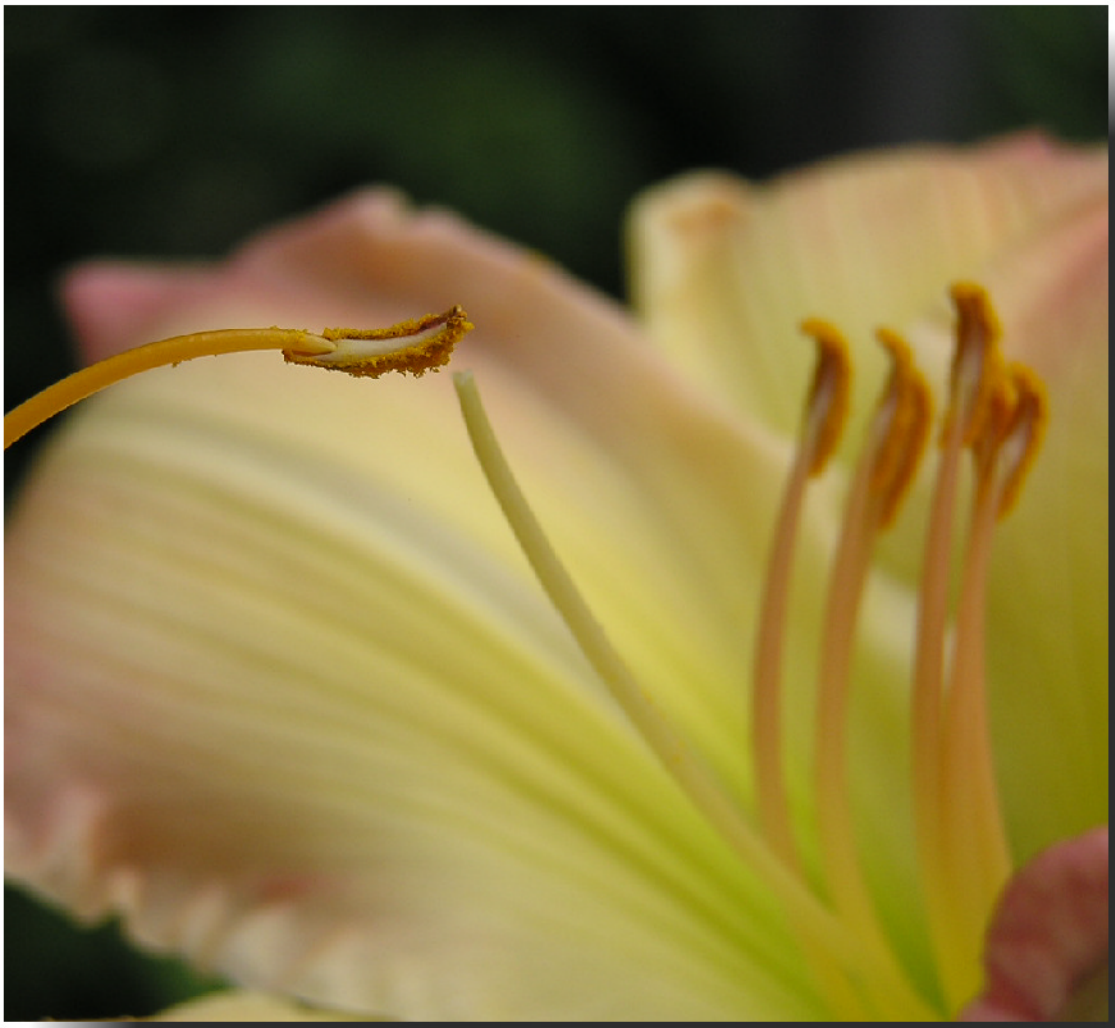
# Daylily Fertility Tips



*A compilation of daylily breeding advice from various hybridizers across the nation and resource information.*

*Terrie Mann*

## Introduction to Daylily Reproduction

It all seems so easy when we look at the daylily reproductive cycle. From dabbing pollen to the end product of a seed for that next greatest daylily to hit the planet, it's fun and addicting. Give a hybridizer pollen and stand back. It's like a loaded gun! Before you know it they will have more seeds than they know what to do with. That's usually the norm. Let's consider daylilies that are not eager to go through that experience, the difficult pod parents.

## What Influences Fertility?

The reproductive path has a number of different areas to investigate.

