PÆONIA

An International Newsletter for Peony Hybridizers

Volume 26, No. 1 **Winter 1995**

Editor and Publisher:

Donald R. Smith
46 Exeter Street
W. Newton, MA 02165

Subscription Rates:

U. S. and Canada	Outside U. S.
5 yrs. -- $25.	$35.
10 yrs. -- $45	$65.

Table of Contents:

THE RECIPROCAL INTERSECTIONAL CROSS: A PROGRESS REPORT

Donald Smith

I reported on the reverse intersectional cross in my first issue of the newsletter (Vol. 25, No. 1). The pattern for this cross reported in that article was repeated again this year as well. Once again many seeds were produced from this cross and again as in past years most of these seeds were no good. I continue to be amazed at the large number and size of the seeds produced by this cross. They are the largest seeds which I have ever encountered. This year there were 62 seeds from 14 crosses; bringing the four year total to 221 seeds from 71 crosses (3.1 seeds/cross). Of this season's total only one seed was "started". This was a huge seed from an *Age of Gold* x *M. Washington* cross with dimensions of 13.5 mm x 9.0 mm x 9.0 mm and a corresponding volume of 0.57 cm^3. Yes, that's right, this seed was over half an inch long. Very large by any standard, but nonetheless typical of those produced by this particular cross. Started on 9/25/95, this seed germinated quickly after only 38 days. I have previously reported on two similar seeds from the same cross which germinated quickly but then stalled and died. This year, however, the root continued to grow rapidly and by 11/15/95 (53 days) had grown to ~25 mm in length; at which time it was transferred to the refrigerator. A mid-winter check of the seed on 12/29/95 revealed that the root had grown to a length of ~60 mm and showed the normal root swelling near the seed which precedes root splitting and

plumule emergence. A second check on 1/16/96 showed continued growth (length ~ 70 mm) and the first signs of root splitting. From this point on, observations were made approximately once per week. The seed was removed from the refrigerator on March 4 (after 110 days) when a check showed the start of normal plumule emergence. After sitting at room temperature (~60-65°F) for two days, it was planted indoors in a 4" plastic pot (as with all of my seeds), watered freely and placed under artificial (growlux) lights. On 3/11/96 the stem appeared above the surface and has continued to grow normally ever since. Few plants totally fail (die) after making it this far (maybe 10% or less), so I am very optimistic about the survival of this one. At this stage (approx. 3 weeks), it is hard to differentiate this plant from other "normal" intersectional hybrids, but time will tell more. I will watch this one very closely and report on its progress in the future.

ABOUT THE EDITOR

A number of you have written asking me for more information about the new editor. Questions have covered a fairly wide range of subjects from general questions like who am I to specific ones like what kind of computer do I use to publish the newsletter? So here goes.

I am 53 years old and working full time as a research physicist in the field of atmospheric physics. I have managed a number of successful rocket and satellite experiments directed at measuring infrared emissions from the earth's upper atmosphere. I am married and have two young children (Haleigh Rose, age 7 and Zachary, age 10). My children are quite fond of referring to their dad as a rocket scientist (as in the expression "You don't have to be a rocket scientist to figure that out"). My wife (Amy) sells computers for a large computer company.

I am a serious runner who also enjoys skiing, fishing, tennis and of course gardening and hybridizing. I coach both boys and girls (youth) soccer and basketball. At present I am running 6 miles a day, 5 days a week. I have run more than 25 marathons (with a personal best of 2 hr 49 min.) and several ultra-marathons including a 50 mile race. I have been running daily for almost 20 years and recently celebrated my 40,000 mile anniversary.

I have had a passion for peonies since I was a young boy. We had 3 giant old plants with big double flowers in the back yard of the house in Maywood, N. J. where I spent most of my childhood (2 whites and a red). I am fairly certain that the whites were *Festiva Maxima* (Miellez, 1851) and the red was probably *Felix Crousse* (Crousse, 1881). I remember they were magnificent in bloom year after year after year.

