ARTESIA

ANNUAL REPORT —— 2021

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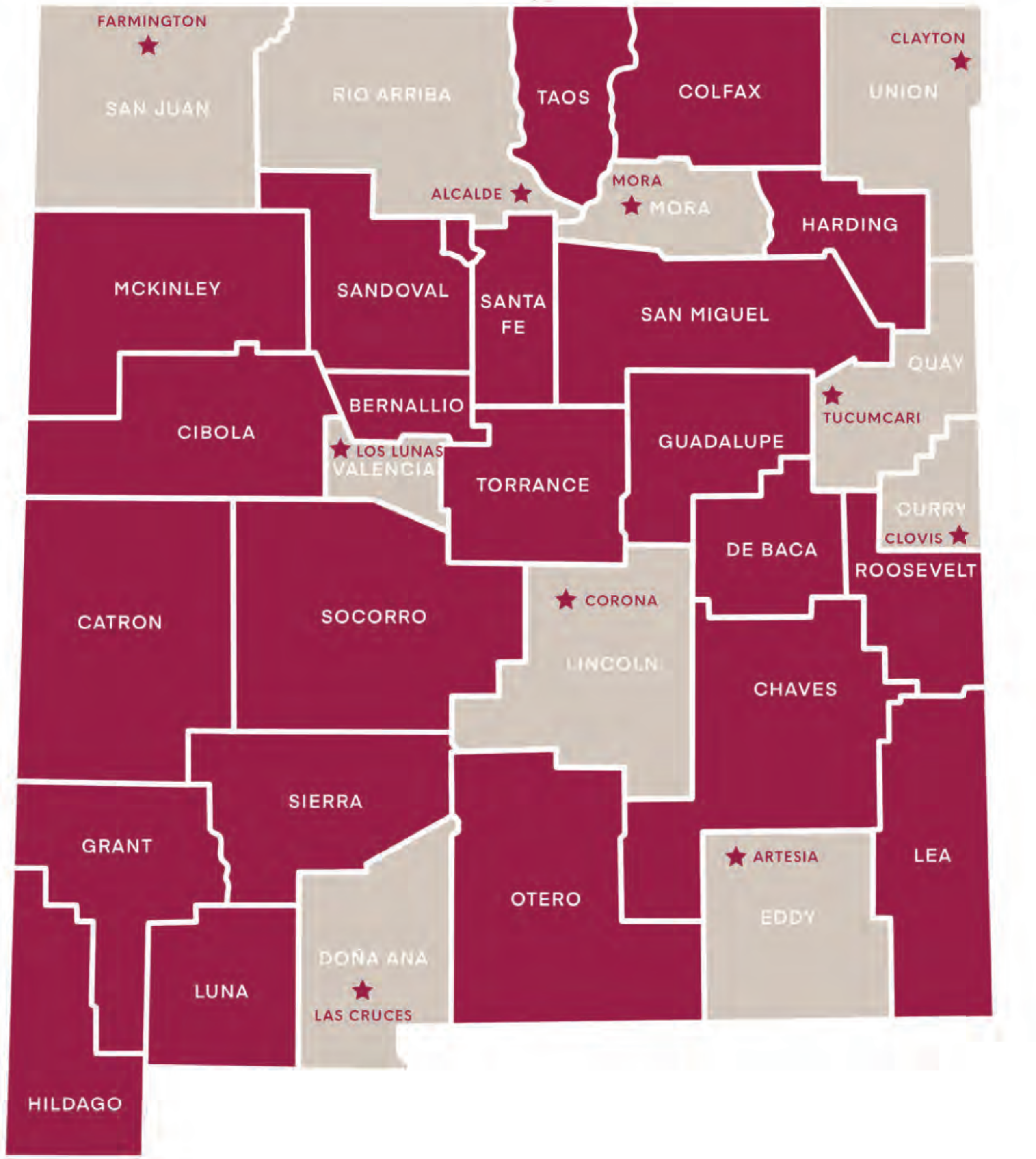
MISSION

The Agricultural Science Center at Artesia (ASC-Artesia) faculty and personnel strive to address emerging research and extension needs in soil health, water management, germplasm screening, crop evaluations, and entomological sciences to enhance the agricultural, economic, environmental, and social well-being of southeastern New Mexico farmers, ranchers, and associated agricultural community businesses particularly in water rights district two. We strive to contribute to the economic development of New Mexico through education, research, and service.

NMSU Agricultural Experiment Stations



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This report has been prepared to aid Science Center staff in analyzing the results of the various research projects from the past year and to record data for future reference. These are not formal Agricultural Experiment Station Report research results. The reader is cautioned against drawing conclusions or making recommendations as a result of the data in this report. In many instances, data represents only one of several years' results that will ultimately constitute the final formal report. Although staff members have made every effort to check the accuracy of the data presented, this report was not prepared as a formal release. None of the data is authorized for release or publication without the written prior approval of the New Mexico Agricultural Experiment Station.

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Contents

Executive Summary

The ASC Artesia experienced almost 15 inches of rain over the year. We hosted a field day that brought in local families. In SE New Mexico and beyond we experienced insect pressure but levels at the ASC were below the threshold that would trigger chemical treatment. Alfalfa fields on the farm had a plethora of beneficial insects that kept the field below the threshold for treatment. The best defense is high levels of predators. This is brought out with what the grants entomology have received. The station is proud to have had a graduate student in entomology that is now Eddy Count's extension agent. Agronomy was going well with alfalfa harvests until the forage harvester experienced mechanical problems forcing some hand harvesting. We finished a project on energy crops on how well they respond to salinity. We also ended the calendar year with a planting of canola for another grant proposal that will look for changes in yields. We are grateful for the grants we have been able to obtain and the funds from the legislature. Southeastern NM farmers stand to learn from the projects we have and we will continue to address issues relevant to southeastern New Mexico.

Meeting the Needs of New Mexico

NMSU ASC Artesia reflects the surrounding agricultural positions of water rights for crops and livestock including alfalfa, corn, sorghum, and pecans. Stakeholders have thousands to millions of dollars invested in the land and crops. We provide a testing platform for breeders to observe how new genetics will perform under different conditions over time. Much of the genetics will be proved to be good and others will be culled over the length of the trial.

2021 Financial Summary

Agricultural Science Center Artesia
Fiscal Year: **2021**
Fiscal Period: **30-Jun-21**

Department		Account Index Desc	Revenue YTD	Expense Budget	Expense YTD	Budget Balance Available YTD	Fund Balance Dr/(Cr)
Ag Science Ctr at Artesia	EVALUATING INSECT PEST MANAGEMENT T	EVALUATING INSECT PEST MANAGEMENT T		$19,000.00	$0.00	$19,000.00	
Ag Science Ctr at Artesia	PREDATION IN ADJACENT COTTON FIELDS	PREDATION IN ADJACENT COTTON FIELDS		$6,000.00	$346.71	$5,653.29	
		Total Restricted Funds		**$25,000.00**	**$346.71**	**$24,653.29**	
Ag Science Ctr at Artesia	APPLIED CHARGES	ASC ARTESIA VEHICLE	$0.00	($300.00)	$3,035.93	($3,335.93)	($3,139.63)
Ag Science Ctr at Artesia	OTHER SOURCES	ASC-ARTESIA LAND USE BY CEHMM	$16,200.00	$20,135.00	$21,354.26	($1,219.26)	($35,672.15)
Ag Science Ctr at Artesia	OVERHEAD TRANSFERS	INDIRECT COST RECOVERY-ARTESIA	$0.00	$2,000.00	$0.00	$2,000.00	($1,227.55)
Ag Science Ctr at Artesia	SALES & SERVICE	ARTESIA ASC SALES	$23,515.72	$5,000.00	$23,179.26	($18,179.26)	($26,727.90)
		Total Sales and Service Funds	**$39,715.72**	**$26,835.00**	**$47,569.45**	**($20,734.45)**	**($66,767.23)**
							* See Note
Ag Science Ctr at Artesia	STATE APPROPRIATIONS	ASC ARTESIA SALARY		$383,417.17	$352,021.16	$31,396.01	
Ag Science Ctr at Artesia	STATE APPROPRIATIONS	ARTESIA ADMIN		$85,086.00	$85,563.28	($477.28)	
Ag Science Ctr at Artesia	STATE APPROPRIATIONS	NUTRIENT MGMT SOIL		$4,777.00	$4,253.96	$523.04	
Ag Science Ctr at Artesia	STATE APPROPRIATIONS	OPTIMIZING INSECT PEST MANAGEMENT		$4,777.00	$4,541.56	$235.44	
Ag Science Ctr at Artesia	STATE APPROPRIATIONS	AES GRADUATE RESEARCH AWARD		$20,000.00	$18,326.16	$1,673.84	
		Total State Appropriated Funds		**$498,057.17**	**$464,706.12**	**$33,351.05**	

Note: "( )" in the fund balance column indicates a positive number

2021

RESEARCH RESULTS

ENTOMOLOGY

Jane Breen Pierce, Patricia Monk

NMSU lab personnel include Jane Breen Pierce PI, Patricia Yates Monk, Research Associate, Ivan Tellez, graduate student, Quinn Tifton, and Chance Campbell high school student part-time/seasonal employees. Ivan has recently accepted a position as Eddy Co Extension Agent and will finish his MS this spring.

Despite some continued restrictions due to Covid-19 the New Mexico cotton IPM entomology lab was able to conduct all of our planned cotton field trials by year-end. I was a co-author on one cotton publication with Charles Allen, the e-book was published in December and the hard copy is being published in January. We also published one proceedings paper in the Beltwide Proceedings. We made several presentations at professional and grower meetings/workshops which are detailed at the end of this report.

One focus was evaluating the potential for okra-leaf cotton as a control measure for bollworm in the face of increasing resistance by bollworm. This is a promising area since we have shown that our New Mexico environment with high temperatures and low RH can produce higher mortality when there is less canopy cover (Pierce et al 1999 and 2002). A closed canopy cover provides shade which can lower the canopy temperature raise relative humidity from plant respiration. Okra-leaf cotton will have more light penetration and air movement which may result in higher temperatures and lower RH more similar to our ambient desert conditions likely resulting in lower hatch rates.

