DRYING AND PRECLEANING - BETTER TRASH REMOVAL AND LESS FIBER DAMAGE WITH THERDYN PROCESSING SYSTEM

Ronnie Valerius, Keith Scott, Homer Sanchez
Kyle Williams and Glenn Ellison
Therdyn Corporation
Levelland, TX

Abstract

"Over drying is a vague and misused term. Cotton fiber dried to a low moisture level is not harmed if the drying is done at low temperature. Cotton fibers are often dried to about 4 or 5 percent moisture while still in the field." (Cotton Ginners' Handbook AH 503 p. 61)

"The classification of cotton as having rough preparation is causing a problem for the cotton industry. The large discounts are keeping ginners from "gentle ginning" cotton because the frequency of abnormal preparation (prep) increases significantly when less drying and lint cleaning are used. Some ginning systems are more prone to produce rougher samples than others." (1995 Proceedings Beltwide Conferences, Vol. 1, p. 460, William Mayfield, Stanley Anthony, Roy Baker, Eugene Columbus, "What We Know and Need to Know About Preparation".)

We agree with these two presentations wholeheartedly. We offer a solution. Dry the seed cotton with low mix point temperatures, keep the heat on it longer, fluff it, single lock it, disperse it, dry it some more (do not scrub it, do not pressure roll it) then send it on to the next stage and keep it at 140° to 170° F all the way to the feeder apron above the gin stand.

Introduction

Some of the variables that we can control at the gin are drying, moisture, temperature, preparation and cleaning by machines. I have always said that the sooner you can help the process upstream, the better job you can do down stream. Following that same thought, if you must add saw lint cleaners (2nd and 3rd stage) to clean up the sample; then something is wrong up stream. Our approach is to dry as soon as possible using the lowest mix point temperature practical, applying this heat longer and cleaning/preparing first with no scrubbing or rolling such as an incline cleaner. The Hot Shelf Tower Drier and Big Mach combination are built ideally for these purposes. In addition, these two machines are proving to do a good job; at the same time, they are very well suited to making good cotton out of bad cotton. They are built to handle wet/rough cotton. These machines are built to deal with narrow row, ultra narrow row, broadcast or any other tough rough cotton.

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Mechanics of the Process

The Hot Shelf (Vandergriff turbulent airflow) Drier is in use successfully at many gins. These driers work well with on hand equipment. (Table 4) I will briefly describe the drier for those who might not be familiar with this drier. The turbulent airflow Hot Shelf is a tower drier with nine cotton stream shelves and seven hot shelves between the cotton shelves. The cotton stream is directly heated with the air carrying/conveying the cotton and the hot shelves are heated separately. The cotton stream starts at the top front and flows horizontal downward back and forth through the nine shelves exiting near the bottom out the back. (Fig. 1 and 2) The hot shelves flow from bottom to top. The hot air enters the front bottom, flows horizontal the length of the drier then moves up through elbows on both sides of the drier and continues back and forth through the seven shelves exiting near the top out the front. The big advantage to this drier system is the feature of maintaining temperature on the seed cotton much longer. In other words, the Hot Shelf drier keeps adding heat energy on the seed cotton as it travels through the drier. This translates to more moisture removed from the seed cotton and transferred to the air. The heat can be controlled to dry the green or wet seed cotton and yet not damage the fiber with extreme high mix point temperatures. The capacity is much higher by using additional heat in the heat shelves for those times when you have difficult green or wet cotton. Other driers can not do that.

The Therdyn Big Mach is the right machine to join the process immediately after the Hot Shelf drier. (Fig. 1 and 3) Fiber quality, minimum fiber damage, bypassing saw lint cleaners, and increasing production were the main consideration for putting these two machines together. The seed cotton comes from the Hot Shelf drier via rectangle duct to the Big Mach. The Big Mach is a spiked cylinder cleaner assembled from multiple units where each unit is a two cylinder section. The air is pulled through the machine out the far end opposite the inlet through a screen separator. The air does not pull the seed cotton down against the grid as in an incline cleaner. The spiked cylinder is constructed with individual removable spikes. (Fig. 3) These spikes extend 2 1/4 inches (5.72 cm) from the mounting angle. There are six rows of spikes per cylinder. There are no wrapper sheets on the cylinder. This construction allows plenty of space between the cylinder core and the grid sections. This means that the seed cotton does not form a batt and it does not go through scrubbing/rolling action. Remember, the seed cotton is not held down against the grid by the air stream. The top of the spiked cylinder rotates in the opposite direction to the air flow. This gives the seed cotton more air wash in the hot air stream. This enhances the drying. The machine has over 12 inches (30.48 cm.) clearance between tip of spike and inside top of machine. The space and construction of the machine allows it to handle high volume and not crowd or press the seed cotton between high pressure points. This action and interaction

