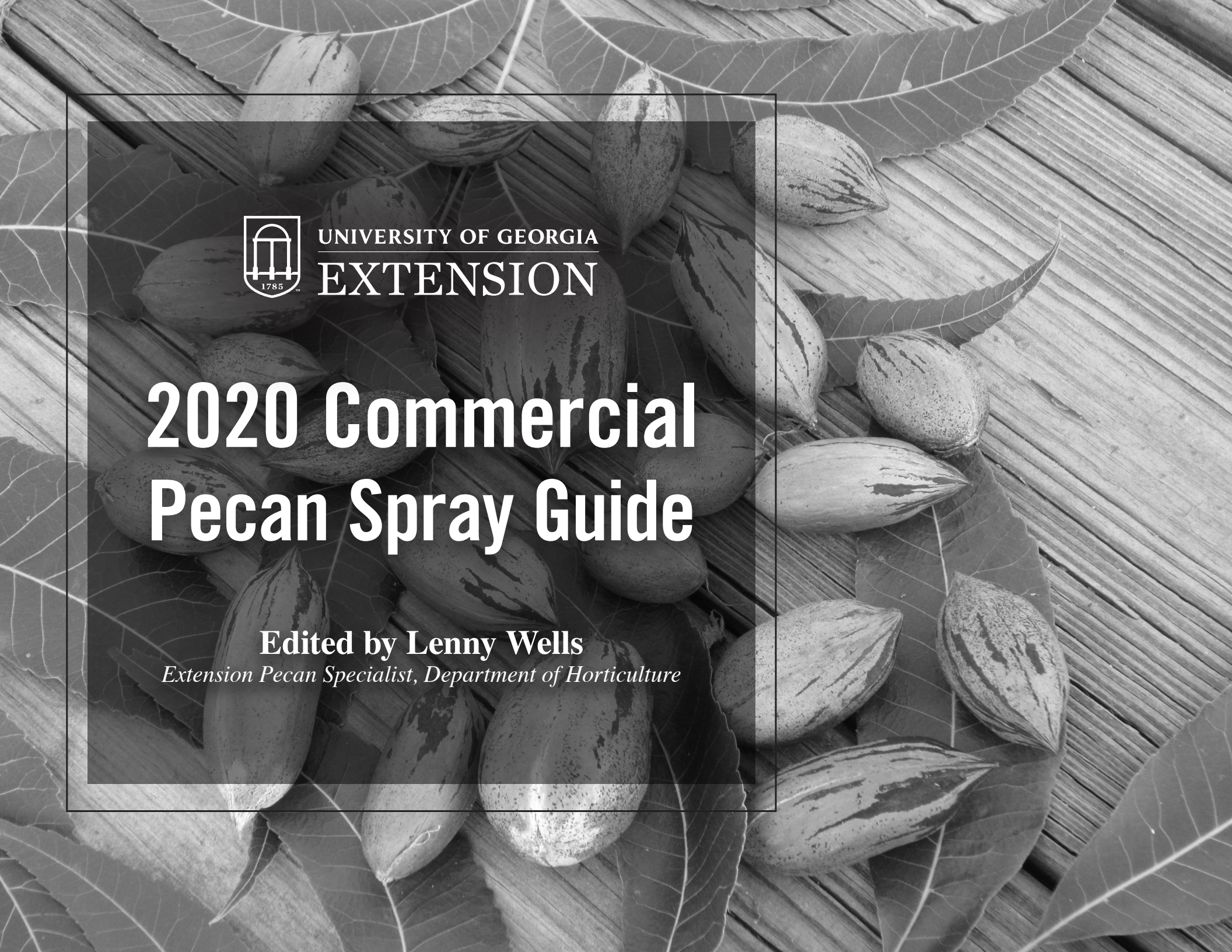

UNIVERSITY OF GEORGIA
EXTENSION

2020 Commercial Pecan Spray Guide

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ONLINE RESOURCES

http://blog.extension.uga.edu/pecan/
www.caes.uga.edu/commodities/fruits/pecan/
http://wiki.bugwood.org/Pecan/Georgia

www.ent.uga.edu/pest-management/

COMMERCIAL PECAN INSECT CONTROL (BEARING TREES)

Will Hudson, Extension Entomologist, and Angel Acebes, Research Entomologist

ORCHARD SURVEY PROCEDURES

Insect and mite infestation levels should be estimated at least weekly based on thorough orchard sampling. Sample trees in all segments of each orchard. A good method is to sample every fourth tree in every fourth tree row (about 10% of the trees). Sample each major cultivar represented in the orchard. Sample a minimum of 10 terminals per tree. Check all compound leaves and the nut clusters on each terminal. Check as high in the tree as possible. Foliar pest counts should be made on compound leaves surrounding the nut clusters. Nut clusters should be inspected carefully for the presence of pests or damage. Hickory shuckworm damage should be monitored mid-season by examining fallen nuts for a whitish spot on the side. Pecan weevil populations should be monitored by survey traps.

PEST	PESTICIDE	MOA	AMOUNT PER ACRE	REI/PHI (Hours or Days)	TIMING AND REMARKS
Phylloxera	Centric 40WG	4A	2-2.5 oz	12 H/ –	Treat trees with a recent history of heavy infestation and surrounding trees. Apply at budbreak with the first pre-pollination spray. Note: Other *imidacloprid* formulations are available. Read labels carefully to find the proper rate.
	imidacloprid Trimax, many generics	4A	3.5 oz 1.3-2.6 oz	12 H/ –	
Spittlebugs	*imidacloprid* Trimax, Provado, many generics	4A	See label *Several formulations are available.*	12 H/ –	Spittlebug infestations are easily recognized by the white, frothy masses on terminals or nut clusters. Definite thresholds have not been established and treatment is seldom needed. Many generic *imidacloprid* formulations are available.
Pecan Nut Casebearer	*chlorpyrifos* 4E Lorsban, Chlorphos	1B	1.5 pt	24 H/ –	Light infestations causing occasional damage do not require control in most crop years. The most serious damage usually occurs in mid-May. Adult emergence should be monitored with pheromone traps. Place traps in orchards by mid-April. Begin sampling for nut casebearer in the first week of May. Pay particular attention to orchards not under a spray program the preceding year and orchards with a recent history of nut casebearer problems. Try to time sprays to stop injury before more than one nut per cluster is infested. It is recommended that broad-spectrum contact insecticides, such as *chlorpyrifos* and the pyrethroids, not be used in early- or mid-season to conserve beneficial insect populations. (See Special Considerations section.)
	methoxyfenozide Intrepid 2F	18	4-8 oz	4 H/ –	
	spinosad Spintor 2SC	5	4-10 oz	4 H/ –	
	diflubenzuron Dimilin 2L	15	8-16 oz	12 H/ –	
	clothianadin Belay	4A	3-6 oz	12 H/ –	
	methoxyfenozide + *spinetoram* Intrepid Edge	5 + 18	4-6.4 oz	4 H –	
	tolfenpyrad Apta	21	17-27 oz	12 H –	**DO NOT** apply more than 1 application. No more than 27 oz/A/season.
	abamectin + *cyantraniliprole* Minecto Pro	6 + 28	8-12 oz	12 H/ 21 D	No more than 2 consecutive applications, no more than 24 oz/season.
Mites	*abamectin* Agri-Mek SC and others	6	2.25-4.25 oz	12 H/ –	A non-ionic surfactant or horticultural oil MUST be added to the tank.
	bifenazate Acramite 4SC	Unclassified	12-16 oz	12 H/ –	See Timing and Remarks top of next page.

