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EFFECT OF SOME TRANSPLANTING METHODS ON DAMSIS (*Ambrosia Maritima L.*) CROP PRODUCTIVITY

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ABSTRACT

The aim of this research is to determine the suitable method for transplanting Damsis. The experiments were performed the objective of EL-Gemmiza Research Station, EL-Gharbiea Governorate, in 2008 season. Damsis was transplanted by New-Holand and Lännen Roulette transplanters at different forward speeds (0.9, 1.3, 1.8 and 2.3 km/h) additional manual transplanting. From the obtained results can be concluded that Damsis transplanting by Lännen Roulette transplanter at forward speed of 1.8 km/h is the suitable method for transplanting Damsis to obtain the optimum seedling uniformity space per unit area (25.6 $\times$ 30.5 cm), missed 5.0 % and floated 4.7 % seedling, field capacity and efficiency were 0.46 fed/h and 85.6 % respectively, yields 17.9 and 0.27 ton/fed. of green plant and seed respectively, energy consumed 2315 MJ/fed. and cost about 8.4 LE/ton.

INTRODUCTION

Damsis (***Ambrosia Maritima L.***) is a species of wormwood, native to temperate regions of Eurasia and Northern Africa. It grows naturally on uncultivated, arid ground, on rocky slopes, and at the edge of footpaths and fields. Damsis crop is medical and aromatic plant. The plant can easily be cultivated in dry soil. Damsis should be planted under bright exposure in fertile, mid-weight soil. It prefers soil rich in nitrogen. It can be propagated by growth (ripened cuttings taken in March or October in temperate climates) or by seeds in nursery beds. It is naturalized in some areas away from its native range, including much of North America. The plant could be used as a spray against pests. It was intercropped with many crops to avoid nematode, weeds or insects attacks. The leaves and flowering tops are gathered when the plant is in full bloom, and dried naturally or with artificial heat. Its active substances include silica, two bitter elements (absinthine and anabsinthine), thujone, tannic and resinous substances, malice acid, and succinic acid. Its use has been claimed to remedy indigestion and gastric pain, it acts as an antiseptic, and as a febrifuge. For medicinal use, the herb is used to make a tea for helping pregnant women during pain of labor. Also, use in treating of kidney, saccharin, and blood pressure, diseases. Damsis crop uses in destroy of shell which support Pelharacia and Fashiola diseases without using the chemicals which imported and cost millions pound every year. A dried encapsulated form of the plant is used as an anthelmintic. A wine can also be made by macerating the herb. It is also available in powder form and as a tincture. The oil of the plant can be used as a cardiac stimulant to improve blood circulation. Pure wormwood oil is very poisonous, but with proper dosage poses little or no danger. Wormwood is mostly a stomach medicine. Also, conserve the environment from chemicals pollution. Damsis crop was used to fight Pelharacia and Fashiola diseases according to (Lust, 1979) and Ministry of Agriculture plan (Mortada, 2002).

The achieve of modern agricultural system is to increase and obtain a high yield from unit area, little water, energy consumed and time. The transplanting is one of the ways to achieve this goal. Mechanical transplanting resulted in winder plant spacing, fewer plants per unit area and fewer detective hills. It also, gave better results than manual transplanting in terms of plant height and depth of the seeding roots from the soil surface. Mechanical transplanting significantly increased fruit weight and number of fruit per plant compared with manual transplanting (Salama, *et al*., 1995). Hand transplanting requires considerable hand labors. Due to the shortage in hand labors and expensive labor costs, a reliable mechanized transplanting operation becomes important (El-Sahrigi *et al.* (1991) and Mady *et al.* (2001)). He added that the two common types of transplanting systems presently available to the farmers, which are manual and mechanical transplanting. Hand transplanting is arduous work, slow process and need consuming more labors than any other operation in vegetable planting.

