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EFFECT OF METERING DEVICE TYPE ON PLANTING OF EGYPTIAN COTTON SEEDS

BY

NABIL MORSY MOHAMED AWAD

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CONTENTS

1- INTRODUCTION

Cotton is considered as the most important fiber crop in Egypt. In 1982, the cultivated cotton area in Egypt was about 1,066,000 Feddans as indicated in the Egyptian Statistical Year Book of 1983. Since 1988 till now the cultivated cotton area flucuates around 900000 Feddans.

Row-crop planters are desinged to place seeds in rows for enough apart to permit the control of weeds by cultivation and to improve harvesting efficiency. Planting without thinning is a suitable method for mechanization of cotton. The farmer is adding about 60 kg seeds per Feddan, while the practical amount of plants needed is about 70000 plants per Feddan, which do not exceed 8 kg per Feddan. If two seeds are sown per hill and the distance between two hills was 10 cm the amount of seeds needed will be about 15 kg per Feddan. Thus, it means to be that about 45 kg seeds per Feddan could be saved annually about and 45000 tons as calculated from the total cultivated areas with cotton.

Thêrefore planting operation of cotton seeds by using planters is faster, cheaper and saving seeds than the Egyptian traditional method. It is a method to insure high yield, since cotton yield is directly affected by plant population during harvesting operation. The practice eliminates the costs of thinning operation, makes the time of thinning operation less critical, reducing the competition between adjacent plants before thinning and reducing the injuries to the remaining plants during thinning operation.

The objective of the present work is to evaluate the performance of the manufactured three different unit-planters. One with pneumatic metering device and another two with mechanical metering devices. The two units with mechanical metering devices, one is equiped with horizontal seed plate and the second equiped with inclined seed plate.

2- REVIEW OF LITERATURE

2.1.: Types and characteristics of planters:

Row crop planters are generally classified according to the crop, they are designed to plant. However, some planters may be used to plant more than one crop. For example, cotton, corn, soybean, sorghum, maize, edible beans, and sun flowers may be planted by the same planters.

Clinton, et al (1983) reported that the purpose of seeding machinery is to place seeds uniformly and at the correct rate in rows. These machines are designed to perform five important functions: a) to develop a seedbed by opening a furrow, b) to meter seeds at a controlled rate to obtain the correct population of plants for maximum yield, c) to place the seed at the proper depth and spacing, d) to cover the seed with soil, and e) to firm the soil around the planted seed for excellent soil and moisture contact.

Kepner, et al (1978) stated the methods of planting with planters as follows:

a) Precision planting (accurate placing of single seeds at about equal intervals in rows).

b) Hill dropping (placing groups of seeds at about equal intervals in rows.

2.2.: Types of seed-metering device:

The seed metering device may be classified into two systems, mechanical and pneumatic.

2.2.1.: Types of mechanical metering device:

There are two different types of mechanical metering device. They are indicated as follows:

2.2.1.1.: Cell type device:

Under cell type device there are flow sub-divisions. These sub-divisions are indicated as follows:

a) Horizontal seed plate:

Roth, and Porterfield (1960) pointed out that, the horizontal plate seed metering device has been used for many years on row crop planters for metering corn, cotton, peanuts, sugar beets and other large seeded crops. They said that, the horizontal plate metering device consists essentially of a seed plate rotating in a horizontal plane with a number of seed cells on or near the edge of the plate. Seed flow into the cells is encouraged by gravity and may be aided by seed orientation devices on the moving plate or on the stationary parts of the seed hopper. A seed cut-off device is used to limit the number of seeds per cell and reduce seed damage. A seed knock-out device insures positive unloading of the cells at the discharge point. The desired performance of this type metering device would feature a high metering accuracy or cell fill relatively independent of plate speed with a minimum amount of seed damage.

Brandt and Fabian (1964) said that, the horizontal rotating seed plate in a hopper bottom had been established as the most economical and dependable seed metering device. In a seed plate only three sides of the cell are contained within the seed plate body. The fourth side is formed by the inside wall of the planter bottom. The most common material for seed plate is iron, one of the easiest low cost material to work with.

Wanjura and Hudspeth, (1968) said that an edge-drop plate rotating in a horizontal plane is a common metering system for drill planting cotton. This system generally does an acceptable job of dispersing cotton seed planted conventional row spacing. A given hopper is capable of metering uniform rates of seed but its rate may differ from that another hopper having the same size seed plate.

Bateman (1972) reported that, there were large variations in kernel sizes within a bag of seed which contributed to extra kernels seeded and to the non-uniform plant spasing a long the row when plate planters were used. The plate type planters are manufactured with sufficient accuracy and most seed corn is sized properly so that the desired kernels per acre can be planted.

Stone and Gulvin (1977) stated that, the seed plates are the heart of the planter, and hundreds of different plates are available; each is made for certain variety and size of seed. The cells are small round, oblong, oval, or other shaped holes in the plate. If the cells are placed around the very far edge of the plate and carry the kernels on edge, the plate is called edge drop Fig. (2-1).

If the seeds lie flat in the cell, it is a flat-drop plate as shown in Fig. (2-2). When the cell is large enough to hold two, three, or four of the seeds used, it is a hill-drop plate which often called a hill-drop plate.

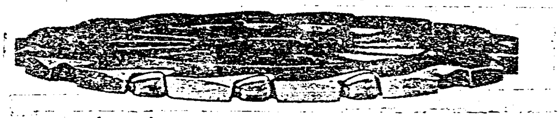


Fig. (2-1) Edge-drop seed plate.

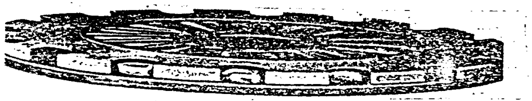


Fig. (2-2) Flat-drop seed plate and filler ring.

Kepner et al (1978) said that, the horizontal-plate planter is the most common example of the cell type. It has a spring loaded cut-off device Fig. (2-3) that rides on top of the plate and wipes off excess as the cells move beneath it. A spring loaded knock out device pushes the seeds from the cells when they are over the seed tube.

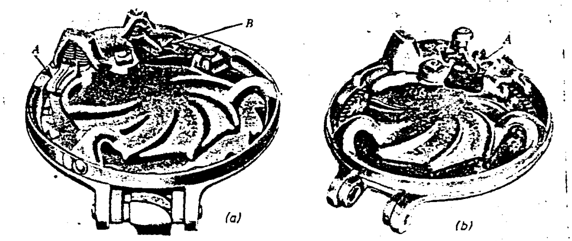


Fig. (2-3): Hopper bottoms for horizontal-plate planters. a) with edge-drop plate for corn. A) spring-loaded cut off. b) Hopper bottom suitable for precision drilling of sugar beets or coated seeds. B) spring-loaded knock-out pawl.

b) Vertical plates:

Richard (1972) designed a vertical-plate for unit planter. A vertical-plate design was chosen as a means of reducing the width of the planter unit and of simplifying the entire mechanism. He showed that this simplification is possible because a vertical plate could drive directly off the press wheel with no angle drive required.

The original design consisted of a saw-toothed seed plate that contacted the seed resevoir at botton dead center and loaded seed as it passed through an arc of about 90 deg. ThE seed was carried over the top and dropped by a combination of gravity and centrifugal force.

Kepner, et al. (1978) mentioned that a vertical-rotor metering devices of the type shown in Fig. (2-4) are often used for precision planting of vegetables and sugar beets. They stated also that vertical-rotor units are available that have seed cups which move up through a shallow seed resevoir, pick-up single seeds, carry them over the top of the circle, and discharge them during the downward travel.

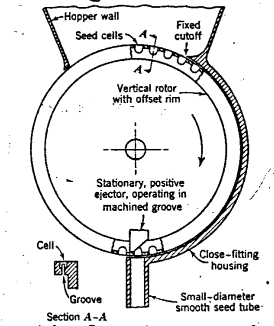


Fig. (2-4): A vertical-rotor precision seed metering device.

c) Inclined plate:

Kepner et al (1978) said that, inclined-plate metering device Figures (2-5) and (2-6) containing cups or cells around the periphery that pass through a seed reservoir under a baffle frame of the hopper, lift the seeds to the top of the plate travel, and drop them into the delivery tube. Seeds are handled more gently than with horizontal plate units because there is no cut-off device.

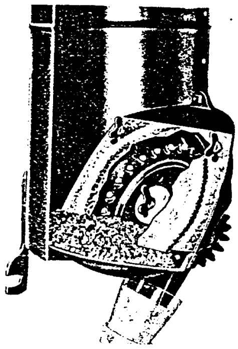


Fig.(2-5): A inclined-plate seed metering device.

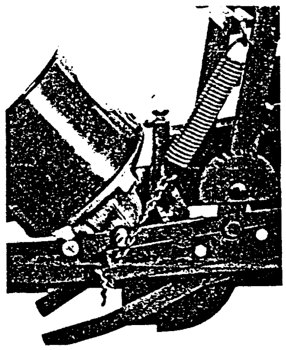


Fig.(2-6): An inclined-plate seed metering device designed for precision planting of small vegetable seeds.

Hunt (1983) stated that the inclined plates with cup shaped vanes dip into a pool of seed and carry seed to the discharge point at top of the plate. A fixed brush ejects the seed into the seed tube. Single seeds are selected if the plate cups can hold only one seed as shown in Fig. (2-7)

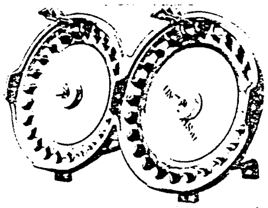


Fig.(2-7): Inclined plate-metering mechanism with brush ejection.

d) Belt-type precision seed metering device:

Lovegrave (1968) said that, many different types of feed mechanism have been interoduced to improve the precision of drills such as the two types are shown in Fig. (2-8) and Fig. (2-9), one employing a cell wheel, and the other a horizontal perforated belt. In single seed dispensing one difficulty encountered is the lack of uniformity of size and shape of some kind of seeds.

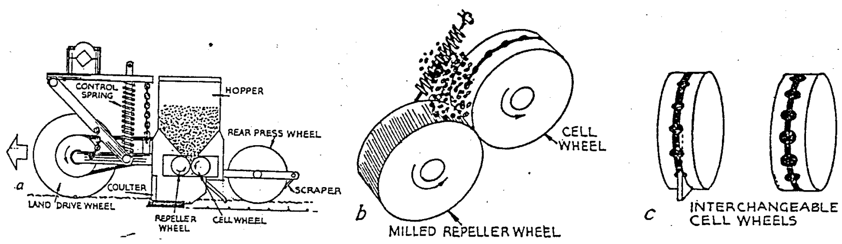


Fig.(2-8): Precision seeder unit; a) General construction, b) Cell wheel and reppeller wheel, c) Alternative cell wheels.

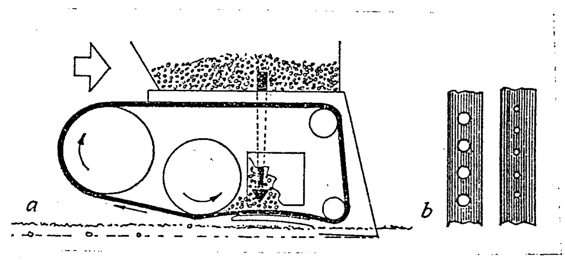


Fig.(2-9): Perforated-belt feed mechanism: a) Feed system, b) Sections of alternative belts.

Figure (2-10) shows a belt-type device (given by Kepner, (1978). This type of seed metering device has cells in a belt. Seed enters the chamber above the belt through opening A and is maintained at a controlled level. As the belt moves clockwise so there is only one seed in each cell. Seeds in the cells are conveyed over the base and discharged from the belt beneath the seed repeller wheel.

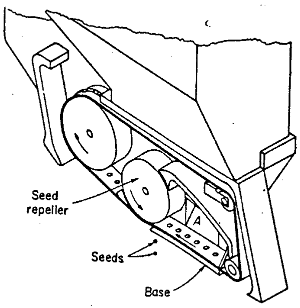


Fig. (2-10): A belt-type precision seed-metering device.

2-2-1-2: Finger-pick-up type seed metering device (plateless planters):

Clinton et al (1983) pointed out that, plateless planters operate by finger pick-up metering, by feed-cup metering, or by one of several air metering methods. The finger pick-up system is specifically designed for corn. It will pick-up individual kernels of various sizes and shapes, reducing the problem of having the incorrect-size plate for the kernel size. The finger pick-up assembly has 12 spring-loaded figuers that are opened and closed by a cam as they rotate.

The assembly rotates in a vertical position. A finger closes upon a kernel of corn and carries clockwise until it reaches a discharge hole where it is ejected into the placement mechanism. Here the seed is confined to one of the openings created by the paddles on the seed belt Fig. (2-11). The rotation of the belt space the kernels in an exact pattern as they are released into the seed tube.

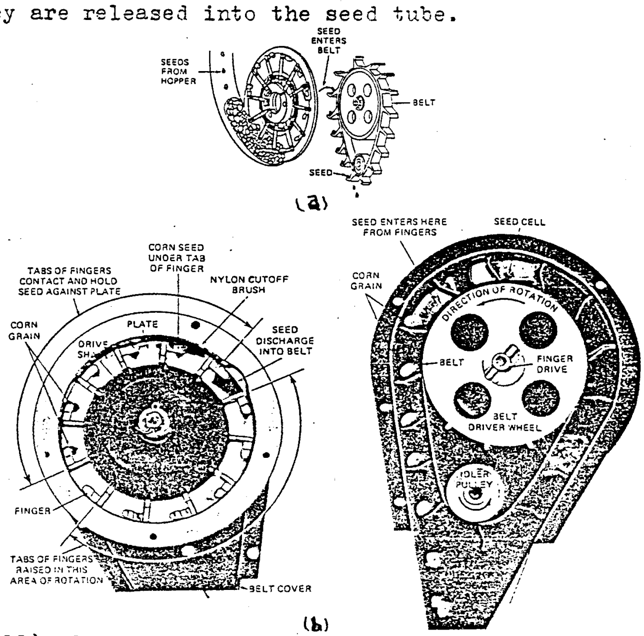


Fig. (2-11): One plateless planter uses a finger pick-up design. Fingers pick-up a single kernel of corn and eject it into the belt seed cell for placement into the seed discharge tube.

They said that the feed-cup mechanism Fig. (2-12) is designed with four interchangeable precision feed cups and corresponding seed guide for planting a variety of types and sizes of seed. Selection of the proper cup is based upon the type of seed to be planted. As the cup rotates, seeds are metered through the seed guide into the seed tube at the furrow openers.

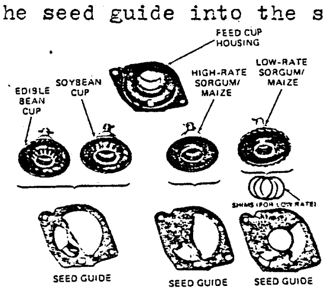


Fig. (2-12): The feed-cup method of metering uses a vertical cup rotating in a housing driven by a horizontal shaft.

Hunt (1983) showed the finger-pick-up metering mechanism for corn seed which is shown in Fig. (2-12) with the finger-wheel section and the conveyor section separated from their normal adjacent assembly.

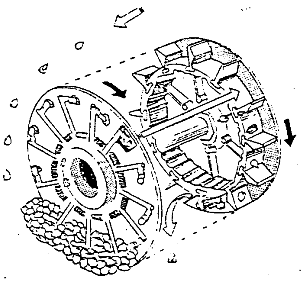


Fig. (2-13): Finger pick-up metering mechanism.

He pointed out that, the finger pick-up metering mechanism is designed for high-speed seeding of single kernels of corn. Unlike plate metering, finger pick-up metering does not require graded seed.

Occasionally the finger will trap two kernels; a brush positioned before the fingers reach the opening in the back plate will usually dislodge one of them.

2-2-2-: Pneumatic metering system:

a) Vacuum type:

Giannini et al (1967) reported that, the vacuum-pressure seeders which is shown in Fig. (2-14) for the most part have valved the vacuum to the orifice at the proper time. Each orifice is connected directly to its own vacuum to vacuum pressure pump cylinder. The piston in each cylinder is controlled by a stationary cam as the cylinder rotates. Vacuum is produced by a spring which forces the relieved portion of the cam. Thus the degree of vacuum is controlled by the characteristics of the spring.

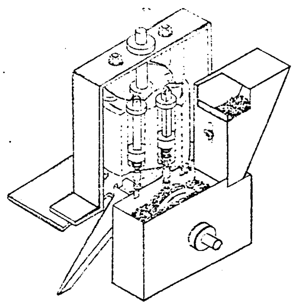


Fig. (2-14): Vacuum seed-pickup mechanism. Horizontal and vertical shafts are geared together with a 1 : 1 ratio so that relative velocity between orifice tip and seed-positioning wheel is nearly zero at the instant when they are closest together- the same instant that vacuum is applied to the orifice.

Stone and Gulvine (1977) pointed out that, several manufacturers have developed hopper-to-opener devices using electric drivenmotors to supply air to the vertical, revolving plate or disk, forcing the seeds out accurately and close to the ground Fig. (2-15). Air from one motor may supply air to two or three disks. The air forces the seeds into slots on the see-through disk. It also holds one seed in place until it reaches a holding plate.

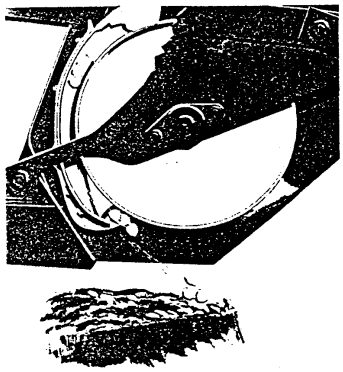


Fig. (2-15): Rotary wheel planter unit that deposits the seeds at zero velocity relative to the soil.

b) Positive ejection:

Hunt (1983) stated that, both air pressure and air vacuum used to meter seed. Figure (2-16) shows a design in which a vertical plate dips into a seed pool kept replenished by gravity flow from the seed box. A small fan pressurizes the pool chamber. Escaping air through the cells in the plate trape the seed in the cell. The escaping air is stopped and the seed falls into the seed tube at the air cut-off point.

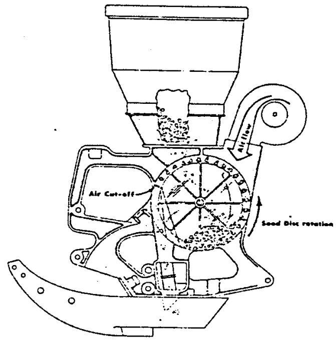


Fig. (2-16): Air seed-metering device.

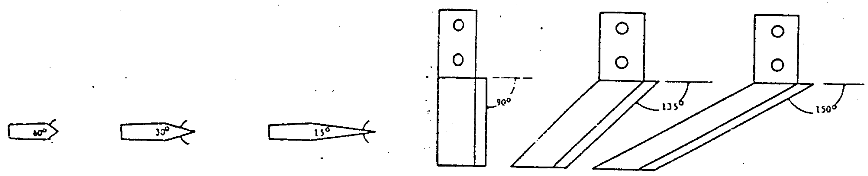
2-3: Factors affecting the accuracy of cotton planters:

Kepner et al (1978) said that, population and spacing requirements are influenced by such factors as the kind of crop, the type of soil, the fertility level of the soil, the amount moisture available, and the effect of plant and row spacing.

Roth and Porterfield (1960) found that the factors which influence the perform and accuracy of cotton planters are: a) relative size of seed and cell. b) relative shape of seed and cell. c) orientation of seed to cell. d) relative speed of seed and cell. e) distance cell travels while exposed to seed f) time interval cell is exposed to seed. g) type of cutoff and knockout device used. h) depth of seed above seed plate. i) general shape of seed. j) variation in seed size and shape. k) surface characteristics of seed. l) density of seed.

Bowen (1966) pointed out that, the total seed environment can be classified into three relatively distinct parts for discussion and analysis: the chemical environment control of all three-parts of the environment is essential. However, the gaining of adequate control of the physical environment has became the primary challenge in the design of planting equipment.