Developing tools for control of lepidopterous pests in the face of developing resistance to Bt genes

Virtually all corn and cotton growers in NM grow transgenic Bt varieties to control insect pests. Resistance to multiple Bt genes has been developing in the US including New Mexico. There are no genes in the near-term pipeline to replace those currently available so alternatives for controlling pests are an imminent need. In response to this issue, we are developing alternative tools for controlling lepidopterous pests and examining the efficacy of existing technologies like insecticides.

In New Mexico, we have relatively high levels of environmental and biological control. Our desert environment has low relative humidity and high temperatures which often has a significant impact with typically 40-60% mortality. Okra-leaf cotton varieties have a more open canopy and could produce a microclimate that is hotter and drier than conventional cotton. This could result in higher mortality from desiccation in lepidopterous pests providing an alternative means of control to both Bt cotton or insecticides for cotton growers. Results from field trials in 2020-2021 did indicate that H. zea egg hatch was an average of two times higher in the standard leaf cotton variety with standard plots and three bioassays producing significantly higher egg hatch.

Populations of cotton bollworm were very low on our research farm but conversations with consultants and sampling in commercial corn fields suggest that only the VIP genes are still extremely effective. Even in VIP fields, we have collected some bollworms (.ca 1% infested ears) suggesting that resistance is inevitable and emphasizing the need to develop alternative controls.

Insecticides are available for control but reductions in insecticide use have numerous positive impacts for growers and the general public. Applicator safety reduced environmental impacts, and increased biodiversity and conservation of beneficial arthropods are benefits in addition to the most apparent cost savings from reducing inputs. As current Bt genes become ineffective controls with the development of resistance, it is important to have alternatives to conventional insecticides with cultural and biological controls. Evaluations of natural control by insect predators in Bt and okra-leaf cotton in 2020 indicated control by beneficial predators in okra-leaf cotton is similar to that in the standard canopy cotton. Predation was fortunately not lowered by the open canopy and subsequent changes in canopy microclimate.

Although travel and in-person visitation were limited in 2021, we were able to do numerous in-person presentations as well as online pesticide applicator training. It was a challenging year not only due to Covid but because Dr. Pierce was the only entomologist with an extension appointment in New Mexico. We had 5 extension entomologists about 10 years ago and still had 3 at the beginning of 2021. The lack of entomologists meant she had to do more fire-fighting than usual. Dr. Pierce is on the search committee for this position and the goal is to have someone in place by summer 2022.

NMSU AES and Cotton Incorporated funded graduate student, Ivan Tellez, placing bollworm egs in okra leaf cotton.

INFLUENCE OF PLANT ARCHITECTURE OF OKRA-LEAF COTTON ON CROP MICROCLIMATE, SOLAR RADIATION AND HELICOVERPA ZEA (BODDIE) EGG HATCH

INTRODUCTION

With resistance to Bt cotton developing in lepidopterous pests, it's important to find alternative methods of control. In Semi-arid cotton-growing areas, low relative humidity and high temperatures can have an impact on hatch rates helping to control insect pests but in late-season, the microclimate of the cotton canopy is more conducive to higher hatch rates and potential yield losses (Pierce and Monk 2010 and Hake et al 1991). The use of okra-leaf cotton may help reduce hatch rates by allowing greater air and light penetration into the canopy producing a microclimate less conducive to high egg hatch. (Andres et al 2016, Jones et al 1976, and Mahan et al 2016).

Figure 1. From left to right. Left: standard, sub-okra /sea-island, okra, and super okra (Andres et al, 2016). Right: Fabric with sentinel H.zea eggs used in field trials.

MATERIALS AND METHODS

Two cotton varieties were planted in 2020 and 2021, the palmately lobed okra leaf cotton (UA107, University of Arkansas) and standard broadleaf cotton (Bollgard® 3- DP1845B3XF, Monsanto Corporation). In 2020, experimental plots consisted of 6 rows, 15.2 meters in length with okra-leaf treatment replicated 5 times and the standard leaf replicated 4 times (n=9) on a randomized block design. In 2021, experimental plots consisted of 8 rows, 15.2 meters in length replicated 4 times for each variety in a randomized block design.

Sentinel H. zea eggs laid on the fabric were stapled to leaves at mid-canopy and left in plots for 48 hours to access predation and impacts on H. zea egg hatch. Eggs were retrieved, brought into the laboratory where eggs were examined for signs of predation and categorized based on the remains. Hollow eggs with holes on each side are typical of green lacewing or immature ladybug predation. Collapsed tent-like eggs are typical of predation by sucking insects such as nabids. Eggs that have been chewed with little remains are typical of predators with chewing mouthparts such as adult ladybugs, spiders, or collops beetles. Intact eggs were then monitored for hatching every 24 hours to determine total hatch rates.

Figure 2. Left: Fabric with sentinel H. zea eggs placed on a cotton leaf. Right: Hobo temperature and relative humidity data logger in the canopy near fabric with sentinel H zea eggs.

RESULTS

H. zea Hatch in Okra-leaf vs. Standard Leaf Cotton

Mean egg hatch was reduced over 50% in okra-leaf cotton compared to standard leaf cotton on two of four dates July 13 and August 17, 2020. There was only 19% and 27% hatch in okra-leaf plots compared to 51% and 52% hatch in standard leaf plots on July 13 and Aug 17 respectively. (Figure3). Egg hatch was less impacted in 2021 with significantly lower egg hatch in okra-leaf cotton on one of three dates in 2021 with 25% lower egg hatch, 45% hatch in okra-leaf plots vs 60% in standard cotton on July 25. There were no differences in hatch rates on July 6 and August 10, 2021.

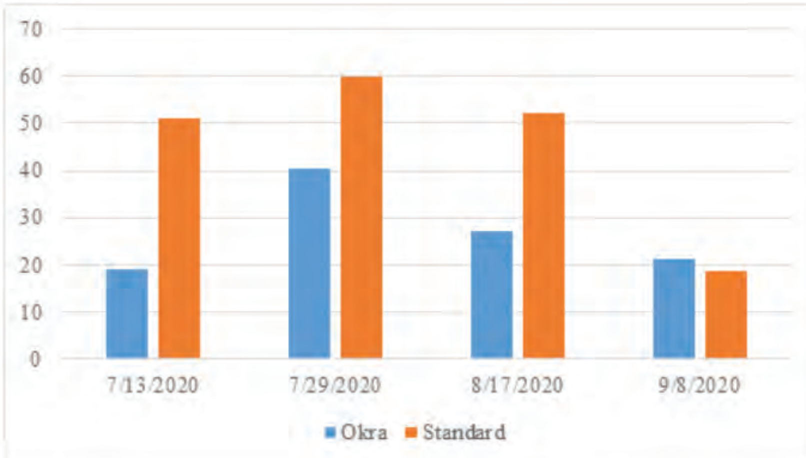

Figure 3: Percent Egg Hatch at 96 hours after 48 Hours in Okra-leaf vs. Standard Cotton Plots.

Mean egg hatch in okra-leaf cotton across all trials was 20% vs 36% in the standard leaf 72 hours after the eggs were introduced to the field. The difference was more evident after 96 hours with the egg hatch almost twice as high in standard leaf cotton vs. okra-leaf cotton.

Temperature and Relative Humidity in the Cotton Canopy

Relative humidity was similar in okra-leaf and standard plots. Surprisingly, the temperature was significantly higher by 3-4oC in standard leaf plots on 2 of 6 dates; July 20th and July 29th with higher temperatures observed in standard leaf cotton vs okra-leaf cotton (Table 1).

Table 1. Average Daily High Temperatures and Relative Humidity in Six Microclimate Trials with Okra-Leaf and Standard Leaf Cotton

	Temperature °C			Relative Humidity (%)		
	Okra-Leaf	Standard Leaf	Difference	Okra-Leaf	Standard Leaf	Difference
7/13/2020[1,2]	40	41	1	82	79	-3
7/20/2020[2]	36	39	3	85	83	-2
7/29/2020[1,2]	43	47	4	98	100	2
8/2/2020[2]	42	45	3	94	97	3
8/12/2020[1]	41	43	2	90	88	-2
8/17/2020[1,2]	38	37	-1	100	100	0
Average	40	42	2.5	91	91	-0.3

Temperature and relative humidity are statistically significant between varieties $p \leq 0.05$.

Egg Tests at Artesia 2020: H. zea Predation

Egg predation was similar in okra-leaf and standard leaf cotton with a mean 41% predation of eggs across seven fields to lab bioassays (Table 2). The highest number of egg remains showed evidence of predation by predators with chewing mouthparts, such as adult ladybugs with 22-23% mean predation season long. There was 12% predation by predators such as ladybug and green lacewing larvae evidenced by hollow eggs with two holes on alternate sides. The lowest predation was by insects with piercing/sucking mouthparts such as nabids which produce collapsed tent-shaped egg remains.

Table 2. Predation of *H. zea* Eggs After 48 Hours in Field Plots From 7 Field to Lab Assays

	2020		2021	
	Okra-Leaf (%)	Standard Leaf (%)	Okra-Leaf (%)	Standard Leaf (%)
Sucked out	7.2	5.7*	13.2	17.2
Chewed	21.7	22.9	23.6	20.4
Hollow Eggs	11.7	11.6	0.01	0
Total Predation	41.3	41.2	36.8	37.2

*Egg predation statistically significant *P*<=0.05.

Egg predation was similar in okra-leaf and standard leaf cotton in 2020 and 2021 with a mean 41% and 37% predation of eggs across okra-leaf and standard leaf cotton plots in ten fields to lab bioassays (Table 2). There were also no significant differences in any species of predators collected in sweep samples in okra-leaf vs standard leaf plots. The most significant predation was by predators with chewing mouthparts such as ladybug adults with 20-24% predation of all eggs in both years and both leaf types. Predators with chewing mouthparts were the most abundant in sweep samples collected with for example spiders and ladybugs representing 39% and 23% of predators collected in 2020. There were significantly more eggs with sucking damage okra-leaf plots in 2020 but not in 2021. Interestingly, there were virtually no hollow eggs in 2021 despite hollow eggs representing 12% of all eggs in okra-leaf and standard leaf plots in 2020. Overall, it is promising that there was no reduction in predation in okra-leaf cotton plots.

