EFFECT OF THE EXTRACTOR-FEEDER* AND THE MODIFIED SEED GRID** ON COTTON QUALITY

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Abstract

The present investigation was conducted to study the effect of both the domestic designed roller gin stand extractor-feeder in conjunction with the domestic designed (modified) seed grid on various aspects of fiber quality for three cotton cultivars namely; Giza 89, Giza 83, and Giza 91 (G+1/8 grade). The results obtained indicate that using the extractor-feeder conjoined with the seed grid No. 2 of the dimensions of 5 mm. finger width, 11 mm. spacing between fingers and 66.9% spacing area exhibited the highest lint grade, upper half mean length, uniformity index, and fiber reflectance percentage, while the lowest ones were obtained as a result of using the hand feeding method with the seed grid No. 1 of the dimensions of 9 mm. finger width, 9 mm. spacing between fingers and 48.5% spacing area (control treatment). However, using the extractor-feeder with the grid No. 2 exhibited the lowest lint percentage, non-lint content, short fiber percentage, and fiber yellowness, while the highest ones were obtained as a result of using the control treatment. The improvements occurred in lint grade as a result of handling seed cotton by the extractor-feeder was 3.9%, raised to 4.1% as a result of using the seed grid No. 2, while the improvement in lint grade resulted from using both the extractor-feeder conjoined with the seed grid No. 2 reached to 4.9%.

Thus, it could be concluded that using the extractor-feeder with the seed grid No. 2 significantly preserved the upper half mean length, while improved the lint grade, fiber length uniformity index, and reflectance of lint to light percentage, and decreased the lint percentage, non-lint content, short fiber percentage, and fiber yellowness.

Therefore, it could be said that using the nominate gin stand extractor feeder conjoined with the seed grid of the total high spacing area and the widest space between the grid fingers resulted in improving the ginned lint quality.

INTRODUCTION

Ginning efficiency depends on a lot of factors. Type and model of the different ginning units, cotton variety and gin stand settings are the most important factors affecting the ginning efficiency. However, the setting and the dimensions of the seed grid of the reciprocating knife roller gin stand and the type of the extractor feeder, feeding the gin stand with seed cotton, play serious roles in the gin stand efficiency.

Youssef (1994) designed ten seed grids in order to be fixed and tested on the conventional reciprocating knife gin stand. He found that the best grid that gave the best ginning efficiency was the grid of 4.5-mm finger width, 11-mm spacing between grid fingers, 60 spaces and 6-mm grid body thickness. Thus he concluded that when ginning the seed cottons of high grades (from "Good" up to the "Excellent" grade), it was preferable to use the mentioned grid, while when ginning seed cottons of low grades (less than "Good" grade) it was preferable to use the grid of 4.5-mm finger width, 9-mm spacing between grid fingers, 72 spaces and 6-mm grid body thickness, while the grid in use (the conventional one) is that of 7.5-mm finger width, 9-mm spacing between grid fingers, 57 spaces and 6-mm grid body thickness. Eweida (1997a) found that as the seed grid spacing was widened, the lint grade, lint color (Rd%), fiber length parameters (2.5% S.L. and uniformity ratio) and micronaire reading of the extra long-staple varieties improved, while the seed grid spacing area had no effect on lint grade, lint color, fiber length parameters or micronaire reading of long-staple varieties (Eweida 1997b).

Thus, the purpose of this study was to evaluate the effects of both the domestic designed extractor-feeder in conjunction with two domestic modified seed grids of higher spacing area on ginned cotton quality.

MATERIALS AND METHODS

In the present study, three seed grids (Fig. 1) were used (two domestic modified ones beside the control one) in conjunction with the designed extractor-feeder (Fig. 2). The seed cottons of three cotton cultivars namely; Giza 89, Giza 83 and Giza 91 (G+1/4 grade for each) were ginned by the McCarthy reciprocating knife 40-inch roller gin stand conjoined with the new designed extractor-feeder.

