Herbicide Injury of Pecan Trees

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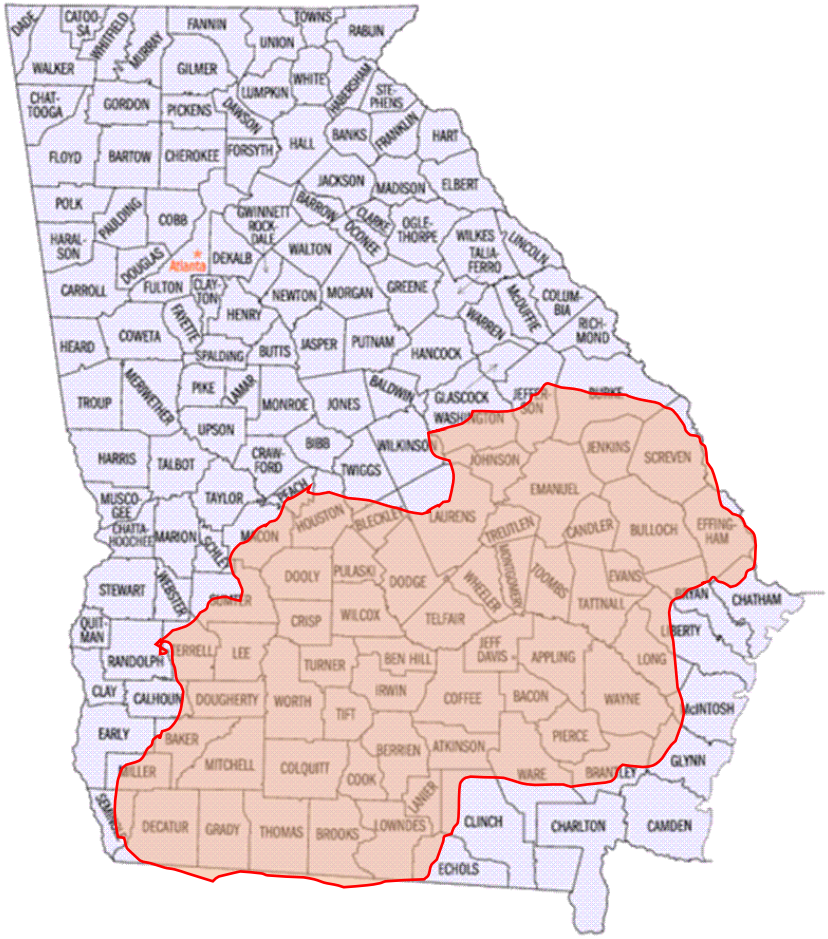
Georgia Pecan Production

- Approx. 180,000 acres of mature orchards in production
- Approx. 30K – 35K acres of new orchards planted in last 5 to 7 years
- ***Pecans share area with all row crops, hay/pasture fields, forest land and produce***



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Herbicide Injury

Rate

Susceptible Crop

Herbicide Type

Environmental Conditions

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Herbicide Drift

- Particle Drift
- Volatilization
- Root Uptake

- *Long-term injury risk is rated on 0 – 10 scale, where 0 = no risk of damage and 10 = potential tree death of long-term loss*

Auxin Herbicide Technology

2,4-D

1. Enlist Duo (Glyphosate + 2,4-D)
2. 2,4-D Choline

Dow AgroSciences

Dicamba

1. Round Up Extend (Glyphosate + Dicamba)
2. Extendimax (Dicamba)

MONSANTO

3. Enginia (Dicamba)?

BASF
The Chemical Company

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Visual Sensitivity Scale for Dicamba in GA

Lower	Moderate	Severe	Extreme
Broccoli	Cantaloupe	Cotton	Grapes*
Cabbage	Cucumber	Pepper	Lima Bean
Kale	Peach	Tomato	Southern Pea
Mustard	Peanut	Watermelon	Snap Bean
Pecan	Squash		Soybean
Turnip			Sweet potato*
			Tobacco*
>1/75X	1/75-1/300X	1/300-1/800X	< 1/800X

Herbicide Rate of Visually Detectable Injury

For relative comparison, tomato, squash, and watermelon response to Roundup would be in the "lower" category.

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*Data from literature; all other data generated in 64 UGA field experiments.

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Cabbage	Canola	Tomato	Grapes*
Kale	Cucumber	Watermelon	Sweet potato*
Mustard	Peaches		Tobacco*
Onions	Peanut		
Turnip	Pecan		
	Squash		
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Symptoms of Herbicide Drift

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Glyphosate

- Symptoms: Thin, strap-like leaves. (May resemble Zn deficiency)
- Injury: when chemical contacts foliage or bark of young trees
- Short term: Deformed leaves, defoliation; subsequent growth returns
- Long term: Repeat applications, kill limbs, tree death

Glyphosate Injury Compared to Zn Deficiency

Herbicide Guard

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Paraquat / Glufosinate / Flumioxazen

- Symptoms: Yellow spots developing to necrosis
- Injury: Usually within 24-48 hrs.
- Old Tree: Large areas of leaf turn yellow, then brown and fall off. Same happens with flowers and nuts. Usually, tree refoliates with no long-term issues
- Young Tree: Paraquat contacting bark of < 3 year-old-tree can girdle and kill tree

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2,4-D / Dicamba

- Symptoms: Folding/Cupping ➡ twisting/curling ➡ chlorosis ➡ dieback

Auxin Injury

80% rate 2,4-D, Ponder Farm, Tifton

Older auxin injury of pecan.

