OPERATING FACTORS AFFECTING USING DIFFERENT TYPES OF PNEUMATIC PLANTERS FOR SOWING SUNFLOWER CROP

Hamada El-Khateeb[1] Husain Sorour[2] M. I. Saad[3]

1- Senior research, Agric. Eng.Res. Inst., A. R. C., Dokki, Giza.

2- Prof. of Agric. Mech. Kafr El-Sheikh Univ.

3- Agricultural Engineer, Agric. Eng.Res. Inst., A. R. C.

ABSTRACT

The results of the present study led to the following points:-

Experiments were carried out to evaluate two pneumatic planters for sowing sunflower crop to select the optimum mechanical planting condition for sunflower crop compared with traditional method.

The pneumatic planter (Kader SPC6) gave the highest values of germination ratio (88.6 %), planting cost (60.37LE/h), (40.25LE/Fed.), power consumption (27.96 kW) and energy requirement (18.64 kW.h/Fed)compared with pneumatic planter (Kader SK6) at different planting speed and planting depth. Also, the pneumatic planter (Kader SK6) gave the highest values of effective field capacity (1.55 Fed./h) and field efficiency (71.3 %) at different planting speeds and planting depths.

The planting cost was ranged from 56.8 to 58.7 LE/h and from 36.88 to 15.74 LE/Fed. at planting speed ranged from 2.52 to 6.80 km/h, respectively for Kader-SK6 planter. However, the corresponding values for Kader-SPC6 planter were from 60.37 to 63.74 LE/h and from 40.25 to 17.75 LE/Fed. at the pervious mentioned planting speed compared with 100 LE./fed. in case of using manual planting.

INTRODUCTION

Sunflower is an important oil crop in the world. It ranks the second after soybeans with respect to oil production in the world **(Yearbook of Agric., FAO, 1990)**. Its seeds are a rich source of oil.

The total planting of sunflower area in Egypt reaches about 35995 fed. and the total production of sunflower seeds in Egypt reaches to about 35350 Mg of seeds according to the Arab Agricultural Statistics **(Yearbook of Agric., FAO, 2004)**.

In Egypt, 1,129000 Mg of oils is consumed annually but till now we produce only 153,000 Mg. This means that we produce only about 13.55% of all our needs and imports about 86.45% (976,000 Mg). **(Oilseed situation and outlook 2002)** So, Egypt costs are about 3220 million Egyptian pound (LE.) to cover this deficiency. This case may be increases from bad to worst in the future that is because of the decreas of cotton planted area from 1.3 to 0.6 million feddans. While the soybean planted area was decreased from 150,000 to 43,000 feddans from 1983 to 1998.

The problem of the planting process of sunflower in new lands includes the shortage of agricultural labors and lower productivity accuracy of manual planting. Meanwhile, using mechanical planting will increase the planting accuracy (planting density and depth), consequently it will increase the sunflower seeds production in addition to decrease the planting cost as recommended by previous researchers ***(Uiger et al., 1993)*** which indicated that the total requirement of human power was about 32 man.hour/Fed. compared with 0.823 man.hour/Fed in mechanical planting. Therefore, using mechanical planting technique for planting sunflower in new lands is consider the first important factor to solve the manual planting problems and helps to increase the sunflower seeds production in Egypt.

Abd Alla (1999) reported that the sowing process is considered one of the most important agricultural operations. The art of placing seeds in the soil to obtain high germination ratio and strong plants is most important objective to achieve highest yield. However, applying mechanization in planting crops by Egyptian farmers still limited because of the little number of available planters.

Kepner et al.(1986) stated that the percent of cell fill for a planter is influenced by such factors as, the maximum of seed size in relation to cell size, the seed shape, the cell shape, the exposure times of a cell to seed in the hopper and the peripheral speed of the cell.

Srivastava et al.(1995) reported that the most important factors affecting germination and emergence included seed viability, soil temperature, availability of moisture and air to the seeds, and the soil strength and resistance to seedling emergence. A seed drill can exert a strong influence on the rate of germination and emergence of seeds through control of planting depth and firming of soil around the seeds.

Imbabi (1996) studied the performance and productivity of mechanical planting equipment when planting sunflower seeds in flat and furrow soil under various field dimensions . He also studied the germination ratio, productivity and he concluded that the planting by machine in flat soil surpassed the planting in furrow soil in all the mechanical criteria evaluation.

Kupresanin (1984) showed that pneumatic seed drill gave better distribution of seeds within the row than mechanical drill. Also, sunflower seed yield were significantly increased , but the increases was small (121 kg / ha).

El-Shal (1987) tested a pneumatic planter to plant different kinds of seeds such as soybean, maize and sunflower under different plate speeds and different air suction pressure to investigate the uniformity distribution. He concluded that the pneumatic planter is too effective for all seeds and grains of different sizes and shapes under special suction pressure and feed plate speed to produce high uniformity of seeds distribution and high filling percentage.

Gomaa (2003) found that the longitudinal and transverse scattering increased by increasing planting forward speed for the two types of planters (pneumatic and mechanical). He also indicated that the mean values of longitudinal and transverse scattering in case of pneumatic planter were less than mean values of longitudinal scattering in case of mechanical planter.

