FACTORS AFFECTING MECHANICAL COTTON HARVESTING AND FIBER QUALITY

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(Manuscript received 3 December 2008)

Abstract

Manual cotton picking is an expensive process that requires large number of labor-hours to harvest one feddan. In addition cotton picking may require to be done twice to minimize production losses. picking cotton from plants during the mechanical harvesting process may be affected by a complex interaction of genetic traits, moisture differentials and machine performance parameters. Impurities such as stems, leaves, capsules (hulls), bracts and weedy material became a common part of the non-lint content of machine-harvested seed cotton. Giza 86 was mechanically harvested at four levels of forward speeds of 1.52, 1.86, 2.10 and 2.35 km/h, and three levels of row spacings of 0.65, 0.76 and 0.85m. Moisture of seed cotton was recorded to test the effect of moisture content on machine performance. The results show the effective field capacity, specific fuel consumption, productivity, total cost and mechanical picking losses. Row spacing 0.85m and forward speed of 2.35 km/h at fiber moisture content of 11.3%(d.b) minimize specific fuel consumption (0.443 L/kW.h) while, the same previous conditions with forward speed of 1.52 km/h gave minimum value of mechanical picking losses (3.11%) also, row spacing 0.85m with moisture content of 8.3% (d.b) and forward speed of 2.35 km/h gave the maximum value of effective field capacity (1.666 Fed/h)and maximum value of productivity (1.967 ton/h) and lower total cost (223.2 L.E/fed). Row spacing 0.85m and forward speed of 1.52km/h achieve maximum value of 2.5% span fiber length (32.8mm), 50% span fiber length (16.8mm), fiber length uniformity ratio (51.2%) and reflectance (73.6%), minimize seed cotton trash content (4.1%) and yellowness (6.9 unit).

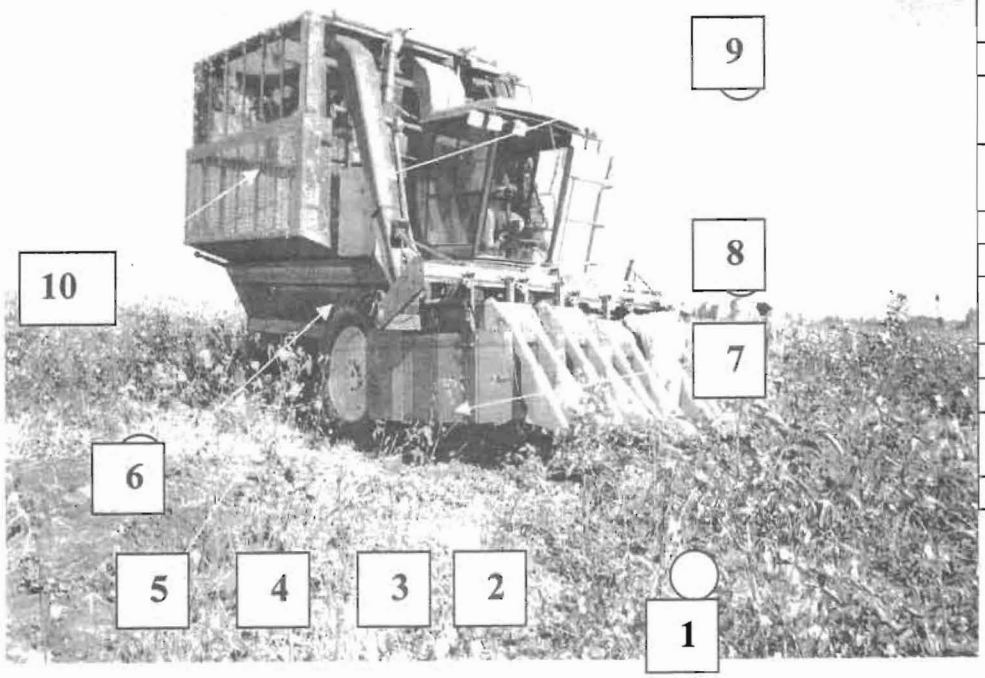
grade. However, the current marketing system depends on grade and fiber length with grade being composed of color and trash components. Several researchers have shown that there is a significant quality variation within cotton produced in a given field. *Ahmed (1985)* reported that, there are several factors, which have a considerable effect on the performance of cotton harvesting machine. Some of these factors depend on the machine itself and its operator, others are connected with the variety of cotton to be grown, the cultural and husbandry practices applied. The mechanical factors which affect the machine mainly concentrated on the picking part of the machine, namely, the number and spacing of the picking zone, shape, size, sharpness and angle of the spindles, and the mechanism of cleaning the spindles. *Corley (1966)* concluded that different harvesting practices affected fiber quality, also indicated that a delayed harvest reduced fiber quality. *Williford et al. (1987)* stated that harvesting prior to exposure to adverse weather conditions was critical to maintaining good quality. *Columbus et al. (1990)* showed that with the effects of initial seed cotton moisture (initial moisture ranged from 8.3 to 12.8%) removed, the only seed cotton parameter that was significantly affected by harvest treatments was feeder foreign matter. They added to that, the HVI measurements and visible non-lint content affected by harvest treatments. *Anthony (1991)* reported that, the machine efficiency depended on many factors including machine design, cotton moisture level, processing rate, machine adjustments and speed, condition of the machine, the amount and nature of trash in the cotton, distribution of cotton across the machine and the cotton variety characteristics. *Corley (1970)* reported that, plant spacing within conventional single rows seems to have no great effect on the performance of either pickers or strippers. *Tupper (1966)* mentioned that, field losses might be in the form of cotton dropped prior to harvesting (pre-harvest loss), cotton left on the plants by the harvester or cotton dropped by the harvester. *Matthews and Tupper (1965)* reported that, general experience with spindle pickers indicates that, with careful attention to the various production and machine-operating factors involving machine losses will usually be 5 to 10% of the yield. *Abd El-salam (2000) and Badr et al. (2001)* reported that positive significant correlations were found between seed cotton yield, boll weight, seed index, lint percentage and micronaire reading and between (2.5%and50%)span length and length uniformity ratio. Thus, this study was carried out to discuss the factors affecting the harvest process and investigate important fiber quality.

