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CENTER FOR PECAN AND SPECIALTY AGRICULTURE

Cross pollination is essential for pecan production

by Charles Rohla, Ph.D. / ctrohla@noble.org

Pollination in the pecan orchard is critical to both the yield and quality of nuts. Pecan trees are cross-pollinated (allogamous) and although self-pollination is possible, the result is largely unsuccessful. Pecan trees are wind-pollinated; therefore, pollinators (i.e., bees) are not required to complete pollination. Cross-pollinated pecans are usually larger and higher quality than self-pollinated pecans. Self-pollination can reduce nut quality and greatly reduce crop yield by as much as 75 percent.

Pecan trees are monoecious, which means both the male and female flowers are on the same tree. Female flowers (pistillate) are located at the end of the current season growth, and the male flowers (catkin) are located at the end of last season's growth. Catkins are easy to spot as they dangle from the tree during the early spring. A single catkin can produce as many as 2.64 million pollen grains. Only one pollen grain is required to produce one pecan. One catkin can produce enough pollen to pollinate flowers to produce 50,000 pounds of average-sized pecans. An average bearing tree is likely to produce several thousand catkins, thus further emphasizing how much pollen could be produced.

Self-pollination is controlled through two types of flower maturation. In type I (protogynous) trees, the pistils mature first before the stamens shed pollen. In type II pecans (protandrous), the opposite is true with stamens shedding pollen before pistils mature. With the separation of stigma receptivity and pollen shed, self-pollination is limited.

Adequate pollinators within the orchard are imperative for optimal production. The first step to ensure adequate pollination is to determine what varieties will best pollinate each other. It is not as simple as planting a combination of type I and type II varieties to pollinate each other. We must determine if the pollination of the different varieties are best suited for a specific variety. Choosing a pollinator is usually accomplished through the use of a pollination chart. These charts list the pollen shed and pistil receptivity times of the major varieties. It is recommended to find at least two to three varieties that shed pollen at the same time the main variety is receptive.

Different pollination charts are available online at the following sites:

- http://www.aces.edu/pubs/docs/A/ANR-0674/
- http://www.lsuagcenter.com/NR/rdonlyres/4447193D-D08A-47A2-B976-B992EB90B04A/46908/Pollinationchartforpecancultivars1.pdf
- http://www.caes.uga.edu/commodities/fruits/pecanbreeding/cultivars/documents/PollinationCompatibilityChart.pdf ■

Scientific advancements provide pecan cultivar ID tools

by Yanina Alarcon / yalarcon@noble.org and Maria J. Monteros, Ph.D. / mjmonteros@noble.org

Most of us enjoy pecan pie during Thanksgiving. Pecans provide multiple health benefits, contain more than 19 vitamins and minerals, and are a great source of protein and fiber. U.S. pecan production represents approximately 75 percent of the pecans grown worldwide and has an annual market value of $500 million with Oklahoma contributing $20 million.

Pecan *(Carya illinoinensis)* is an outcrossing tree species native to the Mississippi River Valley. Commercial production began in the late 1800s with the first commercial orchards established by selecting and planting nuts from a tree with desirable characteristics. Because each nut was the result of an independent pollination event, growers noticed the resulting trees did not look uniform; they were not genetically identical. As a result, pecan cultivars were grafted so that each tree would be genetically identical to the tree from which it came. Pecan cultivars differ in characteristics including nut size and shape, disease resistance, and tree architecture. Some cultivars may be adapted for growth in certain regions based on their winter hardiness and disease resistance. For example, trees grown in Georgia are adapted for growth in humid, disease-promoting conditions, while those grown in Arizona are adapted to much drier conditions. Pecan scab is a disease caused by the fungus *Fusicladium effusum*