Two seed grids, selected from the ten seed grids previously designed, constructed and tested by Maher Youssef (Youssef, 1994) The technical specifications of the selected seed grids were as follows:

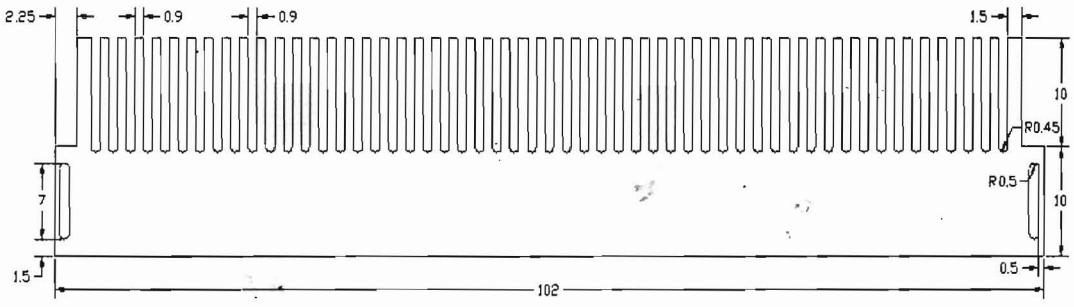
No. of grid	Finger width (mm)	Spacing between fingers (mm)	No. of spacing	Grid body thickness (mm)	Spacing area (%)
1*	9	9	53	6	48.5
2	5	11	60	6	66.9
3	5	9	67	6	61.3

*The conventional seed grid

With respect to the extractor feeder, the screen type conjoined with the extractor feeder was the round-racks one and the cleaning cylinder speed was 142 rpm (1.49 m/s), while the feeding rate was 0.7 rpm (73.24 kg/h/m). The cotton varieties used in the experiment were obtained from the 2006 growing season.

The ginning performance was carried out in 2007 at the Cotton Ginning Research Section, Cotton Research Institute, Agricultural Research Center. A bulk sample for each seed-cotton variety was taken at random and elaborately mixed. For each treatment, three replications each of 5 kg of seed cotton were fed to the extractor-feeder during ginning. The lint percentage was calculated for each lot by dividing the weight of the ginned lint by the initial seed cotton weight. The improvements in lint grade resulted from using the nominate extractor-feeder and the seed grids were determined and calculated according to the following equation:

$$\text{Improvement in lint grade} = \frac{\text{lint grade index - seed cotton grade index}}{\text{seed cotton grade index}}$$



Dim. in cm

Fig. 1. Seed grid of the reciprocating knife gin stand (control one).

