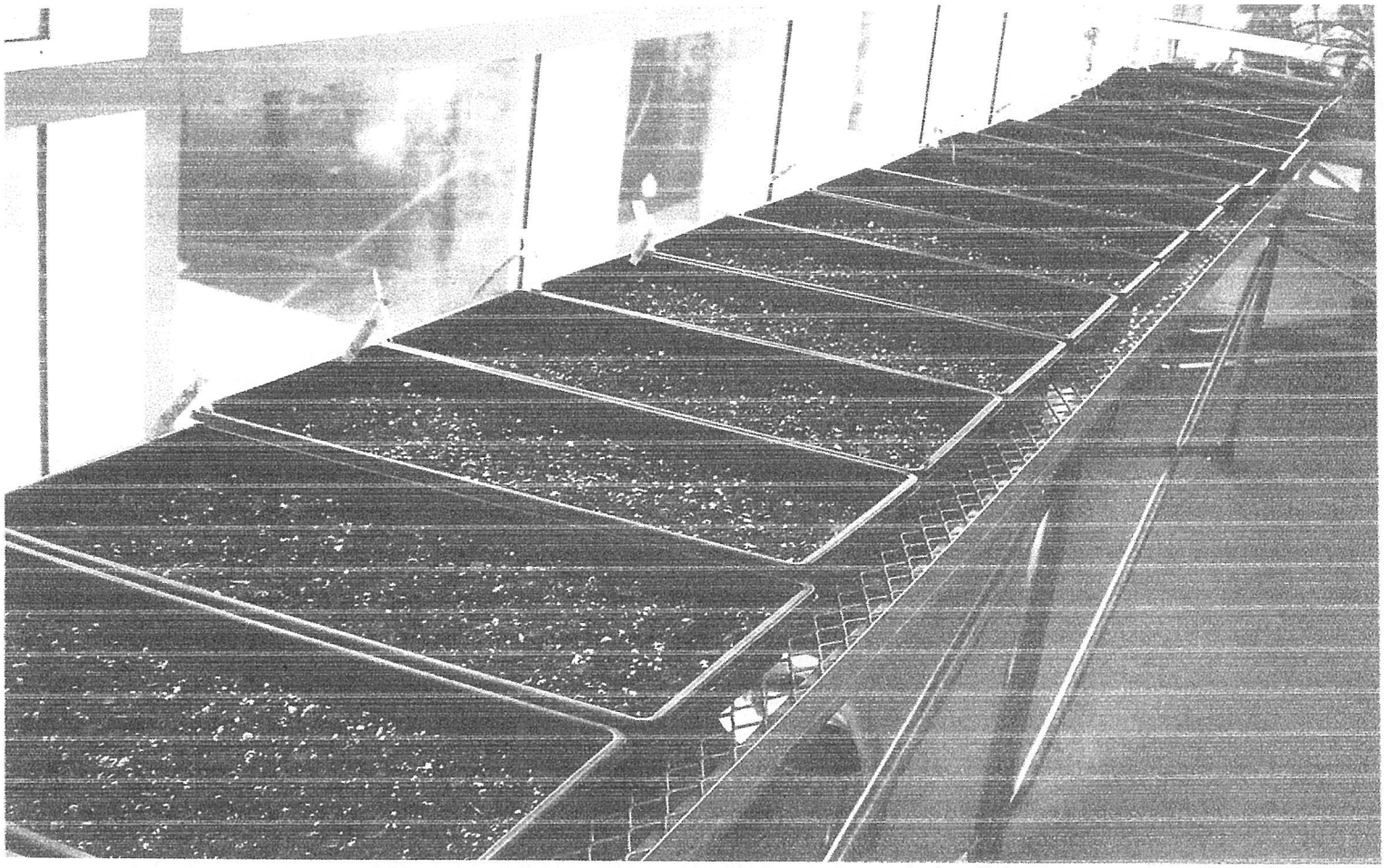

Figure 1. Arrangement of flats along the south window of the UNCG Teaching Greenhouse

An Experimental Test of the Biodynamic Plant Peppers

Melanie Eldridge,[1] Bruce Kirchoff[1,3] and Scott Richter[2]

Introduction

In 1924 Rudolph Steiner proposed a theory of weed control in lecture number six of the Agriculture Course (Steiner 1924/1974). In these lectures Steiner used a commonly accepted definition of a weed: "Everything that grows at a place where you do not want it." His method for controlling a weedy species is relatively simple. First, one collects the seeds of the weed and burns them until carbonized. Second, crush or grind the resulting substance to ash, to produce what is commonly referred to as a "pepper." Finally, scatter the pepper over the affected area. Steiner concludes that after two years of scattering the pepper that there will be a noticeable reduction in the population of the weed. He also states that ". . . after the fourth year you will see, if you continue sprinkling the pepper year by year, the weed will have ceased to exist on the field in question" (Steiner 1924/1974: 111).