I became interested in tree peonies in the late 60's after reading an article in *Horticulture* magazine by the late Silvia Saunders entitled "Those Other Peonies" (Sept. 1969, p. 18-21). This article (which I still have) had several beautiful pictures of Japanese tree peonies (p. suffruticosa). The following year I saw a flower of the bright yellow lutea hybrid *Alice Harding* at the New England Flower Show, and I was hooked.

My interest in breeding peonies began in the early 70's with the introduction of the first Itõ hybrids by Louis Smirnow. I have been fascinated and intrigued by this remarkable cross ever since. A plant which combined the best characteristics of herbaceous and tree peonies was to me the "perfect" peony. I joined the *Pæonia* group in the early years and owe most of what I know about peony breeding to the great teachers of our time; Prof. Saunders, his daughter Sylvia, Roy Pehrson, Don Hollingsworth and, of course, Chris Laning. I am grateful to these great men and women for what they have shared with us all.

Before I forget, I use a Macintosh Performa computer hooked to a color scanner and a color ink-jet printer. I have OCR (Optical Character Recognition) software so that I can scan-in any letters which are typed or produced on a "good quality" printer (this includes all Ink-jet and Laser printers, but <u>not</u> the older dot matrix type). This has saved a great deal of time for me as I am not a speedy typer. For word processing software, I use Microsoft Word, Version 5.1 or 6.0. Those with computers can send material for the newsletter on standard 3.5" floppy disks generated either on a Mac or a PC. I can read documents created with either Word or Word Perfect.

The following article was submitted by a new subscriber to *Pæonia*, Harold Entsminger from Cut Bank, Montana.

A Method of Pollination

Spring is coming, and with it many of our finest peonies will again come into bloom. Many of us have set our hybridizing goals, and have already planned our crosses for the coming season.

I have used the following method of pollinating for years, and can highly recommend it. Tools you need are three, a small painters (artists) brush for application of stored pollens, a curved Kelly forceps of 5-51/2" length for freshly gathered pollens, and a roll of Microporous paper tape. This can usually be found in drug stores or in the fly fishing section of a sporting goods shop.

At the chosen pollen-flower (parent), I extract one or two anthers at the proximal filament using the curved Kelly, and then leave it's handle locked. Next, I gently open the petals of the flower chosen to be the seed parent. Carefully turning the curved-Kelly, I dab the pollen onto the receptive stigma of the mother plant (pod parent). If using previously-dried pollen I use a small artists paint brush.

After pollinating the desired number of carpels, I form an envelope with the microporous tape of appropriate width. This is done by folding the tape in half and pinching both ends, leaving the middle open. Place the opening over the stigma, then pinch it securely over the stigma. thus preventing any contamination of the cross. For those less dexterous, use longer pieces of tape forming longer handles on each end. Then affix the open envelope over the stigma. Trim off the excess folds that you used as handles, making a neat covering over each pollinated carpel. This tape will hold firmly in place, resisting even Seattle rains or Montana winds. If you want to make extra sure that your cross has taken, you may at a later date of hour remove the paper tape, say on a warm sunny afternoon, apply more pollen on the still receptive stigmas. Then recover with microporous paper tape. Or, if say you want to make a cross onto a stigma which is not yet receptive or make a cross with a peony variety which blooms later in the season, you can tape the carpels of the mother plant, protecting it from self, bees, ants, and wind carried pollen, until you are ready to do the hybridizing. Then simply remove the tape, make the cross, and retape while the stigma is still receptive. With this method, no petals need be removed from any flowers and the beauty of the flowers can still be enjoyed, with only a slight distraction from the small pieces of tape. I find I have more options in hybridizing and more flowers to enjoy with this method, than with other methods which I have tried.

Harold Entsminger

LETTERS TO THE EDITOR OF PÆONIA:

The following article was submitted by Rea Peltola in response to my report on the germination of ruptured seeds in the last issue of the newsletter (Vol. 25, No. 4)

About the germination of ruptured seed

In the beginning of 1991 Ed Halas very kindly sent me 141 seeds of P. wittmanniana. During the mailing some of the seeds had become ruptured. I divided the seeds into three groups:

1. 16 Ruptured seeds
2. 45 Good seeds
3. 80 Good seeds

The procedure was not right but I tried to stratify the seeds of groups 1 and 2. I potted them on 2/4/91 with sandy peat in clay pots and stored them in my bookshelf. The clay pots were very

eager to dry out and the conditions in the pots may have been a bit drier than I meant for them to be.