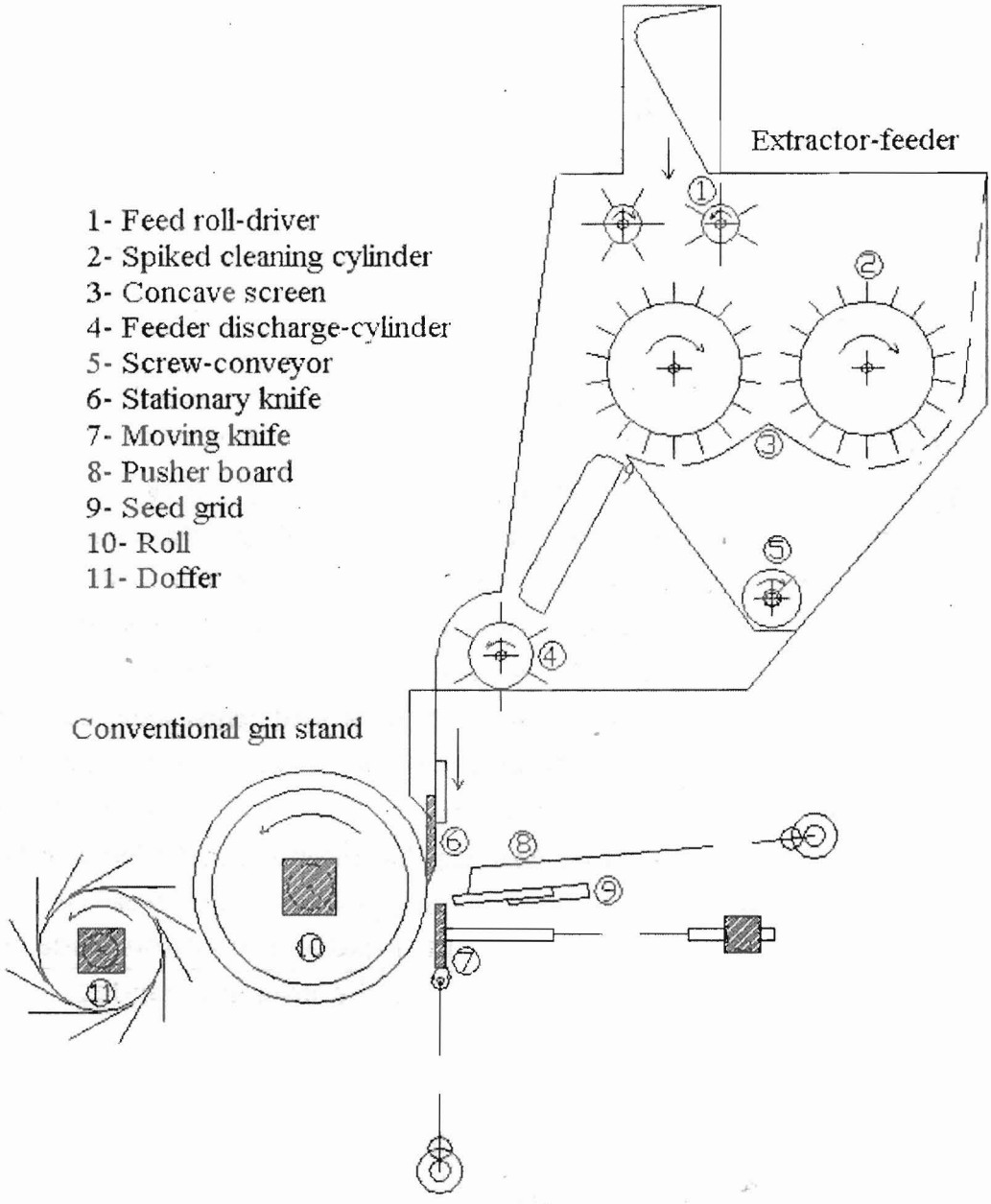


Fig. 2. The newly designed extractor-feeder installed on the gin stand.

Fiber properties were tested at the Cotton Technology Research Section under standard atmospheric conditions of (65 % ± 2) relative humidity and (70° F ± 2, 21.1°C ± 1) temperature degree. Seed cotton grades and lint grades were determined by qualified lint classers. Lint color (reflectance Rd% and yellowness +b) was measured by using the "Nickerson Hunter cotton colorimeter" according to ASTM designation D-2253-67 (1984). The digital fibrograph 630 instrument was operated according to ASTM (D-1447-67) to estimate the fiber length parameters [upper half mean length (mm), uniformity index (%), and short fiber index (%)]. Percentage of

non-lint content was measured by "microdust and trash analyzer" according to ASTM (D-2812-95).

A factorial analysis of variance, in a completely randomized design was conducted and the differences between means were tested by Duncan's new multiple range test according to (SAS, 1996).

RESULTS AND DISCUSSION

The results of the ginned fiber properties of the three cotton varieties, under study, as affected by the nominate extractor-feeder and seed grid specifications are shown in table 1, while the results of the ginned fiber properties of the same cotton varieties as affected by the nominate extractor-feeder conjoined with the modified seed grid are shown in table 2.

1. Effect of the extractor-feeder on cotton fiber quality

The results in table 1 show that using the extractor-feeder significantly decreased the non-lint content, while improved the lint grade and reflectance percentage of the lint to light as compared to the control one (without using the extractor-feeder). The lint grade index and the reflectance percentage improved from 42.1, and 65.0% (control) to 42.6, and 65.8%, respectively. Using the extractor feeder decreased the non-lint content, the lint percentage and fiber yellowness from 4%, 38.3%, and 11.7% (control) to 3.6, 37.9%, and 11.4%, respectively, while the values of upper half mean length, uniformity index, and short fiber percentage did not show any significant differences, resulting from using the extractor-feeder.

