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EFFECT OF SOME MECHANICAL SOWING METHODS, *Bacillus megaterium* INOCULATION AND POTASSIUM FERTILIZER RATES ON THE PRODUCTIVITY OF MUNG BEAN CROP

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ABSTRACT: The aim of this work is to study the effect of some mechanical sowing methods, phosphate-dissolving bacterium (*Bacillus megaterium*) inoculation and different rates of potassium fertilizer on mung bean (Kawamy 1) productivity. The following results were obtained:

The highest yield (902.32 and 963.42 kg / fed) of mung bean crop were obtained by using seed drill at row-spacing of 60 cm, *Bacillus megaterium* inoculation and potassium fertilizer at rate of 48 kg / fed in both seasons respectively.

The lowest values of energy requirement (10.92 Kw.h / fed) were obtained by using seed drill at different row-space. The lowest cost of sowing (11.99 L.E / fed.) was obtained by using seed drill at different row-spaces. In addition, the lowest cost of sowing of unit production (12.85 L.E/ton) was obtained by using seed drill at row space of 60 cm.

Key words: Mung Bean, fertilizing, sowing, mechanization.

INTRODUCTION

Mung bean is a new legume crop in Egypt. It is introducing high yielding food crop with short growing season in the rotation system pattern is an effective mean for narrowing the feed gab in Egypt. Increasing mung bean productivity can be achieved through some agricultural practices such as mechanical sowing and suitable types of fertilizers. Shafey

(1986) found that using seed drill for sowing onion seed, gave high production than the others sowing methods (manual broadcasting, manual sowing in rows, self-propelled machine and planter (Thailot machine). Abo EL-EZZ (1985) found higher increase in production of wheat by mechanical drilling of seed deeply affected by seed depth and width in comparing with traditional methods. Awady *et al.* (2000) reported that, the yield of wheat grains ranged between 3.14 – 3.45 and between 3.21 – 3.51 ton/fed. for mechanical and pneumatic seed drill respectively. Abdou (1995) concluded that using seed drill gave the highest sound seedling of onion compared with row planter. EL-Sayed *et al.* (2001) reported that, canola sowing by seed drill with a suitable row width of 40 cm, gave the highest yield and lowest energy consumption compared with manual and planter methods.Kler *et al* (1991) planted mung bean at rates of 15.20 or 25 kg / ha in rows 15 or 30 cm apart narrow row spacing gave higher yields on average, 20 kg seed / ha and the normal sowing date gave higher yields than 15 or 25 kg sowing rates or late sowing Haghparast and Mengel (1973) found that, the faba bean total yield of protein /pot was increased by about 20% by using the highest rate of K compared with the low level of K also, the total plant mass increased. It is thought that K promotes N_2 fixation by Rhizobium. Karczmarczyk *et al.* (1978) found that, the seed yield with fertilizer rate to be N 15.3 or 45 and K 70,150 or 225 k_2O Lupin seed yields were 1.55 -1.87 and 2.73-3.37 ton / ha. Hegazy and Gennady (1995) found that, applying potassium sulfate fertilizer improved the growth of sugar beet, faba bean, maize and soybean. The relative K fertilizer efficiencies were reduced in inter-cropping compared to mono-cropping, by increasing the K fertilizer rates. Saghin (1998) found that, the application rate NPK fertilizers as well as farmyard manure increased *V. faba* seed contents of total nitrogen, crude protein, phosphorus, potassium, starch and fats. EL-Kramany *et al.* (2001) reported that, Kowmy-1and king plants exhibited the shortest growth period and the highest number of pods / pl. and the

highest values of seed yield with fertilizer NPK and biofertilize.

MATERIALS AND METHODS

The experiments were carried out during two the seasons of 2003 and2004 at Tag EL-Ezz Research Station, Dakahliea Governorate to investigate the effect of sowing by seed-drill at different row-spaces, bacteria inoculation and different rates of potassium fertilizer to obtain the optimum yield of mung bean crop. The experiments were carried out in clay loam soil after wheat harvested. The physical and chemical properties of the experimental soil are summarized in Table (1).

