40TH Annual
WESTERN PECAN GROWERS ASSOCIATION
Conference Proceedings

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The Annual

Western Pecan Growers Association Conference

International Pecan Show

Pecan Food Fantasy

And

Pecan Trade and Equipment Show

sponsored jointly by

New Mexico State University
Cooperative Extension Service
in cooperation with
Western Pecan Growers Association

2006

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New Mexico Pecan Weevil Eradication Progress
(2005 Growing Season)

Brad Lewis/Greg Watson
New Mexico Department of Agriculture

The New Mexico Department of Agriculture's pecan weevil survey and eradication program is in its seventh year. Several significant milestones were reached in 2005 with a few changes made in the program from previous years.

Results from the 2004 cleaning plant survey indicated that we included one pecan weevil "suspect" orchard in the 2005 eradication program. The orchard was categorized as suspect due to several nuts exhibiting symptoms that may be indicative of pecan weevil feeding.

The department placed and monitored approximately 68 pecan weevil traps in three quarantined orchards and one "suspect" orchard. Three insecticide applications were applied to all quarantined orchards and two applications made to one suspect orchard during the growing season. Additionally, all pecan cleaning plants were surveyed continuously throughout the harvest season for evidence of pecan weevil infested nuts.

No pecan weevils were trapped in the state or collected from symptomatic nuts during the 2005 trapping and survey program. For Otero and Doña Ana counties, department survey programs have not detected pecan weevil in those counties for two years. No pecan weevils have been trapped in Luna County for the past four years.

The primary change in the program was the elimination of the freezing requirement for nuts harvested from previously pecan weevil infested orchards. Eliminating the freezing of nuts significantly reduced the cost of the 2005 program.

Financial standings for the eradication program will be presented at the conference.

Acknowledgments: Western Pecan Growers Association, New Mexico Pecan Growers Association, B&G Consulting Services, Rose Garcia, Juan Gamon, Bill Guthrie, Otero County Extension Service, and Otero County Pecan Growers Organization.

Insecticide Resistance Issues in Western Pecan Production

Brad Lewis/Olivia Carver
New Mexico State University

It is evident the western pecan growers management practices are increasingly adapting the practice of controlling blackmargined aphids in their orchards. This management practice is relatively new to most growers and is the result of field research that has demonstrated the benefits of controlling blackmargined aphid populations, and due to the recent registration of neonicotinoid based insecticides for foliar and soil applications in New Mexico and Arizona pecans.

Of concern to regional pest management advisers is the potential for blackmargined aphid populations to develop resistance to insecticides in the neonicotinoid class. Blackmargined aphid characteristics that contribute to the potential for insecticide resistance include: high biotic potential; both sexual and asexual reproduction; no alternate hosts; and limited migratory capabilities. Neonicotinoid insecticide characteristics that contribute to potential insecticide resistant include: highly efficacious; season long residual; increased usage; limited number of alternative chemistries; and availability of both foliar and soil applied labels.

Although slow to materialize, insecticide resistance to neonicotinoid insecticides by several insect species has been detected. Insecticide resistance by a pest population is the result of selecting for resistant individuals already in the population. Neonicotinoid resistance management strategies include alternating insecticide classes between years; leaving rows of untreated trees that will support both resistant and neonicotinoid resistant individuals; end of the season foliar applications of an insecticide from an alternative class to eliminate neonicotinoid resistant individuals.

The neonicotinoid class of insecticides is and will continue to be of significant importance to western pecan producers. Outstanding efficacy, a good environmental toxicity profile, and decrease in price for some neonicotinoid insecticides will ensure its continued and wide spread use by western pecan producers. It is increasingly important that western producers incorporate insecticide resistance management in their aphid control programs.

Aphid Management Decisions

Phil Mulder
Oklahoma State University

In parts of the southwest pecan region, protecting pecans from aphids becomes difficult when pecan weevil season arrives, particularly if that time occurs early, when conditions are still favorable for aphid buildup. If environmental conditions are mild and dry during the latter portion of the season and insecticide applications are introduced to control sub-economic weevil populations, these early applications have been known to cause a dramatic resurgence in aphid numbers. Whether this is due to depletion in predator numbers or just a consequence of favorable environmental conditions is not always certain. Basically, four options exist to combat this problem. Option number one includes applying tank mixes of good aphid control materials with the first treatment for weevils. Option number two might mean user a longer residual synthetic pyrethroid, such as Warrior® or Proaxis®, which are encapsulated. Option number three could be to incorporate an application of Admire® on both sides of susceptible trees just before the problem normally arises. The final option is to do nothing and hope that beneficial organisms (lady beetles, lacewings, etc.) and weather (cool, wet conditions) will eventually bring everything back into harmony. The choice of approaches may be dictated, in part, by the pressure in your area of the country, but more likely will be tied directly to costs associated with these choices.

In trials conducted in Oklahoma in 2005 we looked carefully at option number one. Specifically, we looked at tank mixing an insecticide with Surround WP, an insect deterrent, known to be unfavorable for habitation and proliferation of sucking insects (e.g. aphids). At three grower locations, we tested 5 and 10 pounds of Surround WP per acre, tank mixed with Sevin®, Mustang-Max® or Warrior®. Unfortunately, we could not control the insecticide chosen by each cooperator; therefore, analysis was conducted in two ways. First, we considered insecticide choice (orchard) as a random effect and conducted tests to compare simple effects, where we basically compare treatments for a given time period. The second method of analysis involved using each location as a replication of a single experiment. This approach considered each location separately, to see if any trends due to insecticide might parallel the results from the first analysis. Rather than combine all sample times, we also divided up the monitoring periods into early, mid and late categories; assuming that populations of aphids are building up over time. This did appear to be the case across all orchards.

During mid-and late-timeframe monitoring, when combining all orchards, we found significantly more aphids per compound leaf in untreated areas than in treated areas. During the early monitoring period, leaves treated with the higher rate of Surround WP had significantly less aphids than untreated trees; however, no differences were seen between untreated leaves and those receiving a low rate of Surround WP. When insecticide effects were not ignored (i.e. each orchard considered separate) then different trends were noted. In particular, in the orchard that used Sevin for weevil control, no differences in aphid populations were seen throughout the monitoring period between high or low rates of Surround or between either of the rates and the untreated trees. In the orchard where Mustang-Max was used for weevil control, trees treated with the higher rate of Surround WP showed significantly lower numbers of aphids than the untreated leaves throughout the trial period. Trees treated with the low rate of Surround in combination with Mustang-Max showed significantly lower aphid populations only during the late monitoring period. In addition, at this location, the only time when aphid populations were significantly greater in trees treated with the low rate versus the high rate of Surround was during mid-period monitoring. For the orchard where Surround WP was tank mixed with Warrior, no differences were observed initially between treated and untreated trees. By the time mid-period monitoring occurred, both of the treated sections had significantly fewer aphids than the untreated trees. Finally, during the later monitoring period, only the trees treated with the high rate of Surround had significantly lower numbers of aphids on leaves than the untreated plants, although population levels within the trees treated with the two different rates did not differ.

