The great sprayer nozzle debate of 2006

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Ideally, nozzles should help you to

- Increase efficacy of sprayed products
- Decrease drift
- Lower applications volumes
  - Decrease time involved
  - Decrease compaction
- Avoid nozzle switching
- Avoid watering in

Ideally, nozzles should help you to

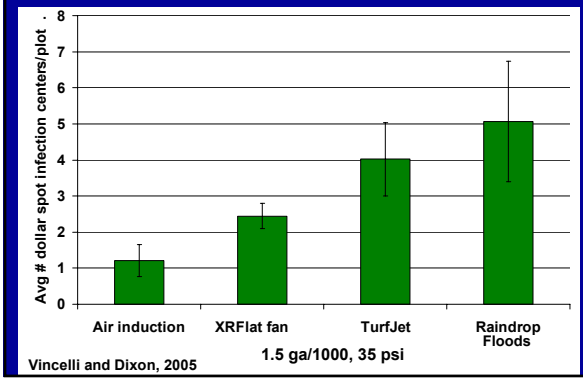
- Increase efficacy of sprayed products
- Decrease drift
- Speed up spray applications
  - Lower volumes
  - Avoid nozzle switching
- Avoid watering in

CAN THEY?

Efficacy

Droplet size	Finer (smaller)
Spray pressure	Higher (>30 psi)
Range of droplet sizes	Narrower

Effect of nozzle type on dollar spot control with Daconil



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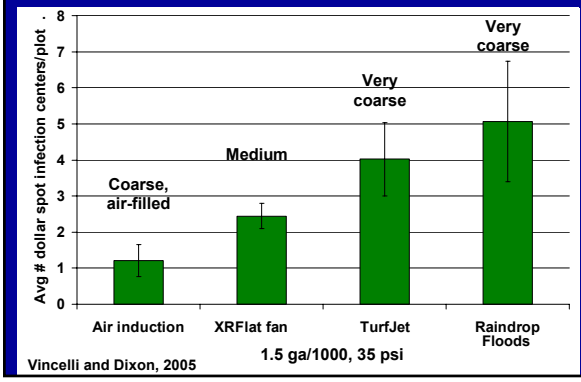
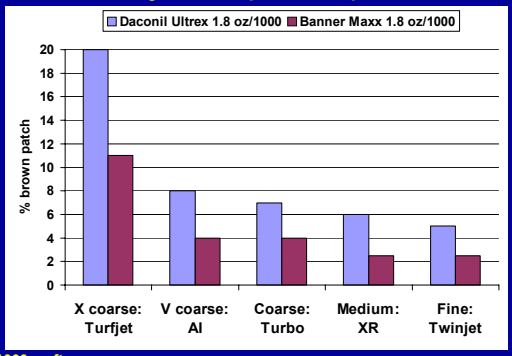
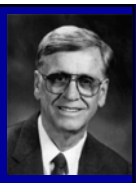


Nozzles vs. brown patch on bentgrass: Pennsylvania (Fidanza), 2005



1 ga/1000 sq ft

Dr. Houston Couch's Application Guidelines (1995)



Still by far the most comprehensive series of studies and summaries for turfgrass application strategies

"Flooding nozzles should not be used to apply fungicides to turf."

Does the target pest or application matter when selecting nozzles?

YES!!

Diseases

FOLIAR (Contact)	ROOT (Systemic)
Algae (cyanobacteria)	Fairy ring
Anthracnose	Necrotic ring spot
Brown patch/yellow patch/Waitea	Pythium root rot
Curvularia blight	Spring dead spot
Dollar spot	Summer patch
Fusarium patch	Take all patch
Gray leaf spot	
Pythium blight	
Rapid blight	

Insects

FOLIAR (Contact)	ROOT (Systemic)
Ants	Billbugs
Black cutworm	Black turfgrass ataenius
Sod webworm	Masked chafer

Weeds

POST-EMERGE (Contact)	PRE-EMERGE (Systemic)
Annual bluegrass	Annual bluegrass
English daisy	Barnyardgrass
kikuyugrass	Crabgrass
Kyllinga	Knotweed
Ryegrass clumps	Kyllinga
Sedges	Smutgrass
Broad leaf weeds	

Plant Growth Regulators

FOLIAR (Contact)	ROOTS (Systemic)
Embark	Trimmit
Primo	
Proxy	

Fertilizers

FOLIAR (Contact)	ROOTS (Systemic)
Floratine products	20-20-20
Griggs products	CAN 17
	MPK (0-52-34)
	Urea (46-0-0)
	Ammonium sulfate (21-0-0)

Bottom line on efficacy

- Most important: avoid flood nozzles, especially for foliar/contact applications
- Many other different nozzle types provide good efficacy of foliar and root pests

Bottom line on nozzles and efficacy for foliar pests and applications

- Nozzle selection has biggest impact for foliar pests or applications
- Avoid flood nozzles
- Choose nozzles:
  - With smaller droplets (on impact)
  - With higher pressures
  - That deliver 1 ga/1000 (43gpa)

