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DEVELOPMENT AND PERFORMANCE EVALUATION OF A SIMPLE GRADING MACHINE SUITABLE FOR ONION SETS

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ABSTRACT

This research was intended to develop a small cylinder type grading machine to suit grading of onion sets crop. Two operating parameters each of four levels were studied. The studied parameters included, riddle revolving speed 35, 45, 55 and 65 rpm (0.366, 0.471, 0.576, and 0.680 m/s), and riddles feeding rates (75, 100, 125 and 150 kg/h). The effect of machine parameters on grading efficiency (%), grading productivity (kg/h) and the mechanical damage percentage, were also considered. Results showed that the machine is quite successful for grading onion sets. The best result was obtained at 55 rpm riddles revolving speeds and 125 kg/h riddles feeding rate. At these values, maximum grading efficiency of 94.34% and permissible mechanical damage of onion sets 4.66% were obtained. These results proved that, the proper operating parameters corresponded with theoretical considerations as the relevant for machine operation.

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important crops widely grown in Egypt, and it has a very high potential for exportation. Onion is grown in Egypt all over the year (winter or summer or interplanted crops). The cultivated area of onion crop is 139835 feddans, which annually produces over 1.79 million tones (Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, 2009). In Egypt, there are several methods to grow onions. These methods include sets, seedlings (transplants), and seeds. Sets are defined as onion bulbs that ranged from 8.0 to less than 20 mm in diameter. These small bulbs are conditioned to be planted later in the field. After planting, they immediately grow to form larger onion bulbs, although sets are sometimes appropriate for growing both bulb onions and green onions. Increasing the production of onion crop is the aim of all onion producers. This may be achieved by using a suitable technology, improving the technique of agricultural process and when sets method will be considered, Hassan (1991), Gamie *et al*. (1995), Ebrahim (2006) and ARC (2007).

Adoption of onion sets method greatly reduces high production costs. Due to poor virulency of fungi causing the white rot, downy mildew and purple blotch diseases from august to December, the crop practically escapes their attacks. Controlling fungicides, costing over 200LE/feddan, can thus be saved. Extra savings result from lower requirements of labor, fertilizers and irrigation and feasibility of mechanization. In addition, earliness of maturity, relative to the transplanted crop, means a better competition in the international market and earlier operation of a local dehydration plants, Gamie *et al*. (1995), Hassan (1991), Amin *et al*. (1998), ARC (2003) and Helmy *et al*. (2005).

Some attempts were carried out to evaluate the available planters for planting onion sets under Egyptian conditions [El-Sahrigy *et al*. (1991), Amin *et al*. (1998), Tayel *et al*. (2001) and Helmy *et al*. (2005)] They stated that mechanical planting of onion sets is introduced to facilitate uniformly planting. Uniformity of sets distribution within row depends to a great extent on the performance of the metering devices of the planting machine, where metering devices (mechanical and pneumatic) are functioning to seeds dimensions and cell conditions, therefore, Planting uniform onion sets leads to increase productivity and quality of onion bulbs, Gamie *et al*. (1995) and ARC (1996 and 2007). On other words, percentages of single bulbs marketable and exportable yields were significantly increased; while, percentage of doubling, bolters, bulb weight, total and culls yields and number of days from planting to harvest were significantly decreased, Gamie *et al*. (1995), ARC (1996) Ebrahim (2006) and ARC (2007).

Mechanized grading is not only to replace the manual work by mechanical grading but also to adapt systems, which may help growers and market dealers to determine their prices in an accurate and accepted way to the consumer. In other words, the cheapness and simplicity of these machines would encourage the farmers to grade onion sets for obtaining a uniform sets categories to suite mechanical planting that leads to produce higher yield and better quality of onion bulbs, and enable farmers to under take cultivation of a large area.

The base of grading onion sets depends on weight or size. Hence, identifying sets properties is meaningful to design special grading machines and to determine the operational parameters such as cell shape, drum (sieve) speed and slope of drum axis. From the standpoint of quality pack, it would be desirable to remove the large diameter products first to avoid the damage during handling through each grading unit. Size separation could be made with a screen, chain, holes in belt, cup, roller above a belt, or over a diverging opening, such as made by a roller and spring or two rollers, Ryall and Lipton (1983).

