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DEVELOPMENT OF THE SEED DRILL TO PLANT COTTON SEEDS UNDER EGYPTIAN CONDITIONS

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ABSTRACT: A new feeder consists of 4 units was developed to change the seeder into planter. Each unit consists of 8 cells distributed in the circumstance of the feeder. The cell volume can be controlled due to the shape and seeds size.

The feeder motion can be adjusted by means of fixed gears in feeder shaft taking their motion from sliding gears on developed bar. Different forward speeds and different feeder speeds were experimented.

The optimum hill spaces of 30 cm and number of recommend seeds of 5-8 were obtained under 4 cells/ feeder, RPM feeder 24 and forward speed of 3.5 km/h. The total yield increased by 9.4% (0.85 quin/fed) than the seeder before development. The cost of one quintal decreased by 43% than the seeder before development.

INTRODUCTION

It is important to decide necessary data to base on the objective and select appropriate new technology through mechanization researches support the strategical crops. which participate in the international income. Nobody can deny that cotton has got to great economical value. it takes about 85% of the world yarn crop and average production is about 65% of the world production of yarn. Special technique had to be considered to deliver seeds in hills distributed through furrowers at recommended spaces.

The objective of this work :

Optimize the seeder use to be polypurpose as seeder and planter by developing new feeder can be

operated for different seed sizes and shapes and cover such problems facing cotton producers through the economical range.

Fleming (1984) mentioned that uneven seed distribution along the seed channel resulted, in the feeder was loaded on sloping ground and it was suggested that properly positioned lamella on the cone of the feeder would guide seed evenly down to channel, while raised lamella in the channel would prevent seeds running along the channel.

Ostuka et al., (1986) stated that, the metering accuracy and sowing accuracy of a belt type seed drill sowing were compared over stretches of 30m. The number of seeds in each hole of the belt (cell) never exceed (2) and the number of cells with (2) seeds did not exceed 5%. The proportion of cells with/seed was 9% when sowing at speed <0.5 m/s. But this decreased to 80%, (18.5% of cells empty) at speed 0.63 m/s, and the degree of slippage from the ideal 1000 cells/30m (Sowing distance 3 cm) increased from 10% to 23%.

Bepetov and Nestorov (1992) studied fluted roller of seed drill. A prototype was built and tested to determine the influence of roller revolution frequency on feed mechanism, productivity seed spacing and seed damage.

Result showed that, increasing the frequency and roller length and diameter led to increase productivity.

El-Hnafy (1997) reported that, by using the developed furrow opener in the case of dropping seeds, behind the press wheel encourage the seeds depth providing more on seeds and as a result, the highest yield was obtained, especially when the soil was chiseled twice followed by rotary tiller.

Helmy et al. (1999), constructed and evaluated an electronic control system on a grain drill unit. The electronic unit is also used to improve machine performance by insuring effective seed scattering and reducing seed losses. This study includes the evaluation of the effect of forward speed, feeder shaft speed and gate opening on seeds discharge rate, and flat opening on seed discharge rate.

As forward speed increased from 3.6 to 8.4 km/h, the discharge rate decreased from 490 to 475 gram/min, seed damage increased from 0.33 to 0.56 and scattering seeds increased from 17.14 to 31.49%. Also as feed shaft speed increased from 0.08 to 0.16 m/s, the discharge rate increased from 304 to 639 gram/min.

MATERIAL AND METHODS

The experiments were carried out at Rahmania Farm, Meet Ghamer, Center, Dakahlia. The experiments were conducted in an area of 2.5 fed. through two successful Agric. Seasons 2001 and 2002.

