# *Development of Alternative Thinning Strategies*

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# *The Most Important Single Spray?*

- Crop load mgt. important for good:
  - fruit size
  - fruit quality
  - return bloom
- Concerns:
  - Consistency of response
  - Cost
  - Regulatory/ Market issues

# *New Thinners Needed*

- New MOA, timings for use in multiple thinner programs.
- Carbaryl concerns:
  - Possible FQPA actions,
  - IFP restrictions on UK exports.
- Organically acceptable options.

# *Fish Oil + Lime Sulfur (FOLS)*

- Liquid Lime Sulfur reduced fruit set when used as a pesticide in early era.
- Burns flowers / Reduced assimilation.
- Certain cultivars susceptible (Macs).
- Role of Fish Oil?
  - Surfactant/penetrant.
  - Also reduces assimilation.

# *Materials:*

- FOLS
  - Crocker's Fish Oil (G.S. Long),
    - Dilute Rate: 2 gal. / 100.
  - Liquid lime sulfur (Miller Chemical),
    - Dilute Rate: 2.5 gal. / 100.
- NC 99 calcium/magnesium brine
  - G. S. Long Co., Yakima, WA,
    - Dilute Rate: 4 gal. / 100.
- Ammonium Thiosulfate (ATS) 1 gal/100.

# *Hudson Valley Study, 2000*

- Mature Delicious / M. 7 trees.
- Transitional block.
- Applied air-blast @ 120 gal./ acre.
- Materials concentrated to dilute equiv.
- Timings: 80% bloom or
  20% + 80% bloom.
- Dates: 2 May, and 5 May, 2000.

# *Western N.Y. Study, 2000*

- Mature McIntosh, Cortland and Delicious trees on seedling rootstock.
- Certified Organic block.
- Single application at 80-100% bloom.
- Applied air-blast, 100 gal / acre.
- Materials not concentrated.
- Date: May 8, 2000.

# *Delicious, Hudson Valley, 2000*

| Treatment | Set (%) | Yield / tree (kg) |
|---|---|---|
| Control | 138 a | 150 a |
| FOLS | 67 bc | 102 b |
| FOLS (2) | 40 bc | 121 ab |
| NC99 | 98 ab | 125 ab |
| NC99 (2) | 106 ab | 141 ab |

# *Delicious, Hudson Valley, 2000*

| Treatment | Wt. (g) | Dia. (in.) |
|---|---|---|
| Control | 157 b | 2.77 b |
| FOLS | 200 a | 3.02 a |
| FOLS (2) | 180 ab | 2.89 ab |
| NC99 | 185 a | 2.94 a |
| NC99 (2) | 183 a | 2.94 a |

# *Delicious, W. N.Y., 2000*

| Treatment | Set (%) | Size (g) | Yield (kg) |
|---|---|---|---|
| Control | 42 a | 168 b | 65 a |
| FOLS | 26 b | 186 a | 59 a |
| NC 99 | 21 b | 170 ab | 68 a |
| ATS | 46 a | 176 ab | 66 a |

# *2000 Summary*

- Both NC 99 and FOLS show promise as blossom thinners for apple.
- Double applications were slightly better than a single spray at 80% bloom.
- No russetting in 2000.

# *Gala Set & Yield , 2001*

| Treatment | Fruit Set (%) | Yield/ tree (lb) |
|---|---|---|
| Control | 79 a | 111 a |
| NC 99 x 1 | 62 ab | 109 a |
| NC 99 x 2 | 47 bc | 75 ab |
| FOLS x 1 | 52 b | 75 ab |
| FOLS x 2 | 57 ab | 69 ab |
| FOLS PF + FG | 25 c | 47 b |
| Wilthin | 76 a | 101 a |

# *Gala Fruit Size , 2001*

| Treatment | Fruit dia. (in) | Fruit wt. (g) |
|---|---|---|
| Control | 2.4 b | 116 b |
| NC 99 x 1 | 2.5 b | 126 b |
| NC 99 x 2 | 2.8 a | 150 a |
| FOLS x 1 | 2.5 b | 124 b |
| FOLS x 2 | 2.8 a | 151 a |
| FOLS PF + FC | 2.8 a | 167 a |
| Wilthin | 2.4 b | 117 b |

# *Gala Phytotoxicity, 2001*

| Treatment | Leaf Burn | Russet |
|---|---|---|
| Control | 0 d | 1 b |
| NC 99 x 1 | 2 b | 1 b |
| NC 99 x 2 | 3 a | 1 b |
| FOLS x 1 | 1 c | 1 b |
| FOLS x 2 | 3 a | 2 a |
| FOLS PF + FC | 1 c | 1 b |
| Wilthin | 0 d | 1 b |

# *Post-bloom FOLS Timing,2002*

- 12-year-old Empire and McIntosh/M.26 trees.
- RCBD with 4 reps in Empire and 5 reps in McIntosh.
- Tank mixed and applied with a high pressure hand gun sprayer.

# Treatments

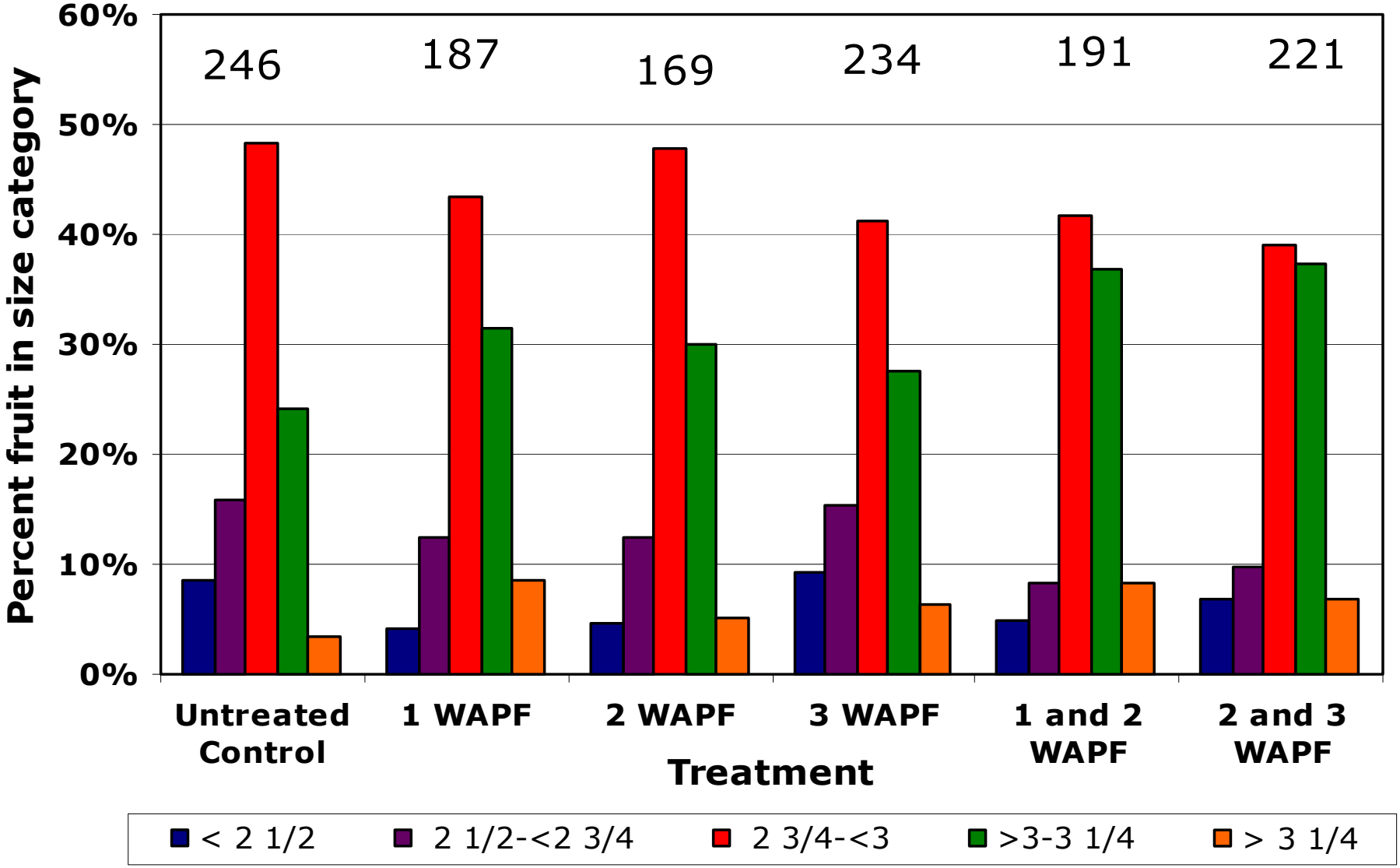
- Control
- 1 week after petal fall (WAPF)
- 2 WAPF
- 3 WAPF
- 1 and 2 WAPF
- 2 and 3 WAPF

Sprays were applied on May 6, 16, and 22.