The highest number of egg remains showed evidence of predation by predators with chewing mouthparts, such as adult ladybugs with 22-23% mean predation season long. There was 12% predation by predators such as ladybug and green lacewing larvae evidenced by hollow eggs with two holes on alternate sides. The lowest predation was by insects with piercing/sucking mouthparts such as nabids which produce collapsed tent-shaped egg remains.

In 2020-2021 there were lower hatch rates in okra-leaf cotton on some dates despite okra-leaf not having higher temperature or lower relative humidity. An alternative reason for lower hatch rates in okra cotton could be direct radiation on the eggs producing higher egg temperatures that are not reflected in the canopy temperature. To determine if the difference in radiation would produce different hatch rates a field trial was conducted in 2021 with shade cloths that reduce light penetration by 30, 60, and 90%.

The degree of shading had a dramatic impact on hatch rates with only 25% hatch in control and 30% shade vs 41 and 56% hatch in 60 and 90% shade treatments respectively (Figure 4).

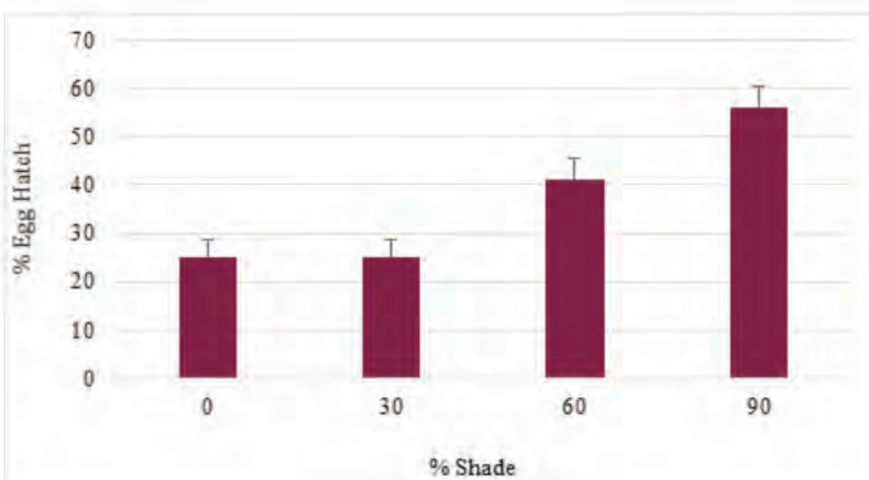

Figure 4: Percent egg hatch of H. zea under different shade treatments.

Figure 5. Left: NMSU Assoc. Dean of ACES with a graduate student discussing microclimate trial. Right: Shade cloth treatments in our cotton trials.

CONCLUSIONS

With developing resistance to Bt cotton and resistance to some insecticides, it is important to develop alternative controls for lepidopterous pests. Cotton varieties with okra-leaf cotton can be useful in helping to suppress populations by reducing egg hatch in arid or semi-arid environments. The impact is not as dramatic or consistent against insects in the canopy as opposed to insects like boll weevil in infested squares on the soil surface. (Pierce et al. 2001). However, in two of seven trials eggs, the hatch was reduced over 50% after only 48 hours of exposure. Eggs generally hatch in 96 hours so greater exposure to desiccating conditions would have a higher impact than demonstrated here. Okra-leaf cotton should be considered for use in breeding programs targeted at areas with semi-arid to arid climates as part of cotton IPM programs.

ACKNOWLEDGEMENTS

We appreciate Fred Bourland, University of Arkansas breeder providing seed from an okra leaf variety. We would like to thank Cotton Incorporated and New Mexico State University Agricultural Experiment Station for support and funding for this project as well as all the staff at the Artesia Science Center.

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ADDITIONAL DATA: OKRA LEAF COTTON RESEARCH IN 2021

Square Damage in Okra Leaf vs DPS

Methods

To assess square damage by H. zea 30 squares per plot, checked on three dates Sept 8, 17, and 24, 2021

Results

Damage by dates was not significantly different so data for dates were combined. Damage was significantly higher in okra leaf cotton with 3% square damage in okra cotton late-season vs 0.8% damage in the Bt cultivar. T=-3, df 18, P<0.004 (Figure 1). This is not surprising since the okra-leaf variety does not have Bt genes but with developing resistance it is good to monitor for possible changes and to be generally aware of damage levels each year.

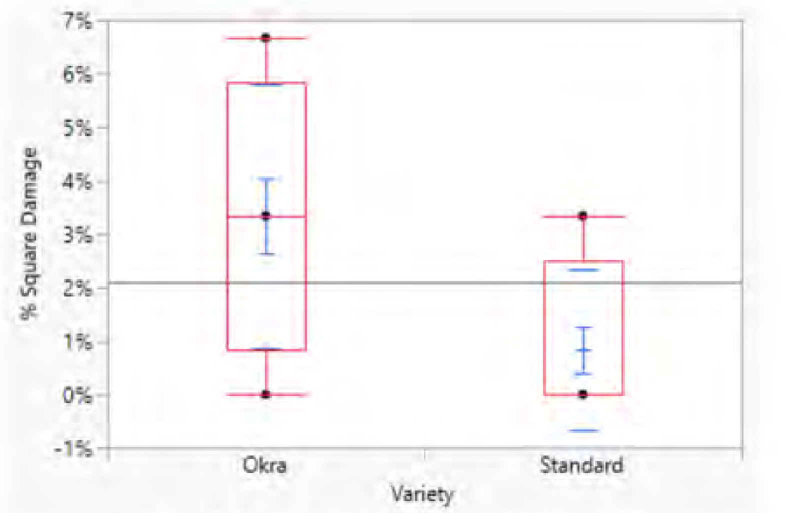


Figure 1. Square damage in okra vs standard leaf plots

Seed Cotton Yields

Seed cotton yield handpicked was significantly higher in DP plots than in the okra leaf plots. DP plots had mean yields of 4.2 bales per acre of seed cotton compared to 5.2 bales/A of the okra leaf cotton. We will gin the cotton and get actual lint yields. Yields are higher than expected if they were machine picked. We had to handpick since our picker was inoperable.

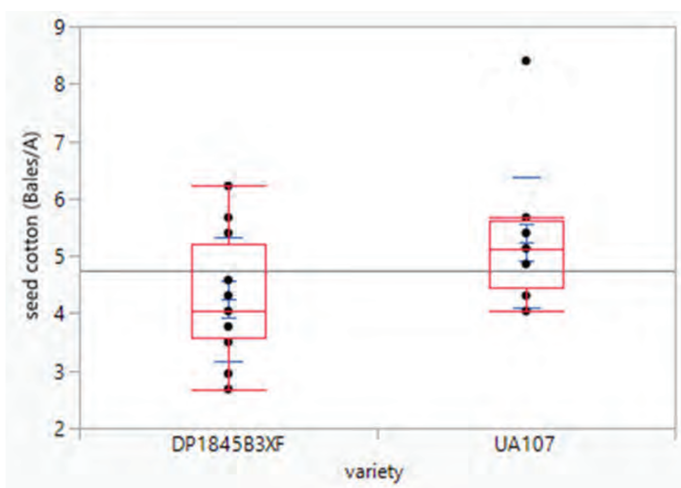


Figure 1. Seed Cotton Yield from Okra-Leaf Trial

Fiber Quality

All parameters were significantly different between cultivars except strength. (Table 1, Figure 1,2,3)

Quality parameters UA107 vs DP1845B3XF

Table 1. Lint Quality of Two Cultivars Used in 2021 Trial in Artesia

Parameter	DP1845B3XF	UA107	P<t
Length	1.19	1.17	*
Uniformity	82.8	83.9	*
SFI	8.4	7.3	*
Strength	30.6	30.6	NS
Elongation	8.8	7.8	*
Micronaire	3.97	4.56	*

