

Table (3) Effect of planting methods on some plant features.

Planting methods	Stem length (cm)	Number of branches per plant	Number of pods per plant	Number of seeds per plant	Weight of seeds per plant (gm/plant)
Manual	52.7	4.6	14.4	59	7.04
Pneumatic planter	38.9	5.9	21.7	89.6	12.14
Seed drill	45.2	5.1	18.5	72.4	9.62

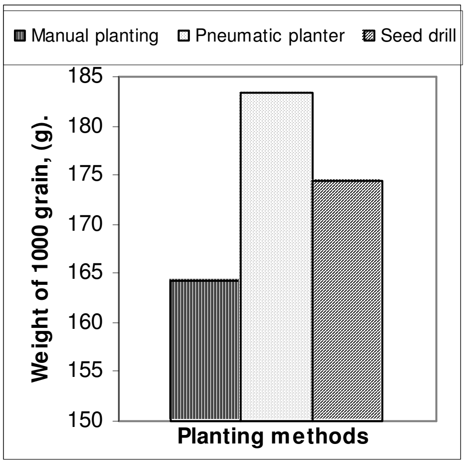


Fig.(1): Effect of planting methods on weight of 1000 grains.

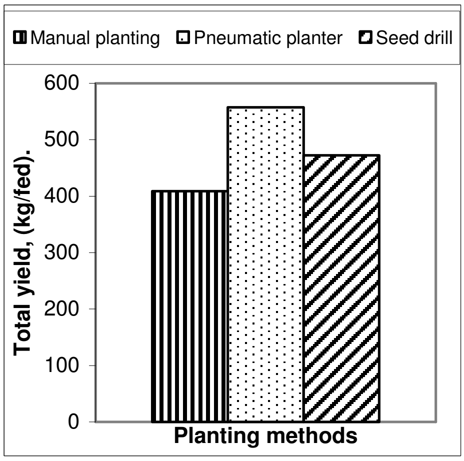


Fig.(2): Effect of planting methods on total yield.

(2) RESULTS OF COWPEA HARVESTING:

2-1- Field capacity and field efficiency of different harvesting methods:

Fig. (3, 4) Show the effect of forward speed on both field capacity and field efficiency of manual and mechanical methods of harvesting. Results obtained for mechanical methods show a drop in field efficiency with a consequent sharp rise in the field capacity as the forward speed increased. Increasing the forward speed from 1.5 to 6 Km/h. increased the field capacity values from 0.4661 to 1.3418 fed./h. and from 0.4062 to 1.4048 fed./h. for rear mounted mower and self-propelled harvester, respectively. On the other hand, increasing forward speed from 1.5 to 6 Km/h. decreased the field efficiency values from 87.01 to 62.62 %, and from 94.80 to 81.96 %, under the same previous conditions. The major reason for the reduction in field efficiency by increasing forward speed is due to the less theoretical time consumed in comparison with the other items of time losses.

A forward speed of 2.7 Km/h., is recommended because increasing it more than 2.7 to 6 Km/h., decreased field efficiency, while decreasing it less than 2.7 to 1.5 Km/h., decreased field capacity.

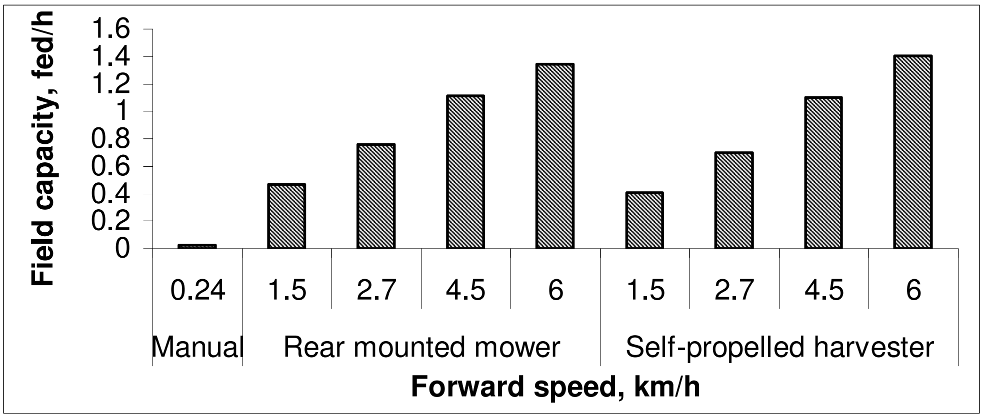


Fig.(3): Field capacity of different harvesting methods at different forward speeds.

