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Integrated Planting Machine with Metering Mechanism Suitable for Various Seeds

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ABSTRACT

This study was conducted for the purpose of developing and manufacturing integrated planting machine with a disc metering device attached crank mechanism suitable for many seeds of different shapes and size. A (4.5 hp) diesel engine as a source of power for machine ground wheel rotation and metering system parts motivation, machine was tested under three ground wheel revolutions GR (30, 45 and 55) rpm, three metering disc to ground wheel revolution ratios MG (0.25, 0.3 and 0.5) and three kinds of seeds variety SV (sun-flower seed, cowpea and black seed).Experimental measurements were taken for the purpose of characterizing the experimental seed factors as follows: shape index (SI), weight of 1000 seeds (W), seeds moisture content (MC) determination, Actual seeds volume (V) and real density (γ). To evaluate the influence of previous factors there were procedural experiments on machine performance with main three measurements visible, invisible and total seeds damage (SD), actual seed feeding rate (SF) /10m of planting row distance and seeds lateral scattering frequency (L.S %) around the planting row centerline. The results showed that: experimental seeds tend to be oval in shape factor and have a low moisture content less than 18.5%, the highest (SD) at the higher value of ground wheel revolutions GR3=55 rpm. The best feeding rate for black seed (4 to 5 seed in feed-blot) obtained with MG2=0.3 while sun flower seed and cowpea (1 seed in feed-blot) with planting distance 20 cm at MG1=0.25 at GR1= 30 rpm.

Keywords: metering device – seed drill – seeder – cultivation – cowpea seeds – sun flower

ITRODUCTION

Agricultural seeds are varied in shape, size, feed rate and cultivation method, each type has its own nutritional value and economic importance, which led to a great diversity of agricultural machines suitable for each type of seed metering rate, planting distance.

Martinez *et al.* (2015) reported that sunflower seed considered one of the rich source for oil, minerals protein and fibers is a by-product. From other side Friedman and Brandon (2001) indicated that among these crops, sunflower seeds are profitable foodstuff because they contain low amounts of anti-nutritional, allergen factors and toxic components. Gonza and Vereijken (2007) showed that sunflower seeds are more prevalent than other seeds, such as soybeans, for their cultivation and its content of nutrients and oils. USDA Oilseeds (2018) reported that sunflower (Helianthus annus L.) is the third most important oilseed crop after soybean and oilseed crops production in the world for year 2018 amounted around 600 million metric tons, most of these seeds production is used for extraction oil. Marcia *et al.* (2017) showed that cowpea is a grain legume native in Africa and for developing world millions of people considered main food source with primary contains of protein, vitamins. Alexandre (2018) indicated that cowpea is rich in diverse nutrients, high levels of protein. Cowpea also is rich in a lot of nutraceuticals components such as antioxidants, dietary supplement, fatty polyunsaturated acids and polyphones. Cowpea available in most regions around the world as a safe food, always, low priced compared to other sources of protein. Based on the analyses performed, it is possible to infer that cowpea for all continents considered the promotion of food security and populations health. Habashi, *et all* (2007) showed that cowpea grown in the old lands with good germination. The recommended cultivation distances for most varieties whose is 15 cm and the planning in both cases is 12 lines / two reeds, with depth of the hole is fixed within 3 cm and this leads to the regularity of germination and growth. Paarakh (2010). Mentioned that plant of black seed considered one of the greatest healing plants has been given a great importance in the religion of Islam because of its number of usage. The Islamic prophet Muhammad once stated that the black seed can heal every disease except death. Dajani and Shahwan (2016) showed that the black seeds oil and its various extracts exhibit very broad pharmacological actions in many laboratory studies, which are predictive of human clinical effective effect in the fight against many diseases and infections. Qutb (2011) showed that there is a lot of research on the development of feeding systems the perfect appointment of sowing Nigella sativa seeds during the months of September and October. Recommended planting distances 25-30 cm, in place of the upper third of the line and on one feather, about 4-5 seeds are placed in each planting furrow hole. Navid *et al.* (2011) showed that the correct seed feeding system in row-crop planters is of great importance in the regularity of the farming process in terms of uniform seed distribution. Many researches and field experiments to develop farming machines and evaluate the performance of feeders and raise the efficiency of their work to suit the diversity of seeds and farming systems, from other hand Pareek *et al* .(2021) indicated that the prime objective of precision planters for better crop growth and yield uniform is seed distribution within the row. Maleki *et al.* (2006) reported that, the volume discharge ratio of grains considered oldest system for metering grains which the agitator is responsible for preventing grains from bridging. Seed in the flute opening is designed to be fluted-roller grain meter responsible for regularly of grain metering. Murray *et al.* (2006)