During the summer of 2005 we designed and carried out an experiment to test the hypothesis that plant peppers will effect seed germination. We used okra seeds and a pepper created from the same seed lot. We tested the effects of the okra pepper on percentage seed germination under greenhouse conditions at the University of North Carolina at Greensboro (UNCG).

Materials and methods

To create the plant pepper, seeds of okra (*Abelmoschus esculentus* (L.) Moench), variety Clemson spinless, were purchased from Southern States (Seed Lot 182-U4). A 13 × 13 cm tin pan

1) Department of Biology, University of North Carolina at Greensboro, Greensobro, NC 27402-6170

2) Department of Mathematics, University of North Carolina at Greensboro, Greensboro, NC 27402-6170

3) Author for correspondence (kirchoff@uncg.edu)

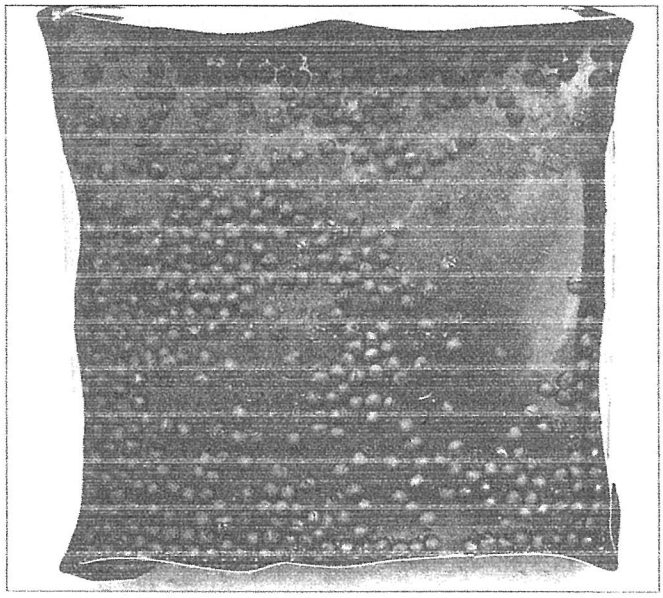

Figure 2. Carbonized seeds in improvised aluminum pan

was constructed to contain the seeds during carbonization (Figure 1.) On May 15, 2005 at 12:30 PM (Moon in Leo) the pan and seeds were placed in a Webber gas grill set to high and left for approximately forty minutes before the gas was turned off and the grill was allowed to cool. The maximum temperature reached was ca. 505° Fahrenheit. At the end of this time the seeds were uniformly black and brittle (Figure 2). The seeds were then crushed to a rough powder using a hammer, and then ground finer with a mortar and pestle. The resulting "pepper" was weighed and divided into ten packets. The total mass of the pepper equaled 17.33 grams. Each packet contained 1.73 grams of powder. Additional okra seeds were purchased for the germination experiment. Seeds from three four-ounce packages of okra seeds (Southern States seed lot 182-P2; reported germination rate = 85%) were mixed together and then randomly divided into lots by the following procedure. Seeds were first divided into twenty lots of approximately 100 each by mass (ca. 5.75 g per 100), then counted to assure that there were exactly 100 seeds per lot. Seeds were added or subtracted from the number determined by weight to give exactly 100 per lot. Seeds with obviously defective seed coats were removed and replaced with apparently good seed.

Each seed lot was planted in a separate ten-inch by twenty-inch non-perforated flat, filled with a uniform amount of soil. Seeds were planted just below the surface of the soil. We made an effort to maintain equal spacing be-

Figure 4. Abnormal seedling of with cotyledons still enclosed in seed coat

tween the seeds. Each flat was randomly assigned to either the control or treatment group by a coin flip and placed along the south window of the UNCG Teaching Greenhouse (Figure 1 on page 30 and Figure 3 below). The ten experimental flats received the plant pepper, while the ten control flats received none. The experimental flats were removed from the window to a separate bench during the peppering process to avoid contaminating the control group. Each experimental flat was dusted with one packet containing 1.73 g of pepper and then placed back in its original space.

