Reticulata Iris – Making A Rainbow

by Alan McMurtrie P. Eng.

I have opened up a whole new world for reticulata irises. I did this by crossing *Iris sophenensis*[1], a diploid form of *Iris danfordiae*, and an unnamed species from Çat, Turkey. These species are notorious for "shattering": producing lots of little rice-grain sized bulblets, along with main bulbs that are too small to bloom the following year. Fortunately the new hybrids are showing hybrid vigour, so in most cases they are blooming consistently year after year. As you would expect with any population, there are good doers and poor doers. Largely these hybrids are good doers.

Reticulata Facts

- from eastern Turkey, Syria, Iran, and Caucasus mountains where it's very dry in the summer
- bloom right when the snow is melting
- flowers 2 ½ - 4 ½ in. tall (6.5 -12 cm), typically 2 ¼ in. in diameter (6 cm)
- leaves square to octagonal in cross section
- leaves grow to 18 – 24 in. 945 – 60 cm) before dying down in early summer
- bulbs have a netted covering (i.e. reticulate)
- produce a wonderful perfume on warm days
- best if replanted and thinned out every 2 years
- 5 years typically from seed to blooming plant
- most are 2n = 20
- *histrioides* and *winogradowii* are 2n = 16, but they are genetically different
- *danfordiae*, *sophenensis*, and the Retic from Çat, Turkey are 2n = 18

Until now reticulata iris were mainly just blues, violets and purples. In the 1970's William van Eeden was able to produce the near-white 'Natasha', which is now grown commercially in reasonable quantities. And of course, there is the well-known lemon-yellow *Iris danfordiae* (the commercial form of which is a triploid -- it has 3 sets of chromosomes and thus is sterile). Hopefully you grow E.B. Anderson's famous 'Katharine Hodgkin' which is from *winogradowii* (egg shell-yellow) x *histrioides* (blue). Its dark blue spotting on cream ground with yellow flash is stunning. The cross has since been repeated and several other named varieties now exist. All are sterile even though both parents have the same chromosome count (2n = 16), so that's a dead-end, you can't go any further.

When Wim de Goede (Holland) saw my first generation hybrids between *sophenensis* and *danfordiae* in 1997 he said they're nice, but "they're just blues." I understood what he meant. However, they are good blues, and do well here in Toronto, Canada. Hence I feel they should at least be marketed in North America.

As you will read below I have moved well beyond "just blues." I have accomplished something that no one else realized was possible. If you will allow me, I'd like to tell you how I got to where I am today and why. I will also give you an overview of my results so far and the colour breaks that have occurred; let you know what I'm doing to make these varieties available to you commercially; and finally give you cultural information. I think you'll be quite fascinated.

In addition to the pictures here in the Bulletin you will find a lot more at www.Reticulatas.com

Skeptical

Stop for a moment and put yourself in my shoes. Let's turn back the clock to 1994 when the first *sophenensis* x *danfordiae* (hereafter referred to as: sxd) hybrids started to bloom. There were 16 clones from 3 crosses. These were expected to be sterile even though they produced what appeared to be nice fluffy pollen. I knew making crosses with things that weren't expected to work was a waste of time. In this case I felt I had to try. If anything might work it would be by selfing them, so that's exactly what I did. Low and behold, I got 130 seeds from 11 successful crosses.

When I let friends like Brian Mathew know, I was well aware they would be skeptical. Even though I had what appeared to be good seed, there was a chance it would die when it tried to germinate (lethal genes). For example, out of the more than 300 crosses I've made with diploid *danfordiae*, which produced over 4800 seemingly good seeds (1997 and prior seed), only one, possibly two[2] have produced blooming bulbs other than the hybrids with *sophenensis*, Çat, and of course *danfordiae* selfs.

Five years later, in 1999, two F2s bulbs bloomed. The first was 94-HW-1 ('Starlight'): white with lovely blue accents and a touch of yellow. Boy was I pleased! I couldn't have asked for anything lovelier. I had expected *sophenensis*' veining would be a predominant "feature", which would take years to get rid of. Instead I got what I had been hoping for: something just as lovely as 'Katharine Hodgkin'. I'm glad to report it's proving to be a good doer giving 1, 3, 7, 13, and 20 blooms to-date. The second hybrid was 94-GU-1, a small pale blue with a bit of yellow influence.

The next year, more of the 1994 F2s bloomed, along with a couple from 1996. Surprisingly many of these were whites with a similar pattern to 94-HW-1: blue stripe on the style-arms, with blue and yellow markings beside the fall blade's ridge. Just so people don't think they are pure white hybrids, I often refer to this group as "white-blues" or "white with

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[1] Formally Iris *histrioides* var. *sophenensis*

[2] I have 4 clones from *hyrcana* x *danfordiae* (89-A-1 thru 4). It's clear when you see them that it was indeed that cross. As well, I have a strange *histrioides*-like hybrid that may actually be a cross with *danfordiae* (92-X-1). It is sterile.

blue accents." 96-DZ-1 is quite amazing because its white is absolutely snow-white. I also like the shade of soft blue on its style arms, plus the way the blue veins merge with very pale yellow around its fall ridge. Unfortunately my sense is that it doesn't do quite as well as some others. That year for the first time a yellow hybrid bloomed. It looked like a more spotted *danfordiae*. Most amazing of all, I got my first glimpse into a beautiful new pattern that for the moment I'm calling the "spotted light blue-green"[3] world: 96-BN-1. It was breathtaking: large blue-green spots on its fall blade, with a predominant yellow blotch in the middle. The style arms have a blue ridge, with the inner portion being light yellow-green. In total there were 6 new F2s that year.