I watered the pots and carried them to our cellar on 3/29/91. The average temperature of the cellar during the winter is from +34°F (+1°C) to +37°F(+3°C) and the air is moist.

I sowed all the seeds on 6/19/1991. From 16 ruptured seeds, 5 seeds had germinated with four inch roots and some others looked promising, as well. From the 45 good seeds; 6 seeds had germinated with one to four inch roots. I sowed all the seeds from groups 1, 2 and 3 near each other in raised, sandy beds, the soil was optimally wet for sowing but the weather after that was warm and dry. I watered the seed beds only occasionally.

Unfortunately, I have not kept notes of their later behavior. We have been treating them as one group since the sowing. All I can remember is that the stratified seeds gave us more plants than those that I sowed directly. Beforehand we were sure that nothing would come from the ruptured ones and I remember we were discussing afterwards that there may be some point when people are advised to file a nick in the peony seeds to hurry their germination.

Rea Peltola, Metsän Reunassa, Finland,
1/3/1996

The above letter moved me to write a brief report summarizing my results concerning the germination time for several groups of intersectional hybrid seeds. My results confirm the observation described above by Rea Peltola that ruptured seeds germinate more quickly than normal (unruptured) seeds. From my experience with Intersectional hybrid seeds, ruptured seeds have germinated in an average of 60 days, nearly two weeks sooner than normal (unruptured) seeds from the same cross. A comparison of several groups of intersectional hybrid seeds are summarized in table 1 below. All seeds were germinated indoors at room temperature using plastic bags with moist sphagnum moss. It is interesting to compare the average germination time for ordinary intersectional cross seeds with those from the reverse cross (lutea hybrid x p. lactiflora). Although most reverse cross intersectional seeds fail to germinate, the few which do, germinate very rapidly compared to most other hybrid seeds.

Table 1

Type of Seeds	No. of seeds in sample	Ave. Germ. Time (days)
Normal "i" cross (3 yr Ave)	149	73
Ruptured "i" cross (1995)	31	60
Reverse "i" cross (3 yr Ave)	3	42

Don Smith

The following letter was recieved from Hermann Krupke of Ljung, Sweden

Ljung 17. 1. 96

Dear friends,

I am always reading the Newsletter with the greatest interest. I feel quite familar with many of you just from reading the Newsletter.

I wonder whether anyone else has ever gotten seeds from CORAL CHARM ? I did, some years ago when pollinating CC with a mixture of pollen from ALICE HARDING and HIGH NOON. There were 18 fine mature seeds but none ever grew. Some years later I found a notable plant not far from the place where these CORAL CHARM seeds were once sown. This plant is now two years old. It has a cluster of broad leaves, different from others.

Leaves are obconic, the apex is rounded. A plant to watch with special interest.

Hermann Krupke, Hov 1037. 520 30 LJUNG, Sweden

The following paragraphs were excerpted from a recent letter sent by Bill Seidl of 732 S 19th St., Manitowoc WI 54220.

Articles in the quarterly publications of the North American Lily Society (NALS) speak of an herbicide which can be used in lieu of colchicine to double ploidy in plants. I don't belong to the NALS, but a member/friend has sent me copies of two pertinant articles which I enclose. (Roger Anderson first told me about it but he had no details.) The subject chemical, Oryzalin, is sold by Dow Elanco as a pre-emergence herbicide under the name 'Surflan AS' available from Hummert Co. inc. in 1 gallon jugs (at about $100) as a 40% preparation to be used as a spray. However, as a substitute for colchicine, the effective strength is only 0.005% to 0.01% !! It should be dissolved first in alcohol to a 1% stock solution, then futher diluted in water. I didn't know anybody who used Surflan - until I read in *Peonies*, Al Rogers excellent book just published by Timber Press that he uses Surflan (see pp 138-139). I haven't mentioned this to Al yet, so I can't speak for him, but perhaps he or some other reader might be able and willing to sell samples or stock solutions to interested readers. Prospective users should first read the pertinent NALS articles. I don't have the original article about Oryzalin use, but it appeared in NALS-LYB (Lily Year Book?) 1990, by Jaap van Tuyl et al., The Use of Oryzalin as an Alternative for Colchicine in In Vitro Chromosome Doubling of Lilium. Oryzalin is much less poisonous than colchicine, which is so dangerous a carcinogen that it is very difficult to obtain. If any reader wants the two NALS articles enclosed, I will send them copies. (Send $1 with a business-size SASE.) The articles give details on the preparation and use on Lilium scales. In peonies I suppose the most likely use would be the treatment of germinating seeds (plumules) in late winter, upside down with the roots escaping treatment.