Bottom line on nozzles and efficacy for root or soil pests or application

- Choose nozzles:
  - That deliver 2 ga/1000 (43gpa) for foliar pests

Drift reduction

• Droplet size	Coarser (larger)
• Range of droplet sizes	Narrower
• Spray Volume	Higher
• Spray pressure	Lower (<60 psi)
• Boom height	Lower (<20”)

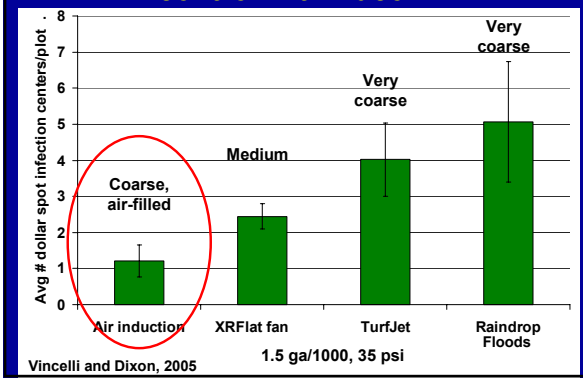
The dilemma:

	Efficacy	Drift Reduction
• Droplet size	finer	coarser
• Spray pressure	higher	lower

The dilemma:

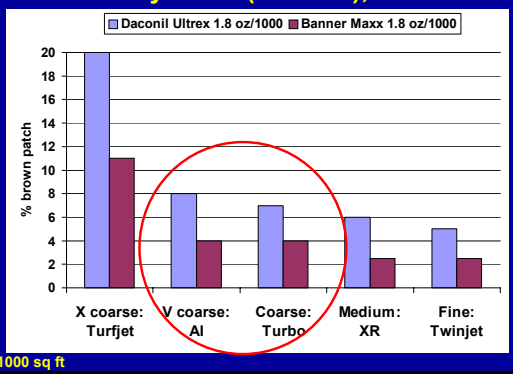
Can you get good efficacy and good drift reduction at the same time?

Effect of nozzle type on dollar spot control with Daconil



Vincelli and Dixon, 2005

Nozzles vs. brown patch on bentgrass: Pennsylvania (Fidanza), 2005



1 ga/1000 sq ft

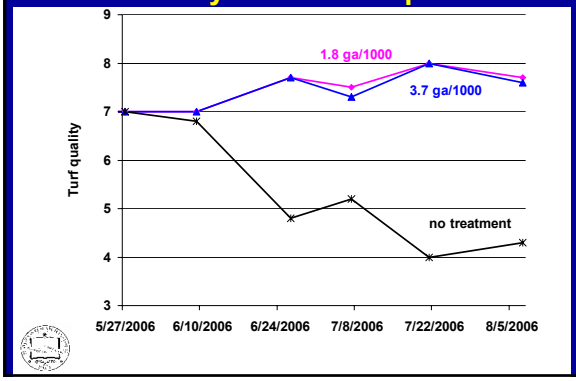
Bottom line on efficacy vs. drift

- A covered sprayer allows you to use whichever nozzles you want – even very fine droplets
- The best combination of efficacy and drift reduction is seen with air induction and Turbo Teejet nozzles
- XR flat fans a close second
- Keep pressures at 30 – 60 psi
- But other factors are important also

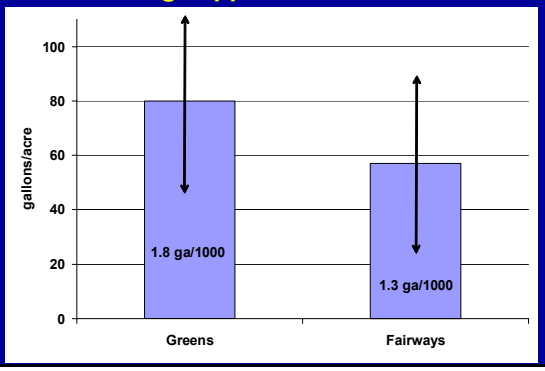
Volume of application

- For foliar/contact applications:
  1 ga/1000 (43 gpa)
- For root/soil applications:
  2 ga/1000 (86 gpa)

Effect of spray volume on Heritage efficacy for summer patch



Syngenta survey (Shepard et. al., 2006): average application volumes



Can a single nozzle do it all?

- 1 or 2 ga/1000
- 30 – 60 psi
- 3 – 4 mph
- Good efficacy
- Good drift control

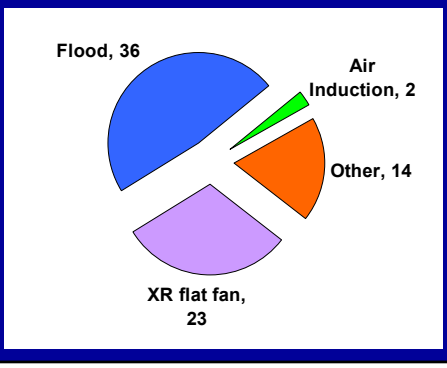
Can a single nozzle do it all?