In 2001 another 13 new F2s bloomed. Many of these were yellow-blue combinations. Of particular interest was a hybrid that wasn't growing where it should have been; presumably I dropped the seed when it was being planted: 95-unknown-1. Its unusual pattern would have baffled me had I not seen last year's 96-BN-1. Clearly it's a sxd back crossed onto *danfordiae*. Looking back at my records for 1995 I still can't figure out exactly which cross it is from. It's similar to 96-BN-1 except in 95-unknown-1, the yellow blotch is almost non-existent.

Another of special interest that year was 94-AT-2. Its falls are a lovely dark brown on a rich yellow background. The yellow shows through mainly around the similarly coloured ridge in the middle of the fall. Its style arms are several shades of dark blue. Unfortunately that year a slug bit the flower off its stem, so I didn't get to see it in all its glory until the following year when it gave 3 blooms. I don't have many problems with slugs; it was just quite disappointing that, out of all the flowers I have, that was one that got damaged.

In 2002 the number of new F2 sxd hybrids jumped by 36, bring the total to 57. Of particular interest were: 97-CQ-1 ('Sea Green': some of you will find the colour of interest – as the flower finishes it becomes more blue – in my mind it's quite intriguing); 3 more "spotted light blue-green" (one didn't have any yellow, so it was actually a gorgeous spotted powder blue); and 2 cream hybrids without much blue influence (unfortunately one of these beauties appears to be a poor doers). In addition there were three special second generation clones involving the as-of-yet unnamed new purple species I collected near Çat, Turkey. One of these I've tentatively named 'Storm' (98-NP-2) because its falls have dense black veins over a bright yellow background, and its style arms are dark blue. In sharp contrast, one of its sibling is cream with bright yellow around the fall ridge. The third clone is a slightly lighter yellow than *danfordiae* with very dark green, almost black, markings on the fall and dark green style ribs (97-VS-1).

In 2003 the number of second-generation hybrids from crosses involving *Iris danfordiae*, *sophenensis*, and the species from Çat, Turkey has climbed to 125. Whites are easy; I now have more than 35. And there are now six "spotted light blue-greens," though two are actually more "spotted light blue." Most amazing, is the number of colour breaks that occurred. There were hints of what was to come with the two clones from 98-NP which bloomed last year, a year earlier than expected. A further eight opened this year. All are absolutely stunning. They cover a range from white, to plum, to pale yellow, to rosewood, and there's even one I can only describe as chameleon. All are gorgeous. In addition, all are a reasonable size (50 to 60 mm tip-to-tip – from the tip of one fall to the tip of another); which is quite something since the Çat parent is a small species, as is Iris *danfordiae*. And on top of all that, they all appear to be good doers. I have to keep pinching myself to make sure I'm not dreaming!

98-NP

91-FC-7 x 88-AX-3

(*danfordiae* Atilla x *sophenensis*) x (Çat ANM2175 x *danfordiae* ANM2325)

Colour Breaks involving Çat

In the past I wrote, "I would classify my second most promising line as involving Çat x *danfordiae*: 88-AX. I believe their biggest potential is in intercrossing with *sophenensis* x *danfordiae* hybrids." 98-NP is realization of that potential. The potential is also embedded in a number of other crosses: 97-VS, 98-OO, 98-PR, and 98-ND. In these cases the clones are on the small side (40 to 45 mm tip-to-tip). Unlike the 98-NP hybrids, most have characteristic medium dotting around the fall ridge as well as a white area by the arch in the fall blade. I think of it as an opaque white flush since it seems to go overtop of the dots. Both of these are from the Çat parent.

98-OO-1 is a cute, very distinct, small reticulata tending toward orange. According to the RHS colour chart it is 15A (Yellow-Orange group). In my eyes it appeared soft apricot. My wife Lynda, who does water colours, saw it differently, and seemed to be suggesting I was imagining things. Regardless, its reddish-brown accents are lovely (wide style arm stripe, and fall dotting). As the flower finished it lightened, and an orange halo became apparent at the end of the fall's ridge. Upon looking back at my earlier pictures, at certain angles you could see the orange. Wouldn't it be fantastic to one day have this same thing except in true orange. Dutch bulb growers would add "and with large flowers." Like *danfordiae* it was devoid of standards. (I'm not sure what will happen in the long term, but one of last

[3] If you look carefully you will actually see Katharine Hodgkin's pattern in a smaller flower. The key difference is my flowers are fertile. ...imagine the possibilities of being able to work with that pattern!