Ozmerzi et al.(2002) indicated that the sowing uniformity of the horizontal distribution pattern was not affected by nominal sowing depths, but uniformity of sowing depth was affected. The maximum emergence rate indices occurred when the nominal sowing depth was 40 and 60 mm, and the least mean emergence time was obtained at the nominal sowing depth of 40 mm. It can be concluded that, the position of the seed in the soil effects mean emergence time and the emergence rate index of plants. As a result of these tests, a nominal sowing depth of 60 mm is considered optimum, according to uniformity of sowing depth and maximum emergence rate index.

The main purpose of this study is to evaluate pneumatic planters suitable for sowing sunflower crop compared with traditional method.

MATERIALS AND METHODS

The experimental work was carried out at the research farm of Rice Mechanization Center, Kafr El-Sheikh Governorate,during sunflower growing season of 2005 (with sunflower Vidoc variety) to study the factors affecting on the planting accuracy and uniformity of pneumatic planter to select the optimum mechanical planting condition for sunflower crop. The experimental area was 1.5 feddan which divided into three equal plots. The first and second plots were planted using pneumatic planters, which the third plot was planted using manual planting method.

To achieve the study goal, the experimental treatments were carried as follow:

1- Two types of pneumatic planters which had different types of feeding mechanisms and seed covering device were used namely, pneumatic planter SK6 and pneumatic planter SPC6.

2- Four different levels of planting speed namely were 0.7, 0.99, 1.61 and 1.89 m/s (2.52, 3.56, 5.80 and 6.80 km/h).

3- Three different levels of planting depths 1.5, 3.5 and 5.5 cm.

Both planter types were adjusted at the same distance between hills on the same row (20 cm) with one seed per hill. However, in the traditional planting methods, the hill depth was ranged from 2 to 3 cm while the hill distance and number of seed/hill were adjusted on the same values for mechanical planting. The main specifications of planters used are shown in Table 1 and Figs. 1 and 2.

Table 1: Specifications of pneumatic planters.

Model	Kader –SK6	Kader – SPC6
Source of manufacture	Romania - Egypt	Romania - Egypt
Number of gear ratio	8	48
Type of planter	Carried during transport	Carried during transport
Seed distribution	Pneumatic-mechanical and vertical disk with holes	Pneumatic, with vertical perforated disk.
Mass, kg	580	700
Type of seed shares	Small slipper for fine seeds Big slipper for coarse seeds	Large-slide and small with depth limiter
Working depth, cm	0 -5 (with small slippers) 0 -10 (with big slippers)	0 -6 (small-sliding share) 4 -12 (large-sliding share)
Number of rows	6	6
Distance between rows, cm	50-70	45-100
Exhauster type	Radial, with blades	Radial, with blades
Exhauster drive	Mechanical from tractor's driving gear.	Mechanical from tractor's power take-off
Drive speed, rpm	540	536-540
Exhauster speed,rpm	3400	3400
Overall dimensions,mm (width × length × height)	1800 x 4300 x 2100	1750 x 4700 x 2100

A Nasr 48.5 kW at 2300 rpm (65 hp) tractor was used for operating both types of planters. The tractor power was transmitted to the two planters through power take off shaft (PTO) on 540 rpm to drive exhauster which produce Vacuum pressure in the seed distributor unit

1- air blower
2- air suction hose
3- frame
4- seeds hopper
5- covering wheel
6- track covering too
7-seed distributor
8- seed distributor di
9-adjusting planting depth.
10- opener share

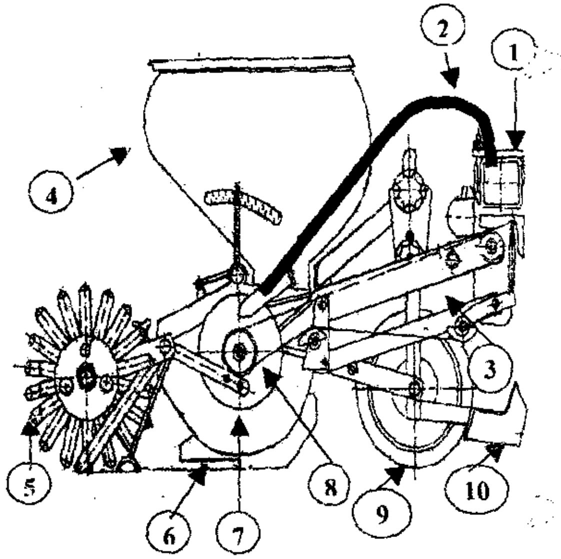

Fig.: 1 : Side view for one unit of pneumatic planter

1- air blower
2- air suction hose.
3-seeds level indicatc
4- seeds hopper.
5- covering wheel.
6- chain drive.
7- seed distributor
8- opener share
9- frame.
10-adjusting planting depth.
11-chain drive cover.