The following equipment were used in this research :

1- Tractor (Roman) of 75 hp (55.20 kW)
2- Chisel plow locally made (9 tines)
3- The furrower (mounted, 3 furrowers)
4- Land leveller locally made (3 m width) hydraulically controlled.
5- Seed drill (Nordsten type). Workable width 225 cm seed hopper capacity 150 kg., workable furrowers (4)

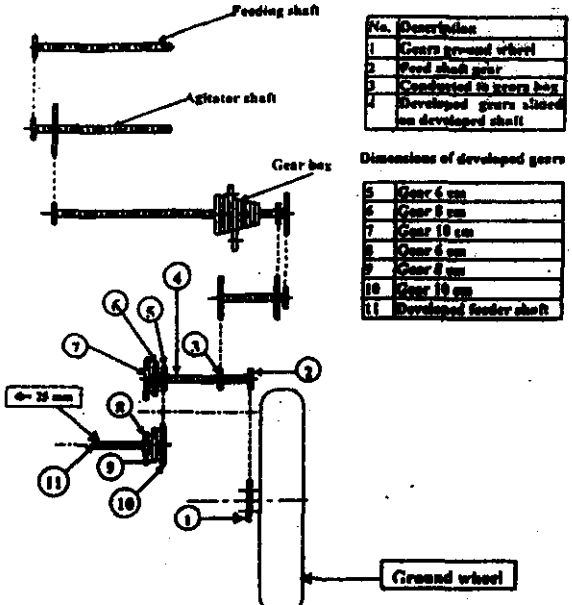
The developed feeder consists of four units. Each unit contains four cells to produce the recommended hill distances of 30 cm. The selected cell number of 4 cell, cell volume of 4.25 cm^3 was chosen under feeder speed of 24 RPM and 3.5 km/h forward speed to obtain the recommend seeds number 5-8 seeds per hill. The four feeder units are fixed in a shaft rotating by mean of three fixed gears having their motion from three gears slided on developed shaft. The motion is transmitted by means of sprokite. Four small seed boxes were developed located underneath the seeder hopper to facilitate the seeds delivery. A cutoff of brush was developed located at each cell face to help cell, to be through by filled. Three furrowers were developed to establish furrowers during planting process.

Crops specifications :

Cotton seeds variety (Giza 89). Mass of 1000 seeds (99.86) gram. Repose angle of seeds (41°).

A new feeder consists of four units was developed to be operated in the seeder to change its function from seeding into planter. Each unit consists of number of cells. 8 cells distributed on the feeder circumstance. The cell volume can be adjusted due to the seed shape, seed size and condition of planting. The four feeder units are fixed in circular section shaft moved by means of fixed gears of different diameters (6, 8 and 10 cm). Motion is transmitted to feeder gears from sliding gears, slided on a developed shaft (6, 8 and 10 cm) diameter by means of sprocket.

Three new furrowers were developed to establish the furrowers during planting operation.

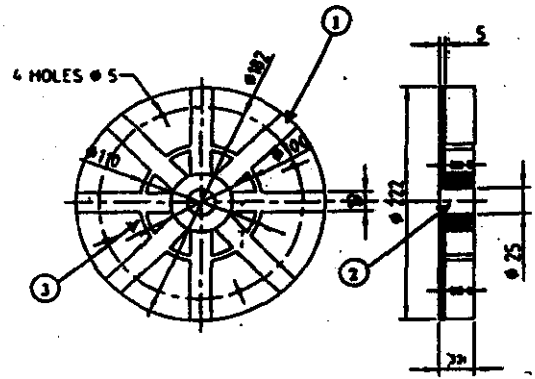


No.	Description
1	Gears ground wheel
2	Feed shaft gear
3	Conducted to gears box
4	Developed gears slided on developed shaft