Table 1: Mechanical and chemical analysis of the farm soil at Tag EL-Ezz research station

Soil properties	Value
1-MECHANICAL ANALYSIS	
COURSE SAND (%)	2.44
FINE SAND (%)	5.82
SILT (%)	35.20
CLAY (%)	54.20
ORGANIC CARBON (%)	2.23
TOTAL NITROGEN (%)	0.11
C / N RATIO	20.13
SOIL TEXTURE	CLAYEY
2-CHEMICAL ANALYSIS	
E.C.	5.4
PH	7.4
SOLUBLE CATIONS (MEQ/LITER)	
NA^+	2.56
K^+	0.04
CA^{++}	1.40
MG^{++}	0.70
SOLUBLE ANIONS (MEQ/LITER)	
HCO_3^-	0.27
CL^-	1.53
SO_4^{--}	2.90

Sowing Machines

Mounted seed-drill

(Tye type) 21 rows, working with of 330 cm. of spacing 15 cm. were used for sowing mung bean by closing feeding gate according to desired spacing. Sand was used as a seed carrier by 10kg / 1 kg seeds.

Tractors

Billarous tractor of 80 hp (59.7 kW) was used in all operations.

Seed rate

Seed rates were 12, 7.75, 6.5 and 5.5 kg / fed for the rows spacing of 30, 45, 60 and 75 cm. respectively, while, rate of seeds 12.5 kg / fed was applied under hand sowing method. Hand sowing operated in hill. After 3 weeks mung bean plants were thinned in order to leave 2 plants every (15-20cm) in rows.

Types of Fertilizers

Bio-fertilizer

The phosphate dissolving bacterium *Bacillus megaterium* was used in this investigation. The bacterium was obtained from Dept. of microbiology, soil, water and environment Res Institute A.R.C. Giza, Egypt and maintained on nutrient agar slant at 5°c till used. For inoculation the bacterium was grown on liquid medium of modified Bunt a rover (Abd El-Hafez, 1966) at 28°c for 7 days. The bacterial growth was suspended in physiological mineral solution. Seed of mung bean were soaked in the cell suspension for 30 min, in the presence of adhesive agent (Arabic gum). Then, were air dried for 30 min and sown immediately.

Mineral fertilizer

The rates of potassium fertilizer were used 24, 36, and 48 (K_1, K_2 and K_3) kg / fed adding all before the third irrigation to mung bean at one time.

Energy Requirement

The energy requirement per feddan was calculated by using the following equation (Embaby1985)

$$E_p = \frac{W_f \times L.C.V \times \rho_f \times \eta_m \times \eta_h \times 427/75 \times 1.3\epsilon}{3600 \times AFC}$$

Where:

W_f = fuel consumption, (L / h)

ρ_f = Density of the fuel kg /L 0.73 kg / L for gasoline fuel.

L.C.V = lower calorific value of fuel K cal / kg (Average L.C.V of fuel is 10000 Kcal /kg.)

427 = Thermo-mechanical equivalent kg / kcal.

η_{th} = Thermal efficiency of the engine % (considered to be about 25% for gasoline)

η_{m} = Mechanical efficiency of the engine % (considered to be 80%for Diesel and gasoline engine)

AFC = Actual field capacity fed./h.

Human Energy

It was calculated by using the following equation: (hunt, 1983)

$$E_H = \frac{0.0746 \times N_L}{A.F.C.} \quad (kW.h / fed)$$

Where:

N_L = number of laborers, (man).

0.0746 = coefficient of changing from hp to kW

A. F. C = Actual field capacity (fed / h)

$$Pact = \frac{60}{Tu + Ti} (fed/h)$$

Where :

Pact = The actual capacity of the machine.

Tu = The utilized time per fed. in minutes.

Ti = The summation time lost per fed. in minutes

Cost of Sowing Operations

It was calculated according to the following equation (Awady 1978):

C = P/h (1/a + I + t/2 + r) + (1.2 w.s.f) + m/144

Where:

C = hourly cost.

P = price of machine.

h = yearly working in hours.

a = life of the expectancy of the machine .

