



## A Further Test of the Biodynamic Plant Peppers

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In May of 2005, we began a series of experiments to test Rudolf Steiner's hypothesis of using plant, or more correctly seed, "peppers" to control weedy species. Steiner's hypothesis states that if a "pepper," consisting of the ash from burnt seeds of a particular plant is scattered over soil where that plant grows, "after four years the plant will cease to grow there" (Steiner 1924/1993). The summary and complete methods of our initial experiment and negative results were published in *BIODYNAMICS* (Eldridge et al., 2005). Since the end of the first experiment in June 2005, we repeated the experiment two additional times to test for a cumulative effect of the plant pepper on the germination of okra seeds, *Abelmoschus esculentus* (L.) Moench. The experimental set up and methods for the two subsequent experiments were identical to the first, with the exception that we used ash from a second pepper preparation. We used the same flats with the same soil as in the first experiment. Con-

trol flats were used as controls, experimental as experimental. To simulate more natural conditions, we mulched the seedlings from the previous experiment(s) into the soil in the flats from which they grew.

For each experiment we replanted the flats with seeds from the original seed lot (Southern States 182-P2). After planting, the experimental flats were re-peppered; each time being moved to a different bench to avoid contaminating the control flats. The plant pepper for all three experiments originated from one seed lot (Southern States 182-U4). The seeds used to create the pepper for the first experiment were

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burned on May 15, 2005, at approximately 12:30 PM Eastern Daylight Time (Moon in Leo; Waxing Moon). The seeds used to create the pepper for the second and third experiments were burned on May 26, 2005 at 7:30 PM Eastern Daylight Time (Moon is Sagittarius; Waning Moon). Our production methods are described in the previous article.

Each experiment ran for thirty-five days. At the end of the thirty-five day period the germination rates were calculated and the mean differences between the control and experimental groups were assessed statistically using a t-test (Tables 1, 2). At the conclusion of the third experiment, we still observed no statistically significant difference in mean germination rates between the control and experimental groups.

In response to our first publication, Glen Atkinson (Atkinson, 2005) and Malcolm Gardner (see page 31 of this issue) provided valuable feedback on our results. We thank both commentators for their time and thoughtfulness. Unfortunately, they offer conflicting advice on the best time to prepare the peppers. Atkinson, quoting Kolisko and Thun (but without citations) suggests burning when the moon is in opposition to the sun (full moon) and Saturn. Gardner, quoting Steiner (1924/1993), suggests burning under a waning or new moon, and denies an influence from the Zodiac. We will deal with the moon phase first, and then turn to a discussion of the Zodiac and the position of the moon in relation to Saturn.

Although we did not previously report the fact, our first burning took place when the moon was waxing. If the time of burning is essential in preparing an effective pepper, and if the full moon is the correct time to burn, then the results of this trial must be viewed with skepticism. The

pepper may not have been effective. If the correct time to burn is during a waning moon, our second and third trials provide some evidence on the effectiveness of the peppers. These trials used a pepper that was burnt during a waning moon. In neither trial did we find a statistically significant effect on seed germination.

Our first indication that the position of the moon in the Zodiac might be important for pepper preparation came from Jon Lyerly, a biodynamic farmer in Cedar Grove, NC. He quoted his teacher, who runs a prominent training center in the United States, and related his experiences using the method. We do not mention the teacher's name because we have not verified these reports with him. The practice of burning when the moon is in a fire sign is also suggested by Hugh Courtney, who writes on the Biodynamic Association website "Gather seeds of the weed in question, and ash them at the beginning of the Moon's passage through a FIRE constellation (with Leo/Lion being first choice), preferably just before a New Moon or a Full Moon. The most propitious time for ashing of weed seeds (as well as application of the resultant ash) is likely when both the Sun and Moon are in Leo/Lion" (Courtney, 2006). He attributes this method to Maria Thun (Thun, 2000). An earlier summary of Thun's work contains indications that are in line with Courtney's recommendations (Thun, 1964), though this work does not mention the seed peppers. Although we have not pursued the original reports of the research leading to these recommendations they may be present in Thun and Heinze (1979). As Gardner point out, they do not originate with Steiner. A summary and generally positive reappraisal of research related to Thun's constellation hypothesis<sup>1</sup> appeared in a peer-reviewed journal (Koller-

**Table 1. Second germination experiment results (08/25/05–09/29/05)**

	Mean % germination	Standard deviation	p-value
Total germination – experimental	72.9%	12.22%	0.17
Total germination – control	77.3%	7.45%	
Abnormal seedlings – experimental <sup>1</sup>	2.6%	2.98%	0.07
Abnormal seedlings – control	4.3%	1.65%	

1) Abnormal seedlings are those that were underdeveloped or had major defects at the end of the experiment (Eldridge et al, 2005). The most common characteristic of an underdeveloped seedling was a 1–2 inch hypocotyl topped with a seed coat still containing the cotyledons.

**Table 2. Third germination experiment results (10/18/05 – 11/22/05)**

	Mean % germination	Standard deviation	p-value
Total germination – experimental	77.9%	8.96%	0.4
Total germination – control	88.0%	4.60%	
Abnormal seedlings – experimental	0.8%	1.23%	0.5
Abnormal seedlings – control	0.8%	1.32%	

strom and Staudenmaier, 2001). The authors examine the experimental evidence that the position of the moon effects crop yield, reanalyzing the data in some cases. They conclude that Thun's hypothesis is "testable and verifiable" and may have practical implications for organic agriculture.

We are unaware of experimental research that demonstrates an effect of moon position on the effectiveness of the seed peppers. This may exist in German, but has so far eluded us. Thun (2000) may contain some information on this topic, though addressed to the general public.