Determining Insect Pests of Stored Pecans

Andrine A. Morrison and Phillip G. Mulder, Jr.
Oklahoma State University

Recent figures from the USDA cite that 25.2 million shelled pecans were in storage on September 30, 2004. These same reports suggest that an additional 38.7 million pounds of inshell pecans are in storage. While the majority of this storage is refrigerated, some non-refrigerated storage is common for a short period of 2-3 months after harvest each year.

Little is known about pests of stored tree nuts and no publications specifically target the pests of stored pecans. As the industry continues to grow, it will be increasingly important to protect stored nuts from destruction by pests. Recently, there have been many inquiries by growers and extension agents alike as to the kinds of pests and the amount of damage expected from these pests. Little to no information is available to distribute to growers, retailers and other short-term storage facilities to answer their questions.

Pecans harvested in Fall 2005 will be stored with insects inside mason jars within a growth chamber for 2, 4, 6 and 8 weeks. Pecans will be prepared for the insect pests in the form of whole, cracked, and nutmeat, and additionally, wheat replications will be used as a control. Insect species to be used are Indianmeal moth (*Plodia interpunctella*), sawtoothed grain beetle (*Oryzaephilus surinamensis*), red flour beetle (*Tribolium castaneum*), and lesser grain borer (*Rhyzopertha dominica*). Insects that survive and reproduce will be counted and the data analyzed for statistical relevance. Results from preliminary trials demonstrated that sawtoothed grain beetle, red flour beetle, lesser grain borer, and Indianmeal moth were able to reproduce successfully on cracked and nutmeat pecans.

In addition, insect traps will be distributed to 6 pecans storage sites in Oklahoma, 6 in Texas, and 2 in New Mexico. These traps will be baited with a combination of pheromone and/or oil to attract insects. Insect species for which traps will be baited include confused flour beetle (*Tribolium confusum*), red flour beetle (*Tribolium castaneum*), khapra beetle (*Trogoderma granarium*), warehouse beetle (*Trogoderma variabile*), sawtoothed grain beetle (*Oryzaephilus surinamensis*), merchant grain beetle (*Oryzaephilus mercator*), dermestid beetles (*Dermestes* spp.), cigarette beetle (*Lasioderma serricorne*), lesser grain borer (*Rhyzopertha dominica*), Indianmeal moth (*Plodia interpunctella*), raisin moth (*Cadra figulilella*), tobacco moth (*Ephestia elutella*), and Mediterranean flour moth (*Ephestia kuehniella*). Traps from New Mexico and Texas will be shipped to OSU twice monthly for identification and recording of species collected. Oklahoma traps will be picked up twice monthly by researchers and insects captured will be identified and recorded. At the end of 1 year, results of insects collected from all 3 states will be complied and reported.

Weed Management in Pecan Orchards

Dr. Mark Renz
New Mexico State University

Several methods are available to manage weeds in pecans including mowing, disking, flaming and herbicides. No one method will be effective in any orchard, therefore site specific management plans should be developed that account for the weed spectrum within the field, stage of development of the orchard (bearing or not), and the grower's budget. Herbicides are an important component in orchard floor management plans, but they are *only one of several options available*. Growers should integrate tools to manage weeds in orchards to prevent herbicide resistant or tolerant weeds from establishing. Use of herbicides with different modes of action or integration of mechanical control methods are often the easiest and most effective methods at preventing these populations from establishing. Currently several herbicides are available for use in pecan orchards. Please consult the tables below for a list of the common herbicides used and restrictions in use pattern.

HERBICIDES LABELLED FOR NONBEARING PECAN TREES

Herbicide	Active ingredient	Timing	Comments
Basagran	benefin	POST	Apply when weeds are young and actively growing; minimum of 20 GPA; do not apply within 1 yr of harvest
Prowl	pendimethalin	PRE	Works best when rainfall or irrigation occurs within 21 days with or shallow tillage (1-2 inches); controls emerging weeds only
SureGuard	flumioxazin	PRE POST	Apply prior to bud swell or after dormancy in fall. Must incorporate for pre-emergent activity (1/2 in water).
Treflan	trifluralin	PRE	Apply and incorporate; soil specific rates; controls only emerging weeds

HERBICIDES LABELLED FOR NUT BEARING PECAN TREES

Herbicide	Active ingredient	Timing	Comments
Devrinol	napropamide	PRE	Incorporate with 2-4 inches of water within 24 hours of application
Fusilade	fluazifop	POST	Grass specific herbicide
Goal	oxyflurofen	PRE	Dormant application only; do not apply after onset of bud swell and when nuts are present; apply in 40 GPA
Gramoxone	paraquat	POST	Contact herbicide, no residual. Do not allow spray to contact green foliage
Karmex	diuron	PRE POST	Do not use on sand, loamy sand, or gravelly soils or where organic matter is < 0.5 %; for POST control apply when seedlings are young; minimum 30 GPA
Manage	halosulfuron	POST	Effective on nutsedge
MANY	glyphosate	POST	Systemic herbicide, no residual. Do not allow spray to contact green foliage
Poast	sethoxydim	POST	Can apply over the top of nonbearing trees and banded to large trees
Princep	simazine	PRE	*Can't use west of pecos river*; do not use on gravelly, sandy, or loamy sand soil; do not use on trees < 2 years old;
Select	clethodim	POST	Grass specific herbicide
Solicam	norflurazon	PRE	Must water in within 4 weeks; min 20 GPA
Surflan	oryzalin	PRE	20-40 GPA; incorporate with ½-1 inch water, or till 1-2 inches deep

Alternate Bearing Research: Implications For Western Pecans

Dr. Richard Heerema
New Mexico State University

Alternate bearing is the tendency of tree species, including pecan, to have wide year-to-year swings in fruit production. Among trees, alternate bearing is very common because it benefits trees in the wild by preventing pest populations from building up. Nevertheless, alternate bearing is a highly undesirable trait in fruit or nut production settings. It causes major problems for:

1. Individual growers because of the instability in cash-flow it creates.
2. Harvesting and processing operations because, for these operations to be prepared to handle the heavy 'On' years, their equipment/facilities must function below full capacity during the light 'Off' years.
3. Pecan marketing efforts because consumers are less likely to buy products with unstable quality, price and availability.

