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DEVELOPING A NEW BED PROFILES SYSTEM FOR FERTILIZER APPLICATOR.

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ABSTRACT

This trial is to use an investigated tool for made accumulated constructing of soil layer by turning operation which acting by two opposite moldboard. Bed profile dimensions, cross section area and fertilizing depth are identify for three setting angles of moldboard share, three operational depths and four forward speeds in light sandy soil. Setting angle included, 20, 30 and 40 degree, operational depth was 10, 15, and 20 cm and 3.92, 4.5, 5, and 6.91 km/h for forward speed.

Data interface measured bed height, bed upper width, bed slop angle, bed cross section area and fertilizing depth. Measurements were compared and found that increasing setting angle from 20^0 to 40^0 the bed height increased by about 18%, while the upper width decreased from 42.25 to 19.87 cm and so the bed angle decreased by about 63%. The cross section area increased by about 36% and fertilizing depth increased by about 16% at increasing the setting angle from 20^0 to 40^0.

INTRODUCTION

Most of the vegetable plants are usually grow in wide bed profile (Mastaba). Constructing of such profiles is difficult. The deposition of fertilizers during constructing the wide bed is a problem. Many trails carried out to solve these problems. Ginn et al (1998) modified an implement of constructing wide beds for vegetables production. This work aimed to develop an implement that could used to construct wide beds of variable heights and width. A bedding implement modified to create 203 cm wide bed.

Deepak and Chaudhuri (2001) investigated a performance evaluation of various types of furrow openers. The studies showed in general that an increase in the rake angles increased both furrow depth and furrow area. For light sandy soils, a rake angle of 30° found to be the best for the depth stability of the openers. Psenkov and Kan (1968) reported that the problem noticed at using the ordinary ridger is that the soil layer previously turned a side usually begins to slide down into the open furrow when the retarding action of the wings stopped. Ismail and Hemeda (1992) determined a new mathematical model to compute the expected height of ridge profile after cultivation. This model showed a good predication of the average height of corn ridge profile. The results also showed that performed profile shape after cultivation tendered to have a normal distribution shape. The theoretical height of the profile was also compared to the actual height, the result comparison showed an agreement with each other.

Homer and William (1985) indicated that, the applied fertilizers for vegetable crops commonly placed before or at the time of planting. They reported that, there was more danger of injury to the plant by burning action of the fertilizer on a sandy soil. Fertilizer should place far enough from the seed to minimize seed injury. There are several methods of fertilizer application. The results of the experiments showed, that the fertilizer should placed in bands 5 to 7.5 cm or more from the seed and 5 to 7.5 cm or more below the surface for most vegetable.

Fertilizer application machinery should distribute fertilizer evenly down the row or over the whole field since there is little horizontal movement of fertilizer in the soil. Investigations have been made into some of the factors affecting the uniformity of distribution of fertilizer-application machinery Pitt et al. (1982) Also, indicated that uniformity in the applications of fertilizing an important factor in the efficiency off fertilizer uptake. In addition, they added that the important factors that determine uniformity are they design of the fertilizer application: machine, field and environmental conditions at or near the time of applications.

Bracy-RP et al. (1994) investigated the fertilizer placement in planting beds for vegetable production. Field experiments were used to evaluate the effects of 3 fertilizer knife configurations and 2 fertilizer rates on fertilizer distribution in the shaped and planted beds of a precision cultural system. The fertilizer knifed into rough beds prior to final bed shaping and planting. Effects of fertilizer placement and rate on yield of several vegetable crops also evaluated. Laboratory analysis of soil samples across the shaped bed profile indicated that careful placement of the replant fertilizer bands did not result in precise band location on the shaped beds. No differences in yield of cabbage or mustard due to fertilizer placement or rate noted.

Liu-F et al. (1998) developed a fertilizer distributor, which applies chemical fertilizers into the subsoil, where the A and B-horizons, which are lacking in phosphorus and calcium, are mixed. In addition, based on root density distribution, a technique developed in which the fertilizer placed more densely in the upper layer than in the lower layer within the 200-600 mm depth of the subsoil. When both granular and powder fertilizers were applied at the rear of the first or second plough body, fertilizers reached the bottom layer with soil mixing by the plough bodies, and fertilizer distribution was greatest in the lower layer of the subsoil. When fertilizers applied at the side of the third plough body, an improved distribution obtained, but was not distributed over the entire operating width (300 mm), but concentrated more around the side of the third plough body. When fertilizer applied both at the rear and at the side of the third plough body, the desired distribution obtained, and the distribution density decreased linearly with tilled soil depth.

Therefore, the objectives of this paper were to (1) test the performance of the proposed fertilizer applicator In (Mastaba) profile. (2) Study the engineering parameters that control the proposed fertilizing applicator performance.

MATERIALS AND METHODS

Figure 1 shows a sketch for the proposed design of a combined implement, which consists of two units, one for fertilizer application and second for forming a wide-bed profile (named as Mastaba).