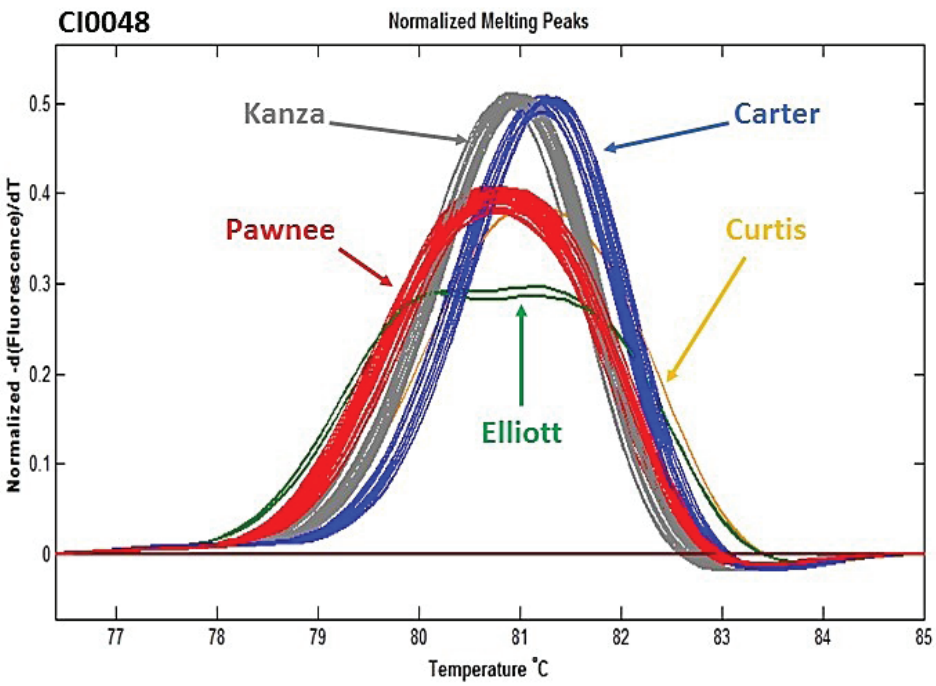

Figure 1: DNA fingerprinting of pecan cultivars. Each color represents a unique DNA sequence that can distinguish the pecan cultivars Pawnee, Kanza, Carter, Curtis and Elliott.

and can completely annihilate pecan orchards. Fungicide applications are used to help mitigate the negative impacts from pecan scab but can be costly and do not represent a viable long-term strategy for managing the disease. An alternative is to plant pecan scab resistant cultivars.

The performance of a pecan tree depends on the DNA of the cultivar planted. Historically, pecan trees have been visually characterized based on the nut size and shape. The challenge is that the nut features used for identification may be impacted by environmental conditions. For example, drought conditions may result in smaller nuts. Because nuts will not be produced until five to ten years after planting, a grower may need to manage the orchard for disease without knowing the specific cultivar and/or disease resistance of the trees present in the orchard. Therefore, the capacity to identify pecan cultivars and select the most suitable cultivars for the growing conditions is a key component for the continued success of an expanding pecan industry.

Technological advances can provide tools for pecan cultivar identification. Each individual tree has a unique combination of letters in its DNA that serve as a "DNA fingerprint," similar to the unique combination of ridges in our fingerprints. In some cases, these DNA fingerprints, represented by molecular markers, are also associated with disease resistance, nut size and shape or composition. Our team at the Noble Foundation has developed a DNA fingerprint for pecan (see Fig. 1) using young leaves as starting material that facilitates the identification of pecan cultivars without having to wait for the tree to produce nuts.

The pecan fingerprints are based on variations in a single base pair (or letter) at the DNA level. The technology's practical value is that cultivar identification can proceed at any time during active tree growth regardless of whether the tree is producing nuts or not. Additionally, a grower will now have the tools to understand the tree genetics and manage their orchard accordingly.