- First you look at the pollen. Is it viable?
- Next the pollen has to germinate on the stigma. Are there problems there?
- Once the pollen has germinated and the pollen tube is growing towards the ovary, does it have any problems?
- The pollen tube is entering the ovary area in search of an individual ovule. Are there problems there? Is the ovule ready for fertilization?
- Fertilization has taken place as the two sperm cells from the pollen tube enter the ovule. Are there any problems there?
- The ovule is working on becoming a full-fledged seed. Starting out white and turning black at maturity. Are there any problems there?

▶ Here it is, what we have been waiting for. A seed to plant.

But, wait... could there still be anything else that keeps us from getting the daylily we worked for? We need to look at seed viability issues, and environmental conditions of seed. What kind of planting medium are you using? Light, water, nutrients... it all matters.

The reproductive path seems complicated, but it works very well. So well, the bees do it for us all the time.


When we consider fertility problems we must look at many factors that could affect the reproductive system. Maybe the daylily you have been working with will does not make any seed or it is compatible with only certain other cultivars. What do you look at? Everything...

**- Plant Physiology Factors:** Anthers, Pollen/ Pollen Tubes, Stigma, Style Pathway for the pollen tubes and the Ovary/Ovules.
**- Genetic Factors**: Incompatibility, Defects or ?
**- Environmental Factors**: Temperature, Humidity, Light, Soil/Nutrients, Wind, Pollution or ?
**- Human Factors**: Is the time of day affecting it? Are you using viable pollen? Or ?

It's like solving a mystery and can be very challenging. If you are curious enough to try different methods, review the daylily fertility tips offered here. Don't limit yourself, talk to other hybridizers and get information on research done on plant fertility (look at other types of plants too ex: Lilium). Remember to step outside the box and have fun experimenting.

Thank you to everyone who contributed to this publication and especially to MaryAnn Pruden for providing her input and experience.

# Daylily Fertility Tips

ADVICE FROM HYBRIDIZERS ACROSS THE NATION

**Darrel Apps**
**Woodside Nursery**
**Bridgeton, New Jersey**
**Zones 6b-7a**

## The Greenhouse Method

In order to get seed set here we had to go to greenhouse culture. The most destructive natural problem here for seed set is wind which dries out the pollen rapidly. Excessive heat is a close second. In the greenhouse where there is no wind we can set seeds on crosses that are made during most of the day. We also move up our bloom time to April when we are not quite so busy as summer. Early morning crosses are usually the best and keep the pollen from drying out too much. This seems especially true on tetraploid spiders that have very long pistils We insure early morning opening by lighting in early morning and keeping the night temperature at a minimum 62 degrees F. Under these conditions we have been able to get seed set on many difficult pod parents.

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**Michael Bouman**

**St. Louis, Missouri**

## Keeping Records

I do all my work early in the morning with plants grown outdoors. In my back yard, the partial shade seems to provide a slightly cooler environment than a full sun bed where I grow another garden. I keep records of which cultivars set pods in "heat," which means above 90 degrees. 'Tuscawilla Blackout' is known for that trait. I have often kept no records on days when the forecast was 94 degrees, tried a few crosses anyway, and then kicked myself when pods formed on some of them and held on! On days with high temps predicted I write the prediction on the cross tag, but I'm not sure that means much, as I don't actually measure the temperature in the yard.

It seems generally accepted that "stud" pollen exists and should be used first on reluctant pod-setters. In my experience, Whatley's 'Butter Cream' and 'Tarta' are both "studs." I've heard 'Ruby Laser' is, also. Oscie Whatley's buddies used to use 'Atlanta Antique Satin' in that role.

I have also noticed that "easy" pod-setters may be impossible some years and vice-versa. Some cultivars need pollen early in the day for success. 'Smuggler's Gold' comes to mind. I had great luck with it, but always worked before breakfast.

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**Jack Carpenter**
**The Lily Farm**
**Center, Texas**
**Zone 8b**

## Greenhouse and Shade House Methods

I hybridize in both the heated greenhouse and outside in the shade house. See specifics below-

GREENHOUSE- I have best results with the application of pollen around the 10 a.m. to 12 noon time-frame. Temperatures are from 75 minimum to 85 degrees maximum in the greenhouse.

OUTSIDE IN THE 30% SHADE HOUSES - Best results seem to be at the 75 to 85 degree as above. I suspect that seed set would be better with up to 50% shade cloth in use, but I use the plants just as they are growing under the 30% shade cloth. Time-frame for hybridizing is best around 10 a.m. to 12 noon.