The advantages of mechanical transplanting are place seeding more uniform than manual transplanting. The uniformity of placing seedlings by the mechanical transplanting attributed to the transplanting mechanism design more than the operation condition. Ground speed of 0.9km/h was suitable for operating the mechanical transplanting (Harb *et al*., 1993). The multiple loading feature mechanism significantly increased the operator speed because it allowed up to five plants to be fed into the mechanism before they are actually needed. One operator on the machine with multiple loading stations could transplant at the same rate (about 70 to 80 plant/min) as two operators on conventional one-row machine. Five or six loading stations were needed to optimized feeding rate (Suggs, 1979). In report of ASAE (1989); Odigbah and Akubuo (1991) and Abdel-Aal *et al.* (2002) found that the field efficiency decreased by increasing forward speed. Also, Helmy *et al*. (2000) found that the sugar yield (and root yield) of sugar beet decreased from about 4.5 to 3.5 Mg/fed by increasing Holland transplanter forward speed from 0.95 to 3.65 km/h respectively. Mohamed *et al*. (2000) found that the energy requirements for tomato transplanting decreased by 41.61 when transplanter forward speed from 0.94 to 2.03 km/h. Seeding damage faulty in planting and feeding losses increased due to increasing transplanter forward speed (Hamad *et al*., 1983).

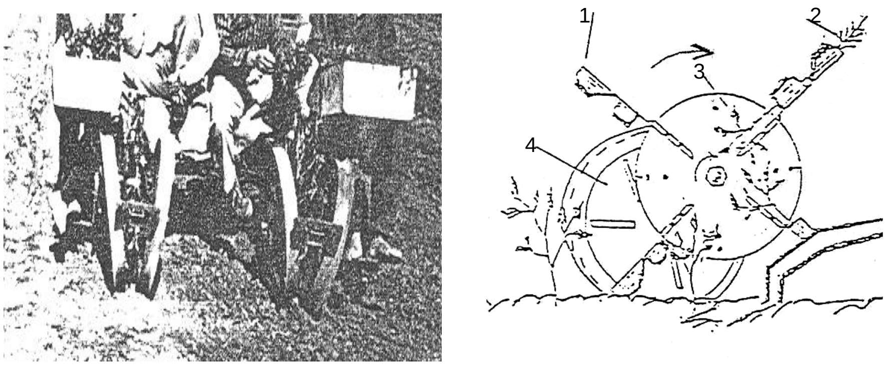
The objective of this study determines the suitable method to transplanting Damsis.

MATERIALS AND METHODS

The experiments were performed the objective of EL-Gemmiza Research Station, EL-Gharbiea Governorate, in 2008 season. To evaluate some transplanting systems for reach the optimum Damsis yield.

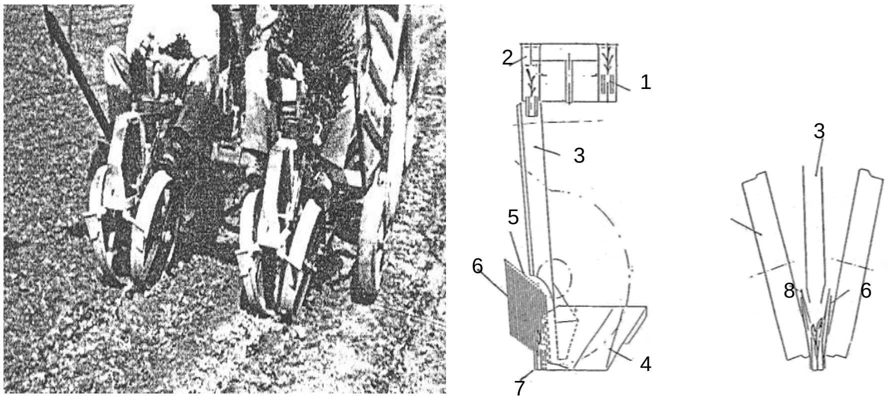
The transplanting systems were:

- Manual transplanting.
- Mechanical transplanting by using semi-automatic transplanters, New-Holland (Fig. 1) and Lännen Roulette transplanter (Fig. 2).



1- Disc pocket   2- Seedling   3- Disk   4- Press wheels

Fig. 1: The photo of New Holland transplanter and the diagram of the disc pocket arrangement transplanting mechanism.