Dimensions of developed gears

5	Gear 6 cm
6	Gear 8 cm
7	Gear 10 cm
8	Gear 6 cm
9	Gear 8 cm
10	Gear 10 cm
11	Developed feeder shaft

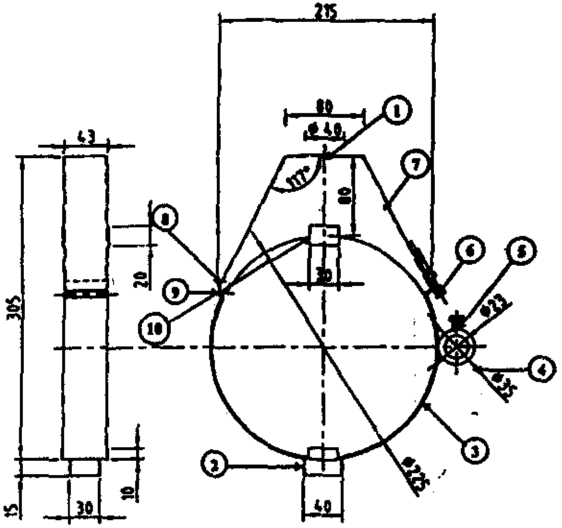
Fig. (1) : The technique of motion transmission from seeder wheel up to the feeder shaft of the developed seeder.



1	A gap in the cell construction.
2	Feeder shaft.
3	A gap in which the frame is fixed

Fig. (2) : The developed feeder construction

(Dimensions in mm)

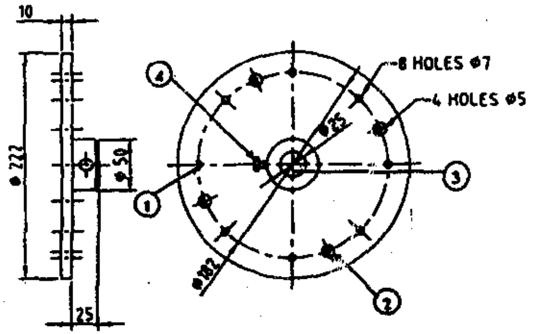


Elevation Side view

Dimensions in mm

No.	Description
1	Seeds input orifice
2	Seeds outlet orifice
3	Cover to close cell
4	A sleeve through which a fixed shaft is elongated to support the developed boxes
5	A bolt to fix seed boxes on the shaft
6	Screw bolt
7	Developed seeds box
8	Brush cut off
9	A hinge between the seeds box and cells cover
10	Steel iron-sheet

Fig. (4) : Elevation and side view of small box and cells cover (sheet-iron 3 mm)

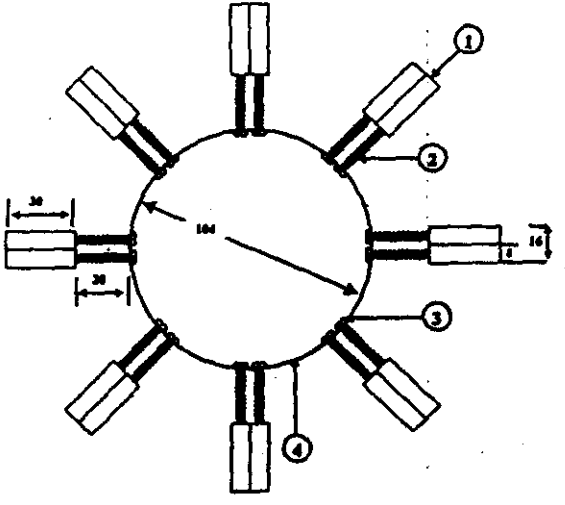


Side view Elevation

No.	Description	No.	Description
1	Fixed-stud nail	3	Feeder-shaft
2	Control-bolt to adjust cell volume	4	Fixed bolt to fix feeder on the shaft

Dimensions in mm

Fig. (3) : Cells Cover of the developed feeder.



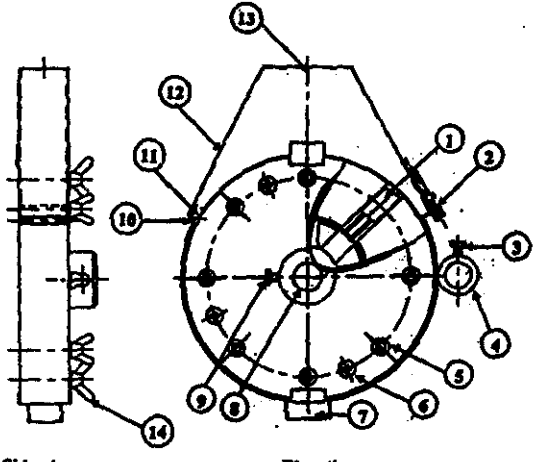
Elevation

Dimensions in mm

No.	Description	No.	Description
1	Coil shell	3	Screw
2	Pressure spring	4	Fixed frame

* The length of screw bolt is 3 cm plus 0.5 cm inserted through the digit

Fig. (5) : Section of digit, screw, spring and fixed frame.