Abernathy and Porterfield (1960) studied the effect of planter opener shape on furrow characteristics and they used three vertical angles (90° , 135° , and 150°) as shown in Fig. (2-17).



a) Horizontal angles b) Vertical angles

Fig. (2-17): Shows the horizontal and vertical angles for different furrow openers.

They revealed to the following points:

a) Planter openers reduced soil density to a depth greater than the operating depth of the opener.

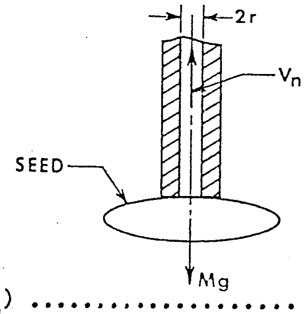
b) Furrow depth was greater for openers with large vertical-face angles and large wedge angles.

c) Furrow area tended to be least for openers with small vertical angles and small wedge angles. The largest furrows were made by openers with medium vertical angles and large wedge angles.

d) The lift-, and drag forces acting on furrow openers increased with increasing vertical face angle and with increasing wedge angle.

Wanjura and Hudspeth (1963) indicated that, the yield increasing can be achieved under certain conditions by increasing the plant population of cotton, corn, and other crops by decreasing the distance between rows. Proper adjustment of spacing, between rows and distances between single plants within the row, results in maximum effective area for each plant.

Short and Huber (1970) designed, fabricated and tested a planetary-vacuum seeding metering device in the laboratory. A statistical analysis indicated that, cucumber seeds were very nonuniform in overall dimensions. They determine the minimum nozzle air velocity to pickup one seed. Assuming that the seed completely closes to the nozzle



$$mg = \pi r^2 (p_a - p_n) \quad \ldots\ldots (1)$$

For incompressible flow:

$$p_a = p_n + \tfrac{1}{2}\,\frac{\gamma_a}{g}\,v_n^2 \quad \ldots\ldots (2)$$

Where P_n is air pressure inside the orifice just prior to the attachment of the seed. Combining equations (1) and (2),

$$V_n = \frac{1}{r} \sqrt{\frac{2m\, g^2}{\pi Y_a}} \quad \ldots\ldots\ldots\ldots\ldots \quad (3)$$

Where:

g = gravitational constant.

m = seed mass.

p_a = absolute air pressure

p_n = average air pressure inside nozzle orifice,

r = radius of nozzle orifice.

v_a = absolute air velocity

v_n = average air velocity inside nozzle orifice, and

Y_a = air specific weight

The pressure difference actually increases after attachment depending upon the characteristies and capacity of the vacuum pump and the percentage of the nozzle orifice that is closed to seed.

Jafari and Fornstron (1972) found that, temperature, moisture, physical impedance, and aeration are basic environment factore which most affect germination and emergance of the seeding. Seed depth and soil compaction should be carefully considered in designing planters. Seed population and spacing uniformity are also primary planter design factors.

Johnson, and Wilcox(1976) reported that, there are three factors are important considerations for obtaining maximum single harvest fruit yields-plant population, uniform seedling emergence, and uniform rapid seedling growth. They indicated that, the tomato planter has a hydroulic driven rototiller to till the soil to a maximum of 25 cm and a hinged shield to smooth and firm the seedbed ahead of the planter.

Nave et al (1977) evaluated the effects of row spacing, variety, planter type, and tillage at planting for soybean seed. They used experimental planter and the 400 cyclo planter an 18 cm and 76 cm spacing between rows for the early variety and late variety. They found that, the yield from the 18 cm rows planted with the experimental planter was 7% greater than from the 76 cm rows planted with the 400 cyclo planter. Also, they pointed out that, the early verieties are more responsive to 18 cm row spacing than the late varieties.

Tompkins, and Bledose (1979) reported that, a vibratory furrow opening tool was designed for use with a minimum tillage row crop planter system. The effectiveness of the vibratory tool was compared to a fluted coulter opener based upon measurements of energy input, clod size distribution, chang in soil bulk density, and seed emergence. The vibratory tool produced more soil breakup and yielded better plant stands.

However, where no additional ballast was needed to assure coulter penetration, the fluted coulter system generally required less power input than the vibratory system.

Abou-Zaid (1983) concluded that variable row spacing (40-80) cm gave higher number of open bolls per plant, seed cotton yield per plant and seed cotton yield per Feddan than regular row spacing (60-60) cm. Boll weight, lint percentage and seed index were not affected by different mechanical planting methods.

Shalaby et al., (1984) mentioned that the mechanically planted cotton treatment at alternative row spacing of (40-80) cm significantly gave the tallest plants than the regular row spacing of (60-60) cm. This trend was maintained at different growth stages of cotton plant until 160 days after sowing. Variable row spacing of (40-80) cm gave the higher number of fruiting branches per plant as compared with the other planting system.

El-Razaz (1987) concluded that variable row spacing (40-80) cm gave the higher number of green leavs per plant at all ages in the three growing seasons.

2-4: Factors affecting seedling rate and cell fill:

Bainer, et al (1955) said that, seedling emergence rates in the field are affected by a number of factors such as the viability of the seed (percent germination under controlled laboratory conditions), the physical condition of the seedbed, soil moisture conditions, intimacy of contact between the seed and the soil, depth of planting, soil temperature, planter performance, formation of surface crusts after planting, and losses due to diseases, insects, and adverse environmental conditions.

2-4-1: Effect of seed size:

Akyurt, and Taub (1966) carried out experiments on sugar beet seeds to aseertain the most suitable cell dimensions of a horizontal cell plate for the seed employed on cell filling. He observed that seed skip (ratio of empty cells to the total), varied inversely with cell depth, whereas doubles (ratio of cells containing two seed balls to the total) increased with increasing cell depth. It was found that the seed skip and shear (crushing of seed ball in the cell), were more dependent on cell depth than on cell diameter.

Harriott (1970) found that, many of the vegetable crops, such as, lettuce, cabbage, caulifower,.... etc., fall into this category and the problem of correct plant spacing is complicated by the fact that plant seeds may be very small and irrgular in shape and thus quite difficult to singularize mechanically. He said that the high seeding rates are used to provide enough seedling to overcome environmental and genetic factors that sometimes reduce seedling emergence to 30%.

Bateman (1972) studied the effect of cell population setting and found that there was a wide variation in the number of kernels seeded for the various settings used for the plate planters. The variation was different for the various setting groups because of seed variations, different soil conditions and planters being used in the various groups.

The seed size analysis indicated the amount of large kernels changed from 38% at the start to 49% at the end. The conclusion was reached that the larger percentage of small kernels in the hopper at the start of the test produced a higher metering rate.

Khalifa (1988) found that, the effect of seed size had a highly significant on the percentage of cell fill. As the seed grade increased the percentage of cell fill decreased. The cell fill and planting rate by using pneumatic metering device was less than planting rate and cell fill by using mechanical metering device because the cells which having 2 to 3 seeds are bigger in mechanical than in pneumatic metering device.

2-4-2: Effect of speed of seed plate:

Autry, and Schroeder (1953) tested a hill-drop planter with different horizontal plates. They pointed out that, the optimum plate speed was greater for the long cell than the short cell. High accuracy and high mean cell fill were obtained at slow plate speed (below 30 f.p.m.).

Bainer et al (1955) indicated that, the percent cell fill (total number of seeds divided by total number of cells passing the discharge point), for a given planter and seed plate is influenced by such factors as the range of seed sizes in relation to the cell size, distribution of seed sizes within the range, the shape of the seed, and the linear speed of the cells. The percent cell fill for a given combination of seed size and cell size decreased as the linear speed of the plate cells was increased. Thus, best performance for a given combination can be obtained only within a small range of plate speeds.

Roth, and Porterfield (1960) found that, the larger-cell clearances to extend the range of high cell fill accuracy as speed is increased. The large cell clearances are also less sensitive to cell speed change.

Khan, and McColly (1971) indicated that the velocity vector diagram of a seed as it starts to move into the cell in a horizontal plate planter (Fig. 2-18).

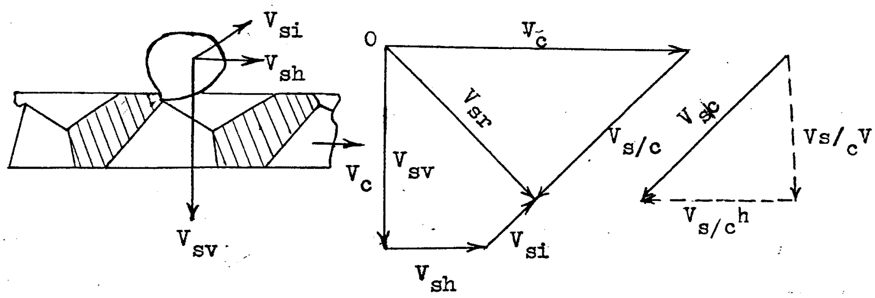


Fig. (2-18): Velocity diagram of seed during cell fill.

Where:

V_{sv} = vertical seed velocity, V_{sh} = Horizontal seed velocity, V_{si} = seed velocity imparted due to impact with edge of cell, V_{sr} = Resultant seed velocity, V_c = Cell velocity (horizontal only), $V_{s/c}$ = Relative seed cell velocity, $V_{s/cv}$= Vertical component of $V_{s/c}$, and $V_{s/c}h$ = Horizontal component of $V_{s/c}$.

The resultant seed velocity (V_{sr}) is due to the velocities caused by the acceleration of gravity (V_{sv}) , friction between seed and seed plate (V_{sh}) , and by the impact of the seed on the edge or walls of the cells (V_{si}).

$$V_{sr} = V_{sv} + V_{si} + V_{sh} \quad \ldots\ldots (1)$$

The relative seed-cell velocity ($V_{s/c}$) is the vector sum of the resultant seed velocity (V_{sr}) and the cell velocity (V_c).

$$V_{s/c} = V_{sr} + \dashrightarrow V_c \quad \ldots\ldots (2)$$

The relative seed-cell velocity is composed of the vertical ($V_{s/c}v$) and horizontal ($V_{s/c}h$) components.

$$V_{sc} = V_{s/c}h + \dashrightarrow V_{s/c}v \quad \ldots\ldots (3)$$

Ideal cell fill would occur when the vertical component of the relative seed-cell velocity ($V_{s/c}v$) is maximum, since it is the velocity along the direction of possible seed movement, with respect to the cell. In a gravitationally dependent machine, this conditions can be achieved when the horizontal component of the relative seed-cell velocity ($V_{s/c}h$) is zero.

Chhinnan (1975) indicated that, an increase in planting speed resulted in larger second and higher-order subpopulations, a larger seed placement index, and a higher average spacing.

Kepner et al (1978) stated that, the most uniform seed distribution is usually obtained with combinations of seed size, cell size, and cell speed that give about 100% average cell fill.

Khalifa (1988), found that the highest percentage of cell fill was 193.5% at speed of seed plate of about 20 min^{-1} and the least value was 128.25% at speed of seed plate of about 38 min^{-1} . Whereas the highest value of planting rate was 19.44 Kg/Feddan at speed of seed plate of about 38 min^{-1}. The least value was 12.13 Kg/Feddan at speed of seed plate of about 20 min^{-1}.

2-4-3: <u>Effect of metering device type:</u>

Autry and Schroeder (1953) determined the effect of cell shape, plate peripheral speed, uniformity of seed size and the number of cells per plate on accuracy of metering. The greased beard was passed beneath the seed tube while each of the four plates as shown in Fig. (2-19) was operated at peripheral speeds ranging from 25 to 95 m. They found that, the highest accuracy can be obtained by using of compact type cells i.e., short and broad rather than long and narrow cells. The accuracy is affected less by changes number of cells per plate than by speed changes; consequently, rates should be varied whenever possible by plate changes rather than by plate speed changes.

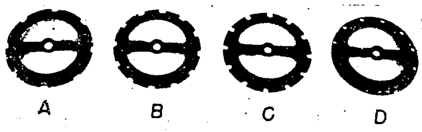


Fig. (2-19) Left to right, full-hill seed plates A, B, C, and D.

Khan and McColly (1971) conducted tests on three makes of conventional planters using 16, 20, and 24-cell edge drop horizontal plates to compare their performance with the experimental machine. These tests were pointed out with the same corn and the best performing plates, which were selected after trials from all the standard recommended plates. The results indicated that an increase in the number of cells increased cell fill at each metering speed.

Bateman (1972) reported that, the metering accuracy comparison of the plate planters with planters using the design of the finger pick-up mechanism includes the variations of the metering mechanism plus the same variations for the speed placement and varying soil conditions.

The finger pick-up mechanism metered out kernel populations that averaged 103 percent of the instruction book populations as compared to 106 percent for the plate planters.

2-4-4: Effect of seed level in the hopper:

Bateman (1972) determined the change in the metering rates as the hopper emptied during the planting operation for 66 comparisons. The metering rate was reduced by an average of 5.5 percent when the hopper was nearly empty as compared to the full condition. The field metering results for three different plates used for one planter, which compared cell sizes larger and smaller than the recommended size with the recommended size, indicated that the metering rate reduced a greater amount as the hopper emptied when the smallest size cell was used. The results also indicated that the percentage change in the cell volume did not give the same percentage change in the cell fill when the cell sizes were exchanged.

Chhinnan et al (1975) studied the effect of seed level in the hopper on metering and seed placement accuracy. They found that, the level of seed in the hopper decreased the sizes of the second and higher-order subpopulations increased and the average spacing increased. There appeared to be no significant effect on the seed placement index.

2-4-5: Seed damage:

Khan and McColly (1971) used an experimental seed metering machine which consisted of metering ring, cell ring and seed chamber. The centrifugal force was used to fill the cells with seeds. The results revealed to the following main points: The ejected corn seeds at 2750 f.p.m. initial velocity (1100 seeds per minute metering speed) did not show any significant reducation in germination after impact on a steel plate at a distance of 18in. from the ejection point. Thus impact of corn seeds on stones during planting will not affect germination up to ejected velocities of 2750 f.p.m. Seed damage at 800 cells per minute averaged about one-half percent and increased to an average of 1.5% at speeds of about 1200 cells per minute. Seed damage within the machine is affected by the cut-off pawl force. This force is best provided by a combination of spring and weight-induced forces. An inverse relationship exists between seed damage and excess seeds passing under the cut-off pawl.

Jafari, and Fornstrom (1972) designed a sugar beet planter which would maintain uniform seed-spacing and depth; plant single seeds without any seed amage. They found that, planting single seeds-along with complete elimination of skips, doubles, and seed damage was established when proper seed was used. A clean, sized seed is essential for practical operation of the unit. The upper size limit prevents seed tube clogging, while the lower size limit prevents seed crushing in the metering device.

Khalifa (1988) found that, the percentage of seed emergence of germination tests for collected seeds after passing through the feeding mechanism of unit-planter with mechanical or pneumatic metering device was 100% compared with percentage of untested seeds which reached 89%. This result was due to missing the cut-off and knok-out valve in his manufactured units.

2-5: Seed scattering:

Autry, and Schroeder (1953) determined the effect of cell shape, plate peripheral speed, uniformity of seed size, and the number of cells per plate on accuracy of metering. They found that, there is little effect of number of cells per plate on dispersion within the range from 4 to 16. This characteristic permits the use of more cells to obtain a closer spacing without affecting dispersion. By selecting the proper ratio of ground speed to plate speed (about 8.2 for the planter used in their work), the effect of ground speed on dispersion can be kept to a minium. They used a commercial type smooth seed tube Fig. (2-20) to determine some of the effects of the factors affecting cell dispersion soon revealed that the tube itself was causing considerable scattering of seed.

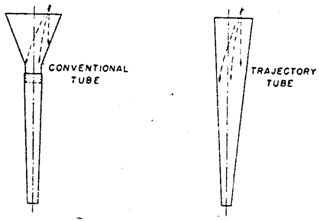


Fig. (2-20): The conventional and trajectory-type seed tubes.

Cell and seed-tube dispersion are not-affected by the height of fall if a trajectory-type tube is used.

Akyurt, and Taub (1966) reported that, the apparent seed scatter may also be due to experimental errors. For instance, in the glued paper tests it was observed that the paper speed varied by approximately ± 10%, resulting in a corresponding error in the apparent seed spacing.

Wanjura, and Hudsepeth (1968) studied the effect of straight seed tubes on delinted cotton seed dispersion parallel and perpendicular to the direction of travel. Ground speed was 3 m.p.h., and the speed of the edge drop plate was 12 f.p.m. Two seed-tube lengths, two diameters, and three vertical angles were studied. They found that, the ¾ in. diameter tubes and tubes angled 30° backward produced the shortest skip lengths. The influence of tube length was inconsistent. Lateral scatter of the seed pattern, expressed as the percentage of seeds in the center ½ in. was influenced most be tube diameter. The ¾ in. diameter tubes gave narrower seeding patterns than the 1¼ in. diameter tubes. Tube length and orientation has no discernable effect on the lateral distribution of the seed pattern.

Wanjura, and Hudspeth (1969) studied the effect of seed-drop height on acid delinted cotton seed pattern efficiency. They compared the pattern efficiency of the spoked wheel at drop heights of 6 and 3 in. with ungraded seed. The 3-inch drop consistently produced the best seed pattern. The pattern efficiency from a 3-in. fall was highest and more uniform as vacuum and wheel speeds were changed. This indicates the metering device on a planter should be located as low as practicable and the seed should fall freely to the bottom of the seed trench. Whereas:

$$\text{Pattern efficiency} = \frac{\text{number of acceptable spaces in 8 ft}}{\text{total number of spaces}} \times 100$$

Acceptable spaces-the distances between adjacent drops of either 2, 3, or 4 in. divisions.

Chhinnan et al (1975) determined the effect of planting speed, seed size, and seed level in the hopper on the metering accuracy and seed placement accuracy of a commonly used peanut planter. They found that, higher planting speeds resulted in more skips, higher seed placement errors, and higher average spacings. Smaller seed sizes resulted in more multiple drops, fewer skips, higher seed placement errors and lower average spacings. As the level of seed in the hopper decreased the number of skips increased and average spacing increased.

Khalifa (1988) found that, increasing the implement forward speed, speed of seed plate and seed grade increased the seed scattering. Also, the seed scattering was decreased when the cell shape varies from round to square. The largest value of seed scattering was 1.45 cm at forward speed of 8.4 km/h., plate speed of 38 min^{-1} and with round cell shape. The smallest value was 0.47 cm at forward speed of 2.1 km/h., plate speed of 20 min^{-1} and with square cell shape.

The seed scattering in the field experiments is more than in the Laboratory tests because the machine vibration in the Laboratory test is less than in the field experiments. However, the highest value of seed scattering in the Laboratory test was found to be 1.94 cm, but the hight value in the field experiments is 5.03 cm.

2-6: Effect of delinting cotton seed:

Nye (1929) in Uganda found that the seed treated with concentrated sulphuric acid for twenty minutes had a germination percentage of 96, compared with 635 percent for the untreated seeds. Furthermore, germination was completed in four days whereas the untreated seed took ten days to germinate.

Christidis (1936) obtained resulte in Greec fawourable with those of Nye, but he pointed out that, in the field, the germination of acid delinted seed was faster than that of undelinted seed.

Costelloe, (1968) said that, a measured quantity of concentrated sulphuric acid was poured onto the seed (210 ml of acid for each 2000 grams of seed). The seed and acid are then firmly mixed with together by using stirring stick for about 15 minutes. When the seed coat is thoroughly charred, water should be added quickly and the resultant mixture of seeds and water briskly stirred.

Watson, (1974) found that, delinting was done in an electrically-powered mixer handling 50 Kg of cotton seed at 40 r.p.m. with 5 litres of concentrated sulphuric acid. The mixer was run for 5 to 7 minutes, depending on the degree of seed fuzz. After delinting, the mixer was stopped and the seeds tipped into a perforated steel-basket, to be washed.