with the air stream along with some adjustments allows the Big Mach to disperse, single lock, dry and clean with less fiber damage. There are deflector plates between each grid section that are adjustable vertically. These deflectors can be adjusted individually. The amount and location of the raised deflector(s) will affect the cotton stream. The cotton can be thrown into the wind again and again. The cotton can be carried back against the wind by the top rotation of the cylinders, and/or the cotton can be passed on the bottom side of the spiked cylinder to pass over the grid sections toward the outlet. The grid sections (Uni-grid) are constructed of curved metal plates that have been computer plasma cut to an endless number of optional configurations. (Fig. 3) The gaps can be spaced any workable way. The grid sections (2 per cylinder, 5 ft. (152.4 cm.) length each) can be changed through a curved slot in the side wall of the machine. This makes changing grids faster and different patterns of slots can be used in the same machine. The machine is very versatile. The construction is made up of two cylinder sections and can be assembled in multiples of 2. We recommend 8, 10 or 12 cylinder machines. The machine removes large amounts of sand and trash in addition to gently fluffing and dispersing everything inside the machine.

Installations, Results and Experiences

The first installation of the Hot Shelf Drier and Big Mach together were operated first in the 1997 season. This is a single stream 72 inch (182.9 cm.) width drier and single 120 inch (304.8 cm.) width cleaner flowing to split 96 inches (243.8 cm.) cleaning machinery. This machinery operated successfully through very rough cotton. Some of the conditions seen were 14% turnout with 15 – 17% moisture in 1997. The gin normally ginned at a rate of 30 to 33 bales per hour and with this cotton the gin still maintained 25 to 28 bales per hour. The owners are planning to add this same equipment to their other gin for the 1999 season.

The next installation is operating in a mote plant. The installation includes one Hot Shelf and one Big Mach. Motes can be packed very tight and hard in those bales. Motes can be very dirty and hard to clean. I will quote part of what the management had to say about this machinery and let it speak for itself. “Due to the introduction of three ingredients; a) Vandergriff Turbulent Airflow Hot Shelf Tower Dryer; b) Pretex chemical applied in three key places; c) Therdyn’s 12 cylinder Big Mach cleaner, South Plains Textile, Inc. has been able to increase production on low grade raw motes by 50%. Not only has the production capacity increased but the “grade” has been elevated from low priced hard to market end product to a higher priced easily marketable product.” Mike Turner.

The next installation contains two Hot Shelves and two Big Machs. Split stream gin all the way to the distributor. This gin was completely rebuilt in 1998 and therefore I do not have comparisons like some of the other examples. The main reason this machinery was purchased is because the producers/stock holders wanted the same thing in their gin as the neighbor gin uses and is doing so well.

The next installation involved adding one Hot Shelf and one Big Mach between their on hand module feeder and first incline cleaner. This success story is like the ones you like to hear and talk about. A gin is being squeezed by larger surrounding gins. The gin has made the members good money over the years and is financially sound. But, no substantial improvements have been made for a long while. It needs to gin faster and do a better job on leaf grade. We guaranteed they would be satisfied with a Hot Shelf and Big Mach. They let us put them in, they ran the season and they are satisfied. They ran 5 weeks and 5 days, 24 hours per day in 1997 to gin 17,430 bales. They had too many high leaf grades. (Table 1) This year, they ran 4 weeks and 3 days (11 days, 24 hours per day, the rest were 16 hours per day) to gin 14,100 bales. This year we did not have a killing freeze, some growers sprayed three times trying to defoliate and we had three rainy spells during harvest. The cotton in a lot of areas, was shorter due to the drought in the growing season and therefore had more sand and higher number of knotty bolls that were smaller than your thumb. Compare the two seasons in Table 1. Note the classing office distribution. In addition, one of the growers said the turnout was better than his other gin by 1 ½%. He has to gin at two gins on account of landlord business. He said the other gin has <u>always</u> beat this one in the past on turnout, but not this year.