The fertilizer application unit consists of three hoppers; each mounted on a horizontal shaft located near the bottom of the fertilizer hopper. The shaft is operated by a transmission system that powered by the ground wheel. The fertilizer is delivered through a rubber tube on soil surface and covered by soil that formed by the profile maker unit.

The profile maker unit consists of two opposite moldboard plows mounted on a tool bar in which the distance between them are controlled. Each moldboard consists of a share, 65 cm long and 9 cm wide, Figure 2 shows the setup of the unit. The moldboard is helicoidally main facade to form obtain a better turning for soil slice and, final square shape profile. A leveling roll, 80 cm wide and 10.5 cm in diameter is used behind the terminal ends of the two opposite moldboard plows. It was used to obtain a flat compressed soil.

Field Test Experiment:

Three different of the setting angles, of a two opposite moldboard units, in the traveling direction were taking in minded. There were 20, 30 and 40 degree. The change in these angles affects the space between the two terminal ends of the two opposite moldboard as shown in (Fig. 3). Consequently, affecting the rack distance, this translated to change in the amounts of rack soil.

The experimental studies were executed to determine the effects of traveling speed of 3.91, 4.5, 5 and 6.92 km/h of the investigated implement at different operational depth of 10, 15 and 20 cm and three different setting angles of 20^0, 30^0 and 40^0, on wide bed profile dimensions, cross sectional area and fertilizing depth in new sand soil.

A rectangular field of about 4 feddans is used for the field experiments. It is located at Agricultural Faculty experimental station (Kalabshu Farm), Mansoura University. It divided into 108 plots; experimental plots for the treatments of 2 m wide by 75 m long and were replicated three time.

Soil mechanical analysis of experimental field at average depth of soil 0 – 20 cm indicated that the soil has clay of 3.48%, silt of 3.14%, and 13.97 fines sand and coarse sand of 79.41%. Then the texture class of experimental soil is sandy soil. The soil moisture content measured by the oven method at 105 °C for 24 hours. It was about 20% dray basis at ranges from zero to 20 cm depth. The soil bulk density was 1.4 g/cm3. It measured before ridging by a cylindrical tube of 250 cm3. The samples taken at depths of 10, 15 and 20 cm.

A two-wheel drive tractor, Romanian model (Universal 650 M) rated at 48.5 kW was used in all tests.

The slopping angles of bed profile calculated from the following equation:

$$S = \arctan \frac{2h}{(w-u)}$$

Where:

S: Mastaba angle
h: bed height, cm
w: bottom wide, cm
u: upper width of profile, cm