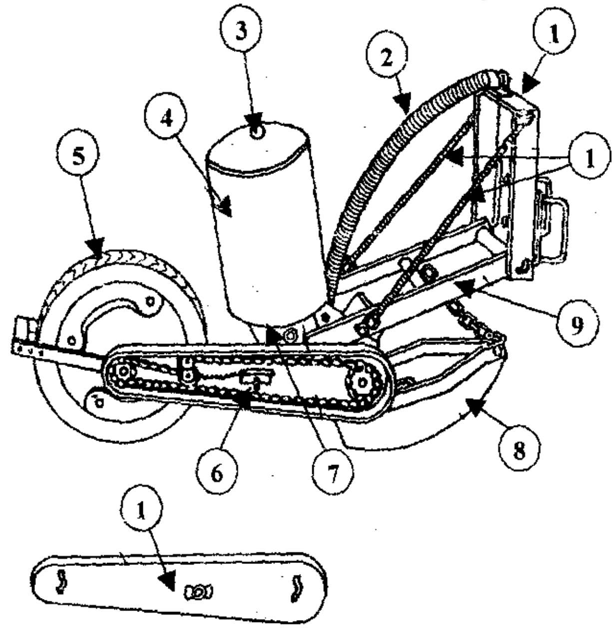

Fig.2: Side view for one unit of pneumatic planter (Kader SPC6).

MEASURMENTS

Germination ratio.

The germination ratio (G_r) was determined according to (***Imbabi, 1996***) by using the following formula:

$$G_r = \frac{N_p}{N_s} \times 100 \quad ,\% \quad \ldots\ldots 1$$

where :

N_p = Number of sunflower plants within a length of 10 m.; and

N_s = Number of sunflower seeds delivered within the same length.

Planting uniformity and accuracy.

The sowing accuracy includes longitudinal and lateral scattering and distribution uniformity were determined and measured in 10 m length with three replicates as follows:

a- Seed scattering

Longitudinal and lateral seed scattering (distribution) were determined by measuring the plants spacing in each treatment. The seed longitudinal and lateral scatterings were calculated from the following formula ***(Steel and Torrie, 1980)***

$$\text{Scattering} = \sqrt{\frac{\text{Sum of saquare of variance of seed scattering from its mean}}{\text{Number of hills}}} \quad \ldots 2$$

b- Uniformity of plant distribution (Coefficient of uniformity)

The plant distribution was analyzed to determine the coefficient of variation (CV) of plants spacing according to the following formula:

$$CV = \frac{\text{SD of plant spacing}}{\textit{Average}\text{ plant spacing}} \times 100 \quad ,\% \quad \ldots\ldots 3$$

where:

SD = Is the standard deviation = $\sqrt{\frac{(S - S^-)^2}{n}}$;

S = On-row spacing, cm;

S^- = Average on-row spacing, cm; and

n = Number of sample.

Field capacity and efficiency.

Theoretical field capacity (T.F.C.) was calculated as follows:

$$T.F.C. = \frac{1}{\textit{Total planting time (h / fed)}} \quad ,Fed./h \quad \ldots\ldots 4$$

However the effective field capacity (E.F.C.) was calculated as follows:

$$E.F.C. = \frac{1}{\text{actual planting time , (h/fed.)}}, Fed./h \quad \ldots\ldots\ldots 5$$

While the field efficiency (η_f) was calculated by using the following formula:

$$\eta_f = \frac{E.F.C.}{T.F.C.} \times 100 \quad \ldots\ldots\ldots 6$$

where:

Total time = actual time + adjusting time + turning time + feeding time

Power consumption and energy requirements.

The energy required (*ER*) for planting sunflower was estimated using the following equation:-

$$ER = \frac{\text{Power consumption (kW)}}{\text{Effective field capicity (fed / h)}}, kW.h / fed \quad \ldots\ldots\ldots 7$$

The power consumed by the planters was calculated according to ***(Embaby,1985).***

$$EP = \left(F_c \times \frac{1}{60 \times 60}\right)\rho_f \times L.C.V. \times 427 \times \eta_{th} \times \eta_m \times \frac{1}{75} \times \frac{1}{1.36} \; kW \ldots 8$$

where:

F_c = fuel consumption, *l/h;*
ρ_f = density of diesel fuel *(0.85 kg/l);*
L.C.V. = lower calorific value of diesel fuel (*10000 kCal/kg);*
427 = thermo-mechanical equivalent, *kg.m/k Cal;*
η_{th} = thermal efficiency of diesel engine, (40%)*;and*
η_m = mechanical efficiency of diesel engine, (80%).

Planting cost.

The cost of planting operation was estimated and calculated according to the equation given by (***El-Awady, 1978***) as follows:-

$$C = \frac{P}{h}\left(\frac{1}{L} + \frac{i}{2} + a + r\right) + (0.9\,W \times F \times U) + b \quad \ldots\ldots\ldots 9$$

where:

C = cost per hour of operation, .(LE/h); i =annual interest rate,% ;
P = Estimated price of the machine, (LE); W= engine power, (hp);
h=estimated yearly hour operation; a = annual taxes and overheads,(%) ;
F=specific fuel consumption, (l/hp.h); B=hourly labor wage, (3 LE/h) ;
L = life expectancy of the machine; U = fuel price, (0.6 LE/L) ;
0.9 = a correction factor for rated load ratio and lubrication;

r = annual repair and maintenance rate, %;

Table 2: Cost assumption.