2. Effect of the seed grid on cotton fiber quality

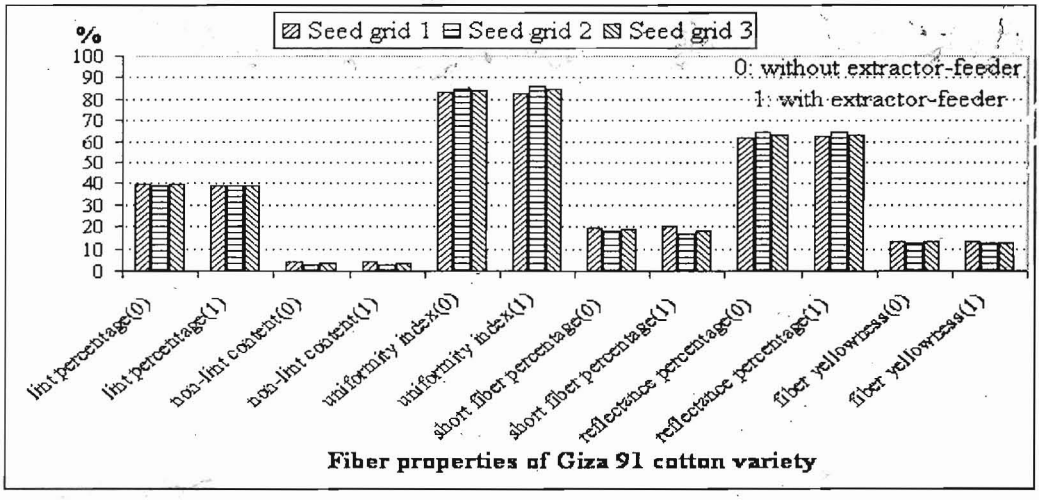
The results of the seed grids in table 1 show that grid No. 2 shows the best favorable results as compared to the seed grid No. 3 or the conventional one. Seed grid No. 2 exhibited the best lint grade, upper half mean length and fiber uniformity index besides it shows the lowest non-lint content and short fiber content. However, both the seed grid No. 2 and No. 3 gave better favorable fiber properties than the control one. This could be due to the effect of the higher spacing area and the wider spacing between the grid fingers of grid No. 2 as compared to grid No. 3 or the conventional grid.

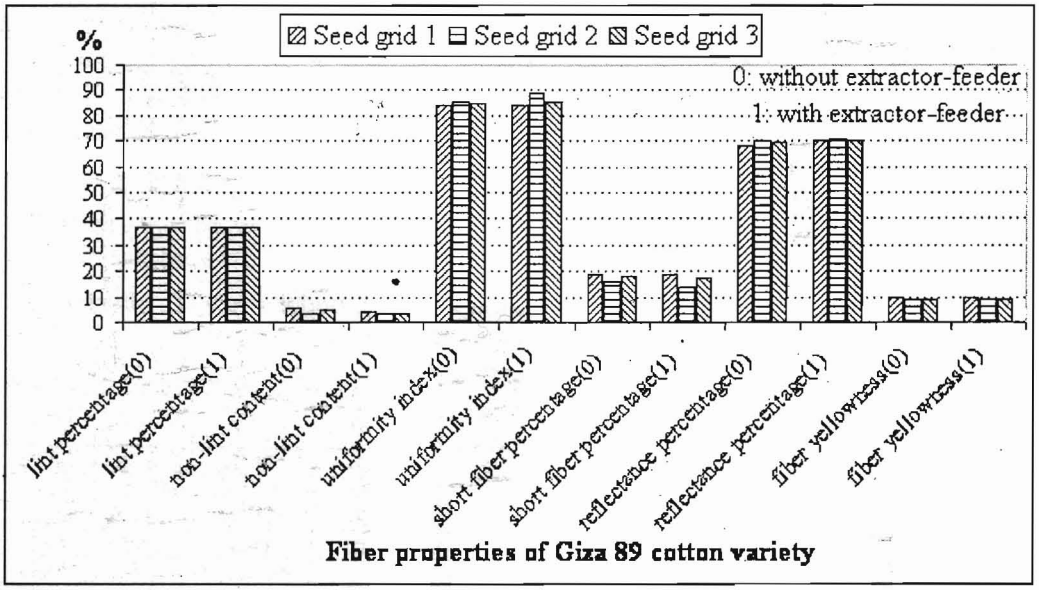
3. Effect of the extractor-feeder conjoined with the modified seed grid on ginned fiber quality