COMMERCIAL PECAN INSECT CONTROL

PEST	PESTICIDE	MOA	AMOUNT PER ACRE	REI/PHI (Hours or Days)	TIMING AND REMARKS
Mites (*continued*)	*bifenazate* Acramite 4SC	Unclassified	12-16 oz	12 H/ –	Mites, especially the pecan leaf scorch mite, are normally late season pests. Mite damage appears as bronzed, scorched areas on the undersides of leaflets. Scorched areas begin at the leaflet midribs then spread out toward leaflet margins. Mites often build up on low limbs in the shaded, interior portions of trees then spread rapidly up and out. For heavy infestations, repeat the application in 5-7 days. Savey is an ovicide and should be tank-mixed with an adulticide. Zeal is primarily an ovicide/larvicide.
	spirodiclofen Envidor 2SC	23	14-18 oz	12 H/ –	
	fenpyroximate Portal	21A	2 pt	12 H/ –	
	pyridaben Nexter	21	5.2-10.67 oz	24 H/ –	
	hexythiazox Savey 50DF	10A	3-6 oz	12 H/ –	
	etoxazole Zeal	10B	2-3 oz	12 H/ –	
	fenazaquin Magister SC	21	24-36 oz	12 H/ 7 D	No more than one application per year.
Yellow Aphids	**FOLIAR APPLICATIONS**				Yellow aphids may be present in orchards throughout the growing season. Populations are usually highest in April-May and again in August-September. In early season, DO NOT treat yellow aphids if they are the only insect problem. Rely on beneficial insects to suppress early season populations. In prolonged dry periods, lower, chronic aphid populations may require treatment to prevent the build-up of unacceptable levels of honeydew and sooty mold. WEEKLY SCOUTING IS VERY IMPORTANT IN TIMING APHID SPRAYS, ESPECIALLY IN LATE SEASON. Rotate among classes of insecticides between treatments to avoid resistance development. It is suggested that pyrethroid materials (*cypermethrin*, *bifenthrin*, etc.) not be used, alone or in combination, in early- or mid-season applications. Many generic formulations of *imidacloprid* are available. Read label carefully for recommended rate. *Imidacloprid* alone may not control yellow and black-margined aphids. Admire can be applied through a drip irrigation system, as an emitter spot application, or as a shanked-in emitter adjacent application. See label for complete details. Apply Admire only to orchards where drip irrigation has been established for at least 5 years. **DO NOT** apply more than 1 application of Apta, no more than 27 oz/A/season. Use the 14 oz rate for black pecan aphid control. For PQZ, no more than 2 applications or 4.8 fl oz per acre per year.
	acetamiprid Assail 30SG	4A	2.5-9.6 oz	12 H/ –	
	clothianidin Belay	4A	3-6 fl oz	12 H/ –	
	flonicamid Beleaf, Carbine	9C	2-2.8 oz	12 H/ –	
	flupyradifurone Sivanto 200 SL	4D	7.0-10.5 oz	4 H/ 7 D	
	imidacloprid Provado, many generics	4A	See label	12 H/ –	
	pymetrozine Fulfill	9B	4 oz	12 H/ –	
	pyridaben Nexter	21	5.2-10.67 oz	24 H/ –	
	pyrifluquinazon PQZ	9B	2.4-3.2 oz	12 H/ 7 D	
	sulfoxaflor Closer	4C	1.5-2.75 oz	12 H/ 7 D	
	thiamethoxam Centric	4A	2-2.5 oz	12 H/ –	
	tolfenpyrad Apta	21A	17-27 oz	12 H/ –	
	SYSTEMIC APPLICATIONS				
	imidacloprid Admire Pro	4A	7-14 fl oz	12 H/ –	

COMMERCIAL PECAN INSECT CONTROL

PEST	PESTICIDE	MOA	AMOUNT PER ACRE	REI/PHI (Hours or Days)	TIMING AND REMARKS
Black Pecan Aphid	SAME INSECTICIDES AS FOR YELLOW APHIDS or *chlorpyrifos* Lorsban, generics	1B	Check label	24 H/ –	Black pecan aphids may cause damage as early as May but are usually a serious problem only in late season. Damage appears as yellow spots on leaflets. Damaged spots later turn brown and 2-4 damaged spots per leaflet can cause leaflet drop. Carefully check all compound leaves on 10 terminals per tree, on at least 10 trees per orchard for the presence of black pecan aphids. Prior to July 1, treat if 25% of terminals have 2 or more black aphids. After July 1, treat if 15% of terminals have more than one black aphid and nymph clusters are found. Concentrate checks on susceptible cultivars such as Schley, Sumner, and Gloria Grande. Be sure to check all compound leaves on each terminal examined. *Gibberellic acid* is a plant growth regulator that prevents damage from black pecan aphid feeding and inhibits establishment in the orchard. It does not affect aphids directly and will not control any other pest, including yellow aphids. Three applications should be made at 2-week intervals, beginning in mid-July, applying 10 oz (or 5 oz of ProGibb LV Plus) each time.
	gibberellic acid ProGibb 4% ProGibb LV Plus	N/A	10 oz 5 fl oz	N/A	
Hickory Shuckworm	*chlorpyrifos* 4E Lorsban, Chlorfos	1B	1-14 pt	24 H/ –	Shuckworms are active throughout the season, but do not cause significant damage until June or later. Prior to shell hardening, larval feeding causes nuts to drop. After shells harden, feeding causes shucks to stick to the shells, reducing quality. If orchards have a history of shuckworm infestation, a spray should be applied in early June. In early August, 2-3 additional sprays should be applied. Initiate August sprays at half-shell hardening and repeat at 2-week intervals until shuck split if shuckworm activity continues. *Chlorpyrifos* and pyrethroids (Asana, Ambush, Mustang, etc.) applied for other pests will also control shuckworm. It is not necessary to spray in August if pecan weevil controls are applied. Please note the Special Considerations section regarding the use of pyrethroid materials. **DO NOT** apply more than 1 application, no more than 27 oz/A/season.
	clothianadin Belay	4A	3-6 oz	12 H/ –	
	diflubenzuron Dimilin 2L	15	8-16 oz	12 H/ –	
	methoxyfenozide Intrepid 2F, Turnstyle	18	4-8 oz	4 H/ –	
	methoxyfenozide + *spinetoram* Intrepid Edge	5 + 18	4-6.4 oz	4 H/ –	
	tolfenpyrad Apta	21A	17-27 oz	12 H/ –	
	abamectin + *cyantraniliprole* Minecto Pro	6 + 28	8-12 oz	24 H/ 21 D	No more than 2 consecutive applications, no more than 24 oz/season.
	chlorantraniliprole + *lambda-cyhalothrin* Besiege	3 + 28	6-12.5 oz	24 H/ –	Besiege contains a pyrethroid, and may flare aphids and mites if used in early or mid-season. The best fit is for late season shuckworm.