In more detailed study, Michael *et al*. (1983) and O'Brien *et al*. (1983) conducted sizing operations by passing the fruits over diverging belts having holes, wire mesh belting, drop roll sizes, or volumetric size. The belts with holes and the wire mesh sizes separate the fruit into two sizes while the others provide up to six sizes by gradual widening of the sizing members that support the fruit.

Balls (1986) showed that the optimum flow rate of material (objects) must be ranged between 250 and 450 object per minute to increase the work rate and accuracy of the operator. Consequently, the machine capacity and efficiency increased, and product injury may be avoided. Meanwhile, Kader (1992) showed that the size grade of an item might be determined by one, two or three linear dimensions or its mass (weight). Single dimension is determined by the minimum distance apart of a pair of parallel bars between which the produce can pass. Two dimensions are determined by the distance between the sides of a square hole or diameter of a circular hole, through which the product can pass. Inclination is normally set to 10°, but some machines allow this to be adjusted to suit crop flow characteristics.

Yang and Liu (1997) designed and constructed a grading mechanism in which the sizing plates are linked to the roller chain and the other side slides against the guide plate. The opening between sizing plates is gradually increased as the roller chain moves. Fruits enter the grading mechanism and lie on the gaps between sizing plates, dropping through the openings and into bins when the openings become large enough. Sorting efficiency and sorting purity were both 88%, while sorting efficiency and sorting purity decreased to 74 and 76%, respectively, when 3 grades of plum fruits were sorted.

In Egypt, numerous researchers have designed and fabricated grading machines for grading fruits and vegetables by shape, size, and or by weight.

Abdel-Mageed and Abd Alla (1994) developed a laboratory-grading machine to grade sphere-like crops. Three machine parameters such as grade inclination angles, height of sizing element (dividers height) and dividers tilt angle were investigated. They stated that adjusting divider height is the most effective parameter on grading efficiency to grade sphere-like crops such as tomatoes. While, Amin (1994) fabricated a laboratory cylinder grader for potato tubers, he concluded that by increasing both of drum speed and its axial slope the length of the drum has to be increased, to get a reasonable grading efficiency of the machine. The machine capacities at optimum drum speed of 25 rpm and slop of zero degree was 1.2 t/h with tuber damage of 0.23%.

EL-Raie *et al*. (1998) designed and fabricated grading machine for orange using diverging bar and roller cylinder. They showed that the optimum speed of feeding conveyor was 70 rpm, the most suitable lines for the grading unit were the cylinder system, and the most suitable tilt angle of grading unit ranged from 3 to 6 deg.

Matouk *et al*. (1999) designed and constructed a portable machine for sorting, cleaning and grading sphere-like crops. They concluded that, at any sieve slope in the range of 5 to 20 degree and all sieve rocking speed in the range of 150 to 300 rpm the mechanical damage percentage of fruit increased as the speed of fruit feeding chain increased from 0.15 - 0.3 m/s. They added that, at high sieve rocking speed the grading efficiency of fruit decreased.

Mostafa (2003) developed and fabricated an appropriate system for grading onion bulbs by size. He showed that, the optimum operational conditions at 0.23 m/s and zero longitudinal angles achieved maximum grading efficiency of (94.9 %) for Giza-20 onion variety. While, Genidy (2003) concluded that the machine grading capacity increased by 22.2 % when the cylinder speed of feeding cells was increased from 10 to 40 rpm (0.11- 0.42 m/s) at different levels of tilt angles during grading the muskmelon.

Abd El-Rahman (2004) adapted a portable shaker type-grader to suit grading of onion bulbs. She found that, the best result was obtained at bulbs feeding rate of 800 kg/h and oscillation levels of 30 osc./s for the grading unit. At these levels, 94.57% grading efficiency and 3.69% mechanical damage were obtained.