MATERIALS AND METHODS

An imported cotton picker was operated and tested at four forward speeds of 1.52, 1.86, 2.10 and 2.35km/h, fiber moisture contents 11.3, 9.8 and 8.3%, d.b were recorded during the test. The test was repeated at fields of row spaces of 0.65, 0.76 and 0.85m, planted with cotton variety Giza 86 located in EL-KARADA farm at kferelshiekh province. The used cotton picker was JOHN DEERE 9970 model PC 602 (Fig 1) .A top view of the operational action of cotton-picker spindles picking from each side of the row is shown in (Fig 2).The specifications of the machine is shown in Table(1).Experiments carried out to determine field capacity, specific fuel consumption, productivity, total cost and mechanical picking losses. Cotton samples were taken randomly and mixed at the laboratory. From each treatment, Three replications used to determine effect of cotton picker on fiber quality represented in 2.5%and 50% span fiber length, length uniformity ratio %, seed cotton trash content %, reflectance % and yellowness.

Table 1. Technical specifications of cotton picker machine

Specifications	Cotton picker machine
Model	9970 John-Deere
Source of manufacture	U S A
Overall length, cm	6 00
Overall width, cm	380
Overall height, cm	450
Front tire, inch	20.8×38
Rear tire, inch	9.0×24
Total weight, Mg	8
Source of power	Diesel engine- 102.9 kW
Number of picking units	Four
All picking unit	Contains two picking drums
Picking drum-type arrangements	Contains 216 spindles



No.	Machine Parts
1	Plant divider
2	Front drum of spindles
3	Rear drum of spindles
4	Drive wheel
5	Steering wheel
6	Water tank for spindles
7	Fan
8	Driver
9	A pneumatic conveying duct
10	Cotton basket

Fig. 1: Cotton picker in operation.

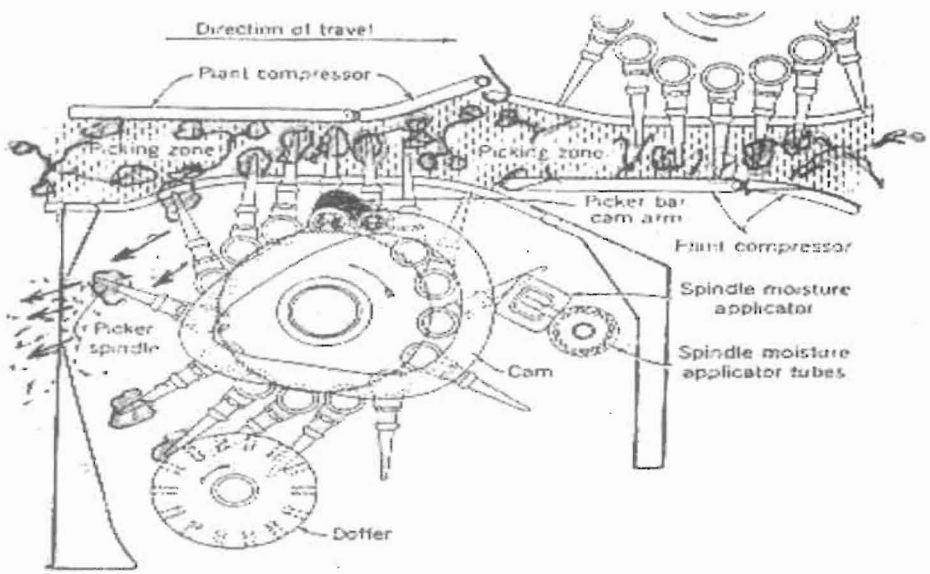


Fig. 2: top view of the operational parts of cotton picker spindles picking.

I-Cotton picker performance:

a) Calculation of the effective field capacity (E.F.C.):

The effective field capacity was calculated from the following formula (Kepner *et al.*, 1982)

$$E.F.C = \frac{1}{\text{total time , h/fed}^*} \text{ , Fed/h} \quad \text{.....1}$$

b) Determination of field efficiency :

The field efficiency was calculated from the following formula

$$\text{Field efficiency} = \frac{\text{Effective field capacity}}{\text{Theoretical field capacity}} \text{ , \%} \quad \text{.....2}$$

c) Determination of mechanical picking losses:

Cotton losses were collected, losses represent cotton formerly dropped from plants and cotton dropped by the action of cotton picker during harvesting operation.

d) Calculation of productivity:

Productivity calculated by measuring weight of cotton picked by the machine (output) and time required for harvesting.

e) Calculation of specific fuel consumption (S.F.C):

The specific fuel consumption calculated using the following formula (Suliman *et al.*, 1993).

$$S.F.C = \frac{\text{Fuel consumption, l/h}}{\text{Power consumed, kW}} \text{ , L/Kw.h} \quad \text{.....3}$$

f) Determination of total cost :