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98-FN-1


98-OO-1


97-DG-4


98-GP-7


White Caucasus


Sea Green


Starlight


96-WR-1


98-BL-2


96-SE-1


98-MN-1


98-HE-1


Tiger


Cat - Turkey


98-NP-7

year's yellow-blue hybrids had a distinctive orange cast to it. I expect it will take a number of generations to pull that characteristic out, assuming it is possible at all. Can you picture it, an orange reticulata!)

Two other clones from this cross were more typical: 98-OO-2 was somewhat similar to its Çat parent (very dark red), with bright yellow around the fall ridge and white into the throat. 98-OO-3 on the other hand looked like *danfordiae*. Eight more clones will bloom in the future with five likely next year.

A similar cross bloomed nearby. 98-PR-1 looked like *danfordiae*, while 98-PR-2 looked like its Çat parent with an orange influence giving it a brown look overall. An area beside the fall ridge was yellow-orange, with medium spots of the main colour. 98-PR-3 had a quite interesting olive colour, with greyed style arms and yellow around its fall ridge. Being olive it's drab, but I found its fall markings to be of particular interest. You really need to see a picture to truly appreciate it and ensure you're not visualizing something different. Another three clones from this cross should bloom next year.

97-VS-1, mentioned above, is another lovely hybrid: greenish yellow with lots of dark green, almost black, dots. Its style arms are perhaps a slightly lighter yellow, with dark green stripes on either side plus veining of the same colour on the style lobes. It and its sibling, which will bloom next year, seem to be slow increasers like their 88-AX parent.

I have a secret admiration for 98-ND-1. There's something about it that makes me believe it will be a good parent. It's a lot like *danfordiae*, so from that point-of-view it's nothing special, but I can see the Çat parent in it. It increases well. Two siblings are expected to bloom next year.

Sophenensis x *danfordiae* Colour Breaks

I have been looking forward to the day when I could say with a certainty that *danfordiae*'s lemon yellow is actually made up of a number of carotenes. Or to put it another way, when I could declare that more than just lemon yellow was possible. My 17 yellow and 21 yellow-blue hybrids all involve *danfordiae*'s lemon yellow colour. We all knew pale yellow was possible because of *winogradowii*, but I want more. For this, you first need the capability to produce the chemical compounds that give the other colours, then you need the genes (switches) to turn those expressions on (or off). You can cross two blue or two purple reticulatas, but you'll never get a yellow. Reason: in all parents the yellow switches are off. Even though yellow is theoretically possible, it never has the chance to express itself. This is why my goal is to shake up the genes as much as possible by working with wide clones from the wild (specifically ones that are distinctly different from each other). To truly shake everything up takes quite a few generations, not just two or three. Then it's a matter of working to open the secrets which are hidden to pull out the recessive characteristics.

Ideally we'd all like to create the 'piece de resistance' right away. It's taken a while, but I'm quite pleased with what I've achieved so far, and the potential of realizing other great treasures is almost assured, not just a dream.

Carotenes are fat soluble pigments in cell walls that give the yellows, oranges, and pinks we see. It seemed that a number of my hybrids hinted more was possible, but it hadn't come out and clearly hit me until this year. One of the first to do so was the ameona 98-MN-1. Its styles and standards are white (with pale greeny-yellow style markings), and its fall is pale yellow. This isn't a rich colouring that will draw you all the way from one side of the garden to the other to see what it is, but it is lovely. There are only a limited number of colours / shades that will do this - ones that are vibrant and vivid, like orange, or red. Yellow would also be included, but we already have *danfordiae*.

98-OO-1, mentioned above, was the second reticulata to break away from lemon yellow. Previously 89-A-3 had suggested orange was possible, but being from *hyrcana* x *danfordiae* that route was a sterile dead end. 98-OO-1 puts orange within reach.

97-CN-2 was the second reticulata to give pale yellow. It is small, 45 mm tip-to-tip, with blue accents: style arm stripes and fall veining. It has reasonable sized standards that narrow to a wisp. For a number of reasons it will probably just be used for breeding purposes. It does increase well.

One other colour break that didn't involve the Çat Retic was 97-BG-1. Its overall colour is dark reddish-brown. This contrasts nicely with its lemon-yellow ground, which shows on the fall between veins of the overall colour. It's of typical size, with standards that are half the normal width (4 mm). They are dull yellow, veined and shaded with the overall flower colour. This nicely accents the flower. In my mind it's quite striking. I certainly hadn't been expecting anything like it.

98-OK-1 (91-FC-1 x *danfordiae*) was the 6th "spotted light blue-green" to bloom. This pattern only occurs occasionally in back crosses to *danfordiae*. When Lynda saw it she said it's "icy green." This led me to giving it the name 'Green Ice'; hopefully it conjures up ice cubes with pleasing green tones in them.