The main objectives of the study were to:

1. Modify and test a simple cylinder type grading machine for onion sets to produce a uniform sets for mechanical planting.
2. Study the effect of some operating parameters such as, speed of cylinder riddles and feeding rate of onion sets on the machine grading efficiency and grading productivity. The effect of machine parameters on total mechanical damage percentage was also considered.

MATERIALS AND TEST PROCEDURE

To fulfill the objective of this study, a small scale cylinder type grading machine was constructed and tested in the Ag. Eng. Res. Inst. (AEnRI), Ag. Res. Center (ARC), to suit grading of onion sets for the planting process. The experiments were carried out in a special farm at Dakahlia Governorate, during 2010 onion harvesting season.

- Materials:

A local cultivar of onion sets (Seds-6) was used in this study. This variety is prevalence grown in upper and middle Egypt and characterized by its marked pungency, high dry matter content, firm and tight outer scales, and closed necks which enable it a longer storage period.

-The developed machine:

The technical specification of the developed machine is shown in Fig 1 (a and b), the machine structure consists of:

1 – Machine frame:

The machine frame constructed from steel angles 25x25 mm, meanwhile the stand of the riddles unit was made from steel section C-channel of 150 x 50 mm, welded together and provided by adjusting screws to tilt the riddles unit. The frame dimensions are 1050 mm long, 550 mm wide and 1250 mm high. All parts of the machine are mounted on the frame in alignment.

2 – Feeding hopper:

A cylindrical metal hopper was fixed on the main frame of the machine to feed the sets into the riddles unit. It was made of iron sheet 1.0 mm thick, with dimensions of 250 x 560 mm for the diameter and height, respectively. The sides of the hopper had a gradual slope of 18.5 degree to allow sliding of onion sets. This angle was chosen according to the measured friction angle. The bottom of the hopper was slightly tilted downwards to encourage sets to pass through the center of the internal riddle. The hopper has a sliding gate to control feed rate.

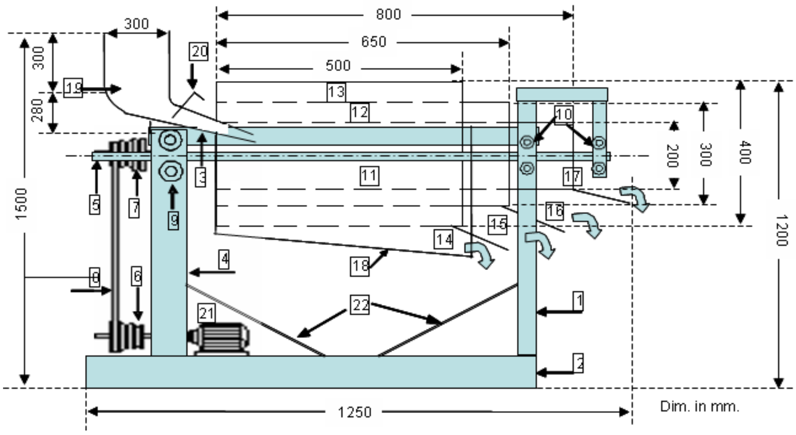
3 - The grading unit:

The grading unit consists of three cylindrical riddles (sieves) having a parallel bars cells. The riddles arranged one inside the other according to the size (the large mesh riddle being the internal, while the smaller meshes riddle being external. The cylindrical riddles are fixed on the drive shaft and fixed with the machine frame. As shown in Fig 1 (a and b), the dimensions of the internal riddle were 800 mm long and 200 mm diameter with cell size of 20 mm; the middle riddle has 650 mm long and 300 mm diameter with cell size of 16 mm; while, the external riddle has 500 mm length and 400 mm diameter with cell size of 8.0 mm. These cell sizes were selected according to the specification of quality standard of onion sets as recorded by, Agric. Res. Center (ARC), 2007. Therefore, onion sets may be sized into four categories, as follow:

Grade (1) sets diameters > 20 mm, large (culls).
Grade (2) sets diameters 16 - 20 mm (medium).
Grade (3) sets diameters 8 -16 mm (small).
Grade (4) sets diameters < 8 mm, very small (culls).