COMMERCIAL PECAN INSECT CONTROL

PEST	PESTICIDE	MOA	AMOUNT PER ACRE	REI/PHI (Hours or Days)	TIMING AND REMARKS
Pecan Weevil	*carbaryl* Carbaryl 80S Sevin	1A	3 lb	24 H/ –	Pecan weevil emergence may extend from July into October. Peak emergence is normally between August 10 and September 20. Emergence should be monitored in each infested grove with traps, knockdown sprays or a combination of these methods. Trees known to have a recent history of weevil problems should be selected for monitoring. If excessive nut drop results from pecan weevil feeding punctures before pecan shells begin to harden, spray at once. After pecan shells harden and nuts reach the "dough" or "gel" stage, treat when weevils emerge (especially following rains) and continue at 7-10 day intervals until emergence stops. APHID OR MITE POPULATIONS MAY BUILD UP WHERE *CARBARYL* IS USED. If these pests become a problem, apply aphicides or miticides as previously directed. **NOTE:** Several pyrethroids, (Asana, Ammo, Baythroid, Brigade, Mustang Max) as well as *Imidan* are labeled for pecan weevil control. If these materials are used for weevils, they can be expected to be most effective where weevil populations are low. They may be adequate to prevent feeding injury from weevils emerging prior to shell hardening but their use could be risky under heavy weevil pressure after nuts reach the gel stage and are subject to weevil oviposition. (See Special Considerations section). Several products are available that combine a pyrethroid insecticide with an aphicide. These products may help suppress aphids while providing weevil control. Brand names include Endigo, Leverage, and others.
	carbaryl Carbaryl 4F Sevin XLR Various pyrethroids	1A	4-5 qt	24 H/ –	
Ants, including fire ants, Argentine ants, acrobat ants, and others	Baits Extinguish, Reemit 0.5 G, Altrevin, and others *chlorpyrifos*	Various 1B	1.0-1.5 lb/A 4 pt/A	Various 14 days	The best approach is to apply a bait twice per season, generally in late April – early May and again in September. If populations are large and active, follow the first bait application with a chlorpyrifos application as a ground spray directed at the herbicide strip. Repeat as necessary when ants interfere with irrigation equipment.

KERNAL FEEDING HEMIPTERANS (Stink bugs and Plant bugs)

A complex of true bugs (stink bugs and plant bugs) attack pecan. They may be present in orchards all year but normally cause their most serious injury from late August through September. Prior to shell hardening, feeding injury causes nut drop. After shell hardening, their feeding causes black, bitter spots on kernels, reducing quality. They can continue to feed, through the hardened shells, until nuts are harvested. The presence and numbers of stink bugs and plant bugs should be noted in surveys throughout the season. Special attention should be paid to the true bugs in late-season orchard surveys. Treat when 1 stink bug is found per 40 terminals OR when 5 or more are found per knockdown spray on a sheet covering 20% of the area under a tree. Sprays for these insects are difficult to time properly because the bugs move in and out of orchards. Close checking is required to detect damaging populations. No materials have consistently given excellent stink bug control, possibly due to the difficulty in timing sprays. The pyrethroids are labeled for stink bug control. Please note the pre-harvest use restrictions of the products.

FIRE ANTS

Fire ants have been known to protect pecan aphids by destroying beneficial insects in pecan orchards. Fire ants should be controlled or at least kept out of pecan trees. Lorsban 4E at 2 pts/A as a ground spray is labeled for fire ant control. Best approach is probably applying an ant bait in late spring.

SCALE INSECTS

Scale populations build slowly, but can reach damaging levels before becoming obvious. Examine fallen limbs carefully during the season for scale presence. Preferred treatment is 1-2% horticultural oil spray, applied in November-December and again in February. For severe problems, an application of Esteem in June may be necessary.

OTHER INSECT PESTS

Pests such as pecan leaf casebearer, leaf miners, walnut caterpillar, fall webworm, pecan budmoth, nut curculio, shoot curculio, Prionus root borers, and others may occasionally cause economic injury to pecan. Growers should be able to identify these pests and their damage. Color photographs of all pecan pests and their injury can be found in the Southern Pecan Growers Handbook and online from the UGA Extension pecan team (Google search "ugapecans"). The publication is available at $30 per copy. For ordering information, visit: extension.uga.edu/publications/for-sale.html

Specific controls for occasional pests not covered in this spray guide can be obtained from your local county Extension agent.

SPECIAL CONSIDERATIONS

Alternative Formulations – Some pesticides listed in this publication are available in formulations other than the ones listed. If different formulations are used, apply an equivalent amount of actual toxicant per acre.

Pest Resistance and Chemical Use – The aphids and mites which attack pecan have demonstrated the ability to become resistant to insecticides applied for their control. The rate at which this resistance develops depends on the chemical used, the frequency of use, the duration of use, and the rates used. Aphid and mite exposure to effective materials should be minimized to prolong the effective life of the chemicals. It is suggested that no insecticide be applied until it is absolutely necessary (this can be determined by thorough sampling) and that chemicals be alternated as much as possible. Resistance to *neonicotinyl* insecticides has developed in some areas for both yellow- and black-margined pecan aphids. This class of insecticides includes *imidacloprid*, *thiamethoxam*, *acetamiprid*, and *clothianidin*. These materials no longer provide adequate control of resistant populations. Aphid and mite populations may flare following application of Sevin or pyrethroids. Growers should be alert for this response, and limit applications of these materials to the minimum necessary for weevil or stink bug control.

Supplemental Control Measures – Beneficial insects such as lady beetles and lacewings provide natural assistance in suppressing aphid and mite populations. Beneficials are of particular value in early season. Elimination of unneeded early-season insecticide sprays conserves existing populations of beneficial insects and reduces the potential for severe aphid problems later in the season. The planting of leguminous cover crops in tree-row middles promotes the build-up and retention of lady beetle populations in orchards. Crimson clover and Hairy vetch appear to be two of the best ground covers. If leguminous ground covers are planted, an herbicide strip should be maintained down each tree row and special attention should be paid to the increased water requirements that are likely to exist. Extraneous plant material resulting from the heavy growth of legumes must be removed or broken down prior to harvest or implementation of a program of row middle vegetation suppression (see Weed Control section).

