IMPACTS OF BALING PRESS AT GINS ON COTTON QUALITY

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Abstract

The performance of cotton baling press used (bale press *type HUTA KROL model NP. 30*) in Egyptian scutchers was evaluated. This bale press was determine the influence of bale weight (kg), bale volume (m^3), bale density (kg/m^3), bale press capacity (bale/h), power requirement (kw), total bale press cost requirement were investigated. Also, all of staple length 2.5%(mm), staple length 50%(mm), strength(g/tex), elongation (%), lint grade(degree) and trash content (%) were evaluated and tested at four levels of lint moisture content of 11.2, 9.8, 8.7 and 7.3% d.b, three levels of tramper strikes of 7, 10 and 14 stroke/bale and four levels of piston compressor of 1422, 1765, 2206 and 2600 N/cm^2. The obtained results show that, the highest value of bale weight and bale volume were 400 kg and 0.757m^3, the highest value of bale density was 552.5 kg/m^3 and the maximum value of productivity was 1400kg/h. also, minimum value of power required was 11.9kw and minimum value of total bale press cost requirement was 141L.E/h. On other hand, results found that studying the characteristics of lint cotton quality at bale press was clear that all the qualities were good to production bales of cotton press when moisture content was less than 11.2% d.b, and more than 7.3% d.b.

Key words*: - bale press, bale weight, bale volume, bale density, bale press capacity, cotton quality.*

INTRODUCTION

Ginning is the process of separation of fiber from cotton seed and bale packing is the final step in processing cotton at the gin. A hydraulic press is a machine using cylinder to generate a compressive force. Cotton fibers pressed to bales by using hydraulic pressing machine. There is a lot of research that has been conducted to determine the effective of baling press at gins on productivity and cotton technical specifications such as *Reed (2002)* provided two hypothetical cases where moisture restoration gave added value to the ginned cotton without grade reduction penalties. An additional incentive to making up the moisture lost during ginning is that this may decrease the conditioning time set aside at the mill for moisture regain. *Agrawal et al. (2003 a)* told that, the size of bale was designed to suit the size of rail wagon ship container and its convenience in handling. Since then, same lint cotton-baling press machines are used with little modifications, they noticed also that, It is found that high-density lint cotton affects further processing in textile mills. Further if bales are

stored for a longer period, the quality of fiber deteriorates. *Agrawal et al. (2003b)* reported that, the process of compressing lint cotton to form a bale is a very complex phenomenon. The independent variables in the process are the bale size (width and length of the package), initial weight of the lint cotton, cotton fiber length, moisture content and basic cotton ingredients which are geographical area specific, like fineness, strength, maturity etc. A typical hydraulic press consists of a pump which provides the motive power for the fluid, the fluid itself which is the medium of power transmission through hydraulic pipes and connectors, control devices and the hydraulic motor which converts the hydraulic energy into useful work at the point of load resistance *(Sharma 2005). Osama Bedair (2010)* their aim was to present an efficient numerical procedure for dynamic analysis of box girders with tee stiffeners utilizing unconstrained optimization techniques. The procedure can be utilized in the industry very effectively for the analysis of box girders. The potential energy of the structure is expressed in terms generalized functions that describe the longitudinal and transverse displacement profiles. The problem is then converted into unconstrained optimization in which mathematical programming techniques are employed to determine the magnitude of the lowest natural frequency and the associated mode shape for pre-selected geometric parameters. *Byler (2004)* reported that, the setting of consistent industry approaches to moisture measurement, and moisture instrument calibration and validation, to ensure industry application of defined levels of moisture during ginning, lint cleaning and baling. It is important that bale moisture is properly managed as bales pressed with more than 7.5% moisture will degrade in quality, particularly over extended storage periods. Moisture levels at the bale press should be recorded and archived for each bale. *Sumaila and Ibhadode (2011)* gave the procedure for designing and manufacturing of a 30-ton hydraulic press. The initial dimension for cylinder and the load were assumed to be 150 mm and 300 kN load respectively. Cylinder end-cover plate, bolt, cylinder flange, piston, seals were designed using standard design procedure. The machine was then subjected to a load of 10 kN provided by two compression springs of constant 9N/mm each arranged in parallel between the plates. The springs were then compressed axially to a length of 100 mm. This arrangement was left to stand for two hours and was observed for leakages. Leakage in the system was not indicated as the lower plate did not fall from its initial position. *Jeronimo et al. (2013)* made new technologies have been incorporated into the Brazilian cotton production system, in order to verticalize the production through processing, allowing the producers or associations to add value to their production. Thus, the present study aimed to develop and evaluate processing equipment composed of mobile gin and baler press.

The ginner consists of cleaner, saw cylinder, cylinder brushes, condenser and coil. The baler press is constituted of pressing sheets, hydraulic cylinders, hydraulic pump, control valve actuation, devices for filtering hydraulic oil and manometer. These devices are mounted on a trailer chassis composed of U-shaped angle iron chassis, four wheels (rim 13), shaft ends, two beams of five springs, steel sheet backing and braking system. In the evaluation and validation of the whole system by the cotton growers, this machine received the concept "very good" concerning efficiency of ginning, the bale weight, and the obtained fiber quality. The quality of fiber obtained with set ginner and baler press meet the standards of the textile industry. *Delhom and Rodgers (2016)* reported that, moisture is an important attribute in the trade of cotton due to not only its impact on bale weight but also the potential impacts on fiber quality and processing. Fiber moisture is important in all aspects of cotton production, from moisture content of the seed cotton during harvesting, storage and ginning through warehousing, shipping and textile processing. Excessively high moisture content can lead to deterioration of seed cotton quality and cause discolored lint and spoiled seed. However, low moisture content of seed cotton can lead to fiber breakage and an overall reduction in fiber quality during harvesting and ginning. Ginners must control the moisture content of cotton carefully to facilitate cleaning and ginning while minimizing fiber damage. Moisture content of the ginned lint is important as too low of a moisture content requires excessive energy at the bale press and too high a moisture content can lead to deterioration of the fiber quality during storage from microbial activity. *Nomeer (1996)* reported that cotton grade is a complex idiom for color, trash content, foreign matter and factors related to cotton preparing, equipping and the effects on appearance and quality for resulting cotton. He added to that, Egyptian cotton classify into main seven grades this: Extra (E), Fully Good (F.G.), Good (G), Fully Good Fair (FGF), Fully Fair (FF), Good Fair (GF) and Fair (F). Then it is classify into half grade such as: Extra – ¼, F.F + ¼, FG – ¼, G + ¼, G-¼ … Etc. *The objective of this study was done to determine the optimal conditions for the cotton bale packing operation and to study effects of cotton fiber moisture content, piston pressure and the number of strikes on bales productivity and characteristics of cotton fiber quality, also study the specifications of output bales.*

MATERIALS AND METHODS

Bale packaging is the final step in processing cotton at the gin and this study was conducted at fundamented seed gin in Sakha - Kafrelsheikh governorate during ginning seed cotton varity of Giza 98 season 2016/2017 on bale press *type HUTA KROL model NP. 30* for estimating the impacts press on the lint cotton quality

properties and specifications of resulting cotton bales. Some of lint quality properties for the experimental gin cotton before press process are given in Table1