Items	p	h	i	L	a	r
Tractor	80000	1000	0.1	10	0.02	0.18
Kader-SK6	35000	500	0.1	5	0.02	0.1
Kader-SPC6	40000	500	0.1	5	0.02	0.1

RESULTS AND DISCUSSION

Germination ratio.

The obtained values of germination ratio are shown in Fig. 3 show the effect of planting speed on germination ratio for both types of pneumatic planter at different planting depth.

However by increasing planting speed from 2.52 to 6.80 km/h, the germination ratio was decreased from 85.95 to 76.75 % at planting depth of 1.5 cm for pneumatic planter kader- SPC6. Also, decreased from 80.67 to 73.30 % for pneumatic planter kader- SK6 under pervious mentioned conditions. In general, the germination ratio was gradually decreased as planting speed increased for all planting depths. This results may be due to lifting seeds uncovered above the soil surface at high planting speed.

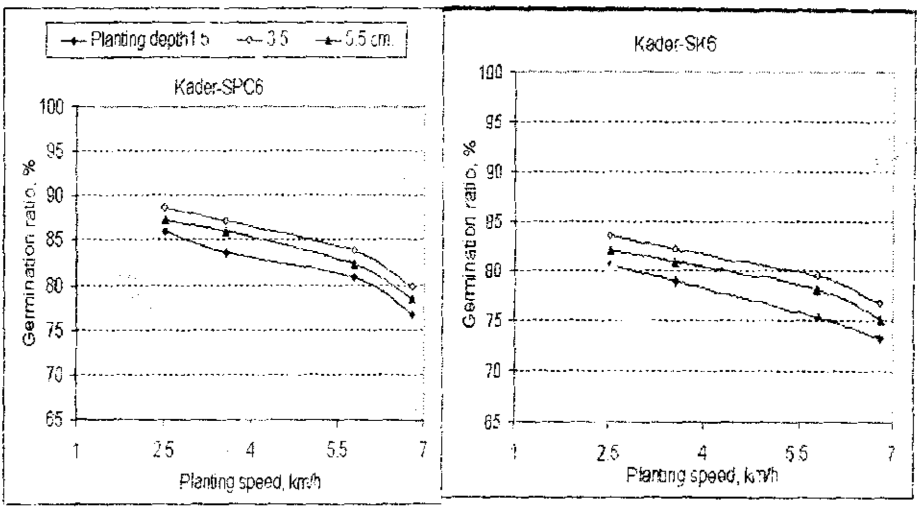

Fig.3: Effect of planting speed on germination ratio at different planting depths for pneumatic planters Kader SPC6 and Kader SK6.

With respect to the effect of planting depth on the germination ratio in the Fig. 3 also indicated that, the germination ratio was highly affected by the planting depth at different planting speeds. Decreasing planting depth or increasing it less than or more than 3.5 cm results in a decrement percentage in germination ratio. This results may be due to covering soil, which was not sufficient for protect the seeds against birds, rodents and surface drying before emergence at shallow depths (<3 cm). However, at deep depths (>5cm) the reason behined these results may be due to a lot of covering soil above seeds, consequently the sunflower seeds could not be able to emergence, specially in high planting speeds. The best results for germination ratio were obtained under the planting depth of 3.5 cm.

Seed Scattering

1- Lateral scattering

In general, increasing the planting speed tended to increase the lateral scattering because the planter vibration is increased as the planting speed increased.

Fig. 4, showed that the effect of planting depth on the lateral scattering for both types of planter Kader SPC6 and SK6. From this figure it is cleared that the highest values of lateral scattering percentage were obtained at planting depth of 1.5cm. However the lowest values of lateral scattering percentage were obtained at planting depth of 5.5 cm at all planting speeds for both types of planter. These values means that the lateral scattering of sunflower seeds around the center of planting row was highly affected by the planting depth.

Also, these results indicated that the frequency percentage of 70, 75 and 81% were obtained at range of central distance 1-1 cm for Kader-SPC6 at planting speed of 2.52km/h compared with 66, 72 and 75% for Kader-Sk6 at the pervious mentioned condition under the planting depth of 1.5, 3.5 and 5.5cm, respectively. However, the corresponding values at planting speed of 6.80 km/h were 60,65 and 71% for Kader-SPC6 comparing with 57, 63 and 66 % for Kader-SK6 at the same range lateral distance of 1-1cm.

2- Longitudinal scattering:

Both types of pneumatic planters were adjusted to give distance of 20 cm between hills within the sunflower plants on the rows. The change in longitudinal scattering in the previous adjusted hill space under study parameters are recorded in Table 3. Generally, the values of longitudinal scattering were increased by increasing planting speed for both types of planters at all studied planting depth.

Increasing planting speed from 2.52 to 6.80 km/h increased the longitudinal scattering percentage by 11.19 and 12.47% using Kader planter SPC6 and Kader SK6, respectively at planting depth of 1.5 cm..