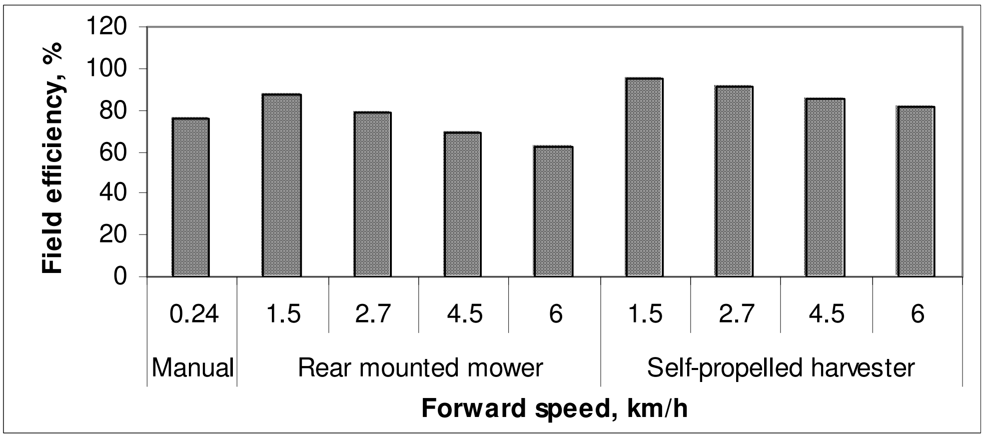


Fig.(4): Field efficiency of different harvesting methods at different forward speeds.

2-2- Effect of harvesting method on harvesting losses:

Fig.(5) Show that harvesting losses increased by increasing forward speed at any planting method. In the manual harvesting at forward speed of 0.24 Km/h., and seed moisture content of 12.22 %, seed losses were 1.43, 1.73, and 1.36 %, under manual planting, pneumatic planter, and seed drill, respectively.

In the mechanical harvesting using tractor-mounted mower, increasing forward speed from 1.5 to 6 Km/h., at moisture content of 12.22 %, increased seed losses from 6.17 to 12.58 %, from 5.58 to 10.52 %, and from 5.9 to 11.64 % under manual planting, pneumatic planter, and seed drill, respectively.

In the mechanical harvesting using self-propelled harvester, increasing forward speed from 1.5 to 6 Km/h., at moisture content of 12.22 %, increased Seed losses from 7.56 to 13.71 %, from 6.61 to 11.25 %, and from 6.92 to 12.26 %, under the same previous conditions.

The increase of grain losses by increasing forward speed was attributed to the excessive load of plants on the cutter bar and the high impact of cutter bar with the plants.

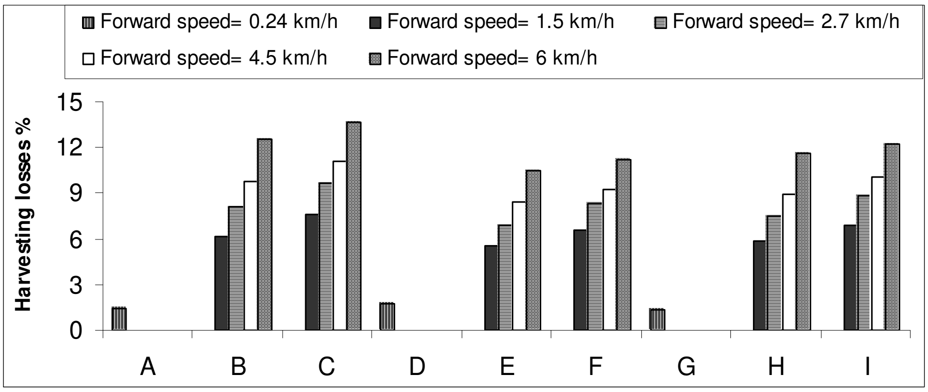


Fig.(5): Effect of harvesting method on harvesting losses under different planting methods and different forward speeds.

Relating to the effect of seed moisture content on harvesting losses, Fig. (6) Show that increasing seed moisture content, decreased harvesting losses up to 12.22 %. Any further moisture content increase, up to 19.63 %., increased harvesting losses.

In the manual harvesting, increasing moisture content from 9.5 to 19.63 %, decreased harvesting losses from 3.51 to 0.36 %, from 4.16 to 0.58 %, and from 3.83 to 0.34 % under manual planting, pneumatic planter, and seed drill, respectively.

