CHAPTER 3: HYPOTHESES

A problem analysis was performed prior to the experimental work. Hypotheses were formed, based on a review of the literature, in order to focus on which questions the research should address.

The first study will examine contact phytotoxicity. In order to minimize contact phytotoxicity and hence enhance triclopyr amine efficacy, an understanding of the effects active ingredient concentration, droplet size, and addition of both organosilicone and conventional surfactants, have on contact phytotoxicity is required. Three concentrations of the active will be used. If the highest concentration of active ingredient shows a high level of contact phytotoxicity then only the two lower concentrations will be used in further studies. Also of importance is whether there is a difference among the three tree species in susceptibility to contact phytotoxicity, if one formulation causes less contact phytotoxicity to all three tree species being studied, or if there is a different formulation which causes the least contact phytotoxicity for each species. Organosilicone surfactants have been shown to enhance the uptake of active ingredient into other plant species, often by stomatal infiltration. The three tree species being studied have stomata only on their abaxial surfaces, so it is also important to find out whether there is a difference in contact phytotoxicity between adaxial and abaxial surface. If the abaxial surface shows much more rapid and severe development of contact phytotoxicity when an organosilicone surfactant is used in the formulation compared to when the base triclopyr formulation alone is used, then this would indicate that organosilicone surfactants were not a good choice for use in the formulation with the tree species in question.

The second study will examine the initial adhesion, and retention, of individual droplets. In order to be efficacious a formulation needs to be able to adhere to, and be retained by, the leaf surface. Again, an understanding of the effects of active ingredient concentration, droplet size, and addition of both organosilicone and conventional surfactants on initial adhesion and retention of individual droplets is required. If it is found that the initial adhesion of Garlon 3A to the adaxial and abaxial leaf surfaces of the three tree species is lower than Garlon 4, then this could be one

reason why the ester formulation is more efficacious than the amine formulation. From the review of the literature, the addition of an organosilicone surfactant should enhance initial adhesion and retention of spray droplets. It is important to find out if adhesion to the abaxial surface is less than adhesion to the adaxial surface, and if so, whether the addition of an organosilicone surfactant can reduce these differences. The tree species being studied have a range of natural leaf angles. It is suggested that adhesion decreases as leaf angle (to the horizontal) increases. Again, an objective is to find out if the use of organosilicone surfactants can reduce the differences in adhesion due to leaf angle.

The third study will investigate spray retention under both field and track-sprayer conditions. Track-sprayer trials are easier to perform than field trials, and track-sprayer trials are often performed in order to choose the best formulations, volumes etc. prior to field trials being performed so an objective will be to find out if there is any significant difference between results of the track-sprayer trial and the field trial. One of the reasons for using an organosilicone surfactant is that they have been shown to be very good spreaders, and a "wrap-around" effect to the surface not directly exposed to the spray may be possible. An objective is for the reformulated triclopyr amine formulation to be retained to an equal or greater extent than the commercial Garlon 4 formulation. The effects of active ingredient concentration, tree species, adaxial and abaxial leaf surface will also be considered.

The fourth and final investigation will endeavor to relate the results of the adhesion / retention study of individual droplets and the spray retention study to the wax character of the foliage of the three tree species being studied and to the dominant angle of their leaves.

The specific hypotheses for each section of study are listed below.

Contact Phytotoxicity Study

Hypothesis 1: Small droplets will cause less contact phytotoxicity than larger droplets.

Hypothesis 2: Contact phytotoxicity will increase with an increase in active concentration.

Hypothesis 3: The addition of an organosilicone surfactant to the active will cause a decrease in phytotoxicity.

Hypothesis 4: Droplets applied to the abaxial surface will cause more contact phytotoxicity than droplets applied to the adaxial surface.

Adhesion and Retention Study

Hypothesis 1: Percentage adhesion to the abaxial surface will be less than the percentage adhesion to the adaxial surface of each species, providing the adhesion is not 100% for both.

Hypothesis 2: As the angle of the leaf increases from horizontal through to 45° both adhesion and retention will decrease.

Hypothesis 3: As droplet size increases, percentage adhesion and percentage retention will decrease.

Hypothesis 4: The addition of an organosilicone surfactant to the base triclopyr TEA salt + sequestrant solution will significantly increase both adhesion and retention (providing there is significant room for improvement).

Hypothesis 5: As percentage concentration of Triclopyr increases, percentage adhesion will increase.

Hypothesis 6: The addition of co-surfactant will not significantly alter the percentage adhesion or the percentage retention results of solutions containing base triclopyr TEA salt + sequestrant + organosilicone surfactant.

Hypothesis 7: There will be no significant difference in percentage adhesion or percentage retention due to the different co-surfactants added.

Spray Retention: Field and Track-Sprayer Conditions

Hypothesis 1: There will be significantly more spray deposition on the adaxial surface compared to the abaxial surface of each tree species.

Hypothesis 2: The use of an organosilicone surfactant will increase the total amount of spray solution retained by the foliage compared to Garlon 4.

Hypothesis 3: The use of an organosilicone surfactant will increase the amount of spray retained by the abaxial surface compared to Garlon 4.

Hypothesis 4: There will be no significant difference between results from the field trial and results from the track-sprayer trial.

Leaf Characteristics

Hypothesis 1: Spray adhesion / retention is related to the microroughness of the leaf surface.

Hypothesis 2: Spray retention is related to the dominant leaf angle of each tree species.