Misr J. Ag. Eng., 24(4): 775-792 FARM MACHINERY AND POWER

SELECTING THE PROPER SYSTEMS FOR MECHANIZATION BEAN CROP IN NEW RECLAIMED LANDS

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ABSTRACT

Filed experiments were carried out to investigate some different mechanization systems for producing bean crop in new reclaimed land under Egyptian conditions. Seed bed preparation was investigated using chisel plow, moldboard plow and land leveler. Planting was investigated using both seed drill and planter comparing with the manual method. Harvesting was investigated using both self-propelled harvester and rear mounted mower at different forward speeds and different moisture contents comparing with the manual method. The obtained data revealed that, mechanical planting using seed drill, mechanical harvesting using self-propelled harvester are considered the proper systems for producing bean crop in new reclaimed land under Egyptian conditions. Sinus they recorded maximum productivity of 1.387 ton/fed and minimum cost unit of 48.3 L.E/ton. Seed moisture content of about 11.5 % and forward speed of 2.8 km/h are considered the proper conditions for harvesting bean crop as it recorded minimum seed losses of 3.41 %.

INTRODUCTION

Agriculture policy depends on the successful technology through mechanizing the agricultural processes of strategically crops. Many researches are deducing in the scope of mechanizing production processes of some crops such as: wheat, rice, soybean, peanut, balady bean, lupine and chickpea. But bean crop processes is still un-mechanized in Egypt. Beans are considered one of the most important legumes crops all over the world. The seeds of bean contain 13 to 33 % of protein, 40 to 55% of carbohydrates and 4 to 10% of oil, **Stallknecht *et al.* (1995)**. In addition, it contains vitamins A and B. It considered one of the crops which play an important role in the improvement of soil properties especially in new reclaimed lands. Bean is currently used in

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human feeding either green pods or dry seeds. More over bean residues serve as a filling material for animal feed.

Simone *et al.* (1992) evaluated two cutter bar and guard designs, three combine forward speeds and two reel indexes in order to identify the best combination for maximum field capacity and fewest losses when harvesting dry beans (*Phaseolus vulgaris L.*). Using a 76.2 mm cutter bar blade, significantly greater harvesting losses were observed at forward speeds >5.5 km/h. Using a 38.1 mm blade, there was no significant difference in losses between 4 and 7 km/h. No significant difference in losses was observed between reel speed to ground speed ratios of 1.1 and 1.2. **Heege *et al.* (1993)** examined the influence of sowing method (drilling or precision drilling) on field emergence, resistance to lodging, yield and profitability of field beans. Trials were conducted on a sandy loam soil with different share loadings (15 and 30 kg per share) and different tillage depths (7.5 and 12.5 cm). Drilling took place at a forward speed of 2.5-10.0 km/h. Results indicated that the depth of secondary cultivation should be no greater than that of seed placement. Deep placement, close row spacing, and precision drilling gave high emergence and yields. Precision drilling at 25 cm row spacing became profitable if >30 hectare were sown annually. **Sosnowski (1993)** studied of 3 *Phaseolus vulgaris* varieties (Atut with small, Igoomska with medium and Wiejska with large seeds), the resistance of seeds to mechanical damage caused by static and dynamic loads was determined in relation to moisture content with a view to minimizing losses due to mechanical harvesting. In respect of static loads, optimum moisture content intervals at which the seeds showed their greatest resistance to cracking were 14.5-16% for Atut, 17-18% for Igoomska and >19% for Wiejska. For dynamic loads the optimum moisture content was higher: 22% in Atut and 24% for the other varieties. With static loads Wiejska showed the greatest resistance to cracking of the seed, and with dynamic loads Atut had the best resistance. **Kayombo *et al.* (2002)** compared between nine tillage treatments in a sandy loam soil: hand hoeing, minimum tillage (MT), MT with mulch (MTM), mould-board plow (M), M followed by disc harrowing once, M followed by disc harrowing thrice, disc plowing (D), D followed by disc harrowing once and D followed by disc harrowing thrice (DH3). The effects of tillage treatments on soil physical conditions for the establishment of beans were better quantified by soil bulk density and soil water content rather than by cone resistance. The DH3 was found to be the best overall tillage method in relation to bean yield of all three test varieties. **Neagu *et al.* (2002)** determined the degree of kidney bean (*Phaseolus vulgaris* L.) plant dislocation and grain losses at the running speed of 5.3 km/h using three equipments with different active parts: special unilateral action knives, toothed swivel disc and double knife mower. The best results were recorded in using the special unilateral action knives while the least was observed on the toothed swivel disc. **Souza *et al.* (2002)** compared between the number of bean rows in each harvesting line (4, 7 and 10 rows), speed of harvesting (4, 7 and 10 km/h), threshing cylinder velocity (420 and 540 rpm), and seed moisture content (10.65+or-0.25 and 14.10+or-0.81%). The seed quality parameters were purity, mechanical damage, germination and vigor. The best seed germination, vigor and purity, and lowest seed damage were obtained with 14.10% seed moisture content and a threshing cylinder velocity of 420 rpm. Seed germination, vigor and purity increased with increasing feeding rate. Seed germination did not decrease with a storage time of 180 days. **Zyla *et al.* (2002)** reported that development of a new crop lifter for direct-cut harvesting narrow-row dry bean (*Phaseolus vulgaris* L.). The crop lifter employs a series of bristles mounted to the cutter bar guard that is positioned perpendicular to the direction of harvester travel. The bristles lift and tilt low-hanging bean pods away from the plant stem preventing them from being cut, thereby reducing losses. To counter the higher resistance to plant flow through the bristle-guards, two reel bat designs were evaluated on a reduced diameter parallel-state pickup reel. Although the target loss of 10% of yield in 'Othello' pinto bean was not attained, losses were as low as 15% of yield. As mentioned before, bean production still depends mainly on manual methods especially in small holdings, consuming time, cost added to the percentage of grain losses. For this reason, this work has turned toward concept of mechanizing bean production. The objectives of this work are selecting the proper seed bed preparation for producing maximum productivity of bean crop, selecting the proper methods of planting and harvesting bean crop to optimize crop yield and minimize cost of production and optimizing both seed moisture contents and machine forward speed for harvesting bean to minimize grain losses.