In the mechanical harvesting using rear mounted mower, increasing moisture content from 9.5 to 12.22 % at forward speed of 2.7 Km/h., decreased harvesting losses from 10.25 to 8.16 %, from 8.92 to 6.93 %, and from 9.61 to 7.55 % under manual planting, pneumatic planter, and seed drill, respectively.

In the mechanical harvesting using self propelled harvester, increasing moisture content from 9.5 to 12.22 %, at forward speed of 2.7 Km/h., decreased harvesting losses from 12.2 to 9.66 %, from 10.11 to 8.35 %, and from 11.03 to 8.83 % under the same conditions.

Moisture content of 12.22 % is recommended in order to minimize losses, under mechanical harvesting methods.

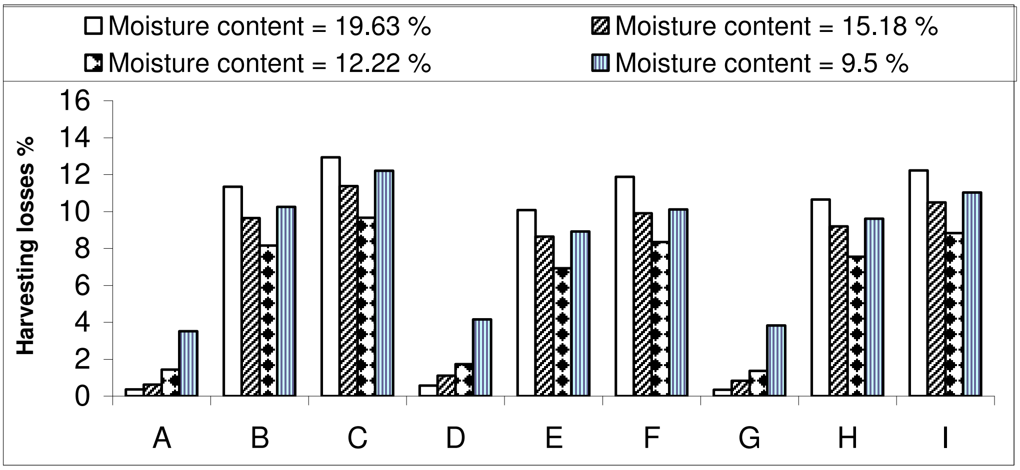


Fig.(6): Effect of harvesting method on harvesting losses under different planting methods and different moisture contents.

(3) RESULTS OF COWPEA THRESHING:

3-1- Unthreshed pods:

Fig.(7) shows the relationship between unthreshed pods and different drum speeds at different seed moisture contents. The obtained results revealed that both drum speed and seed moisture content affect deeply on the percentage of unthreshed pods. The highest value of unthreshed pods of 10.55 %, was observed under the high level of seed moisture content of 16.23 %, and low drum speed of 400 r.p.m, while the lowest value of 0.63 %, was observed under low seed moisture content of 7.14 %, and high drum speed of 600 r.p.m.

3-2- Mechanical seed damage:

Fig.(8) shows the relationship between damaged seeds and different seed moisture contents at different drum speeds. It is noticed, that minimum value of mechanical seed damage was recorded at low drum speed of 400 r.p.m, and high seed moisture content of 16.23 %.

3-3- Threshing losses:

Fig.(9) shows the relationship between total losses (including unthreshed seeds and damaged seeds together) and different drum speeds at different seed moisture contents. It is noticed that minimizing threshing losses can be obtained at a drum speed of 500 r.p.m and moisture content of 9.52%.

3-4- Threshing efficiency:

Threshing efficiency was affected by many variables such as drum speed and seed moisture content. Results obtained in Fig. (10) indicated that the threshing efficiency increased with the increase in drum speed. On the other hand, threshing efficiency decreased by increasing seed moisture content, where the seeds can not be separated easily and as a result, the percentage of unthreshed grains increased.

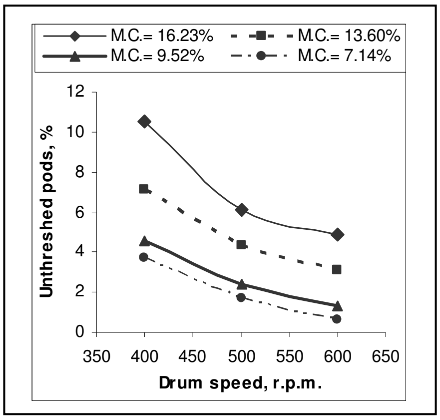


Fig.(7): Effect of drum speed and seed moisture content on unthreshed pods.

