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MECHANIZATION OF ROSELLE CROP PRODUCTION UNDER EGYPTIAN CONDITIONS

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ABSTRACT: The main experiments were carried out during the agricultural season of 2004 at Kafr El-Hamam farm, Sharkia Governorate to investigate some different mechanization systems for producing roselle crop (sabdariffa) under Egyptian conditions.

The experimental area was about one fedden divided into 36 equal plots having dimensions of (2.4 x 50) m per each.

Four seedbed perpatration treatments, namely T1, T2, T3 and T4 were carried out and replicated three times in a completely randomized block design. T1: chisel plough (two Passes) +land leveling, T2: chisel plow (two Passes) + rotary + land leveling, T3: moldboard + rotary + land leveling and T4: moldboard + chisel plow (one pass) + rotary +land leveling.

Roselle crop was planted using three methods as follows:
P1:manual planting, P2: seed drill machine and P3: pneumatic planter.

The results obtained from the present investigation could be summarized as follows:

1. **It is recommended to mechanize Roselle crop production to maximize its yield.**
2. **It is recommended to use treatment T_4 [moldboard plow + chisel plow (one pass) + rotary + land leveler] for Roselle seedbed preparation to improve soil physical properties.**
3. **It is recommended to plant Roselle using the planter to increase yield.**

Key words: Seed bed preparation, planting methods , medical plants and Roselle seeds.

INTRODUCTION

It is evident that improving agriculture production depends mainly on using improved methods and up to date technology through all different agricultural processes. Selections of the appropriation qualitative and quantitative needs concerning agricultural mechanization of any crop is of great importance to minimize cost.

Many researches are running in the scope of mechanizing production processes of some crops such as wheat , rice, soy been , peanut, balady been and others. But roselle crop processes is still un mechanized.

Roselle crop is currently used in the industry of medical products and serve as a medicine for people instead of chemical medicines. More Over, roselle stems server in the fiber production added to that oil can be extracted from its seeds.

According to the statistics of the center Authority for agricultural Economy in 2004, the planted area of roselle crop was about 644 feddan producing 330 ton.

El - Shal (1987) found that the pneumatic planter was produced high uniformity and high yield. He added the pneumatic planter is too effective for all seeds and grains.

Younis et al. (1991) compared between manual, mechanical drilling and machine transplanting methods. They found that mechanical drilling recorded the minimum total cost (65L. E / ton) and maximum net profit (135 LE/ton). They concluded that the mechanical drilling method unconsidered appropriate methods.

Whel (1993) studied the cost of tillage operation as reported in the official govemement and announcements, chisel plow tow passes was 25 L.E/fed., sub soiling (3times) 36 L-E/fed and / land leveler (3 m width) 20 L- E/ Fed.

El - Sayed and Ismail (1994) studied the effect of Tillage techniques (traditional, minimum and improved tillage) on the soil penetration resistance. For pre – tillage condition 91.53 N/cm^2 at soil surface, while it was (12.39, 19.62 and 10.87 N/cm^2) after tillage techniques (traditional, minimum and improved tillage) respectively and they found the energy required under different tillage required was obtained with chisel plow area while. The minimum energy required was obtained with under improved tillage (twice chisel plow + disking harrow + leveling) and at minimum tillage (twice disking harrow + leveling), the minimum of value was 25.13 kw. h/ fed.

Abd El Maksoud et al. (1995) found the mechanical methods reduce soil compactness, soil bulk density and soil moisture content. Mechanical planting gives best distribution of seeds on soil and less cost and suitable of depth, that under pneumatic planter.

Abdou (1995) found that the bulk density increased with increasing tillage time and with increasing depth to planting the emergence ratio was decreased and he added the moldboard plow followed by disking given the maximum of crop production, so the chisel plow (twice) and mechanical planting lead to increasing crop production.