Another hybrid of particular note was 97-DZ-8. It bloomed in 97-DZ-1. The 1997 hybrids had all been replanted last fall. Presumably this hybrid and 97-DZ-1 were growing so close together that I thought they were one-and-the-same; either that or I got the two reversed. This is a lovely white with green and blue accents, plus bits of yellow veining. It has a wide fall blade, but the flower doesn't open as much as it could; the falls and styles tend to be held upwards at high angle. As a result the flower only measured 47 mm from tip to tip. If it was flatter, another 10 mm could easily be added to its size. Of particular note, its flower had quite good substance. It remained fresh for quite a number of days, much longer than the other Retics starting at the same time. I do hope this characteristic continues. It would be valuable for both commercial success, and use in hybridising.

A few of my yellow-blue hybrids are particularly interesting. One I call 'Tiger' (97-AG-6), since it has nice dark green stripes on a lemon-yellow background. (Not quite the black stripes on orange ground you might have been thinking, but close.) There are green dots around the fall ridge, and the arm portion of the style arms is wholly dark green. Another of interest is 94-AT-2. Its falls are a lovely dark brown on a rich yellow background. The yellow shows through mainly around the similarly coloured ridge in the middle of the fall. Its style arms are numerous shades of dark blue. Perhaps most interesting of all is 'Sea Green' (97-CQ-1). I expect you are either going to love it, or hate it. It is an evenly coloured blue-green with yellow tones. The area beside the fall ridge is bright yellow with dark blue-green dots. Its style arms are much bluer. Just as the flower finishes it becomes bluer. Without question it's quite unique.

As mentioned in the first paragraph of this article, a common characteristic of *Iris danfordiae*, *sophenensis*, the Çat reticulata, and their hybrids, is they produce a number of bulblets. Each bloom-size bulb typically produces 8. If left alone many of these will simply die because they can't get their leaf above the soil surface – they use up all their energy trying. Some will make it, but the best thing is to replant the bulblets close to the soil surface. In another four years they will bloom. Thus they can be used to increase a given clone faster than most other reticulatas. The problem with the species is their main bulbs don't regenerate large enough to bloom in subsequent years. This is why people say *danfordiae* "shatters": they find only bulblets and medium-size bulbs (at best) when they dig up ones planted in previous years. What's needed is bulbs with hybrid vigour – ones that regenerate bloom-size bulbs year after year. The optimum situation is to plant several bulbs widely spaced, leave them, and let them form clumps. These would reach an equilibrium giving perhaps 5 or 6 blooms year after year. This is exactly what happened with one of my F1 sxd hybrids (i.e. first generation). A bulblet had been left behind in a replanted seedling patch. After a couple of years it consistently produced 5 to 6 flowers. I finally dug up the clump in 2001. It contained 6 bloom-size bulbs, 5 medium, 23 small and 163 bulblets.

Occasionally the number of bulblets produced by a bloom-size bulb can be as high as 25. The main difference between Holland and Toronto is bulblets reach bloom-size much faster in Holland. They will bloom in just three years, and with some in just two years depending on the size of the bulblet (meaning the bulblet got up to bloom-size in just one year). Rate of increase of a given hybrid is not really an issue in your and my garden – the clone just needs to give consistent bloom year after year. Before you know it, a couple of years have gone by and now you have a nice large display. Rate of increase is an issue for a new hybrid when you want to have enough bulbs to give some to a Dutch bulb grower for testing, and still have enough for use in hybridizing. It is also an issue if you want to have some for entry in a show. It is more of an issue if you want to build up stock to be able to sell a variety commercially; especially on the scale of Dutch bulb sales where 25,000 bloom-size bulbs are needed before starting sales. I'm still a number of years away from that.

Projected Increase If Grown In Toronto

End of:	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Bloom-sized	3	7	12	25	108	268	825	2,437	7,077	20,950
1 year away	4	5	13	83	160	557	1,612	4,640	13,873	40,493
2 years away	5	13	83	160	557	1,612	4,640	13,873	40,493	119,185
3 years away	10	76	148	532	1,504	4,372	13,048	38,056	112,108	329,572
Total:	22	101	256	800	2,329	6,809	20,125	59,006	173,551	510,200
Doubling:	2	4	8	16	32	64	128	256	512	1024

Projected Increase If Grown In Holland

End of:	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Bloom-sized	3	15	47	195	741	2,989	11,679	46,515	183,221	726,405
1 year away	4	10	76	228	1,084	3,876	16,292	62,220	251,228	981,764
2 years away	5	7	25	123	423	1,825	6,865	27,971	108,735	434,449
3 years away	10	76	228	1,084	3,876	16,292	62,220	251,228	981,764	3,910,532
Total:	22	108	376	1,630	6,124	24,982	97,056	387,934	1,524,948	6,053,150

This chart made at the end 1999 is based on typical rates of increase for my best sxd hybrids up to that point, as well as on actual rates of F1 increase in Holland. In the two following years, bulblet production in Toronto was less than previously experienced. Subsequently the clones were too numerous to continue to count. The key point, as illustrated above, is that by working with the bulblets and replanting them near the soil surface each year they can be used to significantly increase the number of bloom-size bulbs. (It also illustrates the advantage of getting bulbs to Holland for commercial production as soon as possible, rather than first trying to build up stock in Toronto.)