Molecular markers can also be used to "tag" valuable characteristics including disease resistance. The use of DNA markers would enable the identification of trees that are resistant to pecan scab within weeks of sampling leaf tissue from young trees. The approach was used successfully by the apple industry to develop scab resistant apple cultivars. Researchers from the Noble Foundation and other institutions are working to understand diversity in the pecan scab pathogen and the mechanisms for pecan scab resistance using molecular markers technologies. The DNA fingerprinting and identification of disease-resistant trees are examples of science- and technology-driven advances that will enable pecan growers to effectively manage their orchards by understanding the disease susceptibility of their trees and contribute to their ability to expand the pecan industry and provide pecans for the traditional Thanksgiving pie or anytime.

We appreciate grant funding from the Oklahoma Department of Agriculture, Food and Forestry to M.J. Monteros and C. Rohla. ■

GENETIC TERMS

DNA encodes the genetic instructions contained in every cell of every living organism for how an individual grows, looks and functions. The DNA code consists of a string of four letters: A, C, G and T.

Molecular markers are small fragments of DNA located in specific regions of the chromosomes. These can be used to identify sequence variations that are unique for each individual. For example, Kanza may have a G while Pawnee may have a C.

UPCOMING EVENTS

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For more information and to register, please visit www.noble.org/events or call Maggie Scott at 580-224-6375. Preregistration is requested.

Veterinary Feed Directive Seminar
1-5 p.m., June 16, 2016
Noble Foundation Kruse Auditorium
No Registration Fee

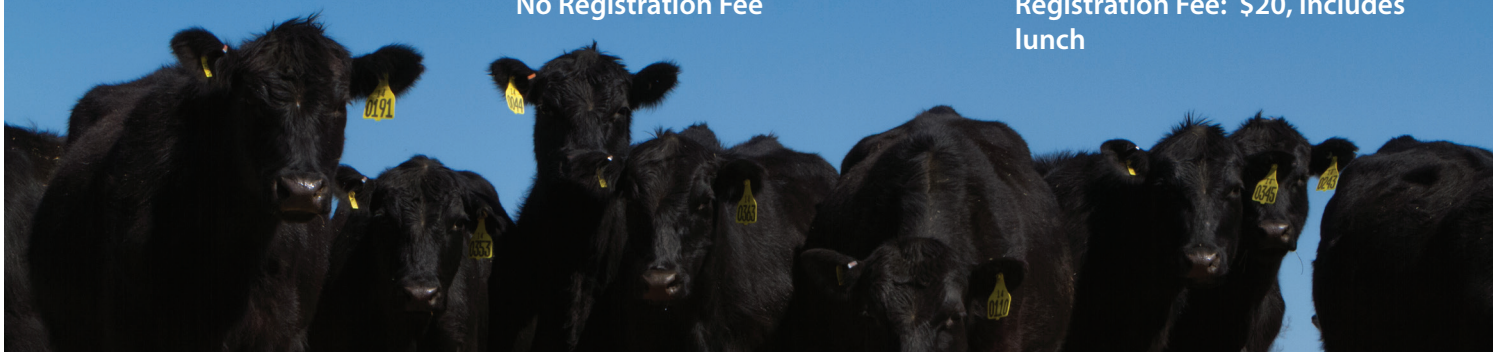
Fence Construction Workshop
9 a.m.-2 p.m., June 23, 2016
Noble Foundation Red River Farm
No Registration Fee

Summer Burn Workshop
8:30 a.m.-5 p.m., July 19, 2016
Noble Foundation
D. Joyce Coffey Ranch
Registration Fee: $20, includes lunch

Beekeeping: Honey Harvest Workshop
9 a.m.-noon, July 23, 2016
Noble Learning Center
No Registration Fee

Winter Pasture Stocker Seminar
1-5 p.m., Aug. 2, 2016
Southern Oklahoma Technology Center
No Registration Fee

White-tailed Deer Management Workshop
9 a.m.-4:15 p.m., Aug. 25, 2016
Arcadia Conservation Education Area
Registration Fee: $20, includes lunch



Calf crop depends on bull management in breeding season

by Clay Wright / jcwright@noble.org

Assuming your bulls have passed a breeding soundness examination within the last 60 days, are carrying adequate condition (body condition score of 6 or higher), are structurally sound, and have been immunized and treated for parasites, they probably are ready to go to work. Your bulls may already be out earning their keep in your spring-calving herd. However, since so many things can go wrong during a 60 to 90 day breeding season, it is good management to observe them regularly after turn-out to make sure they are still willing and able to do their job.