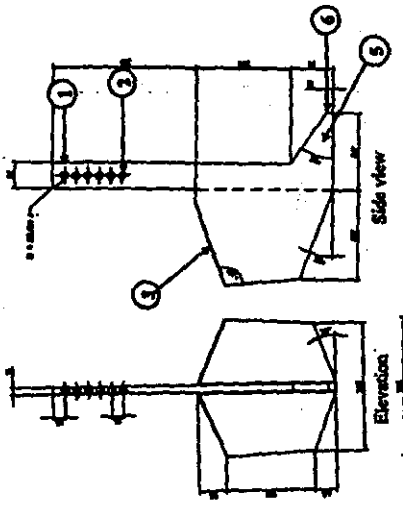


Side view Elevation

No.	Description	No.	Description
1	Feather of the coil	8	Feeder shaft
2	Screw bolt controlling the seed box gate	9	Screw bolt to fix feeder on the rotating shaft
3	Screw bolt to fix seeds box on the fixed shaft.	10	Elbow between seeds box and coil screw
4	Steel sleeve	11	Coil off length
5	Screw bolt to control volume coil.	12	Developed seeds box
6	Fixed pad	13	Seeds inpet orifice
7	Seeds feeder orifice	14	Screw bolt to control volume coil.

Dimensions in mm

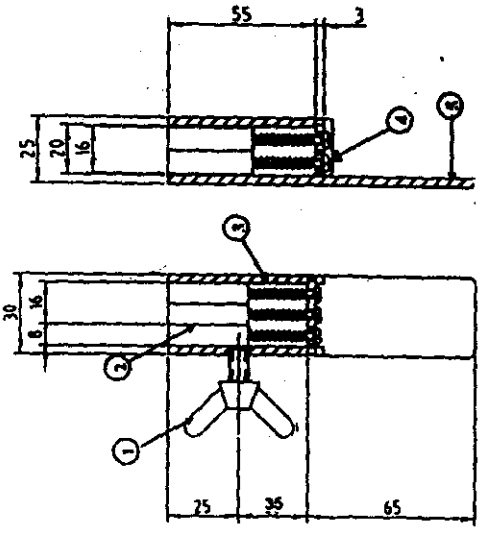
Fig. (6) : Feeder section showing section of the coil.



No.	Description	No.	Description
1	Ridger beam	4	Angle of wing to beam (20°)
2	Control orifice (front)	5	The ridger blade
3	Angle of wing inclination	6	Share tip

Dimensions in mm

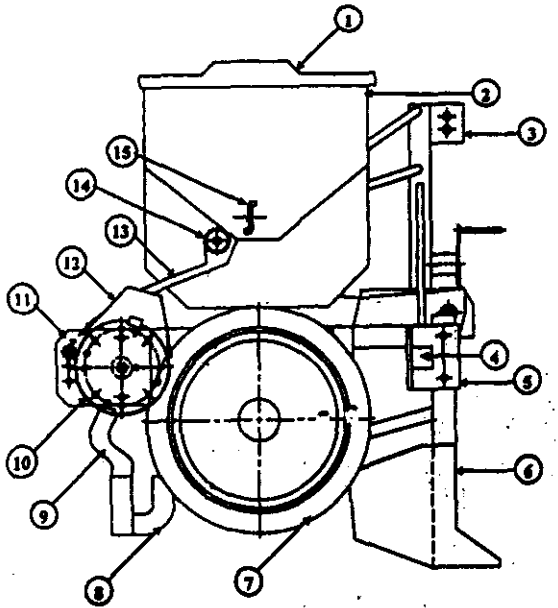
Fig. (6) : Dimensions of developed furrower (ridger)



No.	Description	No.	Description
1	Control hole of volume cell	4	Screw cell
2	Digit	5	Lock head
3	Pressure spring		

Fig. (7) : Dimension of the volume of metered cell to fit into the developed cell.