Annual variation in flower number is the most important factor in alternate bearing. For an alternate bearing tree species, heavy fruiting relative to tree leaf area causes low flower number in the following season; light fruiting relative to tree leaf area, on the other hand, results in heavy bloom the following season. There are two theories as to how this works. Some scientists subscribe to the "hormone theory" which says that chemicals promoting flower formation flow out from leaves and/or chemicals inhibiting flower formation flow out from fruits. Other scientists follow the "carbohydrate theory". According to that theory, carbohydrates promote flower formation and a tree's fruit:leaf area ratio regulates flowering in the subsequent season through its effects on tree carbohydrate availability.

Despite the fact that alternation is sometimes ingrained in a tree's physiology, orchardists have numerous options for managing this problem, including:

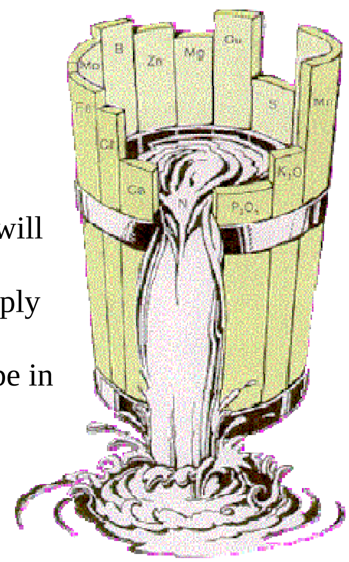
1. **Fruit thinning.** Removing excess immature fruits in 'On' years effectively reduces the severity of the 'Off' years and increases quality during the 'On' years.
2. **Pruning.** Good pruning programs moderate alternation by minimizing heavy within-canopy shading and reducing tree crop load of 'On' years.
3. **Avoiding "triggering events".** Alternate bearing cycles are often triggered by adverse weather or fruit-eating pests. Carefully choosing orchard sites and controlling orchard pest outbreaks may prevent triggering of alternate bearing cycles.
4. **Applying fertilizers at the proper rates.** Adjusting fertilizer application rates to match crop demand may help prevent overproduction of flowers following an 'Off' year and underproduction of flowers following an 'On' year.
5. **Irrigating later in the season.** Later irrigations, especially in 'On' years, can moderate alternate bearing by allowing leaves to photosynthesize later into the fall and trees to build up larger storage reserves for the subsequent winter and spring.
6. **Choosing the right variety.** Some cultivars tend to alternate bear more than others. Fruit set potential, fruit/kernel size, harvest date and bearing habit all can affect a variety's propensity toward alternate bearing.

Nutrient Interactions in Western Pecans

Michael Smith
Oklahoma State University

An essential element may be defined as an element that is necessary for growth or reproduction, performs a specific function, and cannot be completely substituted for in that function by another element. Essential elements are carbon (C), hydrogen (H), oxygen (O), nitrogen (N), phosphorus (P), potassium (K), sulfur (S), calcium (Ca), magnesium (Mg), copper (Cu), molybdenum (Mo), iron (Fe), zinc (Zn), manganese (Mn), boron (B), chlorine (Cl), and the most recent addition nickel (Ni). Carbon, H and O are supplied by the atmosphere or water and will not be considered further in this discussion.

The fertilizer elements are commonly divided in macronutrients (N, P, K, S, Ca and Mg) and micronutrients (Cu, Mo, Fe, Zn, Mn, B, Cl and Ni) representing the relative amounts needed for normal plant growth and not their importance for plant performance. In the 1800's, Justus von Liebig proposed the "Law of the Minimum" that remains relevant today. It states that if one nutritive element is deficient, plant growth will be poor even when all the other elements are abundant (see figure). Supplying the deficient element will increase growth such that the supply of that element is no longer the limiting factor. Increasing the supply beyond that point is not helpful, because another element would then be in a minimum supply and become the limiting factor. In fact, supplying more of an element than needed can be detrimental to growth or reproduction because of the effect it can have on availability of other elements or an excess can directly impact plant growth.



Nutrient availability is strongly affected by soil pH. Typical soils in the southwestern U.S. are calcareous with a pH range from 7 to 9. At such a pH range, availability of Fe, Mn, Cu and Zn will be low. In the southwestern U.S., Zn is deficient in almost all situations, Fe and Mn are occasionally in short supply and Cu is rarely deficient. Applying any of these four elements to the soil would rarely affect availability, since they would rapidly be rendered unavailable in such a pH range. Therefore, foliar applications are the normal method to correct shortages of these elements. Deficiencies of the other micronutrients, B, Mo, and Cl, are also rare in pecan. Nickel has recently been recognized as an essential element. Deficiencies of Ni appear to be common in the southeastern pecan growing region. The extent of nickel shortages in other pecan growing regions is unknown.

Nitrogen applications are normally required on an annual basis. About 20 to 30% of applied nitrogen is absorbed by the pecan tree. The remainder of the nitrogen is lost when converted to a gaseous form, leached through the root zone eventually reaching the ground water, or used by organisms other than the tree. Absorption efficiency is typically inversely related to the nitrogen application rate, i.e. as more is applied a smaller percentage is absorbed.

Potassium is occasionally low in pecans. Deficiencies typically reduce nut quality because kernel oil content is suppressed. Shucks also tend to open irregularly when K is low, similar to drought stress. Leaves frequently develop irregular necrotic areas on the margins during the latter part of the growing season when K is low. These symptoms are normally magnified when the crop is large. Potassium shortages are more common in sandy soils than fine-textured soils and are also easier to correct in sandy soils.

Phosphorus and Mg deficiencies are rare. Phosphorus shortages are more likely to occur on young trees than mature trees. Excess P applications can exacerbate shortages of certain micronutrients. Calcium shortages have not been reported in the southwestern U.S.

Leaf analysis is the most effective method to determine orchard fertility needs. Most states have a leaf analysis program available for pecan producers. Standard elemental concentrations to guide fertilizer recommendations have been developed using leaves collected from a specific location on the shoot at a specific time. The same collection procedures must be followed to obtain reliable fertility recommendations. Producers should consult their Co-operative Extension Service for complete details. Soil fertility analysis is not reliable for predicting pecan fertility needs, but is useful when combined with leaf analysis to diagnose specific problems.

Is Pollination Limiting profitability: How Can You Know?

Bruce W. Wood
USDA-ARS, Fruit and Tree Nut Research Laboratory
Byron, Georgia

Nut yield loss to pollination related factors is likely far more significant in many orchards than commonly recognized. Pollination studies in the southeastern U.S. pecan belt, where there is a relative abundance of pollen from many sources, shows that in certain years many orchards experience pollination associated yield loss. A similar loss has been documented in southwestern orchards where it was thought that there was good flowering complementarity between cultivars. Use of both a "Type I" and a "Type II" cultivar does not guarantee adequate cross-pollination. Pollination affects orchard profitability at several levels. In addition to the harmful and straightforward effect of the absence of pollen at stigma receptivity, there are also subtle secondary aspects of pollination that limit revenue via egg fertilization, fruit-set, and seed development. This talk addresses the pollination/fertilization/seed development process, how pollen and different pollen sources affect these processes, and how growers can determine if there is a pollination problem in a particular orchard.