Ghoniem, (1973) used a commercial sulphuric-acid for few seconds in an amount of ½ Kg per 1 Kg of seeds. For acid delinted treatment, seeds were mixed with the concentrated sulphuric-acid and stirred by a rod for a few seconds; the mixture was then washed out by calcium carbonate for several times and finally air dried.

Singh et al., (1981) studied the effect of sulfuric acid delinting of cotton seeds on the larvae of pectinophora gossypiella. Complete mortality of the pest was obtained by delinting with 120 ml sulphric acid/kg seed for 15 minutes.

Gudnavar, (1982) suggested that the treatment of cotton seed with sulphuric acid increased the germination percentage and seedling vigour.

Singh, (1983) suggested that the delinting of cotton seeds with sulphuric acid increased the germination percentage and decreased percentage of seeds infected by seed micro floral. By using various ratios of sulphuric acid and seeds for delmting, germination percentage was the highest with sulphuric acid and seeds in 1 : 10 ratio.

El-Sory (1989) used three concentration levels of sulphuric acid of about 60, 80 and 98.5% , with acid seed ratios of about 1 : 10, 1 : 5 , and 1 : 3 for a duration of time from 1 to 60 minutes by using an electrical mixture of about 30 r.p.m. The best resultes are obtained by using a commercial sulphuric acid with concentration of about 98.5% during three minutes with a ratio of about 1:3. It gave a germination percentage of about 96%.

3- MATERIALS AND METHODS

An experimantal unit-planter was manufactured in a private workshop. It is equiped with a horizontal metering device. This unit planter was installed in the Research Laboratory of the Department of Agricultural Mechanization, Faculty of Agriculture, Tanta University. A comparison is to be carried out between this unit and another two unit-planters by using cotton seed. The last two unit-planters are manufactured by Khalifa, E.M.A. and used in his experimental work with corn seed.

3-1 Materials:

The three unit-planters are clasified into two types and indicated as follows:

a) Mechanical unit planters and

b) Pneumatic unit planter.

Under the mechanical unit planters there are two sub-type units namely planter with an inclined metering device and another with a horizontal metering device.

The following points were taken into consideration during the construction:

a) All parts are made from local materials.

b) The manufactured units should have simple mechanzim and cheap one.

3.1.1. Specifications and dimensions:

3.1.1.1. The mechanical unit-planters:

These units are sketched in Figures (3-1, 3-2) and photographed in Figures (3-3, 3-4).

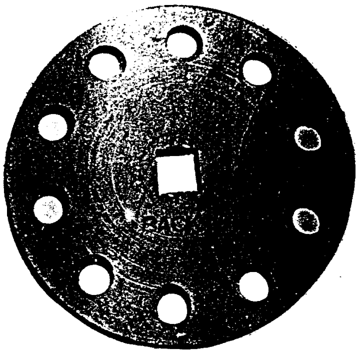


Fig. (3-5): Seed plate

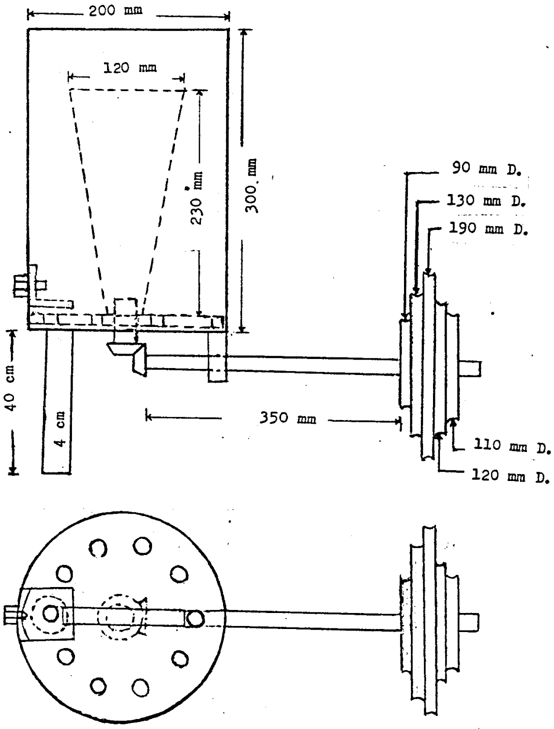


Fig.(3-1): The mechanical horizontal unit-planter.

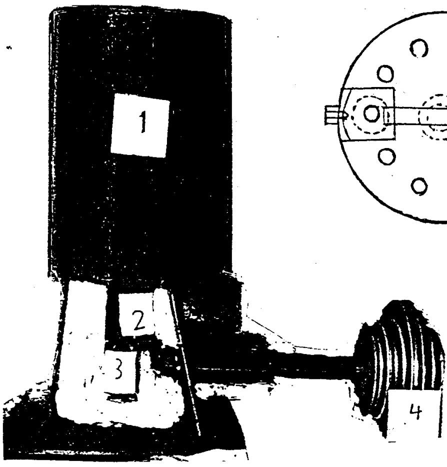


Fig. (3-3): The mechanical horizontal unit-planter.

1- hopper 2- Power transmission shaft to the feeding shaft. 3- Seed tube.

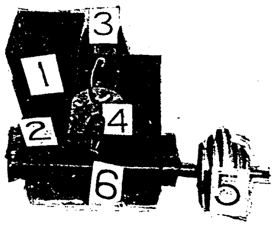


Fig.(3-4): The mechanical inclined unit-planter
1- Assistant hopper 2- Basic hopper.
3- Seed tube. 4- Seed plate
5- Pulley 6- Power transmission shaft to the feeding shaft.

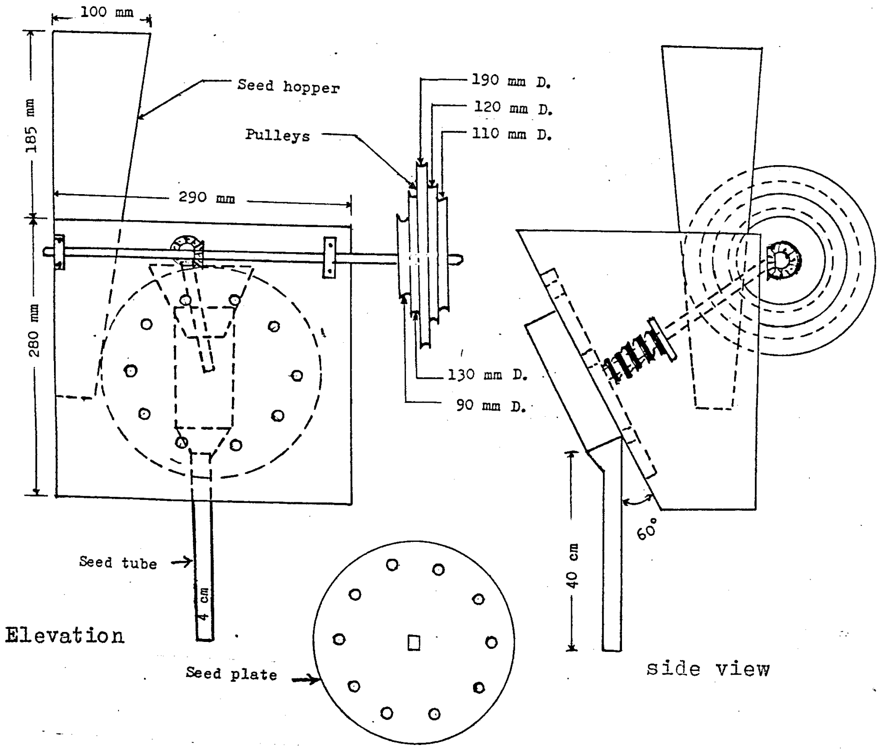


Fig.(3-2): The mechanical inclined unit-planter.

They consist of the following main parts:

1- Frame (supports and machine stand).

2- Hopper. 3- seed plate. 4- Transmission system.

5- Hopper carrier. 6- Power transmission shaft to the feeding shaft.

Frame (supports and machine stand):

The frame is 2 m long, 1.5 m width and 0.2 m height and made from four channel metal pieces.

It is supported on four underneath rollor wheels. The hopper is mounted on the far end of the frame. It is fixed with the frame by means of four angles (1.5 x 1.5).

The hopper of the unit-planter with inclined metering device was made from sheet of metal with about 3 mm thickness and has the following diamensions:

- Top 240 x 290 mm
- Bottom 100 x 290 mm
- Height 280 mm.

The sheet of metal was measured, marked and then cut according to the above dimensions. The hopper have four sides, three of them are vertically and the fourth one is inclined 60° with the horizontal plane. The seed plate was designed to rotate in the inclined plane inside the hopper. The feeding shaft is supported on both sides of the hopper by means of two bearings. Its diameter is reached (20 mm).

The hopper of the unit planter with horizontal metering device has a cylindrical shape with a diameter of 200 mm and hight of about 300 mm. It is made from sheet of metal with 3 mm thickness.

The seed plate is used in both of horizontal and inclined mechanical metering devices. It is made from hard wood of 6 mm thickness and 140 mm diamter which it contains 10 cells near to its far edge Fig(3-5). The seeds are flowing through the seed plate celles and drop by gravity. There is a seed cut-off device (knok-out device) to help the seed to drop in the seed tube.

The transmission system has two functions, first to transmit the rotating motion of electric motor to seed plate and second to change the speed of sowing plate to fit different crops. The transmission system is shown in Fig. (3-6). It is consist of an electrical motor of about 1.4 Kw, pulleys, gears and seed plate shaft.

Three different pulleys were used in the three units. They are made from aluminium alloy. There are two bevel gears in the unit with horizontal metering device are conected together. One of them is fixed on the feeding shaft with 10 teeth. The other one is fixed on the rotating shaft of seed plate and has 20 teeth. Also, in the unit with inclined metering device they have the same number of gear teeth as mentioned before.

1- Seed unit.
2- Electrical motor.
3- Reduction unit.
4- Gears.
5- Smear belt.
6- Pulleys.

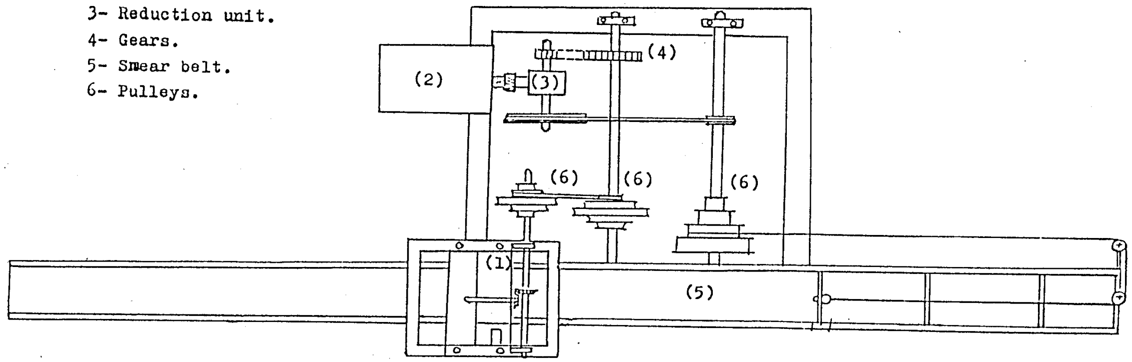


Fig. (3-5): Mechanical unit-planter arrangement.

The dimensions of the pulleys and gears are showing in Figures (3-1, 3-2) and (3-8). The transimission system is providing the seed plate with the reguired speed which transmitted from an electrical motor of about 1.4 Kw at speed of 1410 min^{-1}. The three different pulleys are manufactured to give different speeds to the seed plate. They are: 25, 35, 45 min^{-1} in the three different unit-planters.

Hopper carrier:

The hopper carrier was made from L-section of about 50 cm long, 40 cm width, 80 cm height, and 3 x 3 cm cross section.

Smear-belt:

The seeds were deposited on a 3 m long belt located under the unite planter. The belt is greased on top to retain the seed at its points of impact. This system facilitated the longitudonal and transverse reading of the seed pattern.

3.1.1.2. The pneumatic unit-planter:

This unit is sketched in Fig. (3-8) and photographed in Fig. (3-8). It contains the following parts:

a- Hopper b- seed plate

c- suction tube, and d- blower fan.

a- Hopper:

The hopper consists of two parts, the first part is called the basic hopper and the second part is the seed chamber. They are made from sheet of metal of about 3 mm thickness.

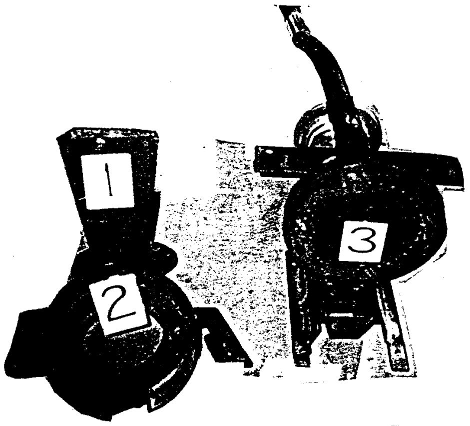


Fig.(3-7): The pneumatic unit-planter.
1- Basic hopper.
2- Seed chamber
3- Seed plate.

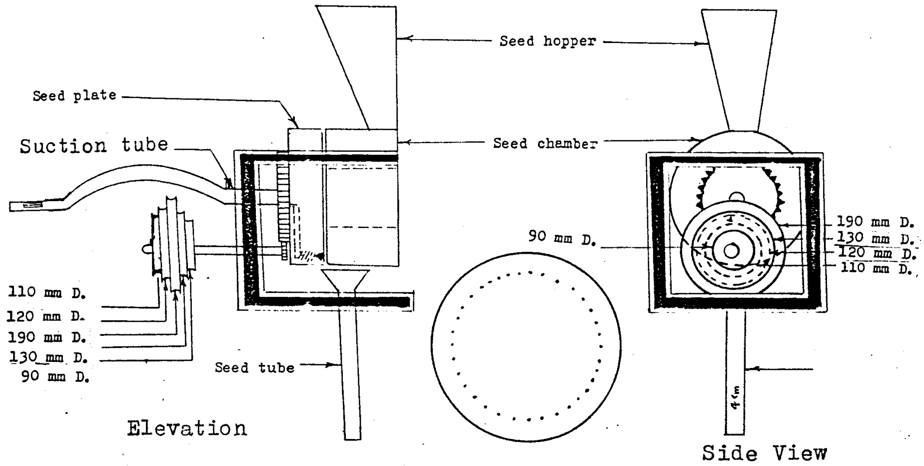


Fig.(3-8): The pneumatic unit-planter.

The main dimensions of the basic hopper are indicated as follows:

- Top is square section with cross sectional dimensions of about 150 x 150 mm.

- Bottom is also square section with cross sectional dimensions of about 65 x 65 mm.

- Height is 240 mm.

The seed chamber is made from sheet of metal of about 3 mm thinckness. Its circular dimensions are 250 mm for external diameter and 150 mm for internal diameter Fig. (3-9).

b- Seed plate:

The seed plate is made from steel with 3 mm thickness and 260 mm diameter. It has 32 cells at about 30 mm from edge Fig. (3-10).

c- Suction tube:

The suction tube is made from rubber with one meter long and 45 mm diameter. It is connected between seed chamber and suction blower fan.

d- Blower fan:

The blower fan is connected with an electrical motor with about 1.4 Kw at speed of 1415 min^{-1}.

The suction output from the blower fan is controled by using a gate valve. It has three vacuum levels 4, 9 and 15.5 cm H_2o. These vacuum levels were measured by using U-tube water manometer. The suction heads were measured

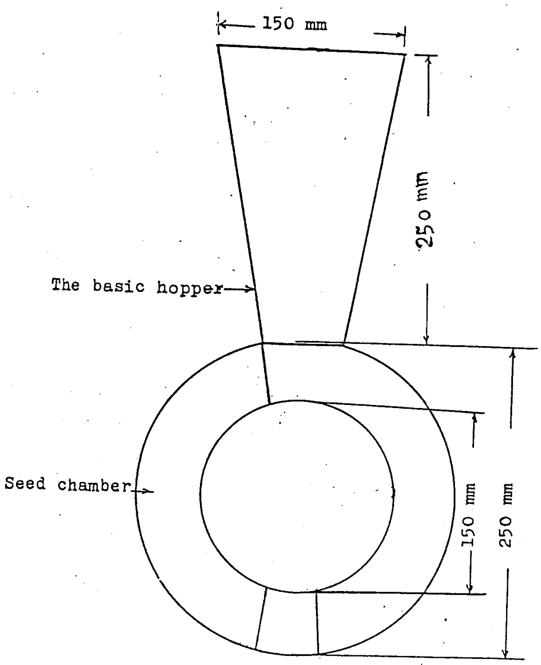


Fig. (3-9): Seed hopper of pneumatic unit-planter

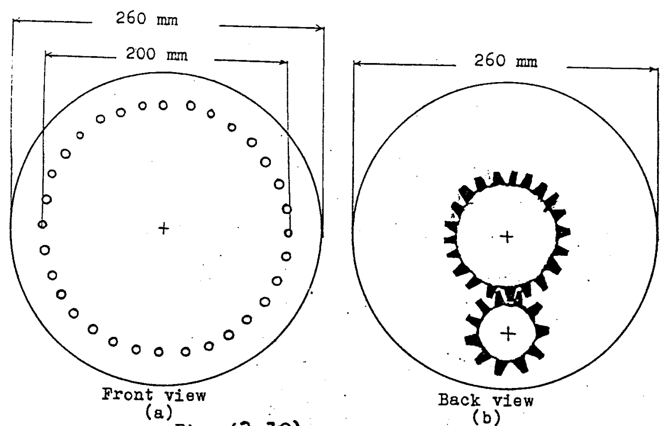


Fig. (3-10): Seed plate of penumatic unit-planter.

1- Seed unit.
2- Electrical motor.
3- Reduction unit.
4- Gears
5- Smear belt.
6- Pulleys.
7- Blower fan
8- Manometer.

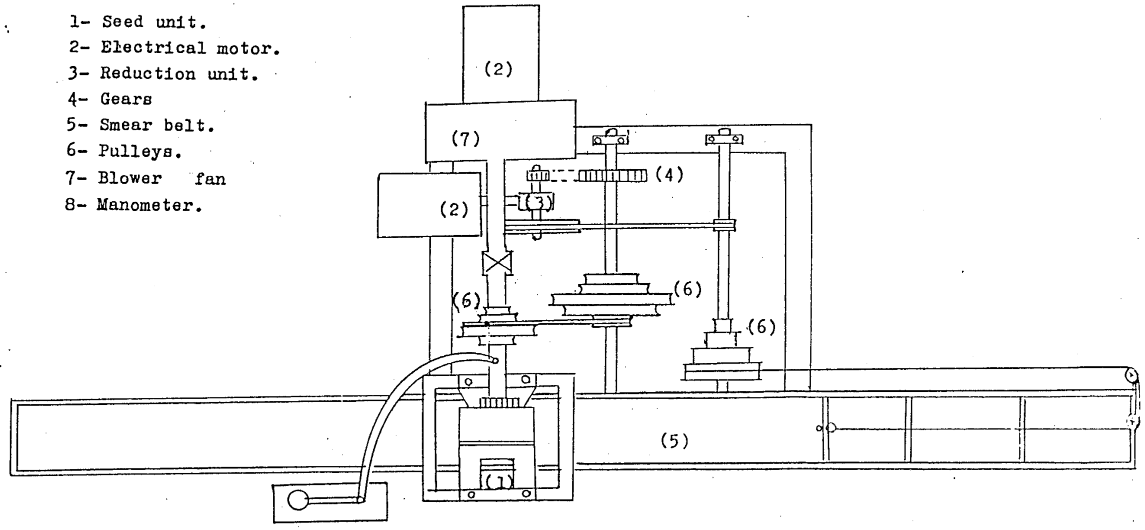


Fig.(3-11): Pneumatic unit-planter arrangement.