Table 1 . Some of lint quality properties for Giza 98 varity before press process.

cotton lint properties items	Mean lint moisture content value			
	11.2	9.8	8.7	7.3
Staple length, 2.5%, mm	42	41.5	41.2	40.6
Staple length 50%, mm	20.7	20.3	20.0	20.0
Strength, g/tex	30.5	30.3	30.0	29.8
Elongation, %	5.1	5.4	5.7	6.0
Lint grade	F.G.+1/8.	F.G.	F.G.- 1/8.	F.G./G.
Trash content, %	0.7	0.88	0.93	1.1

A) Cotton baling press used (*A Universal Density (UD) Bale Press*)

The cotton bale press consists of a frame, hydraulic rams, and a hydraulic power system. Hydraulic compressor locks for the doors give positive locking. The unlocking operation opens all press door simultaneously, making the entire bale accessible for tying out and handling. Bale presses are described primarily by the density of the bale that they produce, such as low. Density (flat or modified flat) universal density gin or compress. Hydraulic compressor locks for the doors give positive locking. The unlocking operation opens all press door simultaneously, making the entire bale accessible for tying out and handling. Safety inter-locks are provided so that the tramper foot and ram platen remain locked clear of the revolving boxes until the boxes are securely locked in place. The baling box construction is unique and unconventional. Bale ties are applied through slots in the side walls, the ram backs off to tension the ties. Where, most gins in Egypt use a double-press box for packaging the cotton into bales. The lint drops into one press box and fills it while a bale is being pressed and strapped in the other box. approximately 370 kilograms of cotton is pressed into a bale before it is wrapped with a cover and strapped. Fig. 1 shown The main parts of used cotton bale press and specification are showed in Table 2.

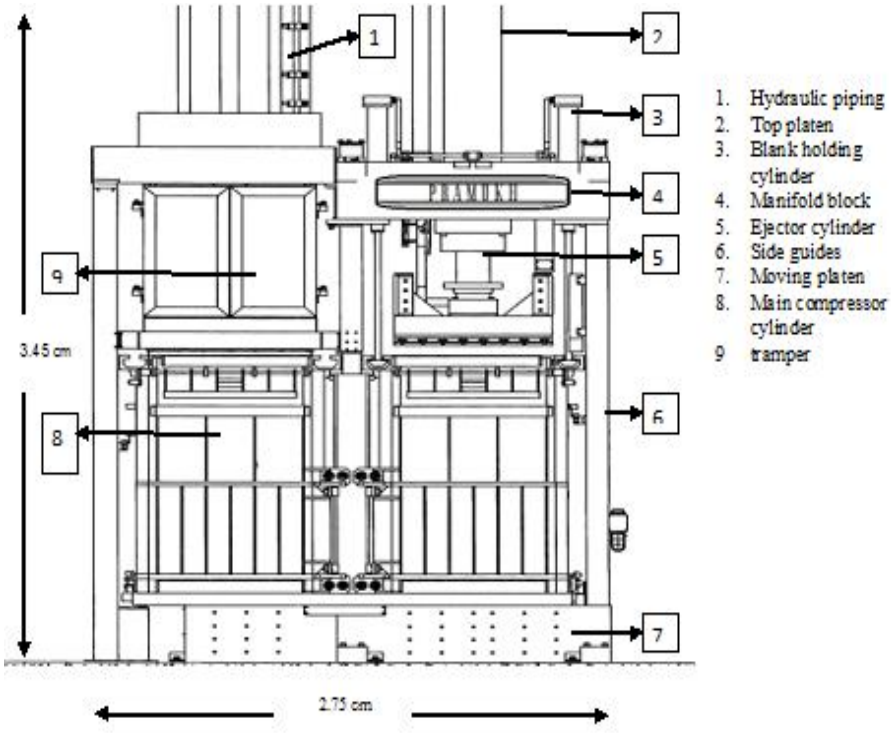

Fig. 1. Schematic diagram of hydraulically operated up packing cotton lint baling press.

Table 2. Specification of press machine

SR. NO	Specification	Capacity	
1	Type	*HUTA KROL model NP. 30*	
2	Application	Metal Forming	
3	Rated Nominal Compressor:	600 KN	
4	Ram Stroke Length	700 mm	
5	Weight of the press machine	15000 KN	
6	Motor Power	30 KW	
7	Work Table size	1500 × 1200 mm	
8	Opening height	600 mm	
9	Knock Out Force	500 KN	
10	Power source	Hydraulic	
11	Slide Speed	Idle Stroke	100 mm/s
		Pressing	5-10 mm/s
		Return	60 mm/s
12	Ejecting Speed	Eject	50 mm/s
		return	150 /s
13	Productivity (by the cotton material)	1.5 - 2 t/h	

Investigated variables:

The present study was carried out to evaluate the effect of lint moisture content, tramper strikes, piston compressor on the lint cotton quality properties and

specifications of resulting cotton bales during the impacts press. The following procedures were taken for evaluation test:

1- Four levels of cotton lint moisture content of 11.2, 9.8, 8.7 and 7.3 % d.b, were used in this study.
2- Three levels of tramper strikes of 7, 10 and 14 stroke/bale were used in this study.
3- Four levels piston compressor of 1422, 1765, 2206 and 2600 N/cm² were used in this study. Also, treatments were replicated three times at each level of the experiment.

MEASURING PROCEDURES :

* Moisture content determination method :

is This done by dividing used seed cotton into four groups and then moistening the cotton bags before boiling using water spray once, twice, three or four times a day to obtain different samples in their wet content when performing the experiment Where each time about 3 liters of water on ten qentars were drained into the storage area. Thermal methods involve heating a pre-weighed fiber sample to dryness for a prescribed period and then weighing the dried sample. Its were determined with using the oven method according to (Ashrae, 1999) the following formula was used for determination:

$$\text{Moisture content} = \frac{M1 - M2}{M2} \times 100 \text{ , \%} \quad \text{.....(1)}$$

Where: M1 = moist mass, g ; and M2 = dry mass, g.

As the maximum hydraulic compressor is known for each case, the compression force exerted by the ram can be computed by the following equation *(Zewei et al., 2015):*

Force = 3.141 (r)² (H) 2

where:

r = radius of the ram in centimeters, and

H = maximum hydraulic compressor in kilogram per square centimeter.

*** Bale density :**

The densities of the bales after they had been wrapped in bale coverings ties, and removed from the press(i.e., the "tied out" density). To compute the in press density, the tied out density may be converted by the following equation *(Zewei et al., 2015):*

Density (in press) = W / A P 3

where:

W = bale weight in kilograms,

A = cross sectional area of the press box in square centimeters, and

P = minimum platen separation in centimeters.

*** Cotton lint trash:**

Cotton lint trash content was determined by means of a fractionator instrument with a sample of 150g. It can be determined as a percentage of trash content using the formula of *Youssef, in Arabic (1992):*

$$Trash\ content, \% = {\Sigma T_w}/{W_o} \quad \text{.....4}$$

Where;

ΣT_w is the sum of trash content masses, g and

W_o is the total mass of original sample, g.