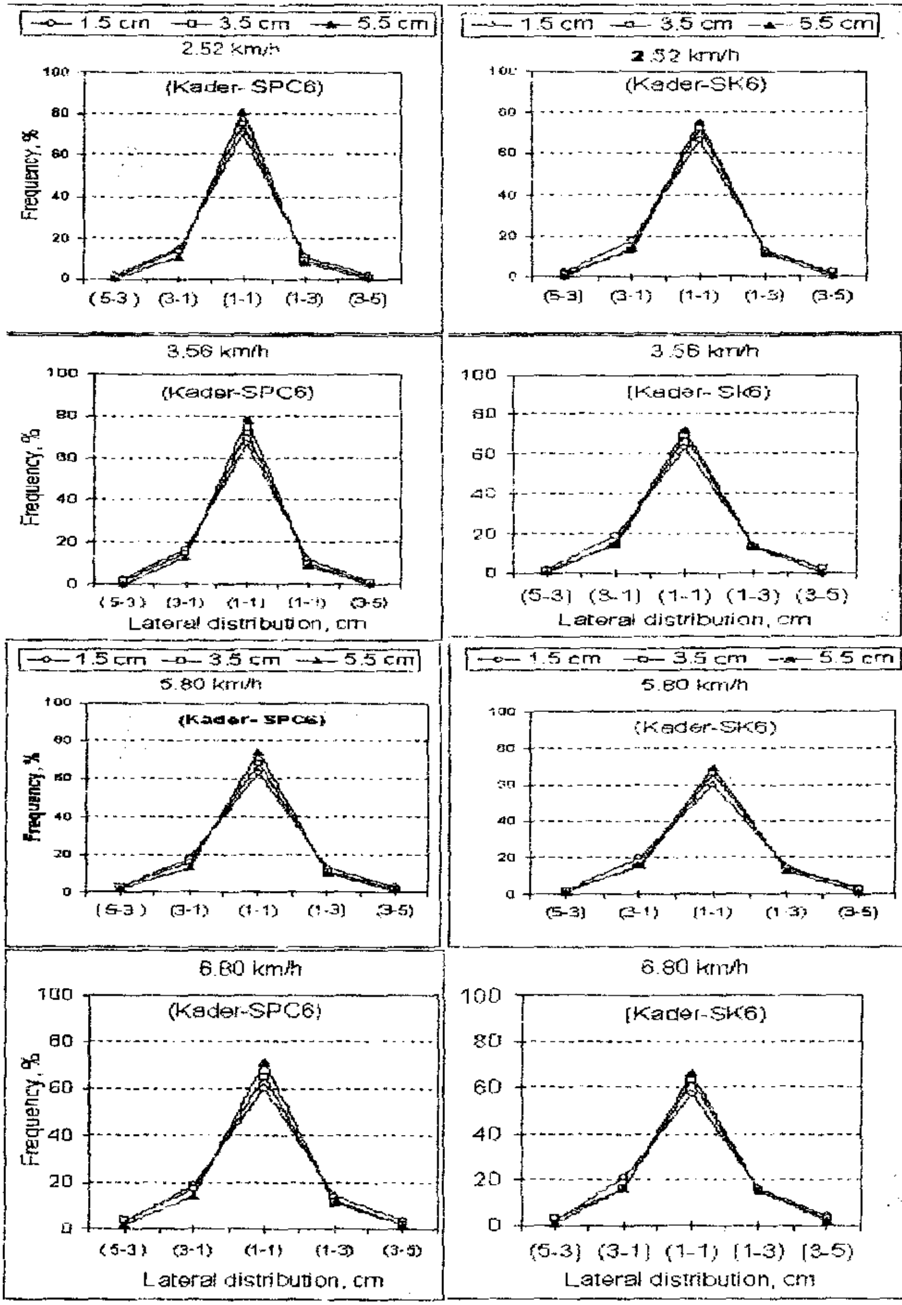

Fig. 4: Effect of planting depth on seed lateral scattering for pneumatic planters Kader SPC6 and SK6 at planting speed of 2.52, 3.56, 5.80 and 6.80 km/h.

However, the corresponding values at planting depth of 5.5 cm are 19.22 and 19.13 % for both types of planters SPC6 and SK6, respectively.

The actual obtained values of hill space were ranged from 19.32 to 19.83 cm for pneumatic planter Kader SPC6 under study parameters, However, in case of using pneumatic planter Kader SK6 the obtained actual hill space was ranged from 18.10 to 19.04cm under the study parameters

Table 3: Effect of planting speed and planting depth on the longitudinal scattering for pneumatic planters Kader (SK6 and SPC6).