Abdou (1996) showed that the use of chisel plow two passes at 18 cm depth gave grain and straw yields 14.7– 22.7 % higher than the same operation at 10 cm depth of 31.6–3.6 % under manual and mechanical planting, respectively and also showed that the use of the disk harrow or rotary plough after chisel plough of one pass gave a higher yield of grain of 3 % and 6.1 % and straw 26.8 % and 2.5 % compared with chisel plough in two passes at the same depth, respectively

Abdul-Elah (1996) found that the soil bulk density decreased for all tillage methods. Increasing implement speed slightly increases bulk density value but less than no-tillage treatment.

Abd El – Aal (1998) found that the weight of 1000 seeds was affected by different tillage treatments. For sunflower yield showed that mean weight 1000 seeds was found (50.69, 96.55 and 90.90 gm). For the treatment of moldboard plow followed by scraber, chisel plow (one pass) followed by scraber and rotary plow respectively.

Magdy (1998) found that the energy requirement effected by tractor forward speed for all equipment tractor attached with moldboard plow, disc plow, disc harrow and ridger were used. Increasing the forward speed from 4.0 to 6.4 k m/h, the energy requirement was increased from 77.72 to 109.4 kW.h, 46.59 to 68.20 kW.h, 60.35 to 88.20 kW.h, 41.08 to 48.5 kW .h respectively.

Khadr et al. (1998) showed that the soil penetration resistance has a good indication about soil physical properties. The decreases of soil penetration resistance allows the roots of the plants easy to penetrate the soil . the soil penetration specific resistance decreases with depth of soil, this may return to the increase of soil moisture content with the increase of depth. They Added also used chisel plough (two passes) followed by disk

harrow, moldboard plough followed by rotary the effect of different tillage speeds and depth on soil physical properties. The soil bulk density, porosity, penetration resistance mean weight diameter (MWD), soil pulverization and yield response. The soil bulk density was compared before and after tillage and the data indicated that, the soil bulk density was decreased by 18.81%, 21.19% and 12.65% for chisel plough, mold board plough and rotary plough, respectively.

Younis *et al.* (2000) found that the fuel and energy consumption by chisel plow one face, chisel plow two faces, land leveler were 4.96 , 4.66 and 6.55 L. E/h. And 47.88, 36.07 and 43.96 kW/fed. Under average speed 3.31, 3.72 and 4.79 km / h., respectively.

Lotfy (2003) showed that the highest yield systems with minimum power requirement and lowest cost noticed by using pneumatic planter under system for seedbed preparation (chisel plow tow passes + rotary tiller + land leveler).

The objective of this research are:

1- Selecting the proper seed bed preparation system for producing roselle with optimum soil physical properties.
2- Selecting the proper planting methods for producing roselle with maximum yield.
3- Evaluating different seed bed preparation systems and planting methods from the economic point of view.

MATERIALS AND METHODS

The main experiments were carried out during the agricultural season of 2004 at Kafr El-Hamam farm, Sharkia Governorate to investigate some different mechanization systems for producing Roselle crop (sabdriffa) under Egyptian conditions. The experimental area was about one fedden divided into 36 equal plots having dimensions of (2.4 x 50) m per each. The mechanical analysis of the experimental soil was classified as clay soil.

Materials

Roselle Seeds: *Hibiscus sabdariffa*, L. *(Malvaceae)* was obtained from Horticulture research Institute "medical and Aromatic plants section" at Dokki, A.R.C the germination ratio for seeds was (90.3 %)

Two types of tractors: were used to oprate and draw the used equipment they were Romanian and Japanese.

Moldboard: TUFLINE Dp23, Three bottoms, working width 125cm.

Chisel plow: Locally made 9 tines working width 150 cm and the mass 200 k.g.

Rotary plow: mounted, working width 125 cm, working hydraulically and total mass 120 k.g.

Land leveller: working width 305 cm, hydraulic and total mass 370 cm

Two different planting machines:: were used in this study namely seed drill and pneumatic planter.

Methods

Seed Bed Preparation Methods

An area of one feddan of Roselle (Sabdraiffa) was divided into 36 equal plots having dimensions of (2.4 x 50m) per each. T1: chisel plough (two passes) +land leveling, T2: chisel plow (two Passes) + rotary plow + land leveling, T3: moldboard + rotary plow+ land leveling and T4: moldboard + chisel plow (one pass) + rotary plow +land leveling.