Bill Seidl

The two articles on Oryzalin mentioned by Bill Seidl in the above letter are reprinted below

Some Random Notes Concerning the Use Of Oryzalin

Eckart Schmitzer, Pinzberg, Germany

From the publication of Jaap van Tuyl[1] and others, we know now that with Oryzalin there is a new means available for doubling the chromosomes of plants with higher effciency than with colchicine. And Oryzalin is much less poisonous than colchicine! Although it seems like a comparason between apples and pears, we know that alreary a few milligrams of colchicine are dangerous to men, while 10 grams of Oryzalin per kilogram of a rat does not kill it[2]. And we use Oryzalin in a much lower concentration! But in spite of this, we should be careful. When I started to look for Oryzalin, I had the impression that it is as difficult to obtain as colchicine and the price is about 4 times higher (between $30 and $50 for 0.25 g depending on the source here in Gerrnany). But we use it in lower concentration. Finally good luck helped in my search for some Oryzalin for our experiments. In a fine book[3] on Kalmias (Mountain Laurel), I found "Oryzalin" mentioned as a herbicide available in the USA under the brand "Surflan". I thought if this stuff is used as a herbicide, it could not be so extremely expensive; otherwise nobody would use it. Thus I sent this message to some of my American letter friends and asked them to look for information. Dr. Arthur Evans answered almost immediately and reported that he could get "Surflan AS". This is a 40% preparation of Oryzalin to be used as a spray, but the smallest available quantity would be 1 gallon! As Art is also interested in polyploid lilies he ordered a gallon. Used

