Nozzle Selection and Effective Fungicide Placement at Two Application Volumes

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INTRODUCTION

The research was initiated to try to address concerns about droplet/product penetration into the soybean canopy. With widely variable systemic properties among the soybean rust fungicides and the likelihood that soybean rust will first develop in the lower canopy, droplet penetration and distribution may be significant issues. While that may be the case, there will likely also be an interaction with specific products. For example, immobile or products with lesser systemic/plant movement capabilities would be better paired with application technologies that optimize coverage and canopy penetration. Conversely, products that move broadly and quickly in the plant may be more forgiving and not require such extension coverage. These studies were initiated to compare the performance of several droplet sizes and commonly used nozzles. In one study, spray volume is held constant at 10 gpa while ground speed is used to maintain volume applied as the nozzle orifice is changed. In the other study, all applications are made at 20 gpa with a constant pressure. In several cases dual orifice nozzles are used.

MATERIALS & METHODS

- Two locations on university research farms at Beresford, SD and at Mead, NE with soybean fields planted in 30 inch (118 cm) rows.
- 30 X 50ft plots were treated at approximately R3 (75% canopy) and again at approximately R5 (90-100% canopy) with Quadris (azoxystrobin) at 6.4 fl oz (467.5 ml/ha) plus crop oil (1% v/v) mixed with 96 fl oz/100 gallons Vision Pink foam marker dye (Elanco, Inc.).
- Twelve different nozzle x pressure configurations were used in each study (six nozzle configurations at two pressures) with application speed adjusted to obtain desired application rate.
- Surface spray coverage was measured on 2 x 3 inch (5.08 x 7.62 cm) white glossy paper cards (Kromecot 2 SOS cardstock).
- Cards were clipped to aluminum trays and placed among the leaves at the widest portion of the crop canopy, which occurred at approximately 2/3 of the plant height.
- Spray coverage, Volume Median Diameter (VMD), and number of droplets per card were analyzed digitally using DropletScan software (Devore Systems).
- Statistical design was a randomized complete block with four replications at each location and treatment date.
- Statistical analysis completed using ARM Software (Gylling Data Management, Brookings, SD).

Study 1 Design

- Applications were made at 10 gpa (93.5 l/ha) carrier volume.
- Six different single orifice nozzles, including flat fan, Turbo TeeJet and Air Induction nozzles were used.
- Nozzles were oriented straight down. The Turbo TeeJet nozzle resulted in a spray pattern being slanted 15° forward, due to nozzle design.
- Two application pressures- 50 psi (345 kPa) and 75 psi (517 kPa) were used for each nozzle tested.
- Application speed was varied to adjust total application to 10 gpa (93.5 l/ha).

Study 2 Design

- Applications were made at 20 gpa (187 l/ha) carrier volume.
- Three single orifice and nine dual-orifice or dual nozzle configurations were tested.
- Single orifice nozzles included two TurboTeejet nozzles, oriented straight down (15° forward) and Hypro ULD 120 flat fan nozzles.
- Twin orifice nozzles were TwinJet nozzles, providing a 60° angle between the fans (30° forward and 30° back). Two nozzle configurations used either the Hypro TwinCap (60° between nozzle bodies) or the TeeJet Duo body (90° between nozzle bodies).
- Turbo TeeJet nozzles in these bodies were oriented to angle the spray fan "inward", producing two fans 30° apart (TwinCap) or 60° apart (Duo body). The Hypro ULD 120 flat fan nozzle was used in the TwinCap, producing a 60° angle between the spray fans.
- All treatments were run at 50 psi (345 kPa), with the exception of the Hypro ULD 120 treatments, which were run at 80 psi (552 kPa).
- Application speed was again adjusted to maintain the desired application rate of 20 gpa (187 l/ha).

RESULTS AND DISCUSSION

- Nozzles performed in the expected range expected for the nozzle VMD at each pressure.
- While VMD remained similar between sites, there were dramatic differences in Study 1 for coverage and droplet number, particularly at the later spray date. This may be due to variation by site in canopy volume or card placement. The canopy was very large and dense in South Dakota and less so in Nebraska.
- Clearly canopy at late season spray dates can dramatically affect coverage, particularly due to the loss of fine droplets (data not shown), which supports the premise that a medium quality droplet offers the best trade off between drift reduction and coverage.