Roselle crop was planted using three methods as follows:

P1: Manual planting, P2: Seed drill machine and P3: Pneumatic planter.

RESULTS AND DISCUSSION

Field Capacity and Field Efficiency for Different Seed Bed Preparation System

The field capacity values was (1.0 , 0.37 , 0.85 , 0.67 , 0.5, 2.0 and 1.5 fed. /h) for chisel plow (one pass), chisel plow (two pass), mould board plow, rotary plow, land leveler, seed drill, and pneumatic planter) respectively. The obtained values of field efficiency were (70, 84, 72, 75, 69, 70 and 68%) under the same machine, respectively.

The minimum value of the soil bulk density 1.18 kg/ cm^3 was observed after [moldboard plow + chisel plow (one pass) rotary plow + land leveller] .

Soil penetration resistance also decreased due to tillage treatments. The minimum value of soil penetration resistance of 1.79Mpa was observed after [moldboard plow + chisel plow (one pass) + rotary plow + land leveler].

Effect of Planting Methods on Some Plant Characteristics

The study included the following items:

Germination ratio, emergence period, uniformity distribution stem length number of branches, number of capsules and number of seeds.

(a) The highest rate of germination was 90.3 % under manual planting . while they were (90 and 87%) under pneumatic planter and seed drill , respectively.

(b) The highest rate of emergence ratio was (84.5 , 84 and 83.3 %) using treatment 4 under planting methods manual, pneumatic planter and seed drill, respectively (Fig. 1).

(c) Uniformity distribution values were (48.7 , 38.3 and 24.21) using pneumatic planter, seed drill and manual planting respectively.

(d) Stem length was (1.82 m) under pneumatic planter while length were (1.58 and 1.56 m) under manual planting and seed drill respectively (Fig. 2).

(e) The highest number of branches per plant was (18.2 under pneumatic planter using treatment 4 with they decreased (10.1and 9.8) under. Manual planting and seed drill using treatment 3 (Fig. 3).

(f) The highest number of capsules was 95 under pneumatic planter using treatment 4, while the lowest was 68 under seed drill using treatment (Fig. 4)

(g) The minimum weight of capsules were 0.197 gm / capsules under manual planting using treatment 1, while these values increased (0.281 and 0.285 gm / capsules) under pneumatic planter using treatment 1 and treatment 4 (Fig. 5)

(h) The highest number of seed per plant were 2280 seed under pneumatic planter using treatment 4 , while the lowest were (1656 and 1632 seed) under manual planting and seed drill using treatment 1, respectively (Fig. 6).

Effect of Seed Bed Preparation and Planting Methods on Roselle Yield

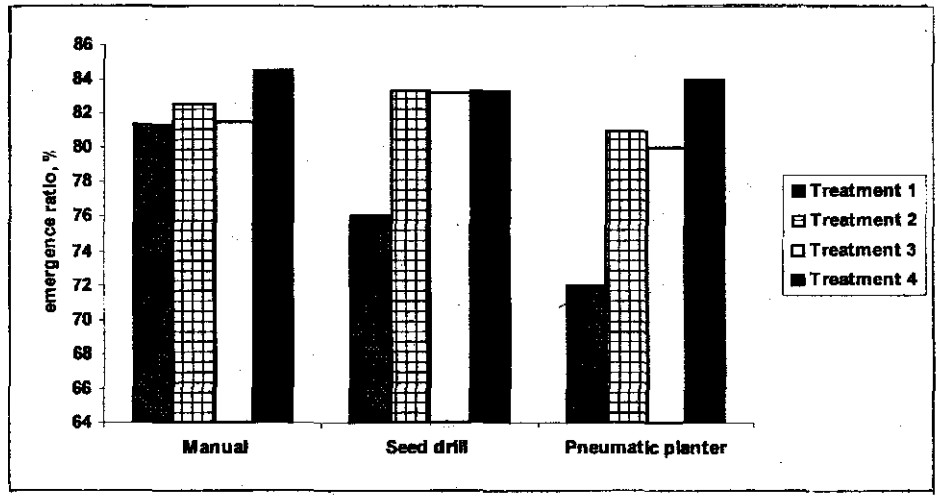
The maximum values of yield obtained were 605.3 , 552.1 and 510.8 kg / fed under pneumatic planter, manual planting and seed drill, respectively using treatment 4 (Fig. 7).