MATERIALS AND METHOD

The main experiments were carried out during the agricultural season of 2006 at EL-Roda Farm, Sharkia Governorate to investigate some different mechanization systems for producing bean crop (Giza 6) variety in new reclaimed land classified as a sandy loam soil as shown in table (1).

Table (1): Soil mechanical analysis:

Clay (%)	Silt (%)	Sand (%)	Soil texture
15.58	23.17	61.25	Sandy loam

(A) Materials:

The following equipments were used to accomplish the present research:

- 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 " M 34 / T " of 60 hp (44.1 k.W) engine power.

- Seed bed preparation machines and equipments:

1- Chisel plow 7 tines, with working width of 175 cm.

2- Mould -board plow 3 boards, with working width of 125 cm.

3- Land leveler, with working width of 305 cm.

- Planting machines:

1- Seed drill 21 rows, model Colorado with working width of 240 cm.

2- planter four rows, type John-Deere with working width of 240 cm.

- Harvesting machines:

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

2- Self-propelled harvester model GS 130-2 CN with cutting width 120 cm and 3.4 hp (2.5 k.W) engine power.

(B) Method:

The first experiment:

The first experiment was detected to select a suitable seed bed preparation system for bean crop the experimental area was about 3.5 feddans divided into four equal plots namely (T1, T2, T3 and T4).

Treatment **T1**: Chisel plough one pass and land leveler.
Treatment **T2**: Chisel plough two passes and land leveler.
Treatment **T3**: Mould board plough and land leveler
Treatment **T4**: Moldboard plough, chisel plough one pass and land leveler.

The second experiment:

The same experimental area of two feddans divided into 27 equal plots having dimensions of (3.5 × 90) m per each for planting and harvesting bean crop. 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 and manual harvesting.

B: Manual planting and mechanical harvesting by self-propelled harvester.

C: Manual planting and mechanical harvesting by tractor mounted mower.

D: Mechanical planting by seed drill and manual harvesting.

E: Mechanical planting by seed drill and mechanical harvesting by self-propelled harvester.

F: Mechanical planting by seed drill and mechanical harvesting by tractor mounted mower.

G: Mechanical planting by planter and manual harvesting.

H: Mechanical planting by planter and mechanical harvesting by self-propelled harvester.

I: Mechanical planting by planter and mechanical harvesting by tractor mounted mower.

The treatment **A** is considered as conventional method. All the experimental plots were treated by treatment (**T4**) 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 (10 cm), respectively. Both manual and mechanical methods require about (40 kg / fed) of seeds. The planting depth was adjusted to be (4 cm) at forward speed of (4 km/h). Surface 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 about 18.3, 15.2, 11.5 and 8.8 % at different workable speeds of 1.5, 2.8, 4.1 and 5.4 km/h.

(C) Measurements:

Some soil physical properties were measured such as, moisture content, soil bulk density and soil penetration resistance.

● ***Soil penetration resistance:***

A Japanese penetrometer was used to measure the penetration resistance.

Soil penetration resistance was calculated according to the following formula:

$$R = F / A \quad \ldots\ldots\ldots\ldots(1)$$

Where:

R = Resistance of soil compaction, kg/cm^2.

F = Force required, kg.

A = Cone area of penetrometer, cm^2.