From table 2 and Fig. 3 it could be seen that using the extractor-feeder with the seed grid No. 2 exhibited the highest favorable fiber properties. The results indicated that using the extractor-feeder with the seed grid No. 2 exhibited the highest lint grade (G+⅜) as compared to the control treatment. This improvement in lint grade

could be attributed to the effect of the extractor-feeder in opening small seed cotton locks for more trash extraction besides getting rid of non-fluffy (defective) locks, which drop down through the concave screen of the extractor-feeder and the clearance between the fingers of the seed grid during handling the seed cotton. However, the improvement in lint grade resulted from handling seed cotton by the extractor-feeder was 3.9%, while the improvement in lint grade was 4.1% as a result of using the seed grid No. 2, while the improvement in lint grade resulted from using the extractor-feeder conjoined with the seed grid No. 2 was 4.9%. Meanwhile, using the extractor-feeder with the seed grid No. 2 exhibited the lowest non-lint content (3.2%) as compared to the control one (4.9%). This result could be explained by the fact that the cotton varieties contain considerable percentage of trash and non-fluffy (defective) seed cotton locks are more liable to drop down such trash and locks through the concave screen of the extractor-feeder and the space between the fingers of the seed grid during handling the seed cotton, consequently, lint percentage decreased. On average, the results show that using the extractor-feeder with the seed grid No. 2 exhibited the highest upper half mean length and uniformity index (32.3 mm and 86.9%, respectively) as compared to the control one (29.7 mm and 83.9%, respectively). The increase could be probably, ascribed to the removal of unopened immature seed cotton locks during seed cotton cleaning by the extractor-feeder and through the clearance between the fingers of the seed grid during ginning the seed cotton. Meanwhile, using the extractor-feeder with the seed grid No. 2 exhibited the lowest short fiber percentage (15.8%) as compared to the control treatment (19.3%). A possible explanation for the decrease in short fiber percentage could be probably, ascribed to the removal of trash and unopened immature seed cotton locks by the extractor-feeder and the seed grid. However, using the extractor-feeder with the seed grid No. 2 increased the reflectance percentage from 63.9% (control treatment) to 66.6%. This increase in percent of reflectance due to using the extractor-feeder and the seed grid No. 2 could be ascribed to the removal of a pronounced amount of trash. Meanwhile, the lowest fiber yellowness was obtained (11.2%) as a result of using the extractor-feeder with the seed grid No. 2 as compared to the control treatment (12.1%). This decrease may be due to the extractor-feeder and the seed grid No. 2 getting rid of a considerable proportion of foreign matter mixed with fibers, that led to decrease non-lint content and so the fiber yellowness decreased.

Thus, it could be concluded that using the extractor-feeder conjoined with the seed grid No. 2 significantly preserved the upper half mean length, improved the lint grade, uniformity index, and reflectance percentage, and decreased the lint percentage, non-lint content, short fiber percentage, and fiber yellowness.