Both of our peppers were prepared when the moon was in a fire sign. Since, according to both Thun's theory, and Steiner's indications on moon phase, the second pepper was prepared correctly, we feel confident in our conclusion that the pepper does not act directly on seed germination. If it had, we would have expected to see some effect in the second or third trial.

An additional suggestion for burning time comes from Atkinson, who suggests burning when the moon is in opposition to Saturn. Apart from his letter we are not aware of any reports of this suggestion, and are not able to comment on it further. None of our experiments tested peppers burnt when the moon was in opposition to Saturn.

We are currently in the process of setting up a new series of experiments to further test the effectiveness of a seed pepper as a weed control method. In these experiments we will use *Brassica rapa* plants (Wisconsin "Fast Plants") grown in the growth chambers at UNC Greensboro. The time from seed to seed in these plants is approximately forty days, under continuous light. We are shifting to *Brassica* because okra is too large and its life cycle is too long to allow us to carry the experiments from seed to seed in our facilities within a reasonable amount of time. We needed to find a plant that is small in size, has a short life cycle and does not spontaneously reseed. *Brassica rapa* satisfies all of these requirements.

The size requirement is due our space constraints. We have the use of two large growth chambers, but need to grow twenty flats of plants, so the plants have to be small.

The short life cycle requirement is needed to make the experiments tractable. We do not have the personnel or the money to carry out long-term experiments. At this time we cannot realistically undertake experiments that will take four years to complete.

The requirement that the chosen plants do not spontaneously reseed is important because we need to be able to count how many seeds are planted in each flat. The first generation does not present difficulties, but if there is reseeded, the later generations become problematical. We need to be able to compare seed production across flats in gen-

erations two through four. If the plants spontaneously reseed, we will never know how many seeds are in each flat, and cannot make comparisons between treatments. Even using *Brassica* we have to be careful not to break open any of the seedpods when we harvest them.

Finally, *Brassica* is a genus that contains many weeds. Using a *Brassica* allows us to more closely mimic a farming situation than does using a plant like okra.

We plan on extending the experiment for several generations, using the seeds produced in one trial as the raw material for the next. Throughout this process we will use the same flats with the same soil, and will re-pepper the soil at the beginning of each generation. We will gather data on the number of seed pods and seeds produced by each flat for each generation, and the percent of progeny seed that germinate in the subsequent generation. Control and experimental results will be compared with a t-test.

Our ashing methods will be consistent with Steiner's (1924/1993) suggestion that the seeds be burnt during the waning moon. In order to keep the experiments as simple as possible, we will not keep track of the moon's position in the constellations during burning. Published reports on crop yield suggest that the effects of planting time under the Thun hypothesis range from 7-10% (Kollerstrom and Staudenmaier, 2001). If the seed peppers cause a complete reduction in the presence of a weed in four years, they should produce a 25% decrease in abundance in the first year, assuming a linear reduction over the four years. Thus, the maximum effect of burning time should only be 2.5% per year. This effect size is unlikely to be a significant factor in our experiments. At this stage we are mainly concerned with producing an effect under experimental conditions. We are not concerned with the magnitude of the effect. For these reasons we feel that the moon's position in the constellations is unlikely to be crucial to our experiments.

### Notes

- 1) In approximately 1956 Maria Thun developed the hypothesis that sowing when the moon was in the appropriate constellation would lead to improved crop yields. Root crops are sown when the moon is in an earth sign, leaf crops in a water sign, flower crops in an air sign, and fruit crops when the moon is in a fire sign (Kollerstrom and Staudenmaier, 2001).

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### Comments from Malcolm Gardner

*The following was received following the publication of the authors' earlier article and was sent to them while they were working on the subsequent experiments. They note in the present piece their intention to address Malcolm's comments regarding the need to study pepperings' effects on seed formation over generations.*

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I was glad to see the report in the Autumn 2005 issue of an experiment addressing the biodynamic weed control technique of "peppering." I agree with the appended commentary by Glen Atkinson that the experiment was flawed insofar as it only looked for immediate effects on seed ger-

mination rather than for effects on seed formation and germination in subsequent generation(s). After all, the report authors themselves quote Steiner as saying the effects would be noticeable (only) after two years.

As far as the burning time is concerned, however, I want to point out that there is an explicit timing indication by Steiner that is consistently overlooked by most biodynamic practitioners and advisors. This indication is in the handwritten notes that Steiner made in preparation for his agricultural lectures, which are published in the American Biodynamic Association's 1993 edition of the agricultural lectures, but not in the British 1974 edition that was referenced in the report. In these notes Steiner writes:

In the presence of the Sun (*full moon*) reproduction is promoted: at new moon it is hindered.

You work against growth by destroying the process taking place between full moon and new moon – during this time you destroy the fruit by burning it – and add the prod[uct] of combustion to the soil. —

[p. 35 in Steiner's numbering of his notes;  
p. 230 in the 1993 edition]

From this it is evident that Steiner regarded the time of the waning moon, and perhaps especially the new moon, as the prime time for burning weed seeds (or "fruit"). It should also be noted that in no place does Steiner suggest that the position of the moon in the zodiac is relevant to the burning time for plant seeds. Indeed, in his sixth agricultural lecture he remarked that, "When you are trying to accomplish something in the plant world, you can stay within the solar system" (page 121 in the 1993 edition).

As part of the design of a follow-up experiment, therefore, I would encourage the authors to try burning the seeds during the waning moon (especially just before new moon) as well as at the other recommended times (especially those that do not occur during the waning moon, such as Atkinson's moon-sun opposition = full moon). **Note:** *In response to this suggestion, Bruce Kirchoff writes that for the next round they will limit the variables involved and follow the practice of ashing during the waning moon, noting "We need a positive result before we try variations. Our first experiments need to be as simple as possible, while still giving us a good chance of getting positive results."*

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