1- Seedling   2- Tube   3- Falling tube   4- Share
5- Belts   6- Spikes   7- Bottom of the furrow   8- Compaction wheels

Fig. 2: The photo of Lännen Roulette transplanter and the diagram of the operator drop the seedlings.

1- New Holland transplanter (Fig. 1)**:** the machine has a disc pocket arrangement transplanting-mechanism. Seedlings are placed manually into transplanting pockets which consist of two rubber plates to hold the seedling. The rubber plates are opened, and closed with special spring mechanism. The closing of rubber plates occurs as soon as the pocket enters two guide plates which are designed for vertical transplanting.

2- Lännen Roulette transplanter (Fig. 2)**:** Lännen Roulette transplanter is semi-automatic. It was designed as seedling block transplanter vegetable and cotton. It was worked by dropping the seedlings into the tubes of the roulette. When the roulette rotates each of the tubes in its turn to meet the falling tube, the roulette tube flap opens and the seedling falls into the falling tube. The seedling drops down the falling tube to the bottom of the furrow opened by the share between the spikes of the belts.

The technical specifications of transplanting machines are indicated in Table (1).

Table (1): Transplanters specifications.

Specifications	Transplanters	
	New-Holland	**Lännen Roulette**
Manufacture	USA	Finland
Model	1700	Rt-2
Main dimensions		
Total length, cm	130	130
Total width, cm	245	240
Total height, cm	90	120
Total mass, kg	250	350
Hitching type	3 points	3 points
No of planting rows	2	2

Source of power: Massy Ferguson MF230 tractor of 35 hp (26.2 kW), 2000rpm was used with both transplanting machines.

Crop variety: Seed variety is Giza21, seedling age is 75-90 days and its average length is 20 – 25 cm.

The experiments were carried out in clay loam soil. The physical properties of the soil under investigation are summarized in Table (2). Soil analyses were done in soil laboratory at EL-Gemmiza Research Station.

Table(2): physical properties of the experimental soil.

Fine sand	Coarse sand	Silt	Clay	Soil texture
21.50	1.30	31.20	46.00	Clay loam

The experimental procedure were done at the transplanters forward speeds of 0.9, 1.3, 1.8, and 2.3 km/h in three replicates then the mechanical transplanting compared with the manual transplanting as a control experiment. To evaluate the machine performance:

- The seedling uniformity

The seedling uniformity (longitudinal – transverse and losses) were estimated by measured the distance between twenty hills along the row and transverse scattering the row center-line, then the number of missing and floated hills/m^2 were determined as a percentage by using the following formula:

$$M_g = \frac{M_m}{M_{th}} \times 100 \quad \text{---------------------- (1)}$$

Where:

M_g = missing hills,%

M_m = number of missing, hill/m^2,and

M_{th} = number of theoretical, hill/m^2.

- The filed capacity and efficiency:

The theoretical (F_{ct}), effective (F_{ca}) field capacity and field efficiency (E) were determined by using the following equations (c.t. El-Shazly, 1989):

$$F_{ct} = \frac{S \times W}{4200}, \quad \text{fed/h ------------------ (2)}$$

$$F_{ca} = \frac{60}{T_u + T_L}, \quad \text{fed/h} \text{-----------------} (3)$$

$$E = \frac{F_{ca}}{F_{ct}} \times 100, \quad \% \text{-------------------} (4)$$

Where:

S = Forward speed, km/h

W = Transplanter width, m

T_u = The utilized time/fed, min.

T_L = The summation of lost time/fed, min.

- Productivity:

The yield production contain two product green plant and seed the grain plant as one gather then the seed yield were determine as a mass/fed.