Total cost of cotton picker, LE/h: include fixed and operating costs. Declining balance method was used to determine the depreciation (Hunt, 1983).

g) Determination of seed cotton technology properties :

Seed cotton samples were collected in plastic bags and isolated to preserve temperature and humidity and transported to the cotton technology Department, cotton Inst., A. R. C (ASTM, 1984). A digital fiberograph (model 630) was used to determined (2.5% and 50%)span fiber length and length uniformity ratio. The 2.5% span fiber length=length (millimeters) at which 2.5% of the fibers are ≥ this length, and 50% span fiber length=length (millimeters) at which 50% of the fibers are ≥ this length (May and Bridges, 1995) the uniformity ratio may then be computed as follows:

$$\text{Uniformity ratio} = \frac{\text{50\% span fiber length}}{\text{2.5\% span fiber length}} \times 100\% \quad \text{.....4}$$

The High Volume Instrument (HVI) was used to determined reflectance, yellowness and seed cotton trash content.

* one feddan = 4200 meter square

h) Statistical analysis :

the study data was analyzed with multiple regression analyses (SAS,1988) as a split split block design to determine analysis of variance, regression equations, determination coefficients and adjust of determination coefficients.

RESULTS AND DISCUSSION

1-Field performance characteristics of cotton picker:

A) Effective field capacity:

Results as shown in Fig. 3 indicate the effect of forward speed on the effective field capacity of cotton picker John Deere 9970 tested at different row spacings. The values of effective field capacity were 0.793 , 0.871, 1.021 and 1.180 Fed/h at forward speeds of 1.52 , 1.86, 2.10 and 2.35 km/h, respectively . Fiber moisture content 11.3% d.b at row spacing of 0.65 cm. The field capacity increased with increasing of the forward speeds from 1.52 to 2.35 km/h and row plants spacing from 0.65m to 0.85m. The maximum value of effective field capacity was 1.666 Fed/h recorded at moisture content 8.3% d.b, forward speed of 2.35 km/h and row plants spacing of 0.85 m, respectively. This was due to increase of space between stripes decreased number of plants in unit area, necessary to increase forward speed of the machine.

B) Mechanical picking losses:

Data of Fig. 4 represent the effect of forward speed, fiber moisture and inter row spacing on mechanical picking losses. Values of cotton losses increased by increasing forward speed and at lower fiber moisture contents. Mechanical losses of cotton picking decreased at wider row spacing. Results show also that, the forward speed is considered the most important effective factor. The minimum picking losses was 3.11% recorded at forward speed of 1.52 km/h, fiber moisture content 11.3% d.b and row plants spacing of 0.85m. higher forward speed of the machine may cause sudden motion of cotton trees and consequently impact of stems and branches that may represent the reason for cotton to drop . On the other hand, at higher speed the spindles miss picking some bolls .

C) Productivity:

Fig. 5 illustrates the effect of forward speed, fiber moisture content and inter row spacing on productivity . Increasing forward speed tends to increase productivity under different fiber moisture contents. Machine productivity decreased at wider row spacing. The maximum value of productivity was 1.967 ton/h recorded at forward speed of 2.35 km/h with fiber moisture content of 8.3 % d.b and row plants spacing of o.85 m .Picking operation through dense crop increase chances of spindle to pick bolls and more ginning achieved. Operating the machine in fields of lower moisture may open more bolls and more productivity may be achieved at higher forward speed (2.35km/h) increase productivity regardless of losses.