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Choosing the appropriate seed feeding system and designing the grain metering disc in terms of thickness and diameter of the feeding device metering disc cells to vary the shapes and sizes of seeds, achieves high efficiency in the feeding process in addition to the use of seeds of regular shape and size and the use of the appropriate feeding disk for the size of the seed at the recommended metering disc rotational speed for the ideal feeding rate and is used a method for measuring the performance of the feed system by calculating the rate of feeding seeds through the feed disk with respect to different rotational speeds. Ismail (2004). Talk about the optimal cultivation method and its importance in crop production, the main condition for high crop productivity based on seeds being replaced in the optimum living area. In other words, it is necessary for placing the seeds at equal planting distances at equal intervals within row for roots regularly growth and high germination rate. Karayel and Ozmerzi (2001). Although, several sowing machines are having various seed metering units. The pneumatic single seed planters widely used and quickly increased because its agriculture precision and their seeding efficiency. Additionally, seeder machines with mechanical seed metering systems do not work efficiently at high speeds Soza *et al*. (2007). showed that, many planters that having a grain metering unit are most commonly used in mechanized seedling process. It is due to there quickly increased results because their sowing efficiency is better than that of others machenes with different sowing methods. Note that the gears of the feed metering disks are not designed to work at high revolutions. Usually, the high efficiency of the cultivation process is at low rotational speeds. Abd alla (2002) show that in agricultural machines, the feed drums take the movement from the ground wheel of the machine to obtain an ideal and constant feeding rate for grains in the planting row, with the difference in tractor forward speed, the feed cylinders contain slots that fit each type of seed planted. The gaps are sized for specific yields as corn, soybeans, sorghum, and so forth the pressure inside the seed-metering drum lightly bigger than an atmospheric pressure outside the drum. Finally we can be noted that multiple studies emphasized the development of agricultural machinery to suit many processes, crops and grains, in order to save time and effort and maximize the benefit from those machines.

MATERIALS AND METHODS

This study aimed developed and performance evaluation of planting machine with a disc metering device, the planting machine was designed and manufactured including the main parts suitable for metering and placing the seed at the appropriate planting distances and enabling planting of 1 to 4 planting rows at a suitable metering rate for many seeds with different shapes and dimensions.

Physical and mechanical properties of seeds samples

Physical and mechanical properties of seeds samples (sun-flower seed, cowpea and black seed) according to the following procedures:

Shape index (SI): For metering disc slots design, a random sample of one hundred seeds was taken, the shape of each seeds sample was studied in terms of length (L), width (W), and thickness (Th) by using the venire caliber with accuracy of 0.01 mm. The obtained data were used to calculate the shape index of each sample from equation (1), according to Ismail (1988). At shape index > 1.5 the grain is considered oval and ≤ 1.5 the grain is considered spherical.

$$\text{Shape index (SI)} = \frac{L}{\sqrt{W \cdot Th}} \quad \text{-------------------------- (1)}$$

Weight of 1000 seeds (W): In order to determine the mean weight of 1000 seeds, samples of 1000 seeds were randomly selected. Each sample was weighted using an electronic balance with an accuracy of 0.01g.

Seeds moisture content (MC) determination: The moisture content of seeds samples was measured by the standard air oven using 25 g sample placed in air oven at 130º C for 16 h as recommended by Matouk (1976)

Actual seeds volume (V) and real density (γ): The actual seeds volume was measured by using half-liter capacity graduated beaker. The graduated beaker was filled with water to a defined level, then (M) 100 grams of seeds were completely immersed in the beaker. The actual seeds volume (V) cm^3 was calculated based on the difference between the two measured volumes of water before and after add seeds sample. Real density of seeds (γ) g/cm^3, was calculated using the following equation (2):

$$\gamma = \frac{M}{V} \quad \text{-------------------------- (2)}$$

The developed planting machine description

The developed planting machine was fabricated and constructed at the local workshop in Mansoura city from simple materials. It's manufactured as one unit seeder suitable seedling of 4 rows and consists of various developed parts as shown in figs. (1A & 1B) with main dimensions are 163 × 130 × 108 cm length, height and width respectively, The machine driving (directing) by labor and accompanied by an diesel engine 4.5 Hp. and gearbox to appropriate movable engine revolutions to ground wheel axe and metering device disc by transmission system with crank mechanism to ensure good appropriate feed rate for every seed varieties, the machine consists of the following main parts as shown in figs. (1A & 1B):

1- Main frame attached with ground, carriage wheels and furrow openers unit.
2- Source of power (diesel engine) and transmission system.
3- Developing metering unit with seed hopper.

Power source:

A (4.5 Hp) mechanical diesel engine with three different revolutions (2100, 3150 and 3850 rpm) attached on machine chassis with revolution speed reducer (gear box) in the rate of 1/70, was used as a source of Power to moving machine ground wheel and seed metering device parts

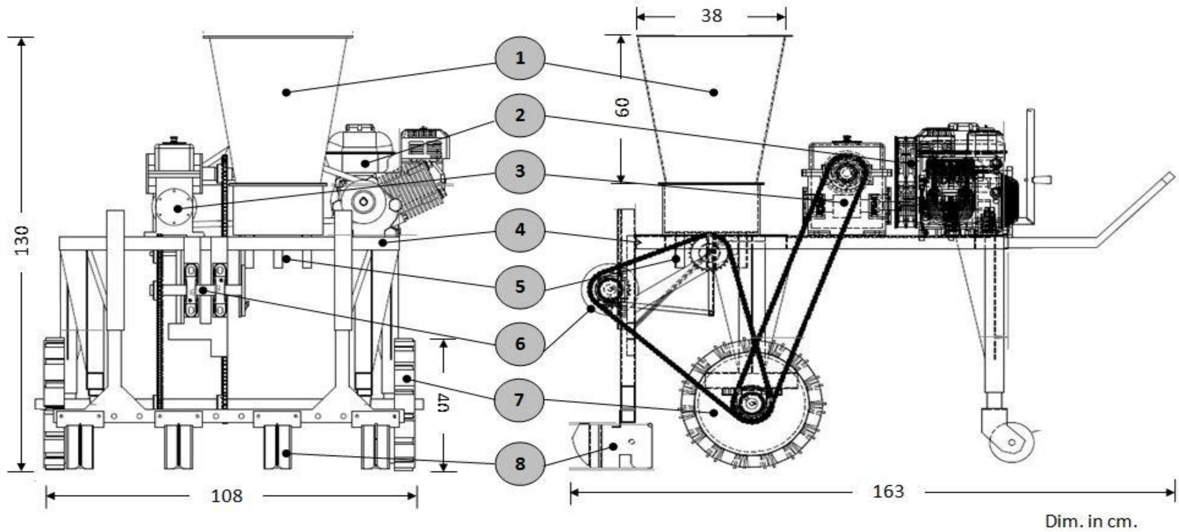
Transmission system:

From fig. (2) we can ravel out the transmission of revolutions between the different parts of the machine, which can be divided into three consecutive stages as follow:

-From engine to gearbox: The main source of power is a diesel engine whose revolutions/min. is controlled by the fuel hand to give (2100, 3150 and 3850) rpm to align with the calculations of the appropriate machine implementation, then by pulleys with the same diameter (15 cm) and belt the rotational movement is transmitted directly from the engine to the gearbox to be reduced by 1:70.

-From gearbox to ground wheel axe: The movement is then transmitted from the gearbox directly to the axis of the ground wheel 120 cm diameter, by two cogwheel (20 teeth) and chain.

-From ground wheel axe to metering mechanism: revolutions is transferred from the ground wheel axis by cogwheel (22 and 45 teeth) to cogwheel (11 and 15 teeth) fixed on metering crank mechanism axe for the appropriate range of metering disk feed slots for each type of seed.



1- Seed hopper.
2- Diesel engine.
3- Gear box.
4- Main frame.
5- Metering disk.
6- Crank mechanism.
7- Ground wheel.
8- Furrow openers.

Fig. 1A. A schematic diagram of planting machine with main dimensions

Fig. 1B. Main parts of planting machine

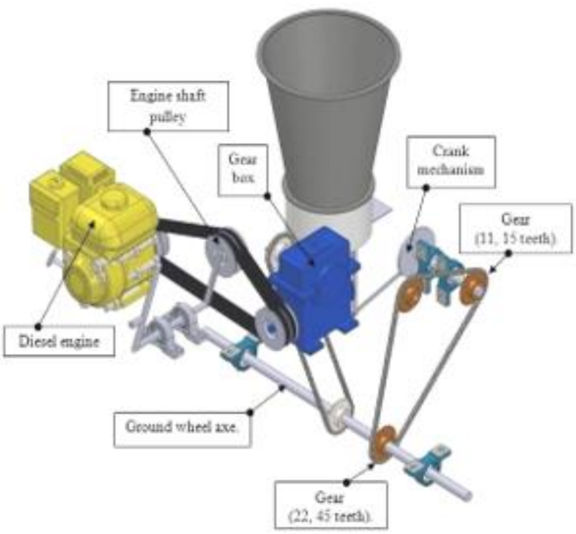


Fig. 2. Planting transmission system

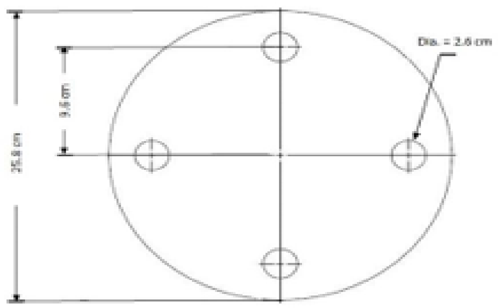


Fig. 3. Metering disc

The developed metering device consists of two disks each diameter is 25.8 cm and 2 mm thickness, above one fixed on the bottom of seed hopper and the other connect the crank mechanism arm to control the seed feed rate by control the size of the seed feeding hole, every metering disc have 4 feeding holes 2.6 cm diameter distributed throughout the disc circumference as shown in fig. (3)

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The experimental variables

To assess the performance of planting machine there were three experimental variables under study were conducted as follow: Three ground wheel revolutions **GR** (30, 45 and 55) rpm.

1) Three revolution ratios between metering disc to ground wheel MG (0.25, 0.30 and 0.50).
2) Three kinds of experimental seeds variety **SV** (sun-flower seed, cowpea and black seed).

The experimental measurements

To determine the effect of passing seeds through feeding system of the developed metering device, there were three main measurements were estimated as the following:

1) Percentage of visible seed damage (external) (VD %)

Visible seed damage was determined by using convex lens for each seed variety sample before and after its passing through feeding metering system of cultivation machine.

Percentage of visible grain damage was estimated through the following equation:-

$$(VD\ \%) = [(VN1 - VN2) / 500] \times 100 \text{ -------------- } (3)$$

Where:-

VN1 = Number of damaged seeds in sample (500 seeds), which randomly segregate from every seed main sample after its passing through seed metering feeding system.

VN2 = Number of damaged seeds before passing sample (500 seeds) through seed metering feeding system.

