

Digitalis grandiflora - New Crop Summary & Recommendations

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Germination Studies & Cross-Pollinating of
Digitalis grandiflora

Introduction

The genus of *Digitalis* is very common throughout Eastern Europe and has become more popular in the United States as a garden perennial. The most common species of the *Digitalis* genus is *purpurea*, or Purple Foxglove. This plant is native to Eastern Europe but has established itself in the United States as well. During its history, it has been used as a medicine for heart conditions and helps relieve people of diet problems. Also, gardeners have produced several hybrids that have become available in the floriculture market (*Digitalis purpurea*). *Digitalis grandiflora*, Yellow Foxglove, is the common relative to *purpurea*. Not only has it been used for the same purposes as Purple Foxglove, but also has found its only niche in naturalized areas of the United States.

An interesting fact about these species of plants; the foxgloves in general is that their name has had many interesting fables. The word *Digitalis* in German means Fingerhut. The common name is derived from the shape of the flowers since they are shaped like the fingers of a glove (Grieve 2010). Throughout Norway, it was a common folklore that this plant was used by fox to put on their feet to dampen their noise while prowling for food in the woods. There have also been numerous names given that dedicate the lethality of the plant such as: Witch's Hut and Dead Men's Bells.

The purpose of this experiment was to analyze the germination and yield percentages of *Digitalis grandiflora*. The crosses that were made were between plants that had varying inflorescences lengths ranging from short to long. The plants were grown in a non-heated with varying degrees from 50-65°F. The plants were two years old and as they aged seeds were hand

harvested from individual capsules, counted, and germination studies were done. The overall experiment took place through the course of 3 months and the main focus was to determine whether or not *Digitalis grandiflora* can become the next big bedding plant produced in the United States and the reasons why this may happen.

Taxonomy

The common name of *Digitalis grandiflora* Mill. is Yellow Foxglove or Large-Flowered Foxglove. There are numerous synonyms for the plant as well including: Witches' Glove, Dead Men's Bells, Fairy's Glove, and Bloody Fingers (Grieve 2010). Yellow Foxglove belongs to the family Scrophulariaceae and can be produced as a biennial or perennial depending on the location (USDA 2010). It can be grown in U.S. Hardiness zones 3-8 and is classified as an herbaceous perennial.

Geographic Distribution/Native Habitat

The genus *Digitalis* was originally found in Eastern Europe. Eventually it came to reside in the United States. As of right now, Yellow Foxglove is native to the states of Minnesota, Ohio, Ontario (Canada) and several Northeastern states in the U.S. (USDA 2010). According to the USDA, it is also hardy to all lower 48 states (L48) meaning that it's not hardy in Alaska or Hawaii (USDA 2010). The plant is easily grown in medium moisture, well-drained soils in part shade and prefers to have a lot of fertilization. Wet soil in the winter can cause damage to the plant preventing them from flowering the next year (Missouri 2010). The plant is not likely to become invasive but does have the capability because it self-pollinates. Plant communities that it grows in are along streams in woodlands after fires, and along roadsides, in Europe.

Taxonomic Description

The plant generally grows to a height of 2-3 feet and a spread of 1.5 feet with a mounding nature. Blooms appear from late May to late June. The flowers are located along the stem which can be up to 2' long. The flowers can grow up to 2" in length and are a soft yellow color with brown spots located in the inner part of the flower. The leaves are "finely toothed, medium green, ovate-lanceolate (up to 10" long and 2" wide) appear in basal rosettes and alternatively up the stem" (Missouri 2010). The flowers from Foxgloves also make very nice cut flowers from the garden and have been used for medicinal purposes since the late 18th century (Grieve 2). In fact, commercial production of *D. grandiflora*'s common relative *D. purpurea* is currently happening specifically for growing of leaves for medicinal purposes.

Names and Descriptions of Varieties on the Market

There are several varieties of *Digitalis* that are on the market. *Digitalis purpurea* has numerous cultivars currently available including 'Camelot' which is bred for a first-year flowering version of foxglove (Pilon 2004). 'Foxy' is another cultivar that is currently on the market (Dole 2005). All of these cultivars are specifically bred for the appeal of easy propagation without a cold-treatment to get flowering and a superb germination rate. Grecian Foxglove (*Digitalis lantana*) is a white variety of *Digitalis* that is just coming out onto the market it has been considered to be invasive in places like Minnesota (England 2007). Grecian is a white color with brownish spots located in the middle. There are about 20 different species of *Digitalis* currently known of.

