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MECHANIZATION OF BLACK SEED (*Nigella sativa, L.*) CROP UNDER EGYPTIAN CONDITIONS

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ABSTRACT: The field experiments were carried out in an area of one feddan at "KAFER EL-HAMAM" experimental research station through in 2005 to study the effect of three planting methods; seed drill, pneumatic planter and manual planting on black seed crop production. The percentage of germination ratio, percentage of seed distribution, plant characteristics, crop yield, energy requirement and cost per production unit were determined. The experimental results revealed that the least amount of energy and cost were found to lie 0.081 kWh/kg and 0.135 L.E/kg for seed drill methods. It is devious the seed drill is the best comparing with the others.

Key words: Seed bed preparation, seed drill, pneumatic planter, land leveler, chisel plow, energy requirement and cost

INTRODUCTION

Egypt is one of the developing countries with limited resources. Where it depends on Agriculture for improving its national income. One of the most important goals; in Egypt now; is increasing the export of medical plants by increasing the cultivated area and unit productivity. Black seed is one of the important medical plants which gain a great deal in the Moslem countries.

Increasing the quantity and quality of crop productivity depends on the soil and plant conditions. The new seedbed preparation and planting methods have a great importance for reducing energy consumption, time, labor and cost.

El-Shafey (1986) found out drilling of onion seeds gave high production than the other planting methods (manual seed broadcasting, manual sowing in rows and self-propelled planter).

Younis *et al.* (1991) treated two rice planting methods; mechanical drilling and transplanting. They found out that mechanical drilling recorded the minimum total cost (65L.E/ton) and maximum net profit (135L.E /ton).

They concluded that the mechanical drilling method is considered to lie an appropriate methods for rice planting.

Moustafa (1993) noticed that the highest number of vegetative branches and the highest yield of soybean were obtained with pneumatic planter. Mechanical planting (pneumatic planter and seed-drill) saved about 67.6% and 31.6% respectively of seeds per fed. Comparing with manual planting.

Moard and El-Shazly (1994) found out that the energy requirements significantly decreased by increasing soil moisture content up to 21% at any operation depth. They also reported that, increasing moisture content from 13 to 21% at operating depths of 10, 15 and 20 cm, increased the energy requirement about 35 and 15.26% however; increasing soil moisture content more than 21 and up to 24% insignificantly affected. It is can be explained by the fact of a lower soil penetration resistance at a high level of soil moisture content.

Taieb (1997) reported that the mechanical planting of sugar beet decreased the costs of consumed energy (L.E/kW.h) by 58% comparing with manual planting. He also reported that the mechanical planting of sugar beet saved 33% of seeds used for planting comparing with manual planting.

El-Saeed *et al.* (1998) found out that the energy requirement increased by increasing the plowing depth. The minimum value of power required for volume unit of distributed soil was 0.044 kw/m^3 for chisel plowing at 10 cm plowing depth.

Naser (1999) indicated that the fuel consumption of the following treatments

1-Chiselling twice + double disc + leveling.

2 Chiseling twice + leveling.

3- Chiseling once + leveling.

Were 23.8, 20.5 and 14.1 L/fed respectively.

Mady (2001) indicated that, the mechanical planting by pneumatic planter (Powell) increased the germination ratio comparing with traditional planting 82.7 and 76.5% respectively for sugar beet yield .

Gamal *et al.* (2001) reported that canola sowing using seed drill with suitable row width of 40 cm. resulted the highest yield and the lowest energy consumption comparing with manual planting and planter.

Helmy *et al.* (2001) reported that fuel consumption and energy

requirements of rotary plow, chisel plow one pass, chisel plow two passes and moldboard plow with disc harrow were 4.2, 5.37, 9.37 and 10.87 liter/hour and 12.28, 13.35, 23.8 and 37.87 kw.h/fed respectively.

Kamel *et al.* (2003) found out that the sowing cost of wheat were 17.88 and 19.13 LE/fed for pneumatic and mechanical seed drilling respectively.

Lotfy *et al.* (2003) found that the highest yield of rapeseed was (1685kg/fed) with lowest cost (0.046 L.E./Kg) using pneumatic planter followed after seedbed preparation chisel plow twice, rotary tiller and land leveler.

The objectives of this study are

1. Study the effect of planting methods on field capacity, field efficiency, fuel consumption, energy requirements, crop yield of black seed and total cost of production.
2. Select the best suitable planting method for the black seed crop production based on the all over parameters.