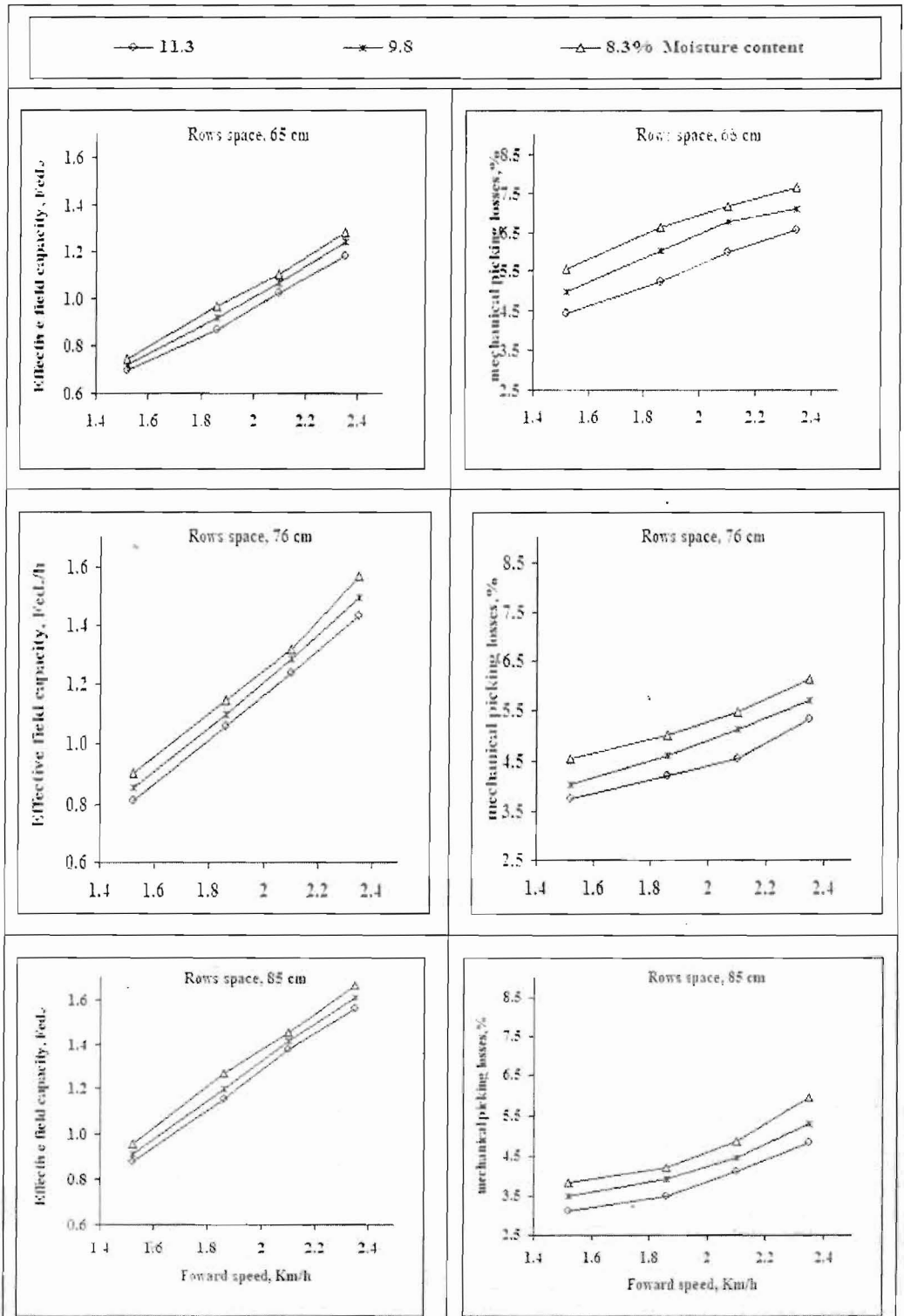


Fig. 3: Main effect of forward speed, space between stripes and moisture content on effective field capacity, Fed /h.

Fig. 4 : Main effect of forward speed , space between stripes and moisture content on mechanical picking losses

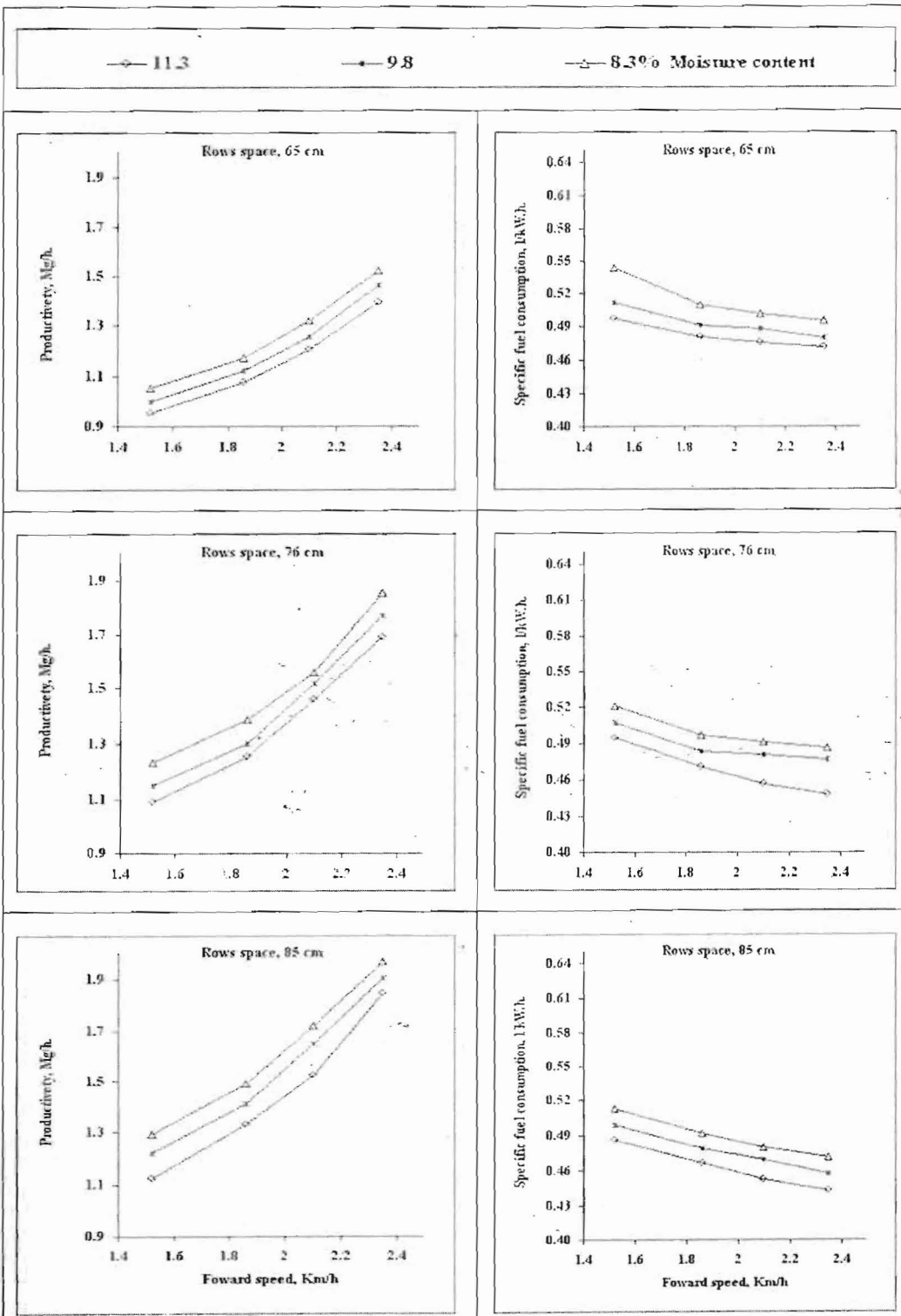


Fig. 5: Main effect of forward speed ,space between rows and moisture content on productivity, ton/h.