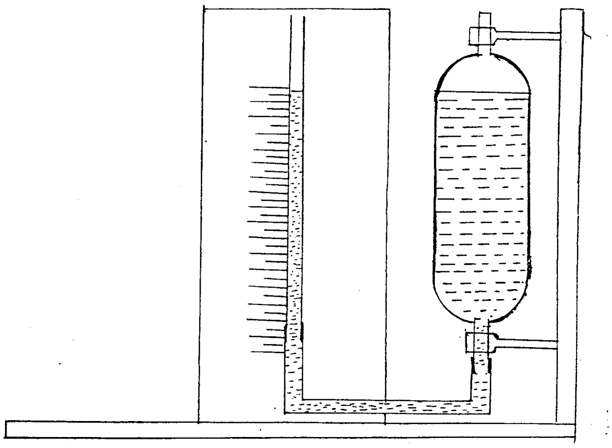
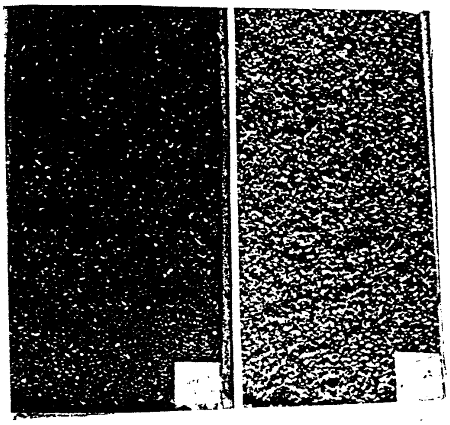


Fig. (3-12): U-tube water manometer.



delinted undelinted

Fig. (3-13): Seed treatment of cotton seed variety Giza 81.

between hose atmospheric pressure and the suction chamber in centimeter head of water (Fig. 3-12).

The pneumatic unit-planter and its issential parts are shown in Figure (3-11).

3.1.2.: <u>Cotton seed</u>:

The cotton seed which were used in the present study were of hybride cotton of the variety Giza 81. A commercial concentrated sulpheric-acid was used to delinting the seeds Fig(3-13). The ratio of concentration was 1 : 5 (one acid to five seeds by weight). Seeds were turned over for three minutes inside the sulpheric-acid. There after water was added on the submersed seeds with continuing turning over for five minutes. Then, seeds submersed in lime water with turning over for five minutes. At the end seeds were washed by water and left to dry.

The variety used in the present study was Giza 81. This variety is acceptable by most of the growers because it has many good characteristices. Giza cotton variety is characterized as long-staple cotton. The seeds are considered of ¾ fuzzy. Hundred seed weight ranged between 9 - 10 gm.

3.2: <u>Methods:</u>

3.2.1.: <u>Cell fill</u>:

The cell fill is affected by the speed of seed plate and suction level. Three speeds of seed plate were recommended as follows 25, 35, and 45 min^{-1}. The two unit planters with mechanical metering device have the same seed plate with a diameter of about 140 mm. Therefore the linear speeds of seed plate will be of about 0.30, 0.43, and 0.55 m/s.

In the unit planter with pneumatic metering device, the seed plate has a diameter of about 200 mm. Therefore the linear speeds in this case will be of about 0.44, 0.61 and 0.78 m/s. Each speed was calculated from seed plate R.P.M. and the external cell diameter on the plate measured from the center-line of the cell.

All tests were started by placing a cup under the seed tube and at the same time a stop-watch was used to record the operating time which was exactly 30 seconds for all runs. The seeds collected during this period were counted. At least three replicates were made from each grade and at each speed.

The percentage of cell fill was calculated from the following formula:

$$\text{Percentage of cell fill} = \frac{\text{No. of dropped seed /min}}{\text{No. of cells /min}} \times 100$$

The percentage of missing was calculated from the following formula:

$$\text{Seed missing} = \frac{\text{No. of hills missing/m}}{\text{No. of hills/m}} \times 100$$

3.2.2.: <u>Seed damage</u>:

The visible damaged seed were separated by hand. The seed damage was calculated as a percentage of the total number of seeds which collected during 30 seconds.

A check of invisble damage was made for the collected seeds after passing through the feeding mechanism should be done and compared to the percentage of germination of untested seeds. Results showed a 94% germination for both seeds, thus all seed damage was to be considered as visible damage.

3.2.3.: Seed spacing and scattering:

In order to study the seed spacing and seed scattering, a longitudinal line was drawn on the endless belt exactly under the center line tube. When of the belt is runing at different speeds, it is presenting the forward speed of the machine in the field.

Three belt speeds were used 2.1, 4.2 and 6.3 km/h. Since the top surface of the belt was coated with grease, the fallen seeds will be rested on the belt. Therefore, it is possible to measure seed spacing. The lateral distance of the seeds relative to the line drawn on the belt was taken as a measure of scattering. This test was conducted on seed variety Giza 81 delinted and undelinted. These tests were carried out in order to study the effect of three forward speeds; the effect of two varieties of seeds and the effect of three speeds of seed plate on seed spacing and scattering.

3.2.4.: Planting rate:

This study was conducted to evaluate the effect of the following factors on the planting rate: plate speed, forward speed, suction level.

All the above mentioned factors have their effects on the planting rate. The planting rate was calculated from the following formula:

$$\text{The planting rate} = n \times F \quad \text{seed/Feddan}$$

$$= \frac{m \times F \times 4.2}{A} \quad \text{kg/Feddan}$$

$$A = \frac{L \times W}{10^4} \quad m^2$$

$$n = \frac{4200}{A}$$

Where:

A = The area which hill occupied m^2.

n = No. of hill per Feddan.

F = Percentage of cell fill %

m = Average of the seed weight g .

L = Distance between hills in row cm

W = Distance between rows cm

4- RESULTS AND DISCUSSIONS

The laboratory tests were carried out to evaluate the three unit planters through the main performance criteria which will be presented in the following main points:

1- Seed scattering (longitudinal and transverse scattering)

2- Percentage of seed missing.

3- Percentage of cell fill.

4- Percentage of seed emergence.

4-1.: Seed scattering:

The seed scattering in both directions (longitudinal and transverse directions) is affected by implement forward speed, suction level, speed of seed plate and seed treatment.

In the present work, three different speeds of seed plate (25, 35 and 45 min^{-1}) and three different forward speeds (2.1, 4.2, and 6.3 Km/h) were used in case of the three unit-planters (Mechanical metering devices with inclined and horizontal seed plates and pneumatic metering device). The standard deviation of cotton seed from the center line of the smear belt is considered as scattering seeds.

Table (1) and (2) and Figures (4-1) up to Fig (4-8) show that the effect of implement forward speed, speed of seed plate, suction level and seed treatment and the interaction between them on the scattering seeds in both of mechanical and pneumatic metering devices.

Table(1):Effect of forward speed, speed of seed plate and seed treatment on longitudinal and transverse scattering and planting rate in case mechanical unit-planters.

Treatment	Longitudinal scattering (Cm)		Transverse scattering (Cm)		Planting rate (Kg/Fed)	
	M_1 Inclined	M_2 Horizontal	M_1 Inclined	M_2 Horizontal	M_1 Inclined	M_2 Horizontal
Forward speed (M) Km/h	* *	* *	Ns	Ns	* *	* *
2.1	3.84	3.84	1.046	0.883	15.91	29.49
4.2	4.77	4.70	1.099	0.916	13.56	21.37
6.3	5.71	5.05	1.332	1.008	9.69	16.84
	L.S.D at 0.05 0.18 0.01 0025	L.S.D at 0.05 0.27 0.01 0.36			L.S.D at 0.05 0.68 0.o1 0.92	L.S.D at 0.05 2.5 0.01 3.4
Speed of seed Plate(s) min	* *	* *	* *	* *	* *	* *
25	3.33	3.40	0.912	0.836	9.99	20.48
35	4.46	3.91	1.220	0.895	13.69	23.69
45'	6.53	6.28	1.344	1.076	15.48	26.53
	L.S.D at 0.05 0.37 0.01 0.50	L.S.D at 0.05 0.47 0.01 0.64	L.S.D at 0.05 0.12 0.01 0.17	L.S.D at 0.05 0.08 0.01 0.11	L.S.D at 0.05 0.67 0.01 0.89	L.S.D at 0.05 2.3 0.01 3.1
Seed traament (V)	Ns	* *	Ns	* *	* *	* *
G.81 T_1	5.56	5.13	1.166	1.011	15.79	32.16
G.81 T_2	3.98	3.93	1.151	0.861	10.32	12.96
		L.S.D at 0.05 0.34 0.01 0.46		L.S.D at 0.05 0.08 0.01 0.11	L.S.D at 0.05 0.67 0.01 0.89	L.S.D at 0.05 1.8 0.01 2.4
Interaction						
MXS	Ns	Ns	Ns	Ns	Ns	Ns
MXV	Ns	Ns	Ns	Ns	* *	* *
SXV	* *	* *	Ns	Ns	* *	* *
MXSXV	Ns	Ns	Ns	Ns	Ns	Ns

* * = highly Significant NS = NO Significant

Table (2) :Effect of forward speed, speed of seed plate and suction level on transverse and longitudinal Scattering and planting rate in case pneumatic unit-planter

Treatment	Transvers	Longitudinal	Planting rate kg/Fed
	Scattering C m		
1-Forward speed (M) km/h	Ns	Ns	Ns
2.1	0.430	3.466	1.673
4.2	0.549	4.316	1.261
6.3	0.703	6.014	1.027
2-Speed of seed plate (c) min^{-1}	**	**	**
25	0.368	2.885	1.055
35	0.544	4.874	1.266
45	0.770	6.036	1.640
	L.S.D at 0.05 0.08 0.01 0.11	L.S.D at 0.05 1.26 0.01 1.7	L.S.D at 0.05 0.24 0.01 0.32
3-Suction level-xseed treatment (SXV)	**	**	**
4.ocmh20 G.81 T_1	1.199	10.910	0.449
G.81 T_2	0.860	8.286	0.0
9.c m h20 G.81 T_1	0.839	5.799	2.336
G.81 T_2	0.447	2.577	0.0
15.5cm h20 G.81 T_1	0.0	0.0	0.0
G.81 T_2	0.0	0.0	0.0
	L.S.D at 0.05 0.12 0.01 0.17	L.S.D at 0.05 1.35 0.01 1.8	L.S.D at 0.05 0.25 0.01 0.33
4-Interaction			
MXC	NS	NS	NS
MXS	**	**	**
CXS	**	**	**
MXSXC	**	NS	NS

T_1 = Giza 81 delinted T_2 = Giza 81 undelinted

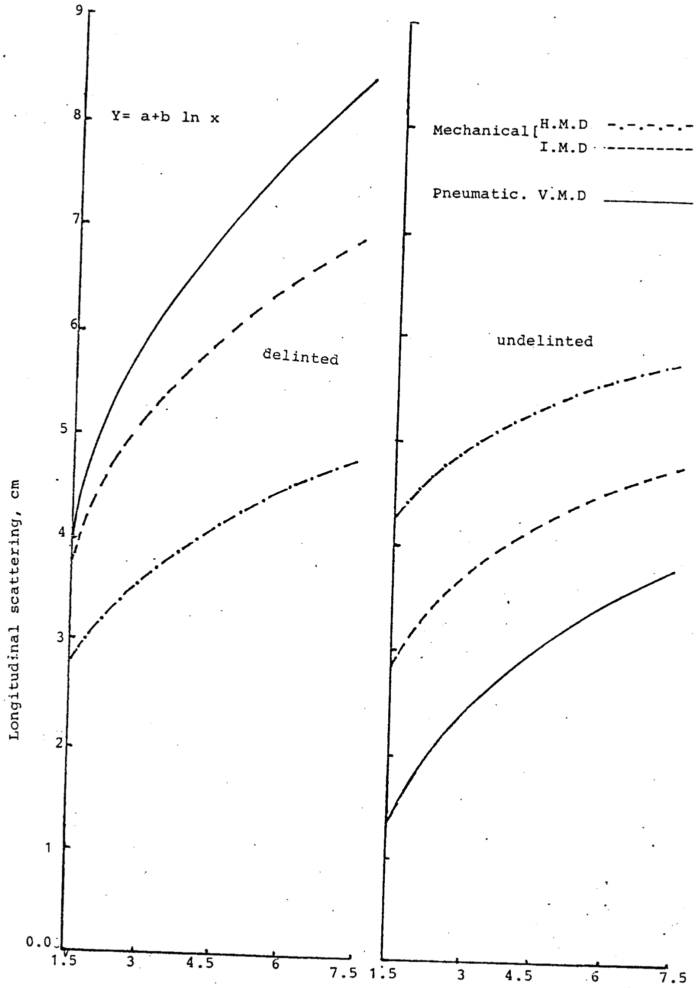
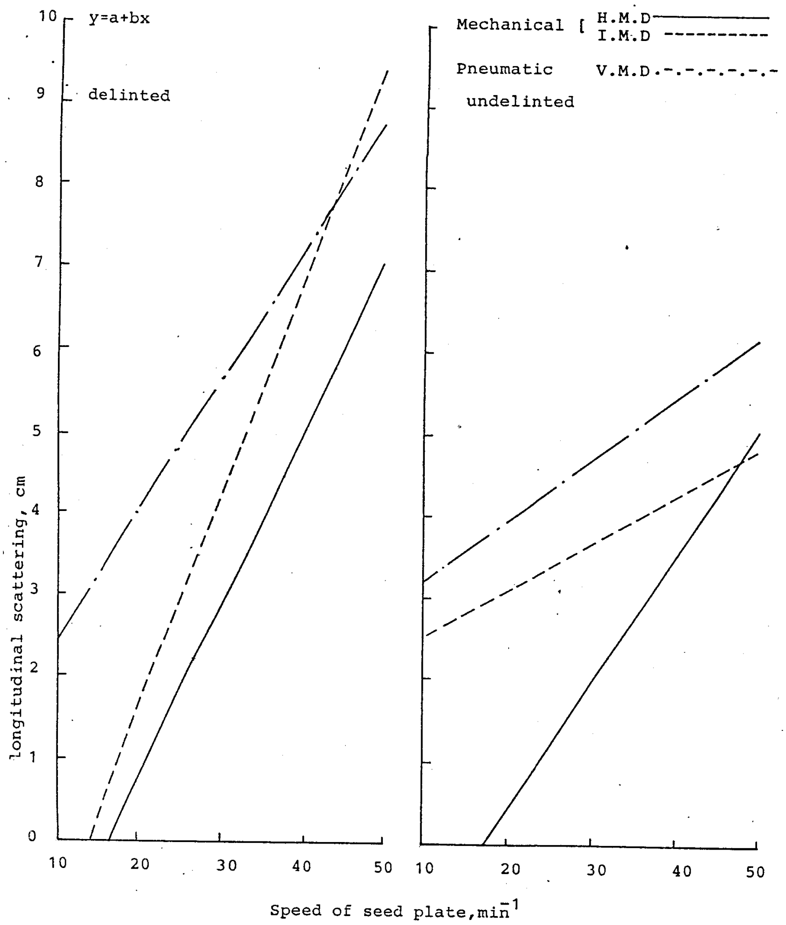


Fig.(4-1):Effect of forward speed,type of metering device and seed treatment on longtudinal scattering.

Type of metering device	Delinted			Undelinted		
	a	b	r	a	b	r
Horizontal metering device	2.25	1.26	0.979	3.83	0.97	0.998
Inclined metering device	2.82	2.05	0.999	2.26	1.28	0.933
Pneumatic metering device	2.59	2.87	0.94	0.70	1.54	0.937



Fig(4-2):Effect of speed of seed plate,type of metering device and seed treatment on longitudinal scattering.

Type of metering devices	Delinted			Undelinted		
	a	b	r	a	b	r
Horizontal metering device	-3.50	0.213	0.923	2.519	0.07	0.970
Inclined metering device	-3.63	0.263	0.987	1.97	0.058	0.949
Pneumatic metering device	0.867	0.159	0.9999	-2.7	0.156	0.954

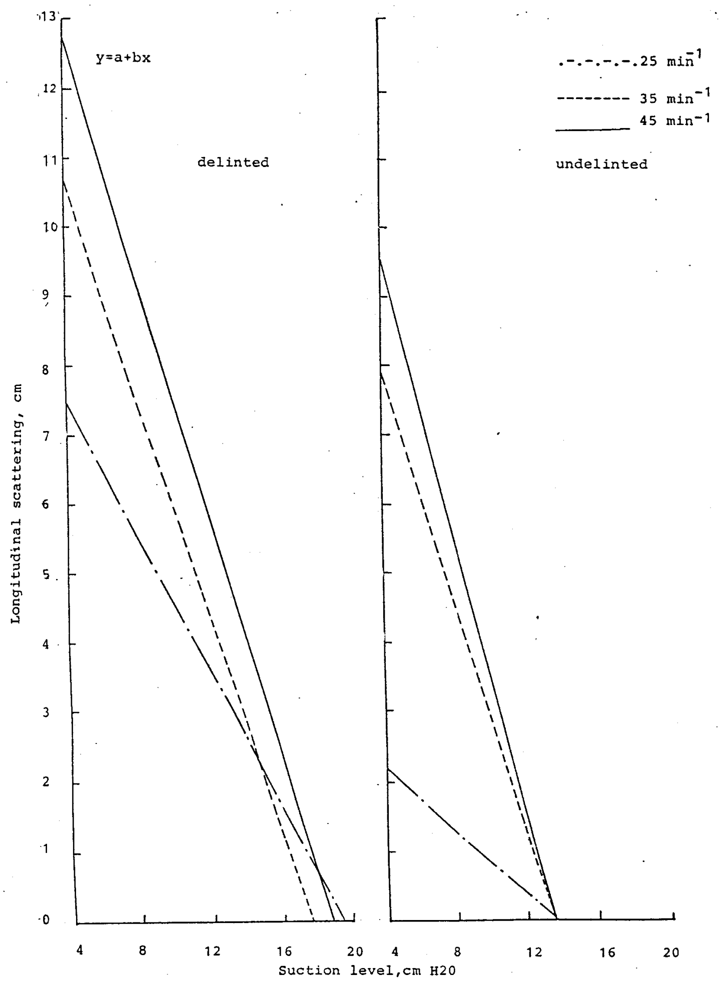


Fig. (4.3): Effect of suction level, speed of seed plate and seed treatment on longitudinal scattering.