2) Percentage of invisible seed damage (internal) (ID %)

Germination test was carried out to determine the invisible damage of seeds. A randomized sample of (100 seeds) to determine the germination percentage, unharmed visible seeds were taken and planted for ten days in Petri dishes. The results were recorded and the germination percentage was estimated by the following equation:-

$$(ID\ \%) = [(PN2 - GN1) / PN2] \times 100 \text{ -------------- } (4)$$

Where:-

GN1 = Number of growing seeds

PN2 = Number of planting seeds (100 seeds).

3) The total seeds damage (TD %)

The percentage of visible seeds damage (VD %) summated with invisible seeds damage percentage (ID %), for all experiments, and the values of total seeds damage (TD %) were estimated basing for the following equation:

$$TD\% = VD\% + ID\% \text{ -------------- } (5)$$

To study the effect of developed planting machine performance on the regularity of the seed feeding rate there were two main measurements were estimated as the following:

1) Actual seed feeding rate (SF) / 10m of planting row distance

By counting the actual fallen seeds from one hole of the feed disk during the operation of the planting machine for a distance of 10 linear meters at the different experimental variables.

2) Seeds lateral scattering frequency (L.S %) around the planting row centerline:

To determine the cross scattering of seeds around the rows, experiments were performed without seed coverage process, the distribution of the seeds around the row centerline was determined after planting operation. The distribution was estimated by relating the number of seeds at different lateral distances from the row center to the total number of seeds at ten meters along of the row. For expressing this relationship for each experimental variable the frequency distribution curves were employed.

RESULTS AND DISCUSSION

Inspections of the data in table (1), it can be seen that all values of shape index (SI) for all seeds treatments are higher than 1.5, this intend that all experimental seeds shape take oval shape. This contributed us to fabricate metering device seed slot cells

shape as a oval spherical form. Also cowpea seeds had highest real density (γ) = 1.25 g/cm^3 and lowest value of moisture content (MC %) = 13.2 but sun flower seeds had lowest real density (γ) = 0.45 g/cm^3 and highest value of moisture content (MC %) = 18.4.

Also from demonstrated data summarized in table (1) clearly shown weight of 1000 seeds (W), and seed real density (γ) take the same trend, whereas its values were significantly increasing with increasing in moisture content but this behavior is contrary with actual seeds volume (V), which decreasing with seeds moisture content increasing.

Table 1. Mean values of seeds and mechanical properties.

Physical and mech properties Seeds treatments	Shape index (SI)	Weight of 1000 seeds (W) grams	Moisture content w.b (MC%)	Actual volume of 100 grams (V) Cm^3	Real density (ϒ) g/cm^3
Sunflower seeds	3.6	116.21	18.4	220	0.45
Cowpea	1.53	195.32	13.2	80	1.25
Black seed	2.1	4.61	15.6	86	1.16

Visible, invisible and total seed damage

The data tabulated in table (2) show the effect of metering disc rotating speed (rpm) at different seeds treatments under study on visible, invisible seeds damage. The demonstrate data show that, highest value of visible seeds damage 2.3% and invisible seeds damage 1.8 was gained by using developed seeder machine metering device with sun flower seeds at GR3 = 55 rpm and MG3 = 0.5, In general from obtained data it can be seen that increasing ground wheel revolution (GR) from 30 to 55 rpm caused more visible, invisible seeds damage.

Actual seed feeding rate (SF) / 10m of planting row distance

The number of seeds falling from the metering disc holes were calculated at different experimental parameters of the machine/10m of planting row distance, the obtained data illustrated in histograms figs (5A throw 5C) explain the following best seed feed rate for all seed variety gained with loast ground wheel revolution GR1 = 30 rpm but revolution ratios between metering disc to ground wheel (MG) had different effect on seed feeding rate This is due to the difference in the feeding rate recommended for each variety of seed. The results showed that the best feeding rate for sun flower and cowpea seeds gained with MG1 = 0.25 while for black seed with MG2 = 0.3.

Table 2. the effect of experimental factors on visible and in visible seeds damage.

Ground wheel revolutions (GR) rpm	Metering to ground wheel revolutions ratio (MG)	Sunflower		Cowpea		Black seed	
		VD %	ID %	VD %	ID %	VD %	ID %
GR 1 = 30	MG 1= 0.25	0	0	0	0.1	0	0.1
	MG 2= 0.3	0.9	0.2	0.2	0.4	0	0.2
	MG 3= 0.5	1.2	0.6	0.7	0.7	0.2	0.4
GR 2 = 45	MG 1= 0.25	0.6	0.4	0.3	0.6	0	0.5
	MG 2= 0.3	1.1	0.5	0.9	0.6	0.3	0.7
	MG 3= 0.5	1.8	0.8	1.1	0.9	0.5	1.1
GR 3 = 55	MG 1= 0.25	0.8	0.9	0.8	0.9	0.5	1.2
	MG 2= 0.3	1.9	1.2	1.4	1.5	0.6	1.7
	MG 3= 0.5	2.3	1.8	1.8	2.1	0.9	2.2

Summation of visible and invisible seeds and data illustrated in figs (4A throw 4C) indicate the same trend to decrease total seeds damage by decrease ground wheel revolutions (GR) with all seeds treatments under study and also total seeds damage values, were increased with increasing (MG) values from 0.25 to 0.5 It is due to the crash of the seeds because its pass through the metering device holes at high rotational speeds.