Fig. 6: Main effect of forward speed ,space between rows and moisture content on specific fuel consumption, l/kW.h.

D) Specific fuel consumption:

Results presented in Fig.6 show the specific fuel consumption of the cotton picker operated at variable forward speeds to harvest cotton planted on rows spacing 0.65 to 0.85m at variable moisture conditions. Increased forward speeds from 1.52 to 2.35 km/h decreased specific fuel consumption. Also, at wider inter row spacing, specific fuel consumption decreased. An inverse relation was detected between specific fuel consumption and cotton moisture content when changed from 11.3 to 8.3% d.b. Forward speed was a more important factor affecting specific fuel consumption . The low value of specific fuel consumption 0.443 l/kW.h, was recorded at forward speed of 2.35km/h, fiber moisture content of 11.3% d.b and row plants spacing of 0.85m .On the other hand high specific fuel consumption (0.544 l/kW.h) was recorded at 1.52km/h at moisture content 8.3% d.b and furrow spacing 0.65m.

E) Field efficiency :

Fig .7 illustrates field efficiency percentage which was directly proportional to forward speed and inversely proportional to fiber moisture content and inter-row spacing. The maximum value of field efficiency was 82.76% recorded at forward speed of 2.35km/h, fiber moisture content 8.3% d.b and inter-row spacing of o.85m. Also, Fig .7 indicates the relationship between field efficiency and mechanical picking losses at different forward speeds , inter-row spaces and fiber moisture content

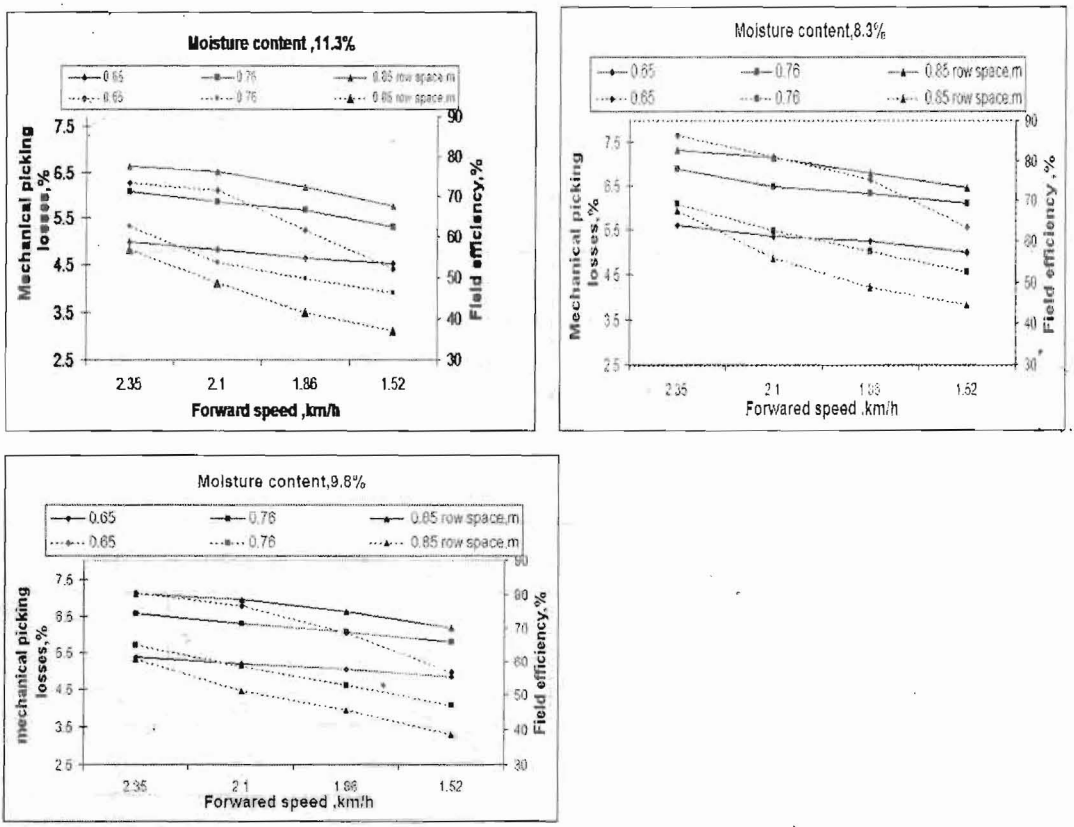


Fig 7 : The relationship between forward speed and both of mechanical picking losses and field efficiency at different inter row spaces and moisture contents.