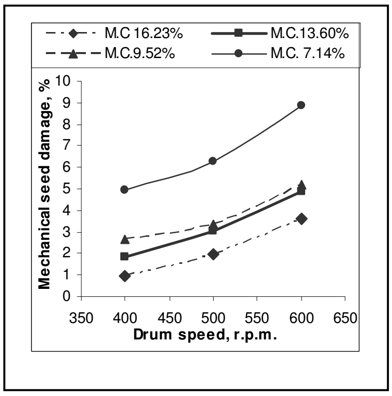
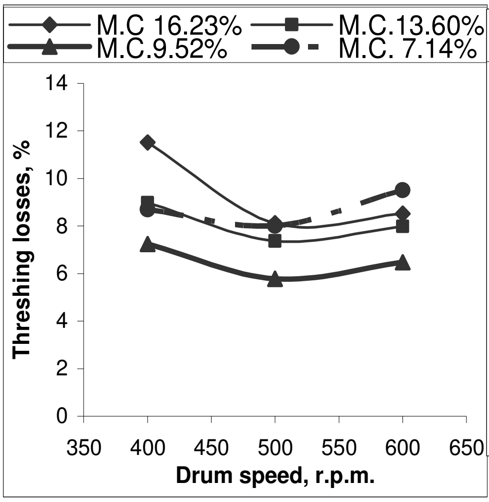


Fig.(8): Effect of drum speed and seed moisture content on mechanical seed damage.

3-5- Cleaning efficiency:

Fig. (11) Show the relation between cleaning efficiency and different drum speeds at different seeds moisture contents. The cleaning efficiency increased from 90.07 to 93.91, from 91.98 to 95.08, from 94.03 to 96.64, and from 96.05 to 98.65 %, at different seed moisture contents of 16.23, 13.60, 9.52, and 7.14 %, respectively by increasing drum speed from 400 to 600 r.p.m.



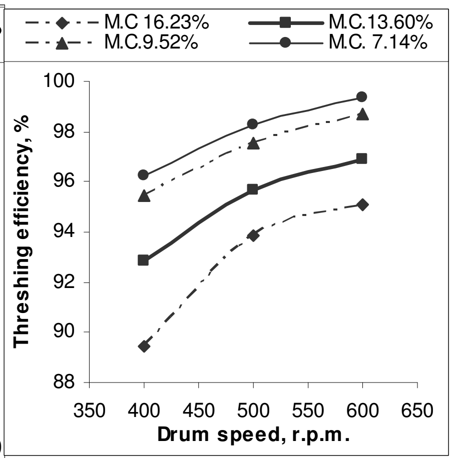


Fig.(9): Effect of drum speed and seed moisture content on threshing losses.

Fig.(10): Effect of drum speed and seed moisture content on threshing efficiency.

3-5- Cleaning efficiency:

Fig. (11) Show the relation between cleaning efficiency and different drum speeds at different seeds moisture contents. The cleaning efficiency increased from 90.07 to 93.91, from 91.98 to 95.08, from 94.03 to 96.64, and from 96.05 to 98.65 %, at different seed moisture contents of 16.23, 13.60, 9.52, and 7.14 %, respectively by increasing drum speed from 400 to 600 r.p.m.

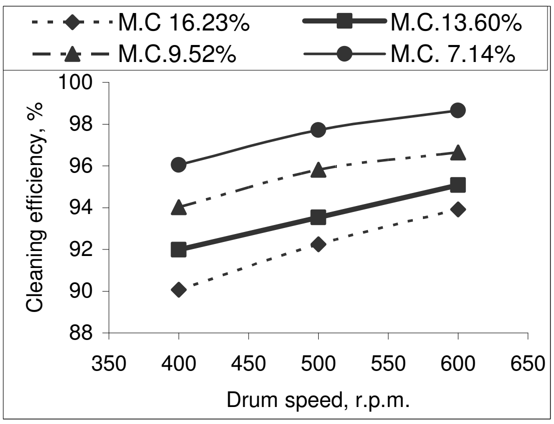


Fig.(11): Effect of drum speed and seed moisture content on cleaning efficiency.

From the above data of the threshing process, it can be concluded that: the moisture content of between 9.52 - 13.60 % and drum speed of 500 r.p.m., are considered the optimum conditions through which losses percentage is minimum.