I have come to realize that the variability of bulblet production, particularly in early years, has a significant influence on how well actual results match predictions. In the case of 94-HW-1 ('Starlight'), in the initial 2 years it looked like 8 were produced per bloom-size bulb, but in fact the average has been 4 in each of the last 3 years. As well, my model didn't make any allowance for bulblet losses, which for conservatism should be treated as 15% (based on 98-NP clones). In many cases there are no losses, where as in others there can be 20% (note: this is based on small populations). All in all, slight differences in the early years have a significant impact on future years, where as with larger populations the slight differences become averaged out.

Another thing the model doesn't account for is loss of bulblets when the bulbs are dug. With small numbers they are dug by hand and essentially 100% are recovered. I have no idea how efficient the digging machines are in Holland. I've heard that a crop like 'Katharine Hodgkin' is dug twice to try to retrieve as many bulblets as possible. Afterwards the field is dug deeply to get rid of any remaining bulblets by putting them so deep they die out, and then don't have to be weeded out from the next crop. How about that... thinking of reticulatas as weeds!

Interestingly many Dutch bulb growers look at flower bulbs as simply a bulk crop / commodity, just as we might think of wheat, corn, soybeans, etc. It just happens they grow flower bulbs.

In theory I should be seeing the first F3 hybrids in 2005 (from 2000 seed), but a quick check at the end of this year's bloom didn't show that any of the 98 seeds from those crosses had germinated. Since *sophenensis*, *danfordiae* and the Çat Retic are pure species what I need to do is shake up the genes as much as possible. In part this happens the further away I get from the original parents (this opens up the expression further).

Other Hybrids

97-DG-1 is a unique purple with blue tones. What makes it so striking is a blue flush around its yellow fall ridge. The purple and blue contrast is quite distinct. This characteristic comes from a reticulata I collected near Van, Turkey. On other hybrids the effect isn't nearly as intoxicating since the main flower colour is typically only a slightly different shade of blue or violet.

One colour break outside sxd breeding was 98-YS-1. It's an ameona: white standards and styles, with coloured falls of light blue with a medium blue halo. The YS row was 1998's catch all for crosses with 3 or less seeds (which typically don't germinate), or ones orphaned while being counted. A number of other outstanding hybrids have bloomed over the past 3 years. I can't possibly describe them all here, nor could words do them justice. I would encourage you to take a look at www.Reticulatas.com

Hybridizing Goal

My goal is to create interesting new hybrids that do well in the average North American garden. On a number of occasions I've heard people complain that they had bought named varieties, and after a couple of years, only had a few leaves come up. I've now just about lost 'George' again: the 25 bulbs I bought in 1999 are about gone, including a couple of the blue form.

More than six years ago, I did an experiment: I bought a dozen bulbs each of *Iris danfordiae* and *Iris reticulata* hort. from a local garden centre. As expected they all bloomed. I left them alone and the following year they each produced 24 flowers. In the third year, and essentially every year since, there have been only about 6 flowers of *reticulata* hort., and none of *danfordiae*. This might seem good from a bulb growers' perspective because it means people have to buy more bulbs, but in truth it isn't. Those people likely ended up disappointed and won't buy more bulbs. Instead they'll buy something else that lasts longer. If they had been happy with their purchase, and an "eye-popping, mouth-watering" new variety showed up, there's a good chance they'd get it.

My experience with daffodils is some will do well, and some won't. It's just a matter of finding the ones that like my growing conditions. On several occasions I've imported a dozen or more from Ireland. They all do well at first, but invariably a couple will vanish, but the remainder will flourish and form nice clumps. I can enjoy them year-after-year, and I'm happy to buy more because I know I will be well rewarded.

Ideally you should be able to plant reticulata iris, leave them alone, and have them bloom consistently year after year. In theory each would form a clump -- an equilibrium point in terms of number of bulbs and flowers. I've seen this happen when the bulbs are initially spaced well apart, but not when they are in close proximity. I tend to either have my bulbs tightly spaced, or I replant them year after year to get maximum increase.

Direction

I don't exactly know where I'm going with all of my crosses. I'm actually going in several directions, since there are a number of lines I'm pursuing. It takes 5 years to go from a seed to a flowering bulb, which is like being the captain of a huge tanker or cargo ship. You need to make course corrections and start turns well in advance of when you want them to happen. If you wait, it will be too late. This is why I make the number of crosses that I do. Of course one could easily make thousands upon thousands of crosses and get absolutely nowhere. The key is to know the theory behind what you are doing, then work in several directions at the same time; you can't predict which is going to be the most important. As I mentioned above, starting with widely different clones from the wild is critical. Currently available commercial clones are genetically too similar to one another.