Energy Requirements for Different Mechanization Systems

The highest total energy were 87.87, 82.54 and 81.7 kW . h/ fed using pneumatic planter, seed drill and manual planting respectively using treatment 4. They were 57.65, 52.32 and 51.48 kW. h / fed using the same systems under treatment 1 (Fig. 8).

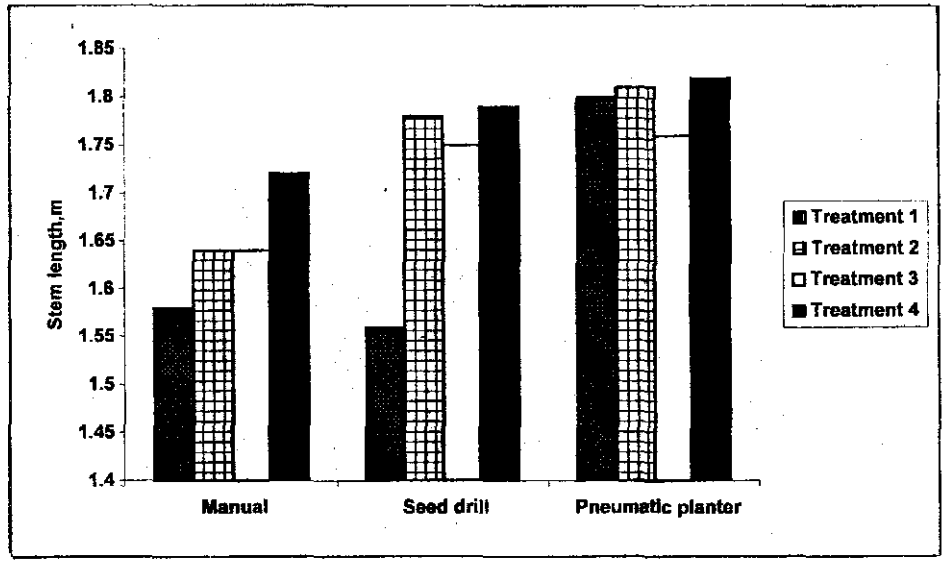
Cost Requirement Analysis for Roselle Yield Production

The highest specific cost per kg was 0.262 L . E / kg under manual planting and the least was 0.223 L . E / kg under pneumatic planter (Fig. 10).



Planting operations

Fig.1. Effect of seed bed preparation and planting methods on emergence ratio %.



Planting operations

Fig. 2. Effect of seed bed preparation and planting methods on stem length.