COMMERCIAL PECAN INSECT AND DISEASE SPRAY GUIDE
(NON-BEARING TREES)

Will Hudson and Angel Acebes, Extension Entomology
Jason Brock and Tim Brenneman, Plant Pathology

FOLIAR SPRAYS

TIME OF APPLICATION	PEST	PESTICIDE	MOA	AMOUNT PER ACRE	REI/PHI (Hours or Days)	INSTRUCTIONS AND REMARKS
Bud Break When first buds open.	Foliar disease	Fungicide + *chlorpyrifos* Chlorphos, Lorsban	1B	 + half rate 1-2 pt 4-8 oz	24 H/ –	Spray sufficient volume for thorough coverage. For fungicide options, refer to the Pre-pollination section for Pecan Disease Control. The phosphorous acid fungicides are particularly useful with their excellent activity on foliar diseases, highly systemic nature, and low risk of fungicide resistance.
	Pecan bud moth	*methoxyfenozide* Intrepid 2F	18	3-4 oz	4 H/ –	
		methoxyfenozide + *spinetoram* Intrepid Edge	5 + 18	4-6.4 oz	4 H/ –	
		abamectin + *cyantraniliprole* Minecto Pro	6 + 28	8-12 oz	12 H/ –	No more than 24 oz/season.
	Hickory shoot curculio	*chlorpyrifos* Lorsban, Chlorphos, etc.	1B	1.5-2 pt	24 H/ –	Apply sprays for shoot curculio at bud-break on the earliest cultivars and repeat at 10-14 day intervals.
Cover Sprays Three weeks after bud-break spray and every 4-6 weeks as needed.	Foliar disease	Fungicide + *chlorpyrifos* Chlorphos, Lorsban	1B	See above + 1-2 pt	24 H/ –	Spray sufficient volume for thorough coverage.
	Pecan bud moth	*chlorpyrifos* Chlorphos, Lorsban, etc.	1B	1.5-2 pt	24 H/ –	
		diflubenzuron Dimilin 2L		8-16 oz	24 H/ –	
		Imidan 70WSP		1.5 lb		
		methoxyfenozide Intrepid 2F	18	4-8 oz	4 H/ –	
		abamectin + *cyantraniliprole* Minecto Pro	6 + 28	8-12 oz	12 H/ –	

PECAN DISEASE CONTROL

Jason Brock and Tim Brenneman, Department of Plant Pathology

DISEASE	CHEMICAL & FORMULATION	MOA	RATE/ACRE	REI/PHI (Hours or Days)	COMMENTS
PRE-POLLINATION APPLICATIONS: Every 10-14 Days From Bud Break Through Nut Set					
Scab; Downy Spot	*azoxystrobin* Abound Azaka	11	12 fl oz	4 H/ 45 D	See MOA info on next page.
	difenoconazole + azoxystrobin Quadris Top Amistar Top	3 + 11	10-14 fl oz	12 H/ 45 D	
	difenoconazole + pydiflumetofen Miravis Top	3 + 7	13.6 fl oz	12 H/ 45 D	
	fenbuconazole Enable 2F	3	8 fl oz	12 H/ Do not apply after shuck split or within 28 D of harvest	See MOA info on next page.
	kresoxim-methyl Sovran Narvos 50WDG	11	2.4-3.2 oz	12 H/ 45 D	
	metconazole Quash	3	3.5 oz	12 H/ 25 D	
	phosphorous acid Kphite 7LP Phostrol ProPhyt FungiPhite Reliant Phiticide	33	2-8 pt 2.5-5 pt 2-5 pt 2-2.5 pt 4 pt 2-5 pt	4 H/ –	With group 33 products, higher rates are best for stand-alone sprays, but lower rates (2-3 pt) can be added to complement other fungicides. See MOA info on next page.
	phosphorous acid + tebuconazole Viathon	33 + 3	2-2.5 pt	12 H/ 0 D	
	propiconazole Orbit Propimax EC Bumper 41.8EC Topaz	3	8 fl oz	12 H/ Do not apply after shuck split	
	propiconazole + azoxystrobin Quilt Quilt Xcel	3 + 11	14-27.5 fl oz 14-21 fl oz	12 H/ Do not apply after shuck split or within 45 D of harvest	
	pyraclostrobin Headline	11	6-7 fl oz	12 H/ 14 D	

PECAN DISEASE CONTROL

DISEASE	CHEMICAL & FORMULATION	MOA	RATE/ACRE	REI/PHI (Hours or Days)	COMMENTS
PRE-POLLINATION APPLICATIONS: Every 10-14 Days From Bud Break Through Nut Set					
Scab; Downy Spot (*continued*)	*tebuconazole* Folicur 3.6F Tebuzole 3.6F Monsoon Orius 3.6F Toledo 3.6F	3	8 fl oz	12 H/ Do not apply after shuck split	**MOA Group 1:** Risk for resistance is high. Use should be limited. When conditions are very favorable for scab, use in combination with either a full rate of TPTH or Elast. Limit the use to 1 or 2 applications per season. Available as Topsin M 70WDG, Topsin M 70 WP, and Topsin M WSB, and Topsin M 4.5 FL. Topsin XTR is a premix of *thiophanate methyl* and *tebuconazole*. **MOA Group 3:** Resistance risk is moderate. For best results, tank mix *tebuconazole* with a surfactant. Do not add a surfactant if mixing with other fungicides. Increasing the rate of a Group 3 fungicide will be important if reduced sensitivity is known or suspected. Stand-alone use is not recommended where reduced sensitivity is known or suspected. **MOA Group 11:** Resistance risk is moderate. Do not make more than 2 sequential applications. If only using solo products, Group 11 fungicides should not be used in more than 1/3 of the total number of fungicide applications. If using Group 3 tank-mixed with other modes of action, they should not be used in more than 1/2 of the total number of fungicide applications. Stand-alone use is not recommended where reduced sensitivity is known or suspected. **MOA Group 30:** Resistance risk is low. **MOA Group 33:** Resistance risk is low. For best control apply in 100 GPA by ground. Do not apply in consecutive applications. Three to five applications are generally recommended. Check labels for potential limitations on maximum number of applications or amount of active ingredient allowed per season. Do not use when there is a *phosphate* deficiency. Do not use these as stand-alone sprays for nut scab on very susceptible cultivars or high disease pressure. **MOA Group U12:** Resistance risk is low. Do not use on Moore, Van Deman, Barton, or Shawnee. Do not use a surfactant. Do not use with foliar *zinc* treatments. For any tank mix combination of Elast, TPTH, Group 3, or Group 11 fungicides, the rates provided are the lowest recommended and will provide excellent control of scab under most conditions. When disease pressure is elevated, the rate of either mixing partner can be increased.
	tetraconazole Andiamo	3	8.5 fl oz	12 H/ 30 D	
	tetraconazole + *azoxystrobin* Brixen	3 + 11	13–20 fl oz		
	tebuconazole + *azoxystrobin* Custodia Helmstar Plus	3 + 11	8.6-17.2 7.2 – 14.4	12 H/ 45 D	
	tebuconazole + *trifloxystrobin* Absolute	3 + 11	5-7.67 fl oz	12 H/ Do not apply after shuck split or within 30 D of harvest	
	flutriafol + *azoxystrobin* Topguard EQ	3 + 11	5.0 – 8.0 fl oz	12 H/ 45 D	
	tetraconazole + *triphenyltin hydroxide* Minerva Duo	3 + 30	16 oz	48 H/ 30 D	
	thiophanate methyl + TPTH or + Elast	1 + 30 or + U12	1 lb + half rate or + 25 fl oz	3 D/ Do not apply after shuck split	
	triphenyltin hydroxide (TPTH) + FRAC Group 3 fungicide	30 + 3	half rate + full rate	48 H/ 30 D	
Anthracnose	Anthracnose is a disease with a long latent period; symptom expression occurs many weeks after infection. Fungicides used for control of scab have been effective in suppressing anthracnose.				