Had I known, for example, that 98-NP would be so good, I would have repeated the cross as many times as possible. Five years ago I never could have guessed how spectacular its results would be. Hindsight is always 20/20. I did expect interesting results, but there are other parents I would have thought would be slightly better. This is where I can think that a particular cross will be good from the point-of-view of mixing things up, but exactly what it will give I can't say until the progeny bloom. It was sheer luck that I happened to repeat the original *sophenensis* x *danfordiae* (and reverse) cross several times prior to seeing it bloom. Interestingly the look of progeny from each of those crosses is slightly different. In contrast, I only made the one Çat x *danfordiae* cross. I am still amazed by how beautiful and distinctly different 98-NP's progeny are... you never know what you'll get!

Reinforcing the idea of pursuing several lines at the same time, as mentioned at the beginning of this article, I made hundreds of crosses with diploid *danfordiae* and produced thousands of seemingly good seeds. Most didn't even germinate. I had speculated that perhaps *danfordiae* x *histrioides* would give interesting results, just as E.B. Anderson found using *winogradowii* to create 'Katharine Hodgkin'. I produced 200+ seeds from at least 15 successful crosses, but have nothing to show for it.

Working with two parents that are widely different is like opening up the potential expression of a 2-dimensional plane as shown in Figure 1. If the two parents are species, then the first generation progeny will all be very similar (the "X" in between) because each parent's genes are essentially uniform. In the second and future generations, by intercrossing the children plus backcrossing to the parents, the possible range of expression extends to the whole plane. It's up to skill of the hybridiser to bring out this full expression. For example, a recessive gene from one species and a dominant gene from the other will always give a dominant expression in the first generation. In the second generation there's a one in four chance the recessive characteristic will be expressed. In the case of *sophenensis* and *danfordiae*, the first generation hybrids are all "just blues." The second generation yielded whites, yellows, blues, yellow-blues[4], and "spotted light blue-greens." Now other expressions are starting to appear such as pale yellow (98-MN-1, 97-CN-2), and brown (97-BG-1).

With three widely different species, the range of expression opens up tremendously. Comparatively speaking it's 3-dimensional as illustrated in Figure 2. These are simplified models of course, but they give you an impression of how much more is possible using three species instead of just two. Now if I could find a fourth 2n = 18 species, that's distinct from the others...

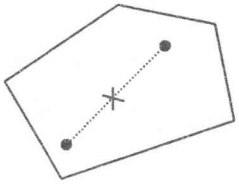

Figure 1 Two Species

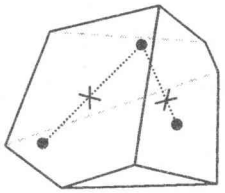

Figure 2 Three Species

Outcrosses to typical reticulatas may yield interesting results, especially once I have even more unique hybrids to use as parents. The progeny will of course be sterile dead ends (due to chromosome incompatibility). Well over 1,000

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[4] Yellow-blues involve a variety of expressions with yellow and blue pigments. So far the yellow has tended to be lemon yellow, and generally the blues are medium to dark. In some cases the result is olive-green.

such seeds potentially should have bloomed by now (I had been curious to see how unique they might be – you never know until you see for sure). With an overall germination success rate of 20% that should have yielded over 200 hybrids. Only a couple of clones from one cross in 1995 bloomed (95-D). The progeny were small (45 mm tip to tip) due to the Çat parent. One is of interest with its unique purple and blue colouring, plus nice spotting (89-D-1). Unfortunately the others are similar to common reticulatas.

Dutch bulb growers have told me a number of conflicting things. One was that they aren't interested in small reticulatas unless they are unusual. To me white with blue accents is unusual; actually very unusual. Yet I was being told 96-DZ-1, whose white is pure white[5], was too small. Hearing that earlier this year didn't bother me much since I had 18 whites (now more than 35), and I am confident that 94-HW-1, my very first white, will be introduced. I still quite like 96-DZ-1 and think that being a lovely pure white, there would be a market for it. If it were to fail testing it should do so on the basis of some other factor, not its small size.

I think a couple of the other whites should also be introduced: 98-DZ-8 has predominantly green accents (most whites have blue accents), and as mentioned above, it seems to have exceptional substance, which translates into extended bloom; 98-WB-1 also has green accents and is quite striking; 98-NP-7 is exquisite with a significant yellow flush on its fall; 98-LQ-1 has wide style arms and seems quite nice… So many truly beautiful whites! How many can the market handle? Which are your favourites?

Until this year I hadn't ever paid attention to flower size when I was hybridizing. It wasn't a characteristic I was concerned about. My highest priority has always been to work with clones that were the most interesting and had the greatest potential, with one of the key characteristics being flower colour. After that I would look around to see what other crosses I should make. If the flowers were a bit small that wouldn't have stopped me from working with them. This year I did specifically intercross some of the larger clones (85 mm tip to tip). I don't really expect much from those crosses; they will likely give large hybrids that look similar to existing ones.