4 - Source of power:

A single-phase electric motor 220 volt, 1.0 hp (0.746 kW) provided with a reducer speed was used for driving the riddles. The power was transmitted from the source to the driving shaft by means of V belt and pulleys.



1, 2, 3 and 4 - frame 5 - driving shaft 6 - drive pulley 7 - driven pulley 8 - v belt 9 and 10- ball bearing 11- internal riddle 12-middle riddle 13- external riddle 14, 15, 16 and 17 – outlets 18 - riddles cover 19 - feeding hopper 20 - sliding gate 21- motor 22 - bracket

Fig. (1- a): Schematic diagram of the developed cylindrical-type grader

Fig. (1- b): Actual photo of the developed cylindrical-type grader

Theoretical Considerations Of The Cylindrical Sieves:

The mix of onion sets is delivered from one end of the rotating cylindrical sieve (inclined or horizontal) and tries to reach the other end of the cylinder.

During this action, onion sets located at the lower portion of the cylinder are lifted upward by the screen surface, after which they are again lifted along with it and slide down. They gradually move toward the opposite end of the cylinder. The sets are in contact with only a part of the cylindrical surface with no relative velocity with respect to it during their lift. The nature of the motion of onion sets over the surface of a cylindrical sieve depends upon the coefficient of friction on the given surface; the kinematics operating condition is governed by centripetal acceleration $r\omega^2$, the initial conditions of motion of the particles, the point at which they are delivered onto the sieving surface and their initial velocity. Depending upon the relationship between the above factors, the sets in the cylinder may slide along it, separate from its surface and perform a free flight or may move with the surface being at rest relative to it. In the last case the sets material is not sieved (Bosoi *et al*. 1991). At neglected the sliding motion of the onion inside the sieves; the release of onion sets through a cylindrical sieve depends upon their relative velocity and the forces acting on them. These forces are:

- The weight of sets mg, directed downward; and the centrifugal force $m\, r\, \omega^2$

Where:

- (m) is the mass of the onion sets;
- (r) is the radius of the cylinder;
- (ω) is the onion sets angular velocity.

The motion of the particle on the cylinder surface is not determined by the tangential forces alone. But, if the resultant of the normal forces (N) is not directed towards the cylinder surface, the particle will loose contact with the cylinder.

To find the equation that describes the motion of the onion sets through the cylindrical sieve (Fig. 2), it can be found that:

$N = m\, r\, \omega^2 + mg \cos \acute{\alpha}$ …..…. in the normal direction (at $y^- y^-$)……….*(1)*,

$mg \sin \acute{\alpha} = \mu N$ ……… .…….. in the tangential direction (at $x^- x^-$)…….*(2)*

Where:

- (N) is the reaction force;
- $(\acute{\alpha})$ is the angular position of the particle on the sieve surface measured from the horizontal axis in the direction of rotation;
- (μ) is the coefficient of friction between the particle and the cylindrical surface.

By substituting (N) from equation (1) into equation (2) then:

$$mg \sin \acute{\alpha} = \mu\, (m\, r\, \omega^2 + mg \cos \acute{\alpha}) \quad \text{………...(3)}$$

$$\frac{mg \sin \acute{\alpha}}{\mu} = m\, (r\, \omega^2 + g \cos \acute{\alpha}) \quad \text{……………….(4)}$$

$$g \sin \acute{\alpha} = \mu(r\, \omega^2 + g \cos \acute{\alpha}) \quad \text{…………………..(5)}$$

$$\mu\, r\, \omega^2 = g \sin \acute{\alpha} - \mu\, g \cos \acute{\alpha} \quad \text{…………………..(6)}$$

$$\omega^2 = \frac{g \sin \alpha' - \mu g \cos \alpha'}{\mu r} \quad \text{……………….… (7)}$$

$$\omega = \sqrt{\frac{g}{\mu r}\left(\sin\alpha' - \mu\cos\alpha'\right)} \quad \ldots\ldots\ldots\ldots\ldots (8)$$