“The gin was able to run full speed on rainy days” said the manager. “We were able to gin some pretty rough stuff at full speed” he said. They hit two record setting shifts in a row and thereby set an all time 24 hour record number of bales ginned.

Installation 5 is somewhat experimental. We started with two Hot Shelves and two Big Machs in series in a single stream. However, we arranged them so that we could split them and run parallel if we wanted to do so. The system was converted to single drier and cleaner. The second drier and cleaner were by passed. This was the arrangement during all of the comparisons and recorded data. The new drier and cleaner were installed and valving arranged so that the on hand system could be used or the new drier and cleaner could be used. Operations showed that the cotton could be ginned faster and had better turnout through the Hot Shelf and Big Mach. (Table 2) This comparison was done with 563 bales ginned in one block. Part of the bales ginned through on hand equipment and part through the Therdyn equipment. Even though the Therdyn stream did not have enough heat to reach the desired levels of temperature, the system still out performed the old system. The old system remained the same. The new way switched off the first 2 pull fans and 2 combo separators and went through the Hot Shelf and Big Mach instead. The turnout increase was not expected. It would seem reasonable that

when you go through more machinery that you would also have move losses. We think the Hot Shelf and Big mach salvaged more of the small bolls and we were able to put more pounds in the bale. This past growing season was hot and dry. We have a higher portion of small bolls this year than would be normal. The best explanation is that we fluffed the cotton so that the other machinery did not drop as much. Another comparison of switching streams (equipment) in the middle of five different modules (Table 3) shows a slight improvement in color grade with the Therdyn equipment. The leaf grade also shows improvement (Table 3 and Fig. 4) with the Therdyn equipment.

Conclusion

You can ask most any ginner how fast his gin will gin cotton; the most common reply will start with these words, "When we have good cotton". It is true, when we have good cotton we can gin our fastest and best. So, why not set up our gin to have more good cotton? It makes good economic sense. to keep production up, quality good, add more product value and more product. Dry the cotton, keep it hot, disperse it, fluff the cotton, reduce fiber damage and bypass saw lint cleaners to add more pounds in the bale.

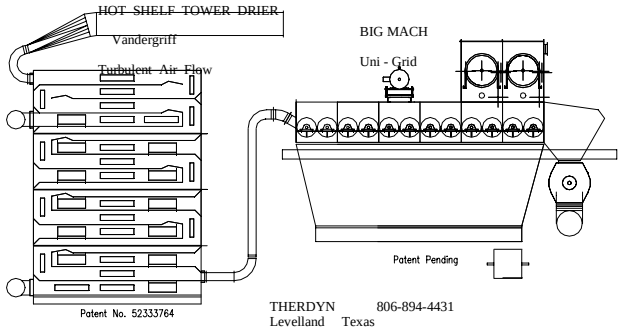

Figure 1. Hot Shelf and Big Mach Combination

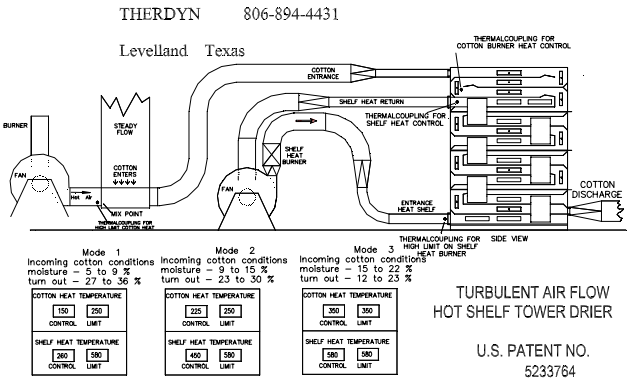

Figure 2. A Typical Hot Shelf Circuit

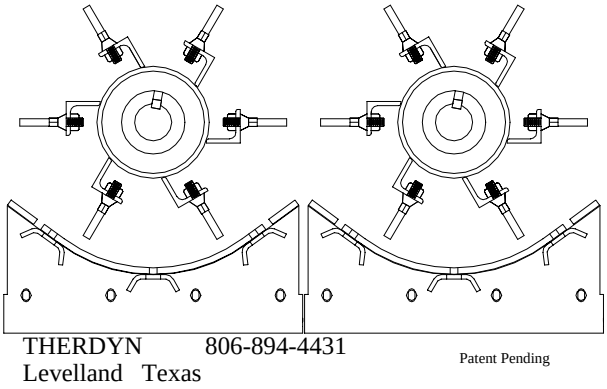

Figure 3. Cylinder – Uni-Grid Construction

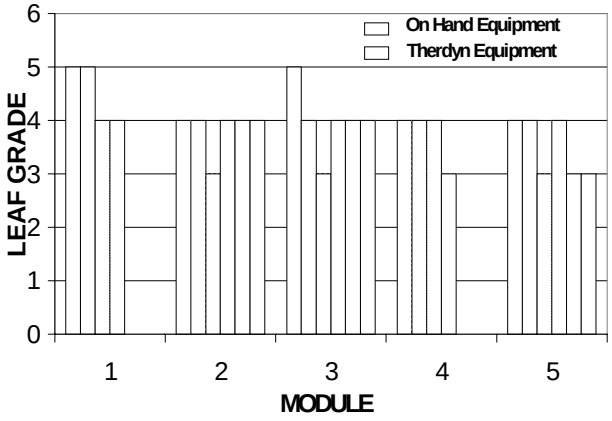

Figure 4. Leaf Grade Comparison. 20.5% turnout-single lint cleaning

Table 1. A gin comparison between ’97 season without Hot Shelf and Big Mach to ’98 season with Hot Shelf and Big Mach using classing office summary.

1997 SEASON DATA COMPARISON				1998 SEASON DATA COMPARISON		
	Gin	U.S.D.A. Classing Office			Gin	U.S.D.A. Classing Office
GRADE	PERCENT	PERCENT		GRADE	PERCENT	PERCENT
COLOR				COLOR		
11	0.7	0.12		11	10.3	4.0
21	29.1	35.83		21	26.0	20.2
31	31.9	55.50		31	47.8	32.2
41	2.1	1.84		41	4.8	14.0
12	0.5	0.04		12	0.3	1.7
22	15.8	4.52		22	3.3	11.9
32	12.7	1.80		32	6.6	11.4
42	0.8	0.07		42	0.3	3.3
23	2.3	0.14		23		
33	2.7	0.06		33	0.5	0.6
34	0.6	0.01		34		
LEAF				LEAF		
1	1.2	0.15		1	6.0	4.3
2	17.1	6.10		2	36.0	22.8
3	38.5	35.38		3	37.0	31.1
4	23.2	31.36		4	17.0	23.3
5	14.6	21.10		5	4.0	14.0
6	4.5	5.37		6		3.9
7	0.7	0.37		7		0.5
8	0.1	0.13		8		
AVG	3.85	3.50		AVG	2.79	3.34
LENGTH				LENGTH		
30	0.6	0.06		30	1.0	1.3
31	2.8	0.85		31	5.0	5.6
32	10.4	0.56		32	25.0	18.4
33	25.8	35.25		33	46.0	33.8
34	33.9	44.29		34	21.0	26.3
35	18.3	10.15		35	2.0	10.7
36	6.4	0.76		36		3.0
37	1.6	0.02		37		0.6
AVG	33.56	33.60		AVG	32.86	33.25
STRENGTH				STRENGTH		
24-25	2.9	0.13		24-25	0.3	6.4
26	5.3	0.68		26	8.0	11.6
27	9.7	2.91		27		20.5
28	15.4	12.13		28	75	26.8
29	22.1	21.28		29		20.9
30	22.7	32.11		30		9.6
31&OVEI	21.6	30.68		31&OVE	14.0	4.0
AVG	29.87	29.12		AVG	28.09	27.89

Table 2. Turnout Comparison

Gin ‘98
63 modules-same producer
(all ginned in one block, all single stage saw lint cleaning)

On Hand Equipment	Therdyn Equipment
20.6 % turnout	21.6 % turnout
27.07 Bales ginned per hour	29.03 Bales ginned per hour