I did manage to measure about 100 of my hybrids this year; a sampling of these is shown. Normally I'm too busy taking pictures and hybridizing to have time for something like that, however I felt it was important. Bob Pries had asked me last summer what size the flowers were. Now I have the grounding to say which hybrids are indeed small (35 mm tip to tip[6]), which are typical (50 mm), and which are large (85 mm). This translates to diameters of 40, 58, and 98 mm, respectively. Interestingly three small flowers would fit in the area of one large flower. Larger is not necessarily better; it's all a matter of proportion. Small flowers are daintier, and simply require more to fill the same space.

Flower Measurements in mm

	Çat ANM2175	danfordiae ANM2325	danfordiae hort.	sophenensis	histrioides -	winogradowii	J.S. Dijt	White Caucasus	87-BB-1	94-HW-1 (Starlight)	97-CQ-1 (Sea Green)	97-BG-1	97-DZ-8	97-DG-4	97-EQ-3	98-MN-1	98-NP-4	98-NP-10	98-OK-1 (Green Ice)	98-OO-1
Diameter tip to tip	38	33	45	70	68	70	50	60	70	60	50	50	47	60	85	45	55	50	47	45
Standard - width	6	-	0.5	9	10	14	8	7	10	0.5	<0.5	4	<0.5	10	15	3	8	5	<0.5	-
Standard - length	30	-	5	55	43	45	45	30	45	15	20	32	7	45	50	25	30	33	10	-
Style lobe width	8	11	17	15	12	20	10	10		15	13	15	20	13	20	15	16	9	20	13
Style arm length	30	25	35	43	35	40	38	35	40	40	35	40	35	35	45	31	35	35	36	27
Fall blade width	9	11	13	15	16	21	12	13	16	19	14	13	16	13	20	15	17	14	16	10
Fall length	35	29	35	51	43	53	45	40	45	45	38	45	40	43	55	32	45	42	36	30
Flower - highest point	90	75	95	110	100	115	140	85	150	80	85	60	110	125	120	85	100	95	100	65
Flower - base	58	50	60	65	60	55	95	55	100	50	55	85	80	80	75	55	65	60	65	35
Leaf (longest)	60	25	20	55	50	70	80	100	120	45	30	45	75	95	125	45	55	90	50	25

[5] I call 96-DZ-1 'Snow-White' since compared side-by-side, most of my other whites are clearly "off-whites" (e.g. creams). Having such a pure bright white is unusual, plus its blue and yellow accents seem to be the perfect pastel shades.

[6] Figures are for bulbs grown in Toronto, Canada. Bulbs from Holland may initially give larger flowers.

One thing to keep in mind about flower size is that it does vary. The main factor is bulb size. Bulbs that are borderline in being large enough to bloom understandably give the smallest flowers. The figures quoted above are for the largest flowers. Generally bulbs that are of a reasonable size will produce larger flowers. Since I was measuring my newer hybrids, in many cases I had only one flower to measure; in others there were no more than three. It was in populations such as 94-HW-1 in which I have more bulbs, and hence a wider variation in bulb sizes, that differences in flower size could be observed.

Genetic Switches

Now that I have a number of F2 sxd progeny, I can start to analyse the high level genetic switches that are at work. Originally if I had tried this I would have been coming to the wrong conclusions (re: all of the whites in the second year, or the high number of yellow-blues in the third year). Fundamentally flower colour is made up of anthocyans (blues and purples), which are water soluble pigments in each cell's vacuole, and carotenes (yellows, oranges, and pinks), which are fat soluble pigments in the cell's walls. True red is also an anthocyan. Unfortunately it doesn't appear that iris have the capability to produce the chemical compounds that reflect fire-engine red back to our eyes (as in geraniums, roses, etc.) - specifically the compounds paeonidin (crimson), pelargonidin (scarlet), and rosinidine (crimson).

As you probably know, reds of a sort are possible in bearded iris (i.e. dark reds). These come from combining the right shades of purple and yellow. To our eye, at the distance we are from the flower, they combine and give the illusion of red. This is what makes 94-AT-2's falls appear dark brown. It's interesting to look at a fall petal under a microscope to see this.

Another point to realize is that there are various shades of blues and purples contributing to the exact colouring we see. Each is controlled by one or more switches. Think of the flower as a chemical factory. The genetic switches control what compounds are produced, and hence what colours are reflected back to our eyes, from light to dark blue light waves, to violet, through various shades of purple. Similarly with yellows, there are a number of switches at work, although with *danfordiae*'s yellow-orange being so dominant, one might think there was only one. It's a nice colour, but I'm now starting to break its dominance so I can get at the others. A beautiful pink reticulata or rich orange would certainly be nice. (perhaps I'm dreaming, but it turned out to be possible in bearded Iris). If these anthocyans and carotenes don't combine just right, all you end up with is a muddy mess.