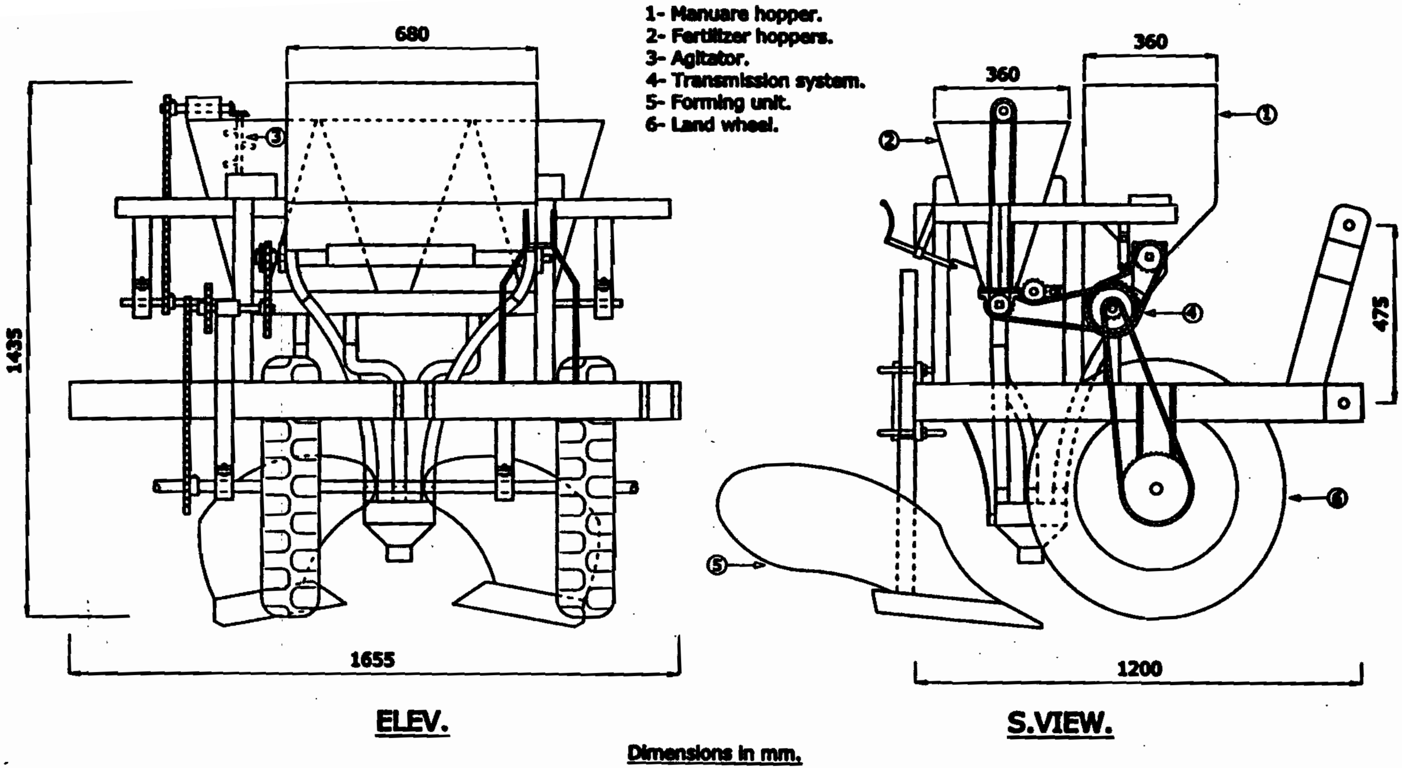
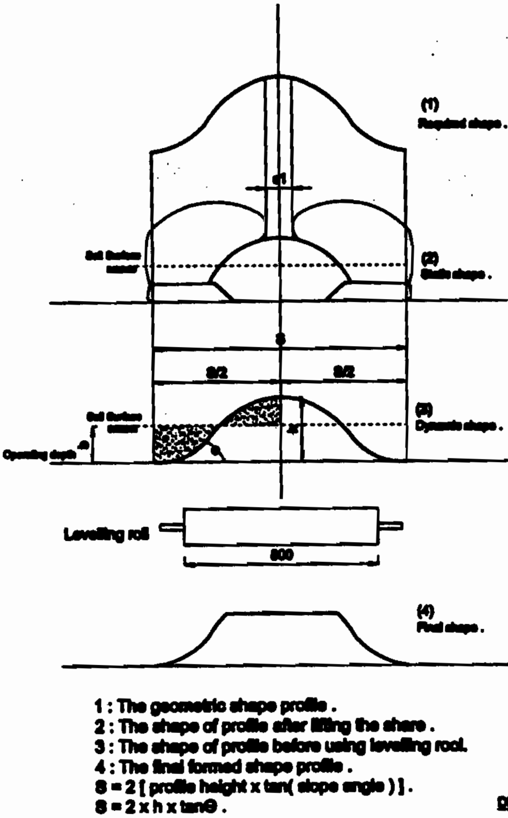


Fig. 1: The investigated unit.



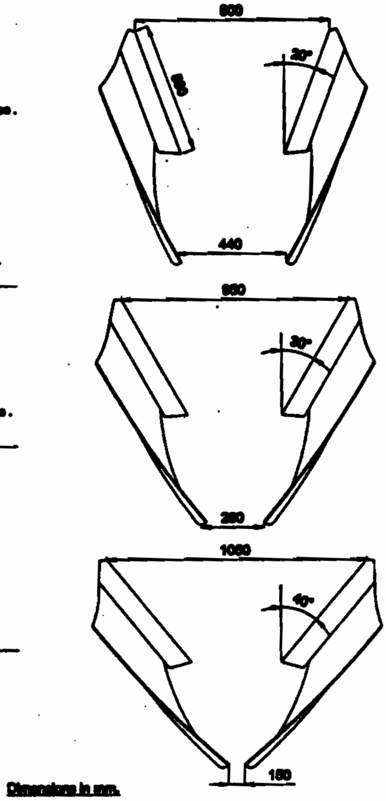


Fig. 2: Constructing shape of wide bed profile.

Fig. 3: Three different setting angles of forming unit.

The operated cross sectional area (A) are determined directly after every test (Sohne et al. 1962) by the following equation:

$$A = \frac{L}{2}(a + 2b)$$

Where:

A = Total cross section area, cm^2
L = Constant horizontal distance, cm
a = Sum. of first and last ordinates, cm
b = Sum. of all ordinates excluding the fist and last ones, cm.

Urea selected to represent fertilizers with spherical particles and the nitrate to represent fertilizers with angularly shaped particles. Red material color used and mixed with fertilizers type to detect fertilizers depth easily.

The fertilizing depths measured after digging lateral sector in the wide bed profile, and when the color fertilizers appeared, the distance between the top surfaces and fertilizers bottom measured. About ten readings taken from each plot.

All data collected for all parameters of different treatments statistically analyzed. The strip plot design, Gomezz and Arture (1984) is used to carry out the field experiments and statistical methods (SAS) were used to analyze data obtained.

RESULTS AND DISCUSSION

The results of data analysis can discuss as follows:

1- Effect of operating parameters on the bed profile (Mastaba) Dimensions

Figure 4 and 5 show the effect of forward speed on the height and upper width of the bed profile respectively at different levels of operational depth and setting angle. The most important indicators used to evaluate the interaction between the operating parameters are the wide bed profiles dimensions. As shown, it obvious that increasing the forward speed, decreases the height while, increases the upper width of bed profile.