MATERIALS AND METHODS

The field experiments were carried out on an area of one feddan at "KAFER EL-HAMAM" experimental research station in 2005. Mechanical analyses of soil as shown as follows:

Table1. Soil mechanical analysis

Mechanical analysis			
Sand %	**Salt %**	**Clay %**	**Texture**
16.75	**34.55**	**48.7**	**Clay soil**

Treatments Used

1- Chisel plowing twice + land leveling followed by Manual planting

2- Chisel plowing twice + land leveling followed by seed drilling.

3- Chisel plowing twice + land leveling followed by pneumatic machine planting.

The following equipment are used in the research

1- FIAT tractor, model "NEWHOLLAND" of 75 hp (55.2 kw).

2- Chisel plow locally made, 7 tines, working width 175 cm and total mass 200 kg.

3- Locally made Land leveler with a hydraulic control unit, working width 305 cm and total mass 370 kg.

4- Seed drill 20 rows, model **TYE** and working width 240 cm

5- Pneumatic planter four rows, model **GAMMA 90** with working width 240 cm

6- Black seeds (*Nigella sativa, L.*) was obtained from Horticulture Research Institute; "Medical and Aromatic plants section" at Dokki, A.R.C. The germination ratio for seeds was (96%).

Number of plants per m^2 under different planting after thinning processes was (13.3, 31.7 and 16.6 plants/m^2) for manual planting, seed drill and pneumatic machine planting respectively.

Uniformity Distribution

The uniformity distribution was measured by using the following methods. Deviation the row from average distance (%). The deviation of hill on row average distance (%) was estimated according to the following equation.

$$c.v. = \frac{\delta n - 1}{x`} \times 100$$

[Snedecor and Cochran 1967]

Where:

C.V.=Coefficient of variation in row for average distance [%]

$\delta n-1$ = standard average distance

$$\delta = \sqrt{\frac{\sum (x - x`)^2}{n - 1}}$$

x = distance between hills on row

x` = the average distance

n = number of readings

RESULTS AND DISCUSSION

Field Capacity and Field Efficiency for Different Machines

Table 2. The field capacity and field efficiency for different machine

The equipment	Forward speed (km/h)	Actual filed capacity (fed/ h)	Theoretical filed capacity (fed/ h)	Field efficiency (%)
Chiseling 1st	**4.0**	**1.15**	**1.60**	**71.80**
Chiseling 2nd	**5.0**	**1.50**	**2.08**	**72.10**
Land leveler	**4.0**	**0.40**	**0.58**	**69.00**
Seed drill	**5.0**	**2.00**	**2.85**	**70.20**
Pneumatic planter	**4.0**	**1.62**	**2.28**	**71.50**
Manual planting	**1.4**	**0.125**	**0.20**	**62.50**

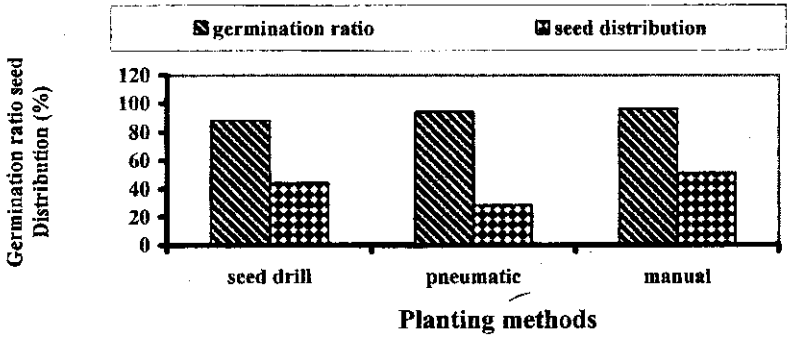

Fig 1. Effect of planting methods on germination ratio and seed distribution

Effect of Planting Methods on Germination Ratio and Uniformity Distribution for Black Seed

Fig. 1 show that the highest germination ratio was 96% for manual planting. This ratio was decreased to 94.6% and 88% for pneumatic planter and seed drill respectively. There were no effects on the seeds using manual planting in addition the friction between silt and seeds as well as compacting of the feeding system on the seeds lead to low the germination ratio for seed drilling. On the other hand the very small effect for feeding system in the pneumatic planter on seeds also resulted in a high germination ratio near to the germination ratio for manual planting.

Fig. 1 show that distribution uniformity was 44.2, 28.6 and 50.9 at seed drill, pneumatic planter and manual planting respectively. That is due to the high control of the seed spacing under pneumatic planter from seed drill and manual planting.