● ***Soil Bulk density:***

The bulk density was calculated by using the following equation:

$$Pb = m_b / v_b \,, \quad \ldots\ldots(2)$$

Where:

Pb = Soil bulk density, gm/cm^3.

m_b = Dry weight of the foil in the container, gm.

v_b = Volume container, cm^3.

●***Field capacity:***

Actual field capacity was the actual average time consumed during digging operation (lost time + productive time). It can be determined from the following equation:

$$F.C_{act} = \frac{60}{Tu + Ti}\,, \quad (fed / h) \quad \ldots\ldots\ldots(3)$$

Where:

$F.C_{act}$ = Actual field capacity of the cutting machine.

T_u = Utilization time per feddan in minutes.

T_i = Summation of lost time per feddan in minutes.

● ***Field efficiency:***

Field efficiency is calculated by using the values of the theoretical field capacity and effective field capacity rates as:

$$\eta_f = \frac{F.C_{act}}{F.C_{th}} \times 100\,, \ (\%) \quad \ldots\ldots\ldots\ldots(4)$$

Where:

η_f = Field efficiency, %.

● ***Energy consumed:***

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

$$EP = [f.c.(1/3600)PE \times L.C.V. \times 427 \times \eta_{thb} \times \eta_m \times 1/75 \times 1/1.36],\ kW \quad \ldots.(5)$$

So, the power can be calculated as following:-

Where:-

f.c. = Fuel consumption, (*l*/h).

PE = Density of fuel, (kg/*l*), (for gas oil = 0.85 and benzene = 0.72).

L.C.V. = Lower calorific value of fuel, (11.000 k.cal/kg).

η_{thb} = Thermal efficiency of the engine (35 and 25%) for Diesel and Otto).

427 = Thermo-mechanical equivalent, (Kg.m/k.cal).

η_m = Mechanical efficiency of the engine (83 % for diesel).

Hence, the specific energy consumed can be calculated as follows:-

$$Consumed\ energy = \frac{Engine\ power, (kW)}{Field\ capacity, (fed/h)},\ kW.h/fed \quad \ldots\ldots\ldots(6)$$

● ***cost analysis:***

Machine cost was determined by using the following equation **(Awady 1978):**

$$C = \frac{P}{h}\left(\frac{1}{a} + \frac{i}{2} + t + r\right) + (0.9W.S.F) + \frac{m}{144} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(7)$$

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 = 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

The data obtained from the field experiments aimed to evaluate some different mechanization systems for producing bean crop in new reclaimed lands. Results and discussion will be presented under the following items:

1-Results of different seed bed preparation:

1-1- Field capacity and field efficiency of different tillage methods:

Field capacity and field efficiency of significantly varies from one tillage machine to another Fig. (1) due to wide variation of both working width and working speed of each machine results show that field capacity values were 1.35,1.66,0.98 and 2.41 fed/h for chisel plow one pass, chisel plow two passes, mould board plow and land leveler, respectively. While field efficiency values were 81.32, 84.69, 86.73 and 83.10 % under the same previous conditions.

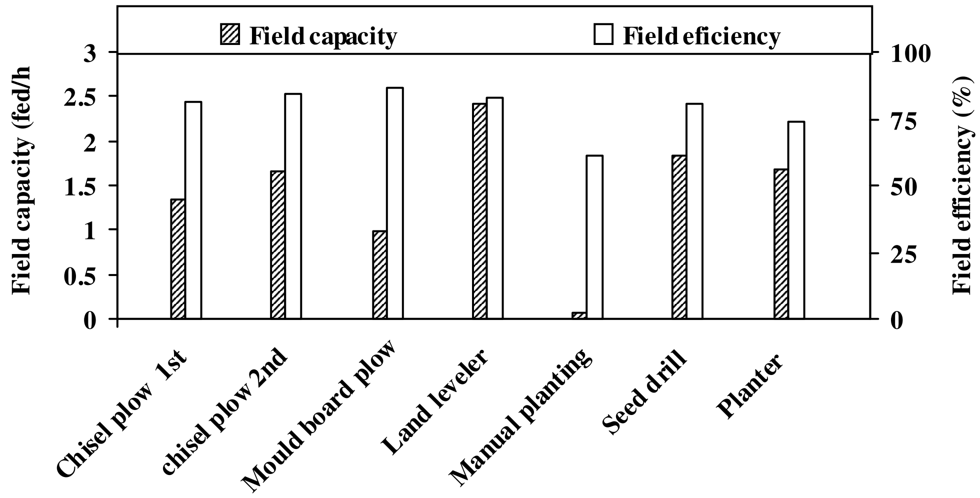

Fig.(1): Field capacity and field efficiency of different tillage methods and planting machine.