4) Energy requirements for different cowpea mechanization systems:

Fig. (12) show that the total energy requirements to produce one ton of cowpea can be arranged in descending order as follows: E, H, B, F, I, G, D, C, and A. It is clear that the treatment (E) (mechanical planting by pneumatic planter + mechanical harvesting by tractor mounted-mower + threshing by threshing machine) required the highest value of energy (110.86 kW.h/ton), while treatment (A) (manual planting + manual harvesting + threshing by threshing machine) required the lowest value of energy (66.77 k.W.h/ton).

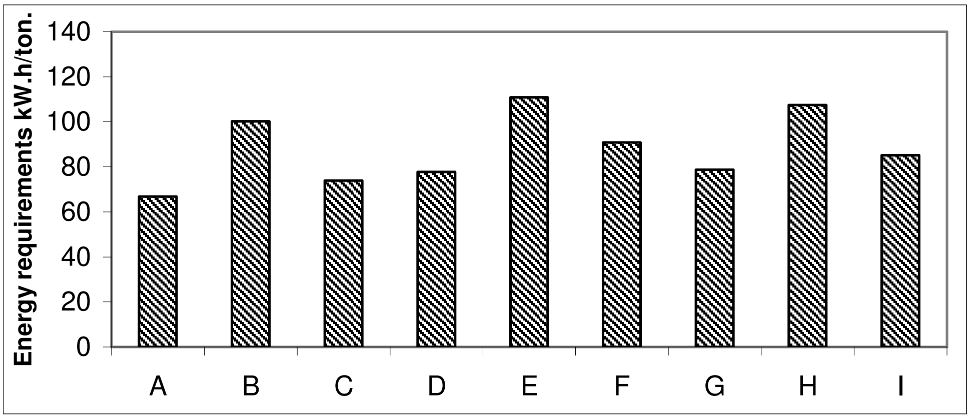


Fig.(12): Energy requirements to produce one ton of cowpea under different treatments.

5) Cost analysis for cowpea production:

The cost of the field machinery is dependent on many factors due to the machine conditions and the mechanization system.

Fig. (13) represent the cost per unit of production for the different treatments. The cost of production per ton of yield can be arranged in descending order of treatments as follows: A (571.10 L.E./ton), G (410.73 L.E./ton), D (348.02 L.E./ton), B (298.20 L.E./ton), C (263.77 L.E./ton), H (169.89 L.E./ton), E (155.75 L.E./ton), I (137.94 L.E./ton), and F (126.71 L.E./ton), respectively. Treatments B, C, D, E, F, G, H, and I reduced the cost of operation by 47.78, 53.81, 39.06, 72.73, 77.81, 28.08, 70.25, and 75.85 %, respectively comparing to the conventional treatment A (571.10 L.E./ton). From this results, it is evident that treatment F (mechanical planting by pneumatic planter + mechanical harvesting by self-propelled harvester + mechanical threshing by threshing machine) recorded the lowest value of cost per unit of production (126.71 L.E./ton).

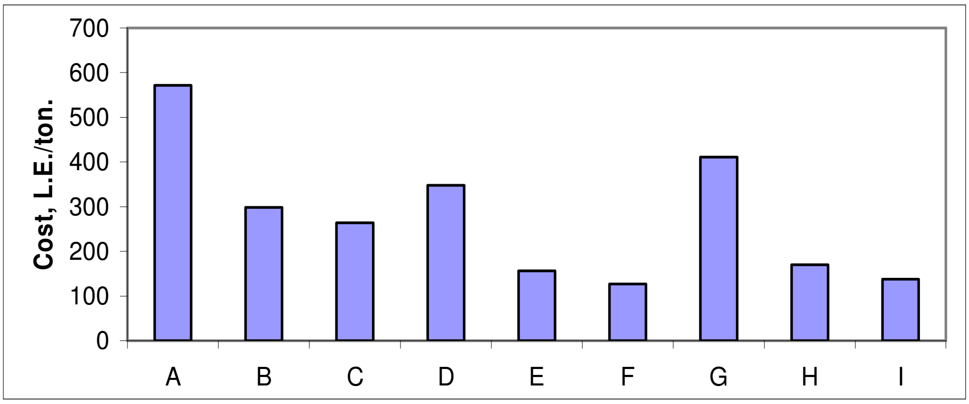


Fig.(13): Cost requirements to produce one ton of cowpea under different treatments.