**Maurice Dow**
**Irish Lilyput Daylily Farm**
**Ontario, Canada**

## Daylily Myths

Some general observations on fertility and what I consider daylily myths.

A suggestion was made many years ago that using diploid pollen on tets might 'jump-start' reluctant tet pod parents. I have also seen suggestions that dip pollen be used first to pollinate a tet flower and that tet pollen be used later on the same flower. It was suggested that the dip pollen would supply 'auxin' that would help the tet pollen grow its pollen tube and fertilize the ovules. I would strongly advise that not be done.

If you place fertile dip pollen on a tet the pollen will grow a pollen tube and fertilize the tet ovules creating triploid embryos. Most of those will abort, due to what has been termed 'triploid block' but is in reality a problem with the parental ploidy of the endosperm within the seed. However, sometimes a few rare triploid seeds will survive. When no triploid seeds are produced, all the 'tetraploid' ovules will have been fertilized by the dip pollen leaving none for the later tet pollen so that the exercise was futile. However, when one or more triploid seeds survives and is viable the ploidy of the seedling will be (most likely) assumed to be tet when it is unknown and this can cause some problems with later registrations, hybridizing, etc.

'Jump-starting' reluctant pod setters by using any 'potent' pollen to set some pods and then using the desired pollen for setting later pods has also been suggested in the past. There is no valid scientific evidence that this works. In fact, when similar effects have been examined in other plant species, either there is no effect of initial pod set on later pod set or the effect is negative. In many plant species the early flowers have a higher probability of setting pods and maturing seeds than later flowers. This is sometimes due to architectural constraints (for example, later flowers are higher on the stem and have thinner branches than early flowers which are lower on the stem and thus the later flowers receive less food). In other cases, the food is directed to the initial pods and the later pods receive less and are more likely to be aborted or have fewer and smaller seeds.

Some years ago I examined the pattern of pod set on scapes to determine if the probability of later pod set was affected by the number of pods previously set and maturing seeds. If setting a pod jumpstarts later pod set then there should be a positive effect. I found no effect or suggestion of an effect.

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**Karol Emmerich**
**Springwood Gardens**
**Minneapolis, Minnesota**
**Zone 4a**

## Greenhouse Hybridizing

I try to hybridize when the temperatures are 65-80 degrees (which is why I use a greenhouse) - above 85 it's usually a waste of time, and above 90 not worth it at all. When I hybridized outside, I usually did it early in the morning and then in the evening (from 7-9PM) when the temperatures had cooled down. Pollen is obviously not ready early in the morning, so I pick flowers the day before and keep them in the refrigerator until the next day, or use frozen pollen. Flowers grown in the shade hold their set pods well, although plants grown in the shade usually won't have as many blooms. It used to be very easy to make plenty of seeds outside in Minnesota, but the past few years have been so hot that even if you get the pod started, it will often abort in the heat.

Some cultivars seem to only be fertile in the middle of the night or the day before bloom - those are the ones that have their pistils sticking out before the flower opens. I slather them with pollen as soon as I see the pistil the day before and sometimes do it again the day the flower is open.

On something that isn't very pod fertile, I make sure I hit all of the early blooms on the scape to get it going, and will use either extremely fertile pollen or will self it on those early blooms. I generally don't keep any of these seeds. Some folks suggest using diploid pollen to get them going, but I don't have any dips at

Springwood to use. On some cultivars, if you don't get them going like this early, you can forget trying to get set on later bloom.

Avoid overhead watering and rain after you've made your crosses:-) Water busts even more crosses than heat.

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**Curt Hanson "Chief Superintendent of Weed Control"**
**Crintonic Gardens**
**Cleveland, Ohio**

**Zone 5-a**

## Nature's Way

I don't waste my time on difficult parents, there are so many wonderfully fertile daylilies with untapped potential that I feel it's not only foolish, but actually bad for the daylily to bring added sterility factors into the genome. Given the remarkable wealth of characteristics in the modern tetraploid, and understanding the potential of any given combination of parents, it seems that only the narrow focused and unimaginative would dither around coaxing reluctant parents to produce seed. I am able to produce more seed each year than actually needed to make progress toward my hybridizing goals, let alone explore the pandoras box that continually opens every season.