But $$\omega = \frac{2\pi n}{60} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

Where *(n)* is the revolution numbers of the cylinder sieve.
From equation (8) and equation (9) we get:

$$n = \frac{60}{2\pi}\sqrt{\frac{g}{\mu r}\left(\sin\alpha' - \mu\cos\alpha'\right)} \quad \ldots\ldots\ldots (10)$$

At *ά = 90°*

$$n = \frac{60}{2\pi}\sqrt{\frac{g}{\mu r}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11)$$

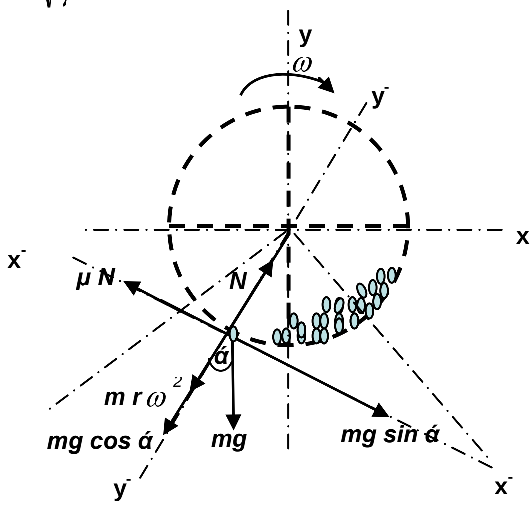


Fig. (2): The forces acting on a particle of onion sets in a rotating cylinder

The behavior of onion depends on the cylinder number of rotations at a given radius with a certain factors such as onion layer, internal friction and others, that affecting the performance of grading. Let us determined above factors as a certain value of (K) that ranged from 0.33 to 0.40 according to Klenin *et al.*, 1985. Then the equation (11) may be equal

$$n = \frac{30K}{\pi}\sqrt{\frac{g}{\mu r}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$$

By knowing of, g = 9.81 m/s, r = 0.10 m and μ = 0.33 (the measured friction angle was 18.5 deg.) and by substituting in equation (12).

The number of rotation per minute (*n*) for the cylinder sieve should be lower than 55.8 rpm (critical speed). The sieves are set inclined to the horizontal plane, to improve the internal pressure forces during the rotation of the particles mass. In this study, the slope angle of the cylindrical sieves on the horizontal plane (10°) was selected according to Klenin *et al*. (1985).

Experimental Treatments:

The experiments were designed, and carried out to study the effect of the following variables:

1. Four different speeds of the riddles unite 35, 45, 55, and 65 rpm (0.366, 0.471, 0.576, and 0.680 m/s), were selected according to the theoretical analysis (equation No. 12).
2. Four different feeding rates of onion sets 75, 100, 125 and 150 kg/h.
   Each experiment was repeated three times and the average values were considered.

Experimental Procedure:

- As described by ARC, 2003, onions sets variety Seds-6 was harvested manually when 50% of the tops were fall down. The sets were left in the field to cure for two weeks. The tops and roots were removed leaving a neck of about 1 cm long. Then, the sets were inspected for damage to eliminate the unfit products (cull and defective sets) by manual picking.
- The sets were put into baskets and manually discharged into the feeding hopper to calibrate the feeding rates of the machine. After machine calibration, the gate opening was adjusted on the desired feeding rate, and then the machine was run. The sets were discharged and rolled to the collecting baskets.
- During the grading process, the consumed time of operation from the moment of sets dropping until the end time was measured, and the amount of graded sets was recorded. Then the machine productivity (kg/h) and the machine grading efficiency (%) were determined. The effect of machine parameters on the total mechanical damage percentage was also considered.

Measurements:

Friction angle of onion sets:

Onion sets friction angle was measured on a metal surface according to [EL-Raie *et al*. (1996)]. The onion sets samples were placed over the surface of the metal sheet and by lifting up the sheet around its side pivot; the angle of friction was determined when 75% of the sets reached the end of the sheet surface. The friction angle of the sets samples was taken as the average of four replicates.

