

# Prospects for using drop nozzles to improve fungicide coverage and control of Sclerotinia head rot



Michael J. Wunsch, Michael Schaefer, Billy Kraft, Jesse Hafner, and Suanne Kallis  
North Dakota State University, Carrington Research Extension Center, Carrington

## Conclusions from field trials conducted 2011 to 2013:

### **WHEN APPLIED ACROSS THE TOP OF THE CANOPY, FOLIAR FUNGICIDES EXHIBITED LITTLE OR NO EFFICACY AGAINST SCLEROTINIA HEAD ROT**

The poor efficacy was likely due to the difficulty of achieving satisfactory fungicide coverage.



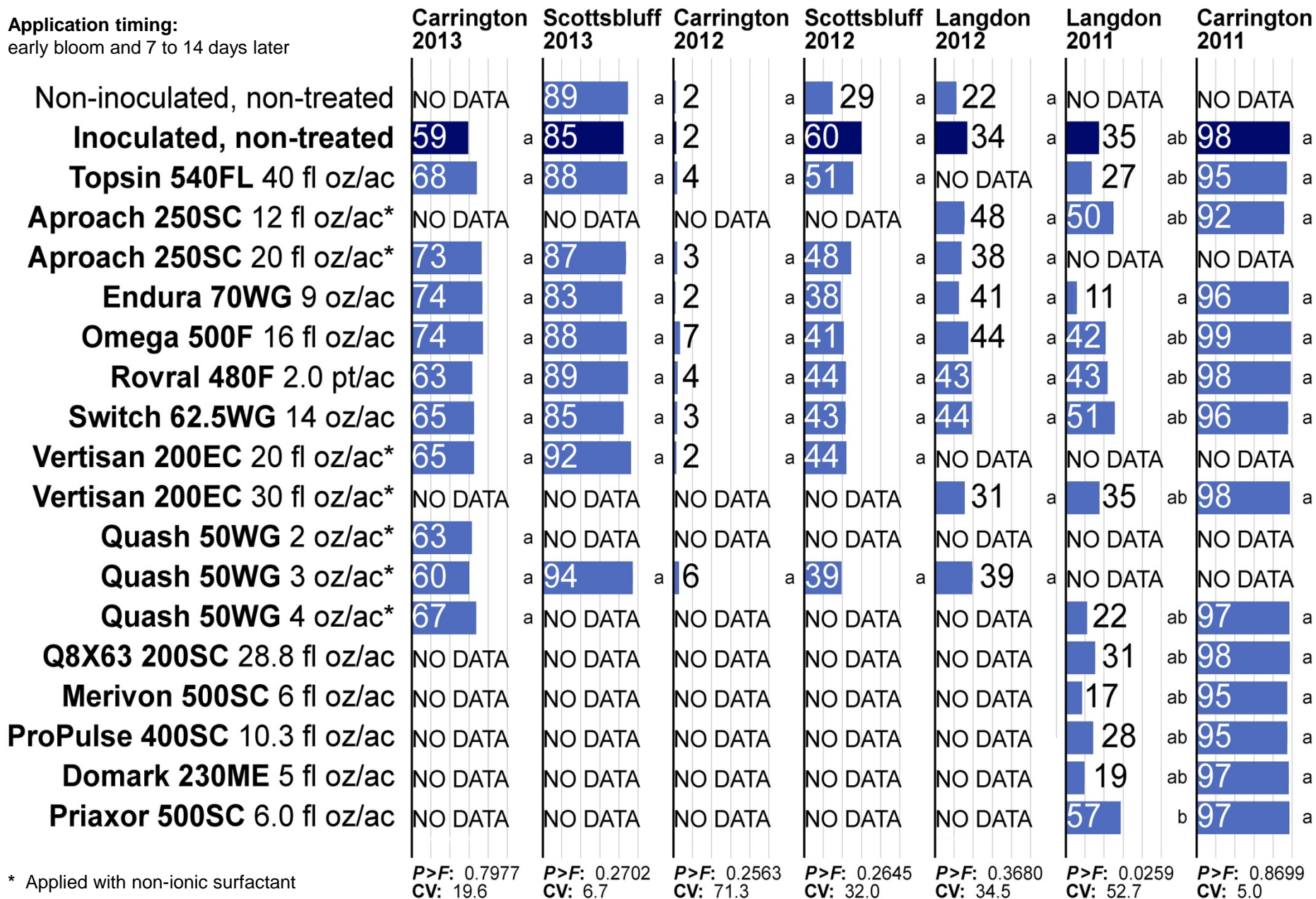
Sam Markell

# Results – Fungicide efficacy

## SCLEROTINIA HEAD ROT INCIDENCE (%)

Application timing:

early bloom and 7 to 14 days later



\* Applied with non-ionic surfactant

P>F: 0.7977  
CV: 19.6

P>F: 0.2702  
CV: 6.7

P>F: 0.2563  
CV: 71.3

P>F: 0.2645  
CV: 32.0

P>F: 0.3680  
CV: 34.5

P>F: 0.0259  
CV: 52.7

P>F: 0.8699  
CV: 5.0



# Results – Fungicide efficacy

**YIELD (pounds/acre)**

Application timing:  
early bloom and 7 to 14 days later

	Carrington 2013	Scottsbluff 2013	Carrington 2012	Scottsbluff 2012	Langdon 2012	Langdon 2011	Carrington 2011
Non-inoculated, non-treated	NO DATA	1402	2251	1887	2177	NO DATA	NO DATA
Inoculated, non-treated	1236	1549	2148	1661	1961	1954	NO DATA
Topsin 540FL 40 fl oz/ac	1278	1538	2071	1462	1795	1901	NO DATA
Aproach 250SC 12 fl oz/ac*	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	1192	NO DATA
Aproach 250SC 20 fl oz/ac*	1349	1639	2194	1849	1982	NO DATA	NO DATA
Endura 70WG 9 oz/ac	1403	1789	2459	2152	2076	2067	NO DATA
Omega 500F 16 fl oz/ac	935	1494	2326	1803	2133	2198	NO DATA
Rovral 480F 2.0 pt/ac	1268	1362	2266	1912	1585	1723	NO DATA
Switch 62.5WG 14 oz/ac	1245	1561	2507	2229	1828	1893	NO DATA
Vertisan 200EC 20 fl oz/ac*	1406	950	2334	1877	1880	NO DATA	NO DATA
Vertisan 200EC 30 fl oz/ac*	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	1923	NO DATA
Quash 50WG 2 oz/ac*	1714	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA
Quash 50WG 3 oz/ac*	1412	237	2236	2133	1664	NO DATA	NO DATA
Quash 50WG 4 oz/ac*	1406	NO DATA	NO DATA	NO DATA	NO DATA	1457	NO DATA
Q8X63 200SC 28.8 fl oz/ac	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	2072	NO DATA
Merivon 500SC 6 fl oz/ac	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	1923	NO DATA
ProPulse 400SC 10.3 fl oz/ac	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	1941	NO DATA
Domark 230ME 5 fl oz/ac	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	1557	NO DATA
Priaxor 500SC 6.0 fl oz/ac	NO DATA	NO DATA	NO DATA	NO DATA	NO DATA	1976	NO DATA

\* Applied with non-ionic surfactant

P>F: 0.4899  
CV: 28.3

P>F: < 0.0001  
CV: 23.5

P>F: 0.1843  
CV: 9.3

P>F: 0.4194  
CV: 23.6

P>F: 0.6979  
CV: 24.4

P>F: 0.3005  
CV: 24.0



# Results – Fungicide efficacy

## ONE vs. TWO vs. THREE APPLICATIONS

### Application timing:

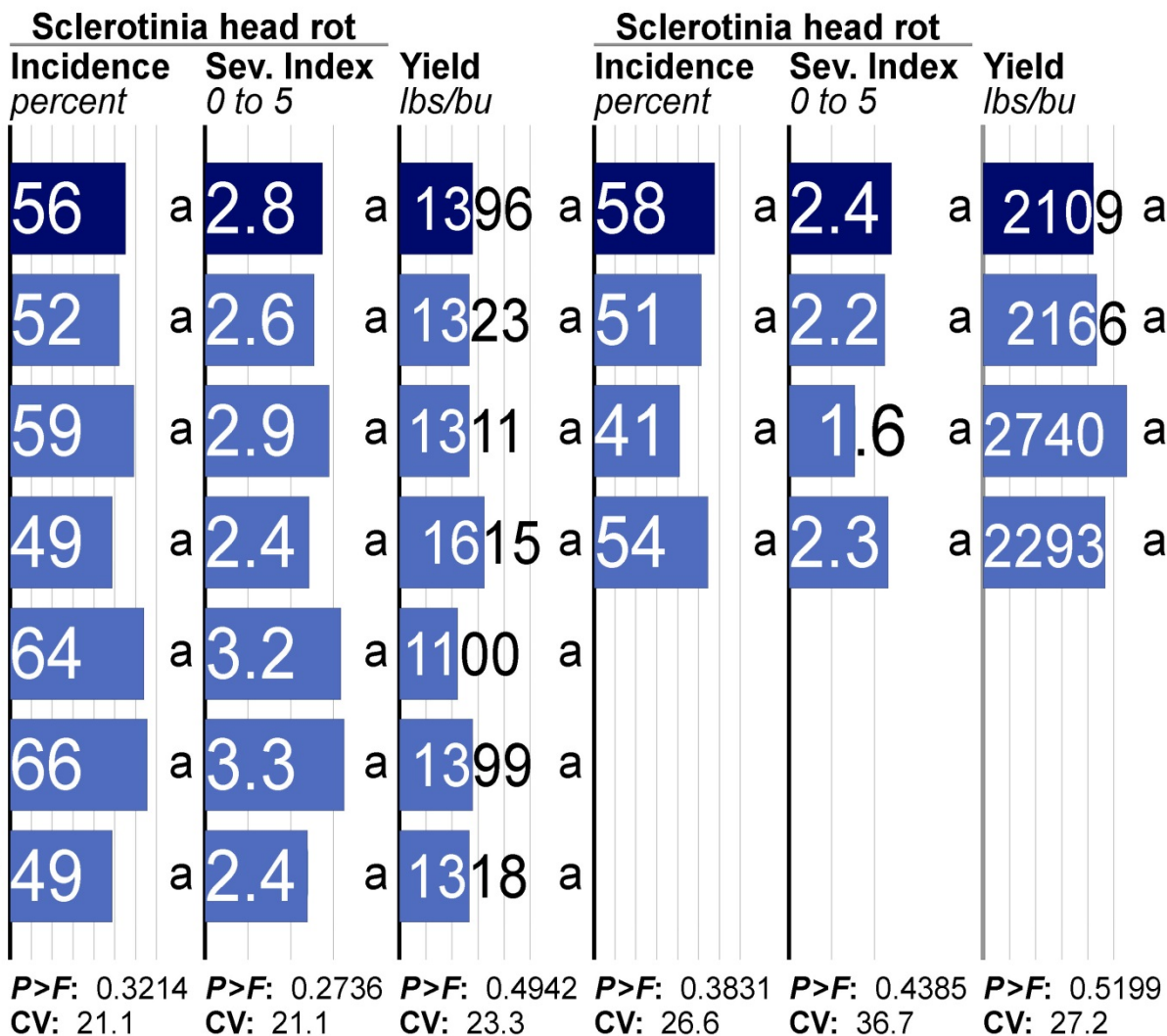
(A): early bloom

(B): 10-12 days after application A

(C): 8-10 days after application B

### Carrington, ND (2013)

### Oakes, ND (2013)



## Research question:

**Can fungicide coverage and disease control be improved by delivering fungicides through drop nozzles mounted on a high-clearance sprayer?**



Sam Markell

- **Confectionary hybrid:** NuSeed ‘Jaguar’
- Planted June 4; overseeded and manually thinned to 17,400 plants/ac (confections)
- **Fungicide applied:** Endura (boscalid) at 8 oz/ac
- **Water volume,** fungicide applications: 20 gal/ac
- **Fungicide application timing:**
  - 82% of plants with an open blossom
  - Among plants in bloom, an average of 30% of disk flowers blooming or already completed bloom
- **Four inoculation treatments:** Non-inoculated, early bloom, mid-bloom, late bloom. **Five replications.** Plots 5 ft x 25 ft.



- **Assessment of fungicide coverage:**
  - Three rows were treated with fungicide: two rows were used to evaluate disease & yield response, and one row was used to evaluate fungicide spray coverage
  - ‘Spray cards’ (water-sensitive paper designed for assessing spray coverage) were attached to the front of five heads per plot in each of 3 replicates
- **Disease assessments:** Sept. 30 at the R8-R9 growth stage

- **Drop nozzle from 360 Yield Center: '360 Undercover'**



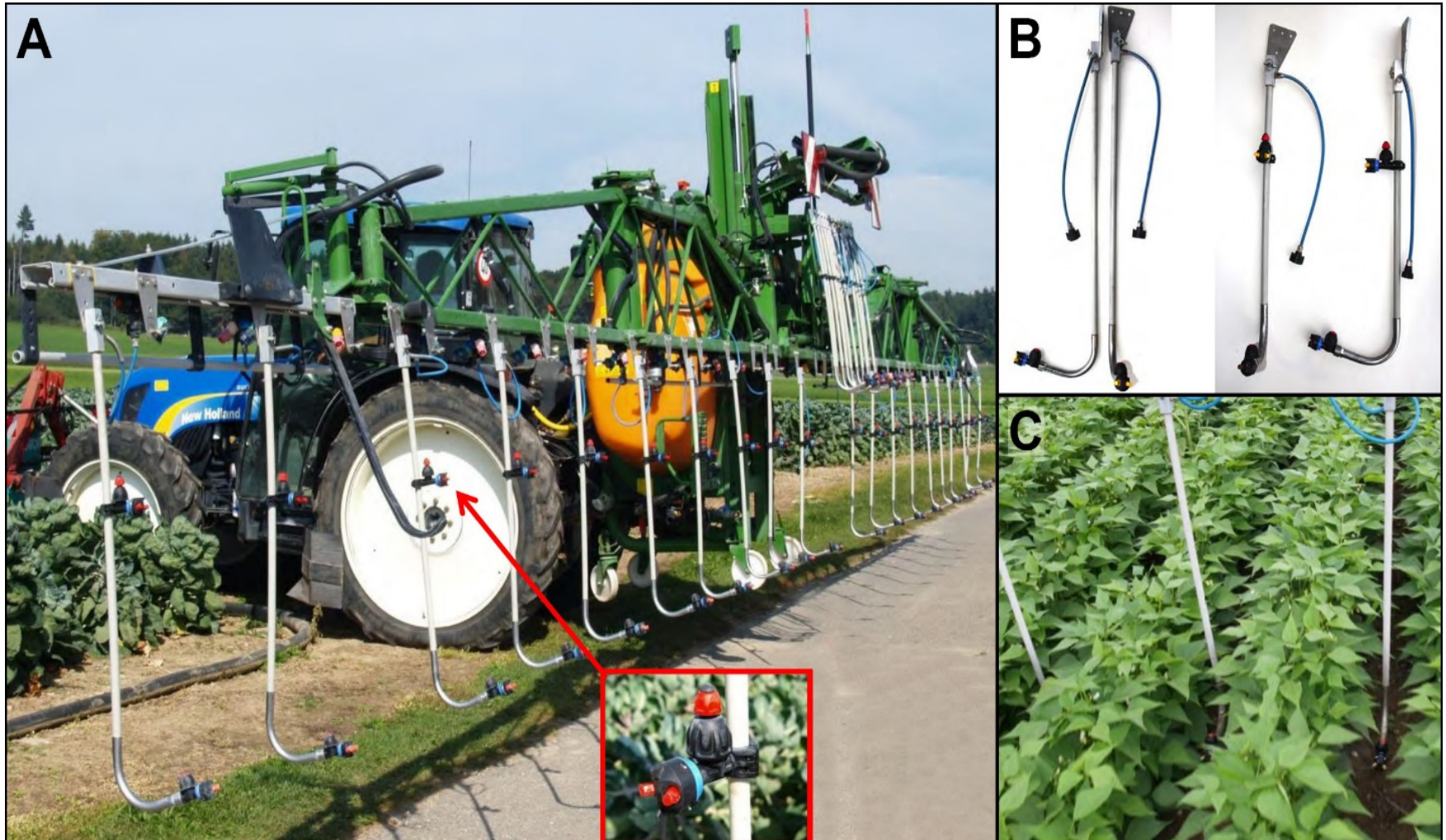
⊕ SENSE

⊕ DECIDE

⊕ **APPLY**

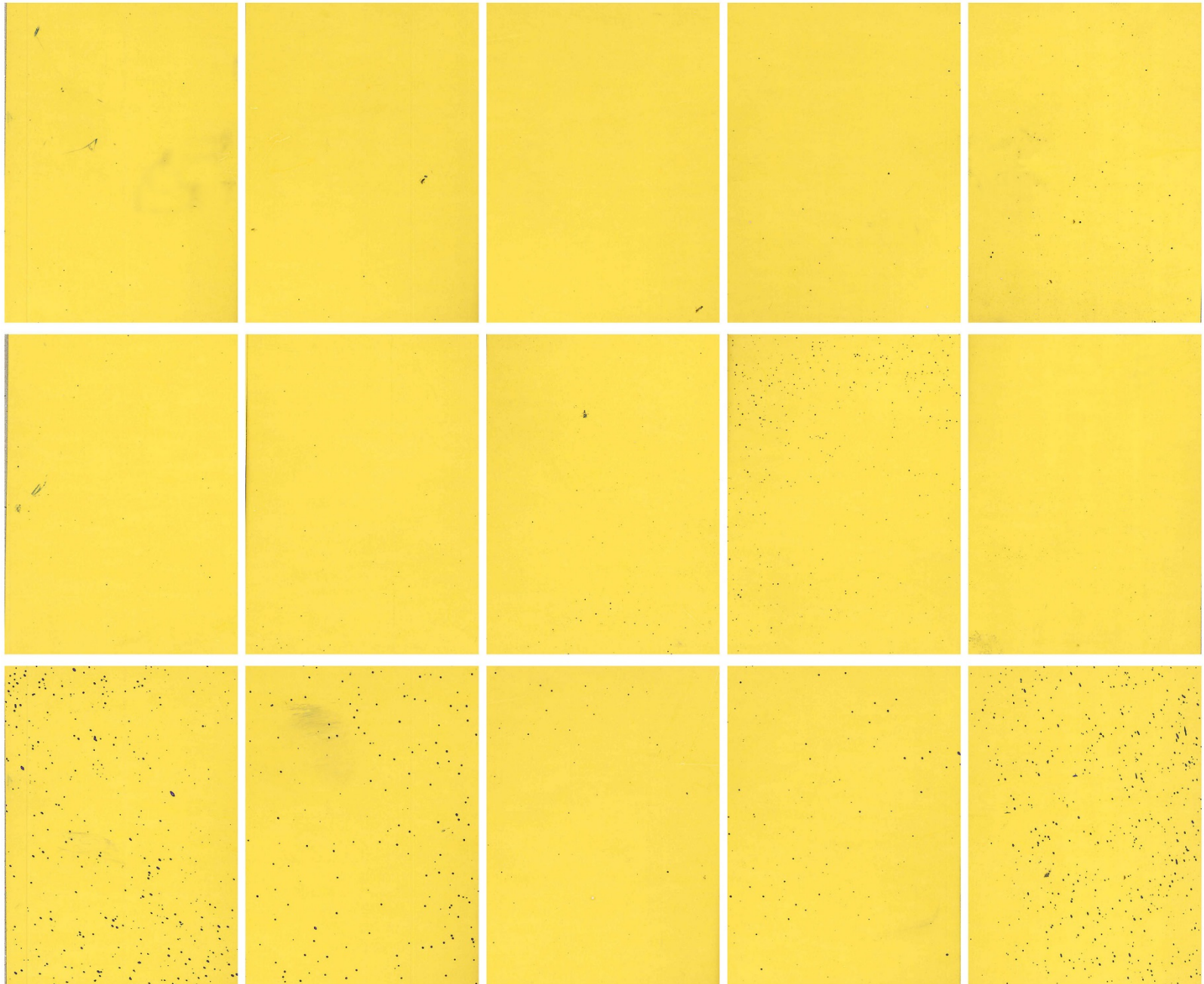


- **Drop nozzles from Kuhn Landmaschinen: 'FK 90 Plus 1' and 'FK 110 Plus 2'**



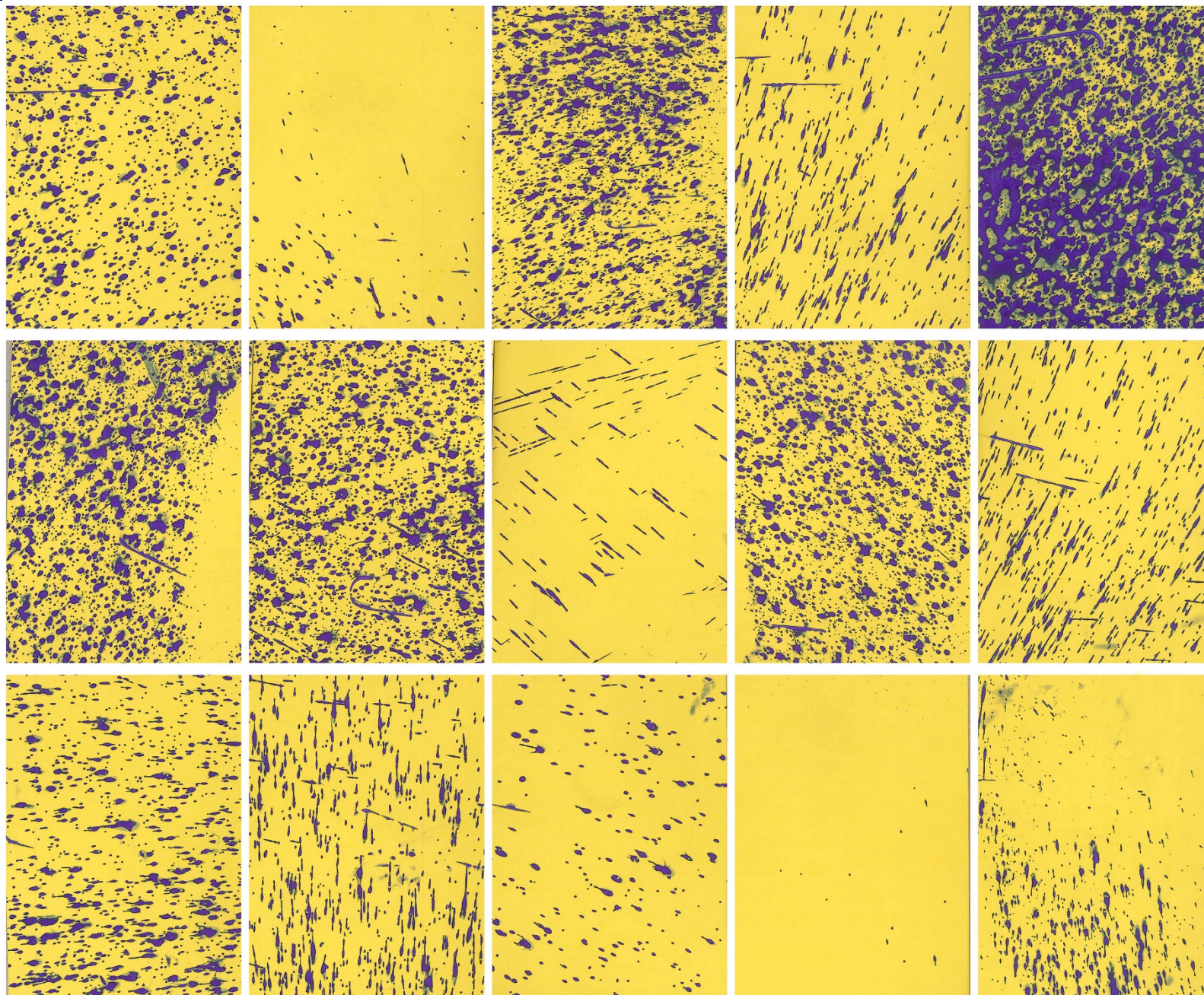


# Turbo-tee 11001 flat-fan nozzles mounted directly on boom



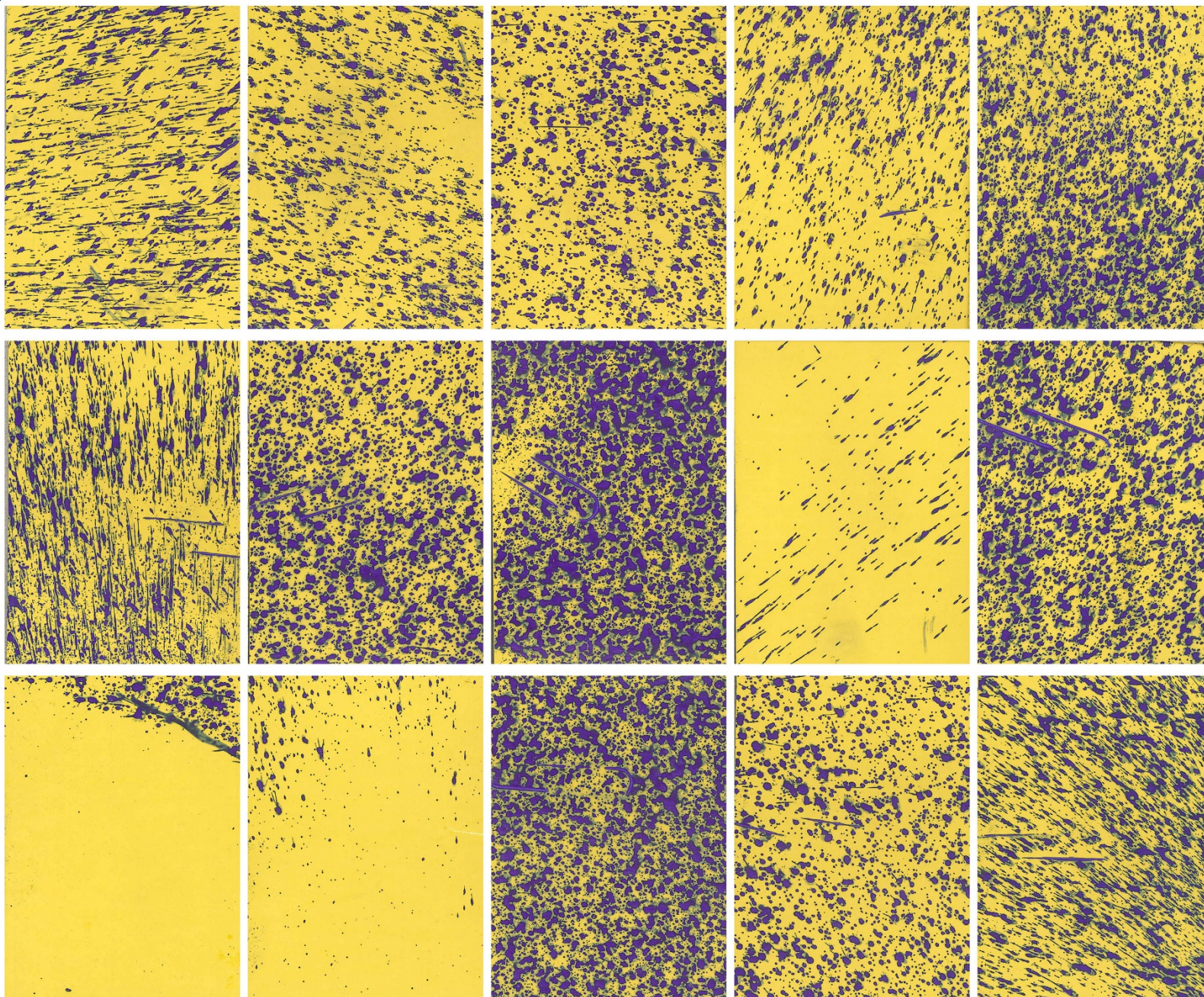


# Turbo-tee 11001 flat-fan nozzles; 360 Undercover drop-nozzle; 40 psi



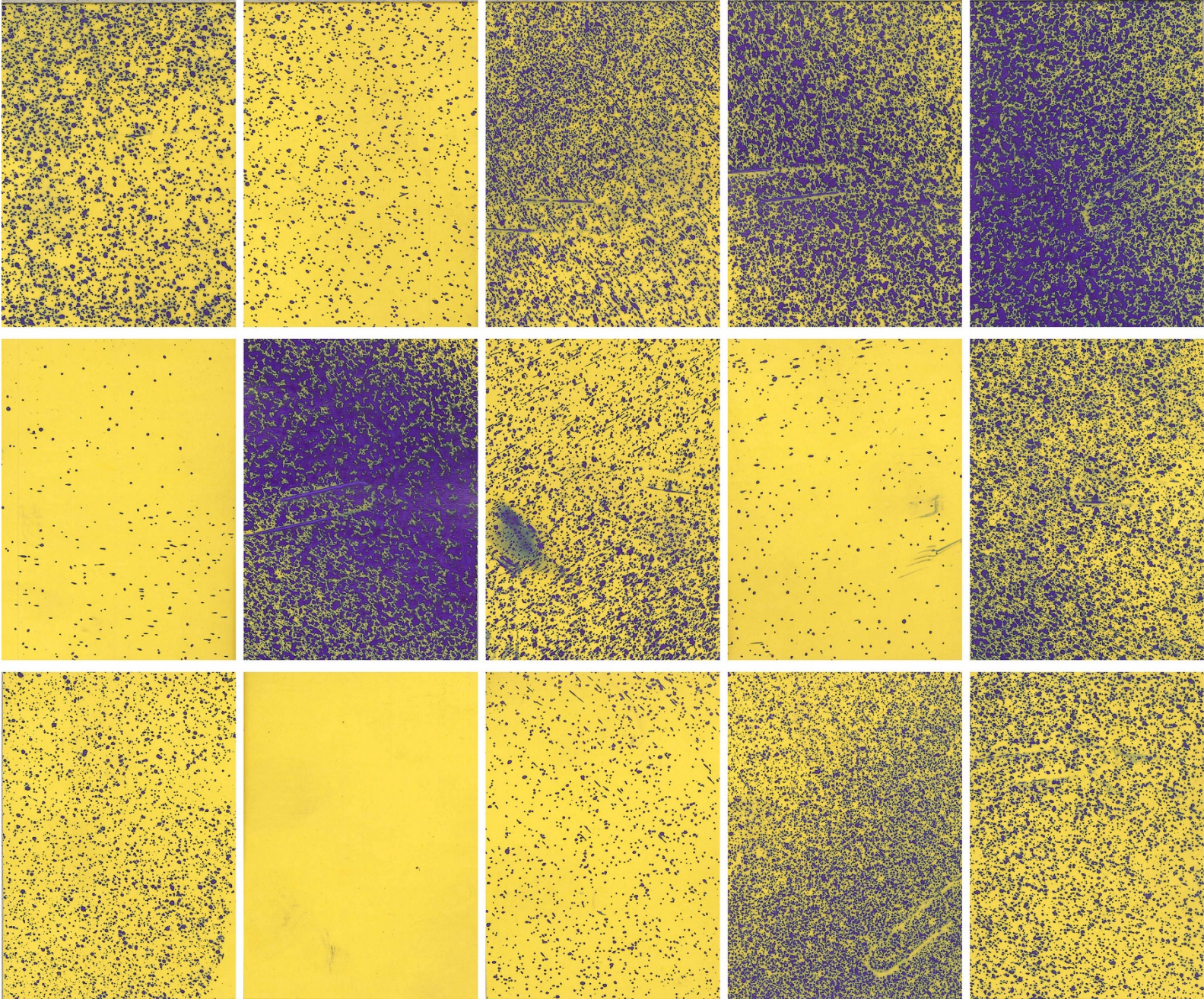


Turbo-tee 11001 flat-fan nozzles; 360 Undercover drop-nozzle; 60 psi





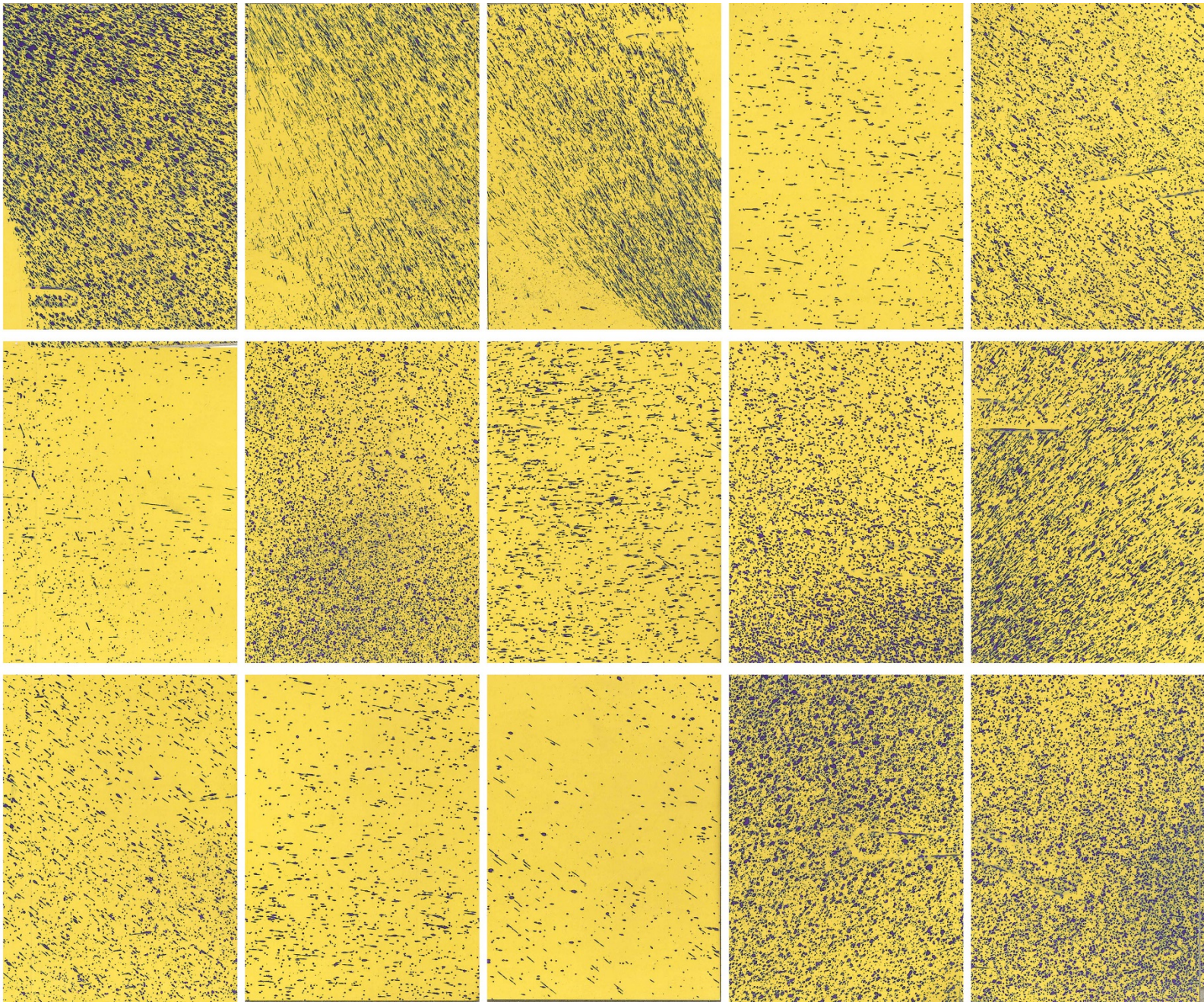
ConeJet TXR8001VK hollow-cone nozzles; **360 Undercover drop-nozzle**; 60 psi





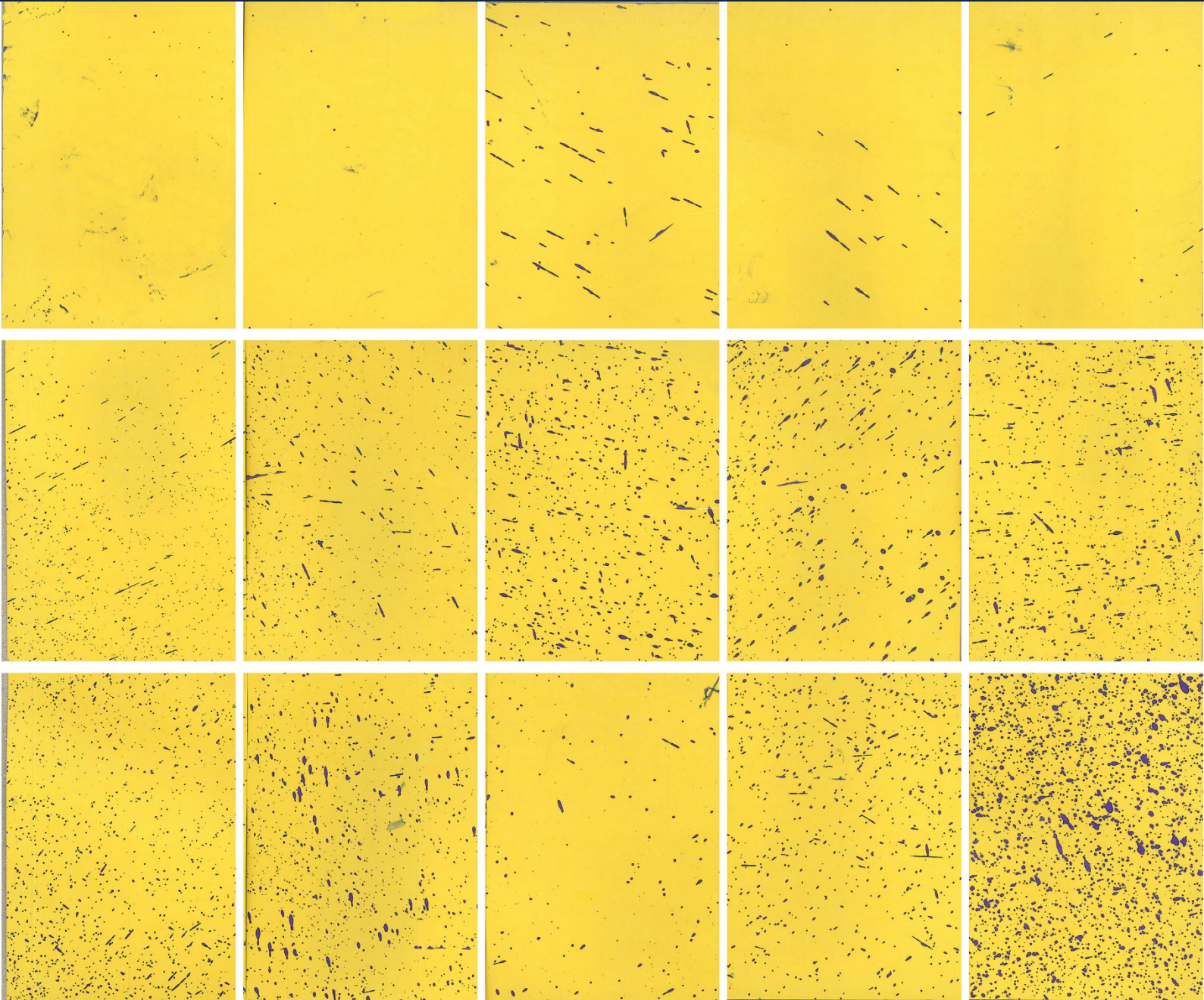
ConeJet TXR8001VK hollow-cone nozzles; **360 Undercover drop-nozzle**; 60 psi

*Sprayer driven in opposite direction*



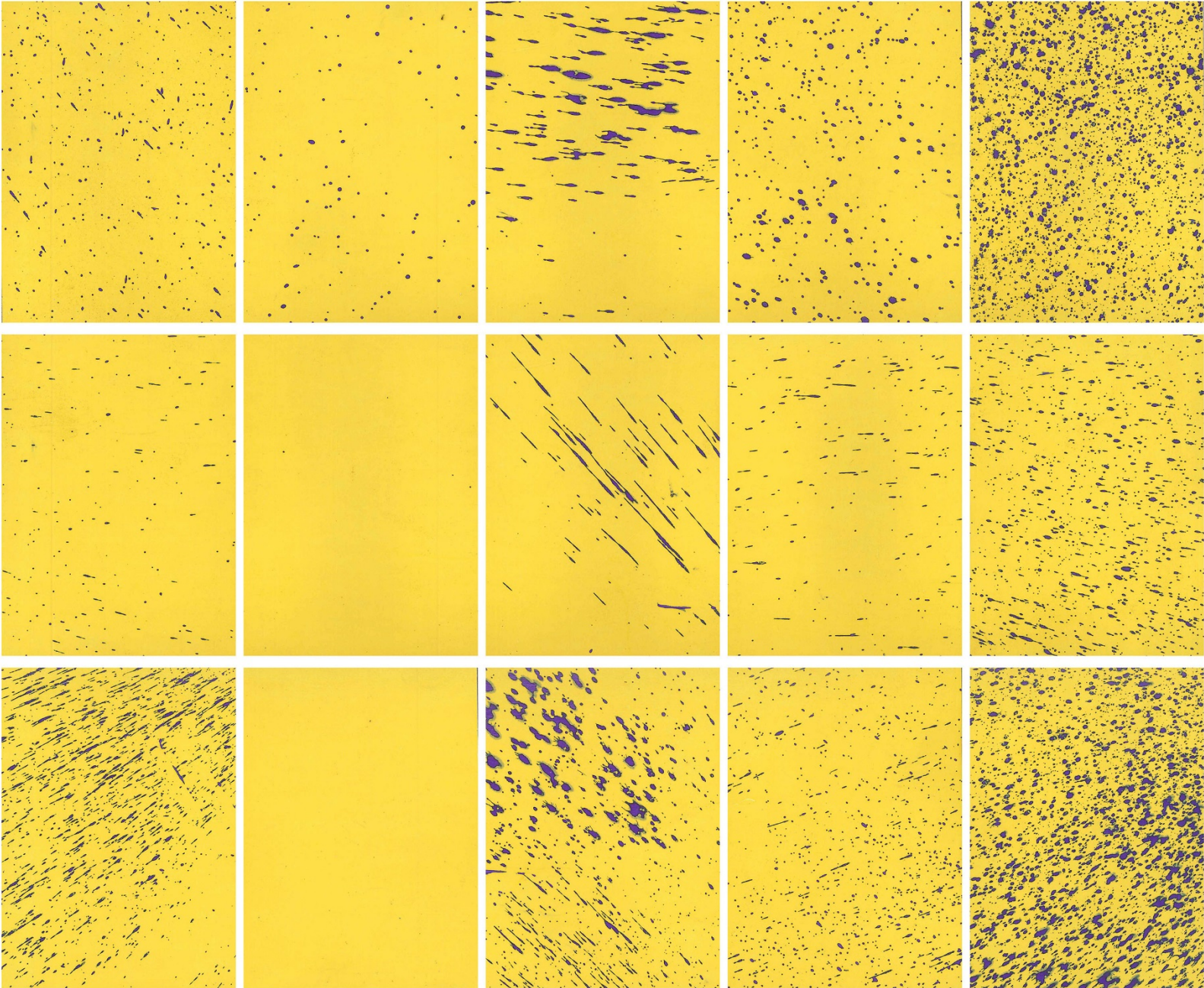


Hypro 0.5 DeflecTip flood-fan nozzles; FK90 Plus 1 drop-nozzles; 40 psi





Hypro 0.5 DeflecTip flood-fan nozzles; FK110 Plus 2 drop-nozzles; 40 psi



# CONFECTION SUNFLOWERS:

Great fungicide coverage ... **but no disease control.**

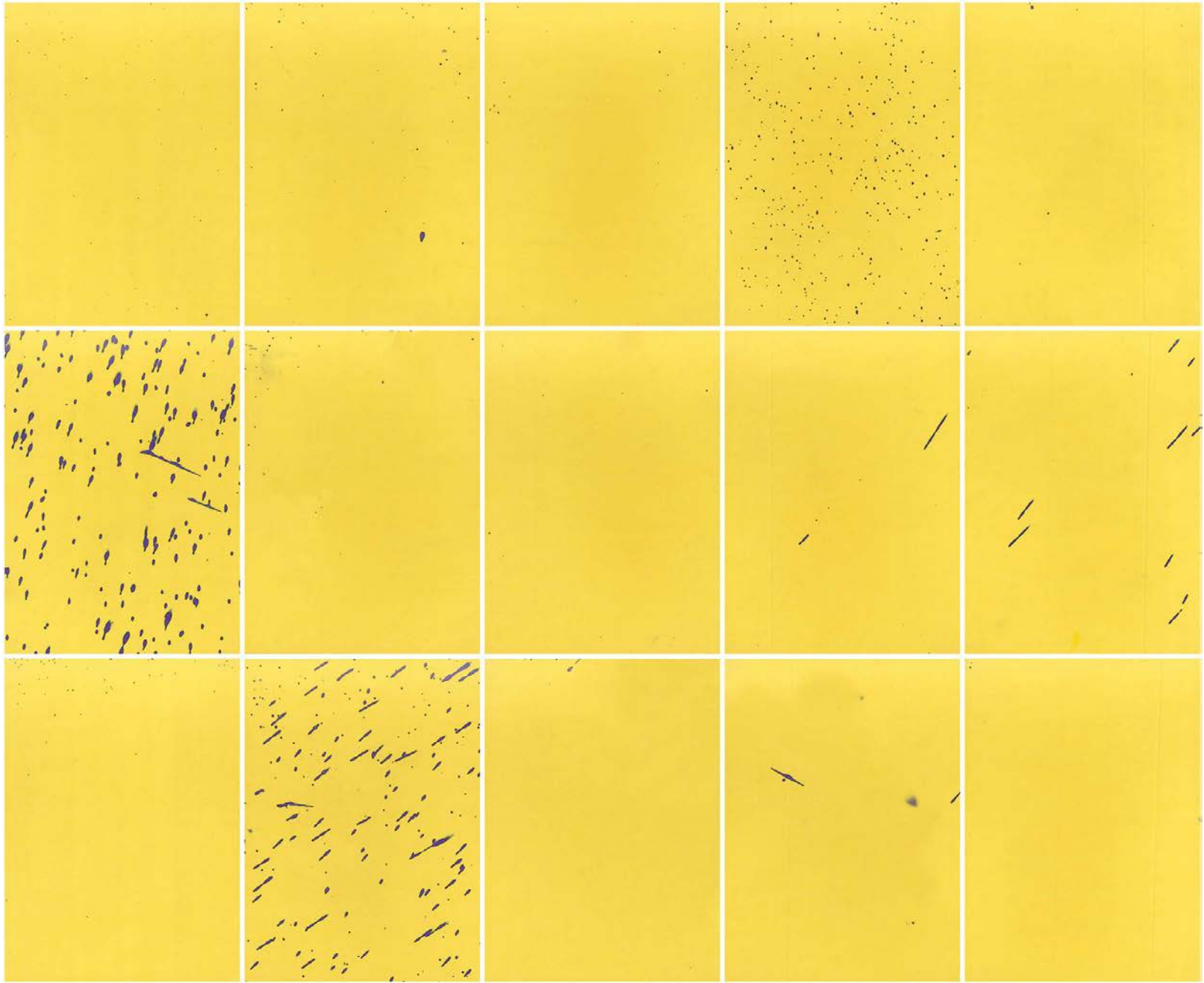
Nozzle placement	Nozzle	Pressure	Head rot incidence	Head rot sev. index	Yield	
			R8 to R9 growth stage			
			Sept. 30			
			%	%	lbs/ac	
Non-treated			36 a*	35 a*	1668 a*	
Boom (20-inch spacing)	Turbo TeeJet TT11001	40 psi	37 a	36 a	1794 a	
Side ports of '360 Undercover' drop nozzle	Turbo TeeJet TT11001	40 psi	37 a	37 a	1753 a	
Side ports of '360 Undercover' drop nozzle	Turbo TeeJet TT11001	60 psi	36 a	36 a	1719 a	
Side ports of '360 Undercover' drop nozzle	ConeJet TXR8001VK	60 psi	39 a	39 a	1666 a	
Side ports of '360 Undercover' drop nozzle	ConeJet TXR8001VK	60 psi	39 a	38 a	1716 a	
'FK 90 Plus 1' drop nozzle	30DT 0.5 DeflecTip	40 psi	41 a	40 a	1749 a	
'FK 110 Plus 2' drop nozzle	30DT 0.5 DeflecTip	40 psi	38 a	38 a	1744 a	
			<i>F</i> :	0.61	0.61	0.59
			<i>P&gt;F</i> :	0.7455	0.7455	0.7608
			<i>CV</i> :	24.9	25.0	14.7

## Methods

- **Oilseed hybrid:** Croplan '305 NS DMR'
- Planted June 4; overseeded and manually thinned to 21,000 plants/ac
- **Fungicide applied:** Endura (boscalid) at 8 oz/ac
- **Water volume,** fungicide applications: 20 gal/ac
- **Fungicide application timing:** Approx. 80% of plants with an open blossom and an average of 30% of disk flowers blooming or already completed bloom
- **Four inoculation treatments:** Non-inoculated, early bloom, mid-bloom, late bloom. **Five replications.** Plots 5 ft x 25 ft.
- **DUE TO A SEVERE WIND STORM – No yield data.** Disease data only from plots with at least 13 plants that remained standing.

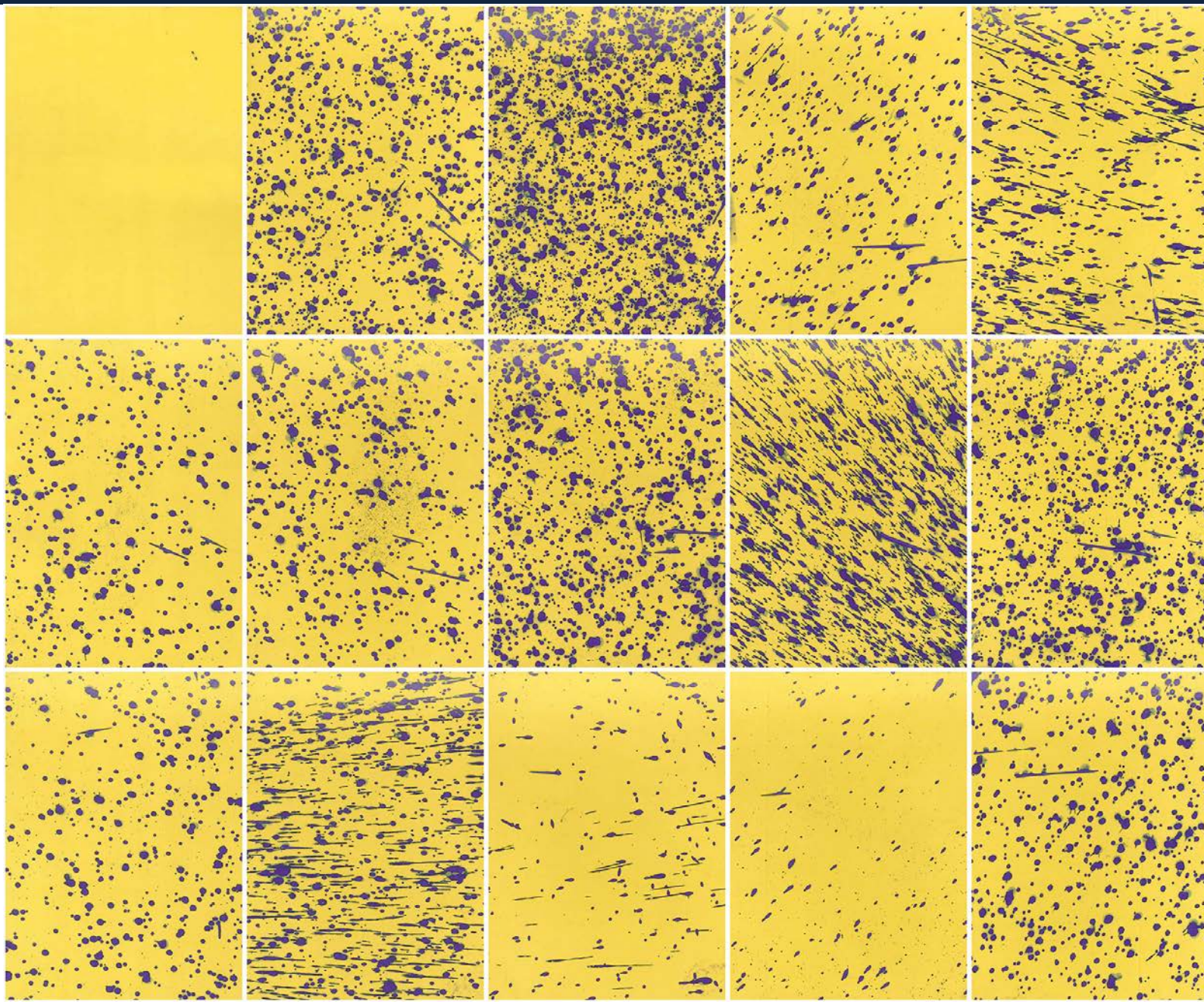


# Turbo-tee 11001 flat-fan nozzles mounted directly on boom



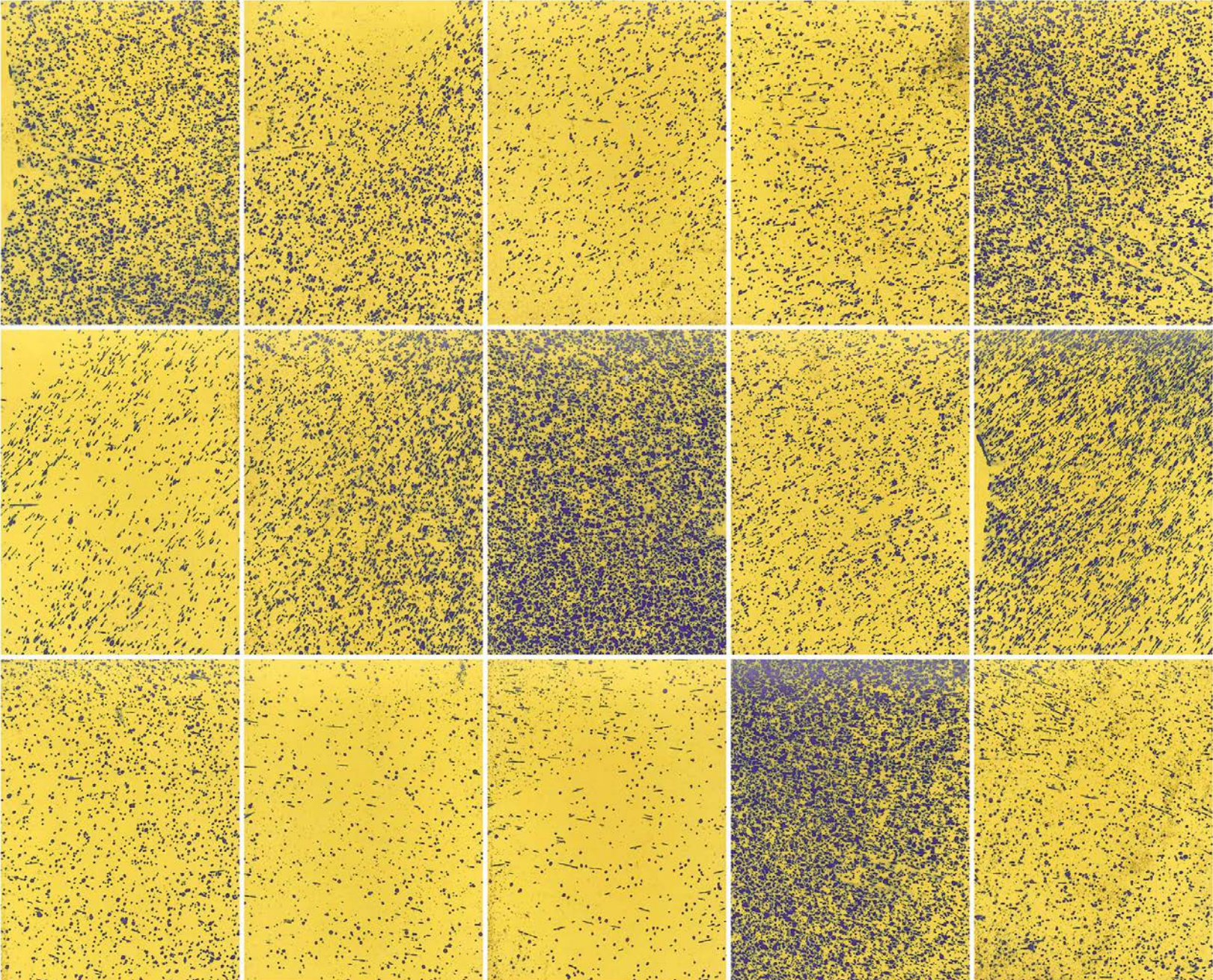


Turbo-tee 11001 flat-fan nozzles; **360 Undercover drop-nozzle**; 40 psi





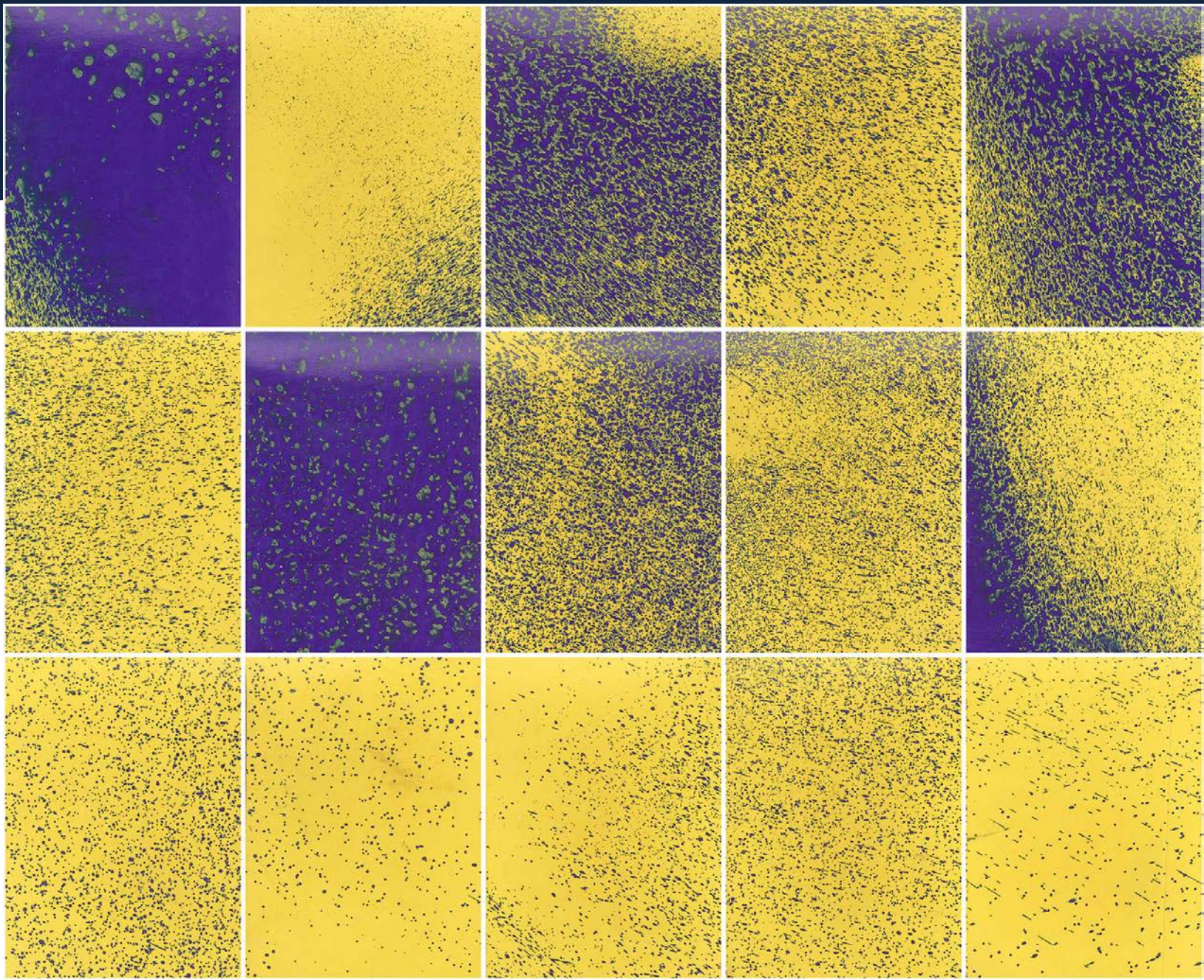
ConeJet TXR8001VK hollow-cone nozzles; **360 Undercover drop-nozzle**; 60 psi





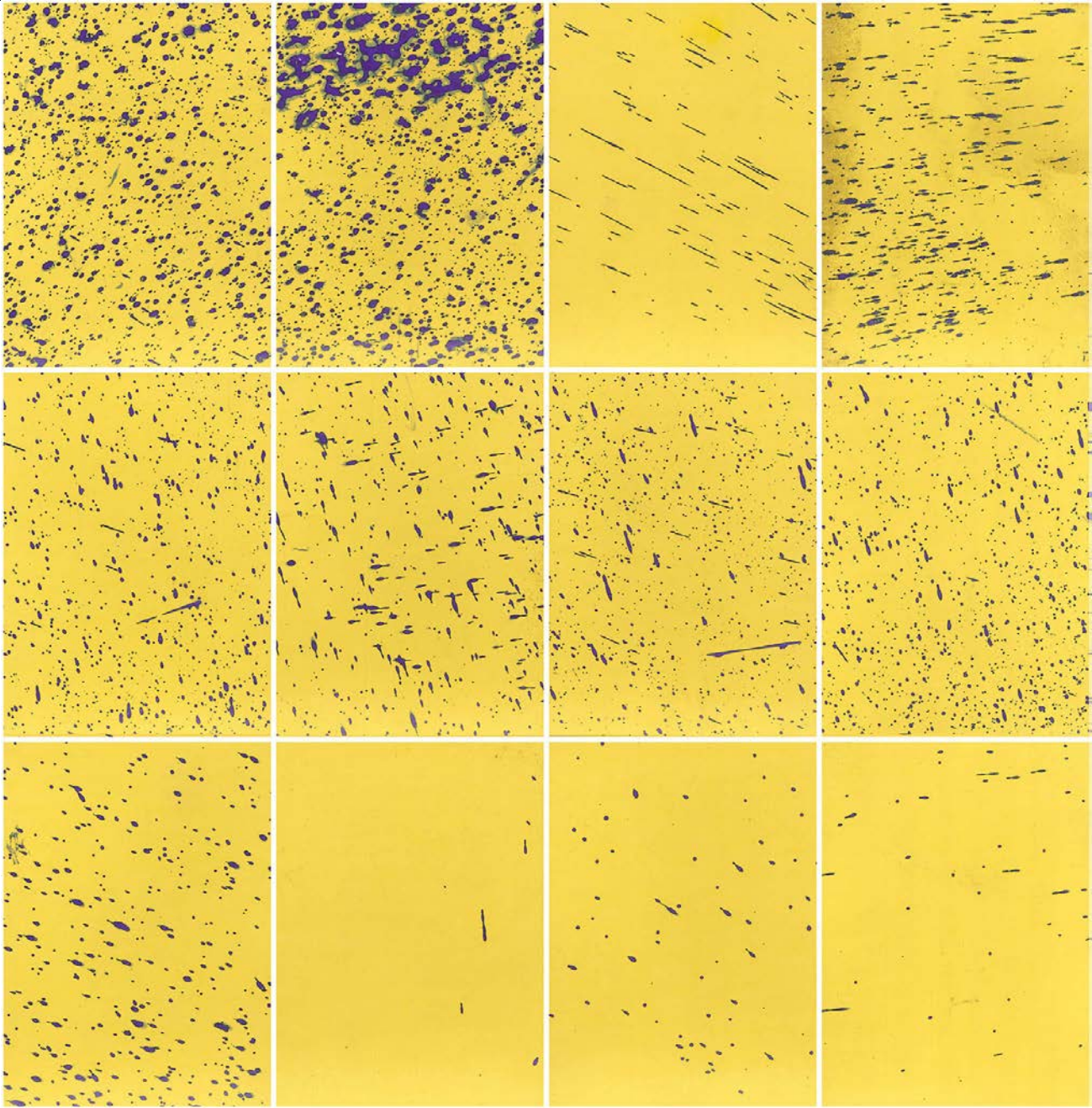
# ConeJet TXR8001VK hollow-cone nozzles; **360 Undercover drop-nozzle**; 60 psi

*Sprayer  
driven in  
opposite  
direction*





Hypro 0.5 DeflecTip flood-fan nozzles; **FK90 Plus 1** drop-nozzles; 40 psi



# OILSEED SUNFLOWERS:

Great fungicide coverage ... **but no disease control.**

Nozzle placement	Nozzle	Pressure	Head rot incidence	Head rot sev. index	
			Oct. 14   R9 growth stage %	%	
Non-treated			29 a*	28 a*	
Boom (20-inch spacing)	Turbo TeeJet TT11001	40 psi	22 a	22 a	
Side ports of '360 Undercover' drop nozzle	Turbo TeeJet TT11001	40 psi	27 a	27 a	
Side ports of '360 Undercover' drop nozzle	ConeJet TXR8001VK	60 psi	28 a	28 a	
Side ports of '360 Undercover' drop nozzle	ConeJet TXR8001VK	60 psi	25 a	24 a	
'FK 90 Plus 1' drop nozzle	30DT 0.5 DeflecTip	40 psi	26 a	24 a	
			<i>F</i> :	0.81	0.83
			<i>P&gt;F</i> :	0.5451	0.5306
			<i>CV</i> :	42.8	43.1



## Conclusions

- **Very disappointing disease control results**
- **Very exciting fungicide coverage results**

Questions that must be addressed to develop fungicides as a tool for managing Sclerotinia head rot of sunflowers:

- (1) How do we achieve satisfactory fungicide coverage?**
- (2) What is the optimal fungicide application timing?**
- (3) Which fungicides are most effective?**



Thank you!



This research was made possible by financial support from  
the **confection growers of the National Sunflower Association**  
and the **BASF Corporation**