Influence of Application Volume and Droplet Size on Spray Penetration into Peanut Canopy

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Introduction

• Peanut production in Southeast United States greatly affected by diseases and pests

• Heavily rely on use of pesticides

• Timely and effective pesticide application is critical

Late Leaf Spot in Peanut

Thrips attack in Peanut

Palmer Amaranth in Peanut
# Spray Application Parameters

## Nozzle Selection

### XRC

![XRC Nozzle Image]

### AIXR

![AIXR Nozzle Image]

### TTI

![TTI Nozzle Image]

## Droplet Size

<table>
<thead>
<tr>
<th>Category</th>
<th>Symbol and color code</th>
<th>Approximate VMD (µm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely fine</td>
<td>XF</td>
<td>&lt;60</td>
</tr>
<tr>
<td>Very fine</td>
<td>VF</td>
<td>61-144</td>
</tr>
<tr>
<td>Fine</td>
<td>F</td>
<td>145-235</td>
</tr>
<tr>
<td>Medium</td>
<td>M</td>
<td>236-340</td>
</tr>
<tr>
<td>Coarse</td>
<td>C</td>
<td>341-403</td>
</tr>
<tr>
<td>Very coarse</td>
<td>VC</td>
<td>404-502</td>
</tr>
<tr>
<td>Extremely coarse</td>
<td>XC</td>
<td>203-665</td>
</tr>
<tr>
<td>Ultra coarse</td>
<td></td>
<td>&gt;665</td>
</tr>
</tbody>
</table>

## Ground Speed

<table>
<thead>
<tr>
<th>Ground Speed (mph)</th>
<th>GPA 18°</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 mph</td>
<td>2.6</td>
</tr>
<tr>
<td>6 mph</td>
<td>3.1</td>
</tr>
<tr>
<td>8 mph</td>
<td>3.2</td>
</tr>
<tr>
<td>10 mph</td>
<td>3.5</td>
</tr>
<tr>
<td>12 mph</td>
<td>3.6</td>
</tr>
<tr>
<td>14 mph</td>
<td>3.9</td>
</tr>
</tbody>
</table>

## Application Volume

- GPA 18°
- Application Volume

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**Note:** The table above illustrates the droplet size distribution for different nozzle categories. The ground speed varies with the application volume, ensuring efficient and precise spray application.
Recent Trends - Pesticide Application in Peanut

- **Lower Application Volumes** – trend towards using lower volumes to be more efficient and cover more acres

- **Larger Droplets** – increased use of nozzles that produce larger droplets due to spray drift concerns
Objective

To evaluate the influence of application Volume and droplet size on spray penetration into peanut canopy
Site and Planting Information

**Study Year:** 2021

**Location:** Lang Farm (Tifton, GA)

**Field Conditions:** Conventional, Irrigated

**Cultivar:** GA-06G

**Seeding Rate:** 87,500 seeds/ac

**Planting Date:** May 25, 2021

**Management:** As per recommendations outlined in UGA Peanut Production Guide

(UGA Tifton Campus, Tift County, Southwest GA)
Study Treatments

Three Spray Volumes: (by varying nozzle size)
- 10 GPA
- 15 GPA
- 20 GPA

Three Droplet Sizes: (by varying nozzle type)
- Medium
- Very Coarse
- Ultra Coarse
**Plot Size:** 4-row plots (12 ft. x 80 ft.)

**Sprayer:** 6-row sprayer with a rate controller

**Design:** Randomized Complete Block (3 replications)

**Fungicidal Application:** Total six fungicide applications

- *Chlorothalonil* @16 oz/ac at 47, 62, 75, 92 & 122 DAP
- *Tebuconazole* @7.2 oz/ac at 62, 75, 92, 106 DAP
Data Collection (2021)

• Coverage and canopy penetration
  o Water sensitive papers
  o Top, middle & bottom of the canopy

• Canopy measurements & leaf area index (LAI)
  o LAI - using ceptometer (AccuPAR LP-80)

• Disease rating (Leaf spot at 90 and 120 DAP and White Mold at 120 DAP)

• Yield (harvesting center two rows for each plot)
Data Analysis (2021)

Data were analyzed using analysis of variance and means comparison using student t-test using $p \leq 0.10$ in JMP Pro 16 (SAS Institute, NC).
## Canopy Measurements (2021)