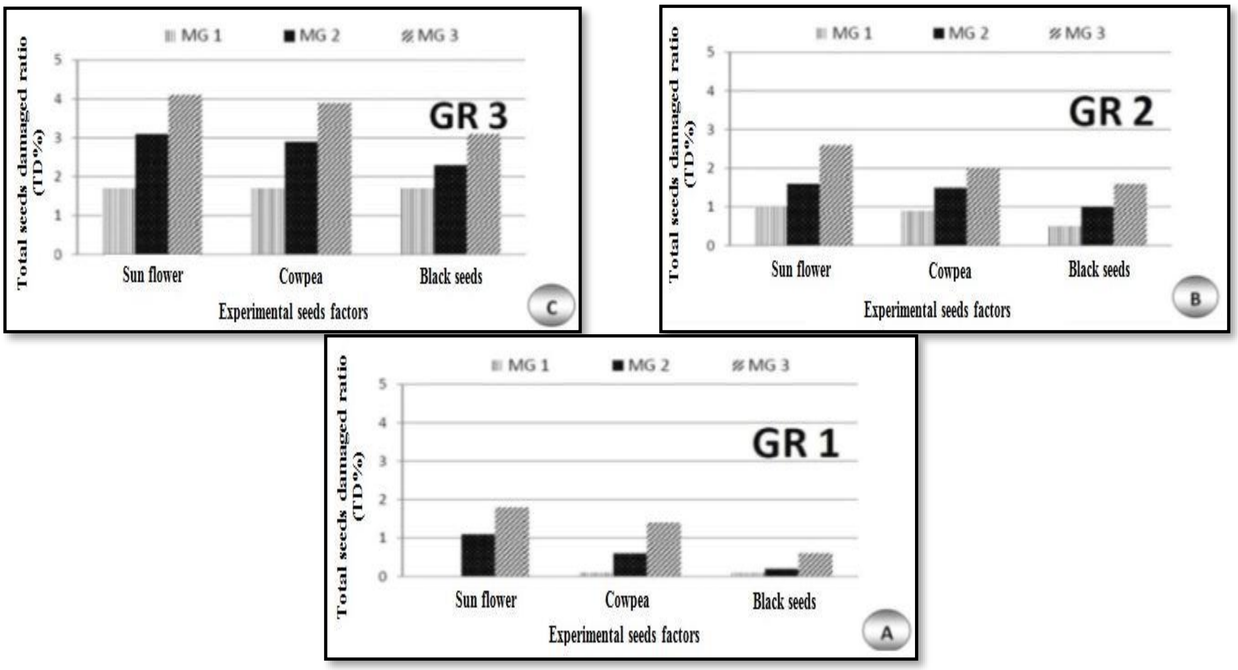

Fig. 4. (A, B and C): Total seeds damage percentage (TD %).

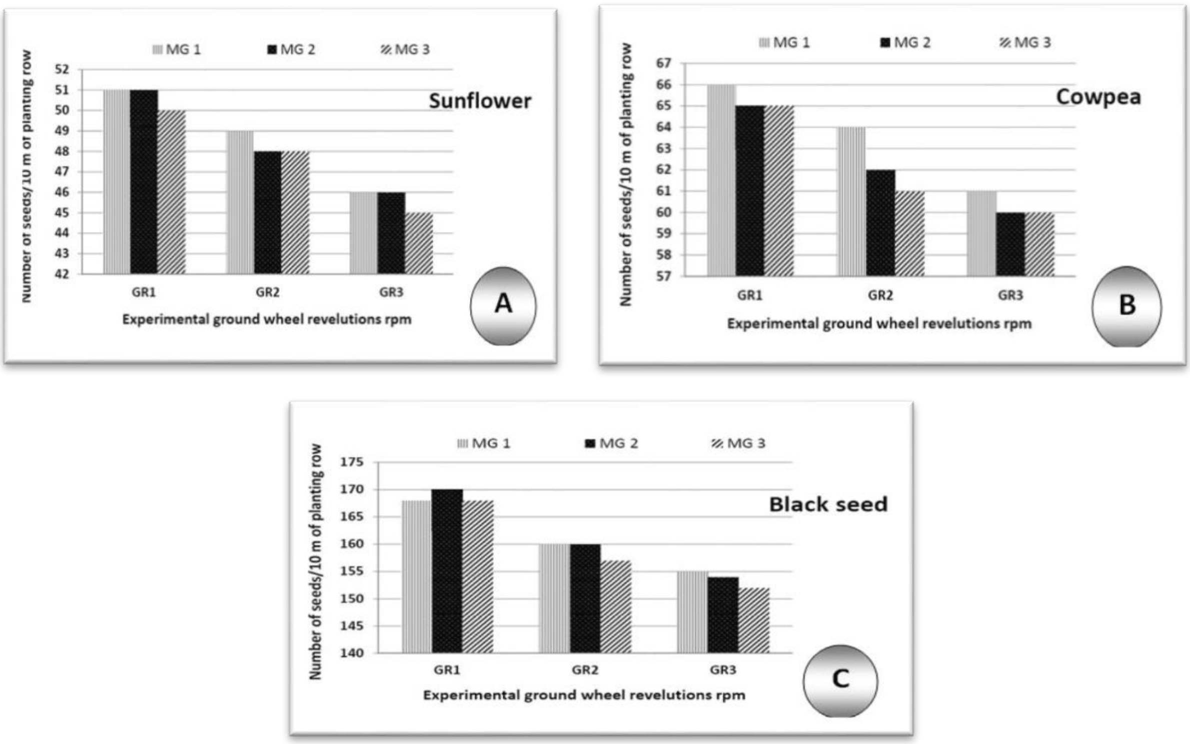

Fig. 5. (A, B and C): Actual seed feeding rate (SF)/10m of planting row distance

Seeds lateral distribution (L.S %) around the planting row centerline:

The obtained data illustrate in fig. (4A to 4C) show that, increasing the Ground wheel revolutions from Gr1= 30 rpm to Gr3= 55 rpm causes an increase in the lateral scattering of seeds (L.S), this is due to the increase in machine vibration at high forward speed, from the other side Increasing the seed weight (W) lead to decrease in seed scattering around the row centerline because Heavy seeds are more equiponderant and do not roll in seedbed.

From figs. (4A throw 4C) it can be seen that black seed with high ground wheel revolution Gr3=55 rpm with high value of revolution ratios between metering disc to ground wheel (MG3 = 0.5) showed the highest lateral scattering frequency of seeds (L.S%), from the other side cowpea seed with low ground wheel revolution Gr1=30 rpm with low value of revolution speed ratios between metering disc to ground wheel (MG1 = 0.25) had a highest lateral scattering frequency of seeds (L.S%).

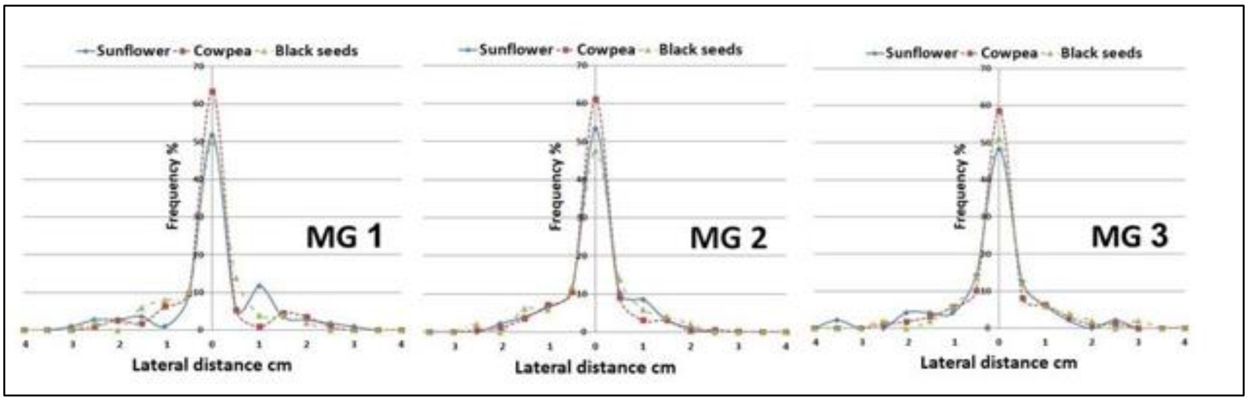

Fig. 4A. seeds lateral distribution around the row center line at GR1= 30 rpm with different (MG) under study.

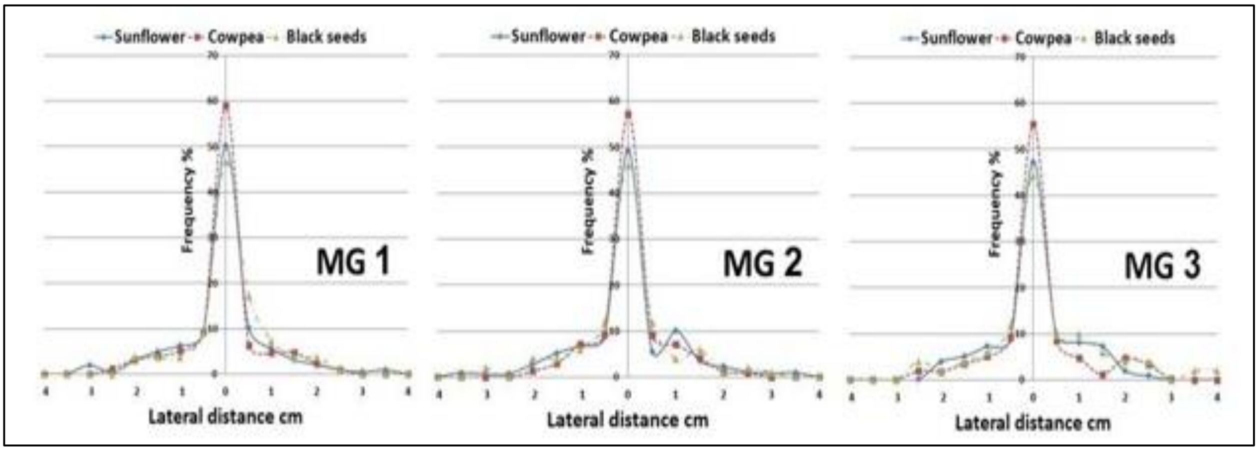

Fig. 4B. seeds lateral distribution around the row center line at GR2= 30 rpm with different (MG) under study.