- Energy consumption:

The following formula was used to estimate engine power (EP) (Embaby, 1985):

$$EP = \frac{Fc}{60 \times 60} \times P_f \times L.C.V. \times \eta_{th} \times \eta_m \times 4.2, \quad \text{kW} \text{ ------} (5)$$

Where:

F.C	Fuel consumption, L/h
P_f	Density of fuel, kg/L (0.85 for diesel fuel)
L.C.V.	Lower calorific value of fuel, kcal/kg = 10^4
η_{th}	Thermal efficiency of the engine, it is assumed about 35% for diesel engine
η_m	mechanical efficiency of the engine, it is assumed about 80% for diesel engine
4.2	Thermo- mechanical equivalent (kJ/kcal)

The energy requirement was estimated by using the following formula:

$$\text{Energy consumed} = \frac{EP}{F_{ca}}, \quad \text{MJ/fed} \text{ - ------ ---}(6)$$

Where:

EP Engine power, MJ

F_{ca} Actual field capacity, fed/h.

- Cost estimation:

Cost of operation was calculated according to the following equation (Awady, 1978):

C = p/h (1/a + i + t/2 +r) + (1.2 w.s.f) + m/144, LE/h - - - - - - (7)

Where:

C	hourly cost
p	price of machine
h	yearly working hours
a	life expectancy of machine
i	interest rate/year
t	Taxes
r	overheads and indirect cost ratio

w power of the machine kW
s specific fuel consumption L/kW
f fuel price LE/L
m monthly wage ratio
1.2 is a factor to take lubrication and greasing into account
144 is estimated monthly working hours

- Human labor energy:

The human labor energy can be estimated by the following equation:

$$E_{HL} = \frac{C_{HL}}{F_{ca}} \times N_L \text{ MJ/fed} \text{ - - - - - - - - - - - - - - - (8)}$$

Where:

C_{HL} = Energy input coefficient represents the human labor energy = 2.3 MJ/man.h (Lower *et al.*, 1977)

N_L = Number of labors required to perform any operation.

RESULTS AND DISCUSSION

Seedling uniformity:

The seedling uniformity divided into both longitudinal and transverse seedling distribution (Figs. 3 and 4). Figure (3) illustrated the effect of transplanting methods on longitudinal seedling distribution at different transplanter forward speed compared with the human transplanting method. From the figure the longitudinal seedling space increased by increasing the machine forward speeds. Therefore, by increasing the forward speed from 0.9 to 2.3 km/h the seedling dispersion increased about 7.9 cm and 6.0 cm by using New-Holland and Lännen Roulette transplanters respectively. Those results mean that the difference by using each machine is slightly differences effect on longitudinal scattering. According to the technical recommendation of medical and aromatic library in Horticultural Institute Research the longitudinal space for transplanting Damsis plant in row was about 25.0 cm. Hence, the suitable results were 25.3 and 25.6 cm of New-Holland and Lännen Roulette transplanters at transplanted forward speed 1.8 km/h while it about 26.2 cm at manual transplanting method.

On the other side, Fig. (4) cleared that the effect of the transverse seedling dispersion at the previous studied parameters. From the figure the transverse seedling dispersion were 4.9, 2.8, 1.7 and 5.5 cm at transplanted forward speed 0.9, 1.3, 1.8 and 2.3 km/h for New-Holland transplanter but for Lännen Roulette transplanter the corresponding results were about 2.7, 0.9, 0.5 and 2.3 cm. Furthermore, according to the technical recommendation of medical and aromatic library in Horticultural Institute Research the space between rows for transplanting Damsis plant was about 30.0cm. Then, from the obtained results the space between rows for transplanting Damsis plant were ranging about 25.1 to 35.5 and 27.3 to 32.3cm by the forward speed increased from 0.9 to 2.3 km/h for New-Holland and Lännen Roulette transplanters respectively. The suitable results were 31.7 and 30.5cm of New-Holland and Lännen Roulette transplanters at transplanted forward speed 1.8 km/h while it about 30.2 cm at manual transplanting method.

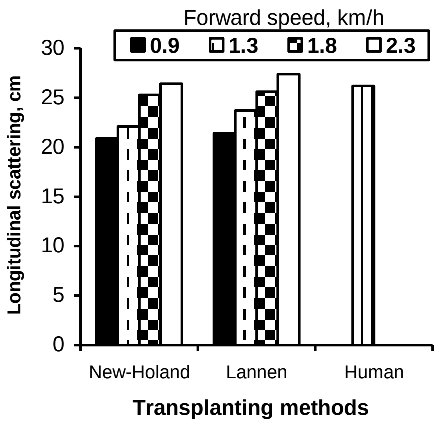


Fig. 3: Effect of transplanting methods on longitudinal scattering.