I recommend making time, daily if possible, to watch each bull in action during the breeding season. A bull's interest in mating, his libido, should be assessed immediately. Obvious physical problems that may have arisen since turn-out can be detected and addressed, like lameness or injury. Another simple management practice is to record the tag numbers of the cows and the dates a bull services them, then find those cows in 18 to 23 days to make sure they are not coming back into heat. That, of course, would indicate he may have become infertile and you could address it in a timely manner.

Another concept is social ranking or dominance in herds where two or more bulls are turned out together. Research shows that dominant bull(s) will breed more cows compared to less dominant bulls, especially when older and younger bulls are used together. In one study, the dominant bull of a four-bull group sired 70.4 percent of the calves. The remaining three bulls, a 4-year-old, a 3-year-old and a 2-year-old sired 16.7 percent, 7.4 percent and 5.5 percent of the calves, respectively, in the first year of a five-year study. Age is usually the primary factor in determining dominance in a bull battery, up to a certain point. In one study, the dominant bull went from siring 70 percent of the calves at 10 years of age to 12 percent just two years later.

Using bulls that are roughly the same size and age can reduce the problem with dominance. Also, since dominant bulls work harder, they will lose condition quicker. Rotating these bulls out of the herd for a week or two of rest and added nutrition is one way to deal with this situation. While they are out of the herd, the less dominant bulls have more chances to work. Another approach is to start the breeding season with older bulls and replace them with the younger bulls later; still though, there will be dominance in each group.

Rotation can also be used to maximize the use of a bull battery made up entirely of young bulls. Glenn Selk, Ph.D., Oklahoma Cooperative Extension animal reproduction specialist, says that rotating them at a minimum of two weeks will allow for optimum reproductive performance and prevent young bulls from becoming too fatigued or lose condition too rapidly. If pasture and management capabilities allow, rotating young bulls once per week should slightly improve reproductive performance.

Bulls need to be managed all year, especially during the breeding season. Your next calf crop depends on it. ■

Intuitive assessment aids stocking rate management

by Hugh Aljoe / hdaljoe@noble.org

Although rainfall can vary significantly from season to season, year to year, it is difficult to know for certain if and when adjustments to cattle stocking rates are warranted without having a professional pasture and range specialist make a thorough assessment of the property. It is a good idea to utilize a pasture and range professional when convenient, but even they prefer to have the producer's input and experience readily available to factor into their projections. A producer with several years of experience with a property can make a determination on whether or not adjustments to the long-term stocking rate are needed by using his or her own intuition and observations.

There are two approaches to determining stocking rate adjustments: professional and intuitive. The professional approach, although thorough, requires a professional trained in pasture and range management to develop. The intuitive approach, although not as technical, can still answer the question of whether or not ranch conditions warrant stocking rate adjustments. The intuitive approach utilizes a producer's experience and historical ranch information.

Start by creating an intuitive assessment table similar to the one in Table 1. Notice that the columns across the top indicate the time periods of interest. This can be a series of annual assessments or, as in this table, periods of years that are of significant interest based on long- and near-time weather events. For this example, we are comparing recent years to the drought years (2011-2012) and then previous years covering two eras.

The next step is to list the important, easily monitored variables. In the simplest form, these include stocking rate, average annual rainfall and percent deviation from average, pasture condition ratings, average cow herd body condition score, months of hay feeding, and months of native grass residual grazing remaining. Apply a four-rating system with each of the variables along with a "heat map" or color-coded system (from highest to lowest rating: green, white, yellow and red).