Effect of Planting Methods on Black Seed Plant Characteristics

Table 3 shows the results of black seed plant length, number of branches per plant, number of capsules per plant and the weight of seeds per plant. The maximum plant length was 74.1cm for seed drilling while the least length of plant was found to lie 65.5 cm for manual planting. This was due to the narrow distances between plants in the same row and high regularity of the planting depth for mechanical planting under seed drill. The maximum number of branches per plant was 13 branches for pneumatic planter while the least was 7.4 branches for seed drill. That was due to the narrow distances between plants in the same row and high number of

Table 3. The Black seed plant characteristics

Plant characteristics	Planting methods		
	Manual planting	Seed drill	Pneumatic planter
Length of plant (cm)	65.5	74.1	71.1
Number of branches per plant	12.7	7.4	13
Number of capsules per plant	42.3	27.5	44.6
Weight of seeds per plant	11.1	6.0	11.2

plants per m^2 under seed drill which didn't give the chance for plants to grow more branches. The maximum number of capsules per plant was 44.6 capsules / plant for pneumatic planter and the least was 27.5 capsules / plant this was due to the number of branches per plant. The maximum weight of seeds per plant was 11.2 g seeds / plant under pneumatic planter and the least was 6 gm seeds/plant for seed drill while is due to the number of capsules per plant.

Effect of Planting Methods on Black Seed Yield

Table 4 shows that the highest black seed yield was 798.8 kg/fed for seed drilling while the least black seed yield was 620.04 kg/fed for manual planting.

Table 4. Productivity of seed yield (kg/fed) under different planting methods.

Productivity (kg/fed)	Planting methods		
	Manual planting	Seed drill	Pneumatic planter
	620.04	798.8	780.8

Effect of Planting Methods and Seedbed Preparation on Total Energy Requirement (kWh/fed)

Table 5 shows that the highest energy requirement was found to lie 68.08 kWh/fed. under pneumatic planter while the least was (63.5 kW.h/fed.) for manual planting.

Table 5. The Energy requirement (kW.h/fed)

Energy requirement (kWh/fed)	Chisel plow tow pass + land leveler		
	Manual planting	Seed drill	Pneumatic planter
	63.5	64.55	68.08

Effect of Planting Methods and Seedbed Preparation on Energy Requirement per kg Yield (kWh/kg)

Table 6 shows that the highest energy requirement per kg was (0.102 kWh/kg.) for manual planting while the least was 0.81 kWh/fed. For seed drill.

Table 6. The Energy requirement per unit of production (kWh/kg)

	Chisel plow tow pass + land leveler		
Energy requirement (kWh/kg)	Manual planting	Seed drill	Pneumatic planter
	0.102	0.081	0.087

Specific Cost of Crop Production

Table 7 shows that the highest specific cost per kg was 0.196 L.E/kg. under manual planting the least was (0.135 L.E /fed.) under seed drill.

Table 7. Cost per unit of production and per unit of area

Cost (L.E/kg)	Chisel plow tow pass + land leveler		
	Manual planting	Seed drill	Pneumatic planter
	0.196	0.135	0.143
Cost (L.E/fed)	121.52	107.83	111.65

CONCLUSION

The aim of this study was to find out the beast planting methods for black seed yield. Results showed that highest black seed yield was 798.8 kg/fed for seed drilling with least energy requirement 0.081 kWh/kg and least cost 0.135 L.E/kg of black seeds.

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ميكنة محصول حبة البركة تحت الظروف المصرية

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يعتبر محصول حبة البركة من أهم النباتات الطبية والعطرية في جمهورية مصر العربية بالاضافه إلى الأهمية الغذائية وتسعى ألدوله إلى زيادة ألمساحه المنزرعة من النباتات الطبيه والعطريه بهدف التصدير ولزيادة المساحه المنزرعه والحصول على اعلى انتاجيه من وحدة المساحه مع زياده جودة المحصول وتقليل التكاليف يفضل استخدم طرق الميكنه المناسبه لكل للمحصول ويهدف البحث هنا الى تحديد افضل طريقة زراعه للحصول على اعلى محصول من حبة البركه مع تقليل تكاليف الانتاج. واشتمل البحث على ثلاث معاملات هي:

١- الزراعة اليدوية

٢- ألزراعه بسطارة البذور

٣- الزراعه بدفع الهواء

وقد سبق هذه المعاملات حرث بالمحراث الحفار مرتين يتبعها تسويه

وقد تم تحديد افضل طريقه زراعه بناء على الانتاجيه والطاقه المستهلكه والتكاليف أظهرت نتائج البحث أن:

السطاره هي أفضل الطرق الثلاثة ألمستخدمه حيت أعطت أعلى إنتاجيه (٧٩٨,٨ كجم/ف) مع اقل استهلاك للطاقه (٠,٠٨١ كيلوات.ساعه / كجم) واقل تكلفه لوحده الانتـــاج (٠,١٣٥ جنيه/كجم).