Mechanical damage percentage of onion sets:

After each experimental run, the surface injuries of onion sets samples were classified as visible damage, which can be seen by bare eye, and invisible damage, which may be determined as follows:

After testing, onion sets bruises were evaluated immediately by cutting the onion in half, separating the scales, and holding each scale up to the ambient light. Damaged area appeared more translucent. The damaged bulbs were distinguished if discoloration of the flesh of any size was found on the impact surface (Maw *et al*., 1996).

Machine grading efficiency:

The total grading efficiency of the machine was estimated according to (Klenin, 1985) using the following formula:

$$\eta = (m1 + m2 + m3 + m4) / m \quad , \% \quad ……….. (1)$$

Where:

□□□□□□□□□□□□□□□□□ η = total machine grading efficiency %;

m = total mass of onion sets in kg;

m1 + m2 + m3 + m4 = averaged mass of classified sets received at all outlets in kg.

Machine grading capacity:

Machine grading capacity was calculated using the following formula:

$$\text{Machine capacity} = m / t \quad , \text{(kg/h)} \quad ………….……… (2)$$

Where:

m = Mass of onion sets received at all outlets in kg;

t = the time consumed in operation, h.

RESULTS AND DISCUSSION

In order to select the appropriate operational parameters for the grading process, it was necessary to determine the percentage of total mechanical damage of onion sets and machine grading efficiency. These parameters varied with onion sets feeding rates, and riddles revolving speed. In other words, the quality of graded sets is largely depending upon the performance of the grading unit.

Machine Grading Capacity.

The effect of both riddles revolving speeds and riddles feeding rates during grading process of onion sets on the machine grading capacity (kg/h) are shown in Fig. (3). It was evidently appeared that increasing riddles revolving speed during the grading process from 35 – 65 rpm at all studied levels of riddle feeding rates in the range of 75 - 150 kg/h cause a corresponding increase in the machine grading capacity.

The maximum machine grading capacity, which was recorded during the grading process at 65 rpm riddles revolving speed and 150 kg/h riddles feeding rate, was 121.3 kg/h. Meanwhile, the lowest grading capacity was 45.4 kg/h at 35 rpm riddles revolving speed 75 kg/h riddles feeding rate. This increase in machine grading capacity by increasing riddles revolving speeds may be attributed to the increase of onion sets speed which resulted in reducing the time of grading and consequently increasing the grading capacity. In other words, increasing the speed of riddles increases the throughput of onion sets from the riddles openings which in turn, increase the machine grading capacity.

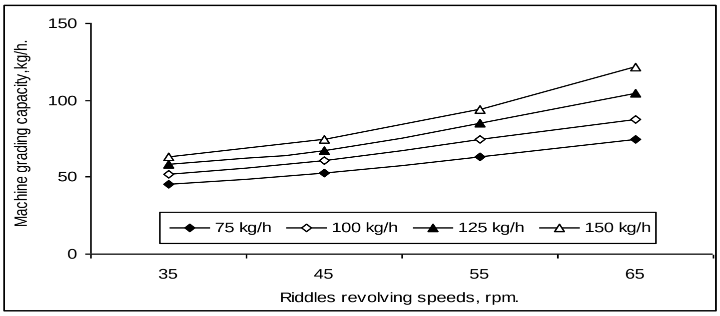


Fig. (3): Machine grading capacity of onion sets as affected by different riddles feeding rates and different riddles revolving speeds.

Total grading efficiency.

Data demonstrated in Figure (4) show the percentage of total grading efficiency of onion sets as affected by different experimental variables.

Data in Figure (4) reveal that at any riddles revolving speed from 35 to 65 rpm, the total grading efficiency increased as riddles feeding rates were increased from 75 to 100 kg/h. However, at 125 kg/h riddles feeding rates the total grading efficiency tended to decrease slightly from 94.34 to 94.2 % as riddles revolving speed was increased from 55 to 65 rpm.