I = interest--- rate / year

t = taxes.

R = overhead and indirect cost ratio.

w = power of the machine---- kW

s = specific fuel consumption L/kW.

f = fuel price L.E / L

m = monthly wage ratio.

(1.2) is factor to take lubrication and greasing into account.

(144) is estimated monthly working hours.

Statistical Analysis

Obtained data were subjected to the statistical analysis as the usual technique of analysis of variance (ANOVA) of the split – split plot design (Gomez and Gomez, 1984), the treatment means were compared using the least significant difference (L.S.D) outlined by Waller and Duncan (1955).

RESULTS AND DESCUSSION

Effect of Seed-Drill Sowing at Different Row Spacing on Mung Bean Yield and its Components

Table 2 showed that the row-spacing of seed-drill sowing had a significant effect on some characters of mung bean yield and its component, such as number of nodules/plant, plant height, number of branches and pods/ pl., seed yield / pl., and seed and straw yields/fed. in both seasons. Data show that, the highest values of seeds and straw yield/ fed obtained by using seed-drill at row spaces of 60 and 30 cm respectively. Increasing ratio of seed yield / fed represented by 19.79, 11.47, 34.97 and 28.92% and 21.57, 27.76, 54.61 and 53.47% at row-space of 75, 45, and 30 cm by using seed-drill and hand sowing in the two seasons respectively. Also, increasing of straw yield / fed were 15.83, 12.85, 3.37 and 31.99% and 25.71, 14.08, 5.28 and 30.47% at row space of 75, 60 and 45 cm by seed-drill and hand sowing in the two seasons respectively.

Effect of Bacteria Inoculation on Mung Bean Yield and its Components

Table 2 shows also, that bacterial inoculation had a significant effect on some characters of mung bean plant such as, number of nodules / plant, plant height, number of branches and pods/ plant and seed and straw yields/fed in both seasons. Data show that, the highest ratio of seed and straw yields/fed were obtained by using *Bacillus megaterium* inoculation, it was represented by 18.84% & 21.31% and 17.34% & 13.34% increasing in both seasons respectively. This may be due to Phosphate-dissolving bacteria have the capability to bring the insoluble phosphate in soil into soluble forms by producing organic acids such as formic and acetic acids (El-Borollosy, 1999).

Effect of Potassium Rates on Mung Bean Yield and its Components

Table 2 shows that the rates of potassium had a significant effect on some characters such as, number of nodules/plant, number of branches/plant, pods/Pl. and seed and straw yields / fed in the two seasons. Data also, show that the highest values of seed and straw yields/ fed obtained by using potassium rate of 48 kg / fed. The ratios of increasing of seed yield/ fed were represented by 16.96 & 52.3% and 12.52% & 34.37% at potassium rates of 36 and 24 kg/ fed., while, increasing ratio of straw yield/ fed were represented

Table 2: Mean values of yield and related characters to sowing methods, bacteria inoculation and potassium rates and their interaction during two seasons (2003 and 2004).