Propagation Methods

All foxgloves can be easily produced from the seeds produced by parent plants. Each seed capsule on the plant can produce up to 200 seeds based off of the research done in this experiment. A good way to collect seeds would be to wrap a plastic bag over the capsule to

retrieve all seeds that may come from the seed pod. After this, seeds should be dried in a small paper envelope and then placed in a refrigerator until planting is done. Seeds should be sown in medium soil and placed on mist benches with the temperature ranging from 70-75°F.

Germination can take up to 2-3 weeks for *Digitalis grandiflora* according to the experiment completed during the semester and growing on will take up to 3 months and maybe longer to get it to flower (Experimental *D. grandiflora* has not reached visible bud date yet after 2 months).

Product Specifications

The ideal *D. grandiflora* to enter the market would be one that is easily propagated by seed and had uniformity while growing and also with the flowers produced. Also, to ensure customer satisfaction and not risk the loss of plants through another growing season, breeding the plant to make sure that it flowers within the first year of planting would be beneficial.

Flowers should be uniform along the stem and also provide large flowers that consumers will enjoy. Developing a continually flowering *Digitalis* would also be beneficial for customers who would like to have that vertical element in their garden throughout the entire growing season.

Market Niche-Identification and Justification

Yellow foxglove would have a target date of early May if it were to be introduced into bedding plant production companies. This would ensure that consumer buying the flower at peak time of flowering and would be allowed to enjoy it flower through May and June. Plant will need to be started a year in advance because the plant is considered a biennial. This will also help to ensure that the plant will survive a winter season. The plant could be used for Mother's Day and Memorial Day but would be hard to produce year round. The major competitors for this crop are going to be shade tolerant perennials that are non-toxic to humans and animals. Some of these include *Astilbes & Hostas*. The fact that the leaves for this plant are

the primary ingredient in the cardiac drug, Digitalis could be a reason for the commercial production to be increased (Floridata 2000).

There are a lot of reasons why this plant may become more common in home gardens. The first reason is because it provides an outstanding vertical element in either pots or along fences in cottage gardens. The fact that it is shade tolerant also makes it a likely candidate for becoming the next big bedding crop. Foxgloves also provide a great cut-flower for homeowners as long as they are aware that it is toxic. Another perk of the product is that it is rabbit and deer resistant because of the toxicity.

The initial problems that this plant will have entering the market is competing with a consumer group who has been buying petunias, pansies, and geraniums for a very long time. For people to buy a perennial that does not have a lot of information about it will be difficult to promote. Also, the fact that this plant is toxic could also turn away a lot of customers, especially those with children. The crop is identifiable to most commercial growers but consumers may have difficulty recognizing this crop at this point in time. If continued breeding were to happen for this plant, it could be on the market in the matter of a couple of years as a highly produced perennial/biennial.

Anticipated Cultural Requirements

As mentioned earlier, the plant is hardy to U.S. Zones 3 to 8 which also give it great marketing capability. Yellow foxglove thrives in well-drained soils meaning it may be somewhat heat resistant. Temperatures should try to remain on the cool side around 55-70°F in order to maintain plant quality. Germination as mentioned before should be between 70-75°F. Digitalis does not respond nor need photoperiods to make it flower. Soil should be well-drained and medium moisture located in part shade (Kemper 1). Plant growth regulators would not be

used based off of the propagation of the seeds collected in the experiment. Seeds should be planted in 288-cell trays with 1 seed per cell. After that plants may be placed in 6-0-6 until ready to be planted outside. If you are growing the plant two years in a row a 5" standard pot will be an adequate size for continued growing on through to the next season.

There are few problems when growing *D. grandiflora*. The main problems the plant has are that of powdery mildew, leaf spot and black spot. If action is not taken when this is initially seen the foliage can fall off of the plant by early to mid-summer (Kemper 1). There are several pest problems that Yellow Foxglove can encounter as well. Some of the pests include: aphids, mealy bugs, slugs, and Japanese beetles (Kemper 1). Also the destruction of natural habitat is causing these plants to lose their habitat in the wild.

