

To prepare your report

1. Use the same title for your report as you used for your proposal, followed by the grant number, which always begins with the letters "FNE." Include your mailing address, your phone number, and your e-mail address if you have one.

Title: *UV-C Weeding Project*

Grant Number:

Mailing Address: 205 Huguenot St, New Paltz, NY 12561

Phone: 845-256-0686

Email: farm@flyingbeet.com

2. Restate the goals of your project.

The goal of our grant was to create a prototypical machine that was pulled behind a tractor and killed weeds using UV-C light. The project was inspired by very encouraging preliminary reports from Denmark.

The project turned out to be a failure and so we only spent a small part of the total grant money that was allotted to us.

3. Update the information on your farm since your project started. Include acres farmed, your current crops or livestock, and other key background on your operation.

We farm about 10 acres of mixed vegetables, herbs and cut flowers under the Certified Naturally Grown (www.naturallygrown.org) certification system. Farming is still our only source of income and that is derived primarily from our 175-200 CSA shares (we're not sure yet where we'll end up this year.) We also do some wholesale to local restaurants and one local grocery store.

4. Describe your cooperators and their roles in the project.

I had very pleasant cooperators, but... there really wasn't a place or need for them in advising on this project because we couldn't get out of the most preliminary stages of development at such an early stage of the process. Mr. Holm really ended up having to play the most significant advisory role in the project in helping to advise a less expensive way to do an initial conclusive analysis in deciding whether or not to continue the project on a full scale.

5. Tell us what you actually did in your project and how it was done.

Instead of making a full prototypical machine, we purchased two special non-UL listed ballasts (enough to control four (4) UV-C bulbs) and set up a frame that suspended the 4 foot long fluorescent UV-C bulbs about 3 inches over flats of young plants.

It looked similar something that a gardener would use to start seedlings for later planting –but ours was created to be the end of plant life, not the beginning.

We started a variety of plants... brassicas, cucurbits, solanaceous, sunflowers and chunks of our local grass in flats. We then put the flats under the Ultraviolet C fluorescent bulbs and turned them on...

Flats were exposed to 5 seconds of light, 15 seconds, 30 seconds, or 60 seconds of light, and then were observed for 48 hours to see which ones would die. None died, which was both discouraging and surprising.

This spring, we repeated the experiment with only one bulb and 1 mixed flat the same plant varieties just to see WHEN the plants would actually die, even if the timings were ridiculously long... we just wanted to be able to report SOME death.

Over a three day period we exposed the flat to 3 minutes of light... then 6 minutes of light... and then finally 35 minutes of light. After exposing the plants to the ultraviolet-C light (which we did in a trailer) the flat was set outside in the sun. Not a single plant of any variety ever actually died, and we just gave up trying anymore, letting the plants die from lack of water.

In all cases, we controlled the ballasts by plugging and unplugging them from a different room so the UV-C light wouldn't injure our eyes.

6. Describe your results and accomplishments – did you have unexpected results? If so what were they?

Very unexpected results. The experiment was a complete failure. Nothing died –not even with 35 minutes of exposure to UV-C light from a fluorescent type bulb.

I have tried in vain to again establish contact with the Danish fellow who is trying to get collaborators and investors for his UV-C weeder idea and he will not return any emails at this point.

The somewhat ambiguous pictures from a German European University study on the effects of UV-C light on plants we had seen when applying for this grant were also missing.

There is still a picture on his website of a machine that he made that clearly shows that he killed grass. He used a different source for the UV-C light, one that produces quite a bit of heat. Given my COMPLETE failure to kill anything with UV-C light, I have three theories about how he was able to kill the grass with his machine:

- 1) Although the bulbs we used are rated to produce the same wavelength of UV-C light that he produced, perhaps they are producing much less of it in that portion of the wavelength that is actually killing the plants. We felt the bulbs he used would NOT be practical for a farm application as they are very costly, use much, much more power and are much more fragile. But the fact that we USED different types of bulbs obviously could be an easy explanation as to why his experiment worked and ours didn't.
- 2) The bulbs he used produce a lot of heat. Perhaps he assumed that it was the UV-C light that was killing the plants, but it was actually the high levels of heat as he went slowly over the plants with his closed up box-type machine. It was built to shield the light from getting out, but perhaps it was also keeping high heat in the box -enough to burst cell walls without actually catching anything on fire.
- 3) Another possibility is that the high heat produce by his bulbs weakened the grass sufficiently that the UV-C light was able to have a killing effect that I have not been able to reproduce since it has never been over 75 degrees where I am conducting my experiments and the bulbs we produce more light than heat.

Only the second of these three theories really makes sense to me. Even assuming that the bulbs I used produce only 5% of the UV-C light that his bulbs produced, based on other information presented on his website I SHOULD have been able to kill the plants several times over after 35 minutes. At the very least I should have seen some negative effects and I saw nothing whatsoever.

7. Describe any site conditions or conditions specific to your farm and this growing season that may have affected your results.

All our experiments were conducted in a controlled environment -inside a greenhouse, a barn and this spring, repeated in a trailer. In all cases the weather was moderate, we made sure there was no excessive dust, dirt or moisture on the plants or bulbs. All the plants were raised in flats in full sun in our greenhouse on heat.

8. Describe your economic findings, if any. This would include changes in expenses or net farm income triggered by the project.

N/A

9. Say whether the results from your project generated new ideas about what is needed to solve the problem you were working on. What do you think is the next step?

We embarked on this experiment primarily because we are interested in a solution for no-till (or very-close-to-the-surface-till) organic farming.

Flame weeding is not a practical solution because our fields are left with so much residue that we just end up catching the residue on fire. Steam weeding is expensive. We're doing a little bit of experimentation with vinegar now... But mostly what we have ended up trying now is an extended period of stale-seedbedding to get weeds under control, followed by cover crop and vegetable rotations with start and end dates planned for weed control even more than disease control.

10. Explain why you plan to continue to use the practice you investigated, or— conversely— why you are *not* going to. If you plan to revise your approach in light of what you learned, describe those revisions.

N/A

11. Explain what you did in your outreach program. Send copies of any articles written about your project, along with any outreach materials you may have developed such as flyers, tip sheets, bulletins, or handouts that were used to explain or publicize your results.

I haven't done any outreach.

12. Include your name and date at the end of the report.

Ron and Kathryn Khosla May 5, 2003