Dimensions in mm



No.	Description	No.	Description
1	Hopper one	9	Seed tube
2	Seeds hopper	10	Developed furrow
3	Potentiometer control unit	11	Plate and roller fastener furrow shaft
4	Frame	12	Developed seed box
5	The fastener point between of ridger and seeder	13	Valve
6	Developed ridgers	14	Furrow feed wheel
7	Ground wheel	15	Adjuster to move seeds in the box
8	Ridger opener of seeder		

Dimensions in mm

Fig. (9) : Section of the developed seeder.

The seeder before development was experimented to investigate its efficiency, hill spacing, number of seeds per hill.

The developed seeder was operated into stages.

1- To obtain the recommend hill spaces.

2- To obtain the recommend seed number/hill.

As to the first experiment, the developed feeder was experimented to select the proper cell number produce the desired hill spaces.

The optimum cell number was of 4 cells produced 30 cm hill spaces in the same row.

The second experiment was carried out in on area of 1.5 fed. Different cell volumes, different feeder RPM, at different forward speed.

To facilitate the discharge of seeds from the main hopper to feeder cells four small boxes were developed located underneath, the main hopper, their gates are facing cell opening to ensure cell fullness, a cutoff of brush was developed at each cell opening.

RESULTS AND DISCUSSION

The experiment was conducted under one cell, two cells, 4 cells, 8 cells at three forward speeds of 0.99, 2.3 and 3.5 km/h.

The obtained result reveal to the following :

1- The normal seeder drilled cotton seeds in rows in a flat area. Seed spaces in row were narrow in the, range (1-5 cm) resulting high plant density table (1). Furrowers had to be established by means of (tractor + furrower) consuming time and cost.

By experimenting the developed seeder, under different cells number and different feeder RPM, at different forward speeds table (1), a wide range of undesired hill spaces 6.8 to 152.5 cm table (1) were remarked. Considering four cells at feeder RPM. (24) and forward speed of 3.5 km/h the recommended hill space of (30 cm) was obtained. As to seeds number/hill, different cell volumes namely 4.25, 8.50, 12.75 cm^3 were investigated under different feeder RPM, different forward speeds considering the selected 4 cell. It is noticed that, the recommend seeds number (5-8)/hill was delivered under cell volume of 4.25 cm^3, feeder RPM (24), forward speed 3.50 km/h. It is interested to know that the usement of cutoff decreased breakage from (1.19 to 0.79%), and increased the germination ratio from (76.8 to

90.3%). As to dispersion percent, the usement of developed seeder decreased long tunal dispersion from (18.11 to 10.11%), side dispersion from (9.45 to 6.61%). So more healthy plants will be expected. Moreover an increase of (0.85) quintal/fed. was recorded under developed seeder. To evaluate the developed seeder economically, it was found, that it save about (349 L.E. fed) including (seed rate, furrow establishing, and yield).

It was found that the optimum cell volume of 4.25 cm^3 under feeder RPM (24) at forward speed of 3.5 km/h the delivered seeds were 5-8/hill. This number is in the range of recommended seeds number.

Table (1) : Hill spaces at different developed feeder speeds RPM, resulted from motative gears, cells number at forward speed 0.99 km/h.

Forward speeds, km/h	Gear diameter of developed feeder shaft, cm	Number of cells on feeder	Gear wheel diameter, cm					
			6		8		10	
			Feeder speed, rpm	Space between hills, cm	Feeder speed, rpm	Space between hills, cm	Feeder speed, rpm	Space between hills, cm
0.99, 2.30 and 3.50	6	1	9.00	91.50	11.97	68.80	14.94	54.95
		2		45.75		34.40		27.48
		4		22.88		17.20		13.74
		8		11.44		8.60		6.87
	8	1	6.75	122.00	9.00	91.50	11.25	73.20
		2		61.00		45.75		36.60
		4		30.50		22.88		18.30
		8		15.25		11.44		9.15
	10	1	5.40	152.50	7.20	114.38	9.00	91.50
		2		76.25		57.19		45.75
		4		38.13		28.59		22.88
		8		19.06		14.30		11.44

Table (2) : The effect of using cutoff on germination ratio under different cell volumes and different feeder speed.