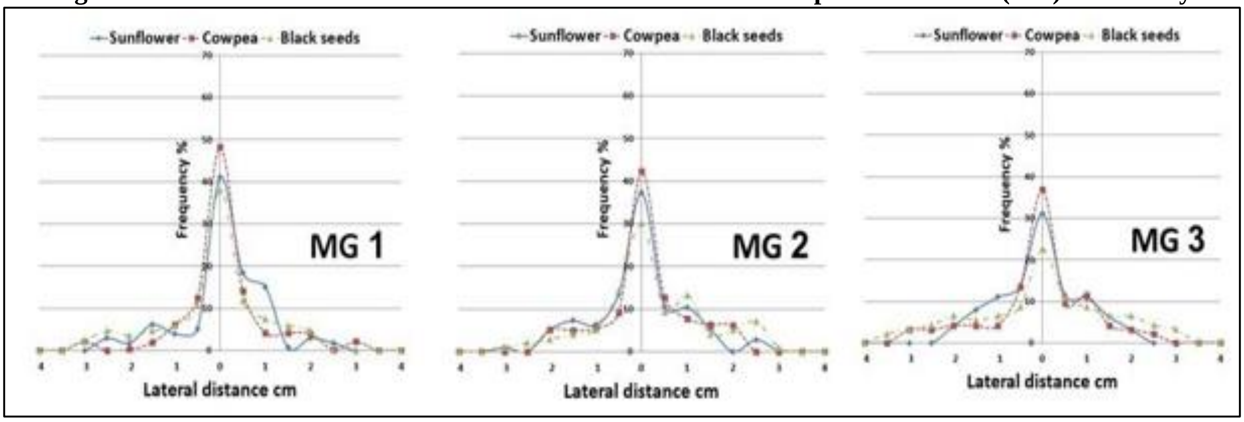

Fig. 4C. seeds lateral distribution around the row center line at GR3= 55 rpm with different (MG) under study.

CONCLUSION

In order to maximize the use of planting machines by planting many different seeds of different shape and size and different in metering feeding rates, planting machine with developed metering system was fabricated with crank mechanism to change the seed feeding cells size. This development contributed to the use of the machine to metering different seeds and the Experimentation with sun flower seed – cowpea – black seed with cylindrical shape (shape index > 1.5) with different volume/100gram 220, 86 cm^3 and density 0.45, 1.16 g/cm^3 for sun flower seed and black seed respectively, and the experiments showed that the feeding rate differs for each type of seeds with different experimental treatments, as it was found that the best feeding rate for all seeds gained with loast value of (GR=30 rpm) while the effect of the revolution ratios between metering disc to ground wheel (MG) on the seed feed rate where is the best sun flower seed and cowpea feed rate, one seed in planting furrow hole gained with (MG1= 0.25) but for black seed, 4 to 5 seed in planting furrow hole at (MG2= 0.3). It is also concluded that the negative effect of increasing seeder machine ground wheel revolutions from 30 to 55 rpm on seeds total damage (TD) and lateral scattering frequency (L.S %) for all experimental seed factors under study

REFERENCES

Abd alla, M. EL. (2002), Developing the metering unit of the pneumatic seeders, Ph.D, Thesis Eng. dept. Fac. of agric. Mansoura University.

Alexandre, C. d. S.; Dyego d. C. S.; Davair L. T. J.; Pedro B. d. S.; Rosana C. d. S. and Amauri S. (2018), Cowpea: A Strategic Legume Species for Food Security and Health, Intech Open,.

Dajani, E. Z. and T. G. Shahwan (2016), Overview of the preclinical pharmacological properties of nigella sativa (black seeds): a complementary drug with historical and clinical significance - Journal of physiology and pharmacology 67 (6): 801-817.

Friedman, M. and Brandon D. L. (2001), Nutritional and health benefits of soy proteins. J Agric Food Chem 49:1069-1086.

Gonza, l. S. and Vereijken J. M. (2007), Sunflower proteins: overview of their physicochemical, structural and functional properties. J Sci Food Agric, 87:2173-2191.

Habashi, A. H.; Abd-elAziz F. and El-Touni A. Cultivation and service of cowpea, Agricultural Research Center Central Administration of Agricultural Extension Publication No. 1087 for the year 2007

Ismail, Z. E. (1988). Same of the phsio-mechanical properties for potato tubers. J. Agric. Sci. Mansoura Univ. 13 B (4): 2259 – 2270.

Ismail, Z.E. (2004). The first report of project (Developing the Metering Unit of the Pneumatic Planter) financed by Mansoura University researches unit.

Karayel, D. and Ozmerzi A. (2001). Effect of forward speed and seed spacing on seeding uniformity of a precision vaccum metering unit for melon and cucumber seeds. J. of the Fac. of Agric., 14(2): 63-67.

Maleki, M. R.; Jafari J. F.; Raufat M. H.; Mouazen A. M. and Baerdemaeker J. D. (2006), Evaluation of seed distribution uniformity of a multi-flight auger as a grain drill metering device. Biosystems Engineering, 94(4): 535-543

Marcia, C.; Teresa a. L.; Eduardo R. and Valdemar C. (2017) Cowpea: a legume crop for a challenging environment,Wiley Online Library.