Items		Kader-SPC6			Kader-SK6		
Plantingdepth,cm.	Speed, km/h	Av.	SD	C.V	Av.	SD	C.V
1.5	2.52	19.38	3.82	19.21	18.94	3.31	17.47
	3.56	19.52	4.12	20.90	18.96	3.45	18.21
	5.80	19.81	4.22	21.36	19.04	3.54	18.56
	6.80	19.56	4.32	21.63	18.89	3.77	19.96
3.5	2.52	19.48	3.24	16.37	19.04	2.82	14.93
	3.56	19.32	3.37	17.18	18.96	3.03	16.00
	5.80	19.54	3.60	18.18	19.01	3.13	16.44
	6.80	19.36	3.69	18.56	18.89	3.23	17.08
5.5	2.52	19.83	2.47	12.48	19.01	2.00	10.57
	3.56	19.72	2.70	13.70	18.96	2.20	11.58
	5.80	19.79	2.76	13.93	18.99	2.26	11.90
	6.80	19.83	3.06	15.45	18.10	2.47	13.07

3- Field capacity and efficiency:

The effect of planting speed on the field capacity and efficiency for both types of pneumatic planter, Kader-Sk6 and Kader-SPC6 are listed in Table 4. From this Table, it could be observed that, the pneumatic planter Kader-SK6 gave the highest values of field capacity and efficiency compared with obtained by using pneumatic planter Kader- SPC6 at different planting speeds. These results may be due to the higher values of lost time in adjusting and repairing the pneumatic planter Kader-SPC6, especially driven chain which used to adjust the gear ratio for seed distribution disk. The field capacity of Kader-SK6 pneumatic planter was ranged from 1.55 to 3.78 Fed./h compared with 1.50 to 3.59 Fed./h for Kader-SPC6 pneumatic planter for the planting speed ranging from 2.52 to 6.80 km/h.

The highest values of field capacity of 3.78 and 3.59 Fed./h were obtained at the highest level of planting speed (6.80 km/h) for Kader-

SK6 and Kader- SPC6 pneumatic planters, respectively. However the highest values of field efficiency of 71.20 and 69.94 % were obtained at the lowest level of planting speed (2.52 km/h) for both types of planting machines Kader-SK6 and SPC6, respectively.

Table 4: Effect of planting speed on the field capacity and efficiency for pneumatic planter Kader-SK6 and Kader SPC6.

Items	Kader-SK6				Kader-SPC6			
Planting speed, m/s	0.70	0.99	1.61	1.89	0.70	0.99	1.61	1.89
Planting speed, km/h	2.52	3.56	5.80	6.80	2.52	3.56	5.80	6.80
Effective field capacity, fed./h	1.55	2.04	3.15	3.78	1.50	1.86	3.03	3.59
Theoritcal field capacity, fed/h	2.177	3.09	5.06	5.96	2.16	3.06	4.97	5.83
Efficiency, %	71.20	66.02	62.23	63.34	69.94	60.78	60.97	61.58

Power consumption and energy requirement.

Fig. 5, shows the effect of planting speed on the power consumption and energy requirement. It could be noticed that increasing planting speed from 2.52 to 6.8 km/h, increased power consumption by 30.33 and 22.59 % and decreased the energy requirement by 68.80 and 85.29 % for Kader-Sk6 and Kader-SPC6 pneumatic planters, respectively.

Meanwhile, the pneumatic planter of Kader-SK6 gave the lowest values of power consumption and energy requirement than that obtained by using pneumatic planter of Kader-SPC6. This results may be due to heavy mass of Kader-SPC6 planter which included fertilizing unit, in addition to the higher draft required for this type of planter due to the higher load and rolling resistance values on each planting unit which driven by comprising (covering) wheel compared with Kader-SK6 planter which driven comparing by the one wheel for all planting units.

The highest values of power consumption of 34.32 and 36.12 kW were obtained at the highest level of planting speed of 6.80 km/h for Kader-Sk6 and Kader-SPC6 planters, respectively. However, the highest values of energy required were of about 15.53 and 18.64 kW.h /Fed at the lowest level of planting speed of 2.52 km/h for Kader-SK6 and Kader-SPC6 planters, respectively.

Planting cost.

The effect of planting speed on the planting cost LE/h and LE/ Fed is illustrated in Figure 6. From this figure it is observed that, the planting cost LE/h was highly influenced directly by planting speed, however the planting cost LE/Fed was highly influenced directly by the effective field capacity of the planter. Increasing the planting speed increased the planting cost LE/h and decreased the planting cost LE/Fed for both types of pneumatic planters. This results may be due to increasing fuel consumption and increasing effective field capacity by increasing planting speed for both types of planter.

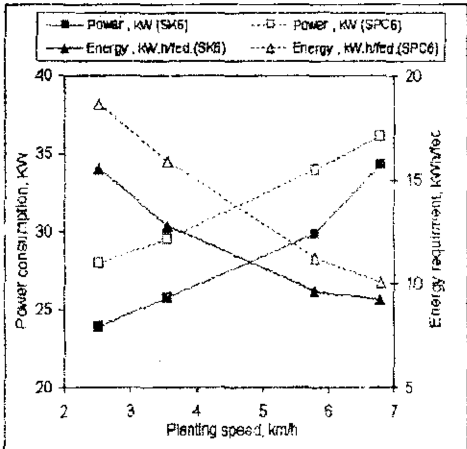

Fig. 5: Effect of planting speed on the power consumption and energy requirement for pneumatic planters of Kader SK6 and Kader SPC6.