Cutoff	Cell depth, cm	Cell volume, cm^3	Germination ratio of seeds %		
			Feeder speed rpm		
			6.75	15.75	24.00
With cutoff	0.8	4.25	93.1	92.1	90.3
	1.6	8.50	93.4	91.7	89.2
	2.4	12.75	94.2	92.3	90.7
Without cutoff	0.8	4.25	82.6	79.2	76.8
	1.6	8.50	87.1	84.0	82.6
	2.4	12.75	88.0	85.1	83.5

◆ **Note:** Number of cells/feeder: 4., The labo-germination ratio was of 95%.

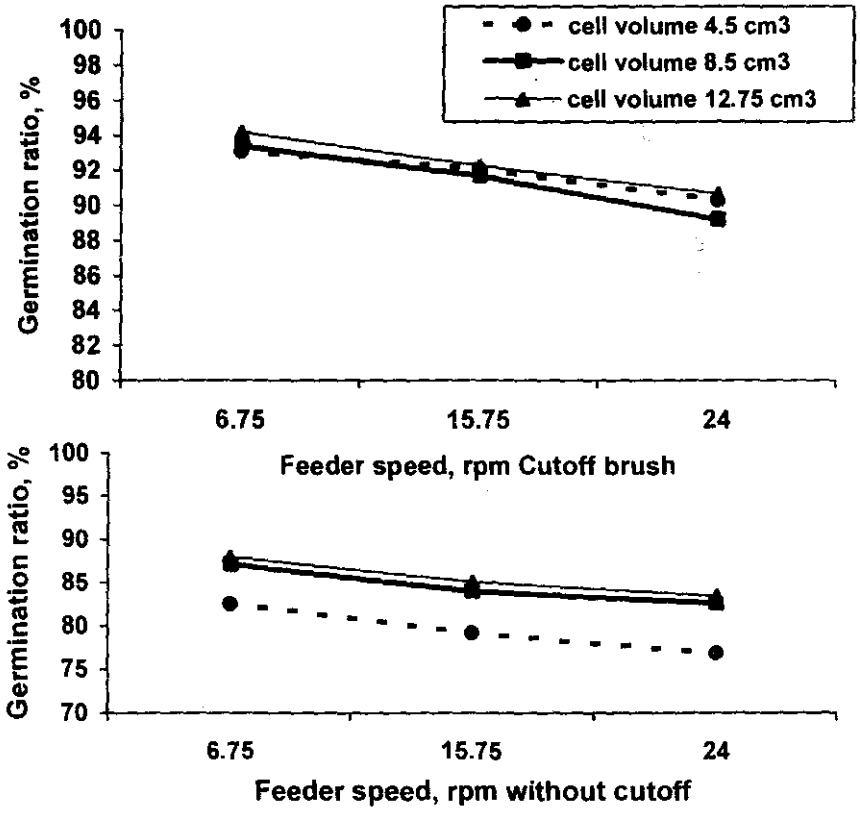


Fig. (10) : Effect of using cutoff on germination ratio (%), under different feeder (rpm), cell volumes.

Table (3) : The effect of using cutoff on seeds breakage percent under different cell volumes and different feeder speed.