PECAN DISEASE CONTROL

DISEASE	CHEMICAL & FORMULATION	MOA	RATE/ACRE	REI/PHI (Hours or Days)	COMMENTS
POST-POLLINATION APPLICATIONS: Every 10-21 Days From Nut Set To Shell Hardening					
Scab	*dodine* Elast 400F	U12	48 fl oz	48 H/ Do not apply after shuck split	**MOA Group 1:** Risk for resistance is high. Use should be limited. When conditions are very favorable for scab, use in combination with either a full rate of TPTH or Elast. Limit the use to 1 or 2 applications per season. Available as Topsin M 70WDG, Topsin M 70 WP, and Topsin M WSB, and Topsin M 4.5 FL. Topsin XTR is a premix of *thiophanate methyl* and *tebuconazole*. **MOA Group 3:** Resistance risk is moderate. For best results, tank mix *tebuconazole* with a surfactant. Do not add a surfactant if mixing with other fungicides. Increasing the rate of a Group 3 fungicide will be important if reduced sensitivity is known or suspected. Stand-alone use is not recommended where reduced sensitivity is known or suspected. **MOA Group 11:** Resistance risk is moderate. Do not make more than 2 sequential applications. If only using solo products, Group 11 fungicides should not be used in more than 1/3 of the total number of fungicide applications. If using Group 3 tank-mixed with other modes of action, they should not be used in more than 1/2 of the total number of fungicide applications. Stand-alone use is not recommended where reduced sensitivity is known or suspected. **MOA Group 30:** Resistance risk is low. **MOA Group 33:** Resistance risk is low. For best control apply in 100 GPA by ground. Do not apply in consecutive applications. Three to five applications are generally recommended. Check labels for potential limitations on maximum number of applications or amount of active ingredient allowed per season. Do not use when there is a *phosphate* deficiency. Do not use these as stand-alone sprays for nut scab on very susceptible cultivars or high disease pressure. **MOA Group U12:** Resistance risk is low. Do not use on Moore, Van Deman, Barton, or Shawnee. Do not use a surfactant. Do not use with foliar *zinc* treatments. For any tank mix combination of Elast, TPTH, Group 3, or Group 11 fungicides, the rates provided are the lowest recommended and will provide excellent control of scab under most conditions. When disease pressure is elevated, the rate of either mixing partner can be increased.
	dodine Elast 400F + Group 3 OR Group 11 fungicide	U12 + 3	25 fl oz + full rate	48 H/ Do not apply after shuck split	
	dodine Elast 400F + TPTH	U12 + 30	25 fl oz + half rate	48 H/ Do not apply after shuck split	
	phosphorous acid Kphite 7LP Phostrol ProPhyt Reliant Phiticide	33	highest label rate	4 H/ –	
	propiconazole + azoxystrobin Quilt Quilt Xcel	3 + 11 3 + 11	20-28 fl oz 20-21 fl oz	12 H/ Do not apply after shuck split or within 45 D of harvest	
	tebuconazole + azoxystrobin Custodia Helmstar Plus	3 + 11	8.6-17.2 7.2-14.4	12 H/ 45 D	
	flutriafol + azoxystrobin Topguard EQ	3 + 11	5.0 – 8.0 fl oz	12 H/ 45 D	
	tebuconazole[4] *+ trifloxystrobin* Absolute	3 + 11	5-7.67 fl oz	12 H/ Do not apply after shuck split or within 30 D of harvest	
	difenoconazole + azoxystrobin Amistar Top	3 + 11	8-14 fl oz	12 H/ Do not apply after shuck split or within 30 D of harvest	
	tetraconazole + azoxystrobin Brixen	3 + 11	13–20 fl oz	12 H/ 45 D	
	tetraconazole + triphenyltin hydroxide Minerva Duo	3 + 30	16 oz	48 H/ 30 D	
	TPTH + Group 3 or Group 11 fungicide	30 + 3	half rate + full rate	48 H/ 30 D	
	difenoconazole + pydiflumetofen Miravis Top	3 + 7	13.6 fl oz	12 H/ 45 D	

PECAN DISEASE CONTROL

DISEASE	CHEMICAL & FORMULATION	MOA	RATE/ACRE	REI/PHI (Hours or Days)	COMMENTS
POST-POLLINATION APPLICATIONS: Every 10-21 Days From Nut Set To Shell Hardening *(continued)*					
Scab (*continued*)	*triphenyltin hydroxide* (TPTH) Agri Tin Agri Tin Flowable Super Tin 80WP Super Tin 4L	30	 7.5 oz 12 fl oz 7.5 oz 12 fl oz	48 H/ 30 D	See MOA info on previous page.
	ziram Ziram		6-8 lb	48 H/ 55 D	Ziram as a multi-site alternative in cases where resistance to other protectants is an issue.

Powdery Mildew	For powdery mildew, the scab fungicide program can be adjusted if needed. The FRAC Group 3 fungicides or mixes containing FRAC 3 fungicides are the best options. Combining sulfur (4-6 lb/A) with fungicides used for scab control is also an option. **DO NOT** mix sulfur with Elast.
Zonate Leaf Spot	For zonate leaf spot, the scab fungicide program can be adjusted if needed. The FRAC Group 3 fungicides or mixes containing FRAC 3 fungicides are the best options. Topsin M also provides suppression of Zonate leaf spot.
Anthracnose	Anthracnose is a disease with a long latent period; symptom expression occurs many weeks after infection. Fungicides used for control of scab have been effective in suppressing anthracnose, particularly FRAC Groups 3 and 11 and the phosphorous acid-based fungicides

NOTE: In orchards where any nuts have any amount of scab by mid-June or in orchards where 10% or more of the nuts have any amount of scab by early July, the following measures should be taken:

- The interval between fungicide sprays should not exceed 14 days until shell hardening.
- On varieties with a summer growth flush, the spray interval should be tightened so that no more than 10 days pass from the onset of the growth flush until a fungicide spray is made.
- If the 5-day forecast shows the probability for several days of rain, close the interval to have as much acreage as possible treated within 7 days of the storm.