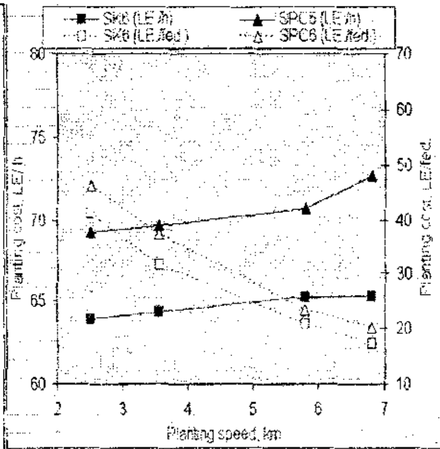

Fig. 6: Effect of planting speed on the planting cost for pneumatic planters of Kader SK6 and Kader SPC6.

The pneumatic planter of Kader-SK6 gave the lowest values of planting cost (LE/h) and planting cost (LE/Fed.) compared with planting cost of Kader-SPC6 planter and manual planting cost.

The planting cost was ranged from 56.8 to 58.7 LE/h and from 36.88 to 15.74 LE/Fed. at planting speed ranged from 2.52 to 6.80 km/h, respectively for Kader-SK6 planter. However the corresponding values for Kader-SPC6 planter were from 60.37 to 63.74 LE/h and from 40.25 to 17.75 LE/Fed. at the pervious mentioned planting speed compared with 100 LE./Fed in case of using manual planting.

SUNNARY AND CONCLUSION

- The germination ratio was gradually decreased as planting speed increased at studied planting depth. However, decreasing the planting depth or increasing it than 3.5 cm results in a decrement percentage in germination ratio.
- Increasing the planting speed and decreasing planting depth tended to increase the lateral scattering.
- Using pneumatic planter Kader-SPC6 results in higher lateral scattering percentage than that obtained when using pneumatic planter Kader-Sk6 at different planting speeds.
- Increasing planting speed from 2.52 to 6.80 km/h increased the longitudinal scattering percentage by 11.19 and 12.47% using Kader planter SPC6 and Kader Sk6, respectively at planting depth of 1.5 cm.
- The pneumatic planter Kader-SK6 gave the highest values of field capacity and efficiency compared with pneumatic planter Kader-SPC6 at different planting speeds.
- Meanwhile, the pneumatic planter of Kader-SK6 gave the lowest values of power consumption and energy requirement than that obtained by using pneumatic planter of Kader-SPC6.
- The planting cost was ranged from 56.8 to 58.7 LE/h and from 36.88 to 15.74 LE/Fed. at planting speed ranged from 2.52 to 6.80 km/h, respectively for Kader-SK6 planter. However the corresponding values for Kader-SPC6 planter were from 60.37 to 63.74 LE/h and from 40.25 to 17.75 LE/Fed. at the pervious mentioned planting speed compared with 100 LE./Fed in case of using manual planting.

RECOMMENDATIONS

The optimum operating conditions for pneumatic planter Kader (SK6 and SPC6) are at planting speed of 5.80 km/h and planting depth of 3.5cm.

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الملخص العربي

عوامل التشغيل المؤثرة على استخدام نوعان مختلفان من آلات الزراعة الهوائية في زراعة محصول عباد الشمس

حمادة على الخطيب[١]　　حسين سرور[٢]　　محمد أبراهيم سعد[٣]

١- باحث أول بمعهد بحوث الهندسة الزراعية – مركز البحوث الزراعية – الجيزة – الدقي.

٢- أستاذ الهدسة الزراعية بكلية الزراعة – جامعة كفر الشيخ.

٣- مهندس زاعي بمعهد بحوث الهندسة الزراعية.

يعتبر محصول عباد الشمس من أهم المحاصيل الزيتية على مستوى العالم حيث يعتبر ثاني امحاصيل الزيتية بعد فول الصويا من حيث إنتاجية الزيت. في

مصر يستهلك سنويا ١١٢٩ ألف طن (١١٢٩٠٠٠ ميجا جرام) من الزيوت وحتى الآن ننتج ١٥٣ ألف طن (١٥٣٠٠٠ ميجا جرام) فقط هذا يعنى أن إنتاجنا من الزيوت يعادل ١٣,٥٥% فقط من الاستهلاك ونستورد حوالي ٨٦,٤٥% (٩٧٦ ألف ميجا جرام زيت)، لذلك تحتاج مصر إلى حوالي ٣,٢٢ مليون جنية مصري موسم ٢٠٠٥م لكي نغطى هذا النقص.

كان الهدف الرئيسي لهذه الدراسة هو تقييم آلتي زراعة في خطوط تعملان بشفط الهواء في زراعة محصول عباد الشمس ومقارنتها بطريقة الزراعة التقليدية (اليدوية) مع حسابات التكاليف.

لكي نحقق ذلك فقد اشتملت الخطة البحثية لهذه الدراسة على المراحل التالية:-

أجريت تجارب هذه المرحلة في مزرعة مركز ميكنة الأرز- محافظة كفر الشيخ- التابع لمعهد بحوث الهندسة الزراعية أثناء موسم زراعة محصول عباد الشمس ٢٠٠٥ (لصنف عباد الشمس فيدويك) وذلك باستخدام آلتين للزراعة في خطوط هما (قادر- SK 6، قادر SPC6) تعملان بشفط الهواء لزراعة محصول عباد الشمس في ظل المتغيرات التالية:-

١- أربعة مستويات من سرعات الزراعة ٢,٥٢، ٣,٥٦ ، ٥,٨٠ و ٦,٨٠ كم/س.