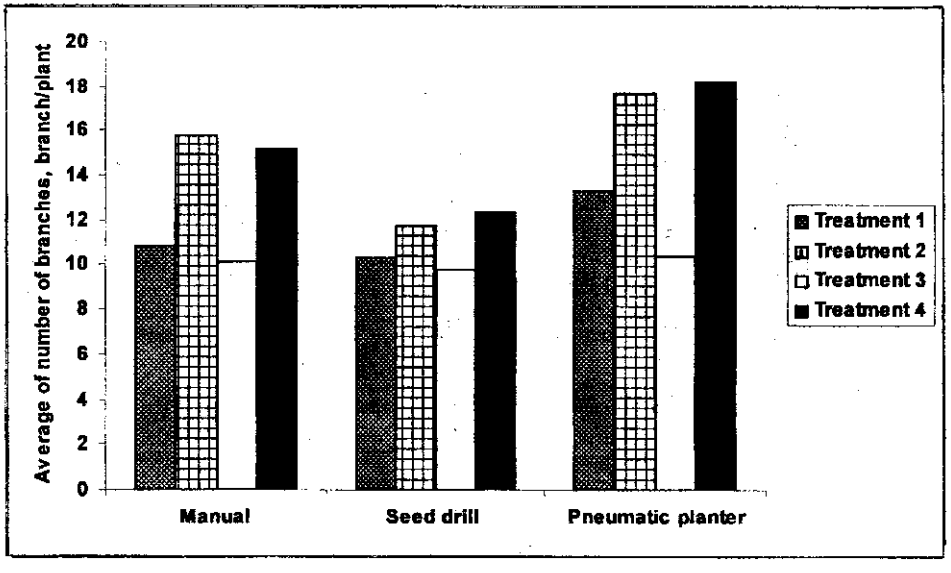


Fig. 3. Effect of seed bed preparation and planting methods on number of branches, branch / plant.

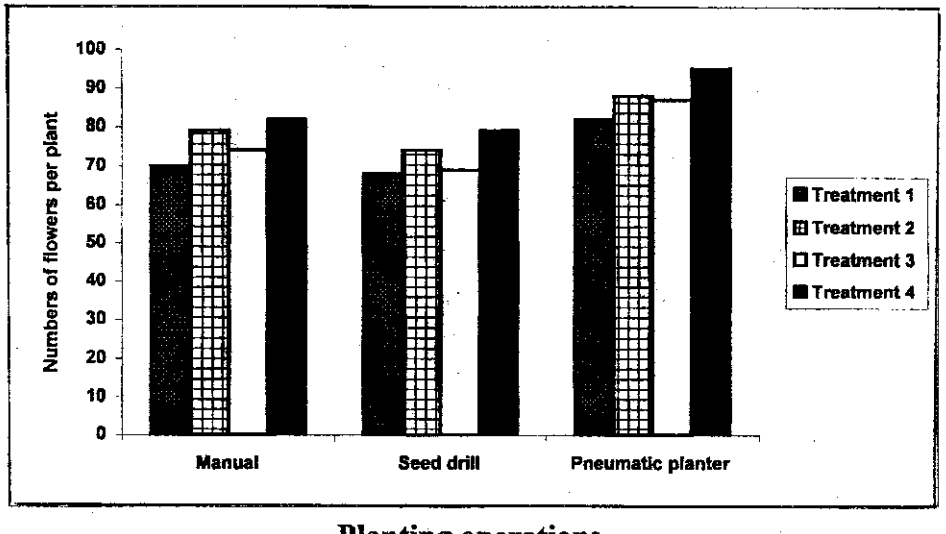


Fig. 4. Effect of seed bed preparation and planting methods on number of capsules, capsule / plant.

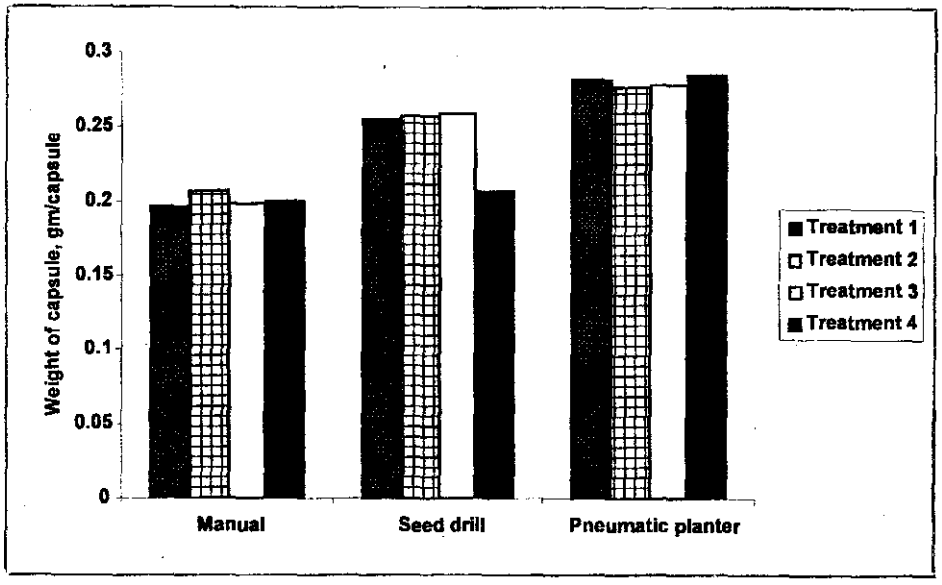


Fig. 5. Effect of seed bed preparation and planting methods on weight of capsule, gm/capsule.