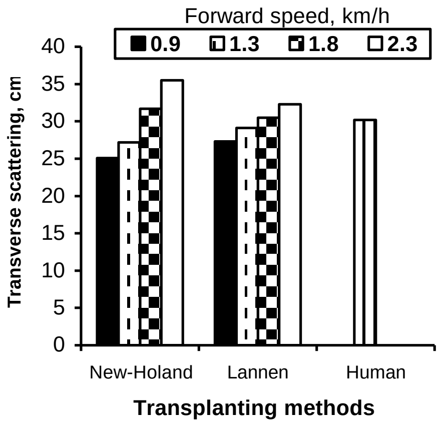


Fig. 4: Effect of transplanting methods on transverse scattering.

Seedling losses:

The seedling losses include two components the missed hill and the floated (un-correct depth) hill. The percentages of missed hill affected transplanting methods at different machine forward speed were illustrated in Fig (5). From the figure the missed hills increased from 2.3 to 8.1 % by increase the transplanter forward speed from 0.9 to 2.3 km/h for New-Holland machine. On the other hand, the missed hills increased from 1.8 to 6.8 % by increase the transplanter forward speed from 0.9 to 2.3 km/h for Lännen Roulette machine.

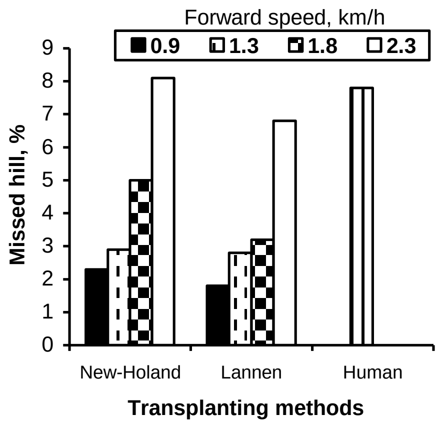


Fig. 5: Effect of transplanting methods on missed hill.

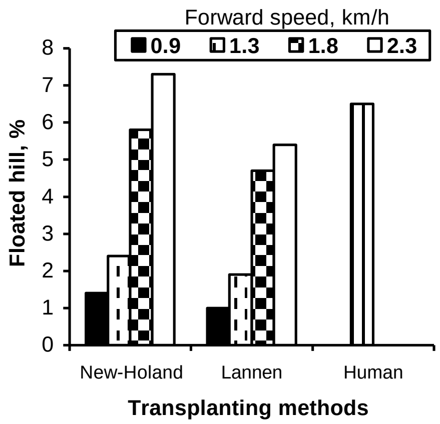


Fig. 6: Effect of transplanting methods on floated hill.

These results cleared that the missed hills increased about 70 % by increasing the forward speed. Also, when two compared between the machines performance, the Lännen Roulette machine slightly increased than the New-Holland machine. While the missed related to the manual transplanting method is about 7.8%, it may be due to the un-attention or integral stress.

Fig. (6) indicate that the floating hills percentage of Damsis seedlings increased by increasing forward speed for New-Holland and Lännen Roulette transplanters. The minimum floating hills percentage of Damsis seedling of 1.0 % was obtained by using Lännen Roulette transplanter at forward speed of 0.9 km/h while the maximum floating hills percentage of 7.3 % found by using New-Holland transplanter at forward speed of 2.3 km/h. The increasing of missing hills by increasing forward speed may be due to increasing the slip percent of transplanter ground-wheel.

Filed capacity and field efficiency

Therefore, Figs. (7 and 8) clear that the relationship between field capacity and field efficiency at transplanting methods and different machine forward speed. Fig. (7) shows the effect of transplanting methods on actual field capacity. From the figure the increasing in transplanting speeds from 0.9 to 2.3 km/h the actual field capacity increased from about o.25 to 0.57 fed./h. Then the semi-mechanical transplanting increment about 0.47 fed./h when compared with the manual transplanting.