Sowing Methods		No.of nodules / plant		Plant height (cm)		No.of branches / plant		No. of pods / plant		Seed yield / plant (g)		100-seed Weight (g)		Seed yield Kg / fed		Straw yield Kg / fed	
		2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Seed drill at different row spacing	75 cm	42.00	43.00	72.43	74.65	4.27	4.23	24.39	25.55	9.53	10.04	3.26	3.68	754.33	8245.33	987.38	932.56
	60 cm	47.17	51.17	79.88	82.44	3.76	3.95	23.41	24.35	9.86	10.50	3.41	3.52	902.32	963.42	1013.42	1077.58
	45 cm	39.94	42.83	83.85	86.77	3.10	3.23	13.66	19.97	6.82	6.53	3.67	3.83	809.48	785.36	1106.36	1113.54
	30 cm	40.67	40.94	84.31	88.55	2.32	2.41	10.26	14.44	4.80	4.50	2.89	3.03	668.53	648.99	1143.65	1172.30
Hand sowing		34.56	35.33	71.32	74.26	3.85	3.98	15.76	20.23	7.36	8.95	3.09	3.32	699.93	653.82	866.42	898.53
F. test		* *	* *	* *	* *	* *	* *	* *	* *	* *	* *	N.S	N.S	* *	* *	* *	* *
L. S.D		2.28	1.90	4.26	3.85	0.82	0.715	3.65	4.38	1.23	1.34	-	-	8.062	7.33	12.36	14.83
Bacteria inoculation	Inocu.	46.47	49.41	80.33	82.94	3.66	3.75	18.39	22.34	7.73	8.27	3.41	3.62	832.74	850.03	1105.05	1103.86
	Uninoc.	35.27	35.89	76.26	79.73	3.26	3.37	16.60	19.48	7.61	7.91	3.11	3.33	700.65	700.73	941.84	973.95
	F. test	* *	* *	* *	* *	* *	* *	* *	* *	N.S	N.S	N.S	N.S	* *	* *	* *	* *
Potassium Rate (kg)	24	36.50	38.03	76.38	79.83	3.18	3.26	14.80	18.78	7.59	8.07	3.19	3.35	600.72	678.46	927.09	942.07
	36	41.00	43.23	76.86	80.13	3.51	3.59	16.84	20.33	7.92	7.94	3.23	3.29	782.26	810.21	1013.48	1030.69
	48	45.10	46.70	81.65	84.04	3.70	3.83	20.84	23.62	7.51	8.30	3.36	3.78	914.91	911.67	1129.76	1143.95
	F .test	* *	* *	* *	* *	* *	* *	* *	* *	N.S	N.S	N.S	N.S	* *	* *	* *	* *
	L.S.D	1.77	1.47	3.61	2.46	0.03	0.02	1.60	2.89								
interaction	Sp x B	*	*	* *	* *	* *	* *	* *	* *	* *	* *	N.S	N.S	N.S	N.S	* *	* *
	Sp x K	N.S	N.S	* *	* *	* *	* *	* *	* *	N.S	N.S	N.S	N.S	* *	* *	* *	* *
	B x K	N.S	N.S	N.S	N.S	* *	* *	* *	* *	N.S	N.S	N.S	N.S	* *	* *	* *	* *

by 11.47% & 21.86% and 10.99% & 21.43% at the same previous rate in both seasons respectively. These results agreed with those obtained by Karczmarztk, *et al.* (1978), Hegazy, and Gennady (1995) Hussein, *et al.* (1997) on faba bean and mung bean. Interaction between sowing methods and bacterial inoculation on yield and components of mung bean: Table 3 shows that the sowing methods and *Bacillus megaterium* inoculation had a significant effect on some characters such as number of nodules/plant, plant height, number of branches and number of pods / plant, seed yield / plant, and seed and straw yields / fed in both seasons. Data show also that, the highest value of seed yield / plant (11.54 and 12.44 g.) obtained by using seed drill at row space of 60 cm with bacterial inoculation in the two growing seasons, respectively, while, the lowest value (4.11 and 4.12 g.) obtained by using seed drill at row space of 30 cm without bacteria inoculation in the two seasons, respectively.

Interaction Between Sowing Methods and Different Levels of Potassium:

Table 4 shows that the interaction between sowing methods and levels of potassium had a significant effect on some characters such as plant high, number of branches and pods / plant, seed and straw yields / fed in both seasons. Data show that the highest value of seed yield / fed. (1134.20 and 1102.82 kg / fed) obtained by using seed drill at row space of 60 cm and potassium rate of 48 kg / fed in the two seasons. While, the lowest value (581.36 and 582.31 kg / fed. obtained by hand sowing and rate of potassium 24 and 36 kg / fed respectively.

Interaction Between Bacteria Inoculation and Different Rates of Potassium

Table (5) shows that the interaction between bacteria inoculation and rate of potassium had a significant effect on some characters such as number of branches and number of pods / Plant and seed yield / fed in the two seasons. Data show that the highest value of seed yield / fed (904.41 and 913.68 kg / fed) were obtained by using potassium rate of 48 kg / fed. with or without bacterial inoculation in the two seasons respectively. While, the lowest values were 647.73 and 655.37 kg / fed. by using 24 kg K. / fed without bacterial inoculation in the two seasons. These results agreed with EL- Kramany *et al.* (2001).