After Shell Hardening: Fungicide coverage for crop protection is necessary to shell hardening. Beginning in early August, monitor for shell hardening and adjust fungicide needs accordingly.

Foliar diseases: Maintaining leaf health past shell hardening is important. If leaf scab, zonate leaf spot, or another foliar disease is of concern, refer to the previous sections for fungicide options and recommendations. Pay attention to use limitations and fungicide resistance management guidelines. DO NOT use Topsin in consecutive applications for leaf disease control.

DISEASE	CHEMICAL & FORMULATION	MOA	RATE/ACRE	REI/PHI (Hours or Days)	COMMENTS
Phytophthora Shuck and Kernel Rot	A treatment is advised in orchards with a history of this disease (primarily Houston, Peach, and Macon counties) during periods of extended wetness and moderate temperatures (< 86° F) occurring between shell hardening and shuck split.				
	TPTH	30	full rate		
	phosphorous acid Fosphite, KPhite Phiticide, Phostrol Rampart	33	full rate	4 H/ –	The phosphite (phosphorous acid based) fungicides listed are EPA approved and considered to be very safe products. Check labels for potential limitations on maximum number of applications or amount of active ingredient allowed per season.
	MOA Group 11 fungicides	11	full rate		
	copper hydroxide Kocide 3000 Kocide 2000	M1	0.75-1.75 lb 1.5-3 lb	48 H/ –	Use higher rates when disease pressure is high and large, mature trees.

COMMERCIAL PECAN WEED CONTROL

Wayne Mitchem, Extension Associate – Weed Science
Timothy Grey, Research Weed Scientist

HERBICIDE	MOA	BROADCAST RATE/ACRE		REI/PHI (Hours or Days)	REMARKS AND PRECAUTIONS
		AMOUNT OF FORMULATION	LBS ACTIVE INGREDIENT		
PRE-EMERGENCE					
oryzalin Surflan 4AS Oryzalin 4AS	3	 2-6 qt	2-6		Use on non-bearing and bearing trees for control of annual grasses and small seeded broadleaf weeds. Use low rate for short-term control (2-4 months); high rate for long-term control (8-12 months). **DO NOT** apply to newly transplanted trees until soil has settled and no cracks are present. Apply before annual weeds emerge in the spring or add *paraquat* or *glyphosate* for control of emerged weeds. Sequential applications may be used so long as total use rate does not exceed 12 qt/A/year and there are 2.5 months between applications.
diuron Karmex XP or Diuron 80DF Direx or Diuron 4L other brands	7	 2-4 lb 1.6-3.2 qt	 1.6-3.2		Use for control of annual broadleaf weeds and some annual grasses only under trees established in the orchard at least 3 years. Apply in spring before annual weeds emerge; if weeds are present, include surfactant to improve contact activity. Make a single band or broadcast application as a directed spray. Use low rate on sandy loam soils. **DO NOT** use on sand, loamy sand, gravelly soils, or on exposed subsoils. **DO NOT** use on soils with less than 0.5% organic matter. **DO NOT** graze treated areas. Add *paraquat*, *glufosinate*, or *glyphosate* for enhanced control of emerged weeds.
simazine Princep, Simazine 90DF Princep, Simazine 4F	5	 2.2-4.4 lb 2-4 qt	2-4		Use for control of annual broadleaf weeds and some annual grasses only under trees established for at least 2 years. Provides good control of annual ryegrass. Use low rates on sandy soils. **DO NOT** apply to gravelly, sand, or loamy sand soils. **DO NOT** apply when nuts are on the ground. **DO NOT** graze treated areas. Add *paraquat*, *glufosinate*, or *glyphosate* for control of emerged weeds.
oryzalin Surflan 4AS Oryzalin 4AS + *simazine* Princep, Simazine 80W 90DG 4L		2-4 qt + 2.5-5 lb 2.2-4.4 lb 2-4 qt	2-4 + 2-4		Use for broad spectrum annual grass and broadleaf weed control. Provides good control of annual ryegrass. *Paraquat*, *glufosinate*, or *glyphosate* may be used with this tank mix to enhance control of emerged weeds. See remarks and precautions for each product.
norflurazon Solicam 80DF + *diuron* Karmex 80DF Direx 4L		2.5-5 lb + 2-3.8 lb 1.6-3 qt	2-4 + 1.6-3		Use for broad spectrum annual grass and broad leaf weed control only under trees established in the orchard for at least 3 years. Apply in the spring before annual weeds emerge. See remarks and precautions for each product.
pendimethalin Prowl H_2O 4EC Prowl or Pendimethalin 3.3EC	3	 2-6 qt 2.4-7.3 qt	2-6		Control of annual grasses and broadleaf weeds such as pigweed. Most effective when adequate rainfall or irrigation is received within 7 days after application. **DO NOT** apply to newly transplanted trees until ground has settled around roots. Sequential applications may be used as long as total use rate does not exceed 6 qt/A and there are 30 days between applications. Prowl H_2O has a 60 day PHI for pecans; however, other *pendimethalin* formulations can only be used in non-bearing pecans.