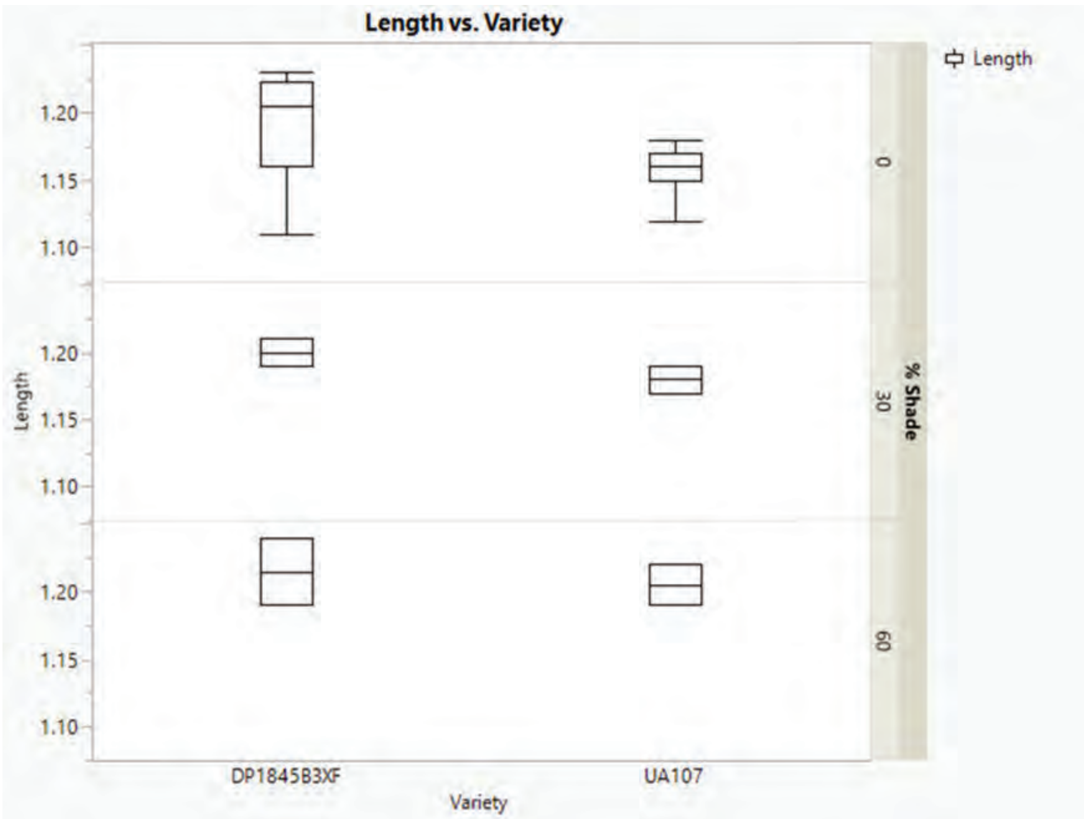


Figure 1. The length by Variety and Percent Shading

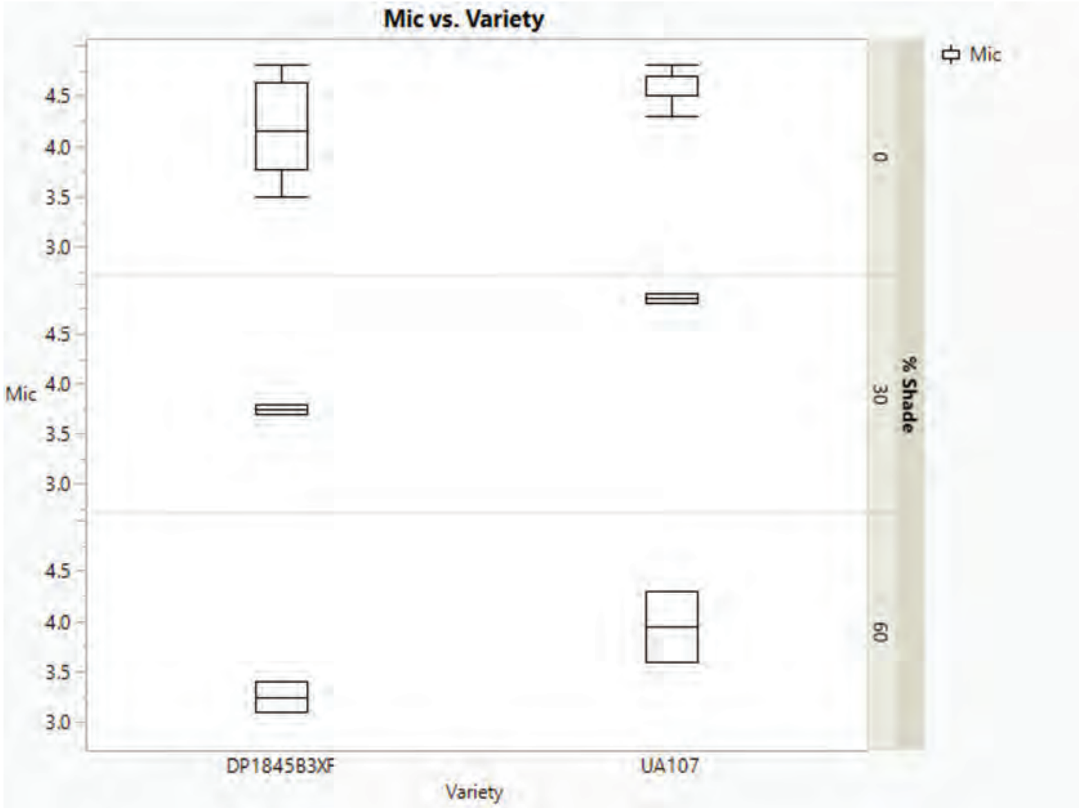


Figure 2. Mic by Variety and Percent Shading

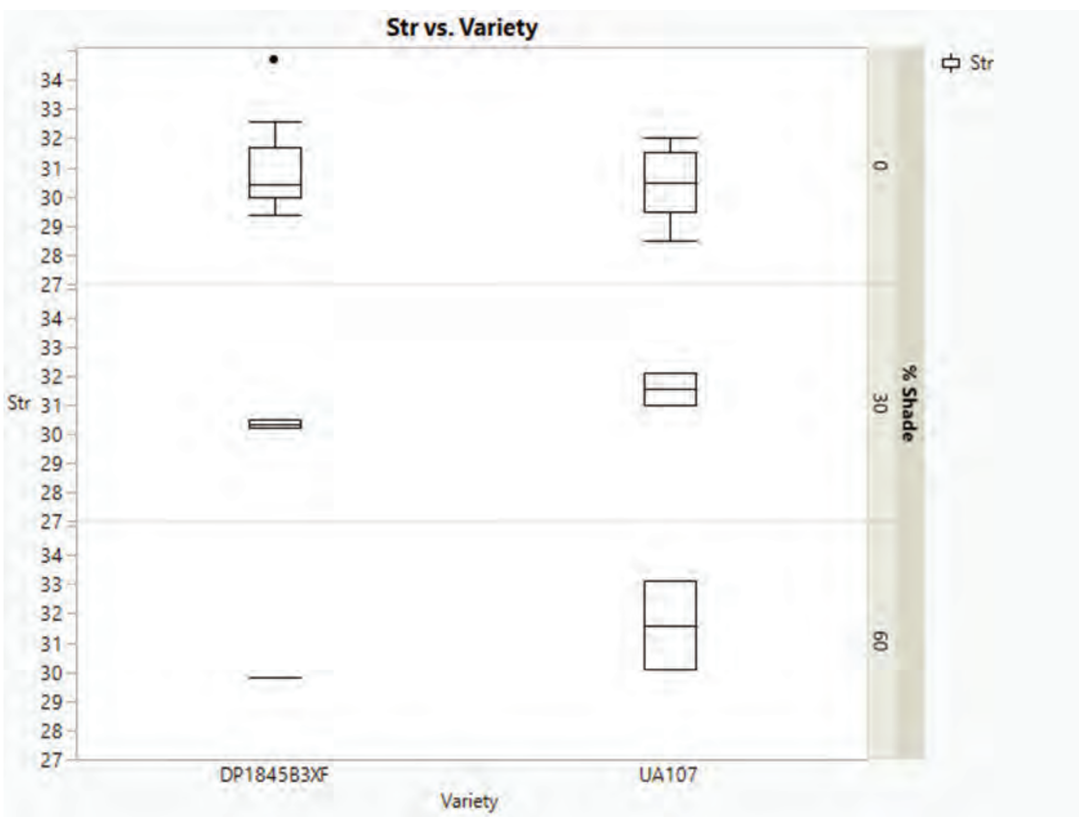


Figure 3. Strength by Variety and Percent Shading

MONITORING RESISTANCE IN COTTON BOLLWORM FIELD POPULATIONS TO PYRETHROIDS

This project was conducted in cooperation with Texas A & M University Kerns et al. The following is a report about the portion that we conducted in New Mexico.

INTRODUCTION

With the increasing incidence of resistance in H. zea to Bt technologies, cotton producers have been forced to rely heavily upon supplemental insecticide applications targeting H. zea to prevent excess economic injury. One of the best candidates for managing H. zea in cotton is pyrethroids. Pyrethroids have the advantage of being very inexpensive but the disadvantages of being highly disruptive and short-lived. Additionally, resistance to pyrethroids is common in many areas. In the nearby High Plains of Texas resistance to pyrethroids has been documented In New Mexico H. zea susceptibility to pyrethroids has not been ascertained. It is imperative to determine if pyrethroid resistance is problematic in New Mexico and Texas so growers will be better able to determine which H. zea management options might work best in their production system.

MATERIALS AND METHODS

Technical grade cypermethrin (94.7%, FMC Corporation, Philadelphia, PA) was used to treat glass scintillation vials for adult bioassays at Texas A & M University by Kerns et al. Color-coded glass scintillation vials contained either 0 (check), 5 or 10 µg of cypermethrin. A 1-ml volume of insecticide solution dissolved in acetone was pipetted into 20-ml scintillation vials. Vials were rolled on their side on a hotdog roller with no heating element to allow acetone to evaporate.

Trapping was conducted at Las Cruces and Artesia, NM. Nylon traps were baited with Helicoverpa zea pheromone to trap male moths for pyrethroid resistance monitoring. During the trapping season, the pheromone lures were replaced every 2 weeks to ensure adequate pheromone plume. Traps were monitored weekly.

Neither trapping location had sufficient moths for the bioassay so our plan was changed and we collected larvae in corn from two locations where there was sufficient non-Bt corn, Artesia and Clovis to rear out sufficient moths for the bioassay. At least 30 moths per dosage were used.

Single moths were placed in equal numbers in the 0, 5 and 10 µg treated vials and placed at room temperature away from sun exposure. After 24 H, the vials were opened, and moths were dispelled by slinging the moth from the vial. Moths able to fly will be considered alive while those that can't be considered functionally dead.

Infested vials were kept at room temperature, with the lid slightly loosened and upright, but at a 45-degree angle. After 24 H, mortality was assessed lightly "flinging" the moth from the vial into the air. Moths that could not fly approximately 3 meters or more were considered dead. Mortality in the 5 and 10 µg dosages was corrected for mortality in the check using Henderson-Tilton's formula. Survival at 5 µg suggests moderate resistance and survival at 10 µg suggests high resistance.

RESULTS NEW MEXICO VIAL ASSAYS

Two vial assays were conducted with moths reared from bollworm larvae collected from corn when near the end of the season there were not enough moths in pheromone traps to conduct bioassays. The assay with the Clovis population had results very similar to results from the nearby South Plains and College Station (Table 1 and 2). Clovis moths had 37.22% survival at 5 µg compared to 28-33% survival in College Station and the South Plains. Clovis moths had 22. 5% survival is more similar to the 33.3% survival in the nearby South Plains than the lower 14.10% survival in College Station although College Station did have a similar 29% survival in 2020.