Cutoff	Cell depth, cm	Cell volume, cm^3	Breakage seeds percent, %		
			Feeder speed rpm		
			6.75	16.75	24.00
With cutoff	0.8	4.25	0.39	0.54	0.79
	1.6	8.50	0.11	0.13	0.16
	2.4	12.75	0.06	0.08	0.11
Without cutoff	0.8	4.25	0.64	0.79	1.19
	1.6	8.50	0.20	0.26	0.31
	2.4	12.75	0.08	0.12	0.16

◆ **Number of cells 4 feeder**

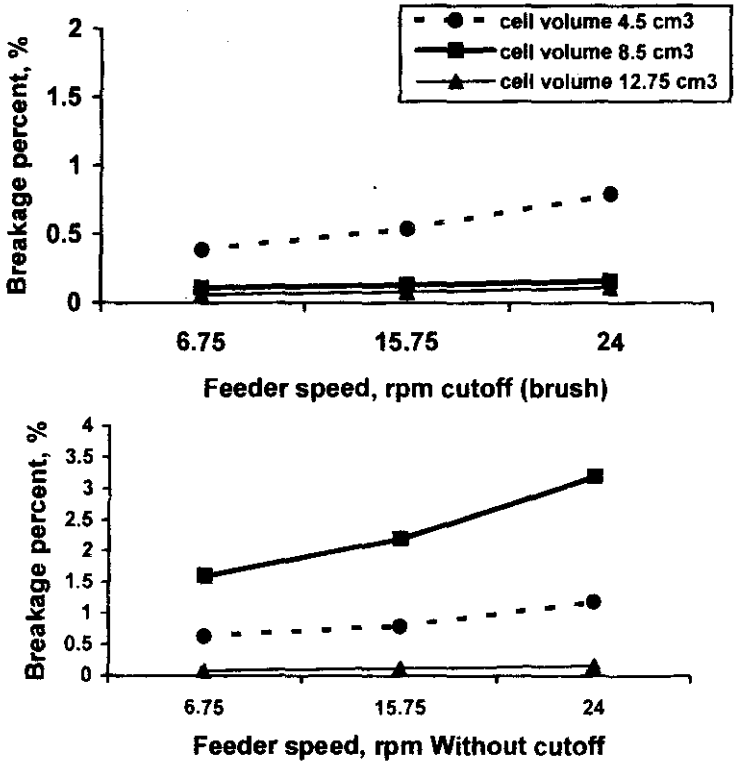


Fig. (11) : Effect of using cutoff on breakage (%) under different feeder rpm and cell volumes

SUMMARY AND CONCLUSION

The main results were as follows :

The seeder before development was operated at different forward speeds 0.99, 2.30 and 3.50 km/h. to drill cotton in rows on flat area. The seeds spaces were narrow range from 6.8 to 152.5 cm. The developed seeder was experimented to investigate the optimum cell number/feeder to results the optimum hill spaces. The experiment was carried out under one cell, two cells, four cells, eight cell at the three forward speeds 0.99, 2.30 and 3.50 km/h. The optimum cell number is 4 cells producing recommended hill spaces of 30 cm. To obtain the recommend seeds number/hill, three cell volumes of 4.25, 8.50 and 12.75 cm^3 were investigated under different feeder RPM, and 0.99, 2.3 and 3.5 km/h forward speeds.

The optimum cell volume of 4.25 cm^3 was selected under feeder RPM (24), and forward speed of 3.5 km/h producing the recommended seeds number of (5-8) seeds/hill. The developed seeder decreased side dispersion, the usement of cutoff decreased the breakage seeds by 0.79% and increased germination ratio to be 90.3%.

To evaluate the developed seeder economically, it was found that, it saves about 346 L.E/fed including (seed rate, furrower establishment, yield). Moreover it save about 28% from energy consumed under the undeveloped seeder. Evaluating the developed seeder, comparing to the seeder before development. the developed seeder save energy by 6.98 kW.h/fed and seeder rate by 3.35 kg/fed.

The developed seeder yield increased by 0.85 quintal/fed. To evaluate the total cost of planting by seeder before and after developing, the developed seeder save 349.01 L.E/fed. This is due to the cost of furrow establishment under ordinary seeder, cost of saving seed rate.

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تطوير آلة التسطير لزراعة بذرة القطن تحت الظروف المصرية.