Trash content output was collected, massed and re-separated into fiber and fiber foreign matter. The percentage of cotton wastage was calculated based on the collected cotton fiber in the sample to the total mass of sample.

- **Determination of cotton lint technology properties :**

1- Staple length

Cotton lint 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 determine (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).*

2- **Strength and elongation**:

Cotton lint strength (*g/tex*) was measured using Stelometer instrument according to ASTM, designated D-1445-75, 1984. This instrument give elongation reading and hence cotton length strength can be determined using the formula of *Nomeir, in Arabic (1996):*

$$Strength\ for\ length\ unit = 1.5\, x \frac{W_c}{W_s} x 100, \% \quad \text{..... 5}$$

Where;

W_c is the cutting mass, kg and

W_s is the total mass of sample, mg.

3- **Cotton lint grade**:

Determined by lint testing laboratory, CRI, ARC, Gaza, By using classify method. It is done by a three cotton classers. The grade was estimated pre-after ginning process.

- **Data 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

Practical bales specifications:-

1- Bale weight

Results indicated that, bale weight was decreased with decreasing of lint moisture content from 11.2 to 7.3 % and it increased with increasing tramper strikes from 7 to 14 stroke/bale while piston compressor had no effect. As shown in Fig. 2. The maximum bale weight value of 400 kg was recorded with lint moisture content of 11.2% d.b, and tramper strikes of 14 stroke/bale. Whilst, the minimum bale weight value of 254 kg was recorded with lint moisture content of 7.3% d.b, and tramper strikes of 7 stroke/bale. These results since it at higher moisture content of the cotton lint increases the value of its weight and increase the number of strikes is increasing push cotton lint and increases compressor inside the cotton bale and thus increase bale weight. While increasing piston compressor was had no effect on bale weight

2- Bale volume

Results as shown in Fig. 3 represent, the effect of lint moisture content, tramper strikes and piston compressor on bale volume. Where, bale volume was had directly proportional with increasing both of lint moisture content and tramper strikes while it was had inversely proportional with increasing piston compressor. Results noticed also that, maximum bale volume of 0.757 m^3 was recorded at lint moisture content of 11.2% d.b, tramper strikes of 14 stroke/bale and piston compressor of 1422N/cm^2. While, minimum bale volume of 0.612 m^3 was recorded at lint moisture content of 7.3%d.b, tramper strikes of 7 stroke/bale and piston compressor of 2600 N/cm^2. And that's where the high moisture content in lint cotton leads to increased water content in cotton and consequently cotton volume, also increasing the number of tramper strikes increase the amount of cotton in the bale and also increasing bale pressure increases bale volume

3- Bale density

From results as shown in Fig. 4 it is clear that, decreasing of lint moisture content from 11.2 to 7.3% led to decreased bale density while increasing of tramper strikes from 7 to 14 stroke/bale and piston compressor from 1422 to 2600 N/cm^2 led to increase of bale density. Results found also that, maximum bale density of 552.5 kg/m^3 was recorded at lint moisture content of 11.2% d.b, tramper strikes of 14

stroke/bale and piston compressor of 2600 N/cm². While, minimum bale density of 372.9 kg/ m³ was recorded at lint moisture content of 7.3%d.b, tramper strikes of 7 stroke/bale and piston compressor of 1422 N/cm². It is known that the bale density determines Exterior bales as uniformity and extent of unsustainable shocks without disintegrating so whenever they are high-value bale density meant that bale in a better position.

4- Bale press capacity and productivity

The average values of bale press capacity in hour are shown in Fig. 5. It is clear that bale press capacity increased with increasing of tramper strikes while both of lint moisture content and piston compressor did not have a clear impact on bale press capacity. The results showed that the number of hesitant strikes that were affecting the number of bales produced, where it is smaller the number of strikes within the same bale was the production of a larger number of bales, but this was at the expense of bale weight. Where bales are produced faster, but less weight on the other consisting of a large number of strikes. So, maximum of bale press capacity was 5 bales/h produced at tramper strikes of 7 stroke/bale and minimum of 3 bales/h was produced at tramper strikes of 14 stroke/bale. On other hand, results as shown in Fig. 6 illustrated that, productivity in hour was increased with increasing both of lint moisture content and tramper strikes while piston compressor had no effect on productivity. Results noticed also that, maximum value of productivity of 1400 kg/h recorded at moisture content of 11.2% d.b., and tramper strikes of 14 strike/ bale. While, minimum value of productivity of 1080 kg/h recorded at moisture content of 7.3% d.b., and tramper strikes of 7 strike/ bale, respectively.

5- Power required

Results in Fig. 7 illustrate that power requirement was decreased with decreasing lint moisture content from 11.2 to 7.3 % d.b, while it was increased with

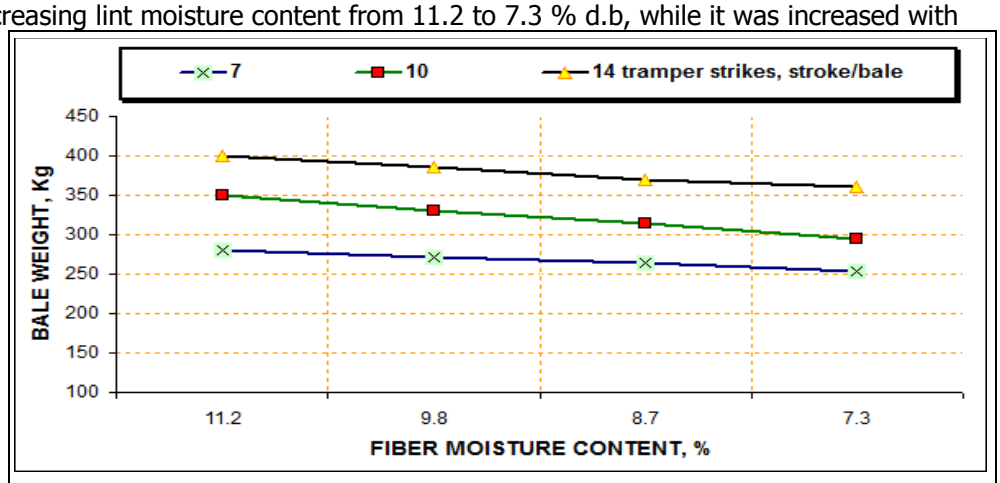

Fig. 2. Effect of fiber moisture content on bale weight at tramper strikes number.

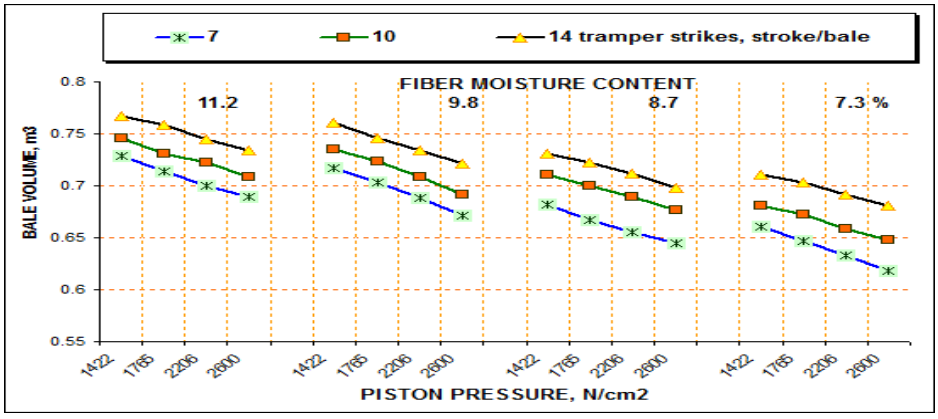

Fig. 3. Effect of piston pressure on bale volume at fiber moisture content and tramper strikes.