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**Becky Hutchins (Miss Becky)**
**Carleton, Southeastern Michigan (Monroe County)**
**Zone 5/6**

## Uncensored Approach!

I garden in full sun, sandy loam soil on a six-acre "farm" - but only approx 2 acres are in daylily production. I fertilize my garden in the spring/fall with chemical fertilizers and/or organic materials if available. Water as necessary (well water) throughout the growing season. I weed and till my brains out till I could drop from exhaustion. Basically what I'm saying is: This is a one gal operation here at my home garden. I plant, I weed, I dab, I harvest, I do it all baby!

My hybridizing trials and tribulations for setting pods consists of:

The usual STUD APPROACH - ie using super fertile pollen to start a pod hence enticing/wooing

the scape to accept pollen from other donors. This has been successful.

I've tried the OTHER BROTHER DARRYL approach - ie using closely related plants (similar parentage/same lines) to get a pod to set. This is sorta like the Burt Reynolds "Deliverance" kissing cousin tactic but it has worked with some fickle Reckamp's.

I've used the PRE-EMPTIVE STRIKE approach by applying pollen to protruding pistils before fluid is present. I've also followed this up with multiple strikes at various times of the day. This has been successful with some stubborn plants.

Similarly I've done the STRIP TEASE where I've deliberately opened a bloom and applied pollen before anything could get to it. I've also CASTRATED blooms to keep them from self-pollinating. Maybe those two words/phrases don't belong in the same paragraph? Strip Tease and Castrated???

I did try the NURSE APPROACH - ie pollen in a syringe injected into the ovary thing once. I was admittedly desperate trying to get Angel's Smile pollen to take on ANYTHING. Totally unsuccessful, but I'm a whimp when it comes to syringes.

On some "hard cases" I've dabbed each and every single bloom on a plant at various times of the day with several different assault tactics to no avail - to witness Curt Hanson's CONCRETE BLONDE won't do a damned thing.

And then of course, there's the dip X tet or vice-versa attempts. Couple seeds here and there of which very few sprout and even fewer mature. Frozen pollen gig, yes. Saving blooms the day before they open yes. Split pistils, yes. You name it, I've tried it.....without the luxury of a greenhouse. Now I realize that the greenhouse provides a specialized environment for hybridizers. Some attempts will be more successful in a greenhouse as opposed to out in the garden. And in some cases it's the exact opposite. But you should note that all of the above tactical approaches have been performed without the aid or assistance of a greenhouse. I regret that I have not recorded temperatures or times for my trials. All of the above mentioned approaches were born from desperation combined with determination.

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**Kathy Lamb**

**Loon Song Gardens**
**Champlin, Minnesota**

**Zone 4**

## Soil, Fertilization and Temperature

Fertility is a big challenge when making crosses in the garden in a MN July! Peak bloom is often accompanied by very hot, sunny weather.

Some of my tips:

Grow daylilies in pots and move them into the shade to make crosses. Or bring them into an air conditioned room in front of a bright window. Plant after you harvest the pods. (I have observed that the pods will often abort if you transplant before the pods are ripe). This is how I use daylilies I receive as new spring orders.

I make crosses in the morning and in late afternoon on hot days. I often use frozen pollen. I do not attempt crosses when temps reach 88 degrees F., but I have been successful with crosses up to that temperature. I have observed that daylily pollination is very successful on warm, humid days, even on days with scattered light rain (off and on). I set the most pods on days like this. I have successfully pollinated a split pistil, so if it is something you are after, go for it. I dab pollen on all three segments and get good results.

My native garden soil is mostly heavy clay with a moderately high pH (7.2). I have areas of loam with good tilth and moderate fertility as well as areas with pockets of sand. (We located on a glacial moraine, so we also have lots of boulders and rocks.) The bedrock is limestone, so pH tends to be high. I bring in amendments and new soil, so much of the topsoil is closer to loam -- at least, for a while.

Culture notes: I irrigate regularly. I use a 13-13-13 Nutricote time release in my pots and a variety of other fertilizers in the garden. I try to use mostly organic fertilizers in the soil, but I have tried other types. My soil tests for most areas show a need for additional nitrogen only, although I have a small field that needs a balanced fertilizer. I believe that water is probably the most crucial factor for good bloom, vigorous plants, pod set, and ripening.