Table 3: Interaction between sowing methods and bacteria inoculation for some characters during two seasons (2003 and 2004)

Interaction between sowing methods and bacteria inoculation.		No .of nodules / plant		Plant height (cm)		No.of branches / plant		No.of pods / plant		Seed yield / plant (g)		Straw yield Kg / fed.	
Sowing methods	Bacteria inoculation	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Seed drill at row spacing of 75 cm	Inoc.	46.78	50.11	81.53	84.14	4.24	4.66	27.51	28.80	10.67	11.57	943.58	976.50
	Uninoc.	37.22	35.89	72.63	75.11	3.10	3.72	22.34	22.35	8.23	8.49	939.42	948.51
	L.S.D	5.20	12.40	0.582	0.361	0.06	0.09	1.03	0.752	0.018	0.247	6.261	12.32
Seed drill at row spacing of 60 cm	Inoc.	53.22	58.33	84.54	89.44	3.32	4.53	26.41	27.54	11.54	12.44	1011.76	1189.51
	Uninoc.	41.11	44.00	73.42	77.11	2.98	3.42	19.61	21.12	7.95	8.55	999.85	1100.0
	L.S.D	7.23	12.60	0.482	1.36	0.03	0.05	0.632	0.541	0.310	0.304	5.671	4.821
Seed drill at row spacing of 45 cm	Inocu.	46.44	51.33	70.77	92.22	3.00	3.18	15.01	17.74	7.01	7.12	999.30	984.70
	Uninoc.	33.44	34.33	74.32	76.55	2.23	2.74	14.58	15.33	4.82	5.94	857.30	896.63
	L.S.D	8.53	11.28	1.00	0.59	0.051	0.040	0.52	0.672	0.072	0.080	5.378	6.866
Seed drill at row spacing of 30 cm	Inoc.	45.78	45.78	80.59	89.05	2.11	2.48	12.01	12.11	4.79	4.92	862.62	894.53
	Uninoc.	35.56	36.11	76.38	77.33	2.10	2.22	11.34	10.17	4.11	4.12	811.60	836.57
	L.S.D	6.20	7.32	1.28	1.39	0.03	0.07	0.65	0.33	0.090	0.111	8.536	7.514
Hand sowing	Inoc.	40.11	41.56	80.41	84.55	3.48	3.97	18.75	19.32	9.32	9.94	895.97	891.98
	Uninoc.	29.00	29.11	71.11	70.66	3.23	3.51	14.32	15.35	8.05	8.04	829.82	789.73
	L.S.D	10.11	9.13	1.66	2.43	0.032	0.041	0.481	0.909	0.06	0.08	4.682	6.851

Table 4: Effect of interaction between sowing methods and potassium levels on some characters of mung bean during the growing seasons of 2003 and 2004

