**High Tunnel sprayer project : SARE Farmer Grant – the sprayer report.**

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Goal - Fabricate and test a high tunnel sprayer that provides better coverage and requires less time to go through the tunnel than existing backpack or caddy sprayers.

**Machine Design**

Make engineering recommendations for the design/development of a sprayer for use on a variety of crops in a high tunnel e.g.

tank, pump, flow, agitation, filtration and nozzle requirements.

The simple sprayer should be capable of spraying tall crops such as tomatoes etc. with a vertical boom or low crops with a horizontal boom.

The basic criteria are that the sprayer be light enough to maneuver and pull through the narrow rows of tomato plants in the high tunnel.

The sprayer should be made of strong materials and components.

The boom should be easily changed from vertical to horizontal mode.

The sprayer should be light enough to handle from one tunnel to another.

The sprayer can be rinsed out easily.

A number of meetings were held throughout the winter months of 2013/14 with Andy and Eric Fellenz to finalize some suitable components and design features.

The final design was made up as shown in Appendix A

**Evaluation**

We undertook an evaluation trial during the 2015 growing season, in a row of tomato plants in full canopy to determine penetration, deposition and coverage. We used water sensitive cards (Syngenta, Basel, Switzerland), positioned throughout the canopy and assessed the % area covered as an indicator of coverage on each card.

Two methods of evaluation were conducted:

Method 1: Visual assessment of WSC coverage, a subjective approach based upon 40 years of card reading, “ reading the tea leaves”

Method 2: Using an HP desktop scanner to scan the WSC into computer software designed for assessment of cards. ASSESS is a program available from the American Phytopathological Society (APS).

Trial details:

Date: August 27th 2015

Three treatments were carried out with three different nozzle types.

Forward speed: Walking speed (2 mph approx.)

Desired flow rate: 0.121 gallons per minute.

Water sensitive cards were placed throughout the canopy the tomato canopy, at the top, middle and bottom of the canopy at internal locations. The cards were placed on the left and right-hand side of the row. Three different nozzle designs were assessed, Table 1 below. 3 replications were made.

 Table 1 Treatments: Nozzle designs

|  |  |  |  |
| --- | --- | --- | --- |
| Treatment Number | 1 | 2 | 3 |
|  |  |  |  |
| Nozzle Type | Hollow cone | Flat fan | TurboDrop Dual flat fans |
|  | Red Conejet TXVS6 | Orange XR11001 | GreenleafSMP 11001SMP 110015 |
| Pressure (psi) | 70 | 50 | 60 |

The above nozzles were selected based upon the following criteria:

Hollow cone and flat fan are very traditional designs for boom sprayers and used by many farmers. The TurboDrop design is a novel design, one flat fan faces forwards and one faces rearwards, the principle being it will provides two opportunities to hit the target and also the angled trajectory of the droplets improves penetration. I have successfully improved deposition with this design of nozzles on onion crops in NY.

Results

Figure 1 below shows the results of the card coverage using three nozzle designs. The visual versus the scanning method of assessment is clearly noticeable, the visual method over-assesses deposition by about 10%, but has a consistent result with that of the scan method.

There is no significant difference between the coverage obtained from the hollow cone and the TuboDrop nozzles. There is significant difference between the hollow cone and twin cap flat fan nozzles and the results obtained from the flat fan nozzles. The TurboDrop nozzles gave more consistent coverage than the hollow cone nozzles (less error). The flat fan nozzles gave at least 60% less coverage than the other two nozzles.

The TurboDrop nozzles are my recommendation for this canopy at this growth stage.



Figure 1. Deposition on Water Sensitive Cards of Three Nozzles

Further work:

Biological assessment could be carried out to assess the difference between the best two nozzles, providing time is available.

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<http://www.greenleaftech.com/>

**Appendix A**

**The manual sprayer at Andy and Erik Fellenz Farm**

I have suggested ¾ “ fittings on the suction side of the pump, I prefer large bore pipes to help flows but if you really want to you could go down to ½” as flow rates will be quite low.

Tank

The cone-bottom 5 gallon poly tank from Plastic Mart looks great. It has 6 nuts molded into it so will be handy to fit to a frame.

It has a 1 1/4” threaded outlet

866 310 2556

Valve

A valve should be fitted at the base of the tank to shut off flow if you need to repair the pump etc. A three-way valve would allow you to empty any excess spray from the tank into a bucket.

e.g Spraying Systems Teejet Directovalve

AA(B) 343M-3-1¼-PP will allow the valve to screw onto the outlet of the tank, but is a large size, you may wish to consider a smaller size, e.g. ½” or ¾” and reduce the cost.

585 394 7260

Need hose tails to fit

Line strainer

This maybe most useful to protect the pump , especially if you go to compost teas etc.

TeeJet Line Strainer AA122-3/4” - PP with a 50 mesh screen (CP45102-3-SSP)

Need hose tails to fit ¾” inlet and ½” outlet

Pump

The Delavan PowerFLO Fat Boy Diaphragm 7870, Bypass mode sounds ideal and will handle the pressures and flow rates we need. Pump is ok with pesticides so should be ok with your products.

866-335-2826

delavansales@delavanagpumps.com

Need hose tails to fit ½”

Main control valve

A TeeValve is a simple one-piece control valve for up to 3 boom sections and on/off

AA17L all ¾” ports

Need hose tails to fit ¾”

Pressure gauge

A good quality gauge is required

Pressure Regulator

TeeJet Model 23120-3/4 - PP

Need hose tails to fit ¾”

Tank connector ¾” and hose tail to fit onto the side or top of the tank to take excess liquid from the pressure regulator back to the tank for agitation of tank contents

Connectors to the booms

Quick detach “Banjo” couplers ¾” will be needed so you can switch between vertical and horizontal booms

Hose clamps:

Boxes!

Hose

Chemical resistant hose

Nozzle bodies/Nozzle clamps/Strainers, Nozzle caps and Nozzles:

I have calculated we will need 6 nozzles each side of the vertical mast, each nozzle with a flow rate of 0.121 gallons per minute. I am particularly keen to try traditional flat fan, hollow cone and TurboDrop Dual fans (forward and rearward facing jets).

I have assumed a walking/pulling/towing speed of 2 mph