in 0.01% concentration for example, he could make with this thousands of liters of usable solution. Maybe you have a friend keeping his grass or corn free of weeds with Surflan. Why shouldn't he give you a small amount of it? You really don't need very much. This way I finally received a good sample of Surflan and tried to make a stock solution as is recommended in the literature. Oryzalin alone is practically not soluble in water. Therefore it is first dissolved in another solvent, like dimethylsulfoxide, or more simply in alcohol to get, for example, a 1% stock solution. From this it can easily be diluted in water to the desired concentration of, e.g., 0.005 to 0.01%. (This procedure was proposed to me by Dr. Jaap van Tuyl in a letter of February 1993. See also ref. 1). This in mind, I measured exactly 1 g, put it into a glass bottle and added 100 ml of alcohol. The reddish-orange stuff curdled like sour milk and turned into numerous flakes. Did I destroy it? Well, after several times of shaking, and waiting until the next morning, the alcohol had turned orange, while the remaining flakes were colorless. Filtering the whole solution removed the flakes that were obviously not soluble in alcohol. This simple way I gained a 0.4% stock solution, that can now be diluted as desired. Putting 1 ml stock solution in 80 ml of water leads to a 0.005% concentration (I myself added 100 ml and thus obtained a concentration of 0.004%, as Dr. van Tuyl had remarked in his article that even 0.005 % seemed to be almost too strong). For completeness, I want to point to the fact that I do not know if and what other substances are contained in Surflan AS that could be extracted by the alcohol. Only such substances would of course appear also in our stock solution and could possibly modify the activities of Oryzalin. But as already the highly active Oryzalin is diluted so much, other substances are diluted by the same factor and might therefore be of no or at least very low influence. Let's simply try and see what happens. In the meantime I have treated many scales in a 0.004 % solution and hope now for new wonderful tetraploids; or for new surprises to learn from. At the first experiments, treating the scales in an open bowl, I could see that after a few hours a reddish-orange sediment appeared. Oh yes, with time the alcohol evaporates and the oryzalin deposits. Normally a treatment for 4 hours is suggested[1]. If you wish to try a longer treatment (maybe the results would be even better this way?), then you should perform the treatment in a covered vessel or you add occasionally a drop of alcohol so that the oryzalin stays dissolved. I treat the scales in 1/2 liter plastic icecream box with a plastic cover and after 5 hours much less deposit had appeared. In later experiments I used a glass vessel with a tight metal cover (a 1~2 liter preserving jar) and no deposit appeared after more than ~ 15 hours, as I had expected. The alcohol could not escape and the oryzalin stayed in solution. These experiments were done and first notes for this article were taken in spring 1994. Now, in spring 1995 as I complete it, first results are available. However, I must remark that while on vacation for three weeks in the USA in September, a period of rain hit my unprotected plants at home and most of them molded. But some survived and some of these show bigger stomates than usual. It almost looks as if more of the diploids have molded and more of the somewhat stronger tetraploids survived. Actually I did not count the chromosomes of these plantlets. I wanted to wait until they are bigger, so that the survival is more probable. What use if I found a tetraploid and the bulb dies after the preparation? Many years ago I once succeeded in converting a seedling with the help of colchicine, but by the time I had developed the film of the chromosome preparation, the bulblet had already molded. Thus the pictures I still have, contain just sad memories. On this vacation trip to the USA, so perfectly planned and organized for us by Charlie Kroell, besides others, we also visited Dr. Arthur Evans in person with whom I had discussed the use of Oryzalin in our correspondence. He had treated in the meantime even more different clones than I and he showed me the results of his experiments (see also his important report[4]). I was simply impressed! Only by touching different leaves was it possible to feel that some were softer and others stronger in texture. Checking the size of the stomate on the underside of the leaves with a pocket microscope (40x or 50x) showed plantlets with a stomate size around 0.06 mm (0.0024 inch) while others were around 0.12 mm (0.005 inch). As in some cases we compared the same genetic material on the diploid and on the polyploid level, the results obtainable with this simple means are much more reliable than by comparing different clones (compare the stomate sizes listed by McRae[5]). This way at least the unconverted, diploid plantlets can easily be removed. Those with the bigger stomates should be chromosome counted, if possible, or at least tested for fertility in crosses with confirmed tetraploids and as pollen parents on several confirmed triploids. If lhey show good fertility, you should even test the pollen on diploids, and pollen from diploids on these new polyploids. In these cases almost no fertility should appear. This way you can collect information that could help to be sure that we succeeded. For completeness, I must also point to the fact that in all such conversions not only tetraploids, but also chimeras and higher polyploids may appear, as was clearly described by van Tuyl[1]. Therefore the bigger stomate alone are not sufficient to be sure to have achieved a true tetraploid. But even a chimera or mixoploid may produce useful pollen and seed, leaving the problem of identification of the ploidy level to the next generation. It is also of importance how much time you wait between breaking the scales and doing the treatment. The longer you wait the better the callus on the wound of the scale, the more bulblets may grow, but the higher is the probability that you get chimeric or mixoploid material with different ploidy levels in one plant. Why? When you do the treatment

rather shortly after breaking the scales (only a few days later), you may hit single cells that later develop into bulblets with all cells of the same ploidy level. But if you wait too long, e.g., until small bulblets have formed, the one cell that started to make a new bulblet has already divided many times and now you have a group of cells that finally grow to the new bulblet. In this case it is almost impossible that all cells are hit and converted and thus a tissue grows that consists of cells of different ploidy levels that are almost impossible to separate to obtain finally a pure tetraploid plant. As the original diploid cells normally grow a little faster, in mixoploid tissue sooner or later the polyploid sections are slowly pushed aside from the vegetative cone into roots, stems or scales and get lost over the years. This is the reason why occasionally it seems that a tetraploid can jump back to the diploid level. It was not a pure tetraploid but of a mixoploid tissue where the tetraploid cells were displaced and finally eliminated. Flow cytometry seems to be an excellent means to find out if a tissue is mixoploid or a pure ploidy level, as was described by Geenen[6], but this seems to be out of reach for the amateur, at least at the present state.