COMMERCIAL PECAN WEED CONTROL

HERBICIDE	MOA	BROADCAST RATE/ACRE		REI/PHI (Hours or Days)	REMARKS AND PRECAUTIONS
		AMOUNT OF FORMULATION	LBS ACTIVE INGREDIENT		
PRE-EMERGENCE					
norflurazon Solicam 80DF	12	2.5-5 lb	2-4		Use for control of annual grasses, broadleaf weeds, and suppression of some perennials under bearing, non-bearing, or newly set trees. Apply to newly planted trees only after soil has settled around roots, at least 6 months after planting. Avoid contact with roots. Apply in the fall or early spring–fall applications control a broader weed spectrum than spring applications. **DO NOT** apply when nuts are on the ground at harvest. Use low rate on coarse-textured soils, higher rates on fine-textured soils. Make only 1 application per year. **DO NOT** graze treated areas. May tank mix with *simazine* or *diuron* for broader spectrum weed control. Add *paraquat*, *glufosinate*, or *glyphosate* for control of emerged weeds. **DO NOT** apply within 60 days of harvest. Sequential applications can be used so long as total use rate does not exceed maximum use rate for soil texture and crop.
rimsulfuron Matrix 25WG Solida 25WG Pruvin 25WG Grapple 25 WG	2	4 oz	0.063		Provide pre- and post- control of broadleaf and annual grass weeds (see label for weed control POST). For broad spectrum residual control tank mix with *diuron*, *oryzalin*, or Prowl H_2O. Use in orchards established at least 1 year. *Rimsulfuron* has a 14-day PHI for pecan. Sequential applications may be used so long as there are 30 days between applications and total use rate does not exceed 4 oz/A broadcast basis.
flumioxazin Chateau 51WDG Tuscany 51 WDG Tuscany 4 SC	14	6-12 oz	0.19-0.38		**DO NOT** apply more than 6 oz/A/application to soils having a sand and/or gravel content > 80%. Trees established less than 1 year must be shielded with a grow tube or waxed container. **DO NOT** apply second application within 30 days of initial application. Applications after bud break can only be made with shielded application equipment. Once trees break dormancy apply with *paraquat* or *glufosinate* for non-selective post-emergence control. Must use shielded application equipment if using in non-dormant pecan trees. *Flumioxazin* has a 60-day PHI for pecans.
penoxsulam + *oxyfluorfen* Pindar GT	2 + 14	1.5-3 pt	0.75 - 1.50		Apply Pindar GT to pecan trees that have been planted at least 9 months and longer. Use trunk guards to protect plants until adequate mature bark has developed. Can be used as a bearing and non-bearing dormant application. Non-bearing are those trees which will not bear a crop within one year after treatment. Applications can be made beginning after pecan harvest up to emergence of green leaf tissue the following season. For best results, apply prior to weed emergence of broadleaf and grass species. Do not apply more than 4.5 pts per acre per year. Tank mix with *oryzalin* or *pendimethalin* for expanded redual control of annual grasses. See label for use rate restrictions.
indaziflam Alion 1.67SE	29	3.5-6.5 oz	0.045-0.085		Use in orchards established 3 years or longer. Sequential applications may be used as long as there are 90 days between applications and total use rate does not exceed 10.3 oz/A/year. Use rate cannot exceed 3.5 fl oz/A/application on soils having less than 1% organic matter. On soils with an organic matter content from 1-3%, no more than 5 fl oz/A can be applied in a single application and the total use rate for the year cannot exceed 8.5 fl oz/A. In order to apply more than 5 fl oz/A in a single application soil organic matter must be > 3%. Alion should be tank mixed with *glyphosate*, *glufosinate*, or *paraquat* for non-selective post-weed control. Alion has a 14-day PHI**.** Do not use on soils having a 20% or greater gravel content. Do not treat soil around trees with cracks or channels, or with depressions.

COMMERCIAL PECAN WEED CONTROL

HERBICIDE	MOA	BROADCAST RATE/ACRE		REI/PHI (Hours or Days)	REMARKS AND PRECAUTIONS
		AMOUNT OF FORMULATION	LBS ACTIVE INGREDIENT		
POST-EMERGENCE					
2,4-D amine Various generic formulations 3.8SL	4	2-3 pt	1-1.4		**DO NOT** apply more than twice a year or within 60 days of harvest. Trees must be at least 1 year old. **DO NOT** allow spray to drift onto or contact foliage, fruit, stems, or trunks of trees. DO NOT apply to bare ground. **DO NOT** apply on light, sandy soils. Past research has shown concerns of injury when applying *2,4-D* on sandy soils, immediately before a large rain and during early bud or leaf break. Extreme caution must be taken to avoid off target movement of *2,4-D*. Certain crops, like cotton and vegetables, can be severely injured by *2,4-D* drift. Some formulations may limit use rate 2 pt/A. Sequential applications may be used as long as there are at least 30 days between applications. See product label for details.
fluazifop Fusilade DX 2EC 2 lb/gal	1	8-24 fl oz	0.125-0.38		Use for control of annual and perennial grasses under bearing or non-bearing trees. Sequential applications will be necessary for control of perennial grass weeds like bermudagrass and johnsongrass. Low spray volumes (10 GPA) generally improve control. Add crop oil concentrate (1 qt/A). Make application to johnsongrass: 12-18" tall; bermudagrass: 3" tall or with 4-8" runners; annual grasses: 2-8" tall. Does not control nutsedge(s). **DO NOT** apply when harvestable nuts are on the ground. DO NOT graze treated area. **DO NOT** apply within 30 days of harvest.
sethoxydim Poast 1.5EC 1.5 lb/gal	1	1-2.5 pt	0.3-0.5		Use for control of annual and perennial grasses. Sequential applications will be necessary for control of perennial grass weeds like bermudagrass and johnsongrass. Low spray volumes (10 GPA) generally improve control. Add crop oil concentrate (1 qt/A). Use low rate on annual grasses up to 6" tall; higher rates on larger annual grasses and perennial grasses. Does not control nutsedge. DO NOT harvest within 15 days of application.
clethodim Select 2.0EC and various brands	1	6-8 fl oz			Use for control of annual and perennial grasses in NON-BEARING trees that will not be harvested within 1 year of application. Use higher rates and sequential applications for perennial grasses. Add a non-ionic surfactant containing at least 80% ai at a rate of 1 qt/100 gal of spray solution (0.25% v/v). Make application to johnsongrass: 12-18" tall; bermudagrass: 3" tall or with 4-8" runners; annual grasses: 2-8" tall. Does not control nutsedge.
Select Max 1 lb/gal					
Intensity One 1 lb/gal		12-1 6 oz			
halosulfuron Sandea 75WDG	2	0.67-1.33 oz	0.032-0.063		For control of nutsedge, pigweed, radish, and cocklebur. Apply as directed spray under trees established for at least 1 year. Avoid contact of spray with trunk, stem, roots, or tree foliage. May apply up to 2 applications. **DO NOT** apply within 1 day of harvest. See label for rate restrictions related to soil texture. Tank mix with *glyphosate* for broad spectrum control
paraquat Firestorm 3SL Parazone Paraquat Concentrate 3 lb/gal	22	1.75-2.7 pt	0.65-1		Use for broad spectrum, contact control of emerged weeds. Apply as a directed spray in at least 20 gal of water with 1-2 pt surfactant/100 gal of spray mix or 1% crop oil concentrate (1 gal/100 gal spray mix). Apply when annual weeds are succulent and 1-6" tall. **DO NOT** allow spray drift to contact foliage or green bark of trees since severe damage may occur. **DO NOT** allow animals to graze on treated areas. May be tank mixed with certain pre-emergence herbicides for effective residual weed control. **DO NOT** apply when nuts are on the ground.
Gramoxone SL 2 lb/gal		2-4 pt			
glufosinate Cheetah, Reckon 280 Rely 280, Lifeline, Surmise 2.34 lb/gal	10	48 fl oz	0.88-1.5		Use for broad spectrum control of emerged weeds and grasses, both annuals and perennials. Apply as a directed spray in high spray volumes on non-bearing and bearing trees. Possesses contact and limits systemic activity, but does well on wild brambles and perennial grasses. Does not have soil residual activity. **DO NOT** contact foliage or green bark. *Glufosinate* formulations are loaded with surfactant therefore **NO** additional nonionic surfactants or crop oil is needed. The addition of spray graded ammonium sulfate fertilizer at 8-10 lb/100 gal will enhance *glufosinate* activity.

FOLIAR ZINC SPRAYS FOR BEARING PECAN TREES

Lenny Wells, Extension Horticulturist

Do not apply foliar zinc unless there is a history of zinc deficiency in the orchard or if leaf analysis suggests a need.

