

**A Sustainable Organic-Based Experimental Weed Control Approach at UBC – Phase 1:
Evaluation of the Efficacy of Organic Acid based Herbicides for control of Thistle
(*Cirsium arvense*), Morning glory (*Calystegia sepia*), Horsetail (*Equisetum arvense*)**

Phase 1

Amritpal Sidhu

University of British Columbia

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A Sustainable Organic-Based Experimental Weed Control
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Phase 1

Patricia...please note this will be the official title on title page

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Evaluation of the Efficacy of Organic Acid based Herbicides for control of Thistle (*Cirsium arvense*), Morning glory (*Calystegia sepia*), Horsetail (*Equisetum arvense*).

Recently, herbicides and other pesticides have been formulated from naturally occurring compounds such as fatty acids (Topgun™) and acetic acids (Ecoclear™). According to a study conducted by USDA (2003), vinegar at acetic acid concentrations of 10-20% aided in efficient control of some annual and perennial weeds. A similar sort of results were obtained by Caulder et al. (1993) as they discovered that application to weeds of a combination of certain chemical herbicides with saturated/unsaturated fatty acid resulted in effective control of broad range of plants. The main objective of this study was to evaluate the efficacy of organic acids based herbicides i.e. Topgun™ (Fatty Acid) & Ecoclear™ (Acetic Acid) for control of Thistle (*Cirsium arvense*), Morning glory (*Calystegia sepia*), Horsetail (*Equisetum arvense*). Other objectives of this research were: to determine application rates of organic herbicides for effective control; to determine whether a combination or mixture of both herbicides will control the weeds more effectively than roughly the same amount of both of the herbicides alone; to determine what concentrations (full strength, half strength, combination and mixture) are effective in killing the weeds; to determine whether the site of application (Apical and Basal) of chemicals will induce lethal phenotype alterations (de-pigmentation, phytotoxicity); and to note the response of other species present around the site of application.

This study was investigated on 7 different sites at UBC Vancouver, BC, Canada. Thistle was tested on 4 sites (1, 2A, 2B, 3&4A), whereas Morning glory on 2 sites (4A&4B) and Horsetail on 1 site (5).

Table 1: Location of Sites

| Sites | Location |
|-------|---|
| 1 | Intersection of Lower mall and University Blvd. |
| 2A | Sustainability Drive |
| 2B | Sustainability Drive |
| 3 | Around the corner of Macmillan Building |
| 4A | By Macleod Bldg |
| 4B | By Macleod Bldg |
| 5 | By Irving.K Barber Library |

All of the species tested showed a very common response to the treatments, as the combination and the mixture of the Topgun™ and Ecoclear™ i.e. C_{100%}, C_{50%}, M_{100%}, M_{50%}, came out to be as the most effective treatments in comparison to Topgun™ and Ecoclear™ solutions i.e. T_{100%}, T_{50%}, E_{100%}, E_{50%}. Between Topgun™ and Ecoclear™ solutions, Topgun™ worked the best on every site, as it induced rapid and more drastic changes in the plants. Apical and Basal treatments were also carried out on Canada thistle and Morning glory plants, and in both species, basal treatments worked the best as T_{100%Basal} in morning glory completely deteriorated the plant, and basal application on thistle plants weakened their stem, making their digging out easier. Resprouting was highly evident in young plants of Canada thistle (Site 4A), Morning Glory (4B) Horsetail (5).

Almost each site was divided into 4 separate grids, and each of those grids represented a treatment; however site 4A was divided into 8 grids. The nature of the treatments used depended on the species and number of replicates available and, therefore each site had a different kind of treatment. All of the sites were subjected to the same chemicals (Ecoclear™, Topgun™) but different concentrations of these chemicals were used depending on the site. Solutions used consisted of Full strength Topgun(T_{100%}), Half strength Topgun(T_{50%}), Full strength Ecoclear(E_{100%}), Half strength Ecoclear(E_{50%}), Full strength Mixture(M_{100%}) and Half strength Mixture(M_{50%}), Full strength Combination (C_{100%}), Half strength Combination (C_{50%}). All of these chemicals were prepared in the fume hood due to their highly acidic contents. Spray bottles, which could hold up to 720 ml of solution, were used to spray the above prepared solutions on the target weeds. Every site was treated on different days, as it was impossible to spray all of the sites on the same day. The entire grid set up and spraying took roughly 1.5 hours per site. There were pictures taken pre-treatment and post-treatment for every site. Every site was monitored for roughly 30 days period till August 5th, except site 1, which was only monitored for 2 weeks. Every week observations were made in the lab book if any major changes took place compared to the previous week. These changes consisted of dehydration of the stem, bending of the plants, and de-pigmentation in the leaves, and stunted growth. On the day of spraying, roughly 4 hours after the application, samples were taken from site 4A (Thistle), 4B (Morning Glory), and 5(Horsetail) and were frozen with liquid nitrogen in the lab. Samples were taken for each of the three species, so that further biochemical analysis can be done in the future. For this part of the experiment, only weekly picture records and phenotype changes were analyzed to deduce results about which treatment is better than the other treatments.

Literature Cited

Caulder, J., Hugh, R., Evans, S.L., & Zoerner, P.S. (1993). Process and Composition for Controlling Weeds. U.S. Patent 5,196,044, filed Jan 8, 1991, and issued Mar 23, 1993.