Also, it can be seen that, at riddles feeding rates of 150 kg/h the total grading efficiency increased as riddles revolving speed increased from 35 to 55 rpm. This increase was followed by an obvious decrease in the machine grading efficiency as the riddle revolving speed increased from 45 to 65 rpm which was decreased from 92.3 to 91.6 %, respectively. This decrease in grading efficiency by increasing riddles revolving speed from 55 to 65 rpm may be due to the increase in the movement of onion sets giving it more ability to skip on the riddle surface. This would in turn increase the mixture between different categories of onion sets. On the other hand, the Figure shows a marked reduction of grading efficiency at (150 kg/h) feeding rate. This decrease in the grading efficiency especially at the higher riddles revolving speed may be due to the increase in the speed of material displacement, which, in turn shortened the time of grading, and also, makes difficult penetration of onion sets through the sieve openings.

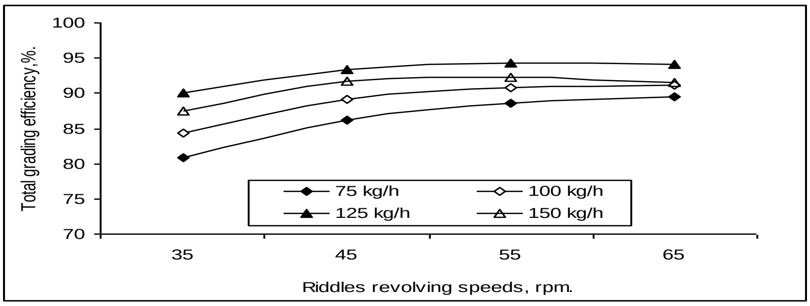


Fig. (4): Total grading efficiency of onion sets as affected by different riddles feeding rates and different riddles revolving speeds.

Bulbs Mechanical Damage Percentage:

Data presented in Fig. (5) show the total mechanical damage percentage as affected by different levels of riddles revolving speeds, different levels of onion sets feeding rates. It can be seen from Fig. (5) that the mechanical damage percentage of onion sets increased as the feeding rates increased from 75 to 150 kg/h and as revolving speed of riddles increased from 35 to 65 rpm under study conditions. The data indicated that, increasing the riddles revolving speed from 35 to 65 rpm caused a gradual increase in the total mechanical damage from 2.26 to 3.81; from 3.26 to 4.8 and from 3.99 to 5.93 % at feeding rates of 75, 100 and 125 kg/h, respectively.

As the riddle speeds increased from 35 to 55 rpm, the same trend of mechanical damage percentage was observed when grading sets at 125 kg/h feeding rate, which was increased from 3.9 to 4.66 %, respectively. Meanwhile, at same riddles feeding rate (125 kg/h), excessive increase in the total mechanical damage percentages was found as the riddle revolving speeds increased from 55 to 65 rpm, which was increased from 4.66 to 5.93 %, respectively.

The grading capacity of onion at 150 kg/h feeding rate is the highest among the studied variables, it was found that the grading efficiency of onion sets tends to decrease and sets damaged also tended to increase over the other variables.

Increasing the riddles feeding rate to 150 kg/h at any riddles revolving speed from 35 to 65 rpm caused an extreme increase in the total mechanical damage percentages from 5.45 to 7.93 %, respectively. This damaged value is more than the values equivalent to the total marketable yield quality.

This increase may be ascribed to the increase in rolling action of onion sets, which always associated with the increase the impact time of onion sets. In addition, bulbs may not sustain the impact. Therefore, the injuries occurred when bulbs hit each other during the grading process.

In general, the best allowable mechanical damaged of onion sets (4.66 %) was obtained at 55 rpm revolving speed of riddles and 125 kg/h of riddles feeding rate during the grading process of onion sets.