The stocking rate numbers for each time period are averages except for the drought years (lowest number) and current years (current stock number). Rainfall information is based on actual information if you have the records or from the nearest weather station. Pasture condition ratings, cow body condition scores, months of hay feeding and months of native grass residual grazing remaining are based on the producer's experience and observations. To make this tool work for the designed purpose, producers have to be honest with themselves and complete the table as conservatively as possible.

If the "heat map" shows lots of green and white space, especially in recent years, the producer may have the opportunity to adjust the stocking rate upward. However, if the table shows red and yellow, the producer should consider adjusting the stocking rate downward, or at the very least it indicates room for improvement in certain management areas.

This intuitive approach to determining if stocking rate adjustments are warranted allows a producer to utilize his or her experience and ranch information to subjectively answer stocking rate questions. The professional approach is often more objective in process, but it does not take into consideration the value of trends over time as does the intuitive approach. The producer's intuition and experience is not as dated as a professional stocking rate estimate would be. ■

Table 1.

	Years 1980-2000	Years 2001-2010	Years 2011-2012* *Drought years*	Years 2013-2016**
Stocking Rate (mature cows)	85	74	42	54
Annual Rainfall (LT Avg.=34.5")	40.1 inches	35.1 inches	21.6 inches	44.9 inches
Percent Deviation from Average	16 percent	2 percent	-37 percent	30 percent
Pasture Condition Ratings				
Overall	Excellent	Good	Poor	Good
Grass cover	Excellent	Good	Fair	Excellent
Litter cover	Good	Fair	Poor	Good
Bare ground	None	Frequent	Abundant	Infrequent
End-of-season residual	Adequate	Limited	None	Abundant
Cow Body Condition Score (Avg.)				
At calving	6+	5.5	5.0+	5.5+
At weaning	6	5.0+	4.5+	5.0+
Hay Feeding (months)				
Planned	5	3	4	2
Actual	6	4	5.5+	2
Native Grass Residual (months)				
Planned	2-	1-	0	0.5
Actual	1.5-	0.5-	3-	1

* = lowest number ** = current number

Honey bees play essential role as crop pollinators

by Will Chaney / jwchaney@noble.org

It could be argued that a bee is one of the most identifiable insects. In fact, the insect is often used in print media, movies and advertisements. Most people become aware of the bee when they are very young. Bees belong to the order of insects Hymenoptera, which also includes ants and wasps. There are more than 20,000 types of bees, but the focus of this article is on the honey bee because of its importance in agriculture. Although widely popular for their honey, the bee's greatest contribution to agriculture is as a crop pollinator.

According to the U.S. Department of Agriculture (USDA) National Agricultural Statistics Service, in 2014 honey bees made 178 million pounds of honey worth an estimated $384 million. In addition, bee pollination accounted for about $15 billion in added crop value. Pollination is vital to the approximately 250,000 flowering plant species that depend on pollen transfer. University of Illinois entomologist May Berenbaum, Ph.D., once told the House Agriculture Committee's Subcommittee on Horticulture and Organic Agriculture that bees "are in effect six-legged livestock that both manufacture agricultural commodities – honey and wax – and, more importantly, contribute agricultural services – pollination."

Bee Facts:

- Because honey bee colonies can be extremely large, only a pest management professional or experienced beekeeper should safely remove a honey bee nest.
- Honey bees do sting, but they only sting once. The sting can be extremely painful if the stinger is not immediately removed from the skin. People allergic to insect stings will have a more severe reaction.
- A honey bee's wings flap 11,000 times per minute, which is why it sounds like they are "buzzing."
- Honey bees have six legs, two compound eyes (one on each side of the head) made up of thousands of tiny lenses, three simple eyes on the top of the head, two pairs of wings, a nectar pouch and a stomach.
- The USDA Agricultural Research Service (ARS) is organizing a national bee genebank as part of the agency's response to ongoing problems facing the country's beekeepers. The genebank will be located in Fort Collins, Colorado, to help preserve the genetic diversity of honey bees, especially for traits such as resistance to pests or diseases and pollination efficiency.
- A bee colony consists of 20,000 to 60,000 honey bees and one queen. Worker honey bees are female; they live for about six weeks and do all the work. The queen bee can live up to five years; her role is to fill the hive with eggs. She is the busiest in the summer months, when the hive needs to be at its maximum strength. She lays up to 2,500 eggs per day. The queen bee has control over whether she lays male or female eggs. If she uses stored sperm to fertilize the egg, the larva that hatches is female. If the egg is left unfertilized, the larva that hatches is male. In other words, female bees inherit genes from their mothers and their fathers, while male bees only inherit genes from their mothers. ■