E) Total cost:

Comparative cost was computed for manual and mechanical cotton picking. Table 2 shows that mechanical harvest cost was lower than manual harvest. Lowest mechanical cost was 223.2 L.E/Fed and lowest manual cost was 1030 L.E/Fed, recorded at forward speed of 2.35 km/h, fiber moisture content of 8.3% d.b and row plants spacing 0.85m. As shown in Table 3 and Fig .8 increasing forward speed from 1.52 to 2.35 km/h, total cost tends to decrease. Total manually and total mechanical cost tends to decrease with decreasing fiber moisture content from 11.3% to 8.3% d.b and increasing row spacing from 0.65m to 0.85m respectively. Where number of plants on the field was decreased therefore, harvesting process was more easy.

Table 2. comparative cost of manual vs mechanical cotton picking at variable machine operation speeds and field conditions.

Moisture content, % d.b.	Forward speed, km/h	Inter-row Spacing, m					
		0.65		0.76		0.85	
		Manually	Mechanical	Manually	Mechanical	Manually	Mechanical
11.3	1.52	1340	511.9	1250	406.7	1190	348.2
	1.86	1340	473.3	1250	368.9	1190	313.9
	2.10	1340	425.2	1250	338.5	1190	280.4
	2.35	1340	382.7	1250	304.5	1190	264.0
9.8	1.52	1290	478.3	1180	375.6	1100	319.3
	1.86	1290	431.1	1180	338.7	1100	285.6
	2.10	1290	387.8	1180	307.6	1100	259.7
	2.35	1290	346.6	1180	278.3	1100	239.7
8.3	1.52	1175	429.1	1120	349.2	1030	289.9
	1.86	1175	395.7	1120	311.8	1030	268.8
	2.10	1175	351.1	1120	290.6	1030	242.6
	2.35	1175	322.5	1120	257.2	1030	223.2

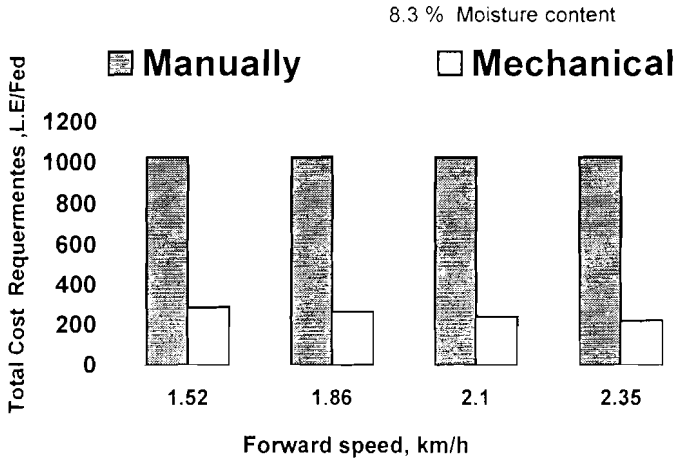


Fig. 8. mechanical vs manual cotton picking cost at variable conditions.

2-Determination of cotton picker efficacy on physical fiber quality properties:

Table 3 data indicated that the values of 2.5% & 50% span fiber length, uniformity ratio and color reflectance show similar trends . These characteristics decreased with increasing forward speed from 1.52 to 2.35 km/h and moisture variation from 11.3% to 8.3% d.b. Increased inter row spacing from 0.65 m to 0.85m improved these characteristics. The maximum values of 2.5% & 50% span fiber length, uniformity ratio and color reflectance (Rd) were 32.8mm, 16.8mm, 51.2% and 73.6%, respectively, recorded at forward speed of 1.52 km/h, fiber moisture content of 11.3% and row spacing of 85cm. Seed cotton trash content and color yellowness decreased with increasing forward speed and decreasing both of fiber moisture content and row spacing. Minimum values of seed cotton trash content and color yellowness were 4.1% and 6.9 unit, respectively, recorded at forward speed of 1.52 km/h, fiber moisture content of 11.3% d.b and row spacing of 0.85m. Increase of row spacing and moisture content improved characteristics of seed cotton picked mechanically which may be limited to the conditions of the current experiments.

Table 3. Effect of cotton picker forward speed, moisture content and inter-row spacing on some seed cotton properties.

Moisture content, % d.b.	Forward speed, km/h.	Span fiber length, mm.		Fiber length uniformity ratio, %.	Seed cotton trash content, %.	Reflectance (Rd), %.	Yellowness (+b), unit.
		2.5%	50%				
Inter-row Spacing o.65m							
11.3	1.52	31.8	15.7	49.4	4.93	73.1	7.4
	1.86	31.5	15.3	48.6	5.32	71.0	7.9
	2.10	31.0	14.8	47.7	5.74	70.5	8.2
	2.35	30.6	14.4	47.1	6.18	70.2	8.8
9.8	1.52	31.5	15.3	48.6	5.42	71.0	7.9
	1.86	31.0	14.9	48.0	5.81	70.5	8.2
	2.10	30.6	14.4	47.0	6.31	70.2	8.6
	2.35	30.2	14.1	46.7	6.53	69.6	9.1
8.3	1.52	30.9	14.8	47.9	5.81	70.5	8.3
	1.86	30.4	14.3	47.0	6.14	70.0	8.7
	2.10	29.7	13.7	46.1	6.60	69.1	9.1
	2.35	29.1	13.3	45.7	7.14	68.7	9.5
Inter-row Spacing 0.76m							
11.3	1.52	32.2	16.3	50.6	4.21	72.8	7.1
	1.86	31.9	15.7	49.2	4.67	72.2	7.6
	2.10	31.5	15.3	48.6	5.24	71.6	7.9
	2.35	31.1	14.8	47.6	5.63	71.1	8.4
9.8	1.52	31.9	15.9	49.8	4.57	72.3	7.6
	1.86	31.5	15.3	48,6	4.99	71.9	7.9
	2.10	31.0	14.9	48.0	5.56	71.2	8.2
	2.35	30.7	14.5	47.2	6.11	70.7	8.7
8.3	1.52	31.5	15.4	48.9	5.32	71.7	7.9
	1.86	30.9	14.9	48.2	5.71	71.3	8.3
	2.10	30.5	14.5	47.5	6.10	70.6	8.8
	2.35	30.0	14.0	46.6	6.48	70.1	9.1
Inter-row Spacing o.85m							
11.3	1.52	32.8	16.8	51.2	4.10	73.6	6.9
	1.86	32.3	16.4	50.8	4.40	73.1	7.2
	2.10	31.9	15.9	49.8	4.93	72.7	7.6
	2.35	31.4	15.4	49.0	5.47	72.2	8.0
9.8	1.52	32.2	16.4	50.9	4.41	73.1	7.2
	1.86	31.8	15.9	50.0	4.79	72.5	7.4
	2.10	31.5	15.5	49.2	5.15	71.9	7.8
	2.35	31.0	14.9	48.0	5.69	71.2	8.3
8.3	1.52	31.7	16.0	50.4	4.76	72.2	7.3
	1.86	31.2	15.5	49.6	5.12	71.8	7.9
	2.10	30.9	15.1	48.8	5.64	71.2	8.4
	2.35	30.4	14.3	47.0	5.96	70.9	8.7