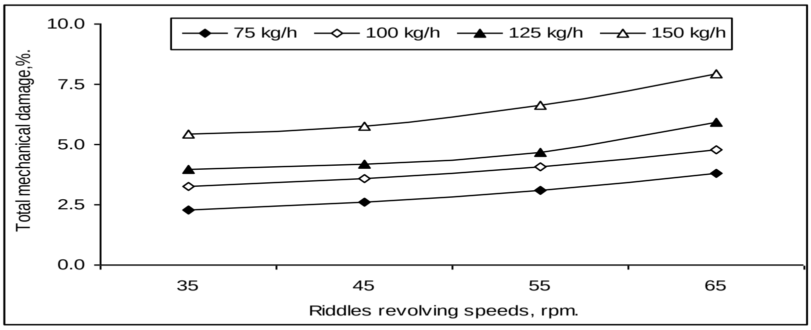


Fig. (5): Total mechanical damage percentage of onion sets as affected by different riddles feeding rates and different riddles revolving speeds.

CONCLUSION

The optimum operating parameters for the modified grading machine were 55 rpm riddles revolving speeds, and 125 kg/h of riddles feeding rate. At these values, maximum sorting accuracy of 94.34% and permissible mechanical damage 4.66% were obtained for grading of onion sets. These results proved that, the proper operating parameters coincided with the theoretical considerations as the relevant for machine operation.

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تطوير وتقييم أداء آلة بسيطة لتدريج محصول البصيلات

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البصل أحد المحاصيل التصديرية الهامة في مصر ويتطلب تصديره مواصفات تسويقية عالية الجودة تتوقف بدرجة كبيرة على دقة عملية الزراعة وكثافة النباتات المنزرعة في وحدة المساحة. ويزرع البصل في مصر يدويا باستخدام البذور المباشرة أو بالشتل أو بإنتاج البصل من البصيلات. وتتميز طريقة إنتاج البصل من البصيلات بمقاومتها لمرض العفن الأبيض والتبكير في مواعيد الزراعة وفي نضج المحصول مما يؤدى الي زيادة الكميات المصدرة بالاضافة لتوفير المحصول في الأسواق المحلية في وقت تخلو فيه الأسواق من محصول الموسم السابق، كما تتميز بسهولتها وزيادة محصولها مقارنة بالطرق الأخري لانتاج الأبصال. ونظرا لارتفاع تكاليف الزراعة بالطريقة اليدوية تم اللجوء لاستخدام الآلات الزراعية في زراعة البصيلات بعد تدريجها يدويا، وحيث أن البصيلات المستخدمة في الزراعة يتفاوت قطرها من 0.8 – 2.5 سم الامر الذي يتسبب فى نزول أكثر من بصيلة في الجوررة الواحدة عند استخدام أبصال غير مدرجة وغير منتظمة الشكل فى عملية الزراعة، مما يتسبب في زيادة نسبة الأبصال النقضة (المجوز والحنبوط) في المحصول الناتج. هذا بالاضافة الى أن الدراسات اوضحت ارتفاع نسب الابصال الصالحة للتسويق عند تجانس حجم البصيلات المستخدمة في عملية الزراعة لانتاج الأبصال.

وقد أجريت هذه الدراسة بهدف تصنيع وتقييم أداء آلة بسيطة محلية الصنع لتدريج محصول البصيلات بهدف توفير بصيلات متجانسة في الشكل والحجم لاستخدامها كتقاوي لانتاج رووس الأبصال عند زراعتها يدويا أو آليا وبالتالي تزداد نسبة الأبصال الصالحة للتسويق فيزداد الربح وتنخفض تكاليف الانتاج.

تم دراسة بعض العوامل الهندسية المؤثرة على سعة وأداء وكفاءة آلة التدريج المقترحة مثل سرعة دوران اسطوانات التدريج للآلة 35، 45، 55، 65 لفة/د، معدل تغذية البصيلات كجم/س. وقد اوضحت الدراسة أن العوامل المثلي لتشغيل الآلة كانت باستخدام سرعة دوران لاسطوانات التدريج (55 لفة/د) ومعدل تغذية للبصيلات قدره 125 كجم/س حيث أعطت الآلة أعلى كفاءة تدريج 94.34%، وأقل نسبة تلف مسموح بها 4.66 % عند تدريج البصيلات.

قام بتحكيم البحث

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