Table 3. *** Therdyn Equipment** Comparison to On Hand Equipment

BALE ID	MIC	LENGTH	UNIF.	SF1	STRENGTH	ELON.	LEAF	CG
13	3.1	1.03	81.2	10.2	32.2	7.3	5	41-3
14	3.2	1.06	81.1	10	30.4	7.1	5	41-4
15 *	3.1	1.05	81.3	9.9	31.4	7.6	4	41-4
16 *	3.2	1.03	80.7	10.8	32.2	7.3	4	41-3
17 *	3.1	1.04	79.9	11.7	33.1	7.6	4	41-3
18 *	3.6	1.03	81.2	10.2	29.1	6.5	4	41-3
19 *	3.5	1.02	81.7	9.8	29.8	7.2	4	41-3
20 *	3.6	1.03	81.1	10.4	28.5	6.9	4	41-3
21	3.5	1.05	81	10.2	31.1	7.2	4	41-4
22	3.5	1.03	81.3	10.1	29.2	6.9	4	41-3
23	3.7	1.05	81.2	10	29.5	6.7	3	41-3
24	4.3	1.03	81.2	10.2	27	6.4	5	41-4
25	4.3	1.01	80.5	11.3	27.7	6.3	4	41-3
26	4.3	1.03	81.6	9.7	26.9	6.5	3	41-3
27 *	4.3	1.01	80.5	11.3	27.6	6.2	4	41-3
28 *	4.3	0.99	81.4	10.5	27.4	6.3	4	42-1
29 *	4.3	1	80.6	11.3	26.8	6.4	4	41-3
30	2.9	1.12	79.6	11	33.2	6.7	4	41-3
31	2.9	1.1	79.3	11.6	31.7	7.3	4	41-3
32 *	2.8	1.08	79.7	11.4	33.2	7.3	3	21-4
33 *	3.4	1.09	79	12.1	29.3	6.6	4	41-3
34	3.9	1.06	82.1	8.7	29.2	6.9	3	41-3
35	4.1	1.05	81.1	10.1	28.7	7	4	41-3
36	4.1	1.03	81.3	10.1	26.6	7	4	41-3
37 *	5.9	1.05	81.5	9.6	22.7	6.5	4	41-3
38 *	4.1	1.07	80.8	10.2	27.8	6.6	3	31-4
39 *	4.1	1.05	81.7	9.4	27.2	6.9	3	31-2

Table 4. Two years of ginning results

1996

MUSTANG FARMERS GIN, INC.

GRADE	PERCENT
11 & 21	20.28%
31	37.07%
41	1.21%
12 & 22	8.93%
32	29.95%
42	1.97%
52	0.18%
13 & 23 & 33	0.36%
43	0.18%
LEAF	
1 & 2	40.31%
3	46.29%
4	11.74%
5	1.63%
6	0.03%
EXT. MATTER	
11 (Bark)	17.58%

U.S.D.A. CLASSING OFFICE

GRADE	PERCENT
11 & 21	6.80%
31	38.80%
41	8.40%
12 & 22	3.30%
32	31.40%
42	9.10%
52	0.10%
13 & 23 & 33	1.20%
43	0.60%
LEAF	
1 & 2	28.60%
3	46.70%
4	17.90%
5	5.40%
6	1.20%
EXT. MATTER	
11 (Bark)	24.90%

1997

MUSTANG FARMERS GIN, INC.

GRADE	PERCENT
11 & 21	58.54%
31	30.64%
41	0.48%
12 & 22	6.89%
32	3.23%
42	0.07%
52	0.00%
13 & 23 & 33	0.08%
43	0.02%
LEAF	
1 & 2	53.13%
3	34.69%
4	9.91%
5	2.04%
6	0.14%
EXT. MATTER	
11 (Bark)	4.30%

U.S.D.A. CLASSING OFFICE

GRADE	PERCENT
11 & 21	41.90%
31	25.80%
41	2.90%
12 & 22	8.40%
32	16.10%
42	3.00%
52	0.00%
13 & 23 & 33	1.20%
43	0.60%
LEAF	
1 & 2	43.00%
3	32.30%
4	15.70%
5	6.80%
6	1.70%
EXT. MATTER	
11 (Bark)	16.408%