Key to successful pollination management is the ability to recognize pollination associated problems. These pollination associated problems can be detected by the asking the following questions:

1) Is there a fruit-set gradient among main crop trees surrounding "off-variety" , "seedling", or "pollinator" trees? A gradient is most apparent when one compares the fruit-set of the side of the canopy facing the aberrant trees to fruit-set in canopies 4-5 trees further away, but is often apparent only 1-2 trees away. Note that such a gradient will not occur around all aberrant trees, even if there is a pollination problem, because the timing of pollen dispersal by aberrant trees will not always overlap with surrounding trees.

2) Is there a fruit-set gradient, or kernel quality gradient, or yield gradient, across the orchard as one traverses from one pollinator row to the next? Note that tree canopies, especially noticeable as orchard canopies crowd, are a substantial barrier to across-orchard pollen movement.

3) Is there a fruit-set, June-drop, kernel quality, or yield gradient across the orchard from the 2nd -3rd row to the center of the orchard? Note that fruit-set is generally good on the perimeters rows of all orchards, but drops off substantially from about the 4^{th}-5^{th} row inward if pollen is limiting fertilization.

4) Is there heavy, or excessive, June-drop accompanied by "fruit-tip senescence"? Fruit-tip senescence is when the shuck of aborted fruit is just beginning to separate from the shell, a physiological process requiring 2+ weeks. Fruit drops due to insect feeding do not exhibit this "shuck separation zone" as such drop occur about 5-7 days after being damaged; thus there has not been sufficient time for senescent processes to produce a shuck separation zone.

Note that fruit will drop due to lack of egg fertilization; thus this drop can be due to either lack of pollination or to genetic incompatibilities with the pollen parent. Thus, selfing, or self fertilization, can cause June-drop, with the problem ranging from nil to severe depending upon the cultivar.

5) Is there a gradient in kernel quality, especially percentage kernel, as distance from the pollinator variety increases? Such a loss is due to self-fertilization, with the degree of loss varying among cultivars.

A variety of factors will be discussed that causes annual variation in complementary pollination. Guidelines will be provided that can be implemented to correct or prevent significant pollination related yield losses.

Salinity Management in Pecan Orchards

Dr. James Walworth
University of Arizona

Managing salts is an important, yet often overlooked, aspect of pecan orchard management. Long-term management is critical for sustained productivity.

Irrigation waters may contain significant levels of salts and contribute to soil salinity. Fertilizers are another source of salinity. However, many southwestern arid-region soils naturally contain high concentrations of salts because desert precipitation is not sufficient to dissolve salts and leach them out of the soil. Adequate water flow through the soil profile will leach salts out of the rooting zone and prevent salt accumulation. Any impediments to soil drainage, including hardpans, clay layers, caliche layers, plowpans, or high water tables restrict downward water flow through the soil profile and prevent salt movement out of the soil. Thus salt management comes down to moving enough water through the soil profile to move excess salts out of the active soil layer.

Soil salts can pose two separate problems. The first is that high concentrations of salts can adversely affect plant growth. The second is that certain salts can negatively impact soil physical properties.

Salinity levels may be maintained at levels acceptable for plant growth by leaching the soil profile with excess water. The amount required for this (the *leaching requirement*) depends on irrigation water quality and crop tolerance. To keep salt concentrations low enough that pecan growth and performance is not affected, the following leaching requirements (irrigation or rain water in excess of what the crop requires) should be added. If the soil has physical impediments to drainage (for example, a hardpan) this will have to be physically addressed through deep tillage.

Irrigation water salinity (ppm or mg/L)	Leaching requirement (% of crop requirement)
500	5 %
1000	12 %
1500	19 %
2000	26 %

The effects of salinity on soil structure are more complex. High salinity concentrations, in fact, promote good soil structure, even as the salt inhibits plant growth. But salts, combinations of soluble cations (positively charged molecules) and anions (negatively charged molecules), are not all created equal. Salts with sodium cations (sodium salts) tend to destabilize soil structure, whereas magnesium and calcium salts improve or stabilize soil structure. We use the *sodium adsorption ratio* (SAR) or the *exchangeable sodium percentage* (ESP) as relative measures of these two different kinds of salts. In general, if the SAR is above 13, or if the ESP is above 10, soil structural problems are likely. The result will be slow water infiltration, and poor soil drainage. Eventually, this will lead to salt accumulation because salts can not be leached.

The solution to excess sodium is to increase soluble soil calcium. This can be accomplished by adding calcium-containing amendments, such as gypsum ($CaSO_4 \cdot 2H_2O$). Alternatively, acids and acid-based amendments can be applied if the soil is calcareous (contains calcium carbonates). Acid dissolves the calcium carbonate, releasing the calcium. The most commonly-used acid for this purpose is sulfuric acid (H_2SO_4).

The key to sodium management in soils is to avoid, rather than correct sodium buildup. One of the primary sources of soil sodium is irrigation water, so have your irrigation water analyzed and develop a management program for your orchard.

Pruning Research Progress

Leonardo Lombardini
Texas A&M University

Tree crowding is a phenomenon that pecan growers have to face at some point in time of their production cycle. There are many negative consequences caused by crowding, the most severe being a reduction of number of flowers and productivity, reduction of percent kernel and increase in alternate bearing. When trees grow crowded, lower limbs begins to die and the bearing portion of the canopy becomes higher and more difficult to manage as trees age. Crowding also reduces the amount of light intercepted by the canopy, thus decreasing the overall carbon assimilation. In areas characterized by high relative humidity (e.g., eastern Texas, Louisiana, Georgia), thicker canopies increase the probability of diseases, such as pecan scab, which are favored by the high moisture trapped in the excessive foliage.

The onset of tree crowding depends mainly on tree spacing, but growth and fruiting habits play a role as well. Woodroof and Woodroof (1934) reported that in a 10-year-old pecan tree the spread of the root system is about double the diameter of the canopy. Consequently, in a commercial orchard roots may start competing for nutrients before canopies show any sign of crowding. As a rule of thumb, for trees planted at the conventional distance of 35 × 35 feet, growers have to start canopy management practices between the 12^{th} and 15^{th} leaf season.

While hedging programs in the irrigated Western Region of pecan production have been successfully implemented since the early-1990's, there is still uncertainty about whether hedging can become a routine procedure for the East or not. Among the factors that raise concerns, the reduced amount of solar radiation that characterizes eastern regions makes it hazardous to reduce canopy size without impairing productivity.

