

## **COTTON MOISTURE CONTROL IN WEST TEXAS**

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### **Abstract**

Cotton moisture control is an increasingly hot topic across the entire Cotton Belt. The popularity of cotton moisture control is that these systems offer many economic benefits for cotton growers, gins, and mills. While the fundamentals of moisture control are the same for most gins, each region faces unique circumstances and must select and use the tools that best fit their conditions. This paper will focus on the benefits of the moisture control technology and techniques used by Windstar Gins in our four West Texas locations.

### **A Brief History of Windstar Gins**

In 1978, a group of five farmers bought the Lively-Bagley Gin near Tulia, Texas. The first year the gin operated with not much cotton to gin and no profit, but in 1979 a good crop and an increase in acres resulted in over 10,000 bales to gin. At that time, that amount of cotton was beyond the capacity of the Tule Creek Gin and the partners expanded their operation by purchasing Lakeview Gin in February of 1980. In May of that same year, a tornado wiped out the Lakeview plant forcing them to rebuild from the ground up.

Mr. Lloyd Graham, a retired gin manager from Olton Coop, oversaw reconstruction of the Lakeview Gin. In retrospect, the tornado was a blessing in disguise because it allowed me to not only learn the intricacies of gin machinery and systems, but I was able to "walk in the shadow" of a very knowledgeable gin man that summer which served me in good stead for years to come. Another key event for our company was the good sense to hire Buck Jones who was employed by Lakeview when it was purchased. Today, Buck serves as our gins superintendent and technical manager of our four gins.

The partnership followed a formula of involving in our company good farmers who were good businessmen, thought progressively, and had integrity. The success that followed led to another expansion in 1987 when the partnership purchased Edcot Gin in Edmonson, Texas. The fourth gin was added in 2001 when the partners built Top of Texas Gin in Dawn, Texas to serve the northern reaches of High Plains cotton. All four plants are in operation today and will gin over 150,000 bales this season. Except for one death, all of the original core partners are still active with the business.

Much of the discussion of Windstar's moisture control systems will involve products from Samuel Jackson, Inc. The relationship between these companies began in 1980 when we bought our first new humid air system from Jackson for Lakeview. However it was not until about 2000 when, after five unsuccessful years of attempting to inject moisture in the condenser, did we turn to Sam Jackson for help in restoring moisture to the cotton. After watching a neighbor gin's operation with a prototype Steamroller machine, we became convinced the Steamroller was the answer we had been looking for in restoring moisture back to the cotton at the press.

### **Cotton Moisture Control Fundamentals**

As mentioned earlier, the fundamentals of cotton moisture control are the same for most gins. Ideally, modules would arrive at the gin between 6-8% moisture content, but realistically it can range from below 4% to above 20%. The goal of moisture control systems is to manipulate the moisture throughout the ginning process so that each process can be done at an optimal moisture content.

Pre-cleaning equipment operates most efficiently with dry cotton, which allows for easier separation of trash. For best results the cotton should be dried to below 5% moisture content before pre-cleaning. Another important fundamental of moisture control at this stage of the process is protecting dry cotton from excessive temperatures. In addition to fiber quality, good drying system control also increases turnout by keeping good fibers from becoming entangled with trash.

The optimal moisture content at the gin stand is higher, with general recommendations usually being around 7-8% moisture. This extra moisture protects the fiber by giving it added strength and elasticity before it goes through the gin saws and the lint cleaners. This impacts quality grades including staple and strength.

Bale moisture at the press is the third area of concern. Lint loses moisture very easily between the lint cleaners and the battery condenser and dry, fluffy lint can make pressing it very difficult. Restoring lint moisture to 7-8.5% moisture makes it easier to press and can make the press operate faster. Proper moisture restoration can also benefit the grower by restoring moisture weight lost during the ginning process and benefit the mill by supplying bales that are pre-conditioned for better spinning.

A successful gin moisture control system should be able to dry or restore moisture to the optimal level for each process in the gin. Windstar Gins use a variety of tools to accomplish that goal.

### **Managing Moisture with the Moisture Mirror**

The Moisture Mirror is a device that monitors moisture and other data at key points in the ginning process and uses that information to help the ginner control all of his moisture systems, as well as provide valuable feedback to system performance.

The Moisture Mirror consists of a PLC and touch screen located at the ginner's console. Moisture signals from the Sled (incoming moisture), after-drying sensor, and Steamroller exit are connected to the PLC and displayed on the touch screen. Load monitors from the module feeder and inclined cleaners are also connected, providing a visual indicator of the volume and split of the cotton.

Information gathered by the Moisture Mirror is used to control outputs to each moisture control system. Drying system temperatures are modulated according to incoming moisture content. Conditioning Hopper valves are automatically closed when wet cotton enters the gin. The Steamroller operating temperatures are automatically adjusted to maintain a target bale moisture. Custom alarms can be configured to "alarm" or close a contact for defined conditions. Each of the above is designed to help ginner get the most performance and benefit from their moisture control systems.

The 2002 gin season in West Texas saw a variety of conditions. A mix of wet and good weather resulted in a wide range of moisture between modules and sometimes within modules. The Moisture Mirror allowed the moisture systems to respond to changing needs and provided the ginner with valuable information.

### **Drying Systems**

The main function of the drying system is to achieve maximum value for the grower and the gin through good cleaning and maintaining consistent throughput. With stripper cotton, good cleaning is a must and as demonstrated in 2002 when we received seven inches of rain in October, notoriously dry West Texas can have some very wet cotton. In West Texas gins, there are a variety of approaches to drying and many of these are very good.

The best drying systems may utilize different dryers and methods, but they all share similar attributes. The most important of these is good airflow. A high volume of air means a high capacity for drying cotton and the ability to accomplish it with lower temperatures. Good heaters with good controls are also critical for properly handling a variety of incoming cotton. This requires moisture sensors that provide information to make good decisions. The final common ingredient is good ginner trained to maintain and troubleshoot the drying system. Several gins have used these principles to build a good, and in some cases great, drying system. However, not everyone is in agreement on all drying issues.

One of the differences in approaches you will find is the placement of machine cleaners in the drying process. One theory is to place cleaners early in the system, sometimes prior to any hot air being introduced. The idea behind this approach is to get the trash out early, which can have several benefits including less wear on other equipment. The downside to this approach is that wet cotton does not clean well. Feeding wet cotton through cylinder cleaners entangles wet fibers with trash and results in lower turnouts and more difficult cleaning later in the process.

With these things in mind, the Windstar group faced an important decision in 2001 when planning the layout for Top of Texas Gin. Historically, we had used a variety of dryers in their gins including a Big Reel Dryer at Edcot. Knowing the importance of a good drying system and a blank slate to work with, the group took a look around the area to see the most successful drying systems that matched their philosophies. One of those visits included seeing the Collider Drying System at Farmer's Coop of Sudan. Based on the drying success at Sudan and knowing the importance of a good drying system, a Collider Dryer System was planned for the new gin.

The Collider Dryer shares some of the same system fundamentals as its predecessor, the Fountain Dryer, but the actual dryer is much different. The two systems share high air-volume, pull-through operation and can be matched with similar components. The action in the dryer is where the improvements have been made. As the cotton enters the dryer it collides directly with a blast of fresh hot air. This collision occurs at about 9,000 feet per minute which both dries and fluffs the cotton. A secondary internal collision repeats the process, hitting the fluffed cotton with another blast of drying.

One of the interesting things to watch when the Collider Dryer operates is the separation of leaf trash from fiber at the collision points. The collision points dry the cotton and shake out trash. Upon leaving the dryer, the cotton is dry and fluffy and properly prepared to let the inclined cleaners perform their job of removing trash.

Of course, as alluded to before, the two Collider dryers are only one part of the drying system at Top of Texas. Two 8-Million Btu/hr heaters provide the heated drying air and a Hot Box II provides an early drying point and a place for junk separation. The drying system is also connected to the Moisture Mirror system, allowing it to respond to changes in incoming moisture and making it easy to monitor the cotton split. Engineered pipe sizes, a custom sized skimmer, and fans provide the proper airflow. The final touch is having a good crew in place with the training and knowledge to make it all work.

After the 2001 experience at Top of Texas, the decision was made to replace the Reel Dryer at the Edcot Gin with a Collider Drying System. This new system shares the same resources as the Top of Texas system and has been given several opportunities to prove itself with some exceptionally wet weather in 2002. The Collider Drying Systems at Top of Texas and Edcot play a key role in Windstar's goal of maximizing grower value and maintaining good production rates in a variety of conditions.

### **Conditioning Hoppers**

Many times in our area we have very dry cotton. We have found that in these instances we can improve the performance of our gin stands, increase the amount of final moisture in the bale, and in dry conditions we help preserve staple and strength grades by using Conditioning Hoppers over the gin feeders. We installed this system at Edcot simultaneously with the Steamroller. Another Humidaire Unit is used to provide the quantity of moisture needed for this process.

One area of concern at Edcot is that our testing also shows a correlation of running the Hoppers with a slight increase in leaf grade. More testing is planned to better quantify the added moisture's impact on leaf, but for now when ginning certain varieties with excessive leaf the Hoppers are turned off. It is worth noting that in some cases, Hoppers have been shown to benefit leaf grades, especially on very dry cotton where static makes trash cling to the lint. Finally, static is a problem in many areas, including West Texas. The moisture applied through the Hoppers kills static and allows the cotton to feed better.

In summary, the Conditioning Hoppers are a valuable tool, giving the ginners at Edcot more options in processing their customer's cotton and providing economic benefits to the growers and the gin.

### **The Steamroller Lint Conditioner**

No discussion of gin moisture control systems is complete without mentioning restoring moisture at the press. A tour of West Texas gins would again demonstrate a variety of approaches and the most popular of these methods is the Steamroller System. Twelve of the approximately 50 worldwide installations are located on the high plains of Texas and two more are just over the Oklahoma state line. The Steamroller offers so many benefits to the growers, gin, and mills that Windstar Gins uses one at each of their four plants.

The Steamroller is positioned within a few feet of the exit of the battery condenser. As cotton feeds out of the condenser, it is fed into the Steamroller by its large perforated steel drum. Once inside, humid air is passed through a stationary perforated bottom and through the batt of lint. This is the point at which the lint becomes moisturized. Cotton is then compressed as the doffer roller feeds it out. As cotton passes over the feed out plate, an imbedded moisture sensor measures the moisture of the lint. That moisture reading is fed back to the Moisture Mirror and is used to modulate the water temperature to achieve the target bale moisture.

The obvious benefit is to the grower because the Steamroller restores moisture weight, which directly adds to the value of each bale. This is also a strong benefit for the gin, as it makes cotton easier to press-hence lowering hydraulic pressure and improving press performance. The Steamroller is also a great marketing tool to attract customers.

Mills receiving Steamroller conditioned cotton also enjoy benefits. Moisturized bales are easier to handle due to fewer broken ties and the elimination of bales springing too high upon opening. Perhaps the biggest benefit is that these bales are pre-conditioned and the required conditioning time in the lay down room is tremendously reduced.

One of the challenges of this system is the cold weather that accompanies part of every West Texas gin season. The Steamroller has inherent protection against cold weather because the only air that enters it is warm air. This keeps the metal surfaces warm and prevents condensation from being a problem. However, in extreme cold conditions the maintenance needs of the Steamroller increased significantly. Metal surfaces that were exposed to the cold air, such as the sidewalls, would have condensation allowing lint to build up and hamper the operation.

Early operators helped develop the ring seal brushes in early Steamroller models. Buck Jones of Windstar Gins led the most significant development for this problem. Buck experimented with piping hot air into the sides of the Steamroller, which kept those surfaces warm and dry and build-up free. In my opinion, this is an excellent example of what the relationship should be between manufacturer and user - Stay closely turned to actual field performance and be willing to rapidly make necessary changes proven to be successful.

Ginners need to understand this moisture restoration system, as is the case with any mechanical device, is not without maintenance and some down time. However it was an easy decision for me to install this system in all four of our gins because of the customer and gin benefits.

### **New and Developing, System Analyzer and Monitor (SAM)**

With the advances in moisture control systems and technology, the need for data collection is growing rapidly. This data is valuable in many ways, including research, trouble-shooting, marketing, aiding the ginner, and making communication easier for all parties. In December of 2002 a prototype of the System Analyzer & Monitor, better known as SAM, was installed at the Edcot Gin to collect that data.

Edcot Gin was selected as the beta site for the prototype because they have the full line of moisture system resources and have shown a great desire to get maximum benefit from those resources. It was also selected based on their relative proximity to the Samuel Jackson office and factory in Lubbock, Texas. Further sites for SAM will be pursued based on the progress that is made in its development.

### **The Key to It All**

The key to any successful moisture system is the people operating it. Much of the success at each of the Windstar facilities is owed to the ginners, the staff, and the technical supervisors. The value of all of the moisture controls mentioned earlier in this paper is dependent on the skill and knowledge of the operators. We are able to squeeze maximum value from our systems by keeping our staff up to date with training and providing them easy access to helpful resources.

One of the ways the training is accomplished is by sending staff members to the Cotton Conditioning Workshop sponsored by Samuel Jackson. At the workshop, their employees get to interact with ginners from across the country as well as the Sam Jackson staff. The latest developments are discussed and hands-on labs provide the opportunity to learn how to maintain and troubleshoot various equipment.

It cannot be overemphasized that it is the human resources that extract the full value out of any gin moisture system.

### **Summary**

Used correctly, cotton moisture control systems offer many benefits to growers, gins, and mills. Each region of the country and each gin faces special circumstances that should be evaluated when determining the best mix of moisture tools to implement. If those tools are well chosen, the gin and its customers will reap tremendous dividends.