# *FOLS Timing: McIntosh, 2002*

| Treatment | Set (%) | Fruit wt (g) | 3 in. & up (%) |
|---|---|---|---|
| Control | 120 a | 164 | 27 |
| 5 DAPF | 89 b | 180 | 40 |
| 15 DAPF | 74 bc | 173 | 35 |
| 21 DAPF | 83 bc | 172 | 34 |
| 5 + 15 | 69 bc | 180 | 45 |
| 15 + 21 | 55 c | 181 | 44 |

# McIntosh Fruit Size Distribution



# *Fruit Russet*

| Treatment | Fruit Russet (1-5 scale) Empire | McIntosh |
|---|---|---|
| Control | 1.3 c | 1.9 b |
| 1 WAPF | 2.2 a | 2.2 ab |
| 2 WAPF | 1.4 bc | 2.3 a |
| 3 WAPF | 1.4 c | 2.2 ab |
| 1 and 2 WAPF | 1.9 ab | 2.4 a |
| 2 and 3 WAPF | 1.5 bc | 2.3 a |


No differences in L:D ratio or seed number

# Return Bloom 2003

| Treatment | Blossoms/LCSA | |
|---|---|---|
| | Empire | McIntosh |
| Untreated control | 10.9 | 8.4 |
| 1 WAPF | 16.9 | 8.5 |
| 2 WAPF | 10.8 | 6.9 |
| 3 WAPF | 15.0 | 8.0 |
| 1 + 2 WAPF | 10.7 | 9.2 |
| 2 + 3 WAPF | 16.6 | 7.9 |

# *McIntosh Summary*

- FOLS reduced fruit set in all treatments.
- Double applications and early thinning of FOLS resulted in the largest fruit.
- FOLS slightly increased fruit russet.

# *Post Bloom Timing Conclusions*

- Post-bloom FOLS applications were effective, especially on McIntosh.
- Later timing more effective, but may not result in larger fruit.
- Growers will have to accept noticeable amounts of leaf burn.
- More studies are needed before FOLS is recommended.

# *Liberty Thinning, 2002*

| Treatment | Rate | Dates applied |
|---|---|---|
| Control | -- | -- |
| FOLS | 2% + 2.5 % | 22, 28 May |
| Kerry seaweed extract | 22 fl. oz./ 100 | 16, 22, 28 May & 2 June |
| 6BA (Valent) | 150 ppm | 16, 22 May |

# *Liberty Thinning, Fruit Size, 2002*

| Treatment | Juice | Bags | 120 ct | 100 ct | 80 ct |
|---|---|---|---|---|---|
| Control | 28 a | 34 a | 35 c | 3 c | 0.4 b |
| FOLS | 5 b | 16 b | 61 a | 17 b | 0.6 b |
| Kerry | 32 a | 39 a | 25 d | 3 c | 0.3 b |
| 6BA | 6 b | 12 b | 47 b | 31 a | 4 a |

# *FOLS Negatives*

- Smelly, corrosive, hard to wash off.
- Limited availability of FO.
- Potentially phytotoxic.
- Not Cheap: $US 45-$90 / Acre.
- Not fully researched.

# *LS Concentration & LS:FO Ratio*

| Lime Sulfur (%) | Fish Oil (%) |
|---|---|
| 0.0 | 0 |
| 1.5 | 0 |
| 2.5 | 0 |
| 0.0 | 1 |
| 0.0 | 2 |
| 1.5 | 1 |
| 1.5 | 2 |
| 2.5 | 1 |
| 2.5 | 2 |

# *LS Concentration & LS:FO Ratio*

| Treatment | Crop Load | Fruit wt. | Leaf burn |
|---|---|---|---|
| Control | 9.4 ab | 98 b | 0.2 c |
| LS 1.5 | 9.8 ab | 122 a | 0.7 b |
| LS 2.5 | 10.1 a | 109 ab | 0.4 bc |
| FO 1.0 | 8.3 abc | 113 ab | 0.7 b |
| FO 2.0 | 6.1 cd | 126 a | 0.4 bc |
| 1.5: 1.0 | 6.4 cd | 128 a | 0.6 bc |
| 1.5 : 2.0 | 7.6 bc | 113 ab | 0.5 bc |
| 2.5 : 1.0 | 6.5 cd | 118 ab | 0.8 b |
| 2.5 : 2.0 | 8.1 abc | 114 ab | 0.4 bc |
| NC99 4% | 5.4 d | 130 a | 2.4 a |

# *FOLS Summary*

- Effective, consistent thinner.
- Broad application window.
  - Effective blossom thinner,
  - Excellent post-bloom activity.
- FOLS shows promise as a replacement for carbaryl & as an organic thinner.
- More research underway.

# *FOLS Research Needs*

- Alternatives to Crocker's fish oil.
- Effect of timing on efficacy and on fruit size.
- Effect of spray volume and concentration on efficacy, $/acre, and crop safety.
- Confirm MOA.
- Pest Mgt. implications need study (scab, beneficials).

# *Co-investigators & Cooperators*

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