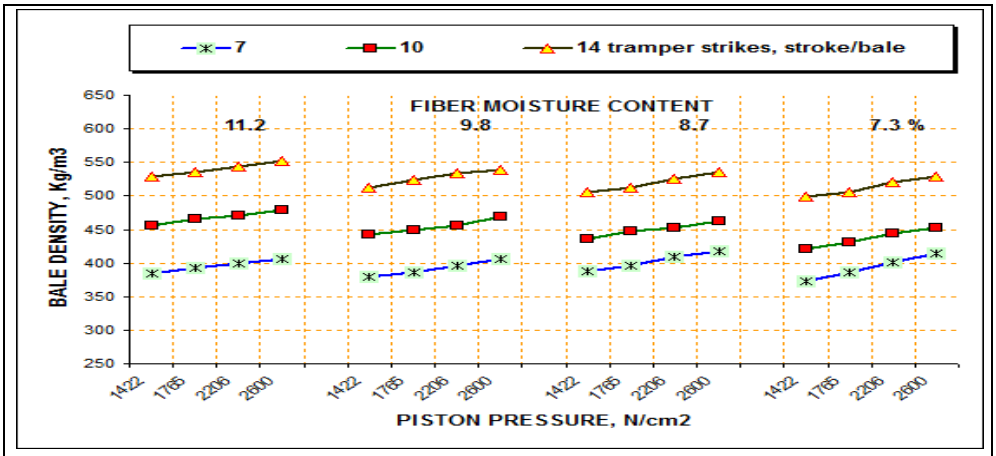

Fig. 4. Effect of piston pressure on bale density at fiber moisture content and tramper strikes.

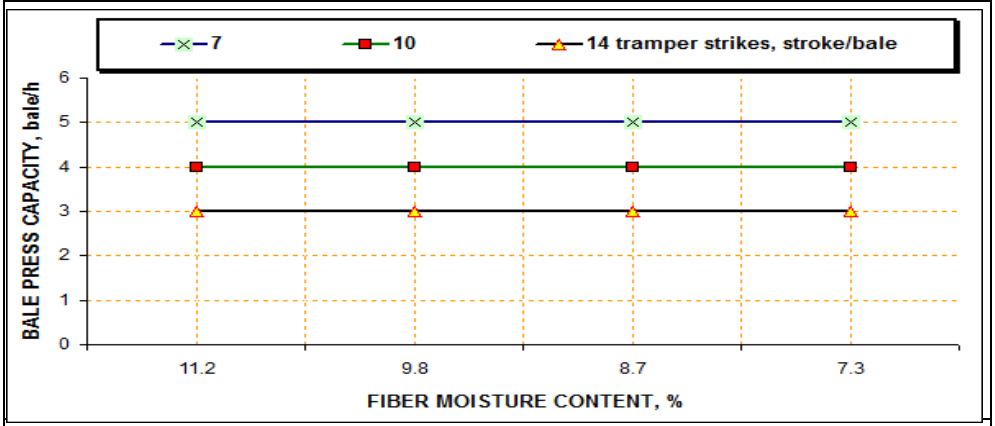

Fig. 5. Effect of fiber moisture content on bale press capacity at tramper strikes.

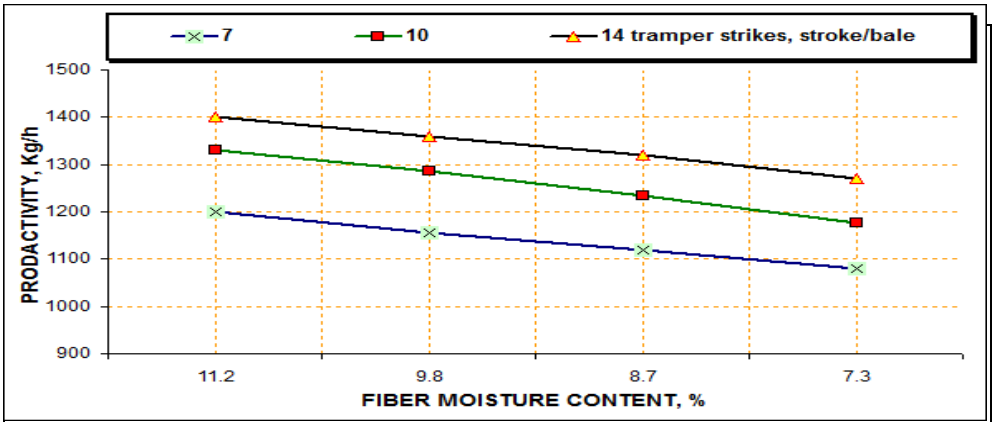

Fig. 6. Effect of fiber moisture content on cotton press productivity at tramper strikes.

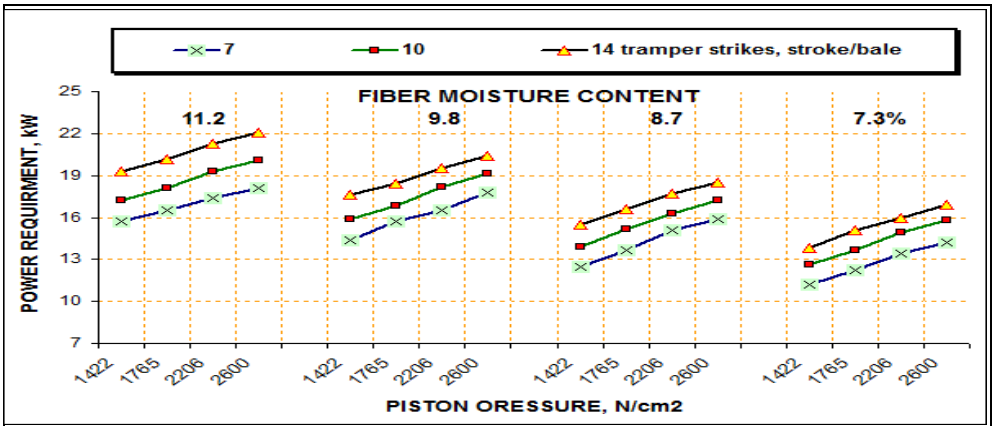

Fig. 7. Effect of piston pressure on power requirement at fiber moisture content and tramper strikes.

increasing both of tramper strikes from 7 to 14 stroke/bale and piston compressor from 1422 to 2600 kg/ cm² at bale press. It is found that, the lowest power requirements value for bale press was 11.9 kW recorded at lint moisture content of 7.3% d.b, tramper strikes of 7 stroke/bale and piston compressor of 1422 N/cm². While the maximum power requirements value of 22.5kW recorded at lint moisture content of 11.2% d.b, tramper strikes of 14 stroke/bale and piston compressor of 2600 N/cm², respectively.