1-2- Effect of different seed bed preparation on some soil physical properties:

Virtually the tillage operations was carried out for the purpose of developing soil structure favorable to plant growth by losing and pulverizes soil particles to improve soil physical properties porosity, void ratio, aggregates and infiltration rate and thus, high percentage of germination will be obtained. The considered soil properties are soil bulk density and soil compaction. The soil bulk density was determined before and after each operation. Fig.(2) show the average reduction for soil bulk density, (%) and average reduction for soil penetration resistance (%). Bulk density generally decreased due to tillage and other treatments considered in seed-bed preparation with the exception of land leveling the maximum percentage of reduction in bulk density of 17.65 % was observed under treatment (**T4**) (moldboard plough, chisel plough one pass and land leveler). This can be explained by the fact that the density decreased by increasing the number of implements passes or tillage procedures involved in the treatment. On the other hand, treatment (**T1**) recorded the lowest percentage of reduction in bulk density of 10.52 % due to eliminating chisel plough one pass and land leveler. Soil compaction was measured by using the soil penetrometer before and after each tillage operation in all treatments the maximum reduction in soil penetration resistance was 68.67 % under treatment (**T4**), while the minimum reduction was 51.89 % under treatment (**T1**).

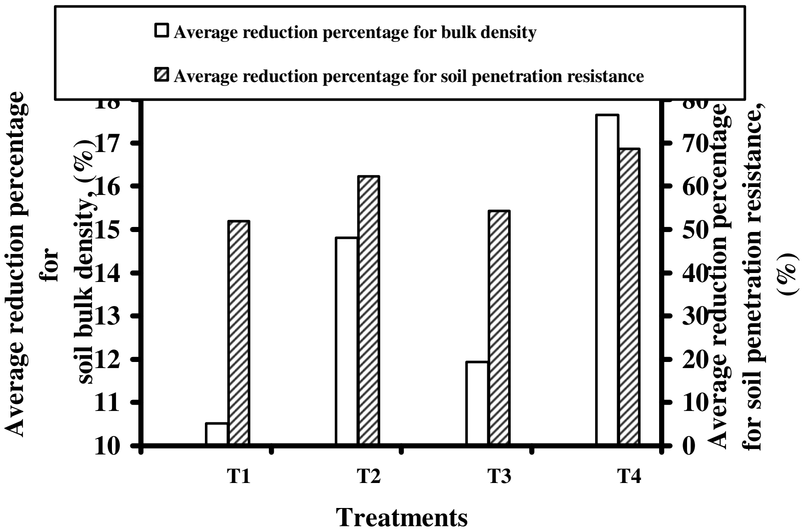

Fig.(2): Average reduction percentage in bulk density and soil penetration resistance after each operation.

1-3-Effect of different seed bed preparation on total yield of bean:

Bean yield is greatly affected by tillage treatment with manual planting. Results show that the average values of seed yield were 1127, 1178, 1152 and1276 kg/fed under treatment (**T1**), (**T2**), (**T3**) and (**T4**), respectively.

It is obvious from the above analysis of the four seed bed preparation systems under test, treatment (**T4**), (moldboard plough, chisel plough one pass and land leveler) is considered the optimum system for preparing soil for bean because the optimum values of bulk density, soil penetration resistance and the maximum values of bean yield.

2-Results of different planting methods:

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

Field capacity and field efficiency of significantly varies from one planting methods Fig. (1) due to wide variation of both working width and working speed of each methods results show that field capacity values were 0.076,1.83 and 1.69 fed/h for manual planting, seed drill and planter, respectively. While field efficiency values were 61.29, 80.26 and 74.12 % under the same previous conditions.

2-2-Effect of different planting methods on some plant characteristics:

Planting method has a great effect on the plant features such as: emergence period, germination ratio, uniformity distribution, plant population, stem length, number of branches per plant, weight of 1000 seed per gm and crop yield per kg/fed. It was observed in Table (2) that the minimum emergence period of 8 days was remarked under seed drill. The emergence period increased to 9 and 11 days under manual planting and planter, respectively. This is due to the fact that the depth of planting could not be thoroughly adjusted. Table (2) shows that the maximum germination ratio of 98% was remarked under the manual method. The germination ratio decreased to 96.5 and 91.2% under seed drill and planter, respectively. That is due to the fracture of the seed and the seed feeder under the planting machines, resulting in cracked seeds. Table (2) shows that distribution uniformity values were 17.38, 11.73 and 26.33 % using manual planting, seed drill and planter, respectively. That is due to the fact that controllable in the seeds spacing under seed drill from planter machine and manual planting. Table (2) shows that the highest plant population of 18.6 plant/m^2 was noticed under manual planting. While it decreased to 15.5 and 13.8 plant/m^2 under seed drill, respectively. This is due to the high germination ratio of manual planting comparing with seed drill and planter. Table (2) shows that the maximum stem length of 54.6 cm was noticed under manual planting. While it decreased to 51.4 and 48.7 cm under seed drill and planter, respectively. Crowded bean plants in the manual planting lead to increase stem length. Table (2) shows that manual planting decreased number of branches by 27.45 and 11.90 % comparing with seed drill and planter, respectively.