Seeds were planted on 5/18/2005 and germination was checked on days 7, 14, 21, 28 and on 6/21/2005 (thirty-five days after sowing) when the number of germinated seeds was recorded.

Results

Each seedling was placed into one of two germination categories: normal or abnormal. Abnormal seedlings were those that were underdeveloped or had major defects at the end of the experiment. The most common characteristic of an underdeveloped seedling was a one to two inch hypocotyl

South window																			
C	C	C	E	E	C	E	C	E	C	E	C	C	E	E	E	C	E	C	E

Figure 3. Arrangement of control (C) and experimental (E) flats along the south window of the UNCG Teaching Greenhouse

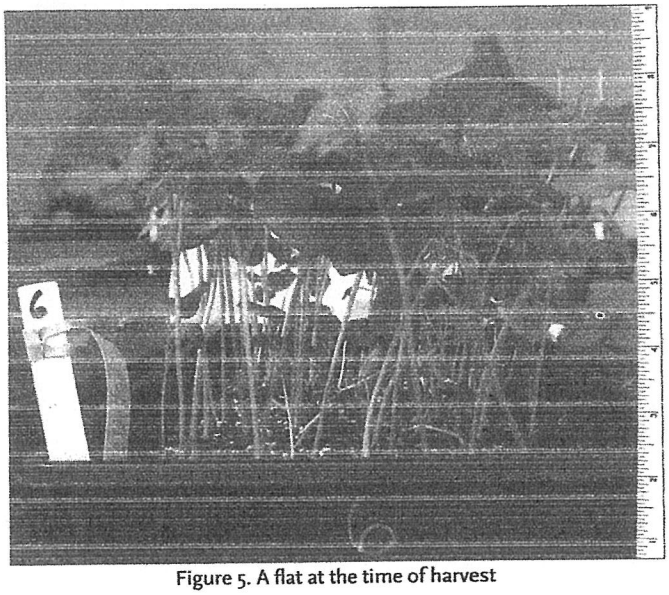

Figure 5. A flat at the time of harvest

topped with a seed coat still containing the cotyledons (Figure 4.) A normal seedling was typically five to eight inches tall with at least two broad, green leaves (Figure 5.)

For the first statistical test, both normal and abnormal seedlings were lumped into the same group: germinated seeds. Using this method the average percent germination of the experimental group was 84.0%, and that of the control group was 84.9% (Table 1.) We also tested for a difference in the production of abnormal germination in the experimental and control groups. Both comparisons were made with a t-Test. There was no statistical difference between the control and experimental groups for either total germination, or abnormal germination (Table 1).

Discussion

While our results were negative, this does not mean that Steiner was wrong. It may be that there was an error in either our experimental design or our initial hypothesis. Steiner stated that results would only be noticed in the second year. We ran our experiment for thirty-five days, not a year. We did this to simulate one growing season, and to make the experiment manageable within our time and resource constraints. Perhaps, if we repeated the experiment for a second growing season, in the same flats and under similar conditions, we would get positive results. However, we should also remember that Steiner never stated that the plant pepper acts on germination. This was our hypothesis. If the plant pepper works by some other mechanism, perhaps by a reduction in seed production in the treated flats, then a replication of the experiment for a second "year" would be unlikely produce positive results. We are in the process of designing more rigorous tests of the plant peppers to take this possibility into account. We welcome informed discussion of these experiments.

References

Steiner, R. 1924/1974. *Agriculture.* London: Biodynamic Agricultural Association. pp.175.

Some comments from Glen Atkinson

In planning for further experimentation, the author sent this article for comment and suggestions to Glen Atkinson in New Zealand. Glen has long pursued an interest in weed and "pest control" through the use of peppers and responded with the following.

Thank you for giving me the opportunity to comment on this experiment.

The concerns you raise in your discussion at the end of this piece, are correct, in my experience.

Our experience with Burdock and Scotch Thistles has shown that it is in the reduced setting and viability in the seed that is set on these 'parent' plants where the peppering effect appears.

Had you let these plants to go to seed, I would have expected there to be a significantly reduced number of viable seeds in the seed heads.

Hence in the second year the number of weeds appears to be reduced and over the subsequent years, as the reservoir in the soil of viable seed reduces, the weed will disappear completely.