Table 1. Adjusted percent survival of *Helicoverpa zea* moths reared from corn in Clovis, NM to 5 or 10 µg cypermethrin in vials in 2021.

Vial (dosage)	Total	Live	Dead	% mortality	% survivorship
Clear (0µg)	35	33	2	0.00	100.00
White (5µg)	32	12	20	60.23	39.77
Maroon (10µg)	33	7	26	77.50	22.50
TOTAL	100	52	48		

Table 2. Seasonal mean percentage survival of *Helicoverpa zea* moths to 5 or 10µg discriminating dosages of cypermethrin using adult vials – 2018-2021 (from Kerns et al)

Location	2018		2019		2020		2021	
	5µg	10µg	5µg	10µg	5µg	10µg	5µg	10µg
College Station	23.20	6.99	43.95	18.21	44.25	28.90	28.13	14.10
South Plains	23.61	8.03	39.29	21.43	43.05	18.32	33.10	33.30
Clovis, NM							37.22	22.50

H. ZEA AND H. VIRESCENS POPULATIONS IN NEW MEXICO AS MEASURED BY ADULT TRAP CAPTURES IN PHEROMONE TRAPS

INTRODUCTION

Cotton bollworm has historically been a major pest of cotton and corn. The introduction and wide adaptation of Bt corn and cotton reduced losses for many years. However, the level of resistance to Bt genes has become a Beltwide concern so cotton bollworm may again become a significant economic pest in cotton as well as corn. Heliothis virescens is less common than H. zea but can be a more significant pest, more difficult to control than H. zea.The recent increase in hemp acreage in many states including New Mexico might increase populations of H. virescens in cotton. Also H. armigera an invasive will likely eventually become established in New Mexico, so an understanding of baseline levels of related insects is important.

MATERIALS AND METHODS

Four pheromone traps for H. zea and H. virescens were maintained in Artesia and Las Cruces to record populations in comparison to other areas and over time in New Mexico. Adults were examined on capture to ensure that they were the expected species and traps were labeled to use the same traps for the same species to ensure that there was no contamination of pheromone for another species.

Populations of several lepidopterous pests were monitored with pheromone traps. Trapping data of H. zea and H. virescens is important to compare changes in the prevalence of H. virescens over time and to provide a heads up for growers in years where traps captures are particularly high. While trap captures do not correlate extremely well with field damage, there is some correlation particularly in years with extremely high damage. (Greene et al 2018)

Also, Helicoverpa armigera is a concern even though it has not yet been found in nearby Texas. We collected data from traps to determine baseline levels of H. zea and H. virescens, in part, to have a comparison of H. armigera makes an incursion into New Mexico.

RESULTS

Four traps for H. zea and H. virescens were maintained in Artesia to evaluate populations in comparison to other areas and over time in New Mexico.The maximum captures in one week were 7.5 bollworm on 8/3 in Artesia and 28 on 9/10 in Las Cruces (Figure 1). The maximum number of H. virescens was 4 /week in Las Cruces and 1/week in Artesia. H zea captures were much higher than in 2020 but similar to captures in 2019 (Figures 2, 3, and 4).

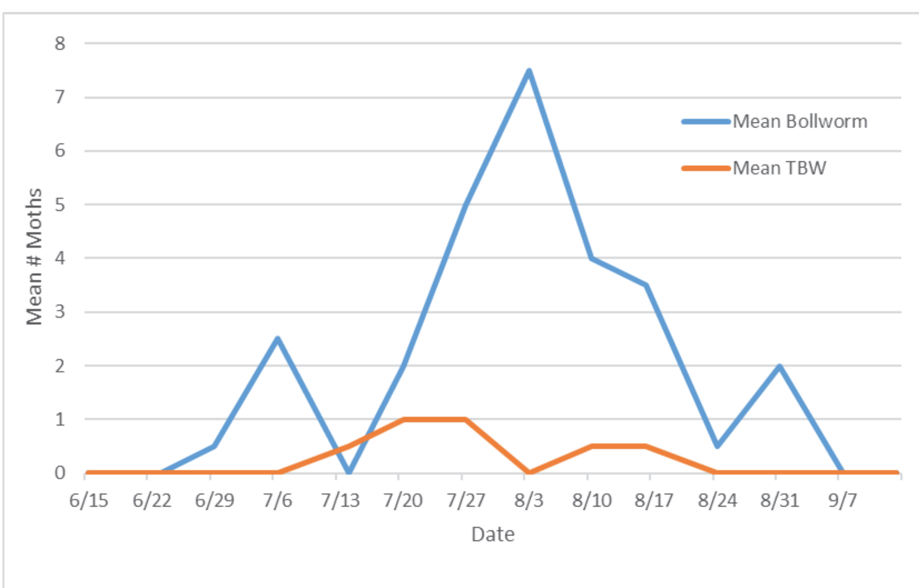


Figure 1. Trap Captures of Cotton Bollworm and Tobacco Budworm in Artesia, NM 2021

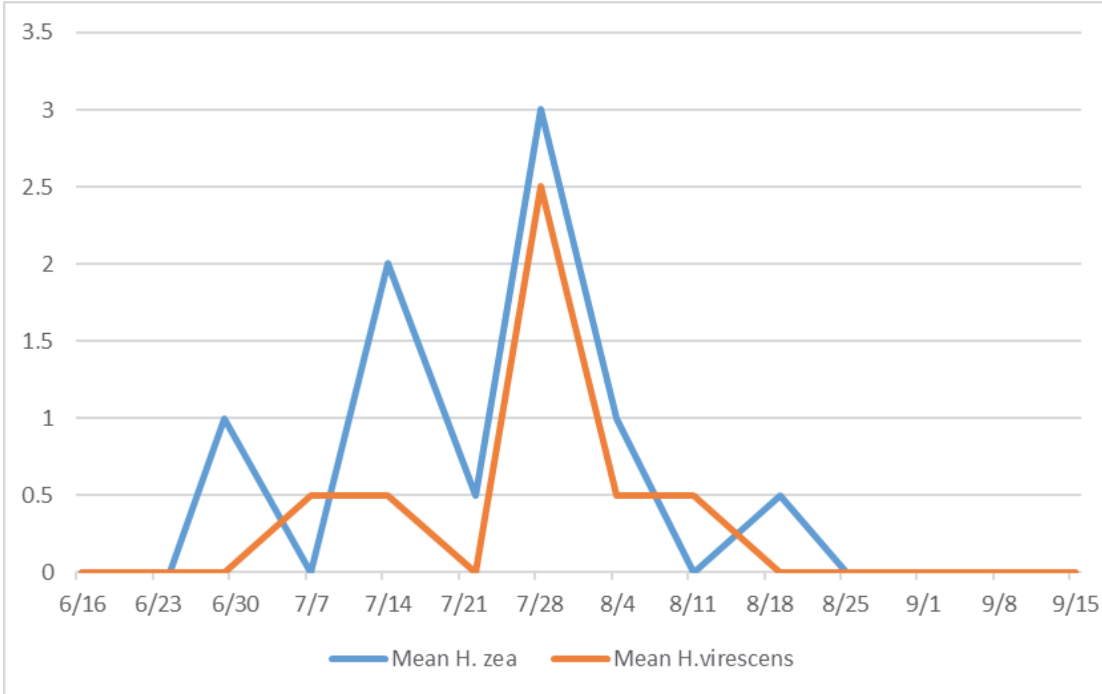
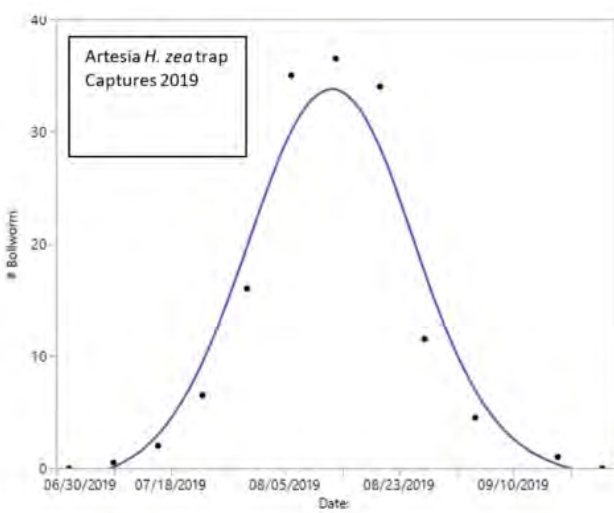


Figure 2. Mean trap captures of H. zea and H.virescens in Artesia, NM 2020



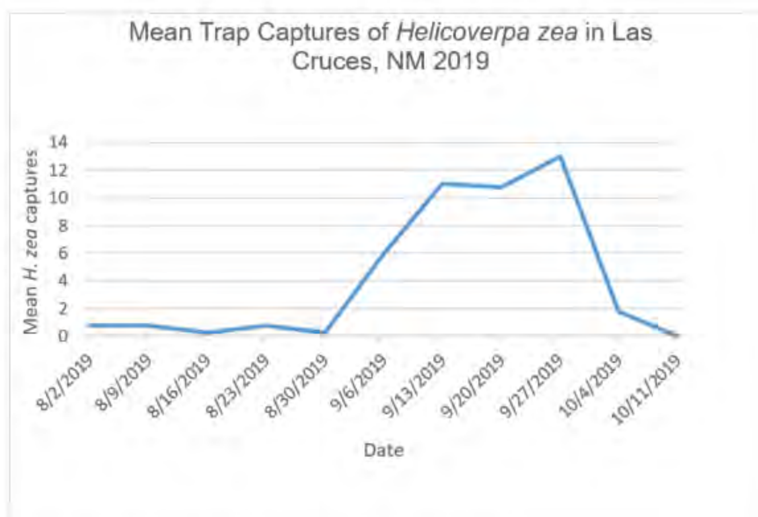


Figure 3. Comparison of *H. zea* pheromone trap captures in 2019 in Artesia and Las Cruces, NM