CONCLUSION

The field experiments aim to evaluate some different mechanization systems for producing cowpea crop. Results showed that:

1- Treatment F (mechanical planting by pneumatic planter + mechanical harvesting by self-propelled harvester + mechanical threshing by threshing machine) is recommended for cowpea production under Egyptian conditions as it required minimum cost (126.71 L.E./ton) and recorded high percent of return (profit 77.81 %) comparing with the other treatments.

2- Seed moisture content of 12.22 % and forward speed of 2.7 km/h. are recommended for harvesting cowpea crop as it recorded minimum seed losses.

3- Drum speed of 19.10 m/s (500 r.p.m.) and seed moisture content of 9.52 % are recommended for threshing cowpea crop as it recorded both minimum losses and energy (5.78 % and 23.38 kW.h./fed.) respectively.

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الملخص العربى

دراسة عن ميكنة إنتاج محصول اللوبيا تحت الظروف المصرية

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أجريت التجربة لزراعة وحصاد ودراس محصول اللوبيا تحت الظروف المصرية خلال موسم 2006/2005 في مساحة 1.5 فدان في ارض رملية بمزرعة كلية الزراعة بالخطارة – محافظة الشرقية.

وكانت أهداف الدراسة:

1- اختيار أنسب طريقة لزراعة وحصاد ودراس محصول اللوبيا للحصول على أعلى إنتاجية وأقل تكاليف.

2- دراسة تأثير كل من المحتوى الرطوبى للحبوب والسرعات المختلفة على الفواقد الحقلية عند الحصاد.
3- دراسة تأثير خواص النبات وسرعة درفيل الدراس على عملية الدراس.

وقد أجريت التجربة باستخدام المعاملات الآتية:

(A) زراعة يدوى + حصاد يدوى + دراس بالالة الثابتة.
(B) زراعة يدوى + حصاد بالمحشة الخليفة للجرار + دراس بالآلة الثابتة.
(C) زراعة يدوى + حصاد بالمحشة الذاتية + دراس بالآلة الثابتة.
(D) زراعة آلية فى جور (البذارة الهوائية) + حصاد يدوى + دراس بالالة الثابتة.
(E) زراعة آلية في جور (البذارة الهوائية) + حصاد بالمحشة الخلفية للجرار + دراس بالالة الثابتة.
(F) زراعة آلية في جور (البذارة الهوائية) + حصاد بالمحشة الذاتية + دراس بالآلة الثابتة.
(G) تسطير الى (السطارة) + حصاد يدوى + دراس بالآلة الثابتة.
(H) تسطير الى (السطارة) + حصاد بالمحشة الخلفية للجرار + دراس بالآلة الثابتة.
(I) تسطير الى (السطارة) + حصاد بالمحشة الذاتية + دراس بالآلة الثابتة.

وقد تم تقيم المعاملات من حيث:

1- تأثير طرق الزراعة على بعض صفات النبات وكذلك على إنتاجية المحصول.
2- تأثير طرق الحصاد والسرعات الأمامية للآلة ونسبة رطوبة البذور على فواقد الحصاد.
3- تأثير بعض العوامل على عملية الدراس (نسبة الرطوبة – سرعة الدرفيل).
4- الطاقة المطلوبة لعمليات الميكنة المختلفة لمحصول اللوبيا.
5- التكاليف المطلوبة للعمليات الآلية المختلفة لمحصول اللوبيا.

ومن خلال النتائج تم التوصل إلى التوصيات الآتية :

1- يوصى باستخدام المعاملة **(F)** وهى (زراعة آلية في جور (البذارة الهوائية) + حصاد بالمحشة الذاتية + دراس بالة الدراس الثابتة) لإنتاج اللوبيا تحت الظروف المصرية، حيث أنها سجلت أقل قيمة للتكاليف مقارنة بباقي المعاملات المستخدمة.
2- يوصى بحصاد محصول اللوبيا عند نسبة رطوبة (12.22 %) وسرعة أمامية لآلة الحصاد (2.7 كم/ ساعة) حيث أنها سجلت أقل قيمة للفواقد الحقلية للبذور.
3- يوصى بدراس محصول اللوبيا عند نسبة رطوبة (9.52 %) وسرعة درفيل 500 لفة/ دقيقة (19.10 م/ ث) حيث أنها تسجل القيمة المناسبة من القدرة وفواقد البذور.

1- أستاذ الهندسة الزراعية – قسم الهندسة الزراعية- كلية الزراعة - جامعة الزقازيق.
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