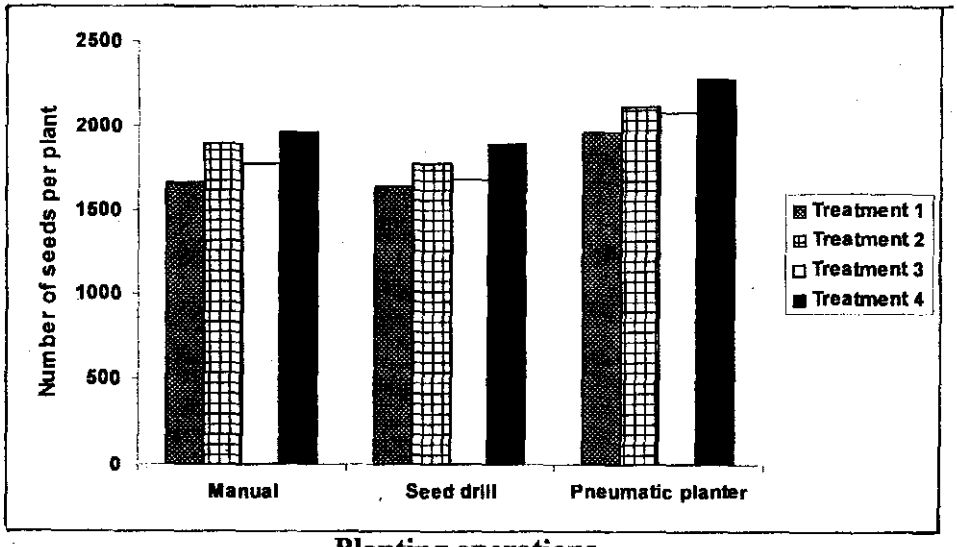


Fig. 6. Effect of seed bed preparation and planting methods on number of seeds per plant.

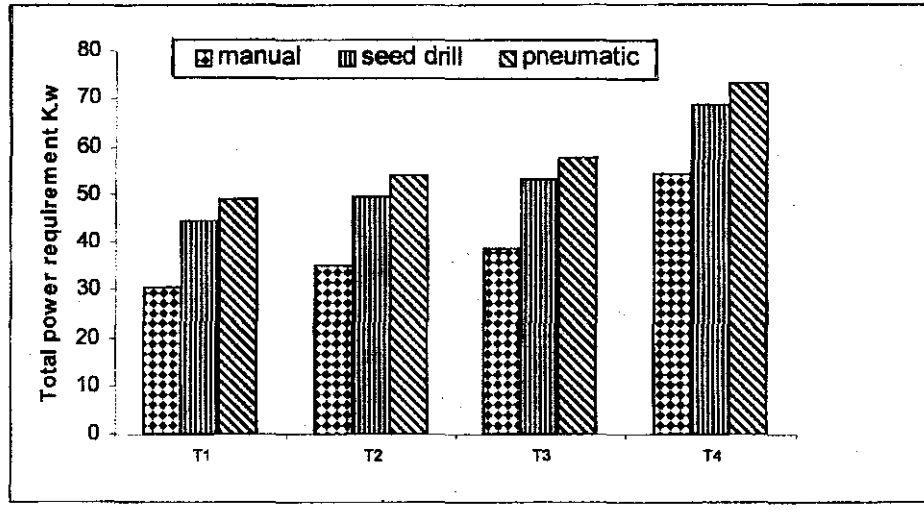


Fig. 7. Effect of seedbed preparation and planting methods on Roselle yield.