6- Total bale press cost requirement

Results in Fig. 8 explain that, total bale press cost was decreased with decreasing of lint moisture content from 11.2 to 7.3 %d.b, while it was increased with increasing of tramper strikes from 7 to 14 stroke /bale and piston compressor from 1422 to 2600 N/cm². Results also show that, the lowest value of total bale press cost

requirement was 141.0 L.E/h recorded at lint moisture content of 7.3%, tramper strikes of 7 stroke/bale and piston compressor of 1422N/cm². While the highest value of total bale press cost requirement was 240.3 L.E/h recorded at lint moisture content of 11.2%, tramper strikes of 14 stroke/bale and piston compressor of 2600 N/cm², respectively.

B) Characteristics of lint cotton output

1- Bale press staple length 2.5% and staple length 50%

Results as shown in Fig. 9 and Fig. 10 indicated that, both of bale press staple length 2.5% and bale press staple length 50% were decreased with decreasing lint moisture content from 11.2 to 7.3% d.b. and with increasing tramper strikes from 7 to 14 stroke/bale and piston compressor from 1422 to 2600 N/cm², respectively. Results indicated also that, maximum value of bale press staple length 2.5% and bale press staple length 50% were 41.3 and 20.3 mm respectively, recorded at lint moisture content of 11.2%, tramper strikes of 7stroke/bale and piston compressor of 1422 N/cm². While minimum value were 37.3 and 17.7 mm respectively, recorded at lint moisture content of 7.3%, tramper strikes of 14 stroke/bale and piston compressor of 2600 N/cm².

2- **Bale press strength lint and bale press elongation lint**

Results as shown in Fig. 11 indicated that, lint strength in bale press was decreased with deceasing lint moisture content from 11.2 to 7.3 % d.b, while it was increased with increasing tramper strikes from 7 to 14 stroke/bale and with increasing piston compressor from 1422 to 2600 N/cm². Results noticed also that, maximum value of lint strength in bale press was 30.1 g/tex recorded at lint moisture content of 11.2 % d.b, tramper strikes of 7 stroke/bale and piston compressor of 1422 N/cm². While, minimum value was 23.6 g/tex recorded at lint

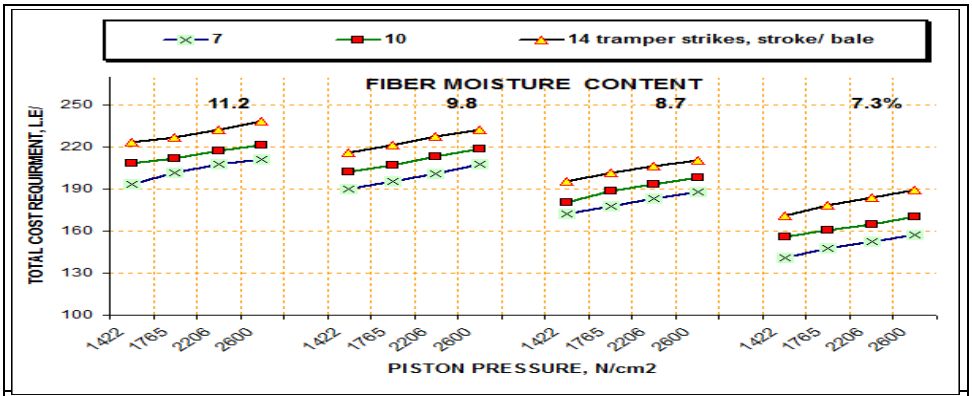

Fig.8. Effect of piston pressure on total cost requirement at fiber moisture content and tramper strikes.

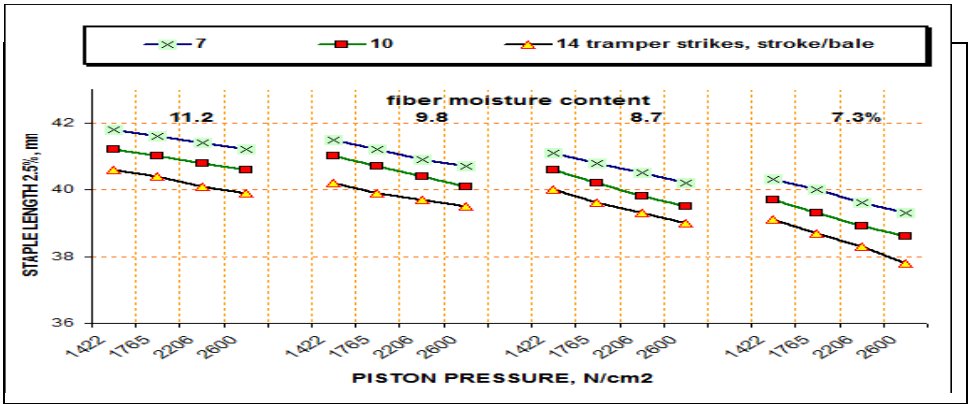

Fig.9. Effect of piston pressure on staple length 2.5% at fiber moisture content and tramper strikes.

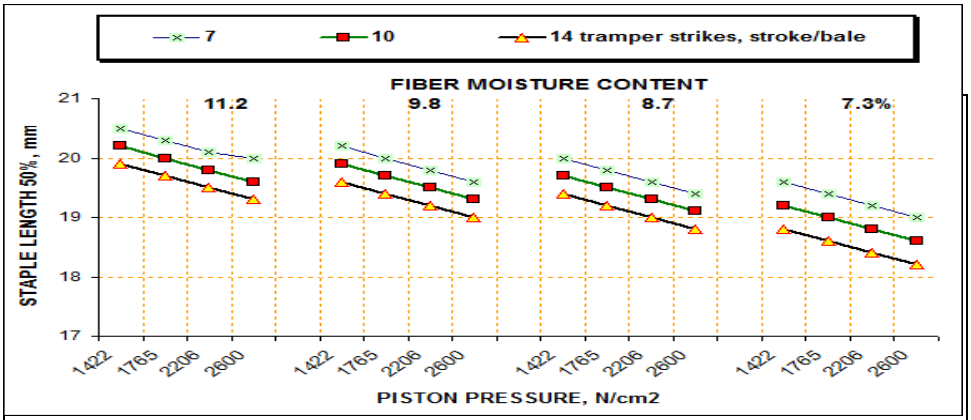

Fig. 10. Effect of piston pressure on staple length 50% at fiber moisture content and tramper strikes.

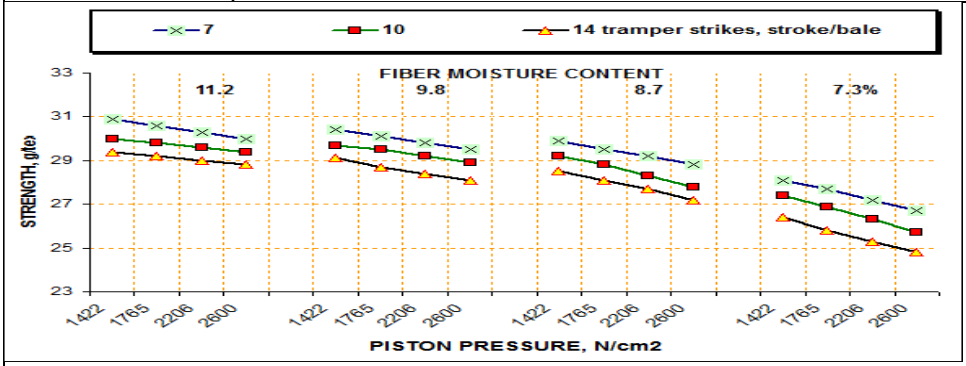

Fig.11. Effect of piston pressure on lint strength at fiber moisture content and tramper strikes.