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**Melanie Mason**
**North Country Daylilies**
**Buskirk, New York**
**Zone 4**

## Fresh Pollen

Here in the northeast, we are prone to relatively cool nights (50 deg.), rain showers, and pollen is often ruined by heavy dew. When I have a valuable new plant that I wish to use in hybridizing, I will cut the scape when the first flower is about to open and bring it inside in a vase. The flowers will continue to open normally for a week or two, and the pollen will be great. You can use it fresh, or refrigerate or freeze it for later use. You don't have to worry about rain, heavy dew, or insects stealing the pollen, and generally in the house, the pollen dries nicely.

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**Jim Murphy**
**Woodhenge Gardens**
**North Garden, Virginia**
**Zone 6b**

## Cloudy, Cool Days

Here in the mid-Atlantic, the daylily growing season is usually extremely hot and humid. Average temperatures in the daytime are around 89F, although frequently are over 90, and up to 102. We use many methods to produce seed. The most important point to remember in our climate is to get an early start on a day with a forecast of cloudy, or rainy, or under 88F. There is so much more seed set on cloudy and rainy days, that it makes sense to do it then. We get an early start, collecting anthers before 7am, and letting them dry inside the kitchen on paper plates , labeled with cultivar name, and allowed to open in the lower household humidity. Once dry, we check the flowers outside, and if the pistils show sticky fluid, the time for pollination is now. Since I work a full time job, and have to leave by 7:30 am, I usually use frozen pollen, collected as above, and stored in mini ziplocks on ½ Q-tips. I pollinate very early, and hope that the sticky fluid develops with the pollen still in place.

Tips: Use dry pollen early in the morning. Pollinate on a cool day. If it is over 90F, forget it. If you are using tets, forget it over 85F. You can also use mobile shade, such as a chair or a big weighted umbrella to achieve a little shade. It is also fine to put your mom plants in pots and keep them in the shade, to keep that temperature down. After pollination, tag the plants with BOTH pod and pollen parent, and the date. We use paper string tags. We then keep the plants well watered, and harvest seeds just when the pods start cracking open. Then we allow the pods to dry in open egg cartons, and finally, shell them with the original cross tag, into mini ziplock bags, and place in the refrigerator.

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**MaryAnn Pruden**

**Lebanon, PA**

**Zone 6**

## Safe Hybridizing

If the parentage of a cross must be 100% certain (ie. to check ploidy by pollination), safe hybridizing techniques must be used to shield both the pistil AND the pollen from contamination by unwanted pollens. Bees and other bugs, birds, and wind can all cause unwanted pollen from nearby plants to contaminate both the pistil and the pollen sacs if they are not protected. I've found pollen already on pistils at 7:00 am before bees were even active!

Method:

The evening before the flower opens, manually open the bloom and cover the pistil with a coffee stir straw. **This can be done early in the day for nocturnal flowers.**

**Collect the target pollen prior to the sac opening. This might be very early morning or even the night before for some plants.**

**At pollination time: Remove the straw and pollinate the pistil with the pre-collected pollen. Re-cover the pistil with the straw. (I leave the straws on until the bloom falls off).**

**The stir straws are also useful for protecting pollinated blooms from rain or overhead watering.**

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**Patrick Stamile**
**Floyd Cove Nursery**
**Enterprise, Florida**

## Prayer and Morning Shade

Prayer helps a lot <VBG>. We try to cross early in the morning. We can do this by refrigerating blossoms from the day before. We pollinate before the stigmatic fluid is present but we have the pollen in place when it begins to appear. We also try to give a light shade (30%) to the daylilies to help keep the plants a little cooler. None of this is necessary with the diploids but it sure helps with the tets.

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**Dan Trimmer**
**Water Mill Gardens**
**Enterprise, Florida**

## Temperature is the Key to Seed Set

I'm sure I can't add to much to the knowledge pool. Temperature seems to be the key to good seed set, so with that in mind here in central Florida I try and bloom my key parents a bit early in a greenhouse before the onset of very hot weather. I cover the geenhouse with shade cloth once the bloom starts and obtain additional cooling via evaporative cooling with cooling pads. On a very few key plants I'll actually bring them into my air conditioned home for a few days at a time and obtain wonderful seed set. I don't believe playing classical music to the plants aids in any additional seed set.
Fresh dry pollen is a must as moisture is our enemy. On a very few cultivars where seed set is very difficult I've found crossing at dusk to be the only way to produced seed.

## Information — The Key to Opening New Doors of Learning

When I first started working with daylilies in 2002 I was determined to find answers. I found a few answers, but many more questions. I found scientific information on hemerocallis limited and some articles on-line you had to pay for or be a member. I've listed some resources below.