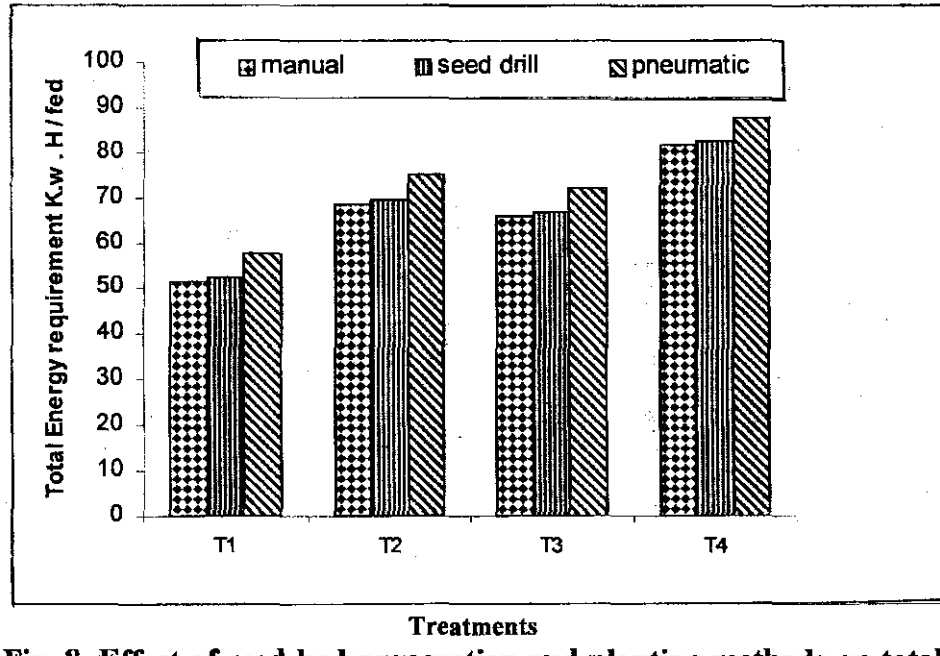


Fig. 8. Effect of seed bed preparation and planting methods on total energy requirements.

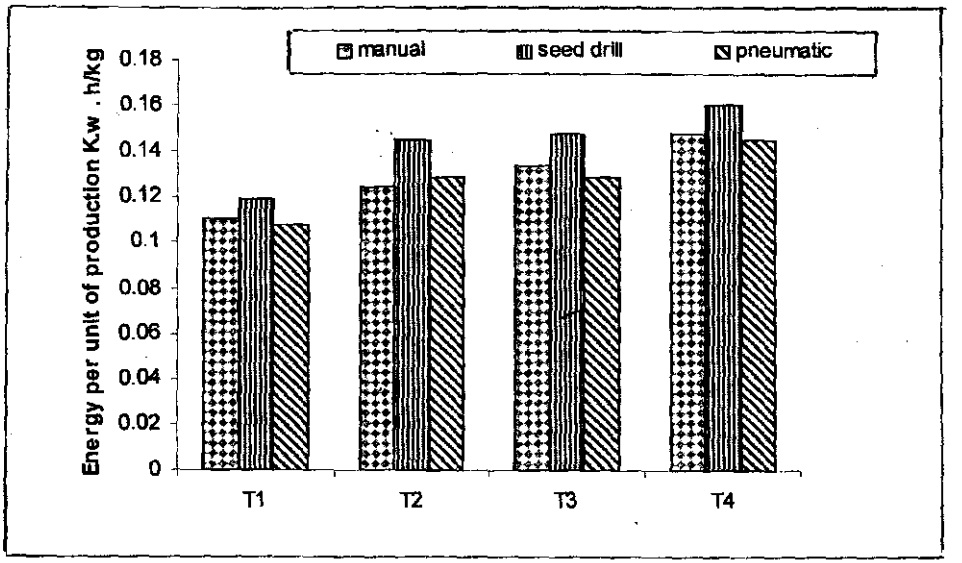


Fig. 9.Effect of seedbed preparation and planting methods on energy per unit of production.

