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Review Paper on Optimization of Cotton Ginning And Pressing Plant

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Abstract: *The process of separation of fibre from cottonseed is called Ginning . Composite ginnery performs ginning and pressing operations to convert lint cotton into a bale. In modern day, various technology and pressing machinery are devolved This review paper discusses a present work for modern technology implemented in a modern gin, to configure an optimal set of equipment during ginning to produce quality cotton. Along with The future expectations of technological development in the Cotton Ginning & Pressing Technology.*

Keywords: *Composite ginnery , and pressing machinery, gin*

I. Introduction

"Cotton Ginning, in its firm sense, refers to the process of separating cotton fibres from the seeds. The cotton gin has as its major function the conversion of a field crop into a salable commodity. Composite ginnery performs ginning and pressing operations to convert lint cotton into a bale. Thus, it is the bridge or link between cotton production and cotton manufacturing. but the gin must also be equipped to remove foreign matter, moisture, and other contaminants that significantly reduce the value of the ginned lint .It is in this respect of trash removal that cotton ginning plays a very important role in the preservation and improve the quality of cotton. for getting maximum value to the grower to meet the demands of the spinner and consumer Gins must produce a quality of lint while. Operating gin machinery in accordance with the recommended speeds, adjustments, maintenance, and throughput rates will produce the highest possible fibre quality. Indian ginneries present a dismal picture in terms of using outdated technology. Most ginneries in India, being in unorganized sector, not having knowledge of modern technology. The ginning industry in the country can be said to be still backward and less progress. The geographical location of ginneries and unavailability of lint cotton packaging machines and spinning mills causes the ginning industry to transport low density voluminous lint cotton package over far distances. A ginning industry has a standardized sequence that includes dryers and sensors to obtain the proper moisture level as well as machines to remove the foreign matter is recommended for processing cotton at the gin.

II. Review Of Literature

Gino J. Mangialardi, Jr. W. Stanley Anthony [1] , describes the design and operation of various types and models of bale presses, and gives an appraisal of press designs and adjustments that may be most useful at current cotton gins. The paper describes up-packing and down packing presses; flat (low density), standard density, high density, and universal density types; and some accessories used with cotton baling systems. Materials from the review are arranged chronologically. The complied information and recommendations should prove useful to ginners, scientists planning future ginning studies, and engineer's selecting cotton bale press designs and types for commercial gins.

LeRoy Fitzwater, Richard Khalil, Ethan Hunter [2], the topology optimization method outlined herein provides convincing evidence to re think the way aircraft structure is designed. Topology optimization is gaining popularity and requires some further development to document the effective use of this tool and to aid the engineer in producing quality designs. The benefits are numerous, including load path visualization, weight savings, increased systems design space, improved ballistic protection and fatigue resistance. These benefits offer a compelling incentive to employ this technology into the current design process to improve the performance of engineering products.

Anthony, W.S. 1982 [3] concluded that After cotton fiber is baled, moisture transfer occurs very slowly especially at high densities. In fact, bales at densities of 12 lb/ft3 required over 60 days toequilibrate with the environment while bales at 28 lb/ft3 required over 110 days.

Neville Saches [4], focused on the causes of failure for understanding mechanical failure in machines components. Paper gives the brief introductions about the ductile fracture, fatigue failure and stress

concentration. Paper also discussed the type of load is responsible to failure i.e., internal pressure, bending, torsion or a combination

Fones McCarthy, Demopolis, Marengo In 1840 [5] works on A roller gin patent was issued to, Alabama, This new type of roller gin which his invention provided became as popular in most countries as the Whitney saw gin was in USA. The Birtish refer to the gin as the McCarthy gin. The McCarthy ginning roller was much grater in diameter than churkha type roller and hence had greater capacity from the start. The first McCarthy Gins used rollers that were of 4" in diameter and 3 Feet in length. By 1850, however, the roller increased in size to almost 7" diameter and their lengths shortly thereafter became standardized into 40 inches. Single Roller McCarthy Gins stayed at 40 inches in length almost universally until the 1940 Era of New Roller Ginning Practices..

Anthony (1990)[6] estimated that one lint cleaner can be eliminated on 50t of the bales ginned. This results in energy and maintenance savings as well as weight loss reductions.

Lalor, et al., in 1994 [7] works on the cottonseed and trash fractions of the seed cotton. After harvesting, the seed cotton is placed in modules or trailers and compacted. Published guidelines establish the upper limit for safe storage of seed cotton at 12% moisture content .