References

1. Jaap van Tuyl et al., The Use of Oryzalin as an Alternative for Colchicine in In Vitro Chromosome Doubling of Lilium, (NALS-LYB 1990), pp 19 to 22 (with 13 other references).

2. Roempp, Chemielexikon, (9th edition,1991), p. 3147.

3. Richard A. Jaynes, Kalmia. The Laurel Book II, (Timber Press, Portland, Oregon, ISBN 0438192-082-7), p. 136.

4. Dr. A. Evans, Cooking Up Tetraploidsin the Kitchen, (NALS-QB 1/1995), p. 4 to 6.

5. Judith Freeman McRae, Stomate Size and Pollen Characteristics as an Indication of Chromosome Numbers in Lilies, (NALS-LYB 1987), pp. 19 to 26.

Cooking Up Tetraploids in the Kitchen

Arthur Evans, Gravette, Arkansas

My wife Crow, is very good about sharing the kitchen with my non-cooking projects. You know, ordinary things like brewing beer, sterilizing soil in the oven, making nutrient medium for the embryo cultures, nuking critter-infested bulbs in the microwave, and storing an unreasonable number of lily bulbs in the refrigerator. She does raise an eyebrow, however, when I start playing with poisonous chemicals in the food-prep area. That's one reason I decided to switch from colchicine to oryzalin for my conversion attempts as per Dr. Jaap van Tuyl's article in the NALS yearbook. Oryzalin is alleged to be much less toxic to people than colchicine. By the same token it is supposedly more effective in interrupting normal mitosis in rapidly dividing lily cells which can result in converting a diploid lily scale into a tetraploid scale bulblet. It works. I've done it. Here's how.

Oryzalin sold by Dow-Elanco as a pre-emergence herbicide under the name Surflan AS. It comes in one gallon jugs of 40% active ingredient at a cost of about $100 per gallon. I got mine from Hummert Co. Inc., the well-known horticultural supply company. Since Dr. van Tuyl advises the .005 % strength treatment solution, I calculate that one gallon would make a fair sized swimming pool of treatment solution, more than enough even for an obsessive-compulsive gardener like me. I might even use some of it for the purpose stated on the label. Seriously though, if my math is correct, .5 ml of 40% oryzalin dissolved in 4 liters of water makes an approximately .005% oryzalin treatment solution. That sounds weak, but it is strong stuff. Don't be tempted to make it stronger. In fact, next time I try a batch of conversions, I will make it half strength. It burns some scales so severely that they never form bulblets.

The oryzalin is hard to dissolve in water. I pre dissolved .5ml (easy to measure with an injection syringe from the drugstore) in .5 cup of warm isopropyl alcohol or vodka to which I have added 1 tablespoonful of 99% DMSO (dimethylsulfoxide) from the veterinary drug shelf of my local farmer's supply store. The DMSO is a strong organic solvent known to enhance absorption of drugs through skin. It smells awful, and it couldn't be good for you, more than enough reason to wear latex rubber examination gloves and a moisture resistant face mask. Your family dentist will be glad to give you plenty of these. Gradually add warm water in increments to the oryzalin and solvent mixture in a clean milk jug with violent agitation and incantation. The incantation is optional, but the looks on the faces of the grandchildren are priceless. I

presume this solution is fairly stable, but I make up a new batch after treating 2 batches of scales.

Use scales which have started to show a tiny ridge or bump of rapidly dividing cells or "callus" around the broken edge at the base of the scale. If you incubate scales in moist sphagnum in a Zip-lock bag at 80°F it takes from 1 to 4 weeks to get to this stage of development. Don't wait until the callus develops a tiny bulblet. The more tissue the drug has to penetrate in order to reach the actively dividing meristematic cells, the less likely you will be to get a completely converted tetra bulblet. If a bulblet arises from a mixture of converted and non-converted cells, we call it a mixoploid. Many of these plants eventually revert to diploid status, some say because diploid cells grow and multiply faster than tetra cells and tend to take over completely in time. An exception seems to be the stable chimera of the white 'Capri', which has sex cells like a tetraploid, but epidermal cells like a diploid.