The results indicated also that the highest value of bed profile height was 26.5 cm when the operational depth, setting angle and forward speed were 20 cm, 40^0 and 3.91 km/h respectively. However, the lowest value of bed profile height found to be 14 cm when the operational depth, setting angle and forward speed were 10cm, 20^0 and 6.92 km/h respectively.

This trend may be attributed to the effect of increment of traveling speed on preventing the forming unit share to penetrate in soil, and not encourage more soil layers to accumulate and constructed a highest bed profile. On the other hand, increasing in both setting angle and operating depth encourage soil layer to form a good accumulation.

Figure 4 shows that increasing the setting angle within the range of 20^0 to 40^0, increases the bed profile height while, decreases the upper bed profile width at all levels of operational depth and forward speed.

Table (1) shows the interactions between the independent variable were not significant.

Table1. The ANOVA Procedure for bed profile height.

Source	DF	SS	Mean Square	F Value	Pr > F
Speed, s	3	434.500	144.833	35.23	<.0001
Angle, a	2	215.166	107.583	26.17	<.0001
Depth, d	2	153.166	76.583	18.63	<.0001
Factor s*a	6	3.500	0.583	0.14	0.9901
Factor s*d	6	3.500	0.583	0.14	0.9901
Factor a*d	4	19.833	4.958	1.21	0.3157
Factor s*a*d	12	7.000	0.583	0.14	0.9997
Error	72	296.000	4.111		

Table (2), (3) and (4) show the mean value of bed profile height as affected by operational speed, setting angle and operational depth respectively. AS demonstrated in Table 2 the increasing in forward speed from 3.91 to 6.92 km/h the bed profile height decreased by about 32%.

In addition, vice versa found at increasing the setting share angle from 20 to 40 deg table 3 the bed height increased from18 to 21.41 cm.

Table 2. Effect of forward speed on bed profile height.

Speed, s, km/h	N	Mean	t Grouping
s_1 = 3.91	27	21.777	A
s_2 = 4.5	27	20.611	B
s_3 = 5	27	19.444	C
s_4 = 6.92	27	16.388	D
Least Significant Difference		1.1001	

Table 3. Effect of setting angle on bed profile height.

Angle, a, deg	N	Mean	t Grouping
a_3 = 40	36	21.416	A
a_2 = 30	36	19.250	B
a_1 = 20	36	18.000	C
Least Significant Difference		0.9527	

Moreover, bed profile height increased from 18.08 to 21 cm by increasing operational depth from 10 to 20 cm because of there is more soil layers translated to change in the amounts of rack soil table 4.

Table 4. Effect of operational depth on bed profile height.

Depth, d, cm	N	Mean	t Grouping
d_3 = 20	36	21.000	A
d_2 =15	36	19.583	B
d_1 = 10	36	18.083	C
Least Significant Difference		0.9527	

The results also show that the least value of bed profile upper width was found to be 16.5 cm when the operational depth and setting angle were 20 cm, 40^0 and forward speed of 3.91 km/h respectively however, the highest value of upper bed width is 51 cm achieved at operational depth of10cm, setting angle of 20^0 and forward speed of 6.92 km/h.

This can be explain by the fact that increasing forward speed, increases the collapsed soil and consequently more soil would fall down on the profile sides. In addition, decreasing the distance between the moldboard terminals ends increases the setting angles, thus the upper width reduce.

Table (5) shows the statistical analysis of data obtained. As shown, it was obvious that there was no significant interaction and all other effects of the independent variables were significant.

Table 5. The ANOVA Procedure for upper width of bed profile.

Source	DF	SS	Mean Square	F Value	Pr > F
Speed, s	3	722.062	240.687	28.76	<.0001
Angle, a	2	9466.541	4733.270	565.64	<.0001
Depth, d	2	248.041	124.020	14.82	<.0001
Factor s*a	6	18.625	3.104	0.37	0.8951
Factor s*d	6	13.125	2.187	0.26	0.9530
Factor a*d	4	7.833	1.958	0.23	0.9183
Factor s*a*d	12	12.500	1.041	0.12	0.9998
Error	72	602.500	8.368		

Table (6), (7) and (8) show the mean values of upper width of the bed profile as affected by forward speed, setting angle and operational depth, respectively. At increasing traveling speeds from 3.91 to 6.92 km/h the upper width of bed profile increased by about 23% table (6).

While, increasing setting angle from 20^0 to 40^0 the upper width of bed profile decreased from 42.25 to 19.87 cm table (7) and decreased from 34.41 to 30.7 cm by increasing operational depth from 10 to 20 cm table (8).

Table 6. Effect of forward speed on upper width of bed profile.