Interaction		Plant height (cm)		No. of branches/plant		No. of pods/plant		Seed yield (kg/fed.)		Straw yield (kg/fed.)	
		2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Sowing Methods	K_2O levels										
S_1	K1	74.30	76.50	3.71	3.73	20.36	22.40	774.32	762.51	996.32	973.54
	K2	75.26	79.92	2.42	2.51	24.32	25.40	785.30	783.42	1006.21	1065.80
	K3	80.36	82.45	2.73	2.83	27.58	28.55	892.00	824.51	1136.20	1175.10
L. S. D.		2.85	2.36	0.021	0.04	2.03	1.72	19.50	22.47	12.57	22.75
S_2	K1	74.33	78.33	3.42	3.50	20.85	21.25	1100.50	1011.33	1142.80	1132.60
	K2	78.56	82.67	3.81	3.90	21.24	24.45	1120.00	1031.52	1230.20	1207.30
	K3	87.32	86.17	4.51	4.47	26.31	27.10	1134.20	1102.82	1362.00	1251.0
L. S. D.		3.22	2.141	0.310	0.11	0.52	0.73	15.14	23.58	46.16	25.83
S_3	K1	78.57	80.67	2.34	2.56	13.65	14.62	698.70	676.32	852.70	863.20
	K2	81.17	83.83	2.81	2.95	16.10	16.60	699.85	694.53	899.30	847.50
	K3	84.33	88.50	3.41	3.35	18.01	18.16	778.53	794.50	879.50	991.40
L. S. D.		3.99	3.82	0.160	0.203	0.84	1.23	8.79	11.87	27.36	38.42
S_4	K1	74.24	78.71	2.13	2.03	8.99	9.88	737.29	626.51	865.43	892.70
	K2	80.36	83.50	2.24	2.38	11.82	12.40	672.22	683.47	853.20	877.70
	K3	84.38	87.06	2.75	2.65	12.10	12.46	765.30	699.38	917.53	983.70
L. S. D.		3.00	2.51	0.030	0.032	0.640	1.034	7.37	10.93	33.53	22.67
S_5	K1	72.65	73.82	3.17	3.35	14.32	15.21	582.31	567.39	731.51	789.50
	K2	74.36	77.17	3.54	3.76	16.20	16.90	581.36	584.92	814.30	826.70
	K3	79.61	81.63	3.88	4.03	19.46	19.87	678.10	699.80	939.40	988.50
L. S. D.		4.32	3.060	0.170	0.170	0.97	1.201	11.85	13.22	14.71	15.82

Table 5: Effect of interaction between bacterial inoculation and potassium levels on some characters of mung bean during the growing seasons of 2003 and 2004

Interaction		No. of branches/plant		No. of pods/plant		Seed yield (kg/fed.)	
		2003	2004	2003	2004	2003	2004
Bacterial inoculation	K1	3.01	3.21	17.55	18.53	746.62	767.85
	K2	3.14	3.41	19.53	20.38	793.53	852.63
	K3	3.52	3.68	20.97	23.32	904.41	913.68
L. S. D.		0.038	0.042	1.003	1.075	6.765	8.532
Without bacterial inoculation	K1	2.64	2.84	13.89	14.32	647.73	655.37
	K2	2.82	2.96	16.76	17.54	713.11	724.63
	K3	2.88	3.01	19.33	21.67	752.32	851.11
L. S. D.		0.041	0.062	0.962	0.542	13.85	4.961

The Energy Consumption for Sowing Methods

Table 6 shows the fuel consumption and energy requirements for sowing operation of mung bean crop. The energy consumed of seed drill at different row-spacing was10.92kW.h / fed while; it and forward speed of 3.6 km/h was 11.78 kW.h/ fed. of hand sowing operation. Data show that, the lowest values of energy requirement were obtained by using seed drill at different row spacing that is due to height field capacity for seed drill and increased of number laborer for hand sowing.

The Crop Yield of Mung Bean

Table 6 show the average values of seed and straw yield of mung bean by using different sowing methods at different row spacing. The yield was affected by row-spacing and sowing methods. Data show that, the highest values of seed and straw yield (932.87and1157.98 kg / fed) were obtained by using seed drill at row-space of 60 cm and 30 cm respectively. While, the lowest values of seed and straw yield (588.00 and 882.48 kg / fed.) were obtained by using hand sowing. This is attributed to good seed distribution at row space of 60 cm and suitable plant area and lights transfer.

Cost of Unit Production and Sowing Operation

Table 6 show the cost for different sowing methods and unit production of mung bean crop. Data show that, the highest cost (35 L.E / fed.) for sowing operation obtained by using hand sowing. While, the lowest cost (11.99 L.E / fed) obtained by using seed drill at different row spacing. In addition, data show that, the high cost of unit production (70.91 L.E / ton) obtained by using hand-sowing .While, the lowest cost (12.85 L.E / ton) obtained by using seed drill at row space of 60 cm. the high cost is attributed to increased of laborer number and wage values. While, lowest cost is attributed to, price if machine and high yield of mung bean crop.