<table>
<thead>
<tr>
<th>Date</th>
<th>DAP*</th>
<th>Height (cm)</th>
<th>Width (cm)</th>
<th>Area (cm²)</th>
<th>LAI*</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 11</td>
<td>47</td>
<td>23.9 d</td>
<td>42.9 d</td>
<td>1031.2 d</td>
<td>0.56 c</td>
</tr>
<tr>
<td>July 26</td>
<td>62</td>
<td>34.7 c</td>
<td>68.0 c</td>
<td>2386.6 c</td>
<td>0.82 c</td>
</tr>
<tr>
<td>Aug. 25</td>
<td>92</td>
<td>45.8 a</td>
<td>83.5 a</td>
<td>3833.6 a</td>
<td>4.45 a</td>
</tr>
<tr>
<td>Sept. 24</td>
<td>122</td>
<td>41.7 b</td>
<td>82.0 b</td>
<td>3415.2 b</td>
<td>3.50 b</td>
</tr>
</tbody>
</table>

*DAP means days after planting and LAI means Leaf Area Index.
## Spray Coverage (2021)

<table>
<thead>
<tr>
<th>Main &amp; Interaction Effects</th>
<th>47 DAP</th>
<th>62 DAP</th>
<th>92 DAP</th>
<th>122 DAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume (GPA)</td>
<td>0.3887</td>
<td>&lt;.0001*</td>
<td>&lt;.0001*</td>
<td>&lt;.0001*</td>
</tr>
<tr>
<td>Droplet size</td>
<td>0.5862</td>
<td>&lt;.0001*</td>
<td>&lt;.0001*</td>
<td>&lt;.0001*</td>
</tr>
<tr>
<td>Position in canopy</td>
<td>&lt;.0001*</td>
<td>&lt;.0001*</td>
<td>&lt;.0001*</td>
<td>&lt;.0001*</td>
</tr>
<tr>
<td>Volume (GPA)*Droplet size</td>
<td>0.0117*</td>
<td>0.0435*</td>
<td>0.025*</td>
<td>0.001*</td>
</tr>
<tr>
<td>Volume (GPA)*Position in canopy</td>
<td>0.9896</td>
<td>0.0009*</td>
<td>&lt;.0001*</td>
<td>0.0013*</td>
</tr>
<tr>
<td>Droplet size*Position in canopy</td>
<td>0.8683</td>
<td>0.0259*</td>
<td>&lt;.0001*</td>
<td>&lt;.0001*</td>
</tr>
<tr>
<td>Volume (GPA)<em>Droplet size</em>Position in canopy</td>
<td>0.6083</td>
<td>0.6791</td>
<td>0.7961</td>
<td>0.651</td>
</tr>
</tbody>
</table>
Application Volume x Position within Canopy

Introduction

Methods

Results

Summary

Future Research

62 DAP

Top:
- 13, C
- 20, B
- 27, A

Middle:
- 5, D
- 11, C
- 13, C

Bottom:
- 3, D
- 4, D
- 5, D

Coverage within canopy (%)

92 DAP

Top:
- 15, B
- 27, A
- 28, A

Middle:
- 4, CD
- 5, CD

Bottom:
- 3, CD
- 6, C

Coverage within canopy (%)

122 DAP

Top:
- 14, C
- 17, B
- 26, A

Middle:
- 5, FG
- 8, DE
- 11, D

Bottom:
- 3, G
- 5, FG
- 6, EF

Coverage within canopy (%)

Legend:
- 10 GPA
- 15 GPA
- 20 GPA
Droplet Size x Position within Canopy

62 DAP
- Top: Coverage 26, A
- Middle: Coverage 12, CD
- Bottom: Coverage 5, E

92 DAP
- Top: Coverage 33, A
- Middle: Coverage 6, DE
- Bottom: Coverage 7, D

122 DAP
- Top: Coverage 25, A
- Middle: Coverage 13, C
- Bottom: Coverage 5, E

Coverage within canopy (%)

Legend:
- Yellow: M
- Green: VC
- Black: UC
Summary

➢ Both application volume and droplet size had a significant interaction with position within the canopy

  - **Spray Volume x Position:** Higher volume increased spray penetration up to middle of the canopy.

  - **Droplet Size x Position:** Both medium and very coarse droplet provided comparable coverage in the middle.

Future Research

Evaluating the influence of these applications parameters on spray coverage, penetration and efficacy in fields with high disease/pest pressure in the season.