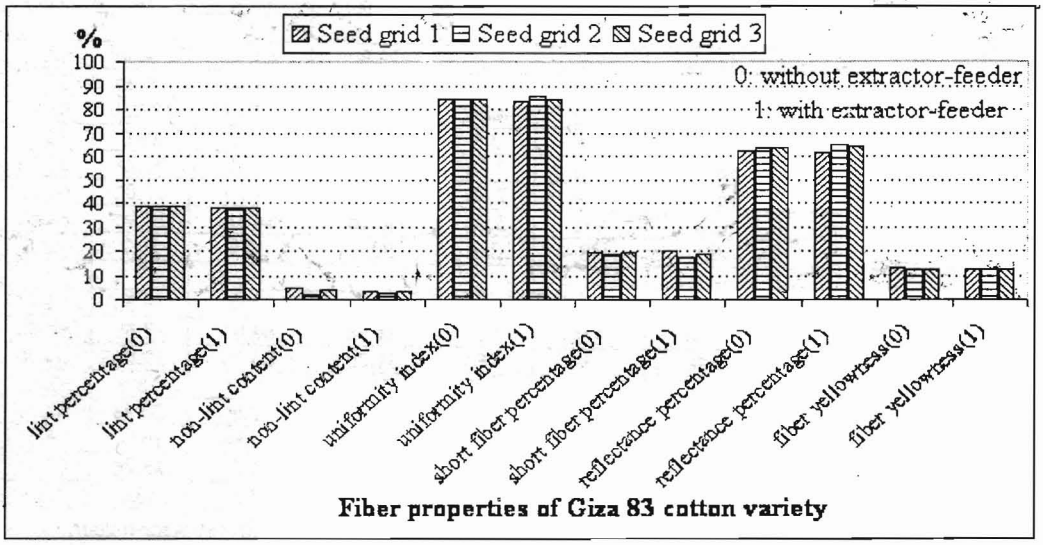


Fig. 3. Fiber properties of some Egyptian cotton varieties as affected by the modified seed grid and the nominate extractor-feeder.

Table 1. Fiber properties of the three cotton varieties, under study, as affected by the nominate extractor-feeder and the modified seed grid.

Treatment	Lint percentage (%)	Lint grade index	Non-lint content (%)	Fiber length parameter			Lint color	
				UHM (mm)	UI (%)	SFI (%)	Rd %	+b
Extractor feeder*								
0	38.3a	42.1b	4.0a	30.7a	84.3a	18.5a	65.0b	11.7a
1	37.9b	42.6a	3.6b	31.0a	85.0a	17.9a	65.8a	11.4b
Seed grid**								
1	38.2a	42.2b	4.6a	29.8c	83.7b	19.5a	64.4b	11.9a
2	38.0c	42.7a	3.0b	32.0a	85.9a	16.7c	66.3a	11.3b
3	38.1b	42.2b	3.9a	30.8b	84.5b	18.4b	65.6a	11.5b
Variety								
G89	36.8c	42.3a	4.3a	31.5a	85.5a	17.2b	69.8a	9.3b
G83	38.3b	42.5a	3.4b	30.1b	84.3b	18.8a	63.2b	12.6a
G91	39.2a	42.2a	3.7b	31.1a	84.3b	18.6a	63.2b	12.8a
Mean	38.1	42.4	3.8	30.9	84.7	18.2	65.4	11.6

*Extractor-feeder 0: without extractor-feeder and **Extractor-feeder 1:** with extractor-feeder.

Seed grid No. 1 (conventional): 9 mm. finger width, 9 mm. spacing between fingers and 48.5% spacing area, **seed grid No. 2:** 5 mm. finger width, 11 mm. spacing between fingers and 66.9% spacing area and **seed grid No. 3:** 5 mm. finger width, 9 mm. spacing between fingers and 61.3% spacing area.

Table 2. Fiber properties of the three cotton varieties, under study, as affected by the nominate extractor-feeder with the modified seed grid.

Variety	EF*	Seed grid**	Lint percentage (%)	lint grade index	Non-lint content (%)	Fiber length parameter			Lint color	
						UHM (mm)	UI (%)	SFI (%)	Rd %	+b
Giza 89	0	1	37.1a	42b	5.5a	30.2b	84.1b	18.9a	68.2c	10.0a
		2	36.8a	43a	3.5c	32.3a	85.6a	16.3b	70.0a	8.9b
		3	37.0a	42b	5.0b	30.4b	84.7b	18.0a	69.3b	8.9b
	mean		37.0	42.3	4.7	31.0	84.8	17.7	69.2	9.3
	1	1	36.6a	42b	4.2a	30.3c	84.3c	18.8a	70.4a	9.4a
		2	36.5a	43a	3.6b	34.1a	88.9a	13.6c	70.5a	9.1a
		3	36.6a	42b	3.8ab	31.4b	85.4b	17.6b	70.4a	9.2a
	mean		36.6	42.3	3.9	31.9	86.2	16.7	70.4	9.2
Giza 83	0	1	38.6a	42a	4.7a	28.8c	83.9a	19.5a	62.0b	13.1a
		2	38.3a	42a	1.8c	31.0a	84.4a	18.4b	63.5a	12.6b
		3	38.5a	42a	4.0b	30.3b	84.1a	19.0ab	63.2a	12.6b
	mean		38.5	42	3.5	30.0	84.1	19.0	62.9	12.8
	1	1	38.2a	43a	3.7a	29.0c	83.3b	20.2a	61.4b	12.5a
		2	38.0a	43a	2.8b	31.2a	85.8a	17.0c	64.7a	12.2a
		3	38.1a	43a	3.3a	30.1b	84.1b	18.9b	64.4a	12.5a
	mean		38.1	43	3.3	30.1	84.4	18.7	63.5	12.4
Giza 91	0	1	39.5a	42a	4.5a	30.2c	83.6b	19.5a	61.5c	13.2a
		2	39.2a	42a	3.1c	31.8a	84.8a	17.8b	64.5a	12.8a
		3	39.4a	42a	3.6b	31.2b	83.7b	19.0a	63.0b	13.1a
	mean		39.4	42	3.7	31.1	84.0	18.8	63.0	13.0
	1	1	39.1a	42b	4.1a	30.3b	82.8c	20.2a	62.7b	12.9a
		2	39.0a	43a	3.1c	31.5a	85.9a	16.8c	64.6a	12.2b
		3	39.1a	42b	3.6b	31.4a	84.7b	18.0b	63.1b	12.4b
	mean		39.1	42.3	3.6	31.1	84.5	18.3	63.5	12.5