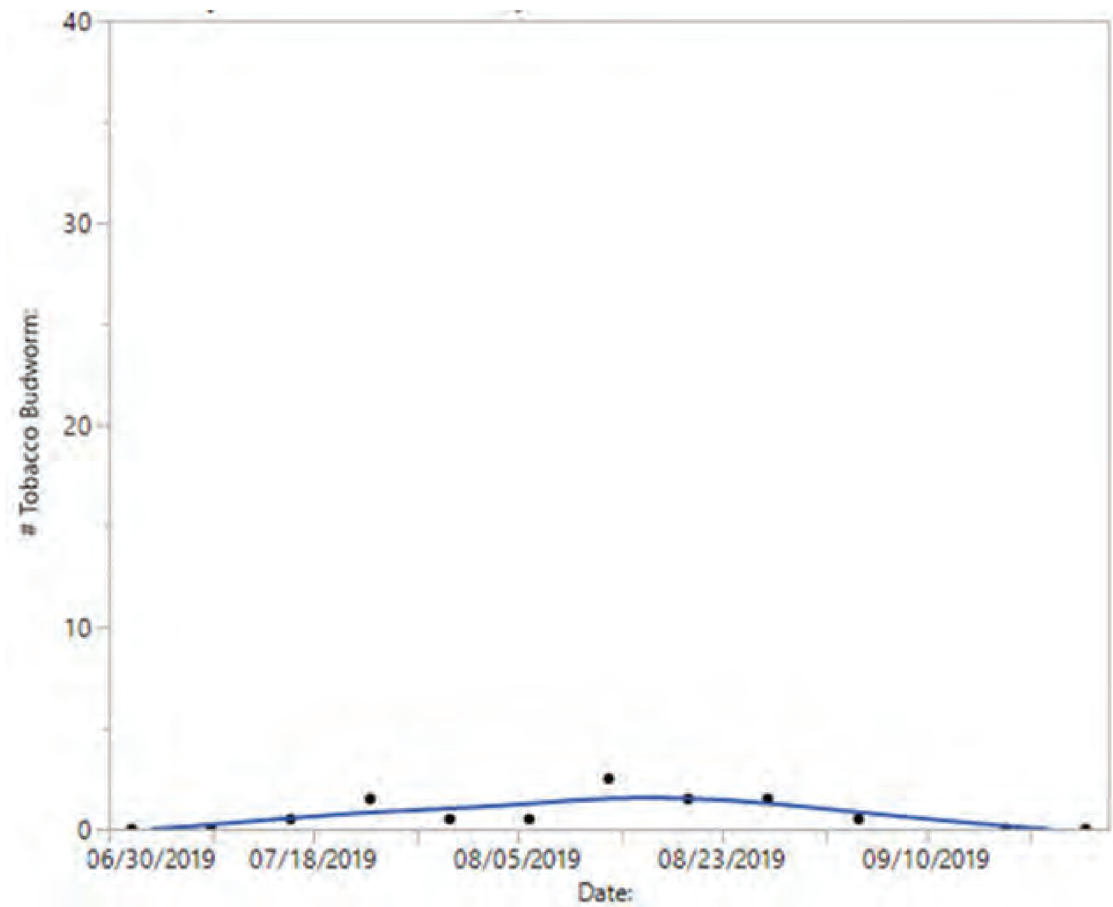


Figure 4. H. virescens pheromone trap captures in Artesia, NM 2019

Cotton bollworm are generally much more prevalent than tobacco budworm and trap captures once again reflect that usual status. In 2021, Trap captures in Artesia showed a peak population August 3 for bollworm with 7 times as many bollworms as tobacco budworms (Figure 5).In 2020 trap captures of H. virescens were unusual in that they were fairly similar to those of H. zea. The highest captures of both insects were 2.5-3.0 per week so in part, this was due to low H. zea captures. In 2018 cotton bollworm represented 94% of total trap captures while tobacco budworm was 6% of captures. Moths were active from 7/9 -9/17. The highest trap captures of bollworm was 7.7 moths/night the week ending 8/13 and 0.6 moths/night for tobacco budworm. The acreage of hemp had increased in 2019 and 2020 but was lower in 2021. There were common reports of damage by H. virescens to where hemp fields needed to be treated in 2020. The lower populations of H. virescens in 2021 might be due to a reduction in hemp acreage.

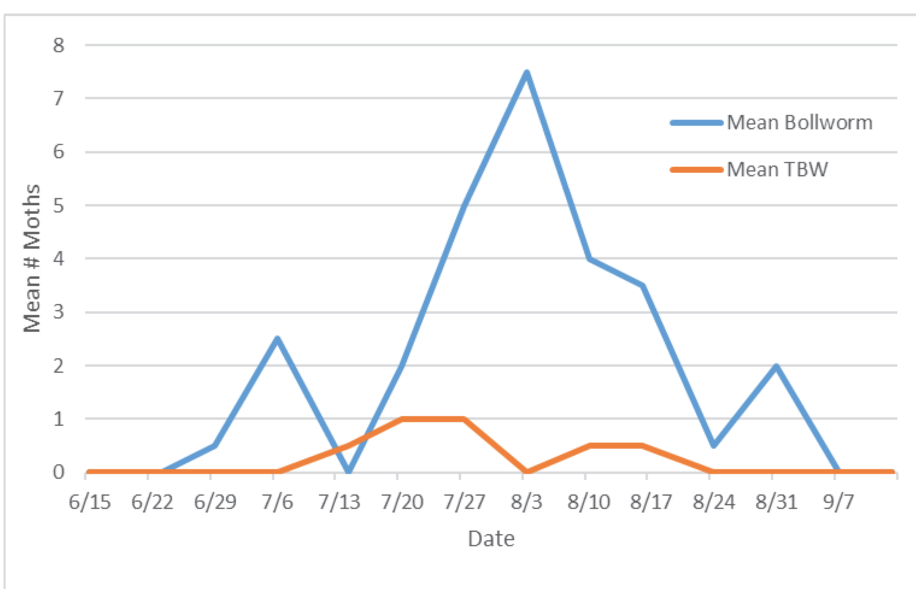


Figure 5. Mean trap captures of H. zea and H.virescens in Artesia, NM 2020

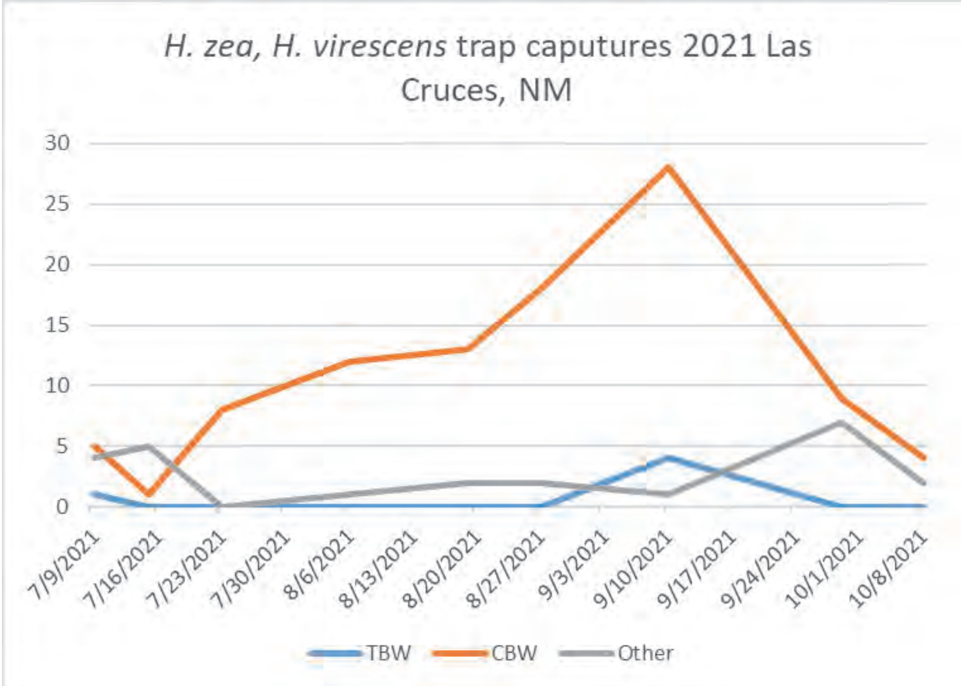


Figure 6. Mean trap captures of H. zea and H.virescens in Las Cruces, NM 2020

EFFECTS OF VARYING RATES OF POTASSIUM ON INSECT PESTS

Several papers have indicated that potassium can affect insect pest populations. (Gormus 2002, Amtmann et al 2008, Sarwar 2011, Myers 2006) One 2017 trial in New Mexico indicated that 240 Kg/ha K2O/ha potassium levels produced 42% higher yields than 120Kg/ha K2O/ha. In 2021 we compared In 2018 we compared 22, 30, and 90 lb potassium fertilizer treatments. Plots were sampled for insect pests multiple times and damaged both foliar and square damage and insect numbers were recorded.

There was a trend but no significant difference in square damage in 2021(Figure 1). In 2021 populations of bollworm in the field were quite low. There was no foliar damage noted.