This study reports the data from a 3-year-long study initiated in 2003 to study the effects of hedging in a 'Pawnee' orchard located in northern Texas. Control trees were hedged during the month of February. All remaining trees were hedged in February as well but received an additional hedging during the month of either May, June, July, or August. Hedging was performed using a tractor-mounted double sickle cutting bar. In 2003, canopy transmission to light was improved in trees that received double hedging, but decreased to control values in the following years. In general, hedging helped little reduce alternate bearing. Cumulative yield at the end of the third year was greatest for control trees (6631 lbs./acre) followed by May, July, August and June (5196, 5119, 4717 and 4628 lbs./acre, respectively). Percent kernel was also affected by the treatments, but was frequently not directly related to yield.

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Woodroof, J.G. and N.C. Woodroof. 1934. Pecan root growth and development. J. Agr. Res. 49:511-530.

Burning and Waste Disposal of Pecan Trimmings

Rita Trujillo
Air Quality Bureau
New Mexico Environment Department

Burning of vegetative materials, including pecan trimmings, in New Mexico is regulated by the New Mexico Environment Department, Air Quality Bureau. The regulations that apply to this burning are 20.2.60 (Open Burning) and 20.2.65 (Smoke Management) NMAC. Essentially, it is a three-tiered program depending on how much material you burn per day. The requirements of the program apply to anyone who burns vegetative material. Burns over 1,000 cubic feet of pile volume in one day must be registered with the Air Quality Bureau. Burns less than or equal to 1,000 cubic feet per day are required to meet the conditions of the open burning regulation. Burns of over 5,000 cubic feet per day must incorporate emission reduction techniques and documentation of why alternatives to burning were not used. Non-compliance with these requirements may result in fines.

In 2005, the Air Quality Bureau received over 30 registrations for burning of pecan trimmings. This is compared to only 10 registrations in 2004. We are hoping to receive more registrations this year as more orchardists become aware of the program. Kudos go to the New Mexico Pecan Growers' Association for their work in informing their members of the program.

An additional requirement of the program is to estimate the total amount of material that was burned in the burning season, or for the entire year. Only eight of the 30 registrations included tracking information. This is an area that does need to improve. We will assist you with this when you call us.

There are also some upcoming changes to the Smoke Management Program. We are planning to develop a fee requirement for the program this year that would become effective for calendar year 2007. The fees would be sufficient to fund one full time position in the Air Quality Bureau. We are also working on developing a field citation regulation. This would allow the Air Quality Bureau to issue a citation, or ticket, to someone not complying with certain aspects of the regulations. If you are interested to assist us with developing these requirements, please let me know.

The Mesilla Valley is growing. With the increased numbers of residents comes increased complaints about air quality issues, including smoke from burning. There are ways to minimize the impacts of burning on the residents in the valley. Burning during a shorter time during the middle of the day, making sure the piles aren’t left smoldering in the evening, and burning during the week and not on weekends have been shown to help with decreasing the smoke in the valley. We understand that the smoke problems are not all caused by the pecan growers. The more you can do to show your community that you are working to improve the problems associated with smoke, the better the perception your neighbors will have of the entire industry.

Alternatives for the Commercial Utilization of Pecan Wood Waste from Pruning New Mexico Orchards

Darien Cabral
N.M. Manufacturing Extension Partnership

The 1997 agricultural census indicated that New Mexico had 29,622 acres of commercial pecan orchards, with almost all of them in or around the Rio Grande in the Mesilla Valley. Adjacent El Paso County in Texas has close to the same acreage planted in pecans as does New Mexico's Doña Ana County where the vast majority of New Mexico orchards are located.

Most of the commercial trees in New Mexico are close to thirty years old, even though many commercial growers continue to plant and expand production capacity. New Mexico growers with the assistance of the State Agricultural Department found that they could increase yield through bi-annual pruning to both allow more sunlight onto the trees and to reduce overall tree size. Pruning in both New Mexico and Texas means that each year over 25,000 green tons of waste pecan wood material is produced. At this time the pecan growers of the Mesilla Valley stack the pruned branches into piles and burn them.

Although no one has plans to tell the Mesilla Valley pecan growers they can't burn wood, virtually everyone would like to find an alternative. Las Cruces is one of the fastest growing areas of the State, and soon it won't be practical to burn 25,000 tons of wood in an area next to a major population.

The irony is that pecan is an extremely valuable hardwood. Pecan and other hickory woods are rated as the number three hardwood group in the United States. This fact motivated a local entrepreneur about to embark upon a furniture manufacturing venture to contact the New Mexico Manufacturing Extension Partnership to do a feasibility study in cooperation with the New Mexico Pecan Growers Association regarding finding alternative uses for waste pecan wood produced by the orchards.

Although it turned out that it was not practical to use the wood from the orchards for furniture manufacturing, there are other ways to set-up lucrative commercial enterprises that can utilize virtually all of the wood produced by the growers. This presentation will outline commercially viable alternatives to burning large volumes of small diameter pecan wood.

Economics of Pecan Production

Trent Teegerstrom
University of Arizona

Flood irrigation is used in most areas either where water is supplied from irrigation districts or water wells is the most common system currently used, however with increasing water availability and energy cost issues high pressure irrigation (mainly trickle or micro spraying) more and more growers are retaining the high-pressure irrigation systems after orchards reach full production. An economic cost comparison between two irrigation systems and practices for pecan production in Arizona was developed to gain insight into the cost advantage (if any) of either system. The spreadsheet template developed during this project will be made available for producers to take home and use on their operation.

Global Promotion of Pecans

Maureen Ternus, M.S., R.D.
INC Nutrition Research & Education Foundation
Davis, CA

Tree nuts (almonds, Brazils, cashews, hazelnuts, macadamias, pecans, pine nuts, pistachios and walnuts) have been considered a healthy food worldwide for centuries. It wasn't until the early 1980's that nuts were suddenly maligned due to their high fat and calorie content, and the media coverage became negative. As a result, the International Tree Nut Council Nutrition Research & Education Foundation (INC NREF) was formed in 1993 to try to reverse this image. Since then numerous studies have shown the health benefits of nuts. INC NREF has funded research on the nutritional content of nuts, including their phytochemical content. Pecans in particular, contain some of the highest levels of phytochemicals and antioxidants.

In 2003 the Food and Drug Administration approved the first qualified health claim for nuts and heart disease. The claim recommends 1.5 ounces of nuts per day. Since most people have no idea what a one-ounce serving size looks like, INC NREF developed a poster that shows an ounce of each nut. The response has been terrific, especially with the nutrition and health educators.

INC NREF is currently funding two studies. The first is the "Descriptive Study of Patterns and Types of Nuts and Seed Intake and Seed Containing Products in the European Investigation into Cancer and Nutrition (EPIC) Study." The purpose of this study is to describe and compare consumption of total nuts and seeds and different types of nuts and seeds in men and women participating in the EPIC study (36,000 participants from 23 centers in 10 European countries). The manuscript is in the final phase of review and will be submitted for publication to the British Journal of Nutrition.