Speed, s, km/h	N	Mean	t Grouping
s_4 = 6.92	27	36.722	A
s_3 = 5	27	32.333	B
s_2 = 4.5	27	31.166	CB
s_1= 3.91	27	29.833	C
Least Significant Difference		1.569	

Table 7. Effect of setting angle on upper width of bed profile.

Angle, a, deg	N	Mean	t Grouping
a_1 = 20	36	42.250	A
a_2 = 30	36	35.416	B
a_3 =40	36	19.875	C
Least Significant Difference		1.359	

Table 8. Effect of operational depth on upper width of bed profile.

Depth, d, cm	N	Mean	t Grouping
d_1 =10	36	34.416	A
d_2 = 15	36	32.416	B
d_3 = 20	36	30.708	C
Least Significant Difference		1.359	

2- Effect of operation parameters on the profile sloping angle:

Figure 6 shows the effects of operation parameters on the sloping angle of the bed profile. As shown, increasing forward speed decreases the sloping angle of the bed profile at all levels of operational depth. It also obvious that increasing the setting angle decreases the sloping angle of the bed profile. It may be due to the high motion of soil layers since the increment of traveling speed leaded to bad accumulation of soil layer.

In table (9), the SAS analysis indicated that only the operational depth factor has no significant effect on the slop angle. Nevertheless, the changes in the setting angle and the traveling speed of investigated forming unit have a significant effect. It may be due to the speed have essential effect on the static and dynamic force effecting on the coefficient of fraction.

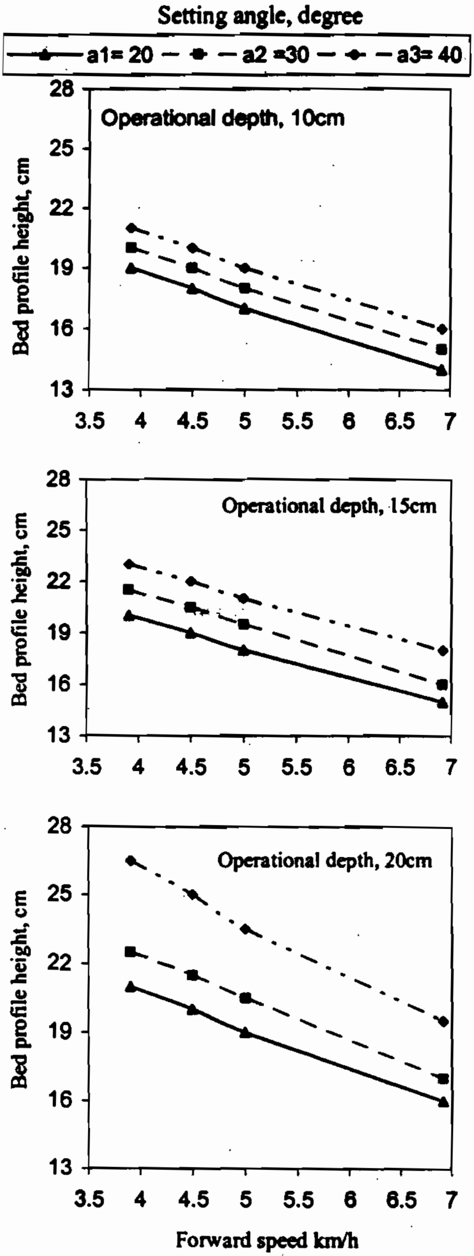


Fig.4: Effect of traveling speed on height of bed profile.

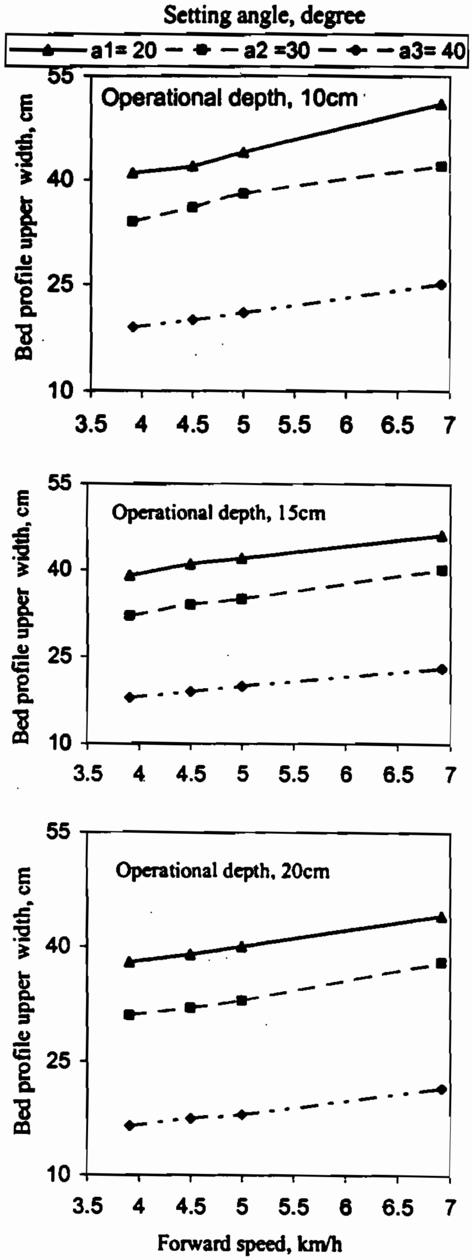


Fig. 5: Effect of forward speed on upper width of bed profile.