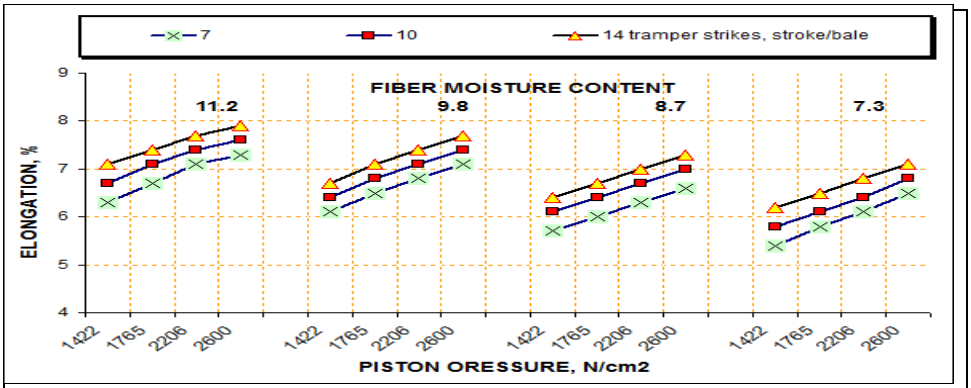

Fig. 12. Effect of piston pressure on lint elongation at fiber moisture content and tramper strikes.

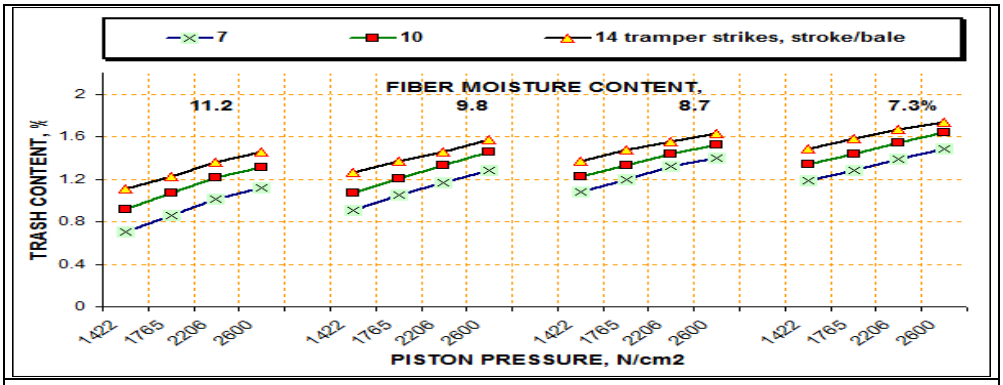

Fig.13. Effect of piston pressure on lint trash content at fiber moisture content and tramper strikes.

moisture content of 7.3 % d.b, tramper strikes of 14 stroke/bale and piston compressor of 2600 N/cm². On the other hand, results in Fig 12 illustrated that, lint elongation in bale press was increased with decreasing lint moisture content from 11.2 to 7.3 %d.b, and increased with increasing of tramper strikes from 7 to 14 stroke/bale and with increasing of piston compressor from 1422 to 2600 N/cm². Also, maximum value of lint elongation in bale press was 7.8% recorded at lint moisture content of 7.3 % d.b, tramper strikes of 14 stroke/bale and piston compressor of 2600 N/cm². While, minimum value was 5.5% recorded at lint moisture content of 11.2 % d.b, tramper strikes of 7 stroke/bale and piston compressor of 1422 N/cm².

3- Lint trash content

It is clear from Fig.13 that, lint trash content was increased with decreasing lint moisture content from 11.2 to 7.3 %d.b, and with increasing both of tramper strikes from 7 to 14 stroke/bale and piston compressor. Results also demonstrated that, the lower value of lint trash content was 0.7% recorded with lint moisture content of

11.2%d.b, tramper strikes of 7 stroke/bale and piston compressor of 1422 N/cm². While, the highest value of lint trash content was 1.94% recorded with lint moisture content of 7.3%d.b, tramper strikes of 14 stroke/bale and piston compressor of 2600 N/cm², respectively.

4-Bale press lint grade

Table 3 illustrated effects of lint moisture content, tramper strikes and piston compressor on bale press lint grade. Where, bale press lint grade was decreased with decreasing of lint moisture content from 11.2 to 7.3 % d.b, and with increasing both of tramper strikes from 7 to 14 stroke/bale and piston compressor from 1422 to 2600 N/cm². Results found that high bale press lint grade value of fully good (FG) recorded at lint moisture content of 11.2%d.b, tramper strikes of 7 stroke/bale and piston compressor of 1422 N/cm². While, the lowest bale press lint grade value of good/fully good fair (G./F.G.F.) recorded at lint moisture content of 7.3%d.b, tramper strikes of 14 stroke/bale and piston compressor of 2600 N/cm². And by studying the characteristics of lint cotton quality at bale press was clear that all the qualities were affected significantly when low lint moisture content of 7.3% d.b, where it was least staple length and strength and the percentage elongation and consequently lint press cotton grade , which was conducive to the reduction of cotton trading prices in this case . On the other hand, results showed also that bale press of cotton at lint moisture content of 11.2% d.b, caused increasing in operating costs and produce cotton lint bales so it is advisable to hold bales of cotton process when moisture content was less than 11.2% d.b, and more than 7.3% d.b,

Table 3 . Bale press lint grade

Lint cotton m.c., %	Piston Compressor, N/cm² / Tramper strikes, Stroke/bale	Lint cotton grades, unit					Grade Change
		1422	1765	2600	2600	Control	
11.2	7	F.G.	F.G. – 1/8	F.G.-1/4	F.G../G.	F.G.+1/8	-
	10	F.G. – 1/8	F.G. - ¼	F.G./G.	G. + ¼	F.G.+1/8	-
	14	F.G. – 1/4	F.G. - ¼	F.G./G	G.+ ¼	F.G.+1/8	-
9.8	7	F.G. – 1/8	F.G.-1/4	F.G /G.	G.+1/4	F.G.	-
	10	F.G.-1/4	F.G /G.	G.+1/4	G. + ¼	F.G.	-
	14	F.G./G.	F.G/G	G. + ¼	G.+1/8	F.G.	-
8.7	7	F.G.-1/4	F.G./G.	G.+1/4	G. + ¼	F.G.-1/8	-
	10	F.G./G.	F.G./G.	G. + ¼	G.+1/8	F.G.-1/8	-
	14	G.+1/4	G. + 1/8	G.	G.	F.G.-1/8	-
7.3	7	F.G./G.	G. + ¼	G.+1/8	G.	F.G./G.	-
	10	G.+ ¼	G.+1/8	G.	G.- 1/8	F.G./G.	-
	14	G.+1/8	G.	G.-1/8	G./F.G.F.	F.G./G.	-

F.G. = Fully Good	G. = Good	F.G.F.= Fully Good Fair
F.F.= Fully Fair	G.F.= Good Fair	F. = Fair

C) Data analysis :

ANOVA of analysis illustrated that arrangement of influence factors were moisture content, %as first of all followed by tramper strikes, stroke/bale later on piston pressure, N/cm². Also A multiple linear regression equation was developed. It had the following formula:

$$E = ao + b1M + b2F + b3S \quad \ldots\ldots (6)$$

Where;

E is the efficiency indicator of prototype, %;

M is the cotton moisture content (%d.b.) ;

F is the tramper strikes, stroke/bale;

S is the piston pressure, N/cm²;

ao is the Y-intercept and

b1,b2 and b3 is the regression coefficients.