Speed of seed plate, min^{-1}	Delinted			Undelinted		
	a	b	r	a	b	r
25	9.47	-0.49	-0.995	3.08	-0.23	-0.83
35	13.87	-0.79	-0.983	11.17	-0.82	-0.83
45	16.28	-0.87	-0.929	13.56	-1.0	-0.83

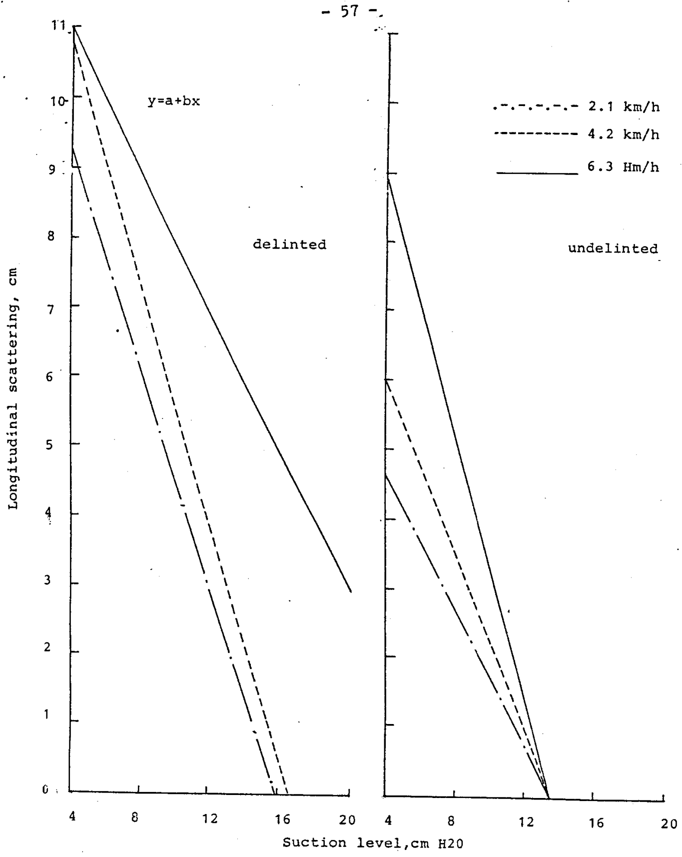


Fig.(4-4):Effect of suction level,forward speed and seed on longitudinal scattering

Forward speed, km/h	Delinted			Undelinted		
	a	b	r	a	b	r
2.1	12.37	-0.78	-0.9989	6.64	-0.49	-0.83
4.2	14.23	-0.86	-0.993	8.55	-0.63	-0.83
6.3	13.03	-0.5	-0.855	12.62	-0.93	-0.83

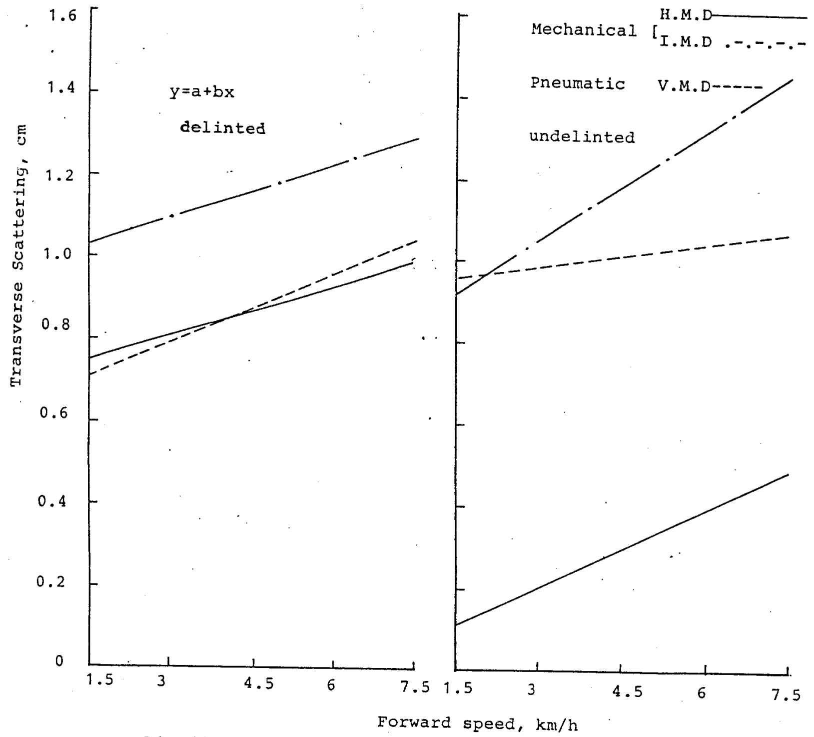


Fig.(4-5):Effect of forward speed,type of metering device and seed treatment on transverse scattering.

Type of metering devices	Delinted			Undelinted		
	a	b	r	a	b	r
Horizontal metering device	0.693	0.04	0.963	0.929	0.02	0.966
Inclined metering device	0.963	0.045	0.968	0.78	0.091	0.923
Pneumatic metering device	0.555	0.067	0.9999	0.015	0.063	0.987

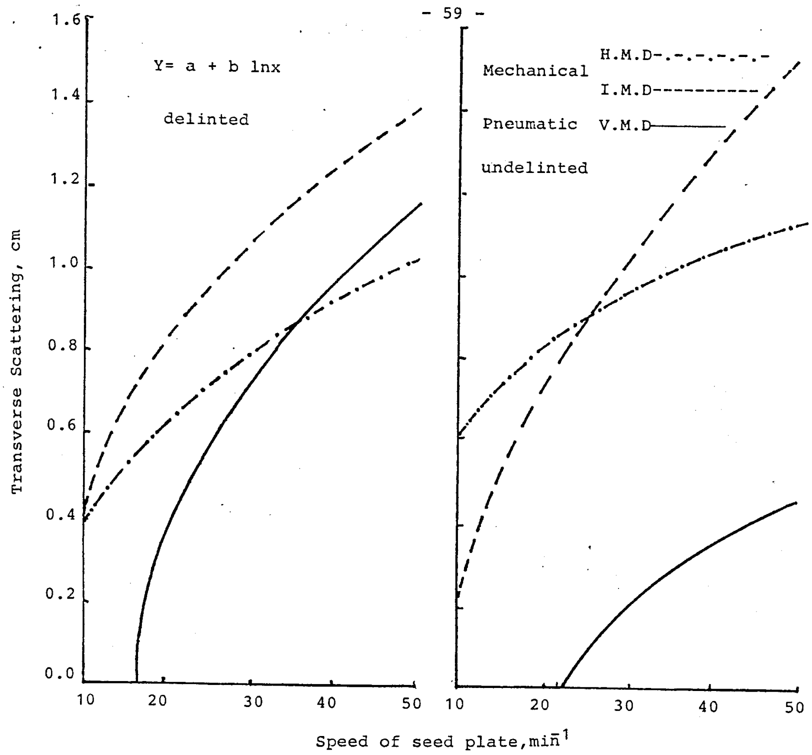


Fig.(4-6):Effect of speed of seed plate ,type of metering device and seed treatment on transverse scattering.

Type of metering device	Delinted			Undelinted		
	a	b	r	a	b	r
Horizontal metering device	- 0.79	0.47	0.873	-0.13	0.32	0.991
Inclined metering device	-1.10	0.64	0.984	-1.84	0.85	0.989
Pneumatic metering device	-2.34	0.90	0.986	-1.34	0.46	0.992

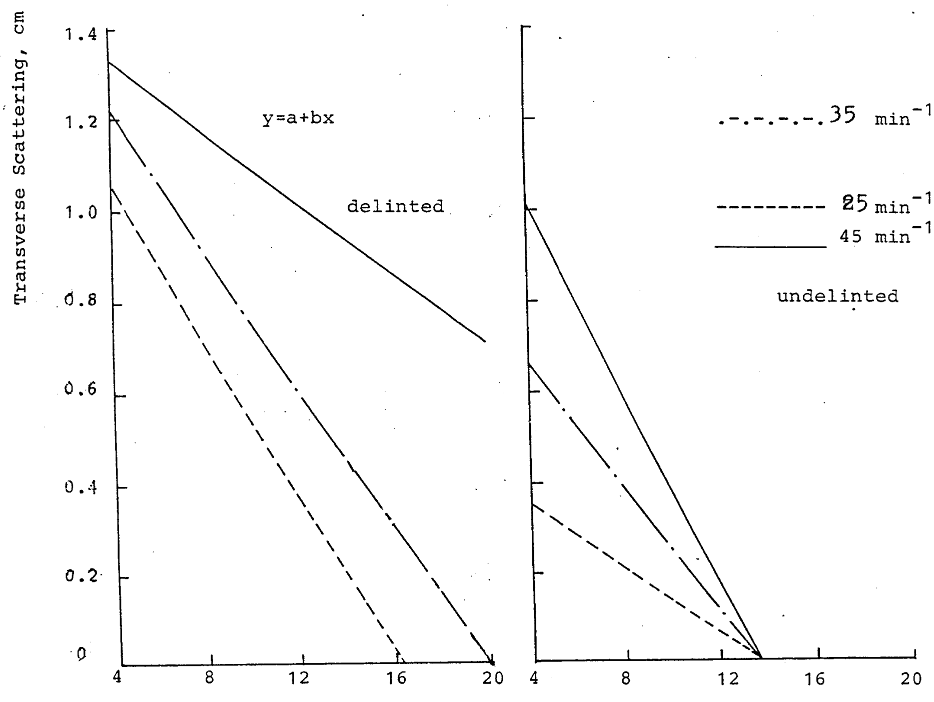


Fig.(4-7):Effect of suction level,speed of seed plate and seed treatment on transverse scattering.

Speed of seed plate, min^{-1}	Delinted			Undelinted		
	a	b	r	a	b	r
25	1.396	-0.086	-0.973	0.49	-0.036	-0.83
35	1.527	-0.076	-0.9987	0.916	-0.067	-0.83
45	1.482	-0.0386	-0.868	1.407	-0.103	-0.83

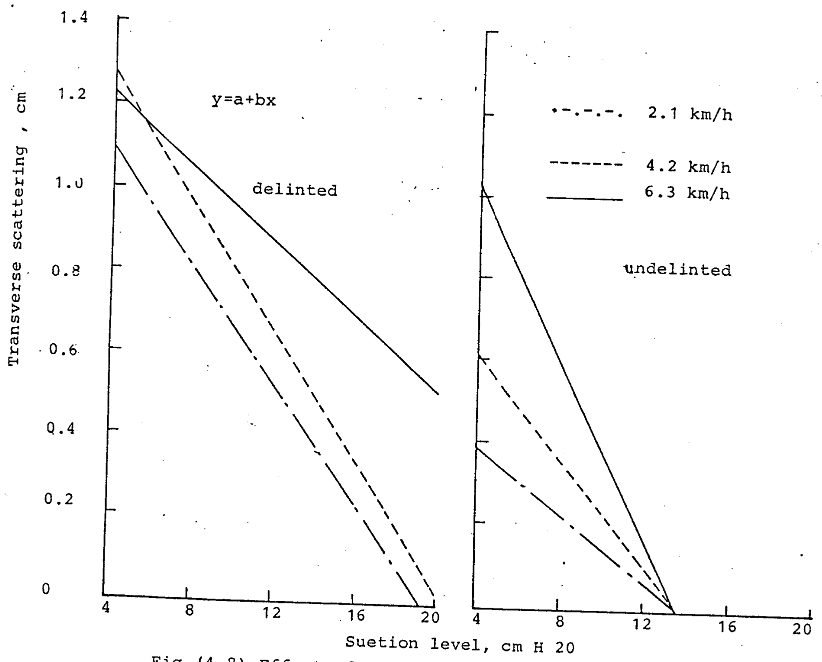


Fig.(4-8):Effect of suction level, forward speed and seed treatment on transverse scattering.

Forward speed,km/h	Delinted			Undelinted		
	a	b	r	a	b	r
2.1	1.379	-0.073	-0.996	0.535	-0.039	-0.83
4.2	1.585	-0.079	-0.996	0.856	-0.063	-0.83
6.3	1.403	-0.045	-0.932	1.423	-0.104	-0.83

Increasing the implement forward speed and speed of seed plate increased the seed scattering. But, the scattering was decreased by increasing the suction level.

The analysis of variance in Tables (A-1) and (A-2) show that the speed of seed plate, seeds treatment and suction level have a highly significant effect on seed scattering. Also, the forward speed had a highly significant effect on longitudinal and transverse scattering in case of mechanical metering devices. But it had no significant effect on seed scattering for pneumatic metering device, and transverse scattering for horizontal metering device. Also the seed treatment had no significant effect on transverse scattering for inclined metering device.

The interaction between speed of seed plate and seed treatment had a highly significant effect on longitudinal scattering in both inclined and horizontal seed plate. The interaction between suction level, seed treatment and forward speed had a highly significant effect on seed scattering for pneumatic metering device. Also, the interaction between suction level, seed treatment and speed of seed plate had a highly significant effect on pneumatic metering device.

The interaction between suction level, seed treatment, speed of seed plate and forward speed had a highly significant effect on transverse scattering in case of pneumatic metering device. But, the other factors had no significant effect on seed scattering.

Table (3) indicates the effect of the interaction between the speed of seed plate and seed treatment on longitudinal scattering.

The smallest and largest values of longitudinal scattering were 2.32 and 8.43 cm for delinted cotton seed variety Giza 81 at (25 and 45 min^{-1}) by using horizontal and inclined metering devices respectively.

Table (4) indicates the effect of the interaction between forward speed suction level, and seed treatment on transverse and longitud inal scattering. Whereas, the largest values of transverse and longitudinal scattering were 1.288 and 12.166 cm, respectively at 9.0 cm H_2o and 6.3 Km/h for delinted cotton seed variety Giza 81.

Table (5) indicates the effect of the interaction between speed of seed plate, suction level and seed treatment on transverse and longitudinal scattering. The largest values of transverse and longitudinal scattering were 1.410 and 14.099 cm, respectively at 9.0 cm H_2o and 45 min^{-1} for delinted cotton seed variety Giza 81.

Table (6) incicated the effect of the interaction between forward speed, suction level, seed treatment and

Table(3): Effect of the interaction between speed of seed plate- and seed treatment on longitudinal scattering and planting rate in case mechanical unit-planters.

Speed of seed plate(s) min^{-1}	Seed treatment (V)	Longitudinal scattering (cm)		planting rate kg/Fed-	
		M_1	M_2	M_1	M_2
25	G.81 T_1	3.48	4.49	11.26	29.67
	G.81 T_2	3.18	2.32	8.72	11.71
35	G.81 T_1	5.07	4.91	17.18	28.18
	G.81 T_2	3.85	2.91	10.20	12.78
45	G. 81 T_1	8.43	6.57	18.92	38.64
	G.81 T_2	4.63	5.98	12.03	14.41

T_1 = Giza 81 delinted T_2 = Giza 81 undelinted

M_1=Inclinad metering device M_2 =Horizontal metering device

L.S.D at 0.05 / 0.01: 0.65 / 0.88 longitudinal

L.S.D at 0.05 / 0.01: 1.16 / 1.57 Planting rate

Table(4):Effect of the interaction between forward speed,suction level and seed treatment on transverse and longitudinal scattering and planting rate in case pneumatic unit planter.

Forward speed Km/ h (M)	Suction level (cm H2o) (S)	Seed treatment (V)	Transverse Scattering Cm	Longitudinal Scattering Cm	planting rate Kg/Fed.
2.1	4.0	G.81 T_1	1.066	4.77	0.588
		G.81 T_2	0.774	5.937	0.0
	9.0	G.81 T_1	0.479	5.099	2.999
		G.81 T_2	0.243	0.366	0.0
	15.5	G.81 T_1	0.0	0.0	5.421
		G.81 T_2	0.0	0.0	1.010
4.3	4.0	G.81 T_1	1.243	11.188	0.407
		G.81 T_2	0.924	7.643	0.0
	9.0	G.81 T_1	0.766	5.810	2.110
		G.81 T_2	0.343	1.232	0.0
	15.5	G.81 T_1	0.0	0.0	4.432
		G.81 T_2	0.0	0.0	0.596
6.3	4.0	G.81 T_1	1.288	12.66	0.351
		G.81 T_2	1.273	11.281	0.0
	9.0	G.81 T_1	0.880	6.488	1.899
		G.81 T_2	0.754	6.132	0.0
	15.5	G.81 T_1	0.0	0.0	3.243
		G.81 T_2	0.0	0.0	0.651

T_1 = Giza 81 delinted T_2 = Giza 81 undelinted

L.S.D at 0.05 0.25, 0.01 0.36 Transverse L.S.D at 0.05 0.05, 0.01 0.65 planting rate

L.S.D at 0.05 2.5, 0.01 3.6 Longitudinal

Table(5):Effect of the interaction between Speed of seed plate,suction level and seed treatment on transverse and longitudinal scattering and planting rate in case pneumatic unit- planter.

Speed of seed plate (c) min-1	Suction level(s) (cm H2o)	Seed treatment (V)	Transverse Scattering Cm	Longitudinal Scattering Cm	planting rate Kg/Fed.
25	4.0	G.81 T_1	0.977	7.343	0.384
		G.81 T_2	0.760	5.41	0.0
	9.0	G.81 T_1	0.440	2.751	1.788
		G.81 T_2	0.0	1.788	0.0
	15.5	G.81 T_1	0.0	0.0	3.843
		G.81 T_2	0.0	0.0	0.296
35	4.0	G.81 T_1	1.210	11.288	0.373
		G.81 T_2	0.872	9.984	0.0
	9.0	G.81 T_1	0.820	5.821	2.366
		G.81 T_2	0.343	2.132	0.0
	15.5	G.81 T_1	0.0	0.0	4.310
		G.81 T_2	0.0	0.0	0.529
45	4.0	G.81 T_1	1.410	14.099	0.588
		G.81 T_2	1.258	12.121	0.0
	9.0	G.81 T_1	0.988	6.166	2.854
		G.81 T_2	0.947	3.810	0.0
	15.5	G.81 T_1	0.0	0.0	4.943
		G.81 T_2	0.0	0.0	1.432

T_1 = Giza 81 delinted

T_2 = Giza 81 undlinted

L.S.D at 0.05 0.25, 0.01 0.36 Transverse

L.S.D at 0.05 2.5, 0.01 3.6 Longitudinal

L.S.D at 0.05 0.45, 0.01 0.65 planting rate

Table(6):Effect of the interaction between forward speed,suction level, seed treatment and speed of seed plate on transverse scattering.

Forward-speed(M) Km/h	Suction level(s) (cm H2o)	Seed treatment (v)	Speed of seed plate,min^{-1}		
			25	35	45
2.1	4.0	G.81 T_1	0.877	1.177	1.143
		G.81 T_2	0.717	0.803	0.917
	9.0	G.81 T_1	0.0	0.510	o.803
		G.81 T_2	0.0	0.0	0.710
	15.5	G.81 T_1	0.0	0.0	0.0
		G.81 T_2	0.0	0.0	0.0
4.2	4.0	G.81 T_1	0.977	1.177	1.577
		G.81 T_2	0.763	0.943	1.343
	9.0	G.81 T_1	0.0	0.863	1.147
		G.81 T_2	0.0	0.0	0.010
	15.5	G.81 T_1	0.0	0.0	0.0
		G.81 T_2	0.0	0.0	0.0
6.3	4.0	G.81 T_1	1.300	12.77	1.513
		G.81 T_2	1.077	1.010	1.510
	9.0	G.81 T_1	0.800	1.007	1.243
		G.81 T_2	0.0	0.959	0.890
	15.5	G.81 T_1	0.0	0.0	0.0
		G.81 T_2	0.0	0.0	0.0

T_1 = Giza 81 delinted T_2 = Giza 81 undelinted

L.D.D at 0.05 0.57
0.01 1.05

speed of seed plate on transverse scattering. The largest value was 1.577 cm at 4.2 Km/h, 9.0 cm H_2o and 45 min^{-1} for delinted cotton seed variety Giza 81.

The previous equations were calculated from data in Tables (A-5) up to Tables (A-10).

An equation was derived to show the effect of implement forward speed and speed of seed plate on longitudinal and transverse scattering by using inclined metering device with delinted, and undelinted cotton seed. It is indicated as follows:

$Y_1 = -5.87 + 0.537\ X_1 + 0.262\ X_2$	delinted	$R_2 = 0.97$
		longitudinal
$Y_1 = 0.689 + 0.307\ X_1 + 0.059\ X_2$	undelinted	$R_2 = 748$
$Y_2 = 0.307 + 0.048\ X_1 + 0.019\ X_2$	delinted	$R_2 = 0.88$
		transverse
$Y_2 = 0.086 + 0.181\ X_1 + 0.006\ X_2$	undelinted	$R_2 = 0.36$

Where:

Y_1 = The seed longitudinal scattering in cm.

Y_2 = The seed transverse scattering in cm.