Table (2): Effect of planting methods on plant characteristic.

Planting methods	Emergence (Period/day)	Germination ratio (%)	Uniformity distribution. C.V. (%)	Plant population (plant/m^2)	Stem length (cm)	Number of branches per (plant)	Weight of 1000 seeds per (gm)	Number of seeds per plant	Crop yield per (ton/fed)
Manual	**9**	**98**	**17.38**	**18.6**	**54.6**	**3.7**	**504.3**	**61.6**	**1.298**
Seed drill	**8**	**96.5**	**11.73**	**15.5**	**51.4**	**5.1**	**526.7**	**67.4**	**1.387**
Planter	**11**	**91.2**	**26.33**	**13.8**	**48.7**	**4.2**	**497.5**	**56.3**	**1.258**

This may be due to the plant density. Plants growing in high densities are taller and little branches. Table (2) Show that the average weight of 1000 grains were 504.3, 526.7 and 497.5 gm under manual planting, seed drill and planter, respectively. Table (2) shows that the maximum number of seeds per plant of 67.4 seeds was remarked under seed drill. The number of seeds per plant decreased to 61.6 and 56.3 seeds under the manual planting and planter, respectively.

2-3-Effect of different planting methods on total yield of bean:

Table (2) show that the average values of bean yield obtained were 1.298, 1.387 and 1.258 ton/fed under manual planting, seed drill and planter, respectively. So, mechanical planting using seed drill is the advisable method for planting bean because of its high resulting yield.

3-Results of different harvesting methods:

3-1- Field capacity and field efficiency of different harvesting methods:

Fig.(3) show that the effect of forward speed on both field capacity and 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 5.4 km/h. increased the field capacity values from 0.384 to 1.057 fed/h and from 0.424 to 1.24 fed/h for self-propelled harvester and rear mounted mower, respectively. On the other hand, increasing forward speed from 1.5 to 5.4 km/h decreased the field efficiency values from 89.51 to 68.54 % and from 82.46 to 64.31 %, under the same previous conditions. While, field capacity and efficiency of manual harvesting were 0.022 fed/h and 73.33 % under forward speed 0.21 km/h. 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 2.8 Km/h is recommended because increasing it more than 2.8 to 5.4 km/h decreased field efficiency, while decreasing it less than 2.8 to 1.5 Km/h decreased field capacity.

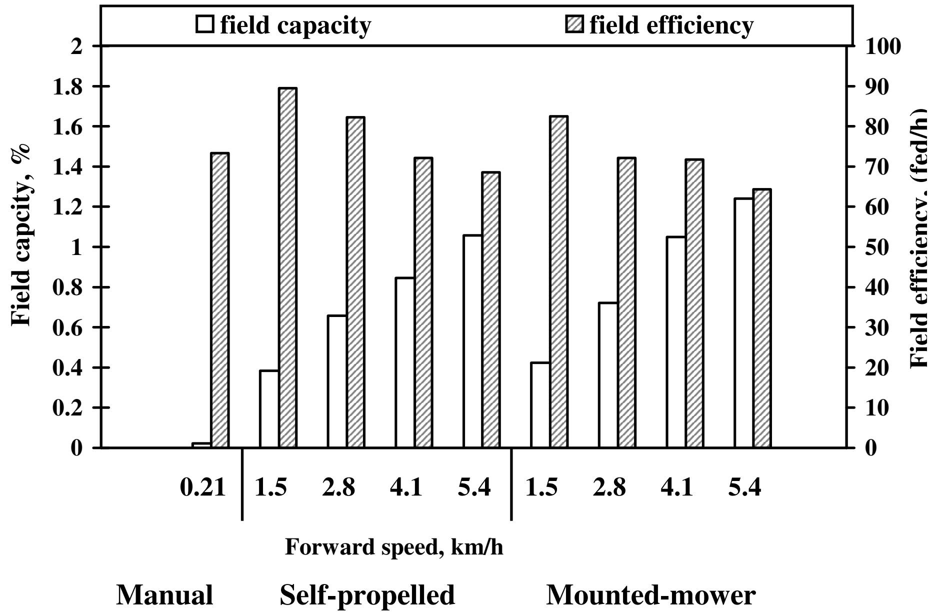

Fig.(3): Effect of harvesting speed on field capacity and efficiency at different harvesting methods.