The second study, "Effect of Nuts on Glycemic Control and Cardiovascular Disease Risk Factors in Non-insulin Dependent Diabetes," is a three-year study that is being conducted at the University of Toronto. This is a follow-up to the pilot study INC NREF funded several years ago. Preliminary findings should be available in early 2007.

In 1995, INC NREF collaborated with the USDA Western Human Nutrition Research Center (WHNRC) at the Presidio in San Francisco on a nut and health symposium. A follow-up to that meeting is being scheduled for early 2007 at the University of California, Davis—home of the new USDA WHNRC building. The purpose will be to review the research that has been done in the last decade or so and to discuss future areas of research. Participants will include experts from within and outside the U.S.

Fortunately, over the last decade the tide has turned and nuts are once again looked upon favorably. Consumption is rising due to positive research and media coverage, and INC NREF will continue to promote the health benefits of tree nuts via research, education and publicity.

International Marketing Efforts for New Mexico Pecans

James G. Ditmore
New Mexico Department of Agriculture

The New Mexico Department of Agriculture through its Marketing and Development Division provides assistance to New Mexico producers in the marketing of their products domestically and internationally. The department is a charter member of the Western United States Agricultural Trade Association (WUSATA) which represents the 13 western most states. The USDA Foreign Agricultural Service provides funding for international marketing and promotion projects primarily through the Market Access Program, and is administered through WUSATA. This funding combined with industry support has provided a major impetus for international efforts in exporting pecans.

International marketing projects in Asia, the Pacific Rim, the European Union and other markets have created export opportunities for pecans. Identification of trade barriers and market constraints are integral components of these projects in the initial development of an export strategy. Trade missions and trade shows provide venues for product introduction, recognition and market acceptance. Consumption and utilization can be identified through in store demos, chef seminars and focus groups.

With the global focus on health and eating healthy foods, pecans rank at the top, for all nuts. This provides an excellent springboard for emphasizing the non-traditional approach to usage and marketing. Another potential marketing tool, for both domestic and international promotions is “branding”. Extolling the established health benefits and the high quality of New Mexico pecans create an excellent core component for branding.

Outlook for Hurricane-Damaged Pecan Orchards

Bill Goff
Auburn University

Pecan orchards in the Southeast have been hit by several devastating hurricanes in the past several years, and the outlook is for more of the same. Weather forecasts from NOAA suggest that we are a few years into a 40-year cycle of similar weather with increased hurricane incidence.

The table shows pecan production in the southeastern states in the past 10 years, and the impact of hurricanes on the various states. The states that have been impacted the most - Florida, Alabama, and Mississippi, - produce collectively only about 6% of the pecans produced nationally, and even a reduction of 50% in these states would only be about 3% of the national crop. Louisiana produces about 5% of the national crop, and was impacted by Hurricanes Rita and Katrina in 2005, but most of the improved crop in Louisiana is in the northern half of the state, where the main force of the hurricanes was lessened as they crossed overland. Most, but not all, hurricane-damaged are recoverable, as trees not blown over or badly leaning come back into substantial production by the second season following the storms. Skips created, if not excessive, provide often- needed additional space and sunlight for remaining trees. Additionally, replants can be of better and more resistant cultivars.

The state of Georgia dominates pecan production in the Southeast, with 69% of the regional production in the past 10 years, and 31% of production nationally. Hurricane tracks through Georgia historically are less common than in the Gulf Coast states. Additionally, by the time the storms reach the major production areas near Albany in southwest Georgia, and Fort Valley in central Georgia, they necessarily have crossed over considerable land with resulting loss of force. Hurricanes have had little long-range impact on Georgia pecan production. Production is declining dramatically in the state, however, for various other reasons. Among these is difficulty in controlling scab, especially on the widely-planted cultivar Desirable. Failure to deal with overcrowded orchards in a timely manner, urbanization, inadequate irrigation systems, and failure to manage crop load and to control aphids and mites satisfactorily are other contributing reasons. With price outlook favorable, many good growers are addressing these problems aggressively and replanting to scab-resistant cultivars, so prospects for a rebound in pecan production are good, but it will be several years away.

Production of pecans from southeastern states in the past 10 years, 1996-2005, and impact of hurricanes. All pecans. ***Source: USDA reports.***

	Avg. pecan production 1996-2005	% of SE	% of US	Impact of hurricanes
	1000 lbs			
Georgia	**78500**	**69**	**31**	**Minor**
Louisiana	**13700**	**12**	**5**	**Moderate - severe**
Alabama	**9310**	**8**	**4**	**Severe**
Mississippi	**3260**	**3**	**1**	**Severe**
South Carolina	**2370**	**2**	**1**	**Minor**
Arkansas	**2245**	**2**	**1**	**Minor**
Florida	**2030**	**2**	**1**	**Severe**
North Carolina	**1700**	**2**	**1**	**Moderate**
SE region**	**113115**	**100**	**44**	
United States	**255775**			

**** SE: GA, LA, AL, MS, SC, AR, FL, NC**

Population Dynamics of Mosquitoes in an Agricultural Setting

Ronnie L. Byford
Jimmy B. Pitzer
New Mexico State University
Department of Entomology

Upon its arrival to New York in 1999, West Nile Virus (WNV) brought more than an arthropod-borne disease to the United States. It destroyed the complacent view most shared towards insects as vectors of disease. More importantly, it allowed people of the United States to see what most of the world had known for decades; mosquitoes are the single most important arthropod vectors of disease.

Mosquitoes vector a number of disease organisms including WNV. Malaria is one of the most devastating diseases known today. According to the Centers for Disease Control, malaria is responsible for an estimated 3 million deaths globally, 75% of these occurring among children in Africa. Resistance of mosquitoes and malarial parasites to treatments are increasing an already difficult control effort. Mosquitoes are known vectors of other diseases such as Yellow Fever, Elephantiasis, Eastern and Western Equine Encephalitis, and Dengue to name a few.

There are several reasons mosquitoes are efficient vectors of disease. The first and foremost is that mosquitoes require a bloodmeal for reproduction. In seeking an adequate dose of animal blood, a mature female mosquito may feed 2 to 3 times. This increases her capacity for transmitting a disease organism between hosts. Add to this the fact a female mosquito lives 2 to 4 weeks and can produce 3 to 5 egg rafts, and the potential for transmitting a disease increases 10-fold.

Human cases of a mosquito-borne disease are increased in areas where urban society encroaches on environments having a high capacity for that disease. A current example of this is seen with WNV. As the city of Las Cruces increases in size two things happen. The first is that an increase in population means an increase in man-made mosquito habitat. In other words, more people, more containers for mosquito breeding. The second thing that happens is that the territory of Las Cruces expands. The area Las Cruces is encroaching upon is the riparian habitat.