TIME OF APPLICATION	MATERIAL	AMOUNT PER 100 GALLONS	INSTRUCTIONS AND REMARKS
All fungicide (scab) sprays through mid-May	Zinc Sulfate + Urea (feed grade) or Potassium Nitrate or Formulated Zn sprays (NZN-NuZinc Tracite 10% and many other trade names)	2 lb 4 lb FOLLOW LABEL DIRECTIONS	Do not concentrate. Use only at the dilute rate. Zinc compatible with pesticides recommended on pecans.
First cover spray	Same as above		

FOLIAR ZINC SPRAYS FOR NON-BEARING PECAN TREES

TIME OF APPLICATION	MATERIAL	AMOUNT PER 100 GALLONS	INSTRUCTIONS AND REMARKS
All pesticide sprays (scab and insects) through mid- August	Zinc Sulfate + Urea (feed grade) or Potassium Nitrate or Formulated Zn sprays (NZN-NuZinc Tracite 10% and many other trade names)	2 lb + 4 lb FOLLOW LABEL DIRECTIONS	Do not concentrate. Use only at the dilute rate. Zinc compatible with pesticide recommended on pecans.

FOLIAR NICKEL SPRAYS FOR BEARING AND NON-BEARING PECAN TREES

TIME OF APPLICATION	MATERIAL	AMOUNT PER 100 GALLONS	INSTRUCTIONS AND REMARKS
Make application 10-24 days after bud break. Followed by a second application in mid-July.	Nickel Lignosulfonate (Nickel Plus) (6% Ni)	1-1.5 pt (April) 1.5-2 pt (July)	Can be tank-mixed with all fungicides, insecticides, nutrients, etc., including zinc. It is not necessary to add urea, which is already present.
For trees with visible mouse ear symptoms, or for newly transplanted trees, especially on sandy sites, or in orchards with a history of high zinc use, make a third application in early October before leaf fall.			Symptoms will be corrected 14-21 days after spring application, therefore all fall application ensures adequate levels of nickel in the plant tissue at bud- break. Research suggests that the lignosulfonate solution poses a lower risk for orchard workers and environmental safety than the metallic salt solution.
Make 1 st application at parachute stage and 2nd application 6 weeks later.	Nickel Sulfate (10% Ni)	1 pt	

All foliar micro-nutrient applications should be made only on an “as-needed” basis as determined by leaf tissue analysis and/or visual symptoms.

FOLIAR BORON APPLICATION FOR BEARING PECAN TREES

TIME OF APPLICATION	MATERIAL	AMOUNT PER 100 GALLONS	INSTRUCTIONS AND REMARKS
Begin Boron applications with 2nd Prepollination spray. Make 3 applications.	Solubur (20.5%)	1/16 lb of actual Boron	Do not concentrate. Do not apply more than 1 lb. of total Boron per season. When mixing Boron with imidacloprid, check pH of the solution and add a n acidifying agent when necessary to bring pH below 7.5.
	Boron Plus (10% B)	1 pt	
	Top Side Liquid Boron (6%)	1 pt	

FORMULATION[1] ABBREVIATIONS

a.i. = active ingredient	EC = emulsifiable concentrate	S = sprayable powder
AC = aqueous concentrate	EL = emulsifiable liquid	SC = spray concentrate
AS = aqueous suspension	F = flowable	SP = soluble powder
DF = dry flowable	FC = flowable concentrate	W = wettable powder
DG = dispersible granules	G = granules	WDG = water dispersible granular
B = bait	L = liquid	WDL = water dispersible liquid
D = dust	LC = liquid concentrate	WM = water miscible
E = emulsifiable	M = microencapsulated	WP = wettable powder

[1] Numbers preceding abbreviations for liquid formulations equal pounds of active ingredient per gallon (e.g., 4EC = 4 lb/gal emulsifiable concentrate); numbers preceding abbreviations for solid formulations equal percent active ingredient by weight (e.g., 50WP = 50 percent wettable powder).

METHOD OR TIME OF APPLICATION ABBREVIATIONS

CR = cracking stage	PEI = pre-emergence incorporated	PRE = pre-emergence
LV = low volume	PO = post-emergence	PT = post-transplant
NS = nonselective	POT = post-emergence over-the-top	RCS = recirculating sprayer
PDS = post-emergence directed spray	PP = pre-plant	ULV = ultra low volume[2]
PE = pre-emergence on surface	PPI = pre-plant soil incorporated	WICK = rope wick applicator

[2] Ultra low volume refers to a total spray volume of one-half gallon or less per acre.

RATE CALCULATIONS AND SPRAYER CALIBRATIONS

See the 2016 Georgia Pest Management Handbook or the "Pesticide Safety & Other Pesticide Information" section online at www.ent.uga.edu/pest-management/

MEASURES AND EQUIVALENTS

tsp	=	teaspoon			1 teaspoon	=	4.9 milliliters
Tbs.	=	tablespoon	1 Tbs	=	3 teaspoons	=	14.8 milliliters
fl oz.	=	fluid ounce	1 fl oz	=	2 tablespoons	=	29.6 milliliters
c	=	cup	1 c	=	8 fluid ounces	=	236.6 milliliters
pt	=	pint(s) (1.04 lb of water)	1 pt	=	2 cups	=	473.2 milliliters
pt/100	=	pint(s) per 100 gal	1 pt/100	=	1 teaspoon per gal		
qt	=	quart(s) (2.09 lb of water)	1 qt	=	2 pints	=	946.4 milliliters
gal	=	gallon(s) (8.35 lb of water)	1 gal	=	4 quarts	=	3.7854 liters
oz	=	ounce			1 ounce	=	28.35 grams
lb	=	pound	1 lb	=	16 ounces	=	453.59 grams
in	=	inch	1 in	=	1000 mils	=	2.54 centimeters (25,400 microns)
ft	=	feet	1 ft	=	12 inches	=	30.48 centimeters
yd	=	yard	1 yd	=	3 feet	=	91.44 centimeters
mi	=	mile	1 mi	=	5,280 feet	=	1,609 meters (16.09 kilometers)
sq in	=	square inch			1 square inch	=	6.45 square centimeters
sq ft	=	square feet	1 sq. ft	=	144 square inches	=	929.03 square centimeters
A	=	acre	1 A	=	43,560 square feet	=	0.4047 hectare
cu in	=	cubic inch			1 cubic inch	=	16.387 cubic centimeters
cu ft	=	cubic feet	1 cu ft	=	1,728 cubic inches	=	0.0283 cubic meter
cu yd	=	cubic yard	1 cu.yd	=	27 cubic feet	=	0.7646 cubic meter
ppm	=	parts per million	1 ppm	=	1,000 parts per billion	=	1 milligram/ kilogram[3]
psi	=	pounds per square inch			1 psi	=	70.3 gram-force per square centimeter

[3] 1 milligram/kilogram or 1 p.p.m. is equal to 1 milligram/liter of water.

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