3-2- Effect of different harvesting methods on harvesting losses:

The main effective parameters under test, which affect the harvesting losses, are: forward speed and seed moisture content. Concerning the effect of forward speed on harvesting losses, Fig.(4) shows that harvesting losses increased by increasing forward speed at any planting method. In the manual harvesting at forward speed of 0.21 km/h and seed moisture content of 11.5 %, seed losses were 1.32, 1.12 and 1.87 % under manual planting, seed drill and planter, respectively. The minimum losses in manual harvesting are due to the uniform plants in the unit area which enable the worker to collect them easily. In the mechanical harvesting using self- propelled harvester, increasing forward speed from 1.5 to 5.4 km/h at moisture content of 11.5 % increased seed losses 2.71 to 7.43 % 2.26 to 6.34 % and 2.95 to 8.21 % under manual planting, seed drill and planter, respectively. In The mechanical harvesting using tractor-mounted mower, increasing forward speed from 1.5 to 5.4 km/h at moisture content of 11.5 %, increased seed losses from 3.05 to 8.32 %, 2.84 to 7.27 % and 3.37 to 8.92 % 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. A Forward speed of 2.8 km/h is recommended because increasing it more than 2.8 to 5.4 km/h decreased field efficiency, while decreasing it less than 2.8 to 1.5 km/h decreased field capacity.

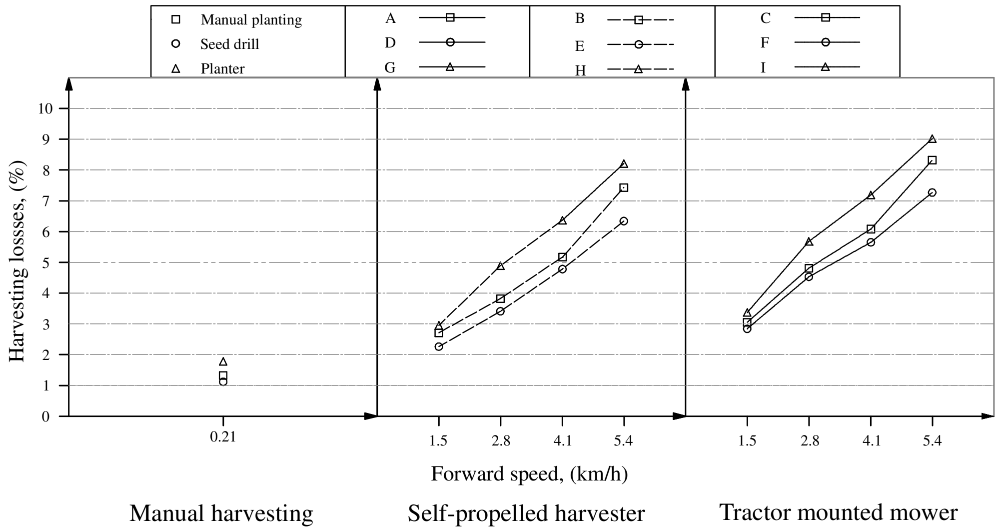

Fig.(4): Effect of harvesting method on seed losses under different machine forward speed.

Relating to the effect of seed moisture content on harvesting losses, Fig.(5) shows that increasing seed moisture content, decreased harvesting losses up to 11.5 %. Any further moisture content increase, up to 18.3 % increased harvesting losses. In the manual harvesting, increasing moisture content from 8.8 to 11.5 %, decreased harvesting losses from 3.11 to 1.32 %, 2.31 to 1.12 % and 3.83 to 1.87 % under manual planting, seed drill and planter, respectively. In the mechanical harvesting using self-propelled harvester, increasing moisture content from 8.8 to 11.5 %

decreased harvesting losses from 5.84 to 3.82 %, 5.28 to 3.41 % and 6.93 to 4.59 % under the same previous conditions. In the mechanical harvesting using tractor mounted-mower, increasing moisture content from 8.8 to 11.5 %, decreased harvesting losses from 6.87 to 4.81 %, 6.14 to 4.53 % and 7.91 to 5.68 % under the same previous conditions. Moisture content of 11.5% is recommended in order to minimize losses under mechanical harvesting methods.