CONCLUSION

Sowing of mung bean by seed drill at row-space of 60 cm, *Bacillus megaterium* inoculation and rate of potassium fertilizer 48 kg / fed gave the highest value 902.32 and 963.42 kg / fed of seed yield at both seasons respectively, lowest value 10.92 kW.h / fed of energy consumption, cost sowing operation 11.99 L.E. / fed and 12.85 L.E / ton obtained byseed drill comparing with hand sowing.

Table 6: Actual field capacity, fuel consumption, energy requirement, cost of sowing operation and unit production, number of plant per feddan and crop yield for sowing methods

Sowing methods		Actual field capacity fed / h	Fuel Consumption L / h	Energy requirement Kw.h / fed	Cost of sowing operation L.E / fed	Cost of unit production L.E / ton	Number of plant per feddan	Seed yield Kg / fed.
seed drill at different row spacing	75 cm	2.25	4.8	10.92	11.99	15.19	74970	789.28
	60 cm					12.85	95634	932.87
	45 cm					15.06	119952	797.42
	30 cm					18.20	151242	658.76
Hand sowing		0.038	-----	11.78	35.00	70.91	58800	676.88

REFERENCES

Abdel-Hafez, A.M. 1966. Some studies on acid producing microorganisms in soil rhizo sphere with special reference to phosphate discolors. ph. D.Thesis, fac.of agric., Ain shams Univ., Cairo, Egypt.

Abdel-Gaffar, S. A. and fatma, A. sharief 1995. Response of some new varieties of mung bean (phasolus aureus) to inoculation under Egyptian conditions. J.Agric. Sci., Mansoura Univ., 20 (1): 475-482.

Abdou, F. M. 1995. Effect of seedbed preparation and plant population on onion crop production. The role of Agr.Eng. In sustainable Development 3rd conf. of Miser society of Agr. Eng. 5- 6 October 1995 :153-162.

Abo El-Ezz, N. A.1985. The effect of seedbed preparation and method of planting on wheat yield .Misr J.Agr. Eng., 2(4):131-136.

Awady, M.N. 1978 .Tractor and farm machines, in Arabic, Text. Col. Agr, Ain shams Uni: 164-167.

Awady, M. N., G.H. El-Sayed, I. Yehia and A.H.A. Mohamad. 2000. Evaluation and comparison of mechanical and Pneumaticdrills for wheat grains. Misr. J. Agr. Eng 17 (4): 123 - 136.

Duncan, D.B. 1955. Multiple range and multiple, f-test. Biometrics, 11: 1 – 24.

El-Borollosy, M. A. 1999. Biofertilization of desert soils using phosphate dissolvers. The 6th National Conf. Environ. Studies & Res., Devel. of Desert Environ., Nov.

El-Karamany, M.F., A.A. Bahr and A.M. Gommaa. 2000.Response of local and some exotic mung bean varieties to bio and mineral fertilization. Acta Agronomica Hungarica, Vol. 49, No. 3, pp. 251-259.

El-Shafy, M.W. 1986. Report about mechanization of onion and pulps production, Agr. Eng.Res.Inst:30-40 (in Arabic)

El-Sayed, G. H., M.A. El-Attar, S.E. Badr and I. Yehia. 2000. Effect of some mechanical-planting systems on canola crop yield. Misr, J. Agr. Eng. Vol. 18 no. 4 p: 163-172.

Embaby, A.T. 1985. A comparison of different mechanization system for cereal production. M.Sc Thesis, Agric. Eng., Cairo University.

Gill, M.A., Naimat Ali and M.M. Nayyar. 1985. Relative effect of P combined with potash and Rhizobium phaseoli on the yield of Vigna aureus (mung) J. of agric. Res. Pakistan, 23 (4): 279 - 282.

Gomes K. A. and A. A. Gomes.1984. Statistical Procedures for Agricultural Research. Jhon Wiley and Sons, inc., New York.

Haghparast, M. R. and K. Mengl. 1995. The influence of increased potassium fertilization on the yield, the content of soluble amine acids and protein in vicia faba. Zeitschrift fur phanzenernahrung and Bodenkunde, vol.135, no.2, pp150-155, loref.

Hegazy, M.H. and S.A. Gennady. 1995. Potassium fertilization for some inters cropping patterins in Egyptian northern delta soils. Egyptian j. of agric. Research, vol. 73, no.1, pp.25-35.