Unfortunately for agricultural producers, this expansion also draws urbanization towards much of the farmland in the Mesilla Valley. This will undoubtedly place more burden on pest control for farmers in the area. Knowledge of mosquito biology and management strategies should become commonplace in an area where agriculture and urbanization overlap.

Simply knowing a few general facts about mosquitoes is a large step towards their control. The life cycle of mosquitoes contains four life stages: egg, larva, pupa, and adult. The first three of these stages take place in an aquatic environment, preferably one of shallow, standing water. After a female mosquito takes a bloodmeal, she rests for two to four days while development of eggs takes place. Once development is complete she seeks a water source on which to lay eggs. One to two days later, 150-300 larvae will hatch and begin growing towards the pupal stage.

Mosquito larvae feed largely on microbes and small organic particles making a lowly oxygenated pool of water ideal for oviposition. The resultant pupae, often called tumblers, are lively but do not feed. This final developmental stage will be completed in 2-3 days, at which time the adults will emerge. A large part of mosquito control lies in elimination of these aquatic environments.

Sprinkler Presentation for Pecan Conference

Dick Eastman
Lesco Enterprises
Bowie, AZ

We have many types of water systems at our operation in Bowie, AZ. We have our original sprinkler system which was installed in 1984 on 6 year old trees that are on 30 x 30 spacing. The sprinkler was put in diagonally which results in a sprinkler on every other tree but alternating on each row. We have Rainbird M-20 brass sprinklers with 7/64 nozzles, this puts out about 2.2 gal/min. This field runs at 40 PSI and 1100gal/min. This results in just over 3” of water in 24 hours. We still have about ½ of the original sprinkler heads in use on this field.

One farm has a tree spacing of 20 x 40 with sprinkler running vertical to the tree line on every other row. On this field we have Rainbird steel heads with 7/64 nozzles. This field was converted from row water to sprinklers when the trees were 15 years old. We use 1100 gal/min @ 40 PSI on this field as well. The steel head sprinklers are about 10 years old and all have been replaced, some have been replaced twice. We are switching back to brass heads this year.

Another farm has 30 x 30 spacing with water lines running vertical to the tree row in every row. On this system we use a Bowsmith Fan jet micro sprinkler with a 30 gal/hour nozzle. We run this field on 950 gal/min @ 40 PSI which gives about 1.2” of water in 24 hours. This system has been in place for 3 crops now. It was installed going into an on year on 25 year old trees with no adverse effect. This nozzle has a 30 foot diameter pattern.

We are now in the process of taking the original sprinkler and renozzling them. We think that less water per irrigation with more frequent irrigation is a better approach.

Modification of Flood Irrigation Borders Saves Water

Layne Brandt
Farmers Investment Company
Sahuarita, AZ

The tree spacing at FICO is 60' x 60' in the Westerns and 30' x 60' in the Wichitas. All of our tree rows are 60’ apart. We have one irrigation berm in every tree row.

When we removed the 30' row of trees in the early 80’s we had 1 berm where the tree row was, (in the middle between the 60' row of trees).

In some orchards we decided to remove the 30' border and put up 2 borders 20' apart. This layout gave us 3 - 20' irrigation panels instead of 2 - 30' irrigation panels.

We decided to experiment with different irrigation regimes as follows:

Plot 1: Irrigate all 3 panels every 10-16 days depending on time of year, temperature, etc.

Plot 2: Irrigate the 2 panels next to the tree every 10-16 days and irrigate the middle space every other time, (20-32 days).

Plot 3: Irrigate the 2 panels next to the tree every 10-16 days and not irrigate the middle space all season.

RESULTS:

Plot 1: Quantity, Quality and return bloom same as farm average.

Plot 2: Same as Plot 1 with a 15% irrigation water savings. There are less tree roots in the middle 20' area, so irrigating less often still provided the trees with sufficient moisture.

Plot 3: The nuts were not as well filled.

In the future we plan to revisit Plot 3 and determine how many years it will take before the quantity and quality is the same as the farm average. We believe a 40'irrigation basin is adequate in size. What needs to happen is the roots to die in the middle 20' area and grow more roots in the 40' area next to the tree.

Time will tell if we are right. I’ll be happy to report these results in 4 years.

Summary for Pecan Conference

Bill Kuykendall
Chase Farms
Artesia, NM

Up until 5 years ago, I was one of those farmers that told people you could not over water a pecan tree in our part of the country. At Chase Farms, we watered based strictly on the calendar. Approximately four to five years ago we began to see health problems in some trees and to associate these problems with an over abundance of water.

We now use the *Diviner 2000* system—a portable monitor that allows us to measure the soil moisture. Using this system, Chase Farms has 65-70 tubes in various locations throughout the farm that are used for monitoring the moisture.

At each site, we get moisture readings every 4 inches to one meter (40 inches) below the surface of the field. These readings are taken 3 times a week and the data is downloaded onto a computer that allows us to view the moisture trends at those sites. We now have three years of historical data to help us schedule irrigations.

I am now a firm believer that in our varying soil types, the trees need to use the available moisture before applying additional moisture. Depending on the size of the trees, spacing, type of soil, weather, time of year, and the stage of development, watering times can vary greatly.

Extent and Duration of Gas-Phase Soil Oxygen Depletion in Response to Flood Irrigations in Two Pecan Orchards

Jeffery C. Kallestad, T.W. Sammis, and John G. Mexal
New Mexico State University

Pecan orchards in the Mesilla Valley of New Mexico are routinely flooded as a means of irrigation. The effect of flooding on gas-phase soil oxygen concentration in orchard settings has received little scientific scrutiny. To assess whether orchard soil oxygen is depleted to levels previously shown to be injurious to pecan seedlings, and to determine if photosynthesis is affected by flooding, galvanic oxygen sensors housed in diffusion chambers were buried in two orchards at 4 depths within the top meter of soil providing hourly concentration data for the 2004 growing season. In addition, carbon dioxide flux measurements were made above the canopy. The maximum and minimum oxygen concentrations decreased with increasing irrigation frequency, and the duration below a 10% or 13% O_2 threshold at each depth increased. Excess soil moisture from rainfall following irrigation resulted in root zone oxygen concentrations below 13% for as much as five weeks, but CO_2 flux measured above the canopy did not change. The data also show the effect of increasing soil temperature on the oxygen depletion rate; a novel bimodal pattern of concentration fluctuation within the diurnal cycle; and an upward venting of oxygen enriched atmosphere during the period of soil surface saturation. This analysis provides an improved perspective of the effect of flood irrigation on the oxygen depletion and re-aeration processes in an orchard setting, and suggests the need for further investigations to more precisely determine critical oxygen concentration-durations for mature pecan trees.