Anthony (1994) [8] reported that fiber length was reduced from staple 37 to staple 35 (1/16th inch) when moisture was reduced from 7.4% to 3.4% across a wide difference in gin cleaning sequences.

Anthony and Griffin (2001) [9] reported that short fiber content increased from 4.6% to 8.7% when moisture at ginning decreased from 8.4% to 4.1%, almost a one-to one relationship! At the same time, the number of seed coat fragments increased from 78 to 121 per 3 grams of lint. These findings clearly indicate the negative impact of low moisture contents on some quality characteristics.

Mangialardi and Griffin (1977) [10] used atomizing nozzles immediately before the conveyor-distributor to increase the moisture content of the fiber before ginning. They reported that fiber length was increased even with small increases in moisture content. They also reported that fiber quality was best preserved at moistures between 6.5 and 8%. Their method of adding moisture differed from the commercial method of applying humidified air between the conveyor-distributor and the extractor-feeder which was used in 12% of gins

The Cotton Ginner's Handbook (1994) [11] recommends fiber moisture at ginning of 6.5 to 8%. Since cleaning efficiency and cotton appearance are vastly improved by drying, many gins tend to over dry the cotton and cause unnecessary fiber damage

Kirk and Hudspeth in 1964 [12] Effective green-boll removers mounted directly on stripper harvesters reduce the number of green bolls, rocks, and other heavy objects in the cotton .

Percent Cocke and Baker 1972,[13] works on the The total trash removal efficiency of cylinder cleaners is generally low. However, usually they are not used alone but are used in combination with other machines. Cylinder cleaners perform a most useful function in opening the cotton and removing fine trash. Studies using both machine-picked and machine-stripped cottons have shown that the total trash removal efficiency of a six-cylinder inclined cleaner with grid rods generally ranges from 10-40

Textile Committee. 2003 CIRCOT and ATIRA[14] sponsored by Technology Mission on Cotton Mumbai survey ,The quality of lint cotton is affected by methods of handling of cotton prior to the gin then the lint from the gin to the press machine and finally the bale handling after pressing. About 80 % of all cotton is handled manually. In the analysis, it was found that 4 the period of operation of about 50 % of the gin is more than six months. The extended period ranges from 7-9 months and in some cases it even extends beyond 9 months. This extended working period decreases moisture, which makes the fibers more brittle and reduces fiber length during ginning.

III. Future Expectation From Cotton Ginning & Pressing Technologies

Technological Progress in the Cotton Ginning & Pressing Technology for getting the future expectations may be summarised, as below:

i. To standardize and provide clear understanding about selection of ginning technology suitable to obtain best results.

ii. To provide solutions to the areas which are yet to be mechanised.

iii. To achieve highest cost efficiency with existing equipments.

(i) To obtain maximum efficiency of plant.

(iiLowest cost per unit of Ginning

(iii) To obtain undamaged clean seed.

(iv) To obtain lint free of Trash and contaminants.

(v) To preserve inherent qualities of fibre.

1.1 Future Development Efforts underway for Cotton Ginning & Pressing Technologies.

I) To standardize and provide clear understanding about selection of ginning technology *suitable to obtain best results.*"Because of the major contribution of ginning to lint quality one should be extremely careful in the selection of ginning machinery. The details about the lint quality obtained on the ginning machine is of prime importance apart from the productivity. The advantages and disadvantages of low production ginning machine as well as high production ginning machine should be carefully compared"

II) To Provide solutions to the areas which are yet to be mechanised:

The areas like contamination removal of foreign partials, seed cotton unloading, stacking of seed cotton, removal are yet to be fully addressed. The proper machines and technologies are yet to be developed. some companies in Indian and international have worked In this area to find solutions for manual picking, however the standardisation and mass acceptance of the same are yet to be achieved. The countries like USA have achieved solutions in this regard by module making however same have not found wide acceptance in many other countries, therefore suitable technologies and equipments to suit different requirements of different countries or equipments which can be accepted by different countries simultaneously have to be developed. The research in this regard is underway.