On the other wise, Fig. (8) clarify that the field efficiency of Damsis seedlings transplanter decreased by increasing forward speed for New-Holland and Lännen Roulette transplanters. The maximum field efficiency of 94.5 % was obtained at forward speeding of 0.9 km/h and the minimum field efficiency of 83.2 % was obtained at forward speed of 2.3 km/h. While the field efficiency was 18.1 % by manual transplanting.

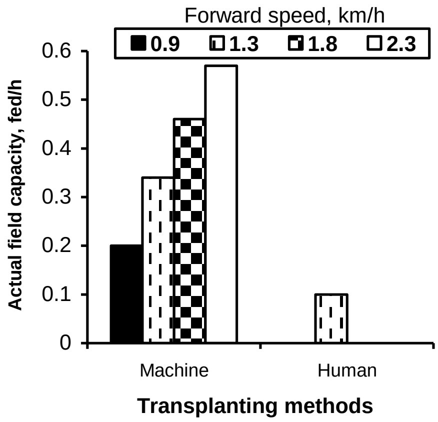


Fig. 7: Effect of transplanting methods on actual field capacity.

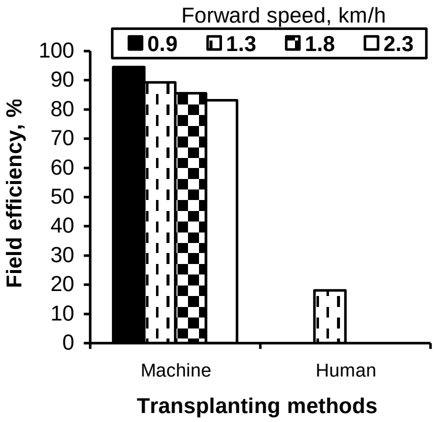


Fig. 8: Effect of transplanting methods on field efficiency.

Effect of transplanting system on Damsis yield.

Figures (9 and 10) show the Damsis green plant and seed yields affect the transplanting methods. The figures clear that the Damsis crop yields decrease from 20.2 to 14.2 and 0.27 to 0.15 ton/fed of green plant and seed respectively by using New Holland transplanter. On the other side, it about 20.5 to 16.3 and 0.31 to 0.21 ton/fed. of green plant and seed respectively by using Lännen Roulette transplanters. When compared the mechanical transplanter results with the manual transplanting can be found the same manual transplanting yields (about 18.1 and 0.27 ton/fed.). The increasing of Damsis crop yields may be due to the suitable uniformity of seedling distribution which gave a suitable plant area.

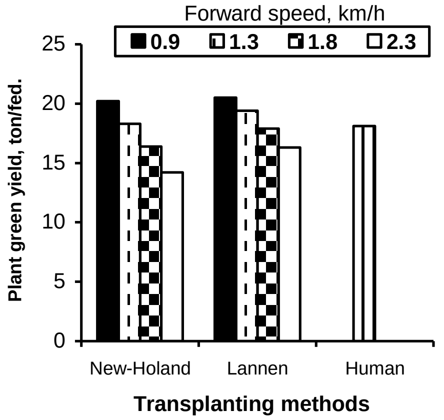


Fig. 9: Effect of transplanting methods on plant green yield.

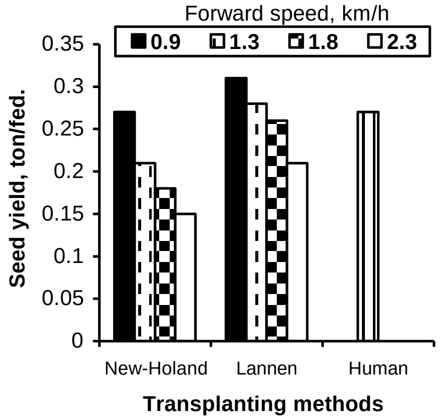


Fig. 10: Effect of transplanting methods on seed yield.