The Effect of Prolonged Flood-Irrigation on Leaf Gas Exchange in Mature Pecan Trees in an Orchard Setting

Jeffery C. Kallestad, T.W. Sammis, and John G. Mexal
New Mexico State University

Woody perennials subjected to root oxygen-stress respond with varying levels of reduced assimilation and leaf gas exchange. Yet, in most studies, seedlings grown in pots were subjected to experimental conditions that rarely exist in nature for mature trees. To determine if flooding mature orchard-grown pecan (*Carya illinoiensis* (Wangh) K. Koch) results in a similar depressed photosynthetic rate (P_n), transpiration (E), and stomatal conductance (g_s) as found in potted seedling studies, 27 year-old trees were continuously flooded for 35 days during which gas exchange measurements were made and compared with non-flooded controls. Flood-treated trees exhibited a continuous decline in P_n, g_s, and E without any apparent recovery throughout the treatment period, and progressively higher levels of intercellular CO_2 (C_i). Flooded trees also exhibited widespread interveinal "bronzing" in subtle blotchy patterns, sporadic adaxial interveinal scorching, and simultaneously put on a flush of new growth, not seen in the control trees. Putative mechanisms are considered relating a disruption in carbohydrate export to reduced levels of photosynthesis; and linking leaf disorders with a release of mid-summer dormancy through respiratory stress and upregulation of antioxidant systems.

Monitoring and Management of Pecan Orchard Irrigation: a Case Study

Jeffery C. Kallestad, T.W. Sammis, and John G. Mexal
New Mexico State University

The amount of irrigation water required to produce pecans in the southwest US ranges from 190 to 250 cm/yr depending on soil type with yearly evapotranspiration (ET) of 142 cm. Soil moisture sensors and computerized data-collection devices have become inexpensive and accessible. With more growers using computers in their business, there is great potential to improve irrigation efficiency using these new soil moisture monitoring tools. The objectives of this project were to introduce 2 low-cost (< $250) soil monitoring instruments, provide instruction on the use of internet-based irrigation scheduling resources, and assist a group of small to intermediate scale pecan producers in utilizing these tools to improve their irrigation scheduling and possibly yield. Another objective was to determine if the technology would be adopted. The Doña Ana County Extension Agent selected 5 small to intermediate-scale pecan farmers based on their expressed interest in improving soil moisture monitoring, and whether they used a computer. Instrumentation was installed in the field and the farmers were instructed on the use of the instruments and associated software. Farmers also received instruction on the use of climate-based irrigation scheduling resources found on the New Mexico Climate Center web site. Most growers in this study were interested in irrigation efficiency at least in a qualitative sense, and all growers understood that better management of water inputs may translate into higher yields that could offset instrument costs. While 3 out of 5 growers indicated they used either a Watermark® or tensiometer to schedule irrigations, compared to the climate-based irrigation scheduling model, all growers irrigated up to 11 days later than the model's recommendation. Changes in the soil moisture extraction trend measured with the Watermark® sensor were coincident with the modeled irrigation dates, supporting the accuracy of the model and suggesting that the model can be used to calibrate the sensors. Four of the 5 growers expressed interest in using tensiometers in the future, only 1 will use the Watermark® sensor, and none of the participants expressed interest in using the climate-based scheduling model. Issues involving ease-of-use; and the farmer's time consumed in sensor calibration, data manipulation, and data interpretation are discussed.

40th ANNUAL WESTERN PECAN GROWERS ASSOCIATION CONFERENCE SPEAKERS

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Irrometer Company, Inc.
Doug Staley
P.O. Box 2424
Riverside, CA 92516-2424

JackRabbit
Eldon Huff
471 Industrial Avenue
Ripon, CA 95366

Gene M. Jessee, Inc.
John Wagner
1627 Nord Avenue
Chico, CA 95926

KCI-Scheidt
Clint Erling
40190 Rd 36
Kingsburg, CA 93631

R. Kaiser Design & Sales
Ron Kaiser
P.O. Box 8
Valley Springs, CA 95252

Linwood Nursery
Joel Hall
23979 Lake Road
La Grange, CA 95329

McCall’s Meters
Ric Parsons
1498 Mesa View Street
Hemet, CA 92543

Medina Agriculture Products Co., Inc.
Jerry Arthur
P.O. Box 309
Hondo, TX 78861

Moore Ag/T-Tech
Gail Moore
11521 Excelsior Avenue
Hanford, CA 93230

Netafim, USA
Pat Fernandes
5470 E. Home Avenue
Fresno, CA 93727

NIPAN, LLC
Mark Crawford
P.O. Box 5611
Valdosta, GA 31603

Orchard Machinery Corp
Don Mayo
2700 Colusa Hwy
Yuba City, CA 95993

Orchard-Rite/Pacific Distributing, Inc.
Hans Bollerud
5724 E Whitmore Avenue
Hughson, CA 95326

Pape Pecan Co.
Harold Pape
P.O. Box 264
Seguin, TX 78155

Rain Bird
John McHugh
2000 S. CR 29
Loveland, CO 80537

Savage Equipment, Inc.
Clay Savage
400 Industrial Road
Madill, OK 73446

Schaeffer Mfg. Co.
Benny Torres
102 Barton St
St. Louis, MO 63104-4729

Servi-Tech Laboratories
Chad Simpson
6921 S. Bell
Amarillo, TX 79109

SNT/PPI
Dewayne McCasland
324 Hwy 16S
Goldthwaite, TX 76844

South Plains Implement, LTD
Chuck Griffith
P.O. Box 609
Mesquite, NM 88048

Southwest Pecan Equipment
Robert Waller
P.O. Drawer 300
Mesquite, NM 88048

Specialized Harvest Mfg., Inc.
Kevin Conley
25950 Avenue 88
Terra Bella, CA 93270

Sun Valley, Inc.
Brad Achen
P.O. Box 540
Hatch, NM 87937

Syngenta Crop Protection
Reagan R. DeSpain
PO Box 64034
Lubbock, TX 79464-4034

USDA/NASS/NM Field Office
Longino Bustillos
PO Box 1809
Las Cruces, NM 88004

Verdegaal Brothers, Inc.
Jim Gregory
13555 S. 11th Avenue
Hanford, CA 93230-9591

Weiss McNair Ramacher
Larry Demmer
531 Country Dr
Chico, CA 95928

Weldcraft Industries, Inc.
Jerry Micke
P.O. Box 11104
Terra Bella, CA 93270

Western Blend, Inc.
Dickie Salopek
P.O. Box 705
Doña Ana, NM 88032

Wizard Manufacturing Inc.
Don Buckman
2244 Ivy Street
Chico, CA 95926

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