Table 9.The ANOVA Procedure for slop angle of bed profile.

Source	DF	SS	Mean Square	F Value	Pr > F
Speed, s	3	208.110	69.370	6.31	0.0007
Angle, a	2	5318.375	2659.187	241.96	<.0001
Depth, d	2	57.263	28.631	2.61	0.0808
Factor s*a	6	20.929	3.488	0.32	0.9259
Factor s*d	6	8.746	1.457	0.13	0.9917
Factor a*d	4	51.477	12.869	1.17	0.3308
Factor s*a*d	12	15.915	1.326	0.12	0.9999
Error	72	791.280	10.990		

The slop angle of bed profile e decreasing by 11% when increasing the traveling speed from 3.91 to 6.29 km/h table (10).

Table 10. Effect of forward speed on slop angle of bed profile.

Speed, s, km/h	N	Mean	t Grouping
s1 = 3.91	27	35.818	A
s2 = 4.5	27	35.038	A
s3 = 5	27	34.154	A
s4 = 6.91	27	32.100	B
Least Significant Difference		1.798	

Nevertheless, in table (11) indicated that by increasing the setting angle from 20^0 to 40^0 the slop angle of bed profile decreased by 63%. Because the upper width of bed profile become large when the setting angle adjusted on 20^0 than 40^0 and the upper width have a positive effect on the bed profile slop angle.

Table 11. Effect of setting angle on slop angle of bed profile.

Angle, a, deg	N	Mean	t Grouping
a1 = 20	36	43.546	A
a2 = 30	36	32.716	B
a3 =40	36	26.571	C
Least Significant Difference		1.557	

While it increasing by 5% by increasing the operational depth from 10 to 20cm table (12) this may be attributed to the effect of the bed profile height which has appositive effect on bed profile slop angle and is increased by increasing the operational depth.

Table 12. Effect of operational depth on bed profile slop angle.

Depth, d, cm	N	Mean	t Grouping
d3 = 20	36	35.170	A
d2 =15	36	34.275	BA
d1 = 10	36	33.387	B
Least Significant Difference		1.557	

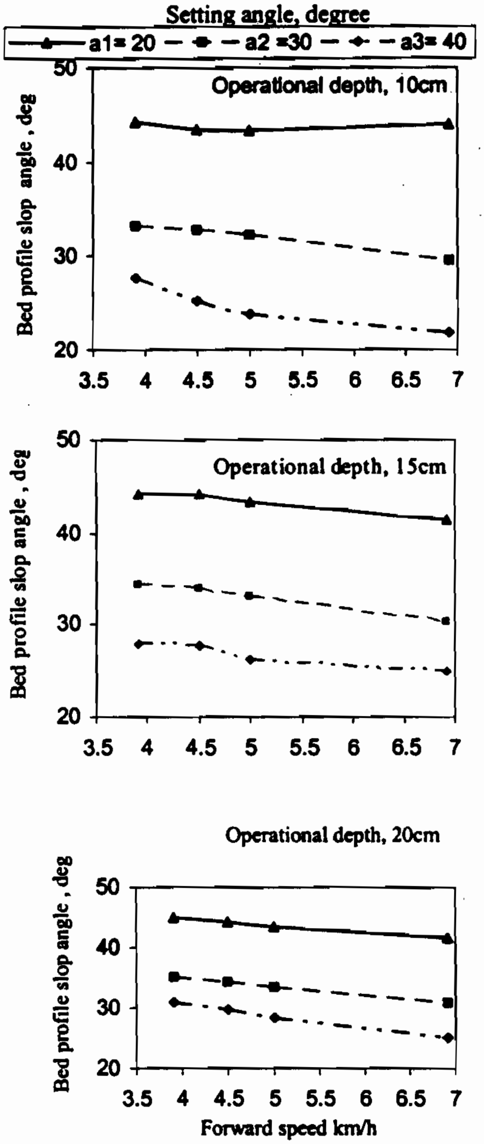


Fig.6: Effect of traveling speed on slop angle of bed profile.