Martınez-Force, E.; Dunford N. T. and Salas J. J. (2015) Sunflower Chemistry, Production, Processing, and Utilization. Elsevier.

Matouk, A. M. (1976). Heat and moisture movement during low temperature drying and storage of maze grain. Unpublished Ph.D. Thesis, Dept. of Agric. Eng., University of Newcastle Upon Tyne, United Kingdom.

Murray, J. R.; Tullberg J. N. and Basnet B. B. (2006), Planters and their components, types, attributes, functional requirements, classification and description. School of Agronomy and Horticulture, University of Queens land, Australia, 135-137

Navid H.; Ebrahimian S.; Gassemzadeh H. R. and Mousavi M. J. (2011), Laboratory Evaluation of Seed Metering Device Using Image Processing Method, Australian Journal of Agricultural Engineering, Vol. 2, No. 1, 2011: 1-4

Paarakh, P. M. (2010), Nigella sativa Linn.- A comprehensive review. Indian Journal of Natural Products and Resources. 1(4): 409 – 429.

Pareek ,V. K.; Tewari R. M. and Brajesh N. (2021), Optimizing the seed-cell filling performance of an inclined plate seed metering device using integrated ANN-PSO approach , Artificial Intelligence in Agriculture Volume 5, 2021, Pages 1-12

Qutb, Sh. (2011), Cultivation, service and cultivation of Nigella sativa Agricultural Research Center, Central Administration of Agricultural Extension - Horticultural Research Institute Publication No. 1730 of 2011.

Soza, E. G.; Botta M. T. and Hidalogo R. (2007). Sowing efficiency of two seeding machines with different metering device and distribution systems: a comparison using soybean. Spanish journal of Agric, Re. 2 (3), 315-321.

USDA: Oilseeds: World Markets and Trade. 2018.

آلة زراعة بجهاز تلقيم يلائم البذور المتنوعة

عبد الله جمال عبد الفتاح ، عماد الدين أمين عبدالله أمين ، الشحات بركات البنا و طارق حسني الشبراوي

قسم الهندسة الزراعية – كلية الزراعة – جامعة المنصورة

تتشابه العديد من الحبوب و البذور الزراعية فى طريقة زراعتها و لكن تختلف فى الشكل و الحجم و معدل التلقيم، و عليه تنوعت الآلات الزراعية و خاصة أجهزة التلقيم بهذه الآلات لتلائم تنوع أشكال و أحجام الحبوب فأجريت هذه الدراسة بغرض تطوير و تصنيع وحدة زراعة متكاملة بنظام تلقيم من النوع القرصى يمكن التحكم فى حجم فتحات التلقيم به و معدل التلقيم مما يتيح استخدام آلة الزراعة المطورة فى تلقيم العديد من البذور المختلفة الشكل و الحجم، و تم استخدام الآلة المطورة فى تلقيم ثلاثة أنواع من البذور مختلفة الحجم و معدل التلقيم (لب عباد الشمس – اللوبيا – حبة البركة) و تم إجراء التجارب باستخدام ثلاثة سرعات دورانية مختلفة من عجلة الأرض بما يلائم معدل التلقيم و سرعة تقدم العامل المتحكم فى توجية و متابعة عمل الآلة GR (30و 45و 55 لفة/دقيقة) و ثلاثة نسب تخفيض مختلفة بين السرعة الدورانية لعجلة الأرض و آلية الكرنك والتى تنقل بدورها الحركه الى القرص المتحرك السفلى بجهاز التلقيم MG (0,25و 0,3و 0,5). و بداية و للمساعدة فى تصميم الآلة و نظام و معدل التلقيم و نقل الحركة تم أخذ بعض القياسات بغرض توصيف البذور التجريبية كالأتى: (معامل الشكل SI) و (وزن 1000 حبة W) و (المحتوى الرطوبى MC) و (الحجم الفعلى V) و (الكثافة الحقيقية γ)، و تم أخذ القياسات التالية للحكم على إنتظام أداء الآلة بنظام التلقيم المطور كالآتى: (التحطم الظاهرى VD%& التحطم الداخلى ID% و التحطم الكلى للحبوب TD%) و (معدل تلقيم الحبوب/10 متر طولى من خط الزراعة SF) و (نسبة التشتت العرضى للحبوب حول مركز خط الزراعة LS%). أظهرت النتائج أن قيمة معامل الشكل لجميع العينات التجريبية من الحبوب أعلى من 1,5 (تميل للشكل البيضاوى) و بنسبة رطوبة منخفضة أقل من 18,5%، بينما أعلى معدل تحطم كلى للحبوب و أعلى نسبة تشتت عرضى مع السرعات الدورانية المرتفعة لعجلة الأرض GR3 = 55 لفة / دقيقة، بينما معدلات التلقيم المناسبة مع السرعات الدورانية المنخفضة لعجلة الأرض GR1= 30 لفة / دقيقة و لحبة البركة من 4:5 حبوب فى الجورة الواحدة عند MG2=0,3 بينما لحبوب عباد لشمس و اللوبيا 1 حبة فى الجورة الواحدة و مسافة زراعة 20 سم عند MG1= 0,25. و نوصي بإستخدام الآلة ذات نظام التلقيم المطور لتوفير الوقت و الجهد و تعظيم الإستفادة لإمكانية زراعتها للعديد من البذور المتنوعة الشكل و الحجم.