٢- ثلاثة مستويات مختلفة من أعماق الزراعة ١,٥ ، ٣,٥ و ٥,٥ سم.

ولدراسة أداء هذه الآلات تم أخذ تحديد المؤشرات التالية:-

١- انتظامية الزراعة (التشتت الطولي- التشتت العرضي)

٢- السعة الحقلية و الكفاءة الحقلية.

٣- القدرة المستهلكة ومتطلبات الطاقة. ٤- تكاليف الزراعة.

يمكن تلخيص النتائج المتحصل عليها كما يلي:-

- أوضحت النتائج أن نسبة الإنبات تقل بزيادة سرعة الزراعة عند كل متغيرات الدراسة الخاصة بهذه المرحلة.
- تبين من الدراسة أن انخفاض عمق الزراعة أو زيادته عن ٣,٥ سم يؤدى إلى انخفاض نسبة الإنبات.
- استخدام آلة الزراعة قادر- SPC6 أدى إلى زيادة التشتت العرضي بالمقارنة باستخدام آلة الزراعة قادر- SK 6 عند كل سرعات وأعماق الزراعة تحت الدراسة لهذه المرحلة.

- زيادة سرعة الزراعة من ٢,٥٢ إلى ٦,٨٠ كم/س أدى إلى زيادة التشتت الطولي بنسبة ١١,١٩ و ١٢,٤٧% باستخدام آلة الزراعة قادر- SPC6 و قادر-SK 6 ، على التوالي عند عمق زراعة ١,٥سم. بينما القيم المقابلة للآلتين عند عمق زراعة ٥,٥ سم كانت ١٩,٢٢ ، ١٩,١٣% على التوالي.
- وجد أن قيم عمق الزراعة الفعلي يكون أكبر بالمقارنة بعمق الزراعة المضبوط عليه الآلة عن ١,٥ ، ٣,٥سم ، باستثناء عند الضبط على عمق زراعة ٥,٥ سم، وجد أن عمق الزراعة الفعلي أقل من العمق المضبوط عليه الآلة عند كل سرعات الزراعة المستخدمة في هذه المرحلة.
- أعطى استخدام آلة الزراعة قادرSK 6 أعلى قيم للسعة والكفاءة الحقلية بالمقارنة بالة الزراعة قادر- SPC6 عند كل سرعات الزراعة المستخدمة.
- زيادة سرعة الزراعة من ٢,٥٢ إلى ٣,٥٦ كم/س أدى إلى زيادة السعة الحقلية بنسبة قدرها ٢٥,٠٢ و ١٩,٣٥ % وتناقص الكفاءة الحقلية بنسبة قدرها ٨,٠٧ و ١٤,١٢% لآلتي الزراعة قادرSK 6 و قادر SPC6 على التوالي. عند عمق زراعة ٣,٥ سم.
- زيادة سرعة آلة الزراعة من ٢,٥٢ إلى ٦,٨٠ كم/س أدى إلى زيادة القدرة المستهلكة بنسبة ٣٠,٣٣ و ٢٢,٥٩% وانخفاض متطلبات الطاقة بنسبة ٦٨,٨٠ و ٨٥,٢٩% لآلتي الزراعة قادر-SK 6 و قادر SPC6 على التوالي عند عمق زراعة ٣,٥ سم.
- أعطت آلة الزراعة قادر-SK 6 أقل القيم للقدرة المستهلكة ومتطلبات الطاقة بالمقارنة بالنتائج المتحصل عليها عند استخدام آلة الزراعة قادر- SPC6.
- تراوحت تكاليف الزراعة بين ٥٦,٨٠ إلى ٥٨,٧٠ جنيه/ساعة ومن ٣٦,٨٨ إلى ١٥,٧٤ جنيها/فدان عند تغير سرعة آلة الزراعة من ٢,٥٢ إلى ٦,٨٠ كم/س، عمق الزراعة من ١,٥ إلى ٣,٥ سم على التوالي لآلة الزراعة قادر-6 SK بينما كانت القيم المقابلة لآلة الزراعة قادر SPC6 تتراوح من ٦٠,٣٧ إلى ٦٣,٧٤ جنيها/ساعة ومن ٤٠,٢٥ إلى ١٧,٧٥ جنيها/فدان عند نفس سرعات الزراعة السابقة الذكر مقارنة بـ ١٠٠ جنيها/فدان في حالة استخدام الزراعة اليدوي (التقليدية).

التوصيات

من خلال النتائج السابقة يمكن التوصل إلى أنسب ظروف تشغيل للزراعة بآلتي الزراعة قادر SK6 و قادر SPC6 تم الوصول إليها عند سرعة أمامية ٥,٨ كم/س وعمق زراعة ٣,٥سم.