3- statistical analysis :

ANOVA of analysis illustrated that arrangement of influence factors were moisture content, % as first of all followed by forward speed, km/h later on space between stripes, cm. Also, a multiple linear regression equation was developed. It had the following equation:

$$E = a + b_1F + b_2S + b_3M \quad \text{.....5}$$

where:

E = the dependent variable under consideration

F = the forward speed, km/h

S = the space between stripes , cm

M = the moisture content,%

a = the y-intercept and

b_1, b_2 and b_3 = the regression coefficients.

values of the predicted regression coefficients(b1, b2 and b3) and its determination coefficients (R^2) and adjust of determination coefficients(R^2adj) are listed in Table 4.

Table 4 . multiple linear regression equation , describing the field performance of cotton picker and some of seed cotton technology properties.

Indicator	a	Regression coefficients			R^2	R^2adj
		b_1	b_2	b_3		
A) Field performance of cotton picker						
Field capacity, fed/h	0.389	+0.612	+0.0021	-0.0533	94.6%	91.3%
Mechanical picking losses, %	3.630	+2.370	-0.0034	-0.2900	88.7%	86.2%
Productivity , Mg/h	0.509	+0.685	-0.0007	-0.0403	93.6%	90.2%
Specific fuel consumption, L/kW.h	0.767	-0.061	-0.0005	-0.0141	95.8%	94.2%
B) Seed cotton technology properties						
2.5%span fiber length, mm	30.3	-1.52	+0.0028	+0.0369	97.9%	94.9%
50%span fiber length, mm	15.4	-1.80	+0.0036	+0.3060	97.7%	94.7%
Uniformity ratio,%	48.7	-2.98	+0.0176	+0.4330	89.1%	85.2%
Seed cotton trash content,%	5.24	+1.64	-0.0056	-0.2610	95.9%	92.7%
Reflectance,%	70.4	-2.16	+0.0062	+0.4720	85.5%	81.3%
Yellowness, unit	8.01	-1.47	-0.0039	-0.2530	94.6%	92.2%

CONCLUSION

From the above results and discussion it can be concluded that:

1- The optimum operation conditions for mechanical cotton picking were, row spacing of 0.85m, machine forward speed 2.35km/h and cotton moisture 8.3% d.b at which field capacity of 1.666 Fed/h and productivity of 1.967 ton/h achieved a cost of 223.2L.E/Fed.

2- Inter-row spacing of 0.65m was suitable for manually harvest, while 0.76m spacing was suitable for machine picking.

3- The maximum effective field capacity of 1.666 Fed/h and the maximum productivity 1.967 ton/h were obtained at row plants spacing of 0.85m, cotton picker forward speed of 2.35km/h and fiber moisture content of 8.3% d.b.

4- The lowest specific fuel consumption of 0.443 l/kW.h and the lowest seed cotton losses of 3.11 % were obtained at row plants spacing of 0.85 m, fiber moisture content of 11.3% d.b and cotton picker forward speed of 2.35 and 1.52 km/h, respectively.

5- The minimum cost of 223.2 LE/Fed recorded at row plants spacing of 0.85m, fiber moisture content of 8.3 % d.b.

6- The obtained results of the physical fiber analysis illustrated that: The highest values of 2.5%&50% span fiber length, fiber length uniformity ratio and color reflectance were32.8mm,16.8mm, 51.2% and 73.6%. And the lowest values of seed cotton trash content and color yellowness were 4.1% and 6.9 unit were obtained at row plants spacing of 0.85m, cotton picker forward speed of 1.52 km/h and fiber moisture content of 11.3% d.b.