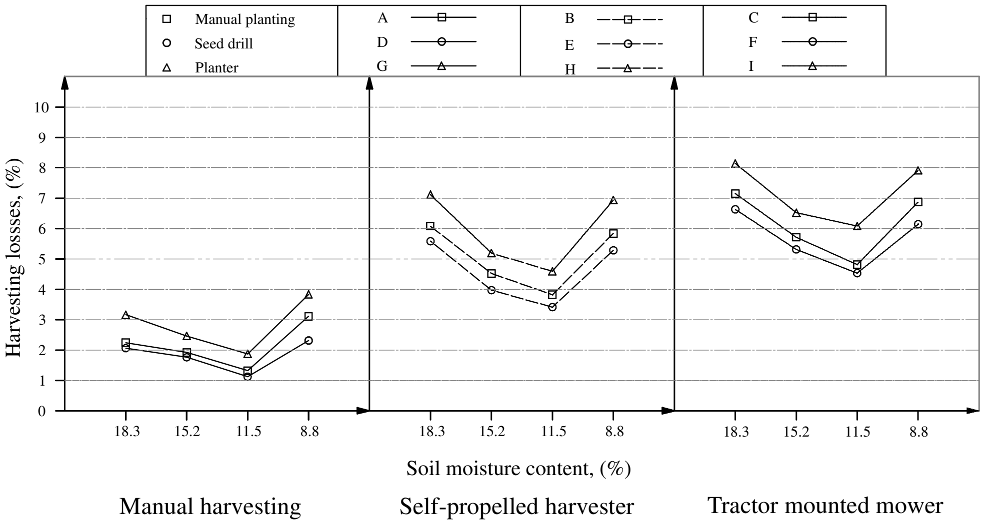

Fig.(5): Effect of harvesting method on seed losses under different soil moisture contents.

4- Energy requirements for different bean mechanization systems:

Fig.(6) show that the total energy requirements to produce one ton of bean can be arranged in descending order as follows: **I**, **F**, **C**, **G**, **H**, **D**, **E**, **A**, and **B**. It is clear that the treatment **I** (Mechanical planting by planter and mechanical harvesting by tractor mounted mower) after treatment (T4) required the highest value of energy (64.41 kW.h/ton), while treatment **B** (Manual planting and mechanical harvesting by self-propelled harvester) after treatment (**T4**) required the lowest value of energy (39.21 kW.h/ton).

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.(7) 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: 177.38, 165.58, 146.22, 93.13, 77.11, 74.48, 66.13, 58.03 and 48.30 L.E./ton for treatments of **A**, **G**, **D**, **C**, **I**, **B**, **F**, **H** and **E**, respectively. From this results, it is evident that treatment **E** (Mechanical planting by seed drill and mechanical harvesting by self-propelled harvester) after treatment (**T4**) recorded the lowest value of cost per unit of production 48.30 L.E/ton.

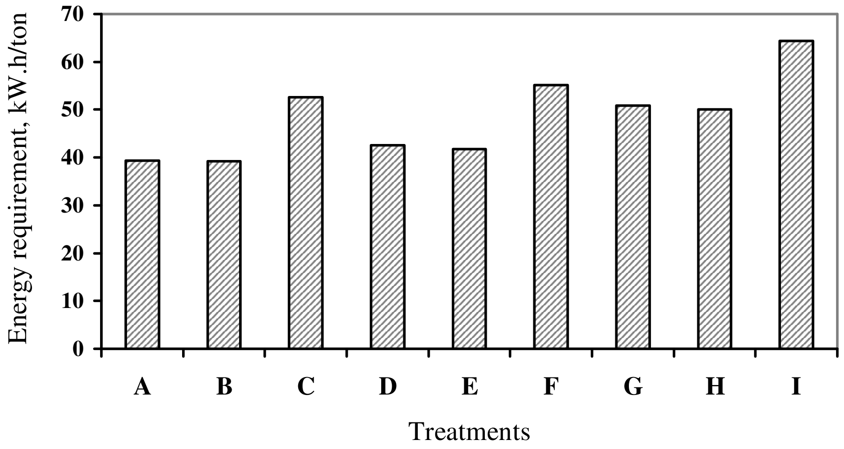

Fig.(6): Energy requirements to produce one ton of bean yield under different treatments.

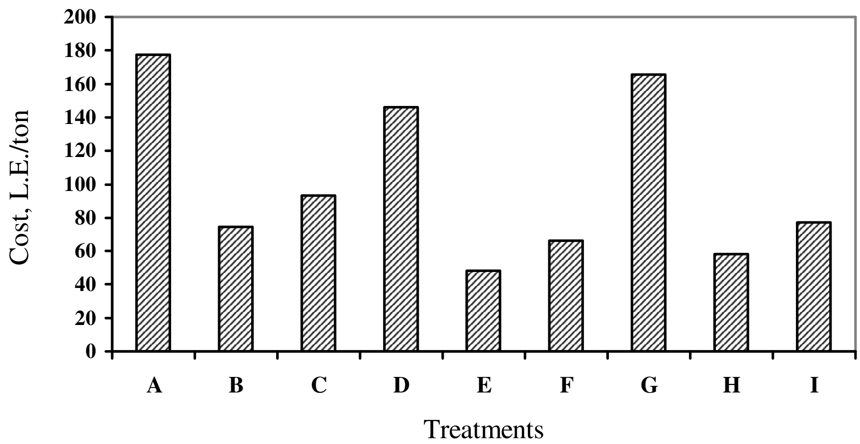

Fig.(7): Cost requirements to produce one ton of yield under different treatments.

CONCLUSION

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

1- Treatment **T4** (Moldboard plough, chisel plough one pass and land leveler) is recommended for producing bean crop in new reclaimed lands as it recorded the suitable values of soil bulk density and penetration resistance comparing with other treatments.