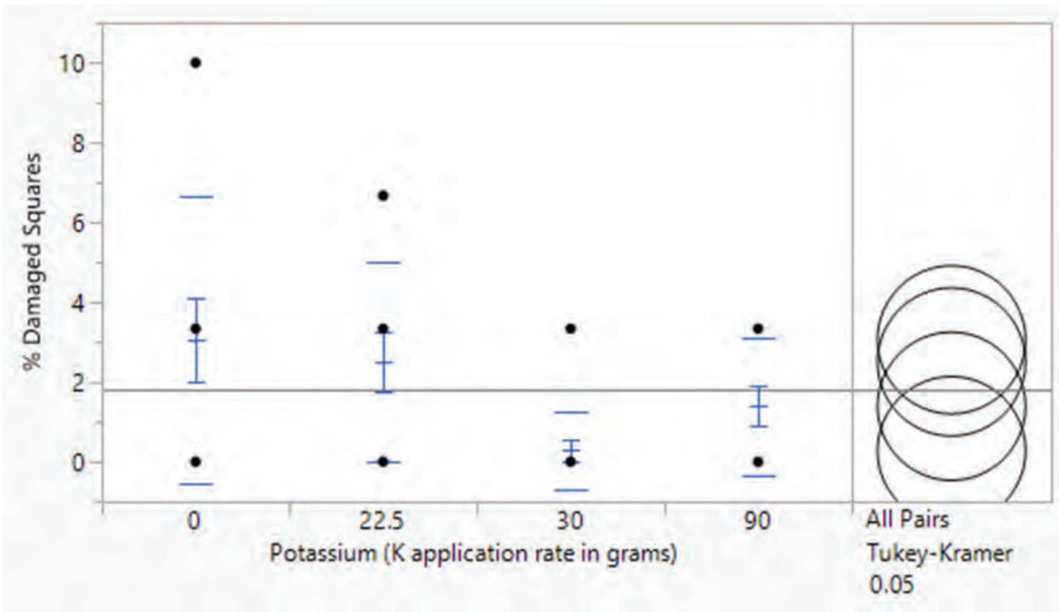


Figure 1. Percent square damage in Potassium plots

ALFALFA WEEVIL BIOCONTROL

Alfalfa weevil has become a very serious pest of alfalfa in New Mexico with up to 100% loss of first cuttings if uncontrolled. There is ample evidence in numerous states including NM that parasitoids can provide good control of alfalfa weevil when 2 parasitoids are established. Most areas of NM have only one species of parasitoid and some have very low rates of even one parasitoid. To help growers establish parasitoids while avoiding moving subspecies of alfalfa weevils we will establish local insectaries in Los Lunas, Tucumcari, and Alcalde in NMSU farms or commercial fields, for growers to access for redistribution (Oomyzus incertus and Bathypletes spp).

The recent acquisition of an insectovac will allow us to scale up a collection of alfalfa weevils where we have previously detected the highest populations of Oomyzus incertus in Las Cruces. Parasitoids of O. incertus and Bathypletes spp. will be released as adults to avoid spreading subspecies of weevils, avoid predation on pupae and avoid hyperparasitism.

Results will be reported at hay and forage meetings conferences and workshops, and NMSU Ag Science Center field days as well as online on our website, Facebook, Instagram, and more traditional media, press releases, radio, and television.

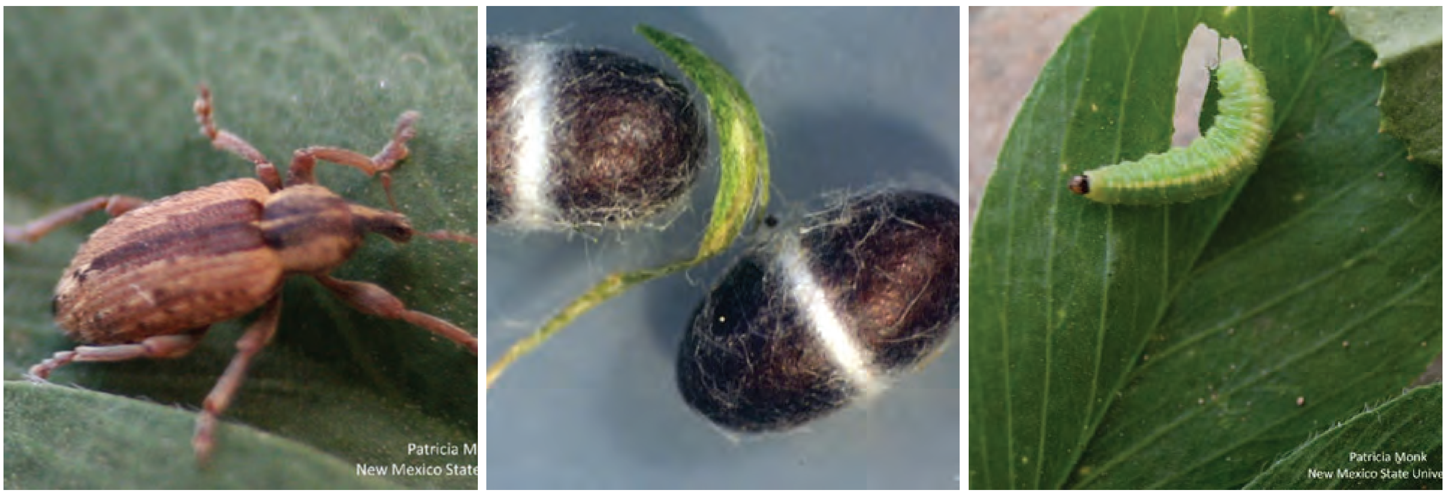


Figure 1. Left to Right: Alfalfa Weevil Adult; Alfalfa Weevil Larvae parasitized by *Bathyplectes spp*.; Alfalfa Weevil larvae

LANDSCAPE IMPACT OF ALFALFA HAY AS A BENEFICIALS INSECTARY

Research conducted on our NMSU farm in Artesia indicates many beneficials move from hay to other nearby crops including cotton. Biological control in New Mexico cotton at least is highly dependent on regular dispersal from hay. Some growers have made adjustments in landscape planning with this aspect in mind but many will not be convinced without on-farm demonstration trials. Other benefits of doing demonstration farm trials are lower, more realistic populations of beneficials on commercial farms and larger fields. Two trials this year included sweep net samples of beneficials at set distances from other crops. Sentinel bollworm eggs were used to determine rates of actual predation rather than inferring predation from collections of predators. Results will be reported at hay and forage meetings conferences and workshops, and NMSU Ag Science Center field days as well as online on our website, Facebook, Instagram, and more traditional media.

SPECIALTY CROPS

Gross receipts: Pecan 2019 $165M, 2017 $220M

BIOCONTROL OF KEY AND INVASIVE PECAN PESTS

Pecan is now the most significant crop in gross receipts in New Mexico with a $220M return in 2017. Pecan value is variable due to alternate bearing and fluctuations in price. The most recent gross receipts in 2019 were $164M. Some years New Mexico has had the highest crop value in the US surpassing even Georgia.

Acreage has increased dramatically in the last 15 years in SE New Mexico so much the impact will only increase as the NM acreage with not yet or bearing trees is not included in gross receipts.

NEW/EMERGING INSECT PESTS OF PECAN

Pecan Budworm New Pest of Pecan in NM

In 2021, we confirmed the presence of pecan budworm in NM. It has likely been here longer as we saw damage typical of pecan budworm in Roswell in 2013. We have an extension publication in progress to inform growers about this new pest.

Figure 1. Left to Right: Pecan Budworm Damage; Pecan Budworm Larva

Pecan Weevil

Pecan Weevil is a very worrisome emergent pest in eastern New Mexico. NMDA is working on eradication, but they will be unlikely to completely eradicate from Lea Co since pecan acreage is continuous from Texas to Lea Co, NM.

Pecan weevil is established in adjacent Texas counties and several orchards in eastern NM are infested. Eradication efforts are underway but counties that are adjacent to Texas will likely develop permanent populations of pecan weevil. Pecan acreage is contiguous from Texas to Lea Co and other border counties. And Texas is not attempting to eradicate or formally suppress pecan weevil populations.

Pecan weevil control is a particular concern in urban areas where homeowners have few pecan trees that are not highly managed and where control with insecticides is extremely difficult. Those trees will serve as a source of infestation for commercial trees. Our approach is to increase predation of pecan weevil in urban areas to suppress it while commercial orchards use conventional chemistry to control pecan weevil.

We have researched the predation of pecan insect pests since 2012. Predation levels in New Mexico are generally high with predation of sentinel eggs often 80-90% but there is significant variability from orchard to orchard and determining the factors that affect predation would be very useful to growers. (Pierce, et al 2018). In 2012 we started investigating the impact of predators on control of pecan nut casebearer, using commercial pecan orchards in Roswell, Artesia, 7 Rivers, Carlsbad, and Loving in the Pecos Valley and Hobbs, Lovington, and rural Lea Co areas outside the cities.

In 2021, we began looking at the potential for predators to suppress pecan weevils using sentinel beetles. This first year of this approach indicated that there is significant potential for control of pecan weevil. Predation of sentinel beetles was noted within only three hours of being placed in our orchard in Artesia.

Figure 2. Left to Right: Pecan Weevil Damage; Pecan Weevil Larva

Pecan nut casebearer is now a key pest of pecan in New Mexico. Biological control is a significant factor in suppression and eradication efforts. Trials have been conducted since 2012. Sentinel frozen eggs and beetles are used to estimate predation in commercial fields. Recent tests indicated maintaining ground cover is a means of enhancing biological control.

Publications

BOOK CHAPTERS

Cotton in the United States of America and Mexico. In G. Matthews (Ed.), Pest Management in Cotton: A Global Perspective. London: CABI.

PROCEEDINGS

Tellez, I., Pierce, J. B., Monk, P. (2021). Effect of Okra-Leaf Cotton on Canopy Microclimate and Helicoverpa zea (Boddie) Survival (pp. 588-596). Carey, NC: National Cotton Council.

EXPERIMENT STATION PUBLICATIONS

Flynn, R. P., Pierce, J. B. (2021). Agricultural Science Center at Artesia Research Snapshot. New Mexico State University.

Flynn, R. P., Pierce, J. B. (2021). Agricultural Science Center at Artesia 2021 Annual Report. Las Cruces, NM: New Mexico State University.

NEWSLETTERS/PRESS RELEASES

Idowu, O. J., Zhang, J., Flynn, R. P., Pierce, J. B., Beck, L. L., Sullivan, P. (2021). Cotton Newsletter Volume 12, Number 3 (ed., vol. Volume 12). NMSU, Extension Plant Sciences.

Pierce, J. B. (2021). Eddy County Invasion of Insects. Carlsbad, NM: Carlsbad Local.

Idowu, O. J., Zhang, J., Flynn, R. P., Pierce, J. B., Beck, L. L., Sullivan, P. (2021). Cotton Newsletter Volume 12, Number 2 (ed., vol. Volume 12). NMSU, Extension Plant Sciences.