Second Generation Hybrids Involving *sophenensis*, *danfordiae*, and the Çat Reticulata

	Blue	White	Yellow-Blue	"Spotted Light Blue-Green"	Yellow[7]
F1 x F1	20	16	8	0	5
F1 x *danfordiae*	3	19	13	6	17
involving Çat	4	4	6	0	4
Total to-date:	**27**	**39**	**27**	**6**	**26**

Clearly there are some high level switches at work controlling whether blues overall are turned on, and similarly, whether yellows overall show up. The table above shows F1 x F1 crosses have 20 + 8 = 28 of 49 with blue (57%), and 8 + 5 = 13 of 49 (27%) with yellow. While back crosses onto *danfordiae* have 3 + 13 = 16 of 58 with blue (28%), and 13 + 19 = 32 of 58 with yellow (55%). Note: I consider 'spotted light blue-green' to be a pattern that appears while both high level yellow and blue are absent. The white category includes whites with blue or green accents (fall markings and style arm stripes), and a couple with no blue.

Since both *sophenensis* and *danfordiae* are pure species, we can assume their genes are mainly homogeneous dominant, or recessive. As all F1s were blue it's clear blue is dominant, and yellow is recessive. Let's first take a look at yellow. If the F1s were Yy, where yy is required for yellow and Y signifies not yellow, then you would expect 25% of the F2s to be yellow. Backcrossing to *danfordiae* should give 50% yellows. Indeed, that's what I got.

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[7] To-date, many of the yellows have been *danfordiae*-like. Only this year's 97-CN-2, and 98-MN-1, which I've included in the yellow category, were not.

	Y	y
Y	YY	Yy
y	Y	yy

F1 x F1 = 25% Yellow

	y
Y	Yy
y	yy

F1 x *danfordiae* = 50% Yellow

Blues are more complicated. If the F1s were Bb, where B is dominant you would expect 75% of the F2s to be blue. However, that wasn't the case. The simplest explanation is that two genes are required (think of it as a two step chemical process): $B_1b_1B_2b_2$, where B_1B_2 is from *sophenensis*, and b_1b_2 is from *danfordiae*. Intercrossing two F1s would be expected to give 9/16 blues (56%), while back crossing to *danfordiae* would give 25%. That's essentially what I got.

	B_1B_2	B_1b_2	b_1B_2	b_1b_2
B_1B_2	$B_1B_1B_2B_2$	$B_1B_1B_2b_2$	$B_1b_1B_2B_2$	$B_1b_1B_2b_2$
B_1b_2	$B_1B_1B_2b_2$	$B_1B_1b_2b_2$	$B_1b_1B_2b_2$	$B_1b_1b_2b_2$
b_1B_2	$B_1b_1B_2B_2$	$B_1b_1B_2b_2$	$b_1b_1B_2B_2$	$b_1b_1B_2b_2$
b_1b_2	$B_1b_1B_2b_2$	$B_1b_1b_2b_2$	$b_1b_1B_2b_2$	$b_1b_1b_2b_2$

F1 x F1 = 9/16 Blue (56%)

	b_1b_2
B_1B_2	$B_1b_1B_2b_2$
B_1b_2	$B_1b_1b_2b_2$
b_1B_2	$b_1b_1B_2b_2$
b_1b_2	$b_1b_1b_2b_2$

F1 x *danfordiae* = 25% Blue

Conclusion: it seems 2 dominant genes are required to turn blue on, and a recessive gene is required to turn yellow on:

sophenensis	$B_1B_1B_2B_2$ YY
danfordiae	$b_1b_1b_2b_2$ yy

This doesn't explain why three of the 56 F1s had a fair amount of yellow on their falls. According to the above, none of them should have had any. Is there a second path for synthesising yellow involving several genes? At some future point I hope to be better able to understand what's behind the 'spotted light blue-green' pattern, as well as the yellow streaking or blotching effect. Of course by that time there will be other mysteries. Somewhere hidden in the genes is *sophenensis*' veining that I had expected would be extremely hard to get rid of. The only F2 hybrids it's shown up in directly are, last year's striking dark blue 97-CC-3, and this year's lovely dark reddish-brown 97-BG-1.

Keep in mind that these plants have 18 chromosomes, so while there may be 9 hybrids that look like *danfordiae*, there's a good chance they may have one or more chromosomes from *sophenensis* -- just not ones with genes directly affecting their appearance. Also remember that for something to be possible the potential has to be there. Then it's a matter of needing a number of generations to pull the characteristic out.

Some of you may have noticed the standards are "missing" on the sxd hybrids. If you look carefully you will see them, it's just that they've been reduced significantly in width: 0.3 to 3.0 mm, verses typical Iris *reticulata* standard width of 7 to 10 mm. Two F2 hybrids have 8 mm widths. In terms of length, most F1 standards are 30 mm in length compared to a more typical ~40 mm. Some are only 20 mm. F2 hybrids are much more variable: from 5 mm to 35 mm. This is of course due to *danfordiae*, which only has short bristles for standards. Perhaps one day I will have sxd hybrids with "normal" standards, however that isn't one of my priorities.

The velvety effect that seems to go along with some reticulata colours, particularly dark ones, is due to papilla-shaped epidermal cