

An Evaluation of the VeriRate Nozzle

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Outline

- Background
- Objectives
- Testing Procedure
- Results and Discussion
- Conclusions

Background on Variable Rate Nozzles

- Variable-rate ground application systems have been around for about 15 years
- Conventional aerial nozzles not appropriate
 - A 2X change in rate requires a 4X change in pressure
 - Droplet size changes dramatically with pressure

Background on Variable Rate Nozzles

- Aerial variable-rate systems more challenging
 - High application speeds
 - High flow requirements
 - Aerodynamic considerations

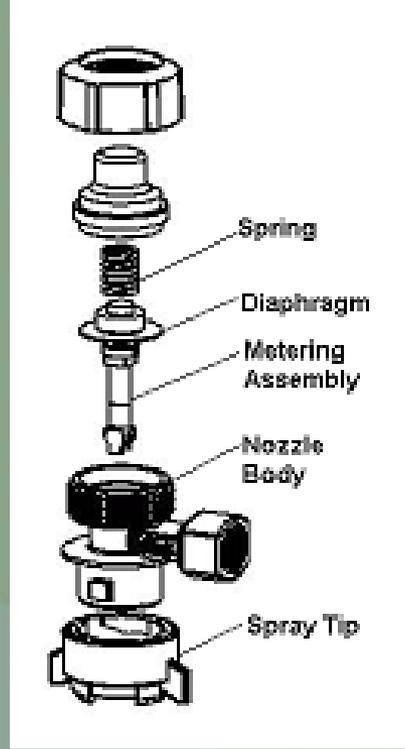
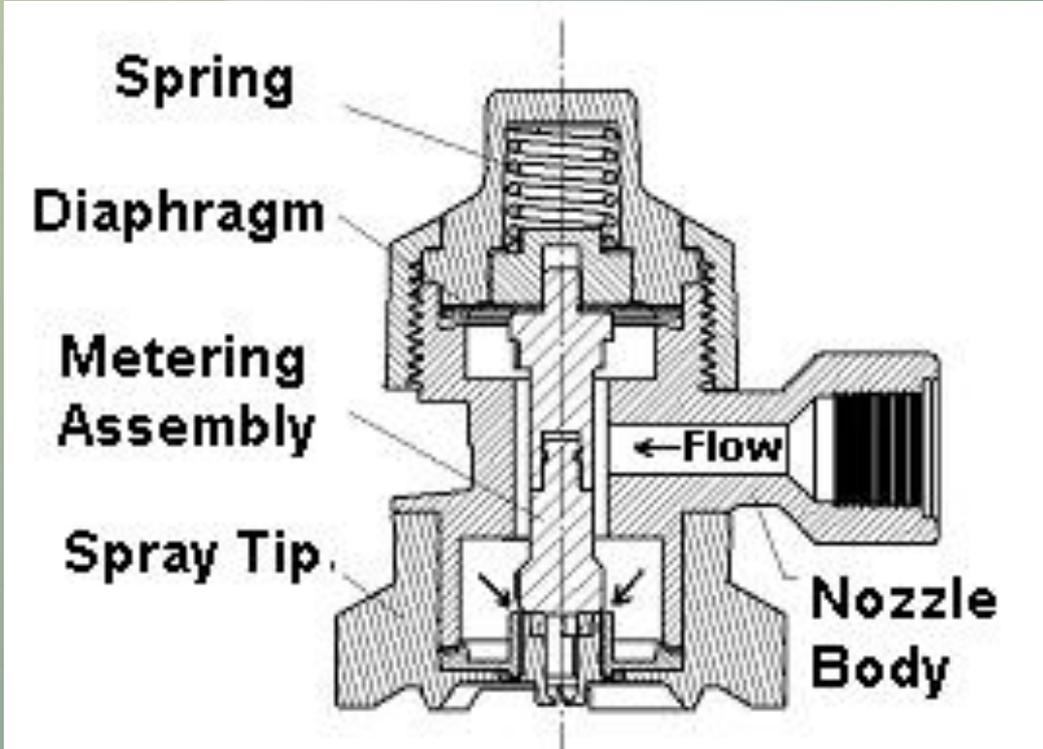
- In 2006, Spray Target, Inc. released the VeriRate aerial nozzle

- Little to no information on performance

Objective

- Measure and document the flow and variability of a full set of different VeriRate variable-rate aerial nozzles at constant pressures ranging from 30-70 psi.

VeriRate Nozzle Function



Testing Procedure

- 48 VeriRate nozzles from manufacturer



Testing Procedure

- Nozzles mounted one at a time on full-size aerial boom



Testing Procedure

- Boom pressure monitored with glycerin-filled pressure gauge



Testing Procedure

- Air purged from end of boom before test



Testing Procedure

- Used custom spray tank and pump system



Testing Procedure

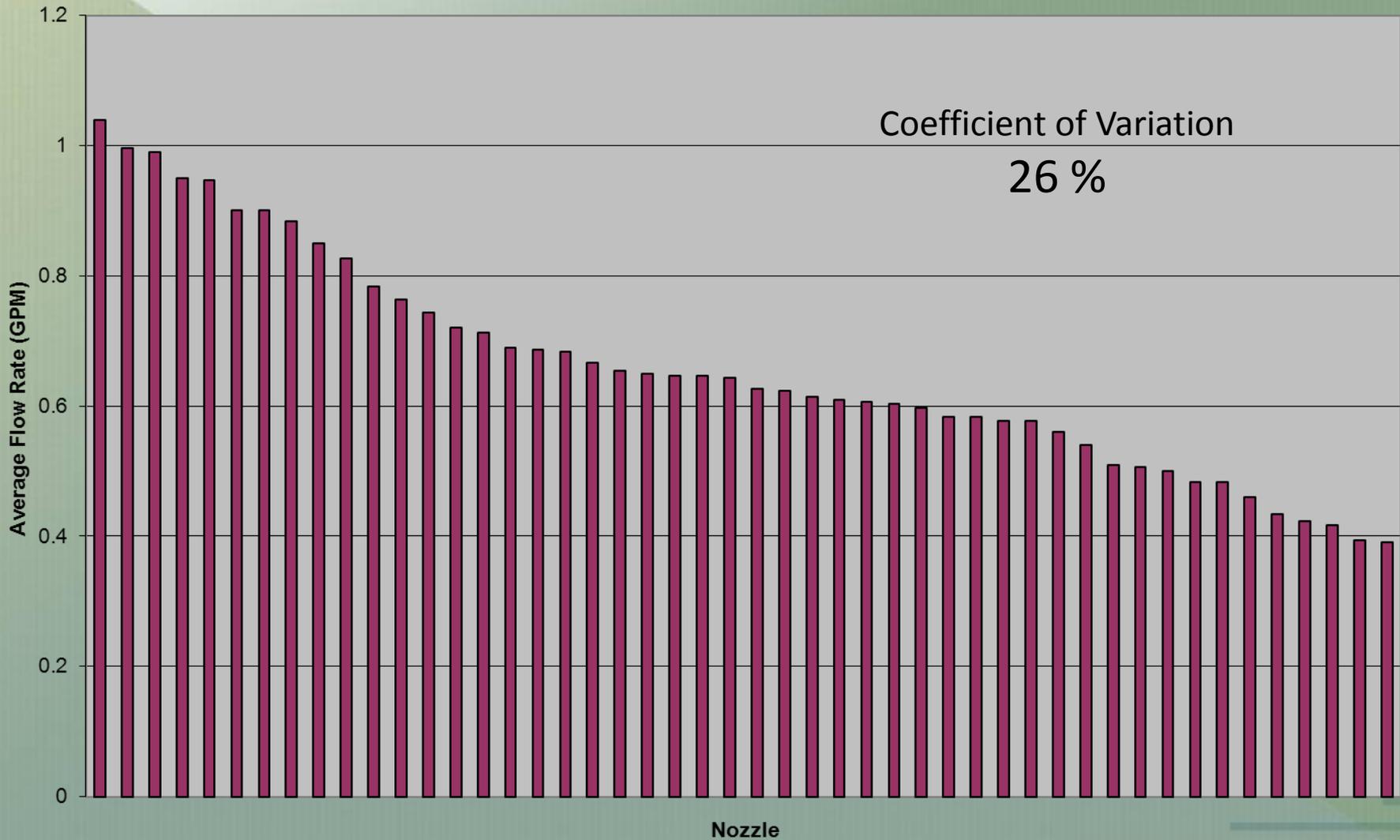
- Digital flowmeter used to measure flowrate



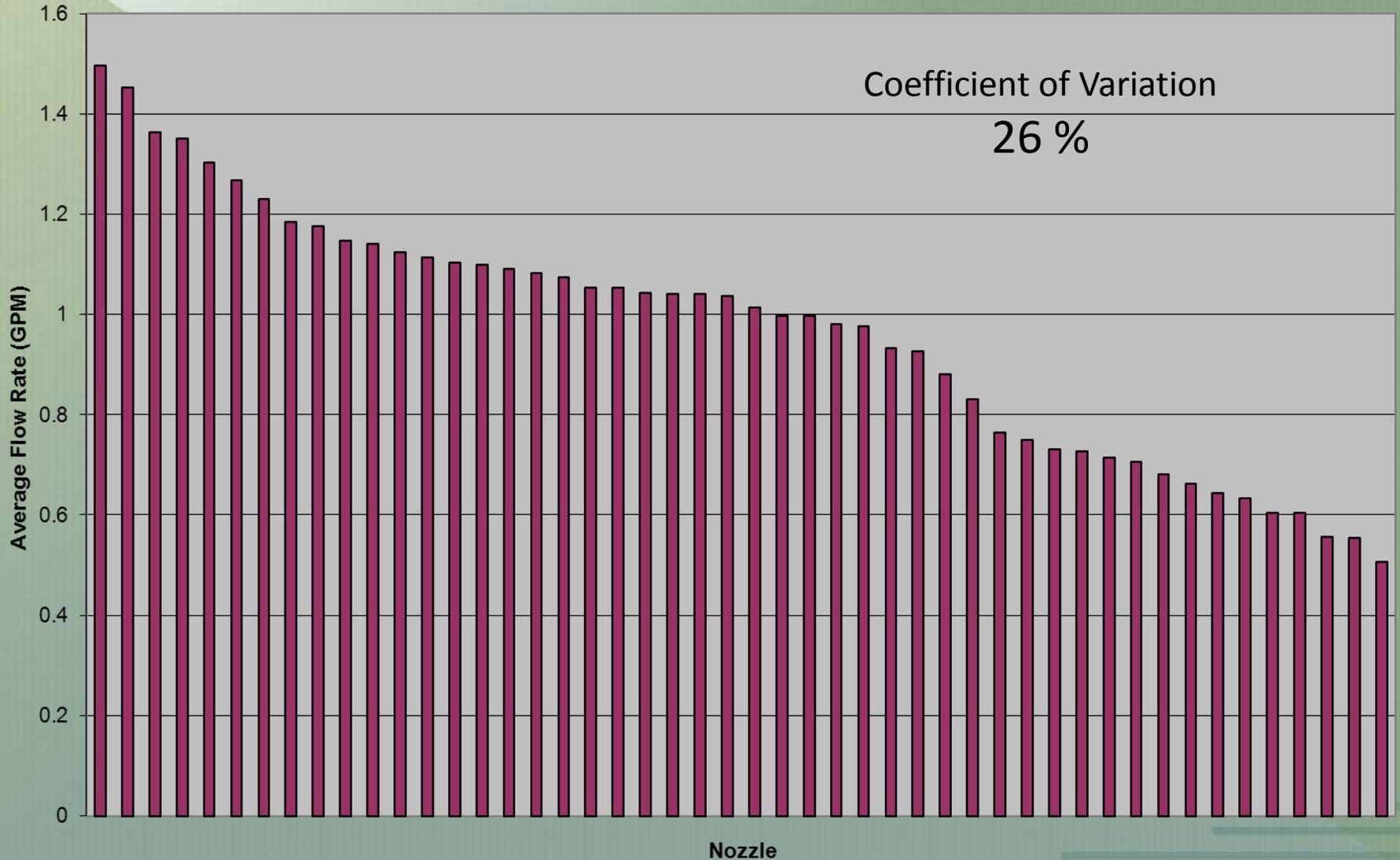
Experimental Design

- 48 nozzles
- 5 pressure levels (30, 40, 50, 60, 70 psi)
- 3 reps

VeriRate Nozzle Flow Rate Study - 30 PSI

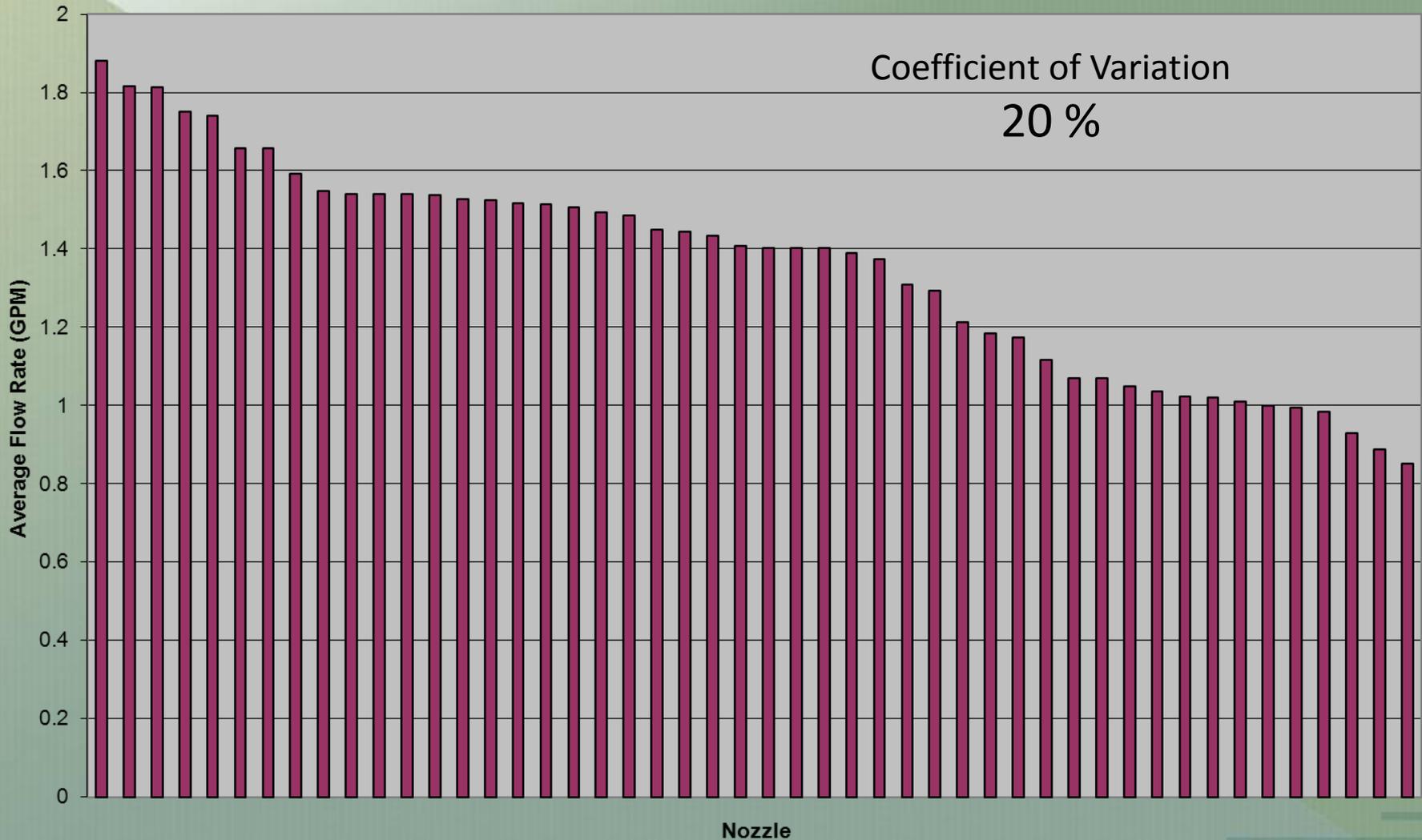


VeriRate Nozzle Flow Rate Study - 40 PSI



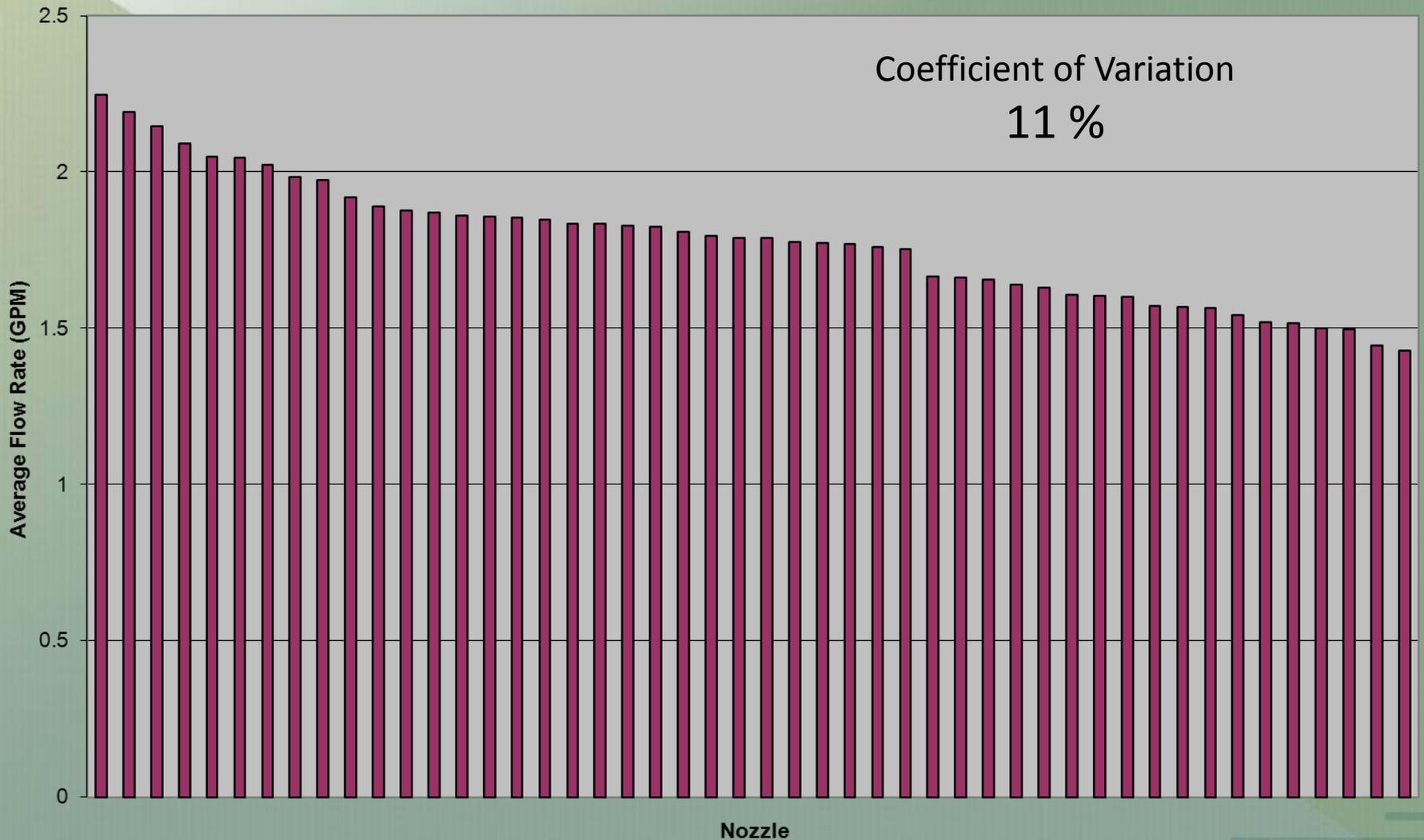
Results

VeriRate Nozzle Flow Rate Study - 50 PSI



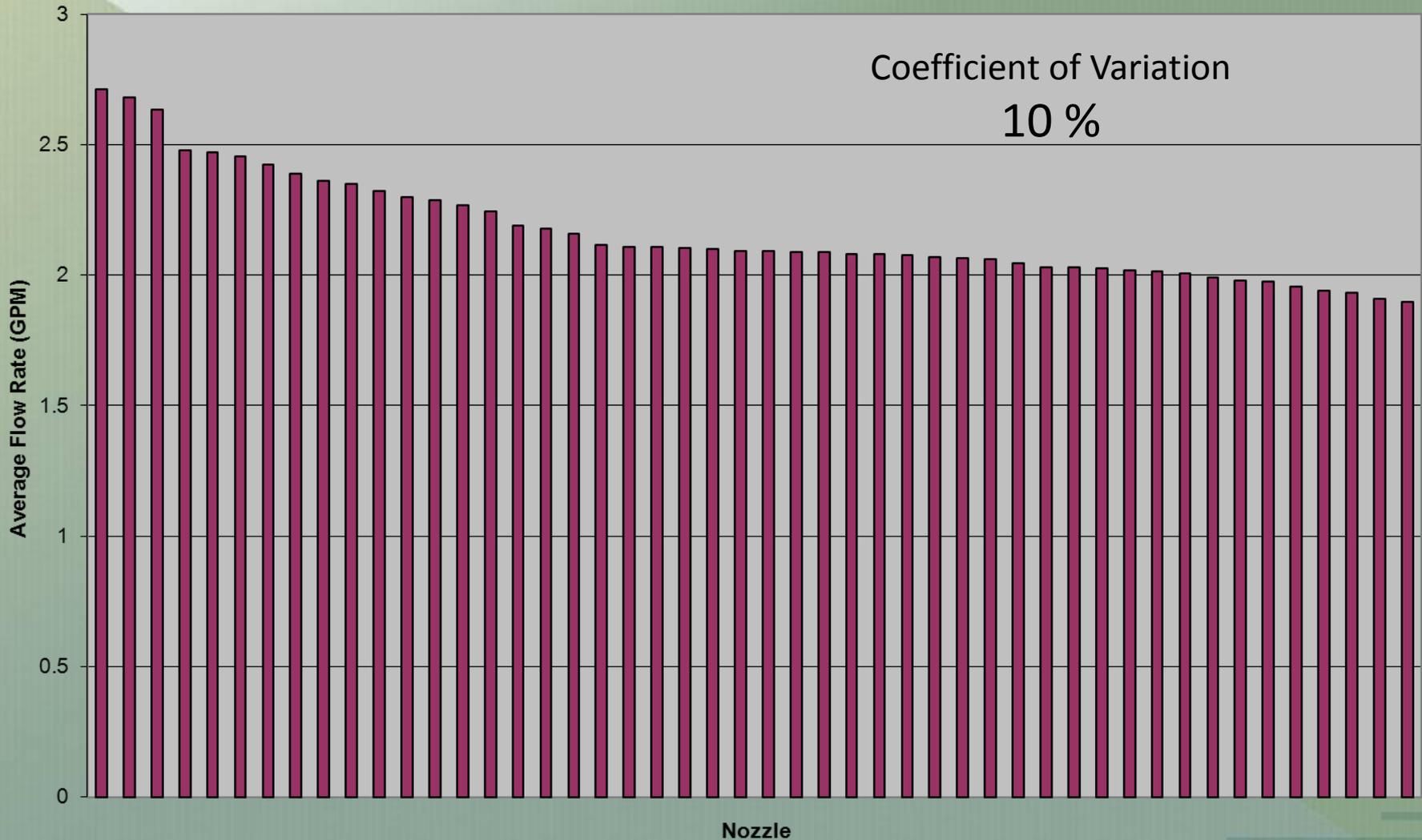
Results

VeriRate Nozzle Flow Rate Study - 60 PSI



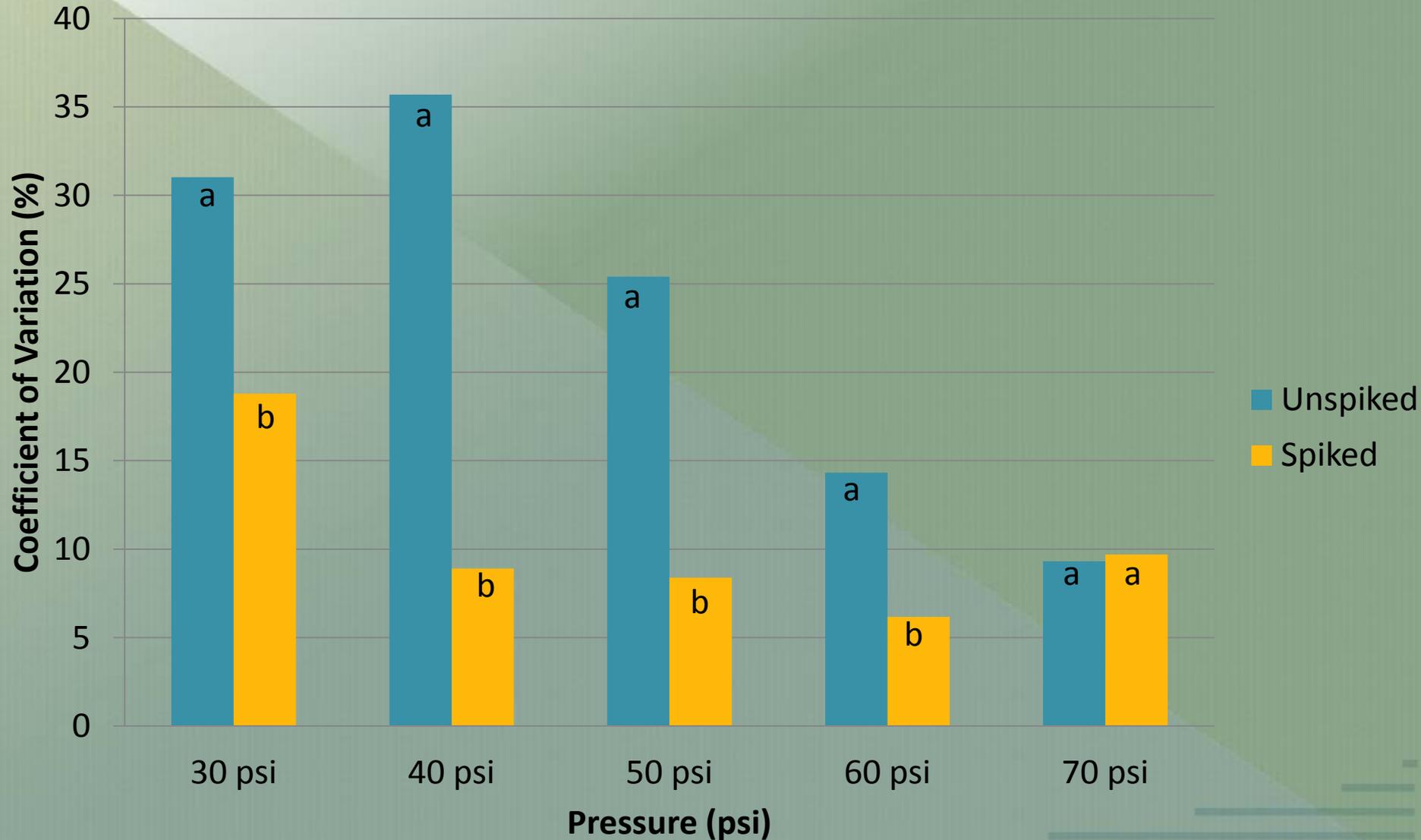
Results

VeriRate Nozzle Flow Rate Study - 70 PSI



Results

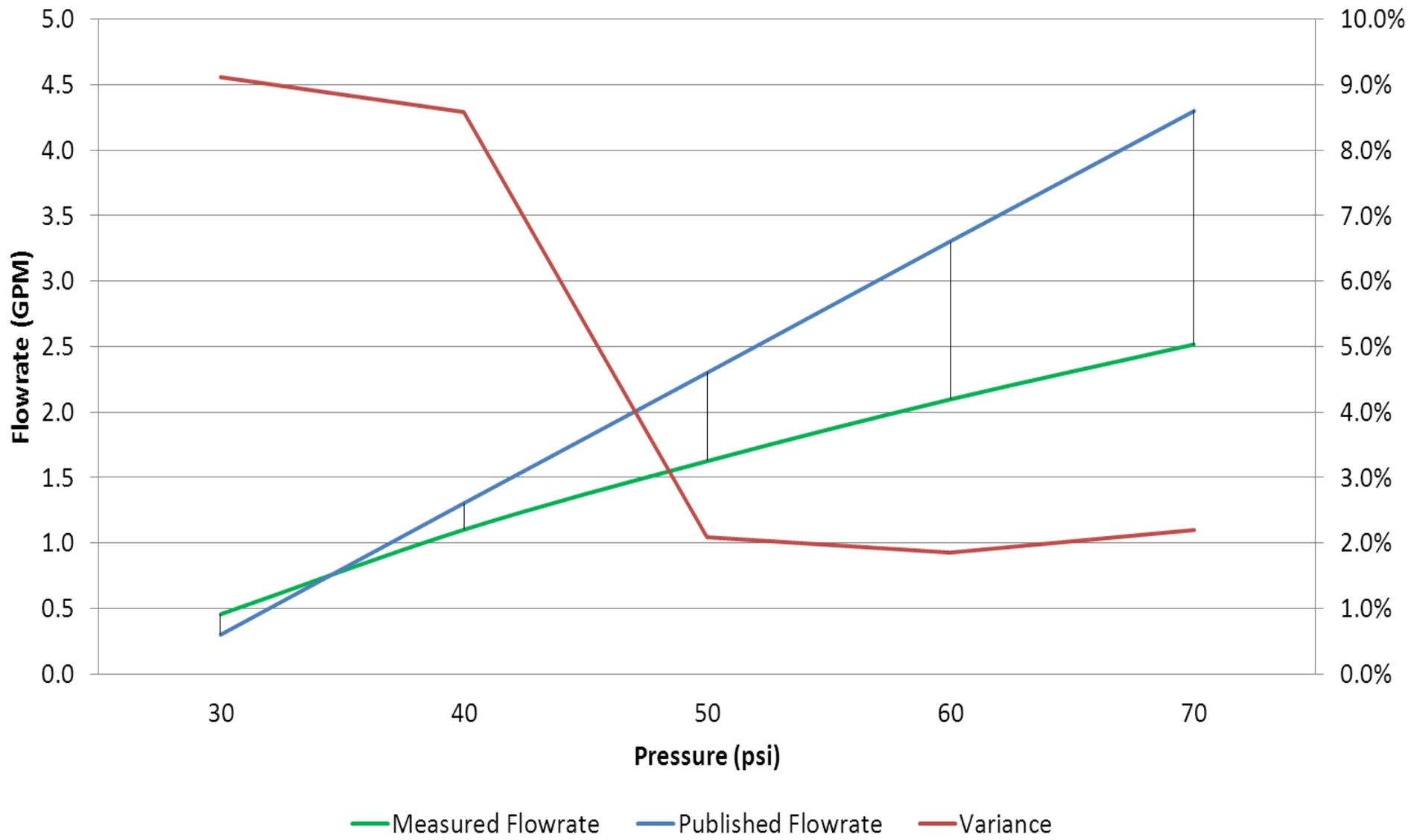
Effect of Spiking Nozzle Pressure on Flow Variability



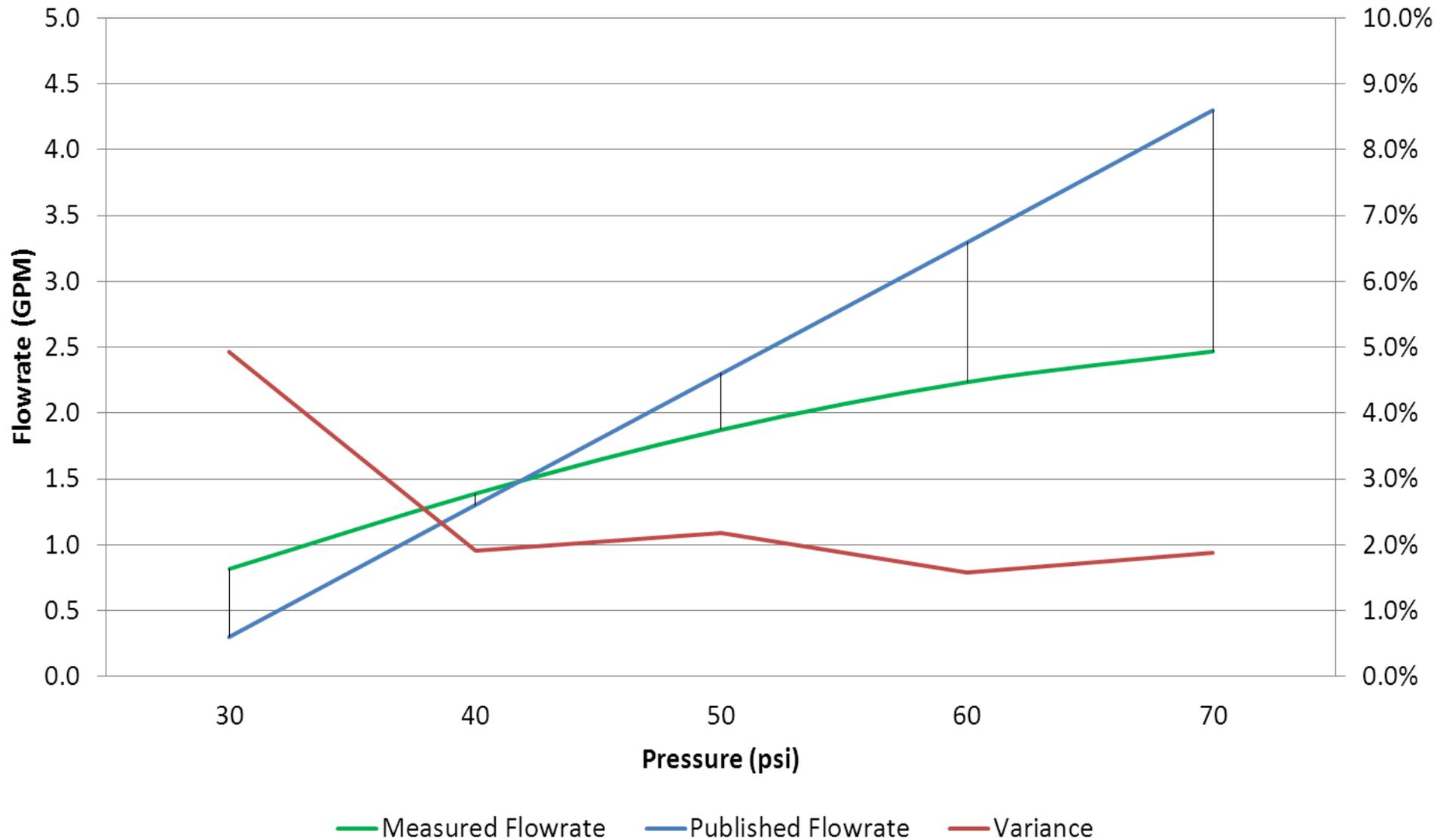
How to resolve?

- Contacted Spray Target
- Informed that original nozzle had been redesigned
- Purchased 6 new nozzles from distributor
- Tested new nozzles
 - Spray weighed instead of using flowmeter

Newly Designed VeriRate Nozzle Study Cold Start

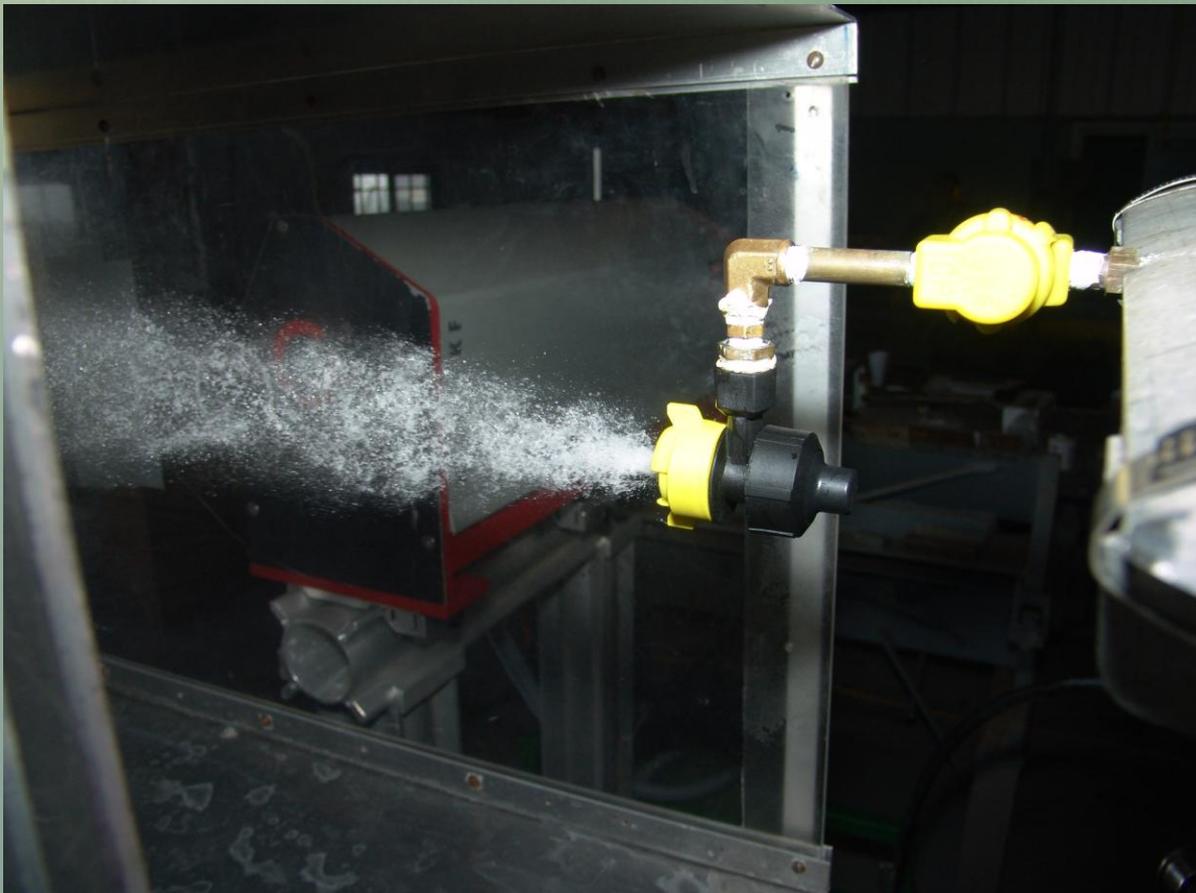


Newly Designed VeriRate Nozzle Study Hot Start

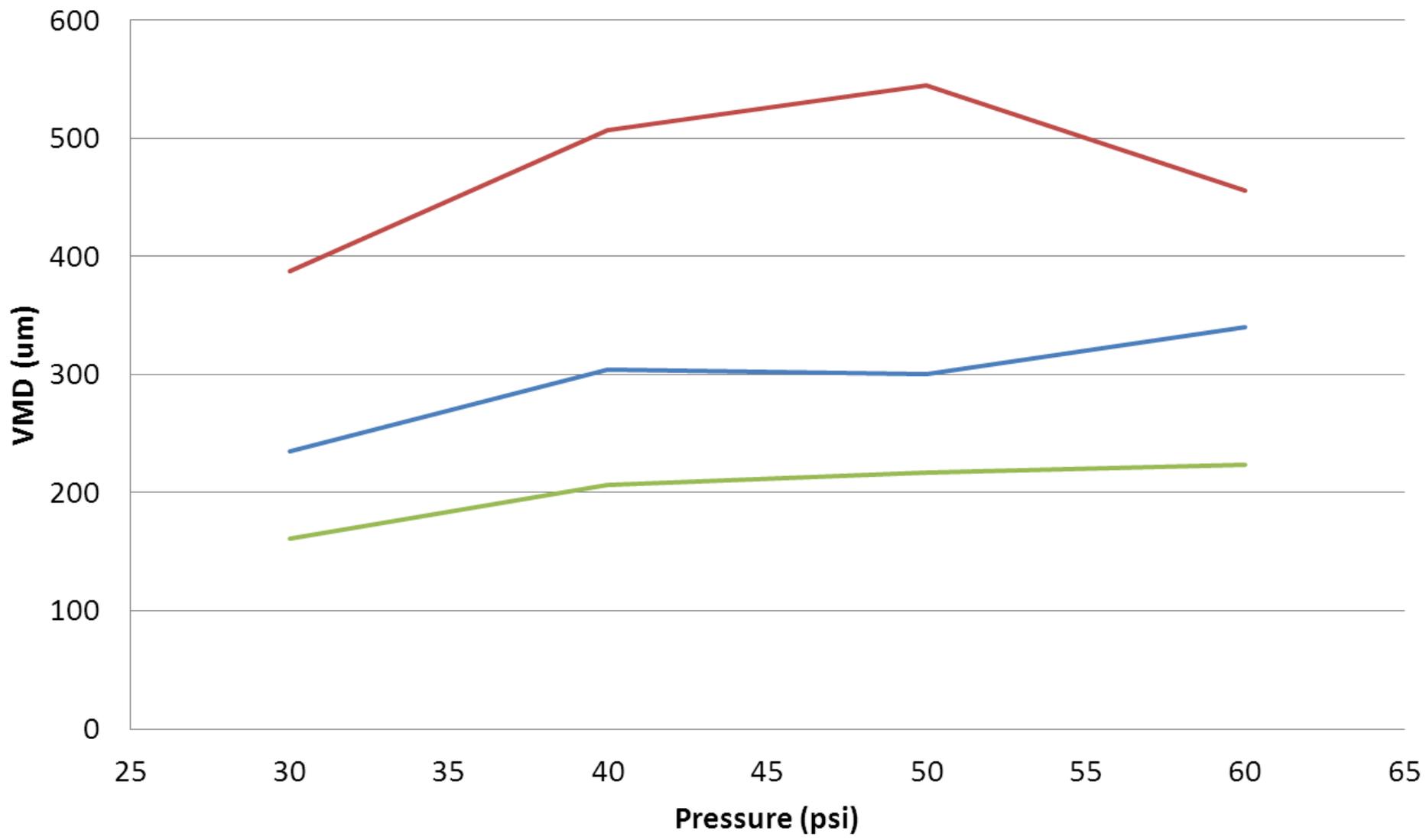


What about Droplet Size?

- Windtunnel Laser Study



Effect of Pressure on Droplet Size



— 100 MPH — 130 MPH — 160 MPH

Conclusions

- The VeriRate variable-rate aerial nozzle fills a void in the aerial application industry.
- It can achieve a 5X+ flowrate change by changing pressure alone.
- However, in order to achieve acceptable flow variability between nozzles, the old nozzles first must be “spiked” to 70 psi.
- The new design eliminates excessive flow variability.

Conclusions

- Changes in pressure only nominally change droplet size.
- Aerial applicators can use this nozzle to make variable-rate applications or multiple constant rate applications.