Tellez, I., Pierce, J. B. (2021). Two NMSU students earn accolades for research presentations at an international conference. NMSU Marketing and Communications., Item applies to Promotion and Tenure criteria: Scholarship and Creative Activity, Item applies to Boyer scholarship(s): Discovery, Teaching.

Idowu, O. J., Zhang, J., Flynn, R. P., Pierce, J. B., Beck, L. L., Sullivan, P. (2021). Cotton Newsletter Volume 12, Number 1 (ed., vol. Volume 12). NMSU, Extension Plant Science

2021 Presentations at Professional Conferences

Pierce, J.B., Tellez, I., Monk, P. 2022. 10th International IPM Symposium. “Integrated pest management of cotton in New Mexico: will okra-leaf cotton reduce I populations in semi-arid environments with developing resistance to Bt cottons” Denver, CO. Not sure if you want here.We have submitted the abstract.

Pierce, J. B., Tellez, I., Monk, P., 2022. Beltwide Cotton Conference, " Influence of Plant Architecture of Okra Leaf Cotton on Crop Microclimate, Solar Radiation and Helicoverpa Zea Egg Hatch".

Pierce, J. B. (Discussant), (plus other coordinators) Cook, D. (Presenter), 2022. Beltwide Cotton Conference, National Cotton Council, San Antonio, TX, "Insect Losses New Mexico", Scope: National, published in proceedings,

Tellez, I., Pierce, J. B., Monk, P., 2021. Entomological Society of America Annual Meeting, Entomological Society of America, " Effect of Okra Leaf Cotton on Canopy Microclimate and Helicoverpa zea Survival".

Tellez, I., Pierce, J. B., Monk, P. 2021. NMSU EPWS 590 Presentation. “Evaluation of plant injury and egg hatch of Helicoverpa zea in select cotton cultivars ”

Pierce, J.B., Tellez, I. Monk, P. 2021. NMSU ASC Artesia Biennial Field Day. “Effect of Okra Leaf Cotton on Canopy Microclimate, Solar Radiation and Helicoverpa zea Survival”

Pierce, J.B., Tellez, I. Monk, P. 2021. International Arid Lands Consortium Conference. “Effect of Okra Leaf Cotton on Canopy Microclimate and Helicoverpa zea (Boddie) Survival” https://www.youtube.com/watch?v=PwzvGpEDrRA (One of six finalists from around the world who won an award)

Tellez, I., Pierce, J. B., Monk, P., 2021. NMSU EPWS 590 Graduate Student Presentations. Evaluation of plant injury and yield by Lepidopteran pests in three cultivars of Bacillus thuringiensis cotton.

Pierce, J. B. (Discussant), (plus other coordinators) Cook, D. (Presenter), 2021. Beltwide Cotton Conference, National Cotton Council, Austin, TX, "Insect Losses New Mexico", Scope: National, published in proceedings,

Tellez, I., Pierce, J. B., Monk, P., 2021. Beltwide Cotton Conference, " Effect of Okra-Leaf Cotton on Canopy Microclimate and Helicoverpa zea (Boddie) Survival".

Extension Presentations

Pierce, J.B. New Mexico Pesticide Training CEU's. "Integrated Pest Management in New Mexico" (August 26, 2021).

Pierce, J.B., Tellez, I. Monk, P. NMSU ASC Artesia Biennial Field Day. "Insect Safari" (August 26, 2021).

Pierce, J.B., Tellez, I. Monk, P. NMSU ASC Artesia Biennial Field Day "Effect of Okra-Leaf Cotton on Canopy Microclimate and Helicoverpa zea (Boddie) Survival" (August 26, 2021)

Pierce, J.B., Monk, P. NMSU ASC Artesia Biennial Field Day. "Value of Agriculture Crops in New Mexico" (August 26, 2021).

Pierce, J.B., Tellez, I. Monk, P. NMSU ASC Artesia Biennial Field Day. "Evaluation of plant injury and yield by Lepidopteran pests in three cultivars of Bacillus thuringiensis cotton" (August 26, 2021).

Pierce, J.B. NMSU Sustainable Agriculture Science Center at Alcalde Field Day "Bio-Control of Alfalfa Weevil." (August 10, 2021)

Pierce, J. B., NMSU Sustainable Agriculture Science Center at Alcalde Field Day, NMSU, Alcalde, NM, "Insect Diversity", Scope: Local. (August 2021).

Pierce, J. B., NMSU Sustainable Agriculture Science Center at Alcalde Field Day, NMSU, Alcalde, NM, "Insect Pests and Beneficials", Scope: Local. (August 2021).

Pierce, J.B., Tellez, I., Kircher, P., Monk, P. ASC Artesia on the Move. "Who's in Your Backyard? : Are there Invisible Heroes inside?", Portales, NM (August 3, 2021)

Pierce, J.B. NMSU Pesticide Applicators Webinar Series, NMSU. "Insect Pest Management" (July 2021)

Pierce, J.B., Tellez, I., Monk, P. Crop Protection Workshop. (June 29 and July 1, 2021)

Pierce, J.B., Monk. P. 4-H Entomology Contest Practice. (Twice Weekly May 19-June 10)

Pierce, J.B., Monk. P. 4-H Horticulture Contest Practice. (Twice Weekly May 19-June 10)

Pierce, J.B., Monk. P. 4-H FCS Contest Practice. (Twice Weekly May 19-June 10)

Pierce, J.B., Tellez, I., Monk, P. NMSU Ag Leadership Seminar "Insect Pest Management." (April 22, 2021)

Pierce. J. B., Monk, P. Cottonwood 4-H Monthly Meeting, Artesia, NM, "Entomology Contest", Scope: Local, Invited or Accepted? Invited. (April 2021).

Pierce, J. B. (Discussant), ASC - Artesia Annual Farm Planning Meeting, Artesia, NM, "IPM of Insects Developments in New Mexico", Scope: Local, Invited or Accepted? Accepted. (February 5, 2021).

Pierce, J. B. (Discussant), ASC - Artesia Annual Farm Planning Meeting, Artesia, NM, "IPM of Insects Developments in New Mexico", Scope: Local, Invited or Accepted? Accepted. (February 5, 2021).

Pierce, J. B. (Discussant), SE New Mexico Agricultural Research Association, Artesia, NM, "IPM of Insects Developments in New Mexico", (February 3, 2021).

Pierce, J.B. In R. St. Hilaire Innovative Extension Programming Meeting. "Entomology Programming during COVID". (January 29, 2021)

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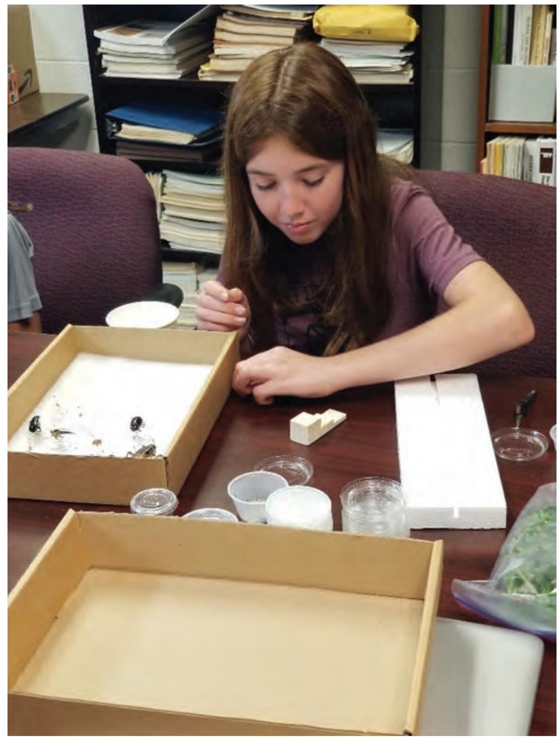
Outreach Activities

2021 Annual Field Day | August 26

Additional Activities

4-H Crop Protection Workshop - June 29; July 1
"Who's in Your Backyard?" Presentation - August 3
Pesticide Training Workshop - August 26


Entomology 4-H students placed 2nd at the District Contest.


Entomology 4-H at insect pinning workshop

Faculty and Staff

Robert Flynn- Ph.D. Agronomy
Interim Superintendent, Extension Agronomist

Jane Pierce- Ph.D. Entomology
Associate Professor, Research and Extension Entomologist

Ruben Pacheco, B.S. Agronomy *Research Assistant*

Patricia Munk, B.S. Entomology
Research Assistant - Sr.

Martin Lopez
Farm Supervisor

Stephanie Tilton
Secretary

Jake Hill
Laborer

Cooperators/Collaborators

Wade Cavitt - Southeastern NM Agricultural Research Association Chair
Ivan Tellez – Eddy County Extension Agent
John Idowu – Extension Agronomist
Miranda Kersten – Sr Program Specialist
Mark Marsalis – Extension Forage Specialist
Leslie Beck – Extension Weed Specialist
Stephanie Walker - Extension Vegetable Specialist
Leonard Lauriault - Superintendent and Forage Crop Management Scientist
Ian Ray – Alfalfa Breeder
Jinfa Zhang – Cotton Breeder
April Ulery -
Marisa Thompson -
Richard Heerema – Extension Pecan Specialist
Wayne Shockey – Eddy County 4-H Agent
Carlsbad Soil and Water Conservation
Woods Houghton
Carol Sutherland
Phillip Lujan
Mark Smith and David Mickelson, S&W Seed Alfalfa breeders
Scott Staggenborg- S & W Seed
Cotton Incorporated
Texas A & M University
Insook Ahn – Fashion Merchandising and Design
Yucca Cowbelles
Cottonwood 4-H
Sam Smallidge – Extension Wildlife Specialist
Leyendecker Farm
ASC Clovis
ASC Los Lunas
Cody Mull-BASF
Ben Benton-Phytogen
Scott Fuchs-Phytogen
David Albers- Bayer
David Mickelson- S & W Seed
Jerry O'Rear-Mojo Seed
Klint Forbes- Brownfield Seed
Shawn Carter- Dyna Gro
Kyle Lawles -Bayer/Dekalb

2021 Report

Agricultural Science Center at Artesia

ARTESIA

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