Energy consumed:

The effect of transplanting methods on energy consumed can be shown in Fig. (11). From the figure the energy consumed slightly increase by using the Lännen Roulette transplanter than using the New-Holland transplanter. The data show that the increase in machine forward speed from 0.9 to 2.3 km/h decrease the energy consumed about 1068 and 1009 indicate the draw-bar power requirement was increased and energy was decreased by increasing forward speed 1068 and 1009 MJ/fed. for New-Holland and Lännen Roulette transplanters. Then the energy consumed was 460 MJ/fed. by manual transplanting method.

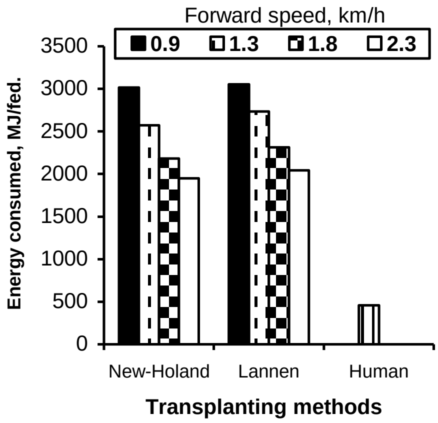


Fig. 11: Effect of transplanting methods on energy consumed.

Estimating the machine costs

The operating costs of different transplanters are determined. The minimum operating cost of 5.30 LE/ton was obtained by using Lännen Roulette transplanter at forward speed of 0.9 km/h and maximum operating cost of 9.31 LE/ton was obtained by using New Holland transplanter at forward speed 2.3 km/h. Whereas the operating cost of manual transplating was about 11.11 LE/ton.

In general the results of the Lännen Roulette transplanter was better than the New Holland transplanter, this may be due to the feeding mechanism for the Lännen Roulette machine is easiest in feeding than the feeding mechanisn of the New Holland machine.

CONCLUSION

Damsis transplanting by Lännen Roulette transplanter at forward speed of 2.3 km/h is the suitable method to transplanting Damsis to obtain the optimum seedling uniformity space per unit area (25.3 $\times$ 30.5 cm), missed (3.2 %) and floated (4.7) seedling, field capacity (4.7 fed/h) and efficiency (85.6 %), yields (17.9 and 0.26 ton/fed. of green plant and seed respectively), energy consumed 2315 MJ/fed. and cost about 8.4 LE/ton.

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تاثير بعض طرق الشتل على انتاج محصول الدمسيسة

محمد محمود عبد الجليل ، هانى عبد العزيز الجندى و جابر غمرى على رضوان
معهد بحوث الهندسة الزراعية – مركز البحوث الزراعية

تهدف هذه الدراسة الى تقييم تاثير بعض أنظمة الشتل (الشتل الالى بواسطة الشتالة "نيو هولاند New-Holland " والشتالة "لانين Lännen" مقارنة بالشتل اليدوى) على انتاج محصول الدمسيسة حيث تمت التجارب فى محطة البحوث الزراعية بالجميزة موسم ٢٠٠٨ عند سرعات تقدم مختلفة لكلا الشتالتان (٠,٩، ١,٣، ١,٨، ٢,٣ كم/ساعة) وكانت أفضل النتائج التى تم الحصول عليها عند إستخدام الشتالة (Lännen) بسرعة تقدم ١,٨ كم/ساعة حيث أعطت أفضل قيم لإنتظامية توزيع الشتلات فى وحدة المساحة (٢٥,٦ × ٣٠,٥ سم)، والجور المفقودة والغير منتظمة العمق ٥,٠ %، ٤,٧ % على التوالى، السعة والكفاءة الحقلية ٠,٤٦ فدان/ساعة، ٨٥,٦ % على التوالى، إنتاجية العشب الأخضر والبذور ١٧,٩، ٠,٢٧ طن/فدان، والطاقة المستهلكة ٢٣١٥ ميجاجول/فدان، والتكاليف ٨,٤ جنيه مصرى/طن.