III) To achieve highest cost efficiency with existing equipments and source :

In order to maximize efficiency, Number of suppliers have come up in to provide customized solutions in respect of seed cotton and lint conveying, however the same do not provide proper solutions for different varieties and compositions of cotton i.e. sometime fibre parameters are getting affected or conveying is obstructed due to higher moisture and other reasons. The tailor made solutions to all such requirements are to be found.

i) High Efficiency Double Roller Ginning Machine:

Double Roller Gins were gives lower capacity at about 50-60 Kgs up to year 1998,. Lint/Hr. thereby operating cost was higher and the ginning was uneconomical. After year 1998,some modern machine was introduce having high capacity at about 90 Kgs. Lint/hr. The modifications have improved the working of ginning factories significantly and economical also. The research to further increase productivity of the Double Roller Gin to reduce the grooving cycle, roller washer technology for longevity and strengthening of machine to increase the ginning speed is going on and in the future a higher capacity Double Roller Gin will be available to Ginning Factories.

ii) High Efficiency Pre -cleaners:

Absence of proper pre-cleaning machines were an impediment in obtaining cotton with lower trash and contamination. These equipments were designed to suit the Indian cotton in different sizes and capacities which are used now by the cotton ginning & pressing industry to obtain clean cotton. Further improvements are underway to improve the grid, spike and speed to optimize fibre parameters and efficiency. Further, trash collection conveyor is added to improve the trash removal system.

iii) Pneumatic / Mechanical Cotton Conveying Systems:

The manual conveying of seed cotton into the ginning hall was replaced by well designed, suitable capacity, electrical power efficient, pneumatic suction system to pull the cotton from length up to 750 feet with multiple points. This has resulted in reduction of substantial number of manpower and dependent inefficiencies due to erratic working / non-availability of manpower. Moreover, regular supply of seed cotton has resulted in uniform and sufficient feeding to Double Roller Gins thereby increasing productivity. This has also helped in reducing the contamination and trash. Further efforts to improve air separators, vacuum wheels, optimized calculations of suction requirement to improve power efficiency as well as maintain fibre parameters are underway.

vi) Automatic Lint Suction System from each DR Gin:

Use of well designed Lint collection chutes, Lint Collection Boxes and incremental lint suction ducting has automized lint collection up to lint cleaner. Which eliminated total requirement of manpower for lint collection from each Gin. Further improvements in respect of central suction pipe connections, improvement in lint collection hopper has improved the efficiency greatly.

vii) Fibre Friendly Lint Cleaners*:*

Use of fibre friendly Lint Cleaner with improved Grid and Spike systems has helped to remove trash from lint without damaging the fibre. Further trash removal systems introduced recently have greatly improved the trash removal efficiency.

Recommended Best Ginning Practices

1) Determine the needs of customers including marketing firms, textile mills, and cotton farmers.

2) Install gin machinery that meets the needs of the customers.

3) Include necessary pollution abatement equipment inside and outside the gin.

4) Ensure that farmers are aware of the best variety selection, production, harvesting and storage practices so that high quality cotton with minimal foreign matter and damage can be delivered to the gin. If this is done,

minimal drying and cleaning will be required, and thus less fiber damage, higher quality fiber, and greater gin turnout will result.
5) Monitor farmer activities and provide guidance if necessary.
6) Develop and implement a comprehensive gin maintenance program that is continually documented and communicated. The maintenance program must include off-season repair, in-season preventive maintenance, and problem repair and documentation. Prime time should be programmed (typically one hour per 12-hour shift) for routine maintenance to include cleanup of facilities and machines. Use maintenance checklist for routine maintenance. Formal reviews should be conducted annually.
7) Develop contamination prevention program to ensure contaminant free bales.
8) Develop specific job description for each employee, and make sure that it is available in the appropriate language.
9) Train gin personnel in basic mechanics and how to use hand and power tools properly. Provide additional training annually.
10) Train personnel in basic gin machinery operations and minor repairs such as how to replace belts, install bearings, etc. Provide refresher training annually.
11) Train management and gin personnel in the capabilities, functions and safe use of each gin machine and associated equipment as well as the entire ginning system.
12) Train senior gin personnel in visual fiber quality assessment and the causatives of changes in fiber appearance.

IV. Conclusions

The ginning of cotton involves a sequence of complex Processes. lots of design process along with technology development successfully Incorporates to optimization Energy consumption, optimized operation of the ginning, To achieve highest cost efficiency with existing equipments, highest fibre quality, cleaning and extracting system. machining cost optimization problem. but still more work is remains which improve all the problems of cotton ginnery. for the further improvement of cotton ginning & processing machinery in future many organizations like Cotton Association of India, Australian cotton industry Association, U.S. Dept. of Agriculture, Southwest cotton. Ginning Laboratory, U.S. Dept. of Agriculture Agricultural Research Service are working.

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