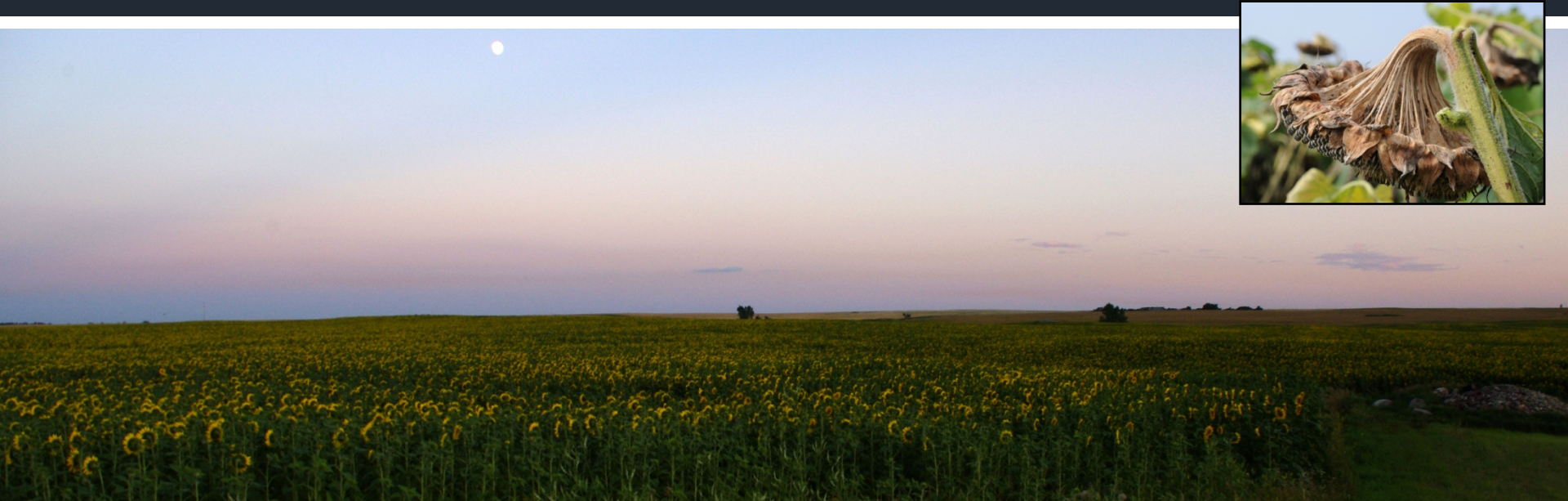


Management of Sclerotinia Head Rot with Fungicides: Fungicide Efficacy, Residual, Application Timing, and Application Methods



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NDSU Robert Titus Research Farm, Oakes

Methods

Fungicide applications

- **Spray volume:** 15 gal/ac
- **Driving speed:** 2.6 mph
- **Nozzles:** Spraying Systems TeeJet
- **Drop nozzles:** 360 Undercover (360 Yield Center; Morton, IL)
- **Pulse-width modulation system** from Capstan AG
- **Nozzle placement:**
 - Boom-mounted nozzles: boom set 20" above canopy
 - Drop nozzles: nozzles centered on mid-point of heads

Methods

Disease establishment

- **Pathogen inoculation:**
 - Carrington – single inoculation (22,500 ascospores/head)
 - Oakes – two inoculations (30,000 ascospores/head)
- **Overhead irrigation:**
 - micro-sprinkler irrigation mist systems
 - intensively irrigation at R5 and R6 growth stages
 - moderate irrigation at R7 growth stage

Fungicide Efficacy

Oakes, ND: sunflowers at average R5.4 growth stage

**Sclerotinia
Head Rot
Severity Index**

Percent of sunflower
head tissue diseased

Oct. 10 | R9 growth stage

**Rust
Severity**

Percent of leaf area
covered by rust pustules;
4th leaf from top of plant

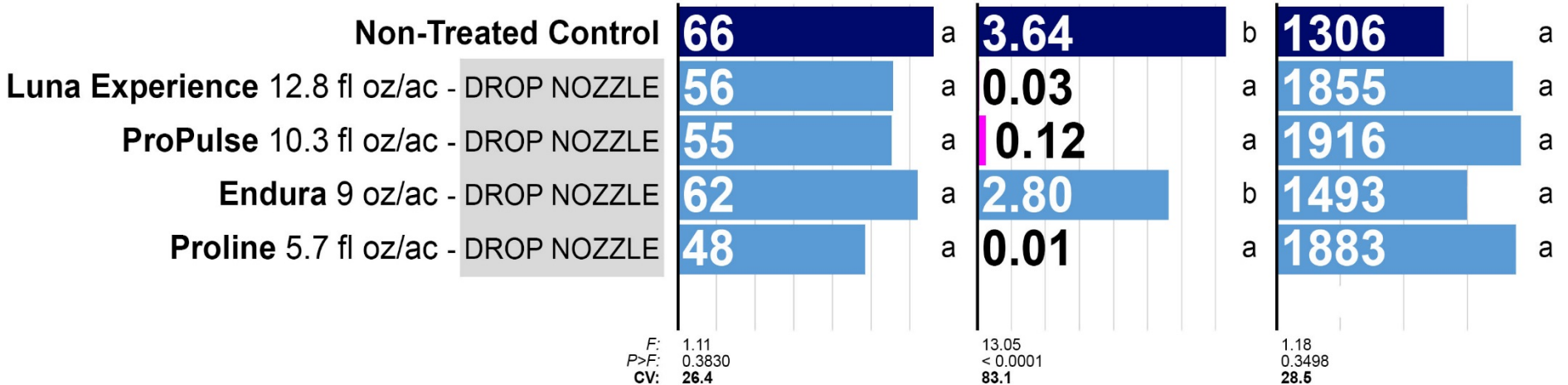
Sept. 7 | R7 growth stage

**Sunflower
Yield**

10% moisture

pounds / acre

Sunflower heads inoculated with ascospores of *S. sclerotiorum* 2 and 3 days after fungicides were applied



Spray nozzles, application pressure:

- Drop nozzle: XR11002 (flat-fan) nozzles on side ports; 40 psi

Fungicide Efficacy

Carrington, ND: sunflowers at average R5.5 growth stage

Spray nozzles, application pressure:

- Drop nozzle: XR11002 (flat-fan) nozzles, side ports; 40 psi
- Boom-mounted nozzles: XR11002 (flat-fan) nozzles; 40 psi

Sclerotinia Head Rot Severity Index

Percent of sunflower head tissue diseased

Oct. 16 | R9 growth stage

Rust Severity

Percent of leaf area covered by rust pustules; 4th leaf from top of plant

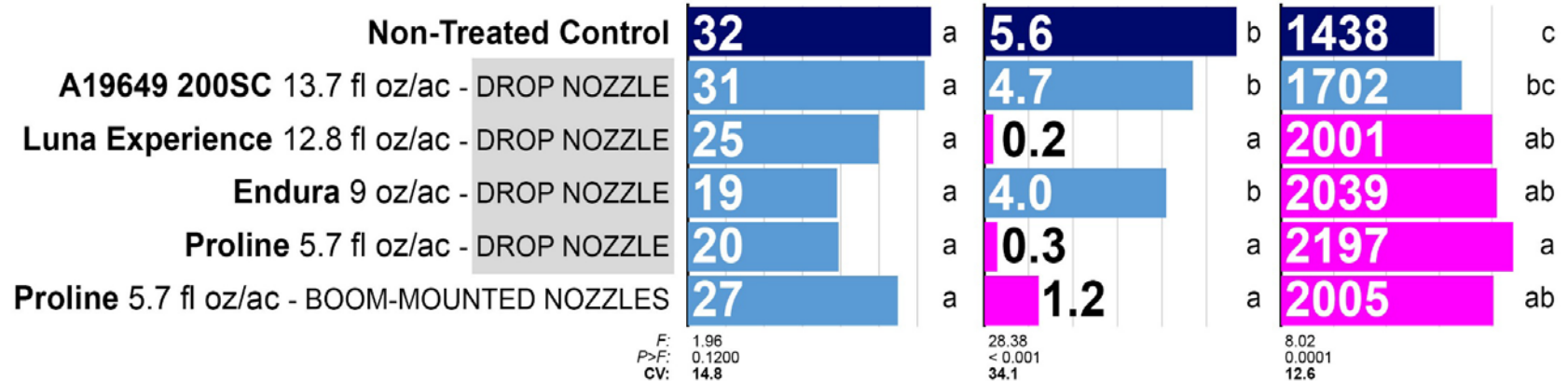
Sept. 25 | R7/R8 gr. stage

Sunflower Yield

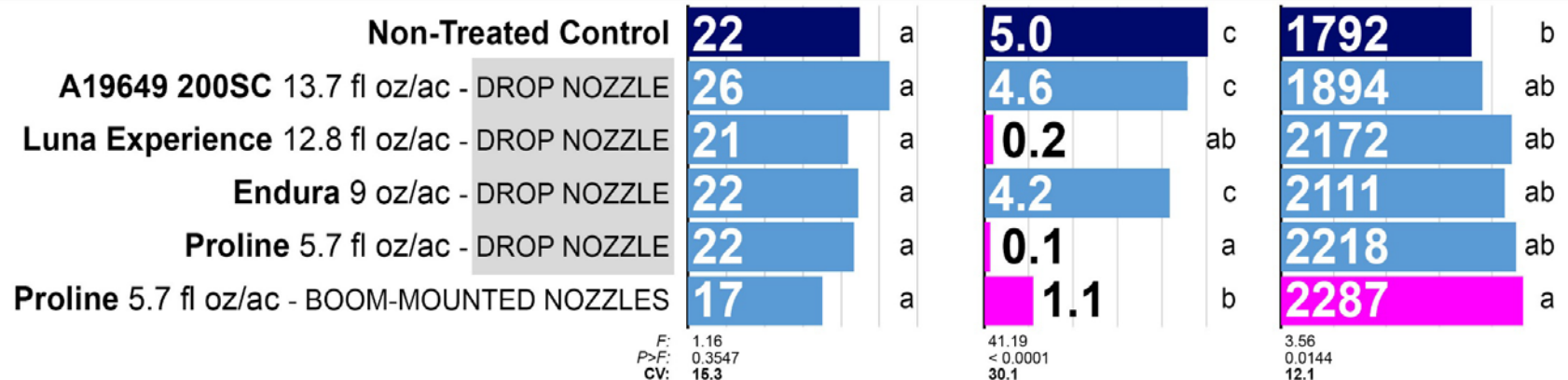
10% moisture

pounds / acre

1. Sunflower heads inoculated with ascospores of *Sclerotinia sclerotiorum* 2 days after fungicides were applied



2. Sunflower heads inoculated with ascospores of *Sclerotinia sclerotiorum* 7 days after fungicides were applied



Fungicide Efficacy

Carrington, ND: sunflowers at average R5.7 growth stage

Spray nozzles, application pressure:

- Drop nozzle: XR11002 (flat-fan) nozzles, side ports; 40 psi
- Boom-mounted nozzles: XR11002 (flat-fan) nozzles; 40 psi

**Sclerotinia
Head Rot
Severity Index**

Percent of sunflower
head tissue diseased

Oct. 16 | R9 growth stage

**Rust
Severity**

Percent of leaf area
covered by rust pustules;
4th leaf from top of plant

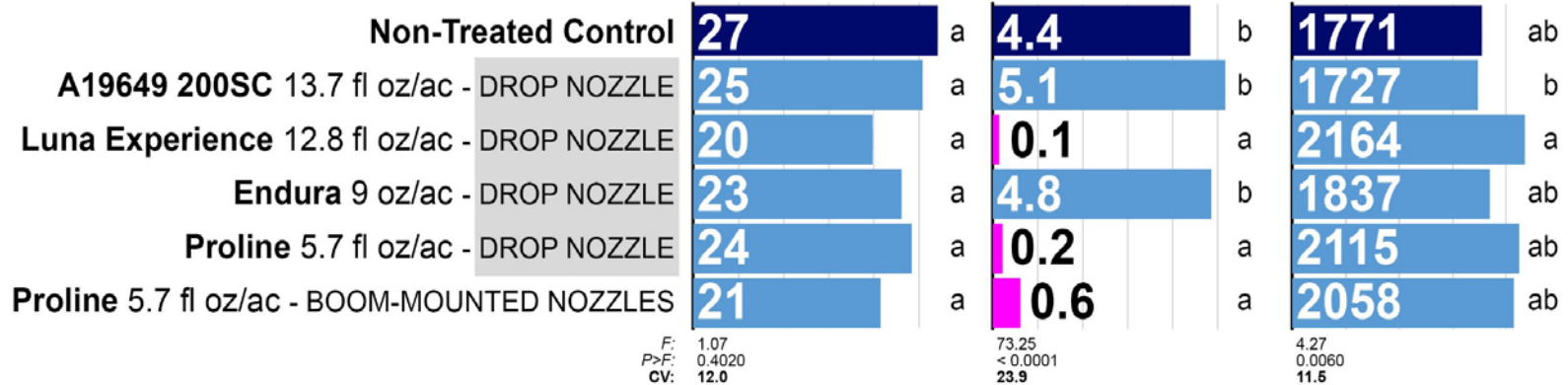
Sept. 25 | R7/R8 gr. stage

**Sunflower
Yield**

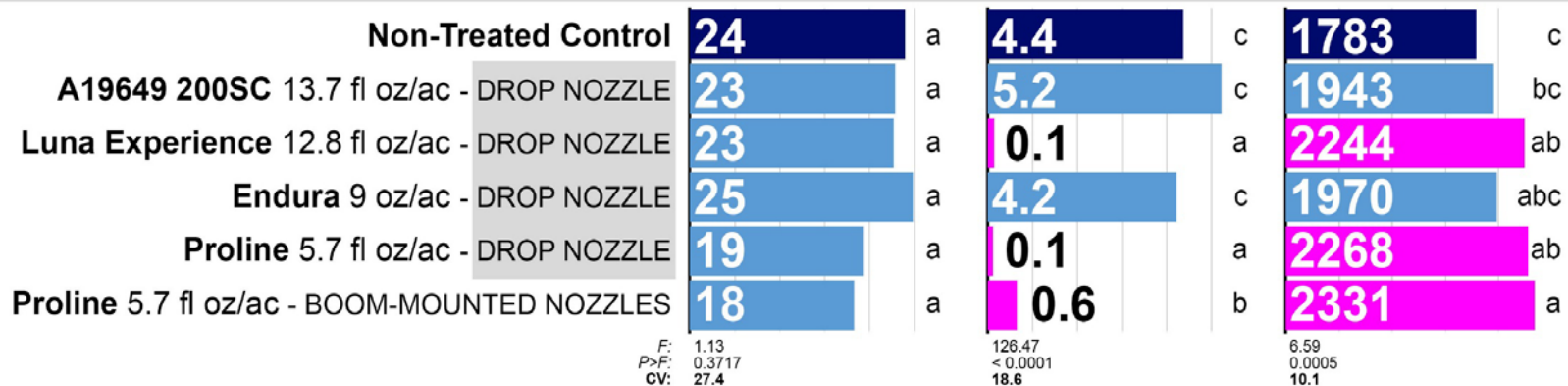
10% moisture

pounds / acre

1. Sunflower heads inoculated with ascospores of *Sclerotinia sclerotiorum* 2 days after fungicides were applied



2. Sunflower heads inoculated with ascospores of *Sclerotinia sclerotiorum* 7 days after fungicides were applied



Fungicide Efficacy

Carrington, ND: sunflowers at average R5.9 growth stage

**Sclerotinia
Head Rot
Severity Index**

Percent of sunflower
head tissue diseased

Oct. 16 | R9 growth stage

**Rust
Severity**

Percent of leaf area
covered by rust pustules;
4th leaf from top of plant

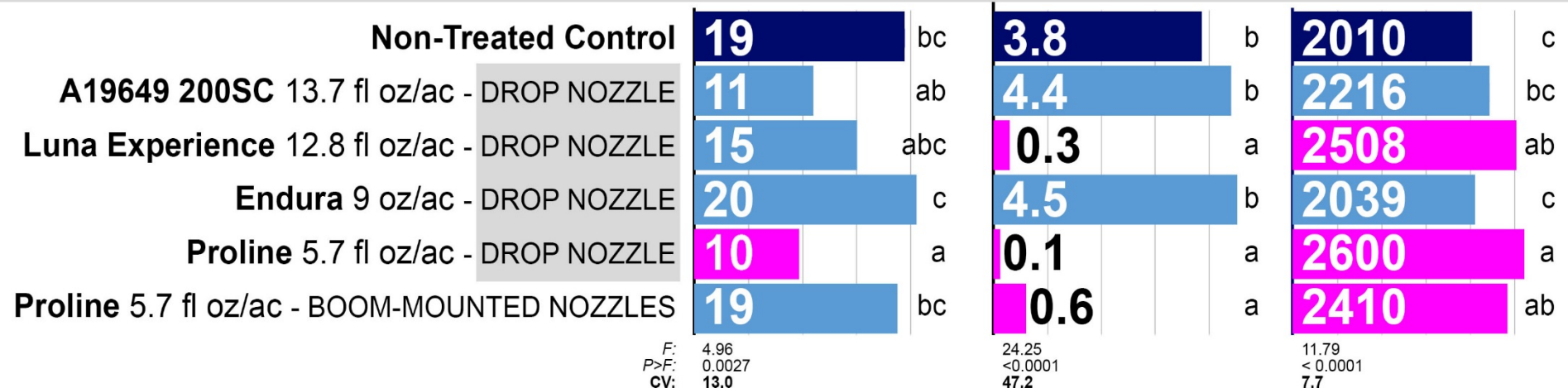
Sept. 25 | R7/R8 gr. stage

**Sunflower
Yield**

10% moisture

pounds / acre

Sunflower heads inoculated with ascospores of *Sclerotinia sclerotiorum* 1 day after fungicides were applied

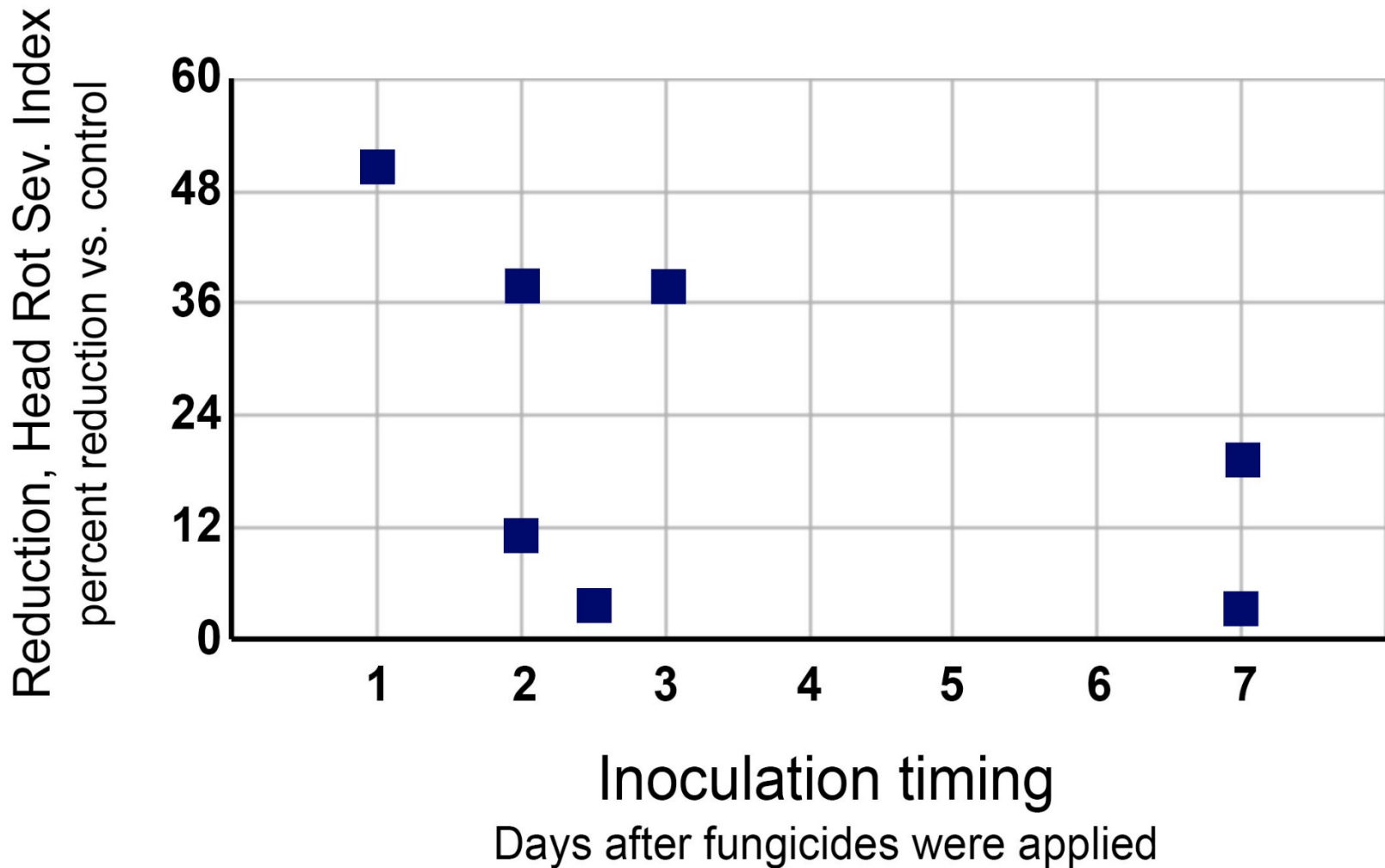


Spray nozzles, application pressure:

- Drop nozzle: XR11002 (flat-fan) nozzles, side ports; 40 psi
- Boom-mounted nozzles: XR11002 (flat-fan) nozzles; 40 psi

Fungicide Efficacy

Carrington, ND: sunflowers at average R5.9 growth stage



Spray nozzles, application pressure:

- XR11002 (flat-fan) nozzles, side ports of drop nozzle; 40 psi

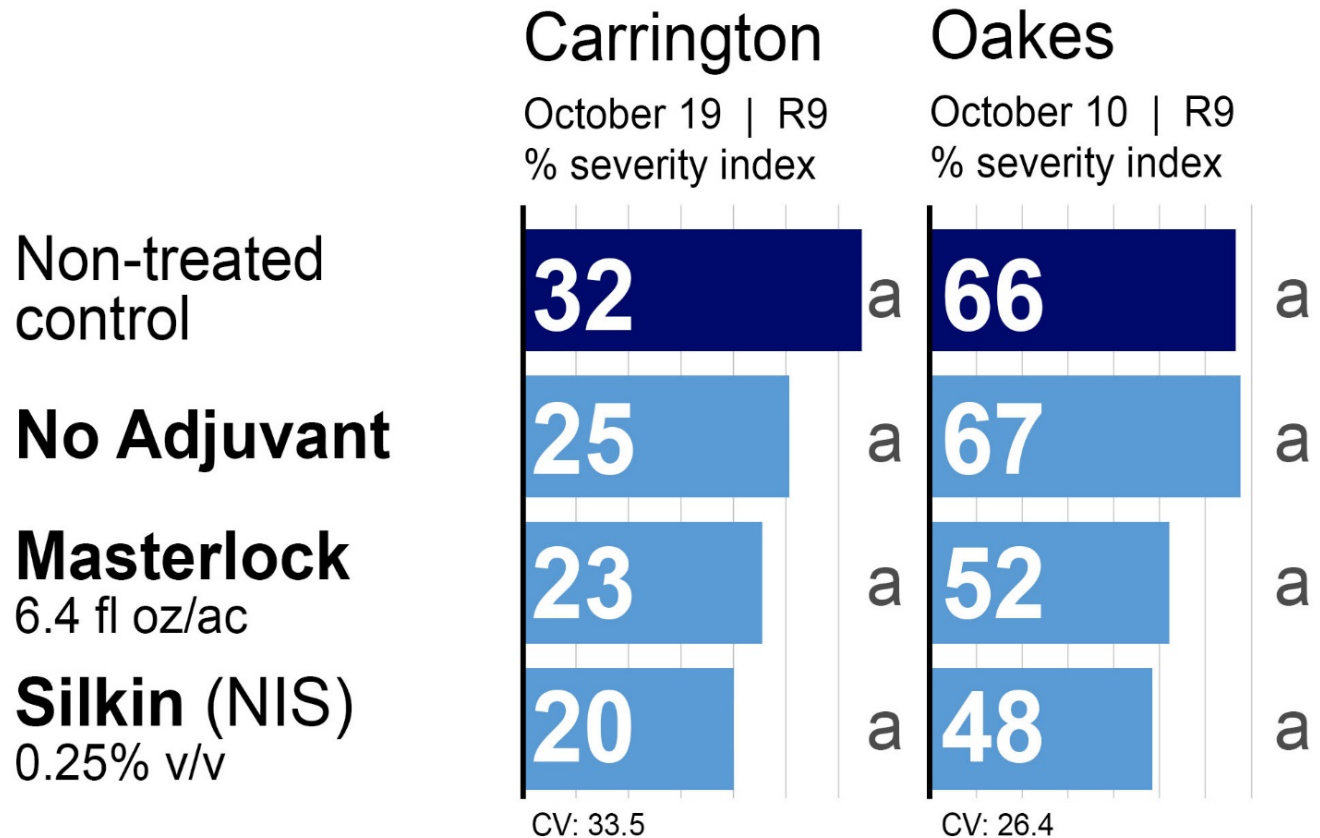
Fungicide:

Proline 480SC 5.7 fl oz/ac + Silkin (NIS) 0.25 % v/v

Impact of adjuvants

Sunflowers at average R5.4 growth stage (Oakes), R5.5 (Carrington)

Sclerotinia head rot:



Spray nozzles, application pressure:

- Carrington: XR11002 (flat-fan) nozzles, side ports of crop nozzle; 40 psi
- Oakes: XR11001 (flat-fan) nozzles, side ports of crop nozzle; 40 psi

Fungicide: Proline 480SC 5.7 fl oz/ac

Inoculated: 3 days after fungicides applied (Carrington)
2 and 3 days after fungicides applied (Oakes)

Impact of adjuvants

Sunflowers at average R5.4 growth stage (Oakes), R5.5 (Carrington)

Rust:

Carrington

Sept. 20 | R7
% severity

Oakes

Sept. 7 | R7
% severity

Non-treated
control

5.2

b

3.6

b

No Adjuvant

0.2

a

0.0

a

Masterlock

6.4 fl oz/ac

0.1

a

1.0

a

Silkin (NIS)

0.25% v/v

1.0

a

0.0

a

CV: 95.1

CV: 83.1

Spray nozzles, application pressure:

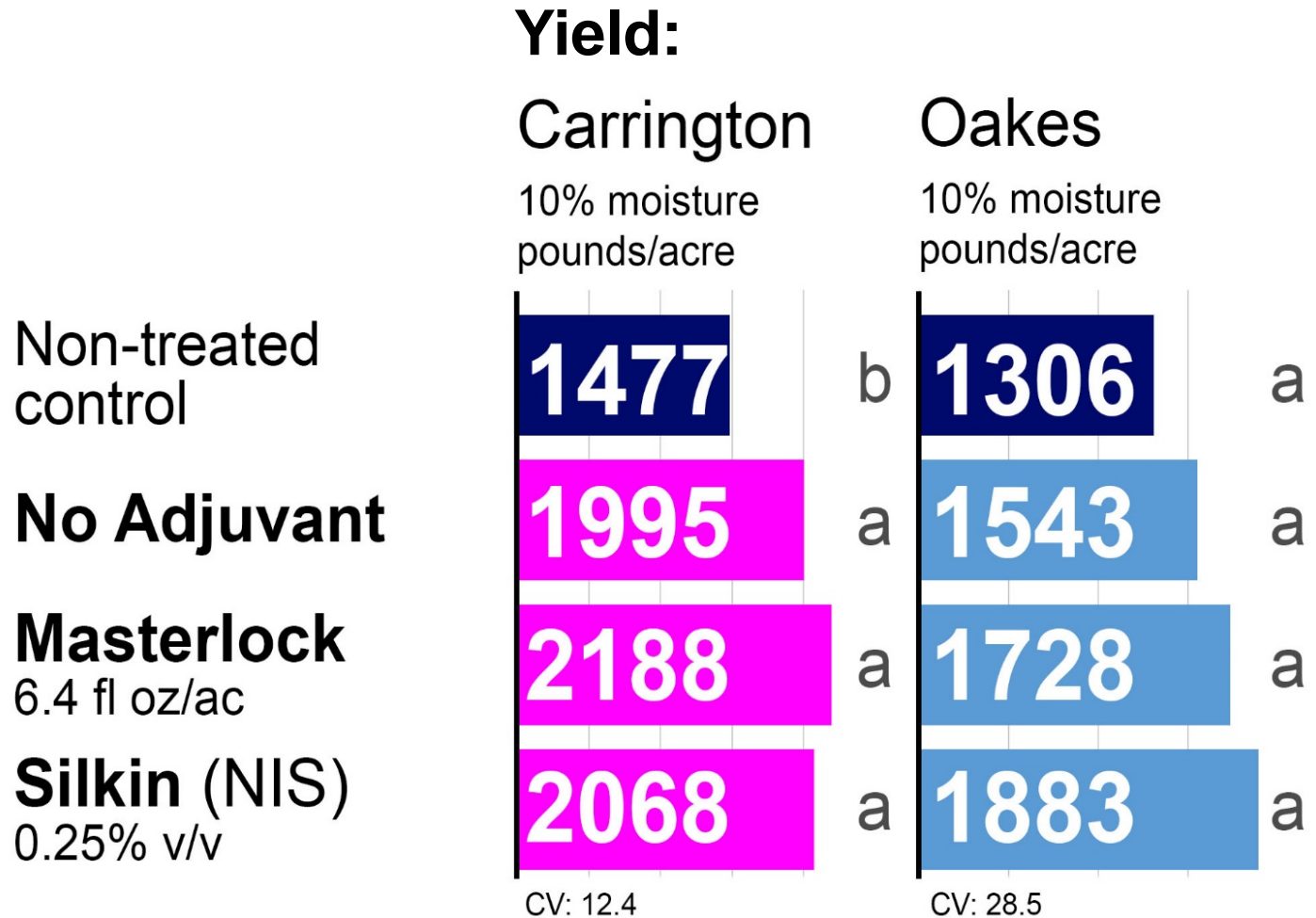
- Carrington: XR11002 (flat-fan) nozzles, side ports of crop nozzle; 40 psi
- Oakes: XR11001 (flat-fan) nozzles, side ports of crop nozzle; 40 psi

Fungicide: Proline 480SC 5.7 fl oz/ac

Inoculated: 3 days after fungicides applied (Carrington)
2 and 3 days after fungicides applied (Oakes)

Impact of adjuvants

Sunflowers at average R5.4 growth stage (Oakes), R5.5 (Carrington)



Spray nozzles, application pressure:

- Carrington: XR11002 (flat-fan) nozzles, side ports of crop nozzle; 40 psi
- Oakes: XR11001 (flat-fan) nozzles, side ports of crop nozzle; 40 psi

Fungicide: Proline 480SC 5.7 fl oz/ac

Inoculated: 3 days after fungicides applied (Carrington)
2 and 3 days after fungicides applied (Oakes)

Impact of application method

Sunflowers at average R5.4 growth stage (Oakes), R5.5 (Carrington)

Fungicide

Proline 480SC 5.7 fl oz/ac +
Silkin (NIS) 0.25% v/v

Inoculation

Carrington: 3 days after fungicide application
Oakes: 2 and 3 days after fungicide application

Sclerotinia head rot:

Carrington

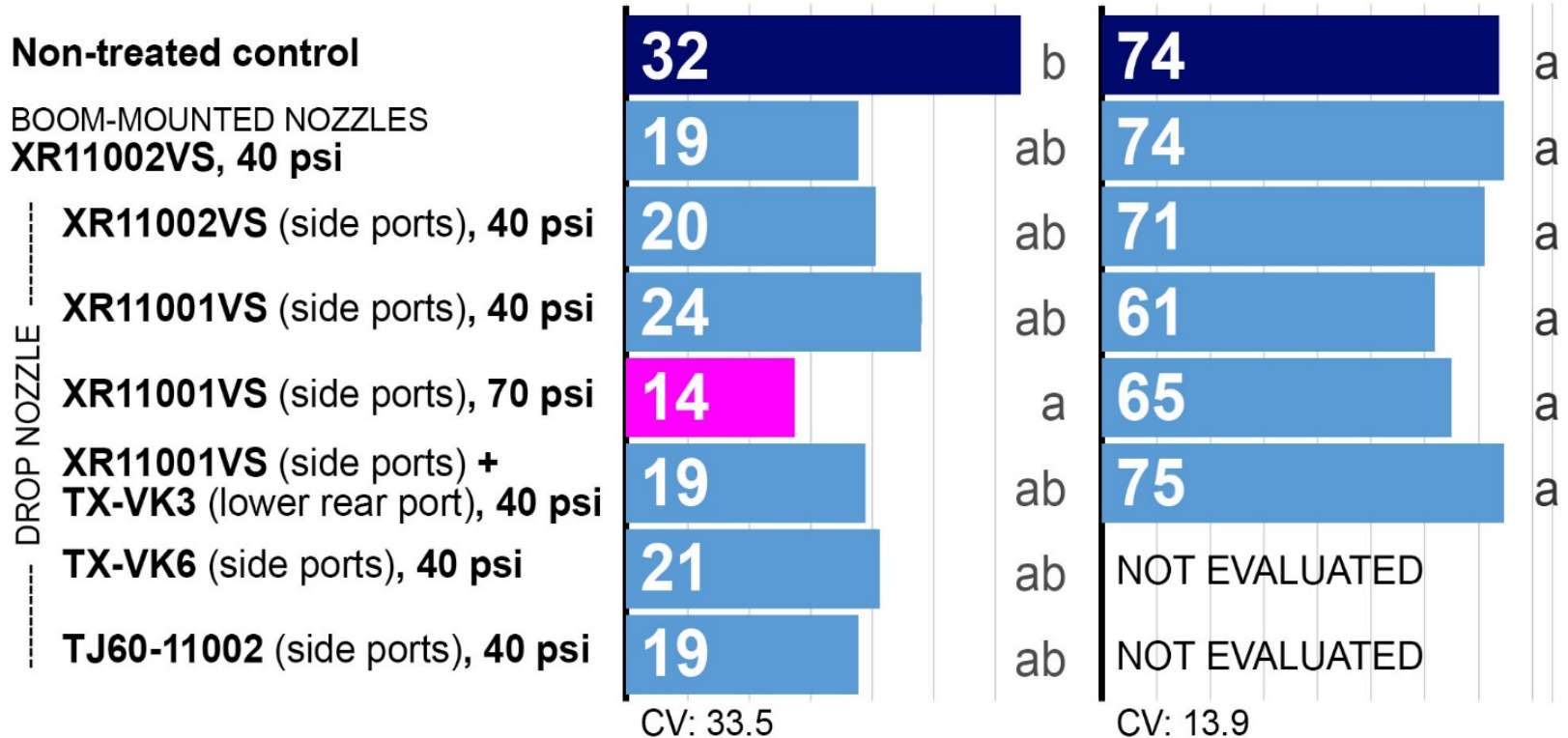
Oct. 19 | R9

% severity index

Oakes

Oct. 10 | R9

% severity index



Impact of application method

Sunflowers at average R5.4 growth stage (Oakes), R5.5 (Carrington)

Fungicide

Proline 480SC 5.7 fl oz/ac +
Silkin (NIS) 0.25% v/v

Inoculation

Carrington: 3 days after fungicide application
Oakes: 2 and 3 days after fungicide application

Rust:

Carrington

Sept. 20 | R7
% severity

Oakes

Sept. 7 | R7
% severity

Non-treated control

BOOM-MOUNTED NOZZLES XR11002VS, 40 psi

XR11002VS (side ports), 40 psi

XR11001VS (side ports), 40 psi

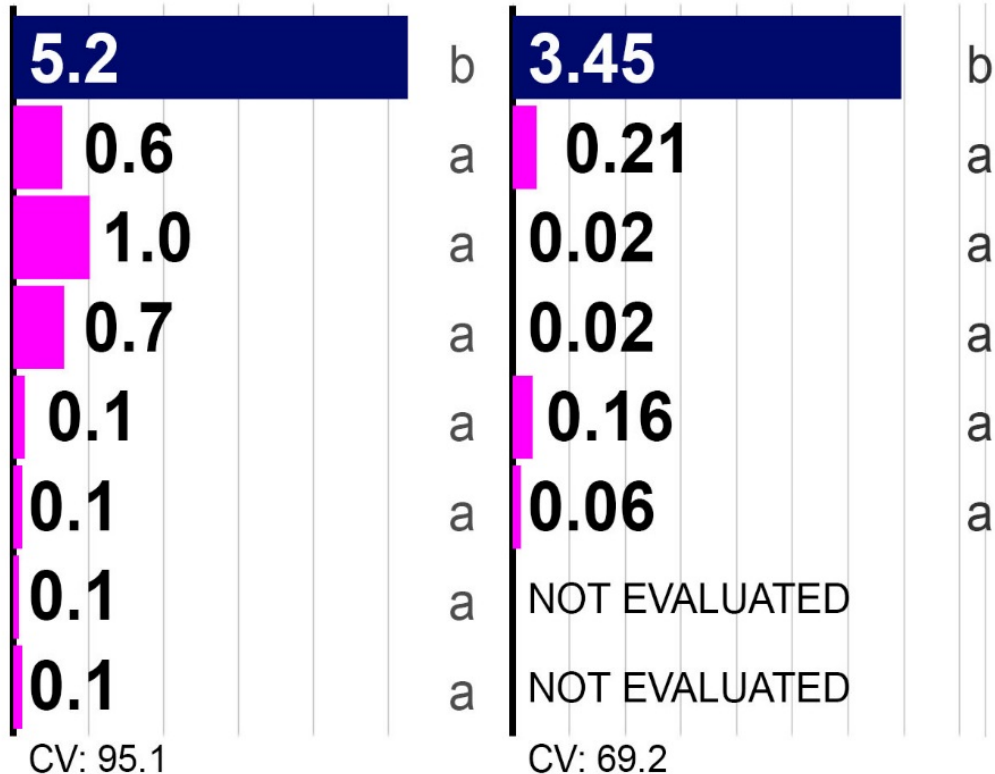
XR11001VS (side ports), 70 psi

XR11001VS (side ports) +
TX-VK3 (lower rear port), 40 psi

TX-VK6 (side ports), 40 psi

TJ60-11002 (side ports), 40 psi

DROPP NOZZLE



Impact of application method

Sunflowers at average R5.4 growth stage (Oakes), R5.5 (Carrington)

Fungicide

Proline 480SC 5.7 fl oz/ac +
Silkin (NIS) 0.25% v/v

Inoculation

Carrington: 3 days after fungicide application
Oakes: 2 and 3 days after fungicide application

Yield:

Carrington

10% moisture
pounds/acre

Oakes

10% moisture
pounds/acre

Non-treated control

BOOM-MOUNTED NOZZLES XR11002VS, 40 psi

----- DROP NOZZLE -----
XR11002VS (side ports), 40 psi

XR11001VS (side ports), 40 psi

XR11001VS (side ports), 70 psi

XR11001VS (side ports) +
TX-VK3 (lower rear port), 40 psi

TX-VK6 (side ports), 40 psi

TJ60-11002 (side ports), 40 psi

1477

2235

2068

2223

2404

2251

2156

2193

CV: 12.4

b

1309

a

1281

a

1473

a

1564

a

1704

a

1220

a

NOT EVALUATED

a

NOT EVALUATED

CV: 23.3

a

a

a

a

a

a

Conclusions

Field trials conducted in 2017

- **Fungicide efficacy:**
 - Proline was best, but performance was inconsistent
- **Fungicide residual:**
 - Residual activity < 7 days with the fungicides tested
- **Adjuvants:**
 - Use of a NIS improves fungicide efficacy vs. head rot
- **Application methods:**
 - For applications via drop nozzles, flat-fan nozzles delivering very fine droplets may be optimal

Next steps

Plans for 2018 field season

- **Funding obtained for one more year of field trials**
- **Fungicide efficacy:**
 - Attempt to test new experimental products
- **Fungicide residual:**
 - Inoculate 1, 4, and 7 days after fungicides applied
- **Application timing:**
 - Target average R5.1, R5.3, and R5.5 growth stage
- **Application methods:**
 - Test different methods of obtaining very fine droplets