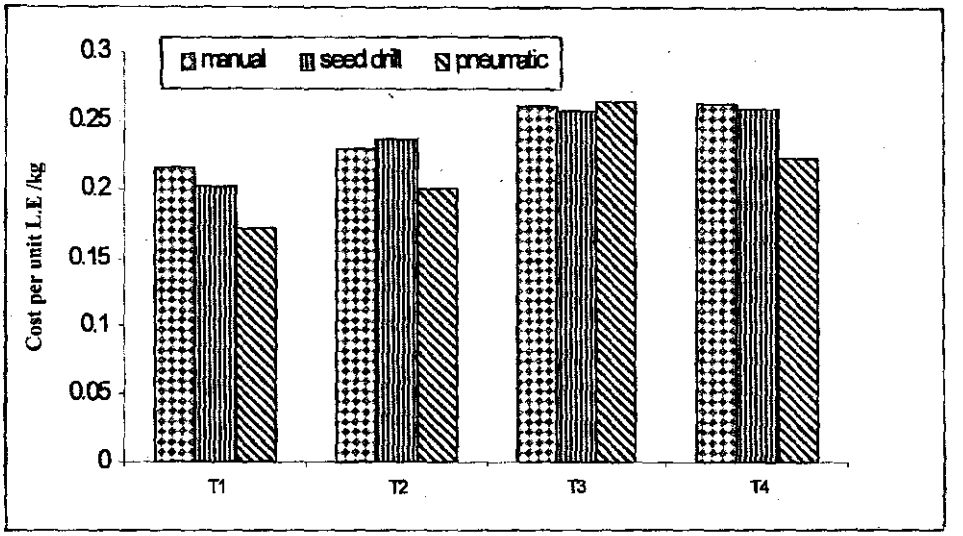


Fig. 10. Shows the cost per unit of production.

Conclusion

1-It is recommended to mechanize roselle crop production to maximize its yield.

2-It is recommended to use treatment T_4 (moldboard plow + chisel plow (one pass) + rotary plow + land leveler) for roselle seedbed preparation to improve soil physical properties.

3-It is recommended to plant roselle using the planter to increase yield.

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ميكنة إنتاج محصول الكركديه تحت الظروف المصرية

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يعتبر محصول الكركديه من النباتات الطبية الهامة حيث يدخل أيضا فى الصناعات الغذائية ولقد اتجهت مصر لزيادة المساحة المنزرعة من محصول الكركديه والنباتات لزيادة الصادرات الاقتصادية لها ونتيجة لذلك يتم دراسة العوامل المؤثرة على ميكنة إنتاج المحصول والهدف من الدراسة الوصول إلى أفضل طريقة زراعة لإنتاج محصول الكركديه بأعلى إنتاجية بأقل طاقة مطلوبة وأقل تكاليف.

الطرق المختلفة لأعداد مرقد البدرة:

T1 الحرث بمحراث حفار (وجهين) + التسوية ، T2 الحرث بمحراث حفار (وجهين) + حرث بمحراث دورانى + التسوية T3 الحرث بمحراث قلاب مطرجى + التسوية حرث بمحراث دروانى ، T4 الحرث بمحراث قلاب + حفار وجه واحد + التسوية .

طرق الزراعة:-

١- الزراعة اليدوية.

٢- الزراعة بالسطارة.

٣- الزراعة بالبلانتر الهوائى.

وقد تم الحصول على أعلى إنتاجية من السبلات والبذور تحت طريقة الزراعة بالبلانتر الهوائى (٦٠٥,٥ كجم / فدان سبلات ، ٨٦٧ كجم / فدان بذور) عند طريقة إعداد (الحرث بمحراث قلاب + محراث حفار (وجه واحد) + عزاقة دوراينة + تسوية) بأقل متطلبات للطاقة (١٤٥كيلووات ز ساعة / كيلو جرام) بأقل تكلفة (٠,٢٢٣ جنيه للكيلو جرام لمحصول الكركديه).