Values of the predicted regression coefficients, determination coefficients (R^2) and adjust of determination coefficients (R^2 adj) are listed in Table 4 .

Table 4 . Multiple linear regression equation, describing The performance of cotton baling press and some of lint cotton technology properties.

Indicator	ao	Regression coefficients			R^2	R^2 adj
		b1	b2	b3		
A) performance of cotton baling press						
Bale weight, kg	0.389	+0.310	+0.002	0.000	94.6%	92.4%
Bale volume, m³	0.320	+0.013	+0.030	-0.0001	88.7%	86.5%
Bale density, kg/m³	6.100	+0.042	0.000	+0.210	93.6%	91.1%
Bale press capacity, bale/h	5.610	0.000	-0.320	0.000	95.8%	93.2%
Productivity, kg/h	872.5	+15.73	+19.78	0.000	96.96%	95.1%
Power, kw	17.142	-0.461	+0.372	+0.002	92.16%	88.3%
Total cost, L.E/h	7.512	+9.621	+10.42	+0.002	91.89%	87.1%
B) lint cotton technology properties						
2.5% span fiber length, mm	38.3	+0.18	-0.003	-0.002	97.9%	94.9%
50%span fiber length, mm	17.4	+0.41	-0.002	-0.001	97.7%	94.7%
Strength, g/tex	39.4	+0.36	-0.730	-0.006	85.5%	81.3%
Elongation, mm	3.90	-0.36	+0.091	+0.002	94.6%	92.2%
cotton trash content, %	2.91	+0.36	-0.080	-0.004	95.5%	92.7%

CONCLUSION

Cotton bale press type HUTA KROL model NP30 was tested during baling cotton varity of Giza 98 in SAKHA cotton scutcher. Evaluating the performance included study the effects of lint moisture content, tramper strikes and piston compressor on some of practical bales specifications and some of lint cotton output characteristics. Conclusions of this study include the following:-

1- The maximum bale weight value of 400 kg was recorded with lint moisture content of 11.2% d.b, and tramper strikes of 14 stroke/bale. Whilst, the minimum bale weight value of 254 kg was recorded with lint moisture content of 7.3% d.b, and tramper strikes of 7 stroke/bale.

2- Maximum bale volume of 0.757 m^3 was recorded at lint moisture content of 11.2% d.b, tramper strikes of 14 stroke/bale and piston compressor of 1422 N/cm^2. While, minimum bale volume of 0.612 m^3 was recorded at lint moisture content of 7.3%d.b, tramper strikes of 7 stroke/bale and piston compressor of 2600N/cm^2.

3- Maximum bale density of 552.5 kg/m^3 was recorded at lint moisture content of 11.2% d.b, tramper strikes of 14 stroke/bale and piston compressor of 2600 N/cm^2. While, minimum bale density of 372.9 kg/ m^3 was recorded at lint moisture content of 7.3%d.b, tramper strikes of 7 stroke/bale and piston compressor of 1422 N/cm^2.

4- Maximum of bale press capacity was 5 bales/h produced at tramper strikes of 7 stroke/bale and minimum was 3 bales/h produced at tramper strikes of 14 stroke/bale.

5- Maximum value of productivity of 1400 kg/h recorded at moisture content of 11.2% d.b., and tramper strikes of 14 strike/ bale. While, minimum value of productivity of 1080 kg/h recorded at moisture content of 7.3% d.b., and tramper strikes of 7 strike/ bale, respectively.

6- The lowest power requirements value for bale press was 11.9 kW recorded at lint moisture content of 7.3% d.b, tramper strikes of 7 stroke/bale and piston compressor of 1422 N/cm^2. While the maximum power requirements value of 22.5kW recorded at lint moisture content of 11.2% d.b, tramper strikes of 14 stroke/bale and piston compressor of 2600 N/cm^2,

7- The lowest value of total bale press cost requirement was 141.0 L.E/h recorded at lint moisture content of 7.3%, tramper strikes of 7 stroke/bale and piston compressor of 1422N/cm^2. While the highest value of total bale press cost requirement was 240.3 L.E/h recorded at lint moisture content of 11.2%,

tramper strikes of 14 stroke/bale and piston compressor of 2600 N/cm².

8- Both of bale press staple length 2.5% and bale press staple length 50% were decreased with decreasing lint moisture content from 11.2 to 7.3% d.b. and with increasing tramper strikes from 7 to 14 stroke/bale and piston compressor from 1422 to 2600 N/cm².

9- Maximum value of lint strength in bale press was 30.1 g/tex recorded at lint moisture content of 11.2 % d.b, tramper strikes of 7 stroke/bale and piston compressor of 1422 N/cm². While, minimum value was 23.6 g/tex recorded at lint moisture content of 7.3 % d.b, tramper strikes of 14 stroke/bale and piston compressor of 2600 N/cm².

10- Maximum value of lint elongation in bale press was 7.8% recorded at lint moisture content of 7.3 % d.b, tramper strikes of 14 stroke/bale and piston compressor of 2600 N/cm². While, minimum value was 5.5% recorded at lint moisture content of 11.2 % d.b, tramper strikes of 7 stroke/bale and piston compressor of 1422 N/cm².

11- Lint trash content was increased with decreasing lint moisture content from 11.2 to 7.3 %d.b, and with increasing both of tramper strikes from 7 to 14 stroke/bale and piston compressor.

12- High bale press lint grade value of fully good (FG) recorded at lint moisture content of 11.2%d.b, tramper strikes of 7 stroke/bale and piston compressor of 1422 N/cm². While, the lowest bale press lint grade value of good/fully good fair (G./F.G.F.) recorded at lint moisture content of 7.3%d.b, tramper strikes of 14 stroke/bale and piston compressor of 2600 N/cm².