## Articles, Books & Web Sites

**American Hemerocallis Society**

You can also request scientific articles from past issues of the Daylily Journal.

http://www.daylilies.org/daylilies.html

**Bill's Hemerocallis – The Daylily**

http://www.ofts.com/bill/daylily.html

**Daylily Rust**

http://web.ncf.ca/ah748/rust.html

**Daylily Spring Sickness**

http://web.ncf.ca/ah748/sstf.html

**Evaluation of genetic variation in the daylily (*Hemerocallis spp.*) using AFLP markers 2000**

J.P. Tomkins, T.C. Wood, L.S. Barnes, A. Westman and R.A. Wing

**Pollination Tips and Techniques**

Mike Huben

http://world.std.com/~mhuben/pollination.html

**The Daylily Place**

http://www.shieldsgardens.com/DLPlace/

**The New Daylily Handbook**

Frances L. Gatlin with James R. Brennan, 2002

Section on Pollination, Fertilization & Seed-Set, Pages 123-129

**The Quest for Unreduced Gametes - Part 1: A Historical Perspective**

MaryAnn D. Pruden

http://members.cox.net/lilyhouse/new_page_3.htm

**Tinkers Gardens**

http://www.tinkersgardens.com/daylilies/

**Triploids are Fertile**

Nick Chase

http://nick.assumption.edu/Daylilies/triploids.html

**Articles by Joe Halinar**

Factors Affecting Fertility in Daylilies
Diagnosing Fertility Problems in Daylilies
Polyploidy and Unreduced Gametes

Daylily parentage
Hybridizing goals
Daylily rust
Tets and parentage
Hybridizing using species
Breeding for foliage

Genetics 101

http://www.open.org/halinar/articles.html

## Scientific Web Sites

**Search Engine for Scientific Articles**

www.scholar.google.com

**HortScience**

**Effect of Plant Growth Regulators on Propagule Formation in Hemerocallis spp. And Hosta spp.**

Melanie Leclere, Claude D. Caldwell and Rajasekaran R. Lada, Jeffery Norrie, 2006

http://www.nsac.ca/pas/staff/rla/Lit/Melanie2.pdf

**Russian Journal of Plant Physiology**

Pollen Chemosensitivity to Ozone and Peroxides

http://www.springerlink.com/content/p53338k0778m5115/

## Daylily Forums

Besides AHS Robin there is a variety of forums. They are a good place to receive and share information. Here is a sample of a few available. There is also a forum at Tinker's Gardens. The internet address is under Articles, Books &Web Sites.

### Daylilies for Northern Climates

http://groups.yahoo.com/group/dayliliesfornorthernclimates/?yguid=127700713

### Daylily Companions

http://groups.yahoo.com/group/Daylily-Companions/?yguid=127482628

### Hem-Forum

http://tech.groups.yahoo.com/group/hem-forum/?yguid=127700713

### Lillium

I added this forum because of all the scientific studies using Lilies. They have people doing embryo rescue in their homes! I've also read articles using many different methods for bridging the gap of fertility issues.

http://groups.yahoo.com/group/Lilium/?yguid=127482628

### Northern Daylily Culture

http://tech.groups.yahoo.com/group/NorthernDaylilyCulture/?yguid=127700713

## Contact Information

**Presenter**

The Secret World of Daylilies – a microscopic journey

***Terrie Mann***

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### My Interests

Daylily Genetics

Daylily Reproductive System

Doubling Chromosomes

Embryo Rescue

Plant Hormones- Gibberellic Acid

Methods for Determining Ploidy

Methods for Improving Fertility

### Microscopic & Close-up Daylily Images

Anther, Pollen, Pollen Tubes, Stigma, Style, Ovary, Ovules, Chromosomes, Petal/Sepal Cross-sections and Surface, Guard Cells

### Past Research Areas

BAP-10, Bud & Seed Conversion (Chromosome Doubling), Chromosome Structures (Root Squashes), Gibberellic Acid, Guard Cells, Daylily Reproduction

**Panel Moderator**

***MaryAnn Pruden***

garymap@comcast.net

### Interests and Experimentation Areas:

Chromosome doubling using caffeine or other methods not using colchicine

Unreduced Gametes

Daylily fertility: Cut & Split Pistils, Stigmatic Fluid, Self-incompatibility, Plant Hormones, Pollen Tubes

Spring Sickness

Daylily Rust

**Panel Members**

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