2- Treatment **E** (Mechanical planting by seed drill and mechanical harvesting by self-propelled harvester) after treatment **T4** is recommended for bean production under Egyptian conditions as it required minimum cost of 48.30 L.E./ton comparing with the other treatments.

3- Seed moisture content of 11.5 % and forward speed of 2.8 km/h are recommended for harvesting bean crop as it recorded minimum seed losses.

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الملخص العربـي

اختيــار أنســب النظــم الآليــة لميكنــة إنتــاج محصــول الفاصوليــا في الأراضـي المستصلحـة حديثـاً

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أجريت العديد من التجارب الحقلية لاختيار أنسب النظم لميكنة عمليات إعداد مرقد البذرة والزراعة والحصاد لإنتاج لمحصول الفاصوليا في الأراضي المستصلحة حديثاً خلال موسم 2004-2005 في مساحة 3.5 فدان في إحدى المزارع الخاصة بقرية الروضة - مركز فاقوس - محافظة الشرقية.

وكانت أهداف الدراسة:

1- اختيار أنسب طريقة لإعداد مرقد البذرة والتي تعطي أفضل مواصفات للتربة وأعلى إنتاجية.

2- اختيار أنسب طريقة لزراعة الفاصوليا والتي تعطي أفضل انتظامية لتوزيع البذور وتحقق أعلى إنتاجية.

3- اختيار أنسب طريقة لحصاد الفاصوليا عن طريق دراسة تأثير المحتوى الرطوبي للبذور والسرعات المختلفة على الفواق الحقلية عند الحصاد.

وقد أجريت التجربة باستخدام المعاملات الآتية:

أ- معاملات إعداد مرقد البذرة:

- (**T1**) محراث حفار وجه واحد + تسوية.
- (**T2**) محراث حفار وجهين + تسوية.

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- (**T3**) محراث قلاب مطرحي + تسوية.
- (**T4**) محراث قلاب مطرحي + محراث حفار وجه واحد + تسوية.

ب- معاملات الزراعة والحصاد:

تمت هذه المعاملات مع (**T4**) وهي أفضل معاملة لإعداد مرقد البذرة.

-(A) زراعة يدوى + حصاد يدوى.
-(B) زراعة يدوى + حصاد بالمحشة الذاتية.
-(C) زراعة يدوى + حصاد بالمحشة الخليفة للجرار.
-(D) زراعة آلية بالسطارة + حصاد يدوى.
-(E) زراعة آلية بالسطارة + حصاد بالمحشة الذاتية.
-(F) زراعة آلية بالسطارة + حصاد بالمحشة الخلفية للجرار.
-(G) زراعة آلية بآلة الزراعة في جور+ حصاد يدوى.
-(H) زراعة آلية بآلة الزراعة في جور + حصاد بالمحشة الذاتية.
-(I) زراعة آلية بآلة الزراعة في جور + حصاد بالمحشة الخلفية للجرار.

وقد تم تقييم المعاملات من حيث:

1- تأثير السعة والكفاءة الحقلية لطرق الإعداد والزراعة والحصاد المختلفة.
2- تأثير طرق الإعداد على مواصفات التربة من حيث الكثافة الظاهرية ومقاومة الاختراق.
3- تأثير طرق الزراعة على بعض صفات النبات وعلى إنتاجية المحصول.
4- تأثير طرق الحصاد المختلفة على الفواقد عند السرعات المختلفة للآلات المستخدمة ونسب الرطوبة المختلفة للبذور.
5- الطاقة المطلوبة للعمليات المختلفة لميكنة محصول الفاصوليا.
6- التكاليف المطلوبة للعمليات الآلية المختلفة لمحصول الفاصوليا.

ومن خلال النتائج تم التوصل إلى التوصيات الآتية:

1- يوصى باستخدام المعاملة (**T4**) لإعداد مرقد البذرة وهي محراث قلاب مطرحي يليه محراث حفار وجه واحد ثم التسوية لإنتاج محصول الفاصوليا في الأراضي المستصلحة حديثاً حيث أعطت أفضل المواصفات لمرقد البذرة مما أدى إلى تحسين صفات النبات وبالتالي زيادة المحصول.
2- يوصى باستخدام المعاملة (**E**) وهى (الزراعة بالسطارة يليها الحصاد بالمحشة الذاتية) حيث أعطت أعلى إنتاجية للفدان وهي 1.387 طن/فدان مما أدى إلى خفض التكاليف الازمة لإنتاج الطن من المحصول وهو 48.30 جنيه/طن، مقارنة بباقي المعاملات المستخدمة.
3- يوصى بحصاد محصول الفاصوليا عند نسبة رطوبة 11.50% وسرعة أمامية لآلة الحصاد 2.8 كم/س حيث أنها سجلت أقل قيمة للفواقد الحقلية للبذور.