صلاح الدين عبد المقصود ، محمد سعد الدين الشال ، مراد على أرناؤط ،

صلاح مختار عبد الحميد

قسم الهندسة الزراعية - كلية الزراعة - جامعة الزقازيق

يهدف هذا البحث إلى زيادة اقتصادية آلة التسطير التى أصبحت شبة عامة لدى محطات الميكنة ولدى معظم مزارعى القمح ويمكن جعلها آلة اكثر اقتصاديا وذلك بأن تصبح متعددة الأغراض لزراعة بذور المحاصيل فى جور.

تم ذلك من خلال تطوير جهاز تلقيم مكون من أربع وحدات مركبة على عمود دائرى المقطع ومركب على العمود ثلاث تروس ثابتة تأخذ حركتها من تروس منزلقة على عمود تم تطويره ليأخذ حركته من عجلة السطارة.

التروس المستخدمة ذات أقطار (٦ ، ٨ ، ١٠سم)

يتم نقل الحركة بواسطة جنزير لخفض فقد الحركة إلى أقل ما يمكن.

كل وحدة من جهاز التلقيم المطور يوجد على محيطها الدائرى عدد ٨ خلايا يمكن التحكم فى عدد الخلايا على القرص وكذلك التحكم فى حجم الخلية بما يتناسب مع شكل وحجم البذور المراد زراعتها وأقصى حجم للخلية الواحدة ١٢,٧٥ سم٣

تم وضع أربع صناديق صغيرة على كل وحدة ولها فتحتان فتحة خروج مواجهة للأرض أسفل وفتحة علوية (دخول بذور) تحت صندوق البذور الرئيسى بالسطارة وأعلى خلايا جهاز

التلقيم تم وضع قاطع من الشعر (فرشاة) على فوهة كل وحدة للتحكم فى حجم الخلايا وتقليل نسبة الكسر للبذور

تم تطوير عدد ثلاث فجاجات تعمل على إقامة الخطوط أثناء عملية الزراعة

أجريت عدة تجارب على اختيار عدد الخلايا وسرعة جهاز التلقيم للحصول على المسافة الموصى بها لزراعة القطن (المسافة بين الجور) للقطن صنف جيزة ٨٩

أجريت عدة تجارب على أحجام خلايا مختلفة تحت سرعات مختلفة لجهاز التلقيم وسرعات أمامية مختلفة للحصول على أنسب حجم خلية يحتوى على عدد بذور مناسب فى كل جورة (حسب التوصيات)

- **أسفرت التجارب بالنتائج التالية**

١- أنسب عدد خلايا فى جهاز التلقيم ٤ خلايا فى كل وحدة نتج عنها مسافة (٣٠ سم) بين الجور وهى المسافة الموصى بها فى زراعة القطن صنف جيزة ٨٩

٢- أنسب حجم خلايا هو ٤,٢٥ سم٣ عند سرعة دوران جهاز التلقيم بسرعة (٢٤ لفة/دقيقة) وسرعة أمامية ٣,٥ كم / ساعة.

٣ – استخدام القاطع خفض نسبة تكسير البذور من ١,١٩- ٠,٧٩ %

٤- استخدام القاطع زاد نسبة الإنبات من (٧٦,٨ –٩٠,٣ %)

٥- استخدام السطارة المطورة تم توفير فى كمية التقاوى وصلت (٤كجم / فدان)

٦- باستخدام السطارة المطورة تم تقليل القدرة المستخدمة حيث انخفضت الطاقة المستخدمة لزراعة الفدان من (٢٥,٧٧ إلى ١٨,٧٩ كيلو وات . ساعة / فدان)

٧ – انخفضت الطاقة اللازمة للزراعة بالنسبة للإنتاج الكلى من (٢,٨٦ – ١,٩٠ كيلو وات/قنطار).

٨ – استخدام السطارة المطورة زاد الإنتاج بحوالى ٠,٨٥ قنطار/فدان بنسبة ٩,٤ %.

٩ – عند التقييم الاقتصادى تبين إن السطارة وفرت عائد كلى (٣٤٩ جنيه/فدان) شمل ثمن توفير تقاوى البذور ، تكلفة إقامة الخطوط (تخطيط) وعائد زيادة الإنتاج.