*Extractor-feeder 0: without extractor-feeder and **Extractor-feeder 1:** with extractor-feeder.

Seed grid No. 1 (conventional): 9 mm. finger width, 9 mm. spacing between fingers and 48.5% spacing area, **seed grid No. 2:** 5 mm. finger width, 11 mm. spacing between fingers and 66.9% spacing area and **seed grid No. 3:** 5 mm. finger width, 9 mm. spacing between fingers and 61.3% spacing area.

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تأثير المغذي-المنظف ومشط البذرة المحور على جودة القطن

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أجري هذا البحث لدراسة تأثير المغذي-المنظف (السابق تصميمه محليا)* ومشط البذرة ذي عرض الأصبع ٥ مم والمسافة بين الأصابع ١١ مم والمساحة الفراغية ٦٦,٩٪ (السابق تحويره)** على جودة الشعر المحلوج لثلاث أصناف من القطن المصري، هي: جيزة ٨٩، جيزة ٨٣، وجيزة ٩١ (رتبة كل منها جود+٤/١). وقد أسفرت الدراسة عن أن كل من المغذي–المنظف ومشط البذرة السابق الإشارة إليهما عندما يعملان معا لهما تأثير معنوي على نسبة العوادم ، وصفات التيلة ، ورتبة القطن الشعر لجميع الأصناف المستخدمة في الدراسة.

وقد أوضحت النتائج أن استخدام المغذي–المنظف مع مشط البذرة السابق الإشارة إليه قد حققا معا أعلى رتبة للشعر وأديا إلى تحسين كل من طول التيلة ونسبة انتظام ودرجة لمعان الشعر مقارنة بالتغذية اليدوية مع مشط البذرة التقليدي ذي عرض الأصبع ٩ مم والمسافة بين الأصابع ٩ مم والمساحة الفراغية ٤٨,٥٪ (معاملة المقارنة). كما حقق المغذي–المنظف مع مشط البذرة المحور أقل نسبة للمواد الغريبة والشعيرات القصيرة، ودرجة اصفرار الشعر مقارنة بمعاملة المقارنة. الأمر الذي أدى إلى تحسين رتب الشعر بنسبة ٣,٩٪ نتيجة لاستخدام المغذي–المنظف، وإلى نسبة ٤,١٪ نتيجة لاستخدام مشط البذرة المحور، بينما ارتفعت نسبة التحسن إلى ٤,٩٪ نتيجة لاستخدام المغذي–المنظف مع مشط البذرة السابق الإشارة إليه معا.

لهذا يمكن القول إنه باستخدام المغذي-المنظف مع مشط البذرة المحور ذي المساحة الفراغية العالية والمسافات الأوسع بين أصابع المشط (السابق الإشارة إليهما) يمكن بهما معا المحافظة على طول التيلة، وتحسين كل من رتبة الشعر ونسبة انتظامه ودرجة لمعانه، وتقليل كل من نسبة المواد الغريبة ونسبة الشعيرات القصيرة ودرجة اصفرار الشعر.

أي أنه باستخدام المغذي–المنظف والمشط المحور السابق الإشارة إليهما معا يمكن تحسين صفات الشعر المحلوج تحسينا مرضيا.

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