What Makes Air Potato Bulbils Sprout?

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What makes air potato (*Dioscorea bulbifera*) bulbils sprout, and when can we expect them to sprout in Florida? These questions may not be on the top of everybody's mind, but I'm sure that some have wondered. A few studies which have been conducted outside of Florida may provide some clues. Okagami and Tanno (1991) found that dormancy in Japanese air potato is controlled by an endogenous sprouting inhibitor that gradually degrades over time, but they also found that a chilling period was required before bulbils would sprout. Martin (1974) worked with air potato in West Africa, and suggested that moisture and photoperiod were important.

No work has been conducted on bulbil sprouting in Florida, so a small study was initiated in the fall of 2006. We hypothesized that humidity, day length, temperature, and size of bulbils may influence sprouting and, in addition, we thought that bulbils collected at different locations might respond differently to environmental cues. Bulbils (80) were collected in November from vines at two locations, Gainesville (Alachua County; USDA Plant Hardiness Zone 8B) and Fort Pierce (St. Lucie County; Zone 9B). The mean weights of bulbils collected from the two locations were not different, with an average of 16 grams, but there was a large range of 0.5 to 107 grams. The bulbils from each site were randomly assigned to eight different treatments with 10 bulbils from each site in each treatment. The treatments included two temperatures, two humidity levels, and two diurnal light/dark regimes (Table 1). Bulbils were placed in incubators at the indicated conditions on November 21, 2006 and thereafter inspected weekly for evidence of sprouting.

Treatment	Temperature (°F)	Relative humidity (%)	Photoperiod (L:D)
1	60	48	14:10
2	60	48	0:24
3	60	70	14:10
4	60	70	0:24
5	80	48	14:10
6	80	48	0:24
7	80	70	14:10
8	80	70	0:24

Table 1. Treatment conditions for air potato dormancy study.

Temperature and bulbil weight were the only factors that influenced the time of sprouting—humidity, day length, and origin of bulbils played no role. Thus, the data from locations, humidities, and day lengths were pooled by temperature for further analysis. In the 60°F treatments, the first bulbils sprouted after 23 weeks and 50% of the bulbils had sprouted at 29 weeks. At 80°F, sprouting occurred much earlier with the first bulbil sprouting at 6 weeks, and 50% of bulbils sprouting by week 9 (Figure 1). When the study was terminated after 39 weeks, 100% of the bulbils at 80°F, and 85% of those at 60°F had sprouted. Smaller bulbils took longer to sprout than larger bulbils, both at 60°F and 80°F, but there was little variation in sprouting date for bulbils that weighed more than 20 grams (Figure 2).

We used the relationship between temperature and time to sprouting to estimate a theoretical lower temperature threshold under which no sprouting would occur and to estimate the number of degree-days required for sprouting. This information was then used to produce a map (Figure 3) for predicting when 50% of the bulbils at any given location can be expected to have sprouted based on average temperatures over the past 10 years. In years that are warmer than average, sprouting would occur earlier and in cooler years, sprouting would occur later. Additionally, we started counting degree days on October 1, when bulbils are maturing on vines in Fort Pierce. The prediction for Fort Pierce appears to be

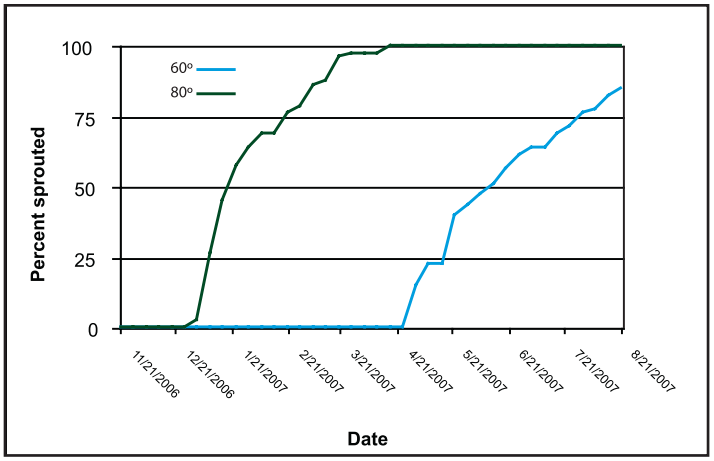

Figure 1. Sprouting dates of Dioscorea bulbifera *bulbils collected in November, 2006 and held at 60° and 80°F.*