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العوامل المؤثرة على جنى القطن الزهر آليا و تأثيرها على جودة الألياف الناتجة

جمال حسن السيد ،أشرف السيد الشاذلى، عاطف عزت اليماني

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عملية الجني اليدوي للقطن الزهر في مصر أ صبحت في الآونة الأخيرة من أكثر بنـود إنتـاج محصول القطن تكلفة نظرا لارتفاع أجور العمالة ولاحتياج العملية لعدد كبير من العمالة. لذلك اصبح من الضروري جدا استخدام الجني الآلي لمحصول القطن لتخفيض تكاليف الإنتاج. ولكن عملية فصل فصوص القطن الناضجة عن نبات القطن عملية صعبة ومعقدة تعتمد على الصفات الوراثية للنبـات ومسافات الزراعة بين الخطوط والمحتوى الرطوبى للمحصول وأيضا تعتمد على كفـاءة أداء آلـة الجني .ولكن يعاب على عملية الجني الآلي ارتفاع نسـبة الشوائب بالقطن الناتج وأيـضا ارتفاع نسبة فقد القطن بالحقل لذلك فقد أجري هذا البحث بهدف تحديد انسب ظروف لجنى المحصول بحيث تعطى إنتاجية مرتفعة ونسبة فقد للمحصول منخفضة مع المحافظـة علـى صـفات الجـودة

أ- السرعة الأمامية للآلة حيث تم دراسة أربعة سر عات هي٠,٥٢ ، ١ ،٨٦, ١ ، ٢,١٠ ،٢,٣٥كم/ساعة .

ب- المحتوى الرطوبى للألياف تم دراسة ثلاثة محتويات رطوبة هى٨,٣،٩,٨،١١,٣ ٪ .

ج- مسافة الزراعة بين الخطوط تم استخدام ثلاث مسافات كانت٠,٦٥ م،٠,٧٦م ،٠,٨٥م .

للألياف. ولذلك فقد تم دراسة تأثير كل من العوامل التالية:

وقد تم فى هذا البحث دراسة تأثير هذه العوامل على مؤشرات الكفاءة التالية و هي : السعة الحقلية الفعلية – الاستهلاك النوعي للوقود – الإنتاجية – التكاليف الكلية – نسبة الفقد للمحصول أيضا تم دراسة تأثير هذه العوامل على بعض صفات الجودة للألياف مثل (طول التيلة عند نسبة توزيع ٢,٥ ٪ – طول التيلة عند نسبة توزيع ٥٠ ٪ – نسبة تماثل الألياف –درجة الانعكاس – درجة الاصفرار – المحتوى من الشوائب بالقطن الزهر). و لقد أظهرت النتائج المتحصل عليها ما يلي :

١- أوضحت النتائج أن مسافة الزراعة بين الخطوط ٠,٨٥م كانت الأفضل للجنى الآلي مقارنة بالمسافات الأخرى حيث أعطت اقل نسبة فقد في المحصول و اقل نسبة شوائب بالقطن الزهر الناتج .

٢- استخدام سر عات أمامية مرتفعة للآلة (٢,٣٥كم/ساعة) ومسافة زراعة بين الخطوط كبيرة (٠,٨٥م) أعطت سعة حقلية وإنتاجية كبيرة وكانت أقصى قيمة للسعة الحقلية هي ١,٦٦٦ فدان/ساعة وللإنتاجية ١,٩٦٧طن /ساعة وذلك عند محتوى رطوبى للألياف ٨,٣ ٪.

٣- اقل معدل استهلاك نوعى للوقود كان٤٤٣,. لتر /كيلووات.ساعة عند استخدام مسافات زراعة بين الخطوط ٠,٨٥م و سرعة أمامية للآلة ٢,٣٥كم/ساعة ومحتوى ر طوبى للألياف ١١,٣ ٪ على التوالي.

٤- اقل تكاليف كلية للعملية كانت ٢٢٣,٢جنية/فدان عند استخدام مسافات زراعة بين الخطوط ٠,٨٥م وسرعة أمامية للآلة ٢,٣٥كم/ساعة ومحتوى ر طوبى للألياف ٨,٣ ٪ على التوالي.

٥- بعد تقدير صفات جودة الألياف كانت أعلى قيم من طول التيلة عند نسبة توزيع ٢,٥ ٪ و نسبة توزيع ٥٠ ٪ و أعلي نسبة تماثل ودرجة انعكاس هي ٣٢,٨ مم ، ١٦,٨ مم ،٥١,٢ ٪،٧٣,٦ ٪ على التوالي . واقل قيم من محتوى الشوائب ودرجة الاصفرار هي ٤,١ ٪ و ٦,٩ وحدة وذلك عند استخدام مسافات زراعة بين الخطوط ٠,٨٥م وسرعة أمامية للآلة ١,٥٢كم/ساعة ومحتوى ر طوبى للألياف ١١,٣ ٪ على الترتيب.

***التوصـــــــــــيات:**

١- عند جنى القطن الزهر يدويا فإنه ينصح أن تكون مسافات الزراعة بين الخطوط ٠,٦٥ م حيث يرغب المزارع في هذه الحالة زيادة عدد النباتات بالحقل وبالتالي يمكنه زيادة إنتاجية الفدان .

٢- عند جنى القطن الزهر آليا فان ضيق مسافات الزراعة بين الخطوط تسبب مشاكل للآلة وتؤدى إلي ارتفاع نسبة الفاقد ولذا فإنه ينصح أن تكون مسافة الزراعة بين الخطوط ٠,٨٥م حيث أن هذه المسافات الواسعة تسمح للآلة العمل بكفاءة مرتفعة وتؤدى إلى انخفاض نسبة فقد المحصول أثناء عملية الجنى وتمكن الآلة من استخدام سرعات تقدم مرتفعة وبالتالي تكون ذات سعة حقلية مرتفعة و تحقق إنتاجية مرتفعة.