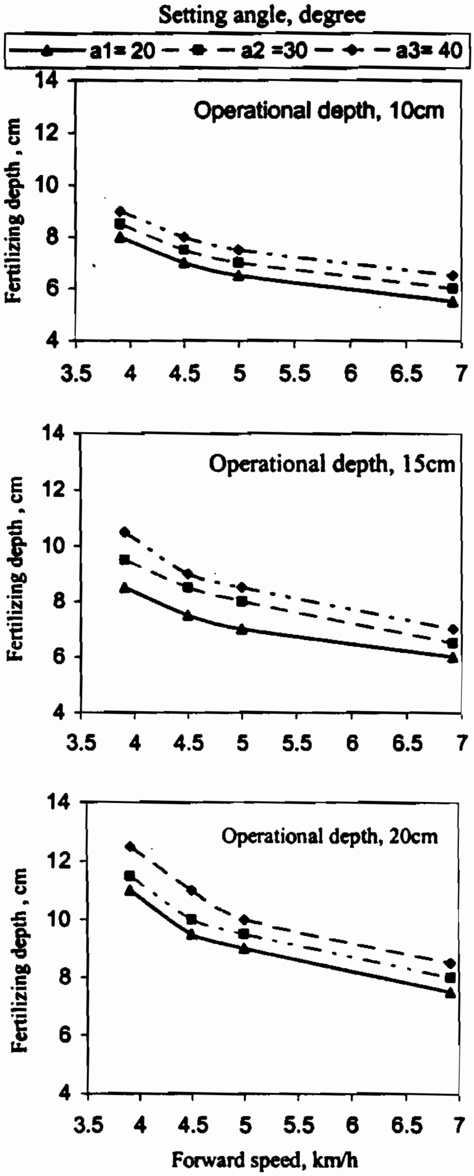


Fig.7: Effect of traveling speed on fertilizing depth.

3- Effect of operation parameters on the Cross section area of bed profile.

The SAS analysis as shown in (Table 13) indicated a high significant difference between the levels of the three experimental factors and the interaction between all levels of three factors except the interaction between the traveling speed and operational depth.

Table 13. The ANOVA Procedure for Cross-section area of bed profile.

Source	DF	SS	Mean Square	F Value	Pr > F
Speed, s	3	1849061.974	616353.991	913.23	<.0001
Angle, a	2	2092021.477	1046010.738	1549.83	<.0001
Depth, d	2	466828.144	233414.072	345.84	<.0001
Factor s*a	6	85441.792	14240.299	21.10	<.0001
Factor s*d	6	4647.292	774.549	1.15	0.3440
Factor a*d	4	80735.485	20183.871	29.91	<.0001
Factor s*a*d	12	12770.302	1064.192	1.58	0.1180
Error	72	48594.167	674.919		

Table (14) indicated the effect of traveling speed on cross section area of bed profile. The cross section area of bed profile is decreased by 37% by increasing the traveling speed from 3.91 to 6.92 km/h. This trend may be attributed to the effect of increment of traveling speed on prevent the forming unit share to penetrate in soil, and not encourage more soil layers to accumulate and constructed a big cross section area of bed profile.

Table 14. Effect of traveling speed on Cross-section area of bed profile.

Speed, s, km/h	N	Mean	t Grouping
s_1 = 3.91	27	1294.639	A
s_2 = 4.5	27	1125.648	B
s_3 = 5	27	1035.639	C
s_4 = 6.91	27	939.361	D
Least Significant Difference		14.095	

The setting angle of 40^0 is more effective on the cross section area of bed profile increased by 36% table (15), than the setting angle of 20^0. It may be due to the increment of cutting width of soil slice which more soil layers accumulate and constructed a highest cross section area.

Table 15. Effect of setting angle on Cross-section area of bed profile.

Angle, a, deg	N	Mean	t Grouping
a_3 = 40	36	1277.604	A
a_2 = 30	36	1080.729	B
a_1 = 20	36	938.132	C
Least Significant Difference		12.207	

And also increasing the operational depth from 10 to 20 cm, the cross section area increased by 15% (Table 16), because there is more soil layers translated to change in the amounts of rack soil leaded to a positive increasing in the cross section area of bed profile.

Table 16. Effect of operational depth on Cross-section area of bed profile.

Depth, d, cm	N	Mean	t Grouping
d_3 = 20	36	1180.688	A
d_2 =15	36	1096.063	B
d_1 = 10	36	1019.715	C
Least Significant Difference		12.207	

4- Effect of operation parameters on the fertilizing depth of the bed profile.

The fertilizing depth as a function of both the three different setting angles and traveling speed at different levels of the operational depth is shows in Fig. 7. Lowest fertilizing depth "5.5 cm" is recorded at using traveling speed of 6.92 km/h, operational depth of 10 cm and cutting angle of 20^0. But using the cutting angle of 40^0, operational depth of 20cm and traveling speed of 3.91 km/h gave maximum value "12.5 cm". This result may be attributed to the bad accumulation of soil layers occurred at using shallow operating depth and a small setting angle with high traveling speed. Consequently, affecting on the amounts of rack soil, this translated to sallow fertilizing depth. On the other hand slow traveling speed and deep operating work at large setting angle encourage more accumulation of soil slice.

Table (17) indicated that there is a significant difference between the levels of the three factors is found, but there is no significance between the interactions of their levels.

Table 17. The ANOVA Procedure for the fertilizing depth of the bed profile.