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تأثير عملية الكبس في المحالج على جودة القطن

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عملية كبس القطن الشعر في المحالج من أهمية حيث أنها المرحلة الأخيرة لمعاملة القطن داخل المحلج قبل تسويقه أو تصنيعه مباشر وتعتبر من أهم العمليات التي تساعد على عمل بالات تناسب عملية نقل و تداول الأقطان و المحافظة عليها من الأتربة والشوائب و أيضا احتفاظها بأشكال و أبعاد منتظمة . و من أشهر أنواع المكابس الموجودة في معظم المحالج المصرية المكبس المائي الهيدروليكي hydraulic press و الذي ينتج بالات منخفضة الكثافة flat bales . و لقد اجري هذا البحث بغرض تحديد الظروف المثلى للتشغيل و دراسة تأثيره على الخواص الطبيعية لألياف القطن الشعر ودراسة مواصفات البالات و الإنتاجية . و قد تم تقدير كل من الخواص البعدية للبالات و كثافة البالة و السعة الإنتاجية لآلة الكبس و التبييل و أيضا أهم خواص الجودة لألياف القطن وذلك أثناء حلج صنف القطن جيزة ٩٨.

وكانت المعاملات التجريبية للدراسة على النحو التالي:

- المحتوى الرطوبى للألياف : يتم إجراء الدراسة عند أربعة مستويات رطوبية كانت ١١,٢ ، ٩,٨، ٨ ,٧ ، ٧,٣ % على التوالي وعلى أساس جاف.
- سرعة الرداخ : يتم إجراء الدراسة عند ثلاثة معدلات هي ٧ ، ١٠ و ١٤ ضربة / بالة.
- ضغط المكبس: حيث يتم إجراء الدراسة عند أربعة مستويات كانت : ١٤٢٢ ، ١٧٦٥ ، ٢٦٠٠ ، ٢٦٠٠ نيوتن / سم٢.

وكذلك دراسة مدى تأثير تلك العوامل على الصفات التالية:

- وزن البالة ، كج
- حجم البالة ، م٣
- كثافة البالة ، كج/م٣
- السعة الإنتاجية لكبس البالات، بالة / ساعة
- احتياجات القدرة كيلووات
- اجمالى التكاليف جنية /ساعة
- طول التيلة عند نسبة توزيع ٢،٥% ، مم
- طول التيلة عند نسبة توزيع ٥٠% ، مم
- المتانة الشعر ، جم/تكس
- نسبة الاستطالة ، %
- نسبة المحتوى من الشوائب ، %
- رتبة جودة الشعر ، درجة

و قد أوضحت الدراسة النتائج التالية :-

١- أقصى وزن للبالة كان ٤٠٠ كجم سجلت عند محتوى رطوبى ١١،٢% و سرعة رداخ ١٤ ضربة/بالة بينما كان اقل وزن للبالة ٢٥٤كجم سجلت عند محتوى رطوبى ٧،٣% و سرعة رداخ ٧ ضربة/بالة.

٢- أقصى حجم للبالة كان ٠،٧٥٧م٣ سجلت عند محتوى رطوبى ١١،٢% و سرعة رداخ ١٤ ضربة/بالة و ضغط مكبس ١٤٢٢نيوتن /سم٢ بينما اقل حجم للبالة كان ٠،٦١٢م٣ سجلت عند محتوى رطوبى ٧،٣% و سرعة رداخ ٧ ضربة/بالة و ضغط مكبس ٢٦٠٠نيوتن /سم٢.

٣- أقصى كثافة بالة كانت ٥٥٢،٥كجم/سم٣ سجلت عند محتوى رطوبى ١١،٢% و سرعة

رداخ ١٤ ضربة/بالة و ضغط مكبس ٢٦٠٠نيوتن /سم٢بينما اقل كثافة بالة كانت ٣٧٢،٩ كجم/سم٣ سجلت عند محتوى رطوبى ٧،٣% و سرعة رداخ ٧ ضربة/بالة و ضغط مكبس ١٤٢٢نيوتن /سم٢.

٤- أقصى سعة للمكبس كان ٥ بالة/ساعة و ذلك عند سرعة رداخ ٧ ضربة/بالة و اقل سعة كانت ٣بالة/ساعة و ذلك عند سرعة رداخ ١٤ضربة/بالة.

٥- أقصى إنتاجية للمكبس كانت ١٤٠٠ كجم/ساعة سجلت عند محتوى رطوبى ١١،٢% و سرعة رداخ ١٤ ضربة/بالة بينما اقل إنتاجية للمكبس كانت ١٠٨٠ كجم/ساعة سجلت عند محتوى رطوبى ٧،٣% و سرعة رداخ ٧ ضربة/بالة.

٦- اقل قدرة لازمة كانت ١١،٩كيلووات سجلت عند محتوى رطوبى ٧،٣% و سرعة رداخ ٧ ضربة/بالة و ضغط مكبس ١٤٢٢كجم/سم٢بينما أقصى قدرة لازمة كانت ٢٦٠٠ كيلووات سجلت عند محتوى رطوبى ١١،٢% و سرعة رداخ ١٤ ضربة/بالة و ضغط مكبس ٢٦٠٠نيوتن /سم٢.

٧- اقل تكاليف لإنتاج البالات كان ١٤١ جنية /ساعة سجلت عند محتوى رطوبى ٧،٣% و سرعة رداخ ٧ ضربة/بالة و ضغط مكبس ١٤٢٢نيوتن /سم٢بينما اقصى تكاليف لإنتاج البالات كان٢٤٠،٣ جنية/ساعة سجلت عند محتوى رطوبى ١١،٢% و سرعة رداخ ١٤ ضربة/بالة و ضغط مكبس ٢٦٠٠نيوتن /سم٢.

٨- طول التيلة عند نسب توزيع ٢،٥%و٥٠%كانت تنخفض بانخفاض المحتوى الرطوبى من ١١،٢%الى٧،٣% وبزيادة سرعة الرداخ من ٧ الى ١٤ ضربة /بالة و ضغط مكبس من ١٤٢٢الى ٢٦٠٠نيوتن /سم٢.

٩- أقصى متانة للألياف الناتجة كانت٣٠،١ جرام /تكس سجلت عند محتوى رطوبى ١١،٢% و سرعة رداخ ٧ ضربة/بالة و ضغط مكبس ١٤٢٢نيوتن /سم٢ واقل متانة كانت ٢٣،٦جرام /تكس سجلت عند محتوى رطوبى ٧،٣% و سرعة رداخ ١٤ ضربة/بالة و ضغط مكبس ٢٦٠٠نيوتن /سم٢.

١٠- أقصى استطالة للألياف كانت ٧،٨% سجلت عند محتوى رطوبى ٧،٣% و سرعة رداخ ١٤ ضربة/بالة و ضغط مكبس ٢٦٠٠نيوتن /سم٢ بينما اقل استطالة كانت ٥،٥% سجلت عند محتوى رطوبى ١١،٢% و سرعة رداخ ٧ ضربة/بالة و ضغط مكبس ١٤٢٢نيوتن /سم٢.

١١- محتوى الشوائب بالبالات كان ينخفض بانخفاض المحتوى الرطوبى و بزيادة كل من سرعة الرداخ و ضغط المكبس.

١٢- أعلى رتبة لقطن البالات الناتجة كان فولى جود سجلت عند محتوى رطوبى ١١،٢% و سرعة رداخ ٧ ضربة/بالة و ضغط مكبس ١٤٢٢نيوتن /سم٢ بينما اقل رتبة كانت جود/فولى جود سجلت عند محتوى رطوبى ٧،٣% و سرعة رداخ ١٤ ضربة/بالة و ضغط مكبس ٢٦٠٠نيوتن /سم٢