Hunt, D.R. 1983. Farm power and machinery management, lowa State University press, Eighth edition.

Hussein, A.H.A., S.A. Saleh, M.A. EL-Deeb and W. kadry 1997. Effect of rhizobium inoculation, phosphorus and potassium fertilization on growth and yield of faba bean cultivated in the newly reclaimed soils of middle Egypt. Bulleyin of faculty of Agriculture, Univ-of Cairo, 1997, Vol.43 No. 1, pp. 201-214.

Jamwal, J. SA., Kalyansing and J.P. Singh. 1989. Effect of phosphorus and biofertilizers on yield and quality of blakgram.Annals of Agr. Res., 10 (3) 249.

Karczmarczyk, S., S.A. Laskowski and B. Biniak. 1978. The effect of supplementary irrigation and mineral fertilization on yields of Lupine and faba bean grown on two types of soil, Growth development and yield of Lupine and field bean. Zeszyty Naukowe Akademii Rolniczey W. Szczecinie Rolnictwo No.72, pp.75-96.

Kler, D.S., Sarbjeet-Singh., K.K. Dhingrand and S. Singh. 1991. Studies on bidirectional, narrow row spacing, seeding date and rates of sowing on grain yield of mung bean (Vigna radiate, L., Wilczek). Environment and Ecology, 9 (4): 93 - 4938. (C.F.Field Crop. Abst, 45: 7858, 1992).

Sighing. 1998. The influence of mineral and organic fertilization in hors bean (Vicia faba L.Var major Harz) on soil agrochemical modification and seed chemical composition. Grcetari Agronomic in Moldova, Vol. 31, No. 1/2, pp.91-98.

تأثير بعض نظم الزراعة الآلية والتلقيح بالباسيلس ميجاتيرم ومعدلات مختلفة من البوتاسيوم على إنتاجية محصول فول المائج

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تهدف هذه الدراسة إلى دراسة بعض نظم الزراعة الآلية{ الزراعة بآلة التسطير على مسافات مختلفة بين السطور (٣٠، ٤٥، ٦٠، ٧٥ سم) والتسميد بالبكتيريا المذيبة للفوسفات ومعدلات مختلفة للسماد البوتاسى (٤٨، ٣٦، ٢٤ كجم/ف) وتأثيرها على إنتاجية محصول فول المائج وكانت النتائج المتحصل عليها كما يلى:

١. أمكن الحصول على أعلى إنتاجية من البذور كانت (٩٠٢,٢٢ و٩٦٣,٤٢ كجم/ فدان) باستخدام آلة التسطير على مسافات ٦٠ سم بين السطور والتلقيح البكتيرى ومعدل ٤٨ كجم/فدان سماد بوتاسى.

٢. أدى استخدام البكتيريا المذيبة للفوسفور إلى زيادة معنوية فى عدد العقد البكتيرية على النبات، ارتفاع النبات، عدد الأفرع والقرون على النبات ومحصول البذور والقش للفدان من فول المائج.

٣. أعطى إضافة البوتاسيوم بمعدل ٤٨ كجم / فدان زيادة معنوية فى عدد العقد البكتيرية للنبات، عدد الأفرع والقرون للنبات ومحصول البذور والقش للفدان من فول المائج . كما أظهر التفاعل المشترك بين طرق الزراعة والتلقيح البكتيرى والتسميد البوتاسى زيادة معنوية فى معظم مكونات المحصول بالإضافة إلى زيادة محصول البذور والقش للنبات لفول المائج.

٤. الطاقة المستهلكة: تحققت أقل قيمة للطاقة المستهلكة (١٠,٩٢ كيلووات.ساعة / ف) مع إستخدام آلة التسطير على المسافات المختلفة بين السطور.

التكاليف: تحققت أقل قيمة للتكاليف الخاصة بإجراء عملية الزراعة(١١,٩٩جنيه / فدان و١٢,٨٥ جنيه/طن) مع إستخدام آلة التسطير على مسافات مختلفة بين السطور.