The peppering 'cuts off' the growing plants from a particular natural 'growth current' – Steiner and Lievegeod call it a moon force – in these parent plants. So when they come to set seed, this 'germination force' is not available to them. If they do set seed, these seeds will be severely weakened in their germination ability. The sixth lecture does give a description of this process.

Table 1. Germination results

	Mean % germination	Standard deviation	p-value
Total germination – experimental	84.5%	4.37%	0.66
Total germination – control	84.9%	4.55%	
Abnormal seedlings – experimental	13.3%	7.56%	0.52
Abnormal seedlings – control	11.3%	5.87%	

I suggest you run your trials for a further life cycle of the plants concerned and test the germination of the treated and untreated plants seeds.

Other considerations of a marginal rather than pivotal concern include the following.

Burning time

Steiner comments that the burning has an inverting effect. Taking this into account, when preparing weed peppers the practice of burning during good germination times has developed, hence enhancing the blocking of the germination process. These have been found to be when the Moon is in opposition (180 degrees) to the Sun and when the Moon is in opposition to Saturn (see Kolisko and also Thun.) Neither of these astronomical phenomena were present when you burned the seeds.

The burning

We use the practice of burning the seeds to a white ash before spreading.

After burning

Peter Bacchus , my associate and very long-term biodynamic practioner, suggests the practice of putting the ash into water, stirring it for a minute or so and then straining it. This works on the notion there is a difference between the carbon ash and the 'salt' ash. The water dissolves the salt ash and leaves the carbon ash, which Peter experiences as being the more potent.

A trial you might like to run would look at the effect on second year germination of these two different ashes, carbon and salt.

Homeopathic dilution

A practice that has developed over the years, is to take the ash and bulk it up through homeopathic rhythmic dilution. This can be with sand or water. One part ash is added to nine parts milk sugar and stirred in a mortar and pestle for one hour. This can then be done again and then spread, or one gram of this mix can be mixed with 9 cc of water and then shaken for 2.5 minutes. This is then repeated a further six times.

The advantage of this is that there is not an enormous amount of liquid that can be sprayed at 250 ml per hectare. I also like this method because it can be sprayed over the plant and so directly influence the plant's growth processes rather than just through the soil.

I trust these suggestions will help you in your endeavors.

A response and outline of further experimentation

We would like to thank Glen Atkinson for his very helpful comments. We are repeating our experiment to see if growing a second set of plants in the same soil effects germination. Based on Glen's comments, we do not expect to see an effect. We are designing experiments to test the effect of the peppers on seed set and viability. We will use a plant that we can take from seed to seed in the greenhouse. *Brassica rapa* satisfies these requirements. It has a life cycle that can be as short as forty-five days under conditions of continuous light. We have some test flats started so we can get experience growing, pollinating and getting seed from these plants before we set up the experiments. We hope to have experiments suggested by Glen up and running by January 2006.

Several questions arose based on Glen's comments. We are unaware of any comments by Steiner or anyone else on the inverting effect of burning. Would someone be kind enough to send us these references? We are particularly interested in any published accounts of the effects of burning the seeds when the Moon is in opposition to the Sun or Saturn. Glen cites Kolisko and Thun, but gives no references. Where do these authors report these results? Has anyone tested these ideas experimentally? We are aware of Maria Thun's suggestion that the peppers should be prepared when the Moon is in a fire sign. We followed this suggestion by burning the seeds when the Moon was in Leo. We know of Thun's work only from her popular books. Does anyone know where these results were originally published?

Dr. Bruce Kirchoff is an Associate Professor of Biology at the University of North Carolina at Greensboro, where he teaches courses in evolution, plant diversity and flowering plant identification. In addition to his university teaching, he has taught courses in How to Know Higher Worlds, and has facilitated Dialogue and Open Space workshops. He was a member of the Piedmont Interfaith Council and the organizer of a series of Interfaith Dialogues in Greensboro, North Carolina, USA. He also served as the Coordinator of the Southeastern Center for Anthroposophy, an anthroposophical center in central North Carolina. His research spans the disciplines of botany, cognitive psychology, and the relationship between science and art. His most recent work deals with holistic modes of perception and their role in the classification of organisms. He has published several papers on this subject in peer-reviewed journals, and has organized international symposia on this and related subjects. Information on his work, and copies of his publications, can be found on his website at <http://www.uncg.edu/~kirchoff/>. Comments and suggestions can be sent to <kirchoff@uncg.ed