- Air induction or Turbo TeeJet type nozzles may work, but the jury is still out
- Optimally, 3 different nozzles
  - Contact/foliars
  - Systemic/soil
  - Standard fertilizers

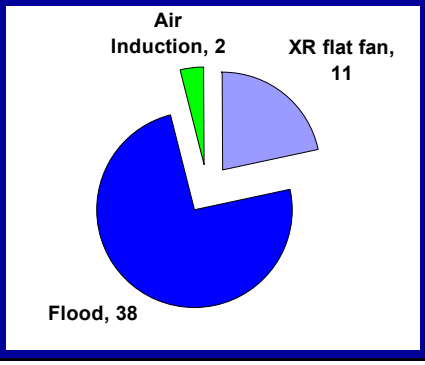
Common nozzle types

Type	Examples	Best for:	Drift Control
Flat Fan	•XR Teejet •TurboTeejet	Contacts	Good Excellent
Air induction (Venturi)	•AI Teejet •Turbodrop •Raindrop Ultra	Systemics (penetrant)	Excellent
Flood	•Turfjet •Floodjet	Fertilizers	Excellent
Whirl chamber	•Whirljet •Delavan RA	Fertilizers	Very Good

Nozzles used on greens: Syngenta survey (Shepard et. al., 2006)

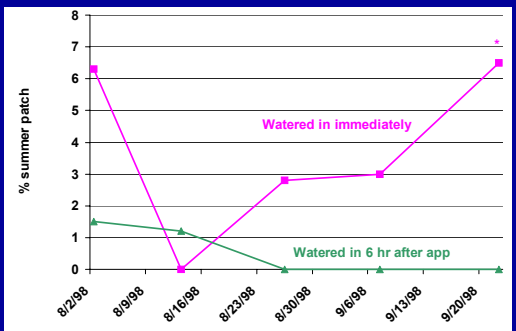


Nozzles used on fairways: Syngenta survey (Shepard et. al., 2006)

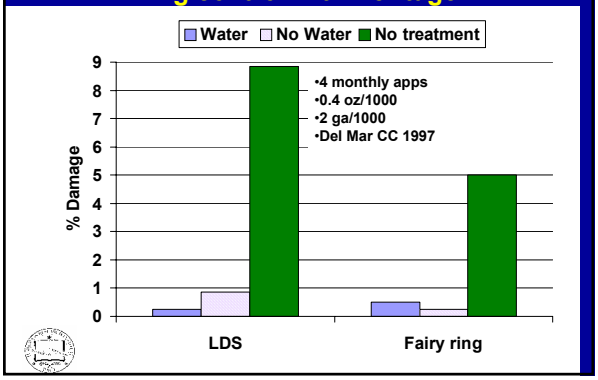


What about watering in?

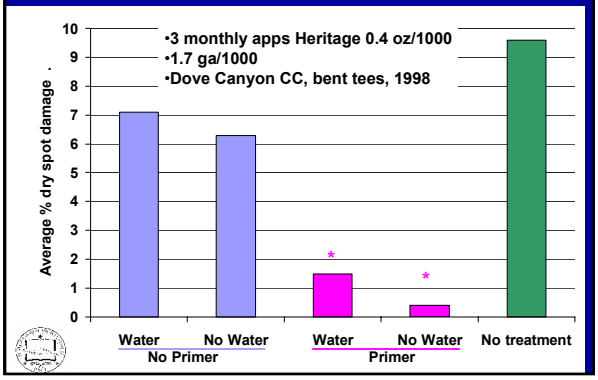
Summer patch control w/Heritage: is it OK to wait to water in?



Effect of watering in (1/10") on LDS/Fairy ring control with Heritage



Effect of watering in (1/10") on LDS management with Heritage and Primer



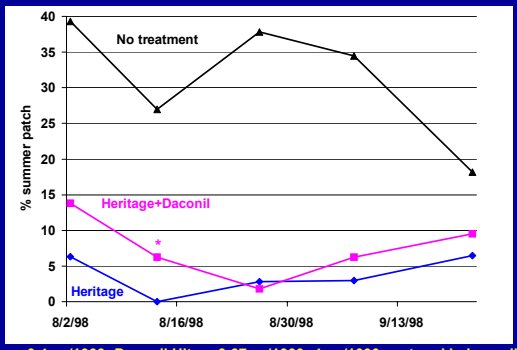
Watering in

- For root/soil targets, water in lightly and use 2ga/1000
- It may be possible to avoid watering in with 2 ga/1000 or more application volume, but there isn't sufficient data
- It is not necessary to water in immediately; waiting until evening is better

What about mixtures of contacts plus systemics?

- Different targets
- Different application volumes
- Different nozzles
- Different watering in guidelines
- Contact formulation additives may interfere with movement

Summer patch control on Kentucky bluegrass: Rutgers, 1998



Heritage 0.4 oz/1000; Daconil Ultrex 3.67 oz/1000; 4 ga/1000; watered in immediately

What about mixtures of contacts plus systemics?

- Separate in time if possible
- If unavoidable:
  - Select practices that target main pest
  - Water in only after sprays are completely dry