Arrested nut development from auxin herbicide.

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Data from Dicamba Study

Herbicide	Rate (% by vol)	Injury (%)	Yield (lbs/tree	Percent Kernel	Tissue Concentration
2,4-D	1.0	30a	44a	56.8bc	26.9a
2,4-D	0.1	0.3c	44a	56cd	3.3b
2,4-D	0.01	0c	57a	57.7a	0c
Dicamba	1	21.7b	37.5a	56.1cd	33.5a
Dicamba	0.1	0.3c	37.5a	57ab	1.7bc
Dicamba	0.01	0c	51a	56.4bcd	0c
Control	---	0c	53a	55.8d	0c

Auxin Herbicide Summary

- No difference in response to 2,4-D and Dicamba at similar rates.
- Damage at auxin rates ≥ 1% (25 ppm) have potential to cause significant injury (deformed foliage, dead foliage, dead limbs)
- Arrested nut development at stage when contact occurred.
- No evidence of translocation in pecans.
- Yield was not negatively affected by any treatments, suggesting that pecan trees can compensate for the observed injury to still produce in a similar manner to untreated trees when a relatively low % of tree is covered.
- 2016: the 0.1% dicamba and 1.0% and 0.01% 2,4-D treatments had higher percent kernel than that of the control.
    - Long-term risk: **8**

Herbicide Uptake by Tree Roots

- Pre-emergent herbicides applied to pecans inside the herbicide strip
- Pre-emergent herbicides applied to adjacent row crops
- Herbicides used in forestry or pasture

Pre-emergent pecan herbicides

- Diuron
- Symptoms: Necrosis (yellowing, browning, scorching) between veins of leaves
- Injury: Trees normally recover; at heavy rates, may see limb dieback
- Example: On sandy soil, following heavy rainfall event a few days after application

Pre-emergent herbicides in other crops

- Imazapic
- Symptoms: Little visible signs initially; however, fruit results in hollow “pops”
- Injury: Long-term injury depends on soil type and amount applied
- Example: Long residual may cause damage to appear again following year

Herbicides used in Forestry

- Herbicides Include: Triclopyr, imazapyr, hexazinone, picloram, sulfometuron, metsulfuron
- Symptoms: Trees do not leaf out in spring; leaves and buds bunched on branches
- Injury: Greater long-term risk

Herbicides used in forestry

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Defoliants

- Ethephon
- Ethylene effects: fruit ripening, chlorophyll loss, abortion of plant parts, stem shortening, leaf abscission (shedding)
- Symptoms: Leaf drop, leaf abscission occurs within a few days, ripening of fruit – shuck split
- Injury to return crop: September – October
- **Complete defoliation in Sept. guarantees no return crop. Depending on crop load, pecan trees can tolerate 10% loss before Oct.**
- **After November 1—no effect**
- Long-term risk: **5**

Herbicide	Symptoms	Long-term injury risk[a]
Glyphosate	Thin, strap-like leaves Dieback at high rates Repeated exposure can result in limb/tree death	4
Paraquat	Exposed areas turn yellow initially, then brown Dieback at high rates Repeated exposure can result in limb/tree death	2
Glufosinate	Same as paraquat above	2
Flumioxazen	Same as paraquat above	2
Auxins (Dicamba, 2,4-D)	Folding/cupping of leaflets Twisting, curling of leaflets Chlorosis Dieback Limbs/trees with complete coverage at full rates may die	8
Cotton Defoliants (Ethylene)	Leaf drop Depending on date of occurrence, quality or return crop may be affected Defoliation after November 1 rarely causes significant damage	5
Diuron	Necrosis between leaf veins Some limb dieback in severe cases	2
Imazapic	Root uptake results in unfilled kernels Planting young trees into fields to which imazapic has been applied can result in repeated dieback or death of trees until herbicide has leached out (Usually requires one year; longer on heavy clay soils)	5
Forestry/Pasture Herbicides[b]	Symptoms vary Can include dieback and delayed tree death depending on chemistry used and degree/nature of exposure	9

[a] Long-term injury risk is rated on a 0-10 scale, where 0 = no risk of damage and 10 = potential tree death or long-term production loss.

[b] Forestry or pasture herbicides may include triclopyr, imazapyr, hexazinone, picloram, sulfometuron methyl, and metsulfuron methyl among others.

Summary

- Symptoms of injury
- Level of injury dependent on:
  1. Herbicide
  2. Rate
  3. Wind speed / direction
  4. Timing
  5. **Coverage**
- Document symptoms of injury ASAP. Tissue sampling through state department.