Incidental surveys yield wild turkey reproduction information

by Josh Gaskamp / jagaskamp@noble.org

Wildlife biologists at the local, state and national level conduct multiple game surveys each year to monitor wildlife populations over time. However, unless a wildlife management plan or harvest program dictates, hunters and land managers typically do little to monitor populations of most game species. White-tailed deer is often an exception to the rule because many hunters use game cameras at bait stations hoping to get a glimpse of a monster buck. But what about wild turkey? Many hunters enjoy the opportunity to harvest a mature gobbler just as much as a white-tailed buck. Just as camera surveys can inform hunters or managers about deer herd composition, health and distribution, incidental surveys for wild turkeys can reveal information about reproductive success and age structure.

Wild turkey abundance fluctuates annually, but wild turkey populations do not experience the extreme boom/bust phenomenon that is common in quail populations. The wild turkey's life span and hen's reproductive potential extends over several years, so one bad season does not mean an imperiled turkey population. Weather, predation and habitat conditions during the breeding and brood-rearing seasons all play significant roles in reproductive success. Incidental surveys of broods, jakes and winter flock counts can be conducted to help determine reproductive success. However, incidental surveys are most useful for landowners.

Incidental surveys conducted during the spring turkey season can yield information on age structure. This can be accomplished by comparing the

number of jakes (male turkeys less than 1 year old) to the number of mature gobblers. Availability of jakes during breeding season (March to May) reveals information on the previous year's reproductive success. When spring hunting for turkeys, a jake can be distinguished by looking at his tail feathers when he struts. All tail feathers of adult males are the same length while the feathers forming the center of a jake's tail are longer than the rest of the tail feathers. Jakes also have short beards and spurs. Jakes and adult gobblers are used as an index for age structure of the population because the different age classes of hens look the same during breeding season. An abundance of jakes during breeding season indicates reproduction was good during the previous spring. An abundance of adult gobblers and an absence of jakes indicates reproductive success was down last year but better previously.

Incidental surveys can also yield information on reproductive success. Most predation on wild turkeys occurs before hatching in the nest by ravens, raccoons, grey fox and feral hogs, or when poults are young. Therefore, incidental surveys can be collected in late summer with reasonable certainty that many large poults will survive to become adults. In August, poults are normally about two-thirds the size of an adult hen. If large clutches per hen are observed in late summer, then nesting success was good. If small or no clutches per hen are observed, most nesting attempts have failed. Reproduction comes from adult and 1-year-old hens.

Winter flock surveys can be used during fall and winter to look at long-term trends and distribution of turkey populations. However, they are less useful to individual landowners with relatively small tracts because winter flocks split up in the spring and move to occupy different areas during the breeding season.

None of these incidental survey techniques give biologists, hunters or land managers absolute densities or abundance of wild turkeys but, when collected over several years, can provide valuable information to make habitat and population management decisions. ■

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Fall Cattle Seminar

1-5 p.m.
Aug. 30, 2016
Ardmore Convention Center
No Registration Fee

Integrity Beef Meeting

5:30-8 p.m., Aug. 30, 2016
Ardmore Convention Center
Registration Fee: $20 for nonmembers

Fall Grazing Workshop

9a.m.-4 p.m., Sept.13, 2016
Dixon Water Foundation
Registration Fee: $20, includes lunch

Pecan 101 Workshop

9 a.m.-4 p.m., Sept. 29, 2016
Southern Oklahoma Technology Center
Registration Fee: $20, includes lunch

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