Source	DF	SS	Mean Square	F Value	Pr > F
Speed, s	3	130.229	43.409	14.85	<.0001
Angle, a	2	28.125	14.062	4.81	0.0109
Depth, d	2	126.125	63.062	21.57	<.0001
Factor s*a	6	0.708	0.118	0.04	0.9997
Factor s*d	6	3.208	0.534	0.18	0.9807
Factor a*d	4	1.000	0.250	0.09	0.9867
Factor s*a*d	12	0.666	0.055	0.02	1.0000
Error	72	210.500	2.923		

A demonstrated in table (18), the increase in forward speed from 3.91 to 6.92 km/h decrease the fertilizing depth of the bed profile by 44%.

Table 18. Effect of forward speed on the fertilizing depth of the bed profile.

Speed, s, km/h	N	Mean	t Grouping
s_1 = 3.91	27	9.888	A
s_2 = 4.5	27	8.666	B
s_3 = 5	27	8.111	B
s_4 = 6.91	27	6.833	C
Least Significant Difference		0.927	

While increasing the setting angle from 20^0 to 40^0 increase the fertilizing depth of the bed profile by about 16% table (19), because the distance between the two terminal ends of the two opposite moldboard decreasing with increasing the setting angle and encourage more soil layers to accumulate and constructed a highest covering.

Table 19. Effect of setting angle on fertilizing depth of the bed profile.

Angle, a, deg	N	Mean	t Grouping
a_3 = 40	36	9.000	A
a_2 = 30	36	8.375	B A
a_1 = 20	36	7.750	B
Least Significant Difference		0.803	

And also the fertilizing depth of the bed profile increased by 35% by increasing operational depth from 10 to 20cm table (20), because there is more soil layers translated to change in the amounts of rack soil.

Table 20. Effect of operational depth on fertilizing depth of the bed profile.

Depth, d, cm	N	Mean	t Grouping
d_3 = 20	36	9.833	A
d_2 =15	36	8.041	B
d_1 = 10	36	7.250	B
Least Significant Difference		0.803	

CONCULUSION

The conclusions of this paper are summarized as follow:

1. By increasing traveling speeds from 3.91 to 6.92 km/h the upper width of bed profile increased by about 23% but, the bed profile height decreased by about 32%. And on the other hand increasing the setting share angle from 20 to 40 deg the bed height increased from18 to 21.41 cm while, the upper width of bed profile decreased from 42.25 to 19.87 cm
2. The bed profile slop angle decreasing by 11% when increasing the traveling speed from 3.91 to 6.29 km/h. But increasing the setting angle from 20^0 to 40^0 the bed profile slop angle decreased by 63%. While it increasing by 5% by increasing the operational depth from 10 to 20cm.
3. The cross section area of bed profile is decreased by 37% by increasing the traveling speed from 3.91 to 6.92 km/h. The setting angle of 40^0 is more effective on the cross section area of bed profile increased by 36% than the setting angle of 20^0.
4. The increase in forward speed from 3.91 to 6.92 km/h decreases the fertilizing depth of the bed profile by 44%. But on the other hand the fertilizing depth of the bed profile increased by 35% by increasing operational depth from 10 to 20cm.

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استخدام أسلحة القلاب المطرحي لتشكيل البروفيل المناسب لزراعة محاصيل الخضر

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تهدف هذه الدراسة إلي إمكانية بناء بروفيل المصطبة بواسطة استخدام سلاحي قلاب مطرحي متعاكسى الاتجاه(أحدهما يعمل علي قلب شريحة التربة لجهة اليمين والآخر لجهة اليسار) مع وجود درفيل أسطواني لعمل كبس خفيف وتسوية لسطح المصطبة. كما استخدم جرار روماني قدرته 65 حصانا.

واشتملت عوامل الدراسة علي:

١-ثلاث ذويا لسلاح القطع مع اتجاه خط سير 20، 30 و40 درجة،

٢-ثلاث أعماق تشغيل 10، 15 و20سم،

٣-أربع سرعات أمامية وهي 3.91 ، 4.50، 5.00 و6.92 كم/ساعة.

تم قياس أبعاد التخطيط وهي:

١-ارتفاع المصطبة، ٢-القاعدة العلوية للمصطبة ، ٣-زاوية ميل المصطبة،

٤-مساحة مقطع بروفيل المصطبة عمق التسميد .

وقد أظهرت النتائج أن أفضل عمق لتسميد محاصيل الخضر وهو 7.5سم كما أوصت دراسات عديدة قد تحقق تقريبا عند استخدام سرعة أمامية مقدارها 5كم/ساعة وذاوية قطع 20 درجة وعمق تشغيل 10 و 15 سم.

كما أنة بزيادة ذاوية القطع من 20^0 إلي 40^0 ذاد كل من ارتفاع المصطبة ومساحة مقطعها وعمق التسميد بمقدار 18% و 36% و 16% على الترتيب وعلى العكس قلت القاعدة العلوية للمصطبة من 42.25 سم إلى 19.87 سم وكذا قلت ذاوية ميل المصطبة بمقدار 63%.