Now, for the actual treatment bear in mind that the drug only works on cells that are actively dividing, so it makes sense that you want to use a temperature high enough to stimulate rapid cell division and a time long enough to intercept lots of divisions. I don't know what the optimum temperature or time is for most lilies. It may vary with the genetic background of the cultivar you are working with. What I have done is soak scales in covered quart jars in the hot water heater closet which maintains about 85°F, for 6 hours. Make sure your jars, scales, and solution are all close to your chosen treatment temperature before you start. Due to the amount of burning of the scales in previous treatments, I may reduce treatment temperature to 75°F or 80°F next time.

After treatment, rinse scales with several changes of fresh water to get rid of as much of the drug as possible. Handle treated scales only with gloved hands. Be a fanatic about cleaning all equipment and food preparation surfaces as soon as you have placed scales in labeled plastic bags of slightly moist sphagnum or vermiculite. I use a Sharpie pen to label the bag with cultivar name, date of scaling, date of oryzalin treatment, and any variation from the standard treatment. This year I used Zip-lock vegetable bags with the ventilation holes. All bags then go into a garbage bag with loosely closed top to keep the small bags from drying out. The big bag then gets incubated from at 75°F - 80°F from October or November until bulblets are well formed, usually about the end of February or March. At that time the bulblets are vernalized, simulating winter chill, for 3 months in a refrigerator set at 35°F.

When the vernalization is complete, I inspect the bulblets individually, looking for physical characteristics which may indicate conversions. Most bulblets will look quite ordinary because they are still unconverted. If you said the aforementioned incantation correctly, however, you may find a few (5%-10% at best) bulblets which have obviously shorter, thicker scales which stand apart from each other at 90 degrees or more. I plant these bulblets in large pots and protect them from all harm. A high percentage of these odd-looking bulblets will soon show the large stomates (.005 inches long) on the underside of the leaf which indicate conversion to tetraploid status. Ordinary looking bulblets are planted in rows in the garden. Their stomates are measured in mid-summer to pick out any tetras that slipped by the earlier inspection. I don't have much space so I don't grow the diploids to maturity. When large enough to bloom, test the converted tetras both ways in crosses with fertile seed-grown tetras. There will be variations in the fertility between different conversions of the same cultivar. Due to the low number of successful conversions in each batch, I would certainly advise that you start with at least 100 clean, healthy scales of each cultivar. If you have large, blooming size bulbs to start with, you can usually harvest 10-20 usable scales from each one. Scaled cores can be replanted to grow again.

In dozens of attempts I was only able to convert one cultivar, the old pink 'Gypsy', with colchicine. In the fall of 1993 I attempted to convert 8 cultivars with oryzalin, and I believe I have succeeded in converting 4 of them. They are 'Ye Iov Star', 'Connecticut Star', 'Shirley', and 'Nutmegger'. These have not been tested for fertility with tetras or chromosome counted, so I will have to wait for these tests to confirm what my stomate measurements and observations of other plant characteristics lead me to believe.

In the fall of 1994 I treated about 20 cultivars and seedlings. The scales are producing a fair crop of bulblets, a few of which look like valuable new tetraploid breeding prospects. I would be interested in corresponding with and assisting anyone who wants to experiment with oryzalin conversion of Lilies. No doubt the method I used can be improved. If we pool our data we might learn a lot.

I believe there will always be a place for excellent diploid lilies. Many of the best garden genotypes are still in the diploid gene pool. Getting those superior genes into the polyploid gene pool is a worthwhile goal for amateurs and pros alike. Some of these diploids can be used with tetras in 4 x 2 crosses if they produce significant amounts of unreduced pollen. Others may produce a new triploid embryos when pollinated by tetras in 2 x 4 crosses. Many diploids however, refuse to participate in such liberal nonsense as crossing with polyploids. In such a predicament the only solution is to convert the diploid to tetraploid status. There is much to do, and though it is time consuming, it is not too difficult for kitchen technology. Hopefully, your spouse will be as understanding as mine has been.