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The journey from seed to harvest is fraught with obstacles for cotton growers. Even after multiple herbicide and insecticide treatments, cotton's crucial defoliation stage remains. It takes a great deal of skill on the aerial applicator's part to deliver the goods when it comes to applying a defoliant.



Cotton

The Importance Of Aerial Application On

A symbiotic relationship between agricultural aviation and cotton that began in the 1920s is as strong as ever in today's high-cost, high-yield, high-stakes cotton growing arena

*By Jay Calleja
Manager of Communications*



“We’re joined at the hip. We can’t grow cotton in my part of the world without aerial applicators.”

—Texas farmer John Barrett, who grows about 1,800 acres of cotton a year in the coastal bend of Texas, near Corpus Christi

As a fiber, cotton is so ubiquitous that Cotton Inc. dubbed it the fabric of our lives. The natural fiber is present in everything from clothing to sheets to bath towels. Cotton is also an important food and feed crop.

Aerial application plays a critical role in the growth and harvesting of cotton, so much so that without it, it is fair to say Cotton Inc. would have to scrap its famous slogan in favor of far more modest claims. Growers and aerial applicators alike agree that cotton would be impossible to produce on a mass scale without aerial support throughout the growing season.

Cotton requires a lot of attention by air,” said 2001–2002 NAAA President Pat Kornegay, Operator of Sun Valley Duster Co. in San Benito, Texas. From insecticide applications to fertilizers to growth regulators, “there’s a lot of different things you can do to cotton, so there’s always been a lot of aircraft working in the Cotton Belt.”

“They couldn’t farm without airplanes or they would be out of business. There’s no way they could do it without them,” said Operator Reid Potter, of Lakeland Dusters Aviation in Corcoran, Calif. “There’s several key factors. No. 1 is time. At 10 o’clock in the morning, I might have 2,000 acres to do. [Meanwhile, farmers and crop

consultants] are all out checking fields. By 3 o’clock I’ve got 12,000 acres to do. They’ve got a fire out there they’ve got to put out *today*. The planes can get across 12,000 acres in one night. Whereas if they’re trying to facilitate ground rigs to do that volume in that amount of time, it would never happen. The crop would be half gone by the time the ground rigs got across it.”

“Farming cotton in our area would quickly become uneconomical,” said Erik Hansen, a grower in California and partner in Lakeland Dusters Aviation. Hansen Ranches grows 5,000 to 10,000 acres of cotton (primarily Pima cotton) each year.



Operator Dan Kubal of Kubal’s Aerial Spraying Inc. treats a cotton field in Levelland, Texas.

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From insecticide applications to fertilizers to growth regulators, cotton requires a lot of attention by air. “Any crop duster you talk to, if their growers aren’t growing cotton anymore, they’ll tell you they miss cotton,” Reid Potter, of Lakeland Dusters Aviation, said.



Joe Harris and Nolan Avila, two longtime pilots with Lakeland Dusters Aviation, fly in tandem over a recently defoliated cotton field.

“Cotton’s impact on aerial application is a long-running affair from the 1920s to the present,” Pat Kornegay said. “Times have changed, techniques have changed and generations of pilots and innovators have come and gone, but the temperate regions that are conducive to cotton growth and a crop that requires a lot of attention by air has, to a great extent, fostered the development of our industry.”

“We’re joined at the hip,” Texas farmer John Barrett agreed. “We can’t grow cotton in my part of the world without aerial applicators.” Barrett and his wife Debra own Barrett Ag, a 3,600-acre farm in the coastal bend of Texas, near Corpus Christi. They grow cotton and grain sorghum on a 50/50 crop rotation, typically producing 1,800 acres of cotton a year.

An Affair to Remember

As essential as aerial application is to cotton, what is equally true is how important cotton has been to the agricultural aviation industry historically and continues to be. It’s hard to imagine where one would be without the other.

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In 1922, Curtiss Jenny biplanes were used to dust cotton fields near Tallulah, La., to control the bane of cotton, boll weevils—a pernicious beetle that averages six millimeters in length and feeds on cotton buds and flowers. According to the Smithsonian Institution’s National Air and Space Museum, Dr. B.R. Coad, a government entomologist, originated the idea that dusting boll weevils would be more efficient if it could be done from the air rather than from mule-drawn wagons. Those initial trials with the Curtiss Jennys convinced Coad that researchers were on the right track, but also highlighted the need for an aircraft specially designed for crop dusting. Enter Huff-Daland Dusters Inc.—the

forerunner of Delta Air Lines—formed in 1923. In 1924, the company used a converted biplane to perform the first commercial dusting of crops in cotton fields around Macon, Ga. The new ag plane quickly acquired the nickname the “Puffer,” an image Huff-Daland incorporated into its logo.

“Airplane technology, spray system technology, dispersal systems, GPS—most of these things were born in the South and cotton’s been kind of a motivator for that development,” Kornegay said. “On a per-acre basis cotton and rice require more applications than any other crop, so a lot of the advances in our industry have come out of the cotton and rice fields of the South and the West, Arizona and California.”

The Cotton Belt

According to the National Cotton Council of America, cotton is grown on more than 18,000 farms in 17 states spanning the southern half of the United States. The Cotton Belt stretches from Virginia to California, but no state grows more cotton than Texas. Planting begins as early as Feb. 1 in South Texas and as late as June 1 in northern areas of the Cotton Belt.

Each region has its own unique weather patterns, insect pressures and growing schedule that affect the type of aerial application services rendered. Likewise, there are different varieties of cotton. Regardless of what type and where it is grown, growers rely on aerial application from the beginning of the planting season to the end when it is time to defoliate, as well as before and after the growing season.

San Benito is located in the southern tip of Texas in the Lower Rio Grande Valley, which is where the first cotton crop is harvested in the United States each year. “By mid to late June we usually get the first bale of cotton,” Kornegay said.

Cotton season starts for Sun Valley Dusting in January and February when Kornegay does pre-plant herbicide applications and burndown—“cleaning winter weeds out of the fields prior to cotton planting and preparing the soil with pre-plant herbicides.”

Located in central California, more cotton is grown in Corcoran than anywhere else in the state. Cotton planting begins around March 15, but the work for Lakeland Dusters begins in January as well. “We do typically two herbicide applications for weed control prior to planting, mainly because it’s too wet to get on them with the tractor,” Potter said.

“In January we usually go over all the cotton ground with some sort of contact herbicide, and then we’ll come back and do pre-emergent. Not on all of it, some of it. It just depends on the variety that they’re growing.”

That’s the extent of the cotton spraying Lakeland Dusters does until mid to late June. “That’s when the ground rigs can’t get in because basically the plants are getting too big, and they don’t want to damage the plant,” Potter said. The fact that farms are on an irrigation schedule and the fields are wet also restricts the use of ground rigs.

Similar to other operations, Potter’s business really picks up over the summer months, from late June through August. About 50 percent of the total acreage Lakeland Dusters services for the year is treated in that two-and-a-half-month stretch.

Time Flies

Some aspects of cotton spraying are planned out ahead of time. For instance, the decision to defoliate is based on crop maturity and harvesting capability. However, most of the work during the growing season is requested on short notice. “The midseason

insecticide applications are ad hoc,” Kornegay said. “You’ve just got to get after them when they’re out there.”

“When I have a pest problem, I want it taken care of ASAP, and an operator like Ed Shores can get that done,” said Barrett, who has been a longtime customer of Shores Ag-Air Inc. (Robstown, Texas).

Rapid response has always been one of the aerial application industry’s best calling cards. “The biggest thing we have to offer is time, the ability to get control of problems fast,” Potter said.

Adds Kornegay, “Where aerial application comes in is on all of these things—from insecticides to growth regulators and defoliants—timing is critical. Especially in regard to herbicides and defoliants, timing and coverage are critical.”

Different insects affect cotton at different growth stages. In Texas, Kornegay sprays for flea hoppers, boll weevils, spider mites, aphids, boll worms and tobacco budworms. “As the crop matures, we’ll start doing pre-harvest treatments of boll openers and defoliants to cause the plant to drop its leaves so that this can be harvested” (*for more on defoliation, see sidebar on pg. 16*).

Lakeland Dusters has done fewer pest treatments on cotton over the last few years, something Potter attributes to acreage being down, less insect pressure and the fact that growers are using more eco-friendly insecticides that do not harm beneficial insects. Lygus, worms and aphids are the primary pests that can wreak havoc on central California’s cotton crop, but the severity varies from year to year.

“My experience is you have one year in five that’s heavy on bugs,” Potter said. “’05 was a big one. ’04 was so-so and ’06 was so-so, and ’07, ’08 and ’09 have been really pretty slow. This year, everybody

thinks it's going to be a heavy bug year, just because we've had more rain than normal. When it rains into the spring typically the weeds in the foothills will stay green and it gives the lygus a host to survive until the cotton is big enough to feed on. The hills will dry down and then they migrate."

Kornegay isn't big on predictions, even after 36 years of ag aviation experience. "I've flown a lot of different cotton seasons both here in Texas and in Mexico and in Central America, Nicaragua specifically, back in the

'70s where I'd fly two different cotton seasons a year. Every area is unique and the insect pressures are different. What I'm telling you is that after all that experience, I sure can't outguess a season. I can't tell you beforehand whether it's going to be good or bad or indifferent because the conditions change."

But it's not just harmful insects that farmers look to aerial applicators to curtail; they also rely on ag planes to keep the height of the cotton plant under control by applying a growth regulator or growth inhibitor. Cotton

growth regulators usually contain Mepiquat chloride or Mepiquat pentaborate. "What it does is it causes the cotton to channel its development energy into fruit development instead of stalk development," Kornegay said.

In some cases, too much moisture or certain insect infestations can cause cotton to go out of bloom and start growing a tall stalk. This diminishes fruit production and makes it very hard to defoliate. Even more problematic, if the cotton plant gets too tall and heavy rainfall occurs, the bolls will rot before

Aerial Artistry Ag Pilots' Work is on Display During Cotton's Crucial Defoliation Stage

Even after multiple herbicide, insecticide and growth-regulator applications, farmers aren't out of the woods when it comes to protecting their crop—nor is the cotton out of the fields. Defoliation is a procedure performed immediately prior to harvest. For a high-input crop like cotton, deciding exactly when to defoliate and doing it well is a make-or-break step.

"If the crop is defoliated too soon, yields, quality and profits suffer," the Mississippi State University Extension Service has written. On the other hand, if they choose to delay defoliation, farmers risk exposing themselves to late-season insect problems and adverse weather conditions, such as hurricanes in the South, which could affect yield and profits.

Defoliation can be done using aircraft or ground rigs, depending on the soil conditions and the amount of row space between the cotton. Narrow-row cotton has to be done by air. Wide-row cotton (38-inch rows) can be done with a ground machine if the soil conditions

are dry enough. "If it's not, I never hesitate to use an airplane," Barrett Ag owner John Barrett said.

As ground rigs have gotten bigger and more technologically advanced, most medium to large growers are using them "to a certain extent," Sun Valley Dusting Co.'s Pat Kornegay said. "But when you have irrigated or wet fields and insect infestations that require immediate attention, they still turn to the airplane to do it."

Growers could use ground rigs for defoliation, but in central California they don't like to because it will knock bolls off and reduce yields, said Reid Potter of Lakeland Dusters Aviation.

"When you have large acreage that has to be sprayed repeatedly, it's faster and more efficient with airplanes," Kornegay said.

Out With the Green, In With the White

Before cotton can be harvested, a chemical defoliant is used to force

the leaves off the plant and halt the cotton's development.

"The defoliant serves two purposes. No. 1 is to knock the leaves off so that it doesn't stain the lint when they go through and pick it. If the leaves are green when the machine goes through and picks it, it will stain the lint green," Potter said. "Secondly, there's always a few bolls on the tops of the plants that are not quite mature or they don't want to open, so they'll use Cotton Quik or Prep to open the bolls on the top of the plant so they can be harvested on the first pick."

In Texas, defoliation typically occurs in August. In California, the process from planting to harvest starts and ends later, which means defoliation doesn't begin until September. Lakeland Dusters starts defoliation around Sept. 22.

"The plant would defoliate itself if you could wait until November, but the problem is it rains in November, and then they lose grade," Potter said. "The ability to defoliate it in September gives them about three weeks, four weeks jump on

they open. “That’s a critical thing,” Barrett said. “If we don’t keep our heights under control, we can lose our whole crop to boll rot.”

Left unchecked, they can grow as high as six feet tall. Barrett doesn’t like to see them over 40 inches tall. When the cotton first starts to square, he exposes it to a low dose of growth regulator as a precautionary step. “We like to get the cotton plants acclimated to the chemical,” he said. “If it doesn’t ever rain again you don’t have to put on any more, but if rains 10 inches in two

weeks like I just experienced, you’re putting it on every four or five days.”

The Price of Progress

The availability of *Bt* cotton and the success of the Boll Weevil Eradication Program are two factors that have dramatically altered the scope of cotton production for growers.

The National Boll Weevil Eradication Program “ranks close to Eli Whitney’s invention of the cotton gin as one of the greatest advancements ever for the U.S. cotton industry,” the Cotton

Council declared on its Web site. Aerial applicators were vital to the program’s success. “That would not have happened without aerial applicators,” Barrett said. Boll weevils have been eliminated across the Southeast in Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Tennessee, Missouri, Arkansas and Mississippi. The cotton-loving critters remain in Texas, which has its own eradication program in place.

Bacillus thuringiensis (Bt) is a spore-forming bacterium that produces

harvesting. And again, if they couldn’t defoliate, they’re out of business.”

Unlike some other applications, it’s easy to assess how good a job the aerial applicator did when applying the defoliant to cotton because the results are plain to see. “When you defoliate cotton it’s like painting,” Kornegay said. “If you make a mistake, it shows up right away. You’ve got to do good, precise, clean work. You’ve got to have a well-calibrated spray system that’s going to give you the pattern that you need.”

“That’s one of the things that we do that you can go back in a few days and see what you did,” Hale Dusting Service’s Randy Hale said. “The cotton goes from being a green lush crop to nothing but white in about a week. It’s kind of neat.”

“For us aerial guys, the challenges are corners that have wires in it and obstacles in the field,” Hale continued. “When a customer asks you to defoliate his cotton he wants all of it defoliated. He doesn’t want one corner green.”

It’s all about going white, not green, with cotton. “Green leaves on cotton when you harvest it with mechanical harvesting equipment will stain the cotton. Dried leaves that have not



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fallen off the plant will get trash in the cotton. They call it pin trash. Bolls that are not completely open can cause tagging,” Kornegay said. “All you want left is the cotton, so you apply defoliants and ripening agents to bring it to its complete maturity.”

Defoliation should begin when about 70 percent of the bolls are open and the cotton is fluffing out, according to Kornegay.

In addition to saving time, coverage and penetration are two more advantages to aerial application. Penetrating the crop canopy can be an issue when defoliating tall, heavy cotton. That’s where an

operator’s equipment and experience come into play.

“While higher volumes of water, say, five to ten gallons per acre, have in my opinion showed no improvement in defoliation, we have found that the use of heavier airplanes that displace more air down into the crop have a marked advantage,” Kornegay said. “When we moved from the smaller, lighter aircraft to the heavy low-wing monoplanes like the Thrush and Air Tractor, the quality of defoliation in heavy, irrigated cotton improved. Also the constant cord wings make for a more even pattern and uniform penetration into the crop canopy.” —J.C. ■



Pat Kornegay knows cotton. Besides treating cotton fields by air for the past 36 years, he and his wife Teresa grow their own cotton. The field they are standing in is ready for harvest.

crystals protein, which is toxic to many species of insects. It was introduced as a genetically modified crop for cotton in 1996. Data compiled by the University of Arizona from 1999–2001 show the use of *Bt* cotton decreased the need for foliar spray on pink bollworm drastically and requires less foliar spray, overall, compared to acres with no *Bt* cotton and acres with a combination of *Bt* cotton and non *Bt* cotton.

“This year, we’ve probably sprayed twice as much Milo as we have cotton,” said Randy Hale, operator of Hale Dusting Service Inc. in Banquete, Texas, and NAAA’s president in 2006. “Seventy percent of the cotton we have here is *Bt* cotton, which doesn’t require as much spraying.”

While the use of *Bt* cotton may have cut down on the number of aerial applications in some respects, that doesn’t mean aerial application is any less important. On the contrary, cotton has gotten so expensive that farmers are eager to protect their investment at every turn.

Technological advances available to the cotton farmer have led to higher yields, but the up-front costs have gotten to the point where growers are investing a significant amount of money just to get the cotton seeds into the ground. Barrett estimates it can cost \$150 an acre or more to plant the seeds. As the stakes go up, so does the need for aerial application.

“When you have that much money at risk it would be crazy to not spray your crop in a timely fashion while you were waiting for the ground to dry up so you could protect your investment in a ground machine,” he said.

Kornegay said the amount of work he does with cotton remains about the same, but the type of spraying is different. “Since we’ve had boll weevil eradication programs and genetically modified crops, the applications that we do have changed,” he said. “There’s been a lot of change in chemistry over the last 20 years, so that’s changed the type of the products we use and when we use them and what we use them for. But we’re still flying over the cotton several times a year.”

Economic and Planting Forecast

Whether an aerial applicator is hired to control pests, apply growth regulators or perform defoliation, the overriding purpose is the same: to protect the farmer’s investment and get the product to market. The cotton market is heavily tied to the national economy.

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Barrett, a fifth-generation cotton farmer, said, "I have my concerns along with many others about the future of the national economy and what that can do to the demand for cotton products in the United States. The main thing is the farmer has to make money for the applicator to have business, so we're all in the same boat here."

When the Cotton Council issued its economic outlook for U.S. cotton back in February, it projected that 2010 would be a year of "recovery" for the U.S. cotton industry. Demand for cotton is improving, the Council reported, after a sharp downturn in 2008, and the Council's annual survey of acreage intentions indicated that more cotton would be planted across the Cotton

Belt, reversing three years of decline. Results, collected through mid-January, "indicate that growers will plant 10.1 million acres of cotton," 10.3 percent more than in 2009, with all regions expected to increase cotton acres.

That's good news for aerial applicators. Sun Valley Dusting works year-round, services more than 20 different crops, including sugarcane, grain sorghum, corn, citrus, soybeans, wheat and vegetable crops, and may cover anywhere from 150,000 to 300,000 acres a year. Of that acreage, "probably 70 percent of our work is related to cotton," Kornegay said.

When the harvest is over, Sun Valley Dusting will sometimes spray for boll

weevils to kill any remaining weevils that would affect the following year's crop. This is known as a diapause application. Kornegay continues to apply herbicide applications throughout the fall to keep the fields clean and weed free, proving that cotton is the commodity that keeps on giving.

Cotton is a huge part of Potter's business as well. "You're going to go over cotton ground eight times over the course of a year versus, say, six on any other crop," he said. "I'm counting herbicide applications and defoliation applications, because we do two defoliation applications in September/October. That basically is our last quarter. ... The tomatoes are done, the alfalfa is done for the most part, so all we've got is cotton."

Not that Potter is complaining. The fabric of his business is closely linked to cotton. Lakeland Dusters works 12 months out of the year and has 25 full-time employees, including six pilots who fly five 500-gallon Thrush aircrafts and 19 shop, ground and office personnel, including Potter, who runs the operation from Lakeland Dusters' headquarters but does not fly himself.

"Any crop duster you talk to, if their growers aren't growing cotton anymore, they'll tell you they miss cotton," Potter said. There are different herbicides for tomatoes and different ways of controlling the insect pressure. "They don't have the insect pressure that cotton does, and you don't defoliate it. In September, they're gone, they're harvested. Whereas, cotton doesn't come off until mid October so they have to defoliate it. So it gives us another job in the fall. That's big. That's real big. If we didn't have cotton here, this company would change—big." ■



WHAT A PEST Although the cotton-loving critters still remain in some states, the threat of boll weevils has been greatly reduced thanks to success of the National Boll Weevil Eradication Program and the role aerial applicators have played in eradication efforts.