Complete Production Schedule

Figure 1(below): Crosses and # of seeds collected

<u>Crossed Plants = Yarn color</u>	<u>Total Number of Seeds Collected</u>
<u>Digitalis (Dig) #7 x Dig #9 = #1 red</u>	<u>468 seeds collected (2 seed capsules)</u>
<u>Dig #5 x Dig #6 = Teal #1</u>	<u>704 seeds collected (3 seed capsules)</u>
<u>Dig #7 X Dig #8 = Blue #2</u>	<u>240 seeds collected (2 seed capsules)</u>

Dig #3 x Dig #2 = Gray #1 & 2

348 seeds collected (2
seed capsule)

Dig #8 x Dig #9 = Yellow #1

323 seeds collected (1
seed capsule)

Dig #1 x Dig #2 = Blue

13 seeds collected (1 seed
capsule)

Dig #1 x Dig #3 = Red #1 & 2

215 seeds collected (2
seed capsules)

Dig #1 x Dig #4 = Teal #1

243 seeds collected (1
seed capsule)

Cross	Germination Counts	Cross	Germination Counts
#1 x #3	10/24	#1 x #3	14/24
#8 x #9	19/24	#8 x #9	21/24
#3 x #2	13/24	#3 x #2	21/24
#1 x #4	11/24	#1 x #4	16/24
#7 x #9	9/24	#7 x #9	18/24
#1 x #2	0/12	#1 x #2	0/12
#5 x #6	16/24	#5 x #6	22/24
#7 x #8	12/24	#7 x #8	18/24

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Figure 2 (Above): Germination Counts take on April 19th and April 31st, respectively

As you can see above, the germination of this plant is very successful. There was only one cross (#1 x #2) that did not produce any seedlings (0% germ count) and no yield percentage. It also had very little seeds produced to begin with. It is also important to remember that only 24 seeds were planted and a lot of the crosses had well over 200 seeds produced in capsules. This is significant because this would make this plant a very cheap one to produce and highly successful to propagate by seed.

Production Schedule

- ⊙ Media
 - > Well drained media in 288 plug trays, 1 seed per plug
- ⊙ Seed Collection
 - > Capsules should be allowed to dry on host plant and plastic bags should be placed around the seed capsule to gather seeds. Over 200 seeds per capsule are produced per capsule.
- ⊙ Stratifying
 - > Not necessary, keep seeds in refrigerator until ready to be sown

- ⊙ Germination 70-75°F
 - > 2 weeks
- ⊙ Plug Stage 65-70°F
 - > 4-5 weeks
- ⊙ Growing On 60-65°F
 - > 8-12 weeks (Make sure to watch for potential development of Powdery Mildew or Black Spot located on the leaves of the plant)
- ⊙ Total Production Time
 - > 14-19 weeks (Could be longer depending on target bud date for the plant)

Time to flower depends on whether or not the plant is a biennial or perennial. If it is a biennial the plant should be grown and then placed outdoors the second year to have flower around early May to late June. If a perennial, time to flower will need to be reached by early May to make sure the plant survives so seeds should be started indoors 2 months prior to last frost date.

Assessment for Genetic/Market Improvements

There are numerous experiments that need to be done in order to make more decisive conclusions on whether or not this can be a popular produced perennial/biennial. With this particular experiment, continued growth needs to be done to determine whether or not the crosses worked. Hardiness in Minnesota winters would also be beneficial. Consumer preference between inflorescence lengths would need to be done by having a survey for potential buyers. Also, intergenus hybridizing would be beneficial to produce more colors of this flower instead of just yellow. Also breeding for more flower power would make it more appealing to consumers.

Marketing of the product would need to be done in order to promote the fact that the plant is poisonous. Indigenous people using this plant as a medicine could be a good way to use that negative aspect as a positive one. Another trait that *D. grandiflora* does not have that *D. purpurea* has is the development of numerous flowers around the inflorescence. If this could be produced in *D. grandiflora* it could make it competitive along with *D. purpurea*.

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