X_1 = Implement forward speed in Km/h, and

X_2 = Speed of seed plate in min^{-1}

An equation was derived for the one with horizontal metering device to show the effect of the previous mentioned factors on both longitudinal and transverse scattering. It is shown as follows:

$Y_1 = -4.91 + 0.325\ X_1 + 0.213\ X_2$	delinted	R_2= 0.838
		longitudinal
$Y_2 = 1.456 + 0.262\ X_1 + 0.073\ X_2$	undelinted	R_2= 0.936
$Y_2 = 0.2286 + 0.041\ X_1 + 0.014\ X_2$	delinted	R_2= 0.905
		transverse
$Y_2 = 0.573 + 0.021\ X_1 + 0.01\ X_2$	undelinted	R_2= 0.902

Where:

Y_1 = The seed longitudinal scattering in cm

Y_2 = The seed transverse scattering in cm

X_1 = Implement forward speed in Km/h, and

X_2 = Speed of seed plate in min^{-1}

An equation was developed to show the effect of implement forward speed, speed of seed plate and suction level on longitudinal and transverse scattering by using pneumatic metering device delinted and undelinted cotton seed. It is indicated as follows:

$Y_1 = -4.68+0.796\ X_1+0.16\ X_2+0.227\ X_3$	delinted	R_2=0.268
		longitudinal
$Y_1 = 9.109+0,428\ X_1+0.101\ X_2+0.655\ X_3$	undelinted	R_2= 0.524
$Y_2 = -0.741+0.079\ X_1+0.028\ X_2+0.031\ X_3$	delinted	R_2= 0.428
		transverse
$Y_2 = -1.177+0.061\ X_1+0.0014\ X_2+0.074\ X_3$	undelinted	R_2= 0.612

Where:

Y_1 = The seed longitudinal scattering in cm

Y_2 = The seed transverse scattering in cm

X_1 = Implement forward speed in Km/h

X_2 = Speed of seed plate in min^{-1} and

X_3 = Suction level in cm H_2o

4-2: <u>Percentage of seed missing</u>:

Tables (7 and 8) and Figures (4.9 and 4-10) indicate the effect of machine type, speed of seed plate, suction level and seed treatment on the percentage of seed missing. It was obvious that the percentage of seed missing by using mechanical and pneumatic metering devices was increased by increasing speed of seed plate. Also, the percentage of seed missing increased by using undelinted cotton seed Giza 81. But, the percentage of seed missing was decreased by increasing suction level.

Table (7) indicates that, the percentage of seed missing increased by 72.57 and 85% for the two speeds of seed plate. of about 35 and 45 min^{-1}, respectively compared with the 1 st speed of seed plate of about 25 min^{-1} in case of using mechanical metering devices.

Table (8) shows that the percentage of seed missing increased by 45.0 and 55.6% for the two speeds of seed plate 35 and 45 min^{-1}, respectively compared with the 1 st speed of seed plate (25 min^{-1}) in case of using pneumatic metering device. But, it was decreased by 33,0 and 63.2% for the two suction levels 9.0 and 15.5 cm H_2o compared with the control treatment (4.0 cm H_2o).

Analysis of variance in Tables (A-3 and A-4) show that the speed of seed plate and seed treatment have a highly

Table(7):Effect of machine type, speed of seed plate and seed treatment on the per centage of cell fill and percentage of seed missingin case mechanical unit-planters.

Treatment	Cell fill % M_1 and M_2	Seed missing % M_1 and M_2
1-Machine type (M)	NS	NS
Mechanical inclined plate M_1	376.410	3.975
Mechanical horizontal plate M_2	340.510	5.338
2- Speed of seed plate(s) min^{-1}	**	**
25	559.360	1.235
35	519.243	8.238
45	476.810	8.238
	L.S.D at 0.05 25.7 0.01 36.0	L.S.D at 0.05 0.91 0.01 1.3
3- Seed treatment (c)	**	**
G.81 T_1	661.888	1.995
G.81 T_2	375.054	7.321
	L.S.D at 0.05 29.4 0.01 40.3	L.S.D at 0.05 0.76 0.01 1.03
4- Interaction		
MXS	NS	NS
MXC	**	**
SXC	NS	**
MXSXC	NS	*

T_1 = Giza 81 delinted

T_2 = Giza 81 undelinted

M_1 = Inclinad metering device

M_2 = Horizontal metering device

Table(8): Effect of suction level, speed of seed plate, and seed treatment on percentage of cell fill and percentage of seed missing in case of pneumatic Unit-planter.

Treatment	Cell fill, %	Seed missing %
1- Suction level (H) cm H_2O	NS	NS
4.0	9.1	90.9
9.0	45.1	60.9
15.5	84.3	33.4
2- Speed of seed plate (s) min^{-1}	**	**
25	79.0	36.5
35	39.8	66.4
45	19.6	82.2
	L.S.D at 0.05 9.2 0.01 12.7	L.S.D at 0.05 5.7 0.01 7.8
3- Seed treatmen (V)	NS	NS
G. 81 delinted	47.2	61.3
G. 81 Undelinted	45.1	61.9
4- Interaction		
HXS	NS	NS
HXV	NS	NS
SXV	**	**
HXSXV	**	**

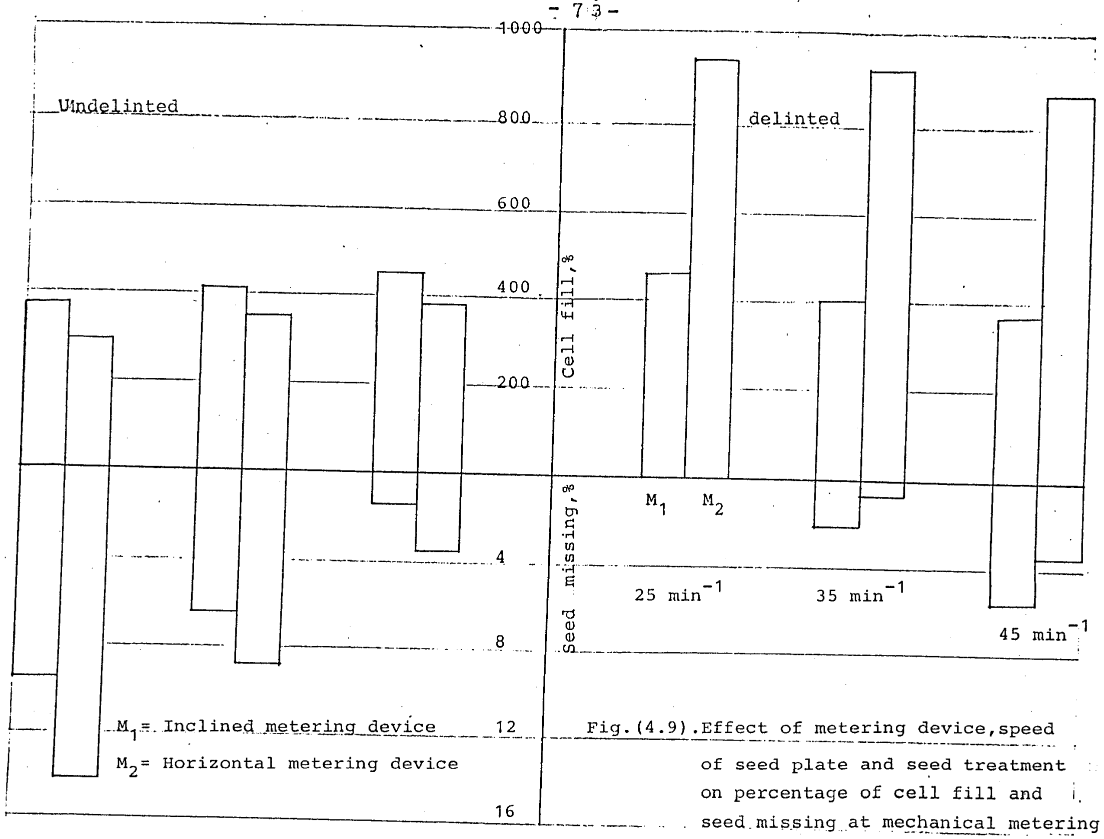


Fig. (4.9). Effect of metering device, speed of seed plate and seed treatment on percentage of cell fill and seed missing at mechanical metering devices.

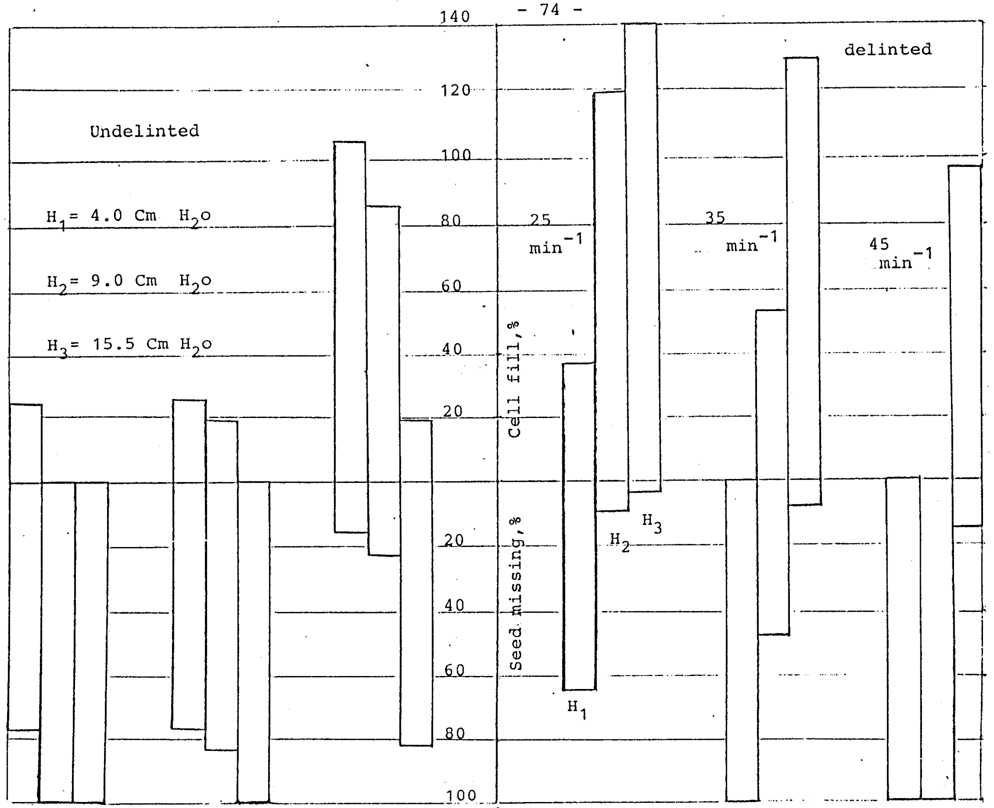


Fig.(4.10).Effect of speed of seed plate, Suction level and seed treatment on percentage of cell fill and seed missing at pneumatic metering device.

significant effect on seed missing. But, suction level and machine type had no significant effect on seed missing. The interaction between machine type and seed treatment had a highly significant effect on seed missing. Also, the interaction between speed of seed plate and seed treatment had a highly significant effect on seed missing by using both inclined and horizontal metering devices.

The interaction between machine type, speed of seed plate and seed treatment had a highly significant effect on the percentage of seed missing by using both inclined and horizontal metering devices.

The interaction between speed of seed plate and seed treatment had a highlty significant. Also, the interaction between suction level, speed of seed plate, and seed treatment had a highly significant in case of using pneumatic metering device. But, the interaction between suction level and seed treatment had no significant effect on seed missing.

Table (9) indicates the effect of the interaction between machine type and seed treatment on the percentage of seed missing. The highest values were 5.799 and 8.843% by using inclined and horizontal metering devices, respectively for undelinted cotton seed variety Giza 81.

Table (10) shows the effect of the interaction between speed of seed plate and seed treatment on the percentage

Table(g):Effect of the interaction between machine type and seed treatment on percentage of cell fill and seed missing

Machine type (M)	Seed treatment (c)	Cell fill %	Seed missing %
Mechanical inclined plate (M1)	G.81 T_1	413.410	2.158
	G.81 T_2	340.510	5.799
Mechanical horizontal plate (M2)	G,81 T_1	910.366	1.832
	G.81 T_2	409.599	8.843

T_1 = Giza 81 delinted T_2 = Giza 81 undelinted

L.S.D at	0.05	44.8	cell fill
	0.01	64.3	
L.S.D at	0.05	1.5	seed missing
	0.01	2.3	

Table(10):Effect of the interaction between speed of seed plate and seed treatment on percentage of seed missing in case mechanical metering device

Speed of seed plate (s) min^{-1}	Seed treatment (c)		Seed missing%
25	G.81	T_1	0.0
	G. 81	T_2	2.460
35	G. 81	T_1	1.377
	G. 81	T_2	7.627
45	G.81	T_1	4.598
	G.81	T_2	11.877

T_1 = Giza 81 delinted T_2 = Giza 81 undelinted

L.S.D at $_{0.01}^{0.05}$ 1.5 / 2.3

of seed missing. It is clear that the value of the percentage of seed missing equals zero by using delinted cotton seed variety Giza 81 at 25 min^{-1} speed of seed plate. But, the highest value was found to be 11.877% by using undelinted cotton seed variety Giza 81 at 45 min^{-1} speed of seed plate.

Table (11) indicates the effect of the interaction between machine type, speed of seed plate and seed treatment on the percentage of seed missing. The highest values were found to be 9.510 and 14.243% by using mechanical inclined and horizontal metering devices, respectively at 45 min^{-1} speed of seed plate by utilizing undelinted cotton seed variety Giza 81. The smallest value was found to be zero by using two mechanical metering devices at speed of seed plate of about 25 min^{-1} by using delinted cotton seed variety Giza 81.

Table (12) shows the effect of the interaction between speed of seed plate, and seed treatment on the percentage of seed missing. The highest value was found to be 92.1% at speed of seed plate of about 45 min^{-1} by using undelinted cotton seed variety Giza 81. The smallest value was found to be 26.13% at speed of seed plate 25 min^{-1} by using delinted cotton seed variety Giza 81, in case of using pneumatic metering device.

Table (13) indicates the effect of the interaction between suction level, seed treatment,and speed of seed plate

Table(11):Effect of the interaction between machine type, speed of seed plate and seed treatment on percentage of seed missing.

Machine type(M)	Speed of seed plate(s)min	Seed treatment (c)	Seed missing %
Mechanical Inclined plate (M1)	25	G. 81 T_1	0.0
		G.81 T_2	1.443
	35	G. 81 T_1	0.710
		G.81 T_2	6.443
	45	G. 81 T_1	5.753
		G. 81 T_2	9.510
Mechanial Horizontal Plate(M2)	25	G. 81 T_1	0.0
		G. 81 T_2	3.477
	35	G. 81 T_1	2.043
		G. 81 T_2	8.810
	45	G. 81 T_1	3.443
		G. 81 T_2	14.243

T_1 = Giza 81 delinted T_2= Giza 81 undelinted

L.S.D at 0.05 2.8
L.S.D at 0.01 5.2

Table (12):Effect of the interaction between speed of seed plate and seed treatment on percentage of cell fill and percentage of seed missing in case of pneumatic unit-planter.

Speed of seed plate min^{-1} (S)	Seed treatment (V)	Cell fill, %	Seed missing %
25	G.81 T1	96.5	26.13
	G.81 T2	61.5	46.9
	G.81 T1	65.7	46.7
35	G.81 T2	14.0	86.2
	G.81 T1	31.3	72.3
45	G.81 T2	7.9	92.1

T1 Giza 81 delinted T2 Giza 81 Undelinted

L.S.D at $^{0.05}_{0.01}$ 13.6 / 19.5 cell fill

L.S.D at $^{0.05}_{0.01}$ 8.8 / 12.7 seed missing

Table(13):Effect of the interaction between speed of seed plate, suction level, and seed treatment on percentage of cell fill and percentage of seed missing in case of pneumatic Unit-planter.

Speed of seed plate min^{-1} (S)	Suction level cm H20 (H)	Seed treatment (V)	Cell fill %	Seed missing %
25	4.0	G.81 T1	36.3	63.7
		G.81 T2	0.0	100.0
	9.0	G.81 T1	117.3	10.03
		G.81 T2	83.2	23.9
	15.5	G.81 T1	135.8	4.7
		G.81 T2	101.2	16.8
35	4.0	G.81 T1	18.5	81.5
		G.81 T2	0.0	100.0
	9.0	G.81 T1	52.0	48.7
		G.81 T2	17.73	82.7
	15.5	G.81 T1	126.8	9.9
		G.81 T2	24.2	75.8
45	4.0	G.81 T1	0.0	100.0
		G.81 T2	0.0	100.0
	9.0	G.81 T1	0.0	100.0
		G.81 T2	0.0	100.0
	15.5	G.81 T1	93.83	16.9
		G.81 T2	23.767	76.3

T1 Giza 81 delinted T2 Giza 81 Undelinted

L.S.D at $_{0.01}^{0.05}$ 33.1 / 60.7 cell fill

L.S.D at $_{0.01}^{0.05}$ 21.6 / 39.7 seed missing on the percentage of seed missing. The smallest value was found to be 4.7% at speed of seed plate of about 25 min^{-1}, suction level of about 4 cm H_2o and delinted cotton seed variety Giza 81.

4-3: Percentage of cell fill:

Table (7), (8) and Figures (4-9 and 4-10) show the effect of the machine type, speed of seed plate, suction level and seed treatment on the percentage of cellfill. It was obvious that the increasing of speed of seed plate decreased the percentage of cell fill in both mechanical and pneumatic metering devices. But, the increasing of suction level increased the percentage of cell fill. Also, the utilization of delinted cotton seed variety Giza 81 increased the percentage of cell fill. But the using of undelinted cotton seed variety Giza 81 decreased the percentage of cell fill.

Table (7) indicates that the percentage of cell fill decreased to arround 72.6 and 85% for the two speeds of seed plate of about 35 and 45 min^{-1}, respectively compared with the speed of seed plate of about 25 min^{-1} in case of using mechanical metering device.

Table (8) shows that the percentage of cell fill decreased to arround 45.0 and 55.6% for the two speeds of seed plate of about 35 and 45 min^{-1}, respectively compared with the speed of seed plate of about 25 min^{-1} in case of using pneumatic metering device. But it was increased to arround 79.8 and 89.2% for the two suction levels of about 9.0 and 15.5 cm H_2o respectively compared with the first suction level of about 4.0 cm H_2o.

Analysis of variance in Table (A-3) shows that speed of seed plate and seed treatment had a highly significant effect on the percentage of cell fill. But, the machine type had no significant.

The interaction between the machine type and seed treatment had a highly significant effect on cell fill. But, the other factors had no significant effect on the percentage of cell fill.

Analysis of variance in Table (A-4) indicates that the effect of suction level and seed treatment has no significant effect on the percentage of cell fill. But, speed of seed plate had a highly significant effect on cell fill.

The interaction between speed of seed plate and seed treatment had a highly significant effect on cell fill. Also, the interaction between suction level, speed of seed plate, and seed treatment had a highly significant effect on cell fill. But, the interaction between suction level and seed treatment had no significant effect on cell fill.

Table (9) indicates the effect of the interaction between machine type and seed treatment on the percentage of cell fill. The highest values were 413.410 and 910.366% for mechanical inclined and horizontal metering device, respectively by using delinted cotton seed variety Giza 81.

Table (12) shows the effect of the interaction between speed of seed plate and seed treatment on the percentage of cell fill. The largest value found to be 96.5% at speed of seed plate of about 25 min^{-1} by using delinted cotton seed variety Giza 81.

Table (13) indicates the effect of the interaction between speed of seed plate, suction level, and seed treatment on the percentage of cell fill. The highest values were 135.8 and 126.8% at 25 and 35 min^{-1}, 15.5 cm H_2o by using delinted cotton seed variety Giza 81.

4-4: Percentage of seed emergence:

Seed samples were choosen at random after passing through the feeding mechanism of pneumatic or mechanical metering devises to evaluate the test of germination. The percentage of germination tests were 94.0% and 89.0% by using delinted and undelinted cotton seed variety Giza 81, respectively. The metering devises had no effect on the percentage of seed emergence due to missing of the cut-off and knock-out valves in our manufactured units. The increase in the percentage of seed emergence for delinted seed cotton compared with undelinted was carried out by the effect of sulpheric-acid.

4-5: Planting rate:

Tables (1 and 2) and Figures from (4-11) up to (4-14) indicate that, the effect of suction level, implement forward speed, speed of seed plate and seed treatment and the interaction between them on planting rate. When the implement forward speed decreased the speed of seed plate and suction level increased the planting rate were increased. Also, by using delinted cotton seed variety Giza 81 the planting rate was increased. But, by using undelinted cotton seed the planting rate was decreased in both mechanical and pneumatic metering devices.

Table (1) shows that, the planting rate increased to arround 27.0 and 35.5% for the two speeds of seed plate of about 35 and 45 min^{-1}, respectively compared with the speed of seed plate of about 25 min^{-1} by using inclined metering device. Also, it was increased to arround 1.02 and 22.8% by using horizontal metering device.

The planting rate decreased to arround 14.8 and 39.1% for the two forward speeds 4.2 and 6.3 Km/h, respectively

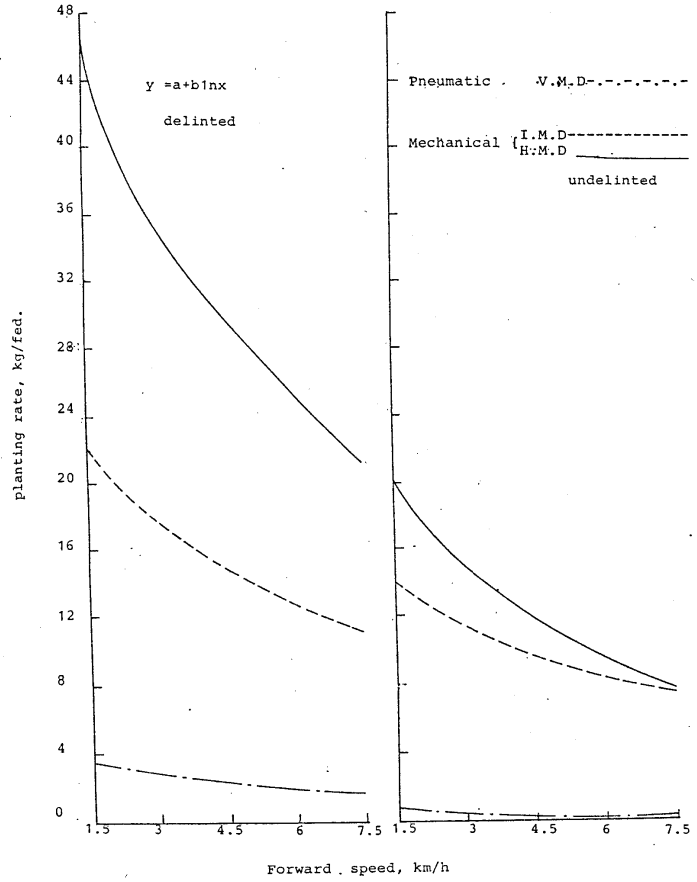
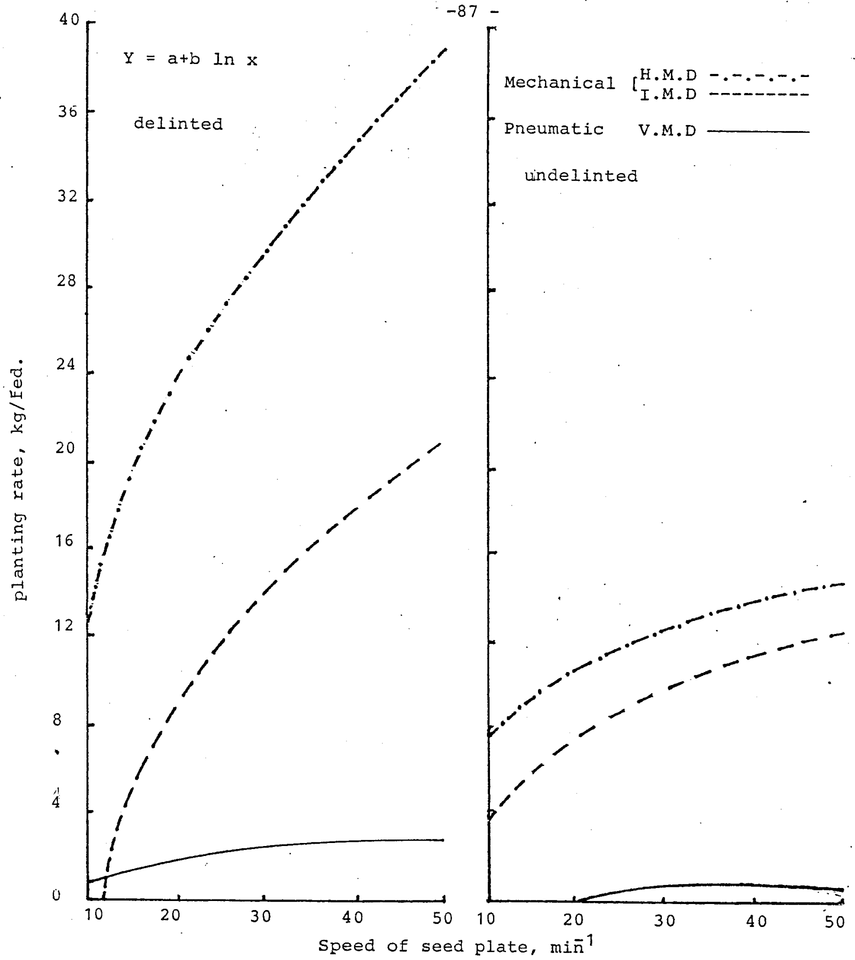


Fig.(4-11):Effect of forward speed, type of metering device and seed treatment on planting rate.

Type of metering device	Delinted			Undelinted		
	a	b	r	a	b	r
Horizontal metering device	52.94	-15.51	-0.997	23.08	-7.55	-0.991
Inclined metering device	25.0	-6.88	-0.983	15.613	-3.95	-0.896
Pneumatic metering device	3.80	-1.058	-0.998	0.420	-0.127	-0.969



Fig(4-12):Effect of speed of seed plate,type of metering device and seed treatment on planting rate.

Type of metering device	Delinted			Undelinted		
	a	b	r	a	b	r
Horizontal metering device	- 28.01	17.06	0.889	-2.96	4.52	0.974
Inclined metering device	-31.06	13.28	0.975	-9.31	5.56	0.989
Pneumatic metering device	-2.30	1.33	0.987	-0.52	0.22	0.886

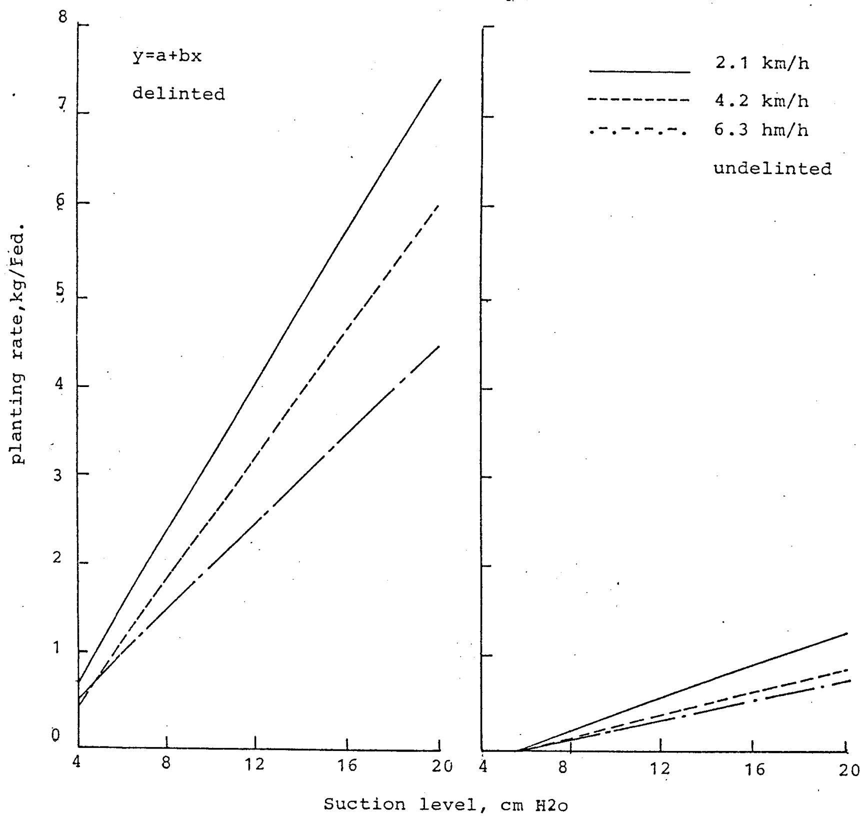


Fig.(4-13):Effect of suction level,forward speed and seed treatment on planting rate.

Forward speed, km/h	Delinted			Undelinted		
	a	b	r	a	b	r
2.1	-0.967	0.418	0.997	-0.514	0.090	0.901
4.2	-1.012	0.3503	0.9999	-0.326	0.058	0.901
6.3	-0.537	0.249	0.993	-0.297	0.053	0.901

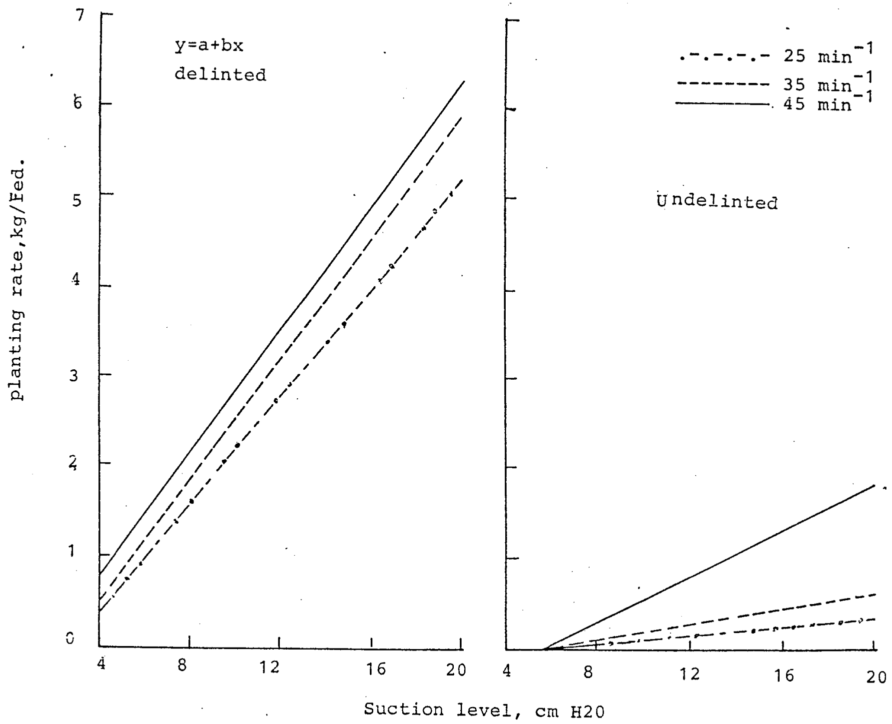


Fig.(4-14):Effect of suction level, speed of seed plate and seed treatment on planting rate.

Speed of seed plate, min^{-1}	Delinted			Undelinted		
	a	b	r	a	b	r
25	-0.86	0.302	0.9995	-0.14	0.026	0.901
35	-0.883	0.340	0.9966	-0.262	0.047	0.901
45	-0.776	0.376	0.9951	-0.735	0.128	0.901

compared with the forward speed of about 2.1 Km/h in case of using inclined metering device. Also, it was increased to arround 27.5 and 42.9% for the horizontal metering device.

Table (2) indicates that, the planting rate increased to arround 16.7 and 35.7% for the two speeds of seed plate of about 35 and 45 min^{-1}, respectively compared with the speed of seed plate of about in case of using pneumatic metering device. But, the planting rate decreased by 24.6 and 38.6% for the two forward speeds of about 4.2 and 6.3 Km/h, respectively compared with the forward speed of about 2.1 Km/h.

The planting rate increased to arround 80.8 and 89.7% for the two suction levels 9.0 and 15.5 cm H_2o , respectively compared with 4.0 cm H_2o suction level for delinted cotton seed variety Giza 81. But, in case of using undelinted cotton seed, it was zero at 4.0 and 9.0 cm H_2o.

Table (A-1) shows the analysis of variance of planting rate. The effect of the seed treatment, implement forward speed and speed of seed plate on planting rate had a highly significant.

The interaction between forward speed and seed treatment had a highly significant. Also, the interaction between speed of seed plate and seed treatment had a highly significant in both inclined and horizontal metering devices.

Table (3) indicates the effect of the interaction between speed of seed plate and seed treatment on the planting rate. The largest values were found to be 18.92 and 38.64 Kg/Fed. by using inclined and horizontal, metering devices respectively at speed of seed plate of about 45 min^{-1} and delinted cotton seed. Whereas the smallest values were found to be 8.72 and 11.72 Kg/Fed. at speed of seed plate of about 25 min^{-1} and undelinted cotton seed.

Table (14) shows, the effect of the interaction between forward speed and seed treatment on planting rate. The largest values were found to be 19.60 and 41.73 Kg/Fed. for inclined and horizontal metering devices respectively at forward speed of about 2.1 Km/h and delinted cotton seed. Whereas the smallest values were found to be 7.55 and 8.78 Kg/Fed. at forward speed of about 6.3 Km/h and undelinted cotton seed.

Table (A-2) shows that, the effect of forward speed, implement suction level, seed treatment and speed of seed plate on planting rate. The effect of the speed of seed plate, suction level and seed treatment had a highly significant. Also, the interaction between forward speed, suction level and seed treatment had a highly significant.

Table(14): Effect of the interaction forward Speed and seed treatment on Planting in case mechanical unit- planters.

Forward speed (M) km/h	Seed treatment (V)	planting rate kg/ Fed	
		M_1	M_2
2.1	G.81 T_1	19.60	41.73
	G.81 T_2	12.22	17.24
4.2	G.81 T_1	15.93	29.86
	G.81 T_2	11.18	12.88
6.3	G. 81 T_1	11.83	24.90
	G.81 T_2	7.55	8.78

T_1 = Giza 81 delinted T_2 = Giza 81 undlinted

M_1=Inclinad metering device

M_2=Horizontal metering device

L.S.D at $^{0.05}_{0.01}$ 1.16 / 1.57 Inclined

L.S.D at $^{0.05}_{0.01}$ 3.14 / 4.24 Horizontal

The interaction between speed of seed plate, suction level and seed treatment had a highly significant, but the effect of the other factors has no significant.

Table (4) indicates, the effect of the interaction between suction level and seed treatment on planting rate. It is clear that the maximum value was found to be 5.421 Kg/Fed. at forward speed of about 2.1 Km/h and 15.5 cm H_2o using delinted cotton seed.

Table (5) shows that, the effect of the interaction between implement suction level, seed treatment and speed of seed plate on planting rate. The maximum values of planting rate were found to be 3.843, 4.310 and 4.943 Kg/Fed. at speeds of seed plate of about 25, 35 and 45 min^{-1}, respectively under suction level of about 15.5 cm H_2o and delinted cotton seed.

5- CONCLUSION

Three experimental unit-planters were manufactured and constructed from materials locally available to run the set of the laboratory experiments. Two of these untis are classified under mechanical metering devices and the third one is classified under pneumatic metering device.

The main parts of the unit-planter are indicated as follows: a) Seed box is made from galvanized steel sheet of metal, b) Feeding system, c) Frame made from iron angles, d) Smear belt,. e) Transmission system, and f) Electrical motor.

The present investigation was carried out to study the effect of seed treatment of cotton seed, speed of seed plate, implement forward speed, and suction level on the performance of previous manufactured units. The study was extended to include seed longitudinal and transverse scattering, percentage of cell fill, percentage of seed missing and planting rate.

5-1: Seed scattering:

The seed longitudinal and transverse scattering were calculated from the following formula:

$$\text{Seed scattering} = \sqrt{\frac{\text{Sum of squares of variance of seed scattering from its mean}}{\text{No. of hills}}}$$

The results revealed to the following:

- Increasing the implement forward speed and speed of seed plate increased the seed scattering.

- The seed scattering was decreased as the suction level increased from 4.0 to 15.5 cm H_2o.

- The longitudinal scattering by using delinted seed were 5.56, 5.13 and 6.43 cm for inclined, horizontal and pneumatic metering devices, respectively. They were 3.98, 3.93 and 2.8 cm by using undelinted seed.

- The transverse scattering by using delinted seed were 1.166, 1.011 and 0.83 cm for inclined, horizontal and pneumatic metering devices, respectively. They were 1.151, 0.861 and 0.28 cm by using undelinted seed.

5-2: <u>Percentage of seed missing</u>:

Percentage of seed missing was calculated for one meter long from the following formula:

$$\text{Percentage of seed missing} = \frac{\text{No. of hills missing /m}}{\text{No. of hills /m}} \times 100$$

The results of the above mentioned factors are indicated as follows:

- The percentage of seed missing increased by increasing the speed of seed plate, as the seed treatment varies from delinted to undelinted cotton seed.

- The percentage of seed missing decreased by increasing the suction level.

- The highest value of seed missing was 61.7% by using pneumatic metering device and the smallest value was 3.975% by using inclined metering device.

5-3: Percentage of cell fill:

Percentage of cell fill was calculated for a period of one minute from the following formula:

$$\text{Percentage of cell fill} = \frac{\text{No. of dropped seeds/min}}{\text{No. of cells/min}} \times 100$$

The experiments indicated the following important results:

- The percentage of cell fill was decreased by increasing speed of seed plate, as the seed treatment varies from delinted to undelinted cotton seed.
- The percentage of cell fill increased by increasing suction level from 4.0 to 15.5 cm H_2o.
- The percentage of cell fill were 340.510, 376.410 and 46.15% for inclined, horizontal and pneumatic metering devices, respectively.

5-4: Percentage of seed emergence:

Germination tests indicated that, there was no damage in seeds by using the three different types of unit-planters.

5-5: Planting rate:

Planting rate was calculated from the following formula:

$$\text{Planting rate} = \frac{m \times F \times 4.2}{A} \quad \text{Kg/Feddan}$$

and $A = \frac{L \times W}{10^4} \; m^2$ $n = \frac{4200}{A}$

Where:

A = Area held with one hill, (m^2).

m = Average of seed weight, (g).

F = Percentage of cell fill, (%).

L = Distance between hills in one row in cm.

W = Distance between rows in cm.

n = No. of hill per Feddan.

The experiments revealed to the following results:

- The planting rate was increased by increasing both speed of seed plate and suction level.

- The planting rate decreased by increasing implement forward speed, when the seed treatment varies from delinted to undelinted cotton seed.

- The planting rates with delinted seed were 15.79, 32.16 and 2.4 Kg/Feddan by using inclined, horizontal and pneumatic metering devices, respectively. They were 10.32, 12.96 and 0.25 Kg/Feddan by using undelinted seed.

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Appendix(A):ANOVA Table(A-1)Mean squares of forward speed,speed of seed plate and seed treatment longitudinal and transverse scattering and planting rate in case mechanical unit- planters.

S.V	DF	Longitudinal scattering (cm)		Transverse scattering (cm)		planting rate(kg/fed)	
		M_1	M_2	M_1	M_2	M_1	M_2
Block(R)	3	0.2915	0.35643	0.01212	0.0096	3.3894	10.135
Forward speed(M)	2	21.0014**	9.31167**	0.5550**	0.1007514	236.77**	985.935
ERROR(a)	6	0.1072	0.211296	0.01416	0.02422	1.3199	17.520
Speed of(s) seed plate	2	63.21335**	56.388**	1.1865**	0.375206**	187.9912**	282.71**
MXS	4	0.843056	0.610833	0.0033	0.02429	1.9042	10.2501
ERROR(b)	18	0.3832	0.621343	0.0366	0.025167	1.27505	14.168
Seed treat-ment (V)	1	44.8089**	25.80014**	0.0042014	0.400512**	838.467**	6635.52**
MXV	2	1.514306	0.32889	0.07573	0.01228	16.667 **	127.113**
SXV	2	25.801806**	14.31264**	0.024422	0.03607	38.806**	123.89**
MXSXV	4	0.61722	0.22014	0.031297	0.022783	4.2997	8.8221
ERROR(c)	27	o.603704	0.52819	0.03275	0.0344	1.922	14.07
TotAL	71	Inclined	Horizontal	Inclined	Horizontal	Inclined	Horizontal

ANOVA table(A-2): Mean squares of forward speed, speed of seed plate and interaction between suction level and seed treatment and their effect on longitudinal and transverse scattering and planting rate in case pneumatic unit-planter.

S.v	df	longitudinal	Tranverse	planting rate. (kg/fed)
		Scattering Cm		
Block(R)	2	2.976	0.05705	0.05389
Forward speed (M)	2	90.950	1.00564	5.77002
ERROR (a)	4	6.4935	0.1073	0.275
Speed of seed Plate (c)	2	137.0803**	2.1992**	4.7297**
MXC	4	3.466	0.08679	0.083506
ERROR(b)	12	10.671	0.054921	0.3794
Suction level x seed treatm-ent (sxv)	5	545.761**	6.446**	80.0364**
MXS	10	17.1187**	0.2579**	1.7183**
CXS	10	39.083**	0.40691**	0.791**
MXCXS	20	3.6802	0.12332**	0.25334
ERROR(C)	90	5.864	0.04604	0.186
TOTAL	161			

ANOVA Table(A-3)Mean square of machine type, speed of seed plate and seed treatment and their effect on percentage of cell fill and percentage of missing in case mechanical unit-planters.

S.V	df	Cell fill, %	Seed missing, %
Block (R)	2	5092.21	0.40444
Machine type (M)	1	720914.2	16.633 NS
ERROR (a)	2	451.63	1.239
Speed of seed plate (s)	2	20448.9**	147.325**
MXS	2	287.15	0.56997
ERROR (b)	8	842.33	1.05165
Seed treatment (c)	1	740460.25**	255.31 **
MXC	1	411907.24 **	25.553 **
SXC	2	177.73	19.4051 **
MXSXC	2	661.053	7.778 *
ERRORC	12	1765.03	1.1942
ToTAL	35		

ANOVA Table(A-4):Mean squares of suction level,Speed of seed plate, and seed treatment and their effect on percentage of cell fill and percentage of seed missing in case of pneumatic Unit-planter.

S.V	df	cell fill, %	seed missing, %
Block (R)	2	247.4	282.01
Suction level(H)	2	25422.4 Ns	14886.7 Ns
ERROR (a)	4	34.4	25.6
Speed of seed plate (s)	2	16388.1 **	9684.01 **
HXS	4	2666.8 **	1789.93 **
ERROR (b)	12	175.2	64.8
Seed treatment (V)	1	64.9 Ns	1.89 Ns
HXV	2	47.8	187.51
SXV	2	9977.6 **	5352.01 **
HXSXV	4	2704.7 **	1361.33 **
ERROR(C)	18	161.7	69.97
TOTAL	53		

Table (A-5): Effect of implement forward speed (x_1), speed of seed plate (x_2) and seed treatment on transverse scattering (y) in case mechanical inclined metering device.

Forward speed x1 kmlh	Speed of seed plate x2 min^{-1}	Transverse scattering (cm)	
		G.81 delinted y_1	G.81undelinted y_1
2.1	25	0.86	0.74
2.1	35	1.14	1.1
2.1	45	1.2	1.22
4.2	25	0.95	0.74
4.2	35	1.16	1.2
4.2	45	1.33	1.3
6.3	25	1.0	1.2
6.3	35	1.4	1.4
6.3	45	1.4	1.62

Table(A-6):Effect of implement forward speed(x1),speed of seed plate(x2) and seed treatment on longitudinal scattering(y) in case of mechanical inclined metering device.

Forward speed x1 kmlh	Speed of seed plate x2 min⁻1	Longitudinal scattering (cm)	
		G.81 delinted y_1	G.81 undelinted y_1
2.1	25	2.0	3.3
2.1	35	3.6	3.6
2.1	45	7.4	3.6
4.2	25	3.5	3.4
4.2	35	5.4	3.8
4.2	45	8.4	4.2
6.3	25	4.1	3.7
6.3	35	6.2	4.6
6.3	45	9.5	6.1

Table(A- 7):Effect of implement forward speed(x1),speed of seed plate(x2) and seed treatment on longitudinal scattering(y) in case of mechanical horizontal metering device.

Forward speed x1 km/h	Speed of seed plate x2 min^{-1}	Longitudinal scattering (cm)	
		G.81 delinted y_1	G.81 undelinted y_1
2.1	25	2.0	4.0
2.1	35	2.0	4.4
2.1	45	5.3	5.2
4.2	25	2.4	4.5
4.2	35	3.1	4.9
4.2	45	7.1	6.2
6.3	25	2.5	5.0
6.3	35	3.6	5.4
6.3	45	7.3	6.5

Table(A- 8):Effect of implement forward speed(x1)speed of seed plate(x2) and seed treatment on transverse scattering (y) in case of mechanical horizontal metering device.

Forward speed x1 km/h	speed of seed plate x2 min^{-1}	trans verse scattering (cm)	
		G.81 delinted y_1	G.81 undelinted y_1
2.1	25	0.7	0.85
2.1	35	0.8	1.0
2.1	45	0.9	1.1
4.2	25	0.8	0.93
4.2	35	0.9	1.0
4.2	45	1.05	1.1
6.3	25	0.8	1.0
6.3	35	0.92	1.01
6.3	45	1.2	1.2

Table(A- 9.):Effect of implement forward speed(x1),speed of seed plate(x2) suction level (x3) and seed treatment on longitudinal scattering (y)in case pneumatic metering device.

Forward speed x1 km/h	speed of seed platex2 min	suction level x3 cm h20	Longitudinal scattering	
			G.81 delinted y1	G.81 undelinted y1
2.1	25	4.0	0.0	0.0
2.1	25	9.0	6.60	0.0
2.1	25	15.5	4.60	0.0
2.1	35	4.0	0.0	0.0
2.1	35	9.0	9.70	0.0
2.1	35	15.5	5.0	6.30
2.1	45	4.0	1.10	0.0
2.1	45	9.0	11.70	0.0
2.1	45	15.5	5.60	11.40
4.2	25	4.0	0.0	0.0
4.2	25	9.0	6.90	0.0
4.2	25	15.5	5.70	0.0
4.2	35	4.0	0.0	0.0
4.2	35	9.0	11.60	0.0
4.2	35	15.5	5.80	11.0
4.2	45	4.0	3.70	0.0
4.2	45	9.0	15.10	0.0
4.2	45	15.5	5.90	11.90
6.3	25	4.0	5.30	0.0
6.3	25	9.0	8.50	0.0
6.3	25	15.5	5.90	8.2
6.3	35	4.0	6.40	0.0
6.3	35	9.0	12.5	0.0
6.3	35	15.5	6.60	12.60
6.3	45	4.0	6.70	0.0
6.3	45	9.0	15.5	0.0
6.3	45	15.5	7.0	13.0

Table(A-10):Effect of implement forward speed(x1),speed of seed plate (x2),suction level(x3)and seed treatment on transverse scattering(y)incase pneumatic metering device-

Forward speed x1 km/h	speed of seed plate x2 min^{-1}	suction level x3 cm h20	Transverse scattering cm	
			G.81 delinted y1	G.81 undlinted y1
2.1	25	4.0	0.0	0.0
2.1	25	9.0	0.91	0.0
2.1	25	15.5	0.70	0.0
2.1	35	4.o	0.0	0.0
2.1	35	9.0	1.20	0.0
2.1	35	15.5	0.80	0.50
2.1	45	4.0	0.70	0.0
2.1	45	9.0	1.20	0.0
2.1	45	15.5	0.80	0.90
4.2	25	4.0	0.0	0.0
4.2	25	9.0	1.0	0.0
4.3	25	15.5	0.74	0.0
4.3	35	4.0	0.0	0.0
4.3	35	9.0	1.20	0.0
4.3	35	15.5	0.80	0.90
4.3	45	4.0	1.0	0.0
4.3	45	9.0	1.50	0.0
4.3	45	15.5	1.15	1.34
6.3	25	4.0	0.0	0.0
6.3	25	9.0	1.10	0.0
6.3	25	15.5	0.80	1.2
6.3	35	4.0	1.30	0.0
6.3	35	9.0	1.30	0.0
6.3	35	15.5	0.95	1.0
6.3	45	4.0	1.20	0.0
6.3	45	9.0	1.50	0.0
6.3	45	15.5	1.15	1.50

بسم الله الرحمن الرحيم

دراسة تأثير نوع جهاز التلقيم على زراعة بذور القطن المصرى

الملخص العربى

مقدمـــة :

يعتبر محصول القطن من المحاصيل الهامة فى مصر حيث يشغل مساحة تتراوح فـــى حدود المليون فدان ويقدر انتاجها السنوى فى حدود ٠٠٠ر٢١١ر١ طن منهـــــــا ٠٠٠ر٦٥٧ طن بذرة ، ٠٠٠ر٤٦١ طن الهشـاف يمعنى ان بذرة القطن تمثل نسبة حوالى ٥٤٪ من الانتاج الكلى .

وترجع اهمية بذرة القطن الى اعتبارها احد المصادر الهامة للزيوت النباتية وصناعـة كسب العلف ويستعمل حوالى ٥ر٧٪ من اجمالى انتاج البذرة كتقاوى للزراعة فى الموســم التالى والتى تقدر بحوالى ٢٧٥ر٤٩ طن بذرة بواقع (٥٠ كيلوجرام / فدان) فـــى المتوسط باستخدام الطريقـة التقليدية (اليدوية) . وباستخدام الات الزراعـة فـــى جـور فان الاحتياجات الفعلية للفدان من البذرة تقدر بحوالى (١٠ ــ ١٥ كجم / فدان) اى ان الفرق بين استخدام الطريقتين (الفواقـد) يقدر بحوالى (٣٥ ــ ٤٠ كجم / فدان) .

ومن اصناف القطن طويل التيلة والتى يجود زراعتها فى مصر هى جنـيزة ٤٥ ، ٦٨ ، ٧٥ ، ٧٦ ، ٨١ ... الخ . ويتواجد الزغـب بكثافـة على بذور هـــــذه الاصناف والتى يصعب ازالتـه كلية بالطرق الميكانيكية فى المحالج الحديثة .

وفى مجال الزراعة يتسبب الزغب فى صعوبة استخدام الآلات الزراعية الحديثة لزراعـة بذور اصناف القطن المحلية نظرا لتواجد الزغب الذى يعمل على تجميع البذرة فى كتل كبـيرة حيث يصعب مرورها فى جهاز التغذية وانابيب البذور فى الآلـة .

وتتم الزراعة حتى الآن بالاعتماد على العمالة اليدوية وما يتبعها من عمليات الخـف والترقيع الناتجة عن عدم امكانية زراعة العدد المناسب من البذور الجيدة فى الجـــــورة الواحـدة .

وتعتبر عمليات انتاج تقاوى القطن المنتقاة فى مصر من العمليات التى لم تدخــل حيز التنفيذ لصعوبة عمليات الفصل والتدريج للبذور ذات الزغب . ولامكانية القيـــام

باعداد البذور الجيدة المنتجة يجب التخلص من الزغب كلية وذلك باستعمال الطرق الكيماوية مثل حامض الكبريتيك المركز ٠

اهم ميزات ازالة الزغب بالحمض في مجال الزراعة :

١ ـ امكانية التدريج والفصل (فصل الشوائب والبذور المصابة والضعيفة والميتة) بهدف الحصول على البذور الصالحة للزراعة ٠
٢ ـ انتاج تقاوى ملساء خالية من الزغب يمكن زراعتها باستخدام آلة التسطير ٠
٣ ـ القضاء على الكائنات الحية الدقيقة والبويضات واليرقات الحشرية المتواجد على سطح البذرة وبداخل الزغب
٤ ـ توفير حوالى ٣٥٫٠٠٠ طن بذرة يمكن استخدامها فى انتاج الزيوت والاعلاف ومن ذلك يتضح ان اهمية ازالة الزغب باستعمال حامض الكبريتيك والتى تعتبر الطريقة المثلى والمفضلة لمزاياها العديدة الا انها تحتاج الى حرص شديد للتعامل مع الحامض ٠

وقد اجرى هذا البحث بغرض تقييم ثلاثة انواع مختلفة من اجهزة التلقيم (افقى ـ مائل ـ رأسى) والتى تستخدم فى نوعين من الآت الزراعة فى جور

١ ـ النوع الاول : وحدة التلقيم الميكانيكى وتشتمل على نوعين من اجهزة التلقيم (افقى ـ مائل) ٠
٢ ـ النوع الثانى : وحدة التلقيم بشفط الهواء يستخدم شفط الهواء فى تشغيل جهاز التلقيم ذو القرص الرأسى ٠

وقد اجريت تجارب معملية استخدم فيها ثلاث وحدات تلقيم مختلفة مصنعة من خامات محلية مع بذرة قطن صنف جيزة ٨١

النوع الاول : (افقى ـ مائل) :

تم تصنيعهم من اطار من الحديد الزهر وصندوق للبذور من الصاج المجلفن واستعملت وحدة تخفيض مزودة بترس دودى لتخفيض سرعة الموتور وطارات من الالومنيوم للحصول على السرعات المطلوبة لعمود التلقيم واستعمل قرص بذور واحد فى الآلتين ٠

النـوع الثانى : (رأسـى) :
عبـارة عن صندوق للبذور من الصاج المجلفن مقسم الى قسمين غير منفصلين هما : الصندوق الاساسى للبذور وحجرة البذور وهى متصلـة بقرص البذور الذى يحتوى على ٣٢ خلية مصنوع ايضا من الصاج المجلفن وانبوبة شفط الهواء من المطـاط متصلة بمروحة تدار بموتور كهربائـى .

ويستعمل مانوميتر لقياس درجة التفريغ كما استخدمت نفس وحدات تخفيـض السرعة والطارات كما فى النوع الاول .

وتم استخدام حامض الكبريتيك المركز بنسبة (١ : ٣) لازالـة الزغب لامكان دراسة تأثير ذلك على اداء هذه الوحدات الثلاثة السابقة بالاضافة الى البـذور الغير معاملـة بالحامض .

وقد تم دراسة تاثير كل من : معاملة البذرة ، سرعة قرص البذور ، السرعـة الاماميـة المتمثلة فى سرعـة سير استقبال البذور ، ومستوى تفريـغ الهواء علـى النحـو التالى :

١ ـ التشتت الطولى والعرضى للبذور
٢ ـ النسبة المئوية للخلايا الغائبـة
٣ ـ النسبة المئوية لملىء الخليـة
٤ ـ تكسير الحبـوب
٥ ـ معـدل الزراعـة

(١) التشتت الطولى والعرضى للبذور :

تم حساب التشتت الطولى والعرضى من العلاقة الاتيـة :

$$\text{تشتت البذور} = \frac{\text{مجموع مربع انحراف البذور عن متوسطها}}{\text{عدد الجور}}$$

وقد خلصت التجارب الى اهم النتائج الاتية :
ـ بزيادة كل من السرعة الامامية وسرعة قرص البذور ادى الى زيادة التشتت
ـ يقل التشتت عندما يزيد مستوى الشفط من ٤ الى ١٥٫٥ سم ماء .

- التشتت الطولى للبذور المعاملة حامضيا كانت ٦ر٥ ، ١٣ر٥ ، ٤٣ر٦ سم لكل من الثلاثة آلات (ذات قرص التلقيم المائل ، الافقى ، الرأسى) على الترتيب، وكانت ٩٨ر٣ ، ٩٣ر٣ ، ٨ر٢ سم باستخدام الصنف الغير معامل .
- التشتت العرضى للبذور المعاملة حامضيا كانت ٦٦ر١ ، ١١ر١ ، ٨٣ر٠ سم لكل من الثلاثة آلات (ذات قرص التلقيم المائل ، الافقى ، الرأسى) على الترتيب . وكانت ١٥١ر١ ، ٨٦١ر٠ ، ٢٨ر٠ سم باستخدام الصنف الغير معامل .

(٢) النسبة المئوية لغياب البذور :

تم حساب النسبة المئوية لغياب البذور فى المتر الطولى من العلاقة الاتية :

$$\text{النسبة المئوية لغياب البذور} = \frac{\text{عدد الجور الغائبة / متر طولى}}{\text{عدد الجور الكلى / متر طولى}} \times 100$$

ومن النتائج المتحصل عليها اتضح تاثير العوامل الاتية :

- تزداد نسبة الجور الغائبة بزيادة سرعة قرص البذور،عندما تتغير البذور المعاملة بالبذور الغير معاملة لصنف قطن جيزة ٨١
- تقل نسبة الجور الغائبة بزيادة مستوى الشفط
- اعلى قيم للجور الغائبة كانت ٧ر٦١ باستخدام ماكينة شفط الهواء ذات قرص التلقيم الرأسى واقل قيمة كانت ١٧٥ر٣٪ باستخدام الماكينة ذات قرص التلقيم المائل .

(٣) النسبة المئوية لملء الخلية :

تم حساب النسبة المئوية لملء الخلية لكل دقيقة عن العلاقة الاتية :

$$\text{النسبة المئوية لملء الخلية} = \frac{\text{عدد البذور الساقطة / دقيقة}}{\text{عدد الخلايا / دقيقة}} \times 100$$

ومن نتائج التجارب اتضح ان :

- تقل النسبة المئوية لملء الخلية بزيادة سرعة قرص البذور ، عندما تتغير البذور المعاملة بالبذور الغير معاملة من صنف قطن جيزة ٨١

- تزداد النسبة المئوية لملء الخلية عندما يتغير مستوى الشفط من ٤ الى ٥ر١٥ سم ماء ٠
- النسبة المئوية لملء الخلية كانت ١٠ ٥ر٣٤٠ ، ٣٧٦٫٤١٠ ، ٦ر٤٦٫١٥٪ لكل من الالات ذات قرص التلقيم المائل ، الافقى ، الرأسى على الترتيب

(٤) تكسير البذور :

اتضح من اختبار نسبة الانبات انه لا يوجد تكسير فى البذور باستخدام الثلاث انواع من الالات السابقة الذكر ٠

(٥) معدل الزراعة :

تم حساب معدل الزراعة من العلاقة الاتية :

$$\text{معدل الزراعة} = \frac{\text{نسبة امتلاء الخلية} \times \text{متوسط وزن البذرة الواحدة (جم)} \times ٤ر٢}{\text{المساحة التى تشغلها الجورة الواحدة (متر}^٢\text{)}} \text{ كجم / فدان}$$

والمساحة التى تشغلها الجورة الواحدة =

$$\frac{\text{المسافة بين الصفوف (سم)} \times \text{المسافة بين الجورتين المتجاورتين فى الصف (سم)}}{١٠^٤} \text{(متر}^٢\text{)}$$

ومن نتائج التجارب يتضح ما يلى :

- يزداد معدل الزراعة بزيادة كل من سرعة قرص البذور ، مستوى الشفط ٠
- يقل معدل الزراعة بزيادة السرعة الامامية وعندما تتغير البذور المعاملة بالبذور الغير معاملة من صنف قطن جيزة ٨١
- معدل الزراعة باستخدام البذور المعاملة كان ٧٩ر١٥ ، ١٦ر٣٢ ، ٤ر٢ كجم/فدان لكل من الآلات ذات قرص التلقيم المائل ، الافقى ، الراسى على الترتيب ٠ وكانت ٣٢ر١٠ ، ٩٦ر١٢ ، ٢٥ر٠ كجم / فدان باستخدام البذور الغير معاملة ٠

تأثير نوع جهاز التلقيم على زراعة بذور القطن المصرى

رســـالة مقدمـــة من

نبيـــل مرسى محمـــد عوض

بكالوريوس علوم زراعيـــة (ميكنة زراعية)
جامعـــة طنطـــا ١٩٨٧

للحصول على

درجة الماجستير فى العلوم الزراعيـــة
الميكنـــة الزراعيـــة

قسم الميكنة الزراعية
كلية الزراعـــة بكفر الشيخ
جامعـــة طنطـــا

١٩٩٢

لجنـــة الإشـــراف
أ.د. متـــولي متـــولي محمـــد
د. ســـيد محمـــد شـــرف
د. سميـــر محمـــود جمعـــة