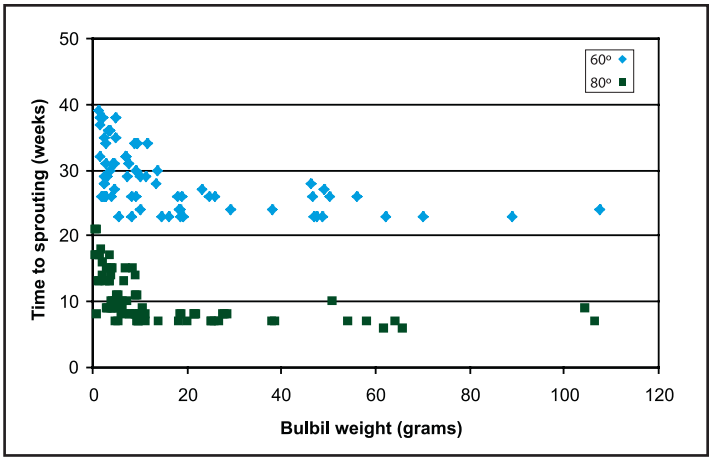

Figure 2. Relationship between bulbil weight and time of sprouting.

reasonable as we have field data from the spring of 2007 which indicates that 50% of bulbils have sprouted by April 19. However, the dates predicted for other areas of the state require field verification. It is likely that bulbils farther north in Florida mature later than those in Fort Pierce, which may influence the predicted time of sprouting.

The results of the study appear to support those of Okagami and Tanno (1991) who found that dormancy was controlled by a sprouting inhibitor which degrades over time. When the level of the inhibitor falls below a certain threshold, bulbils sprout. It would make sense that the degradation of the chemical inhibitor would occur more quickly as temperature increases. However, the same authors indicated that a chilling period was required for bulbils to sprout. Since we did not subject our bulbils to a chilling period, this clearly suggests that there are physiological differences between Japanese and Florida air potato.

The fact that bulbils from Gainesville and Fort Pierce responded in a similar manner to temperature may be a reflection of low genetic diversity of air potato in Florida. In the native range of air potato, sexual reproduction occurs, but this has not been observed in Florida, where we believe that all reproduction is clonal. If this is true, the genetic diversity currently present in the state will be the same, or somewhat less, than the diversity that was originally introduced. Coursey (1967) speculated that air potato was first introduced into North America from Africa during the early years of the slave trade. The first record of the vine in North America was from Mobile, Alabama in 1777 (Bartram 1791).

The predicted sprouting dates of air potato in Florida may be of use to land managers in their efforts to control the plant. If air potato could be controlled in early or mid-summer before bulbils were present on vines, it would decrease the number of propagules available to start the next season's crop. Finding air potato plants in the spring when they first start to grow is difficult, and our work does nothing to improve that situation, but at least there is now some indication of when land managers can start to look for this FLEPPC Category 1 invasive plant species.

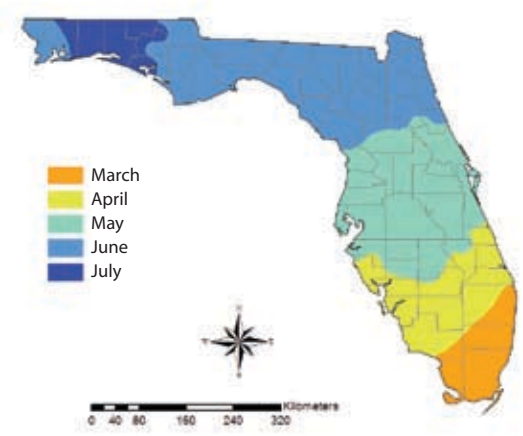

Figure 3. Estimated months of 50% sprouting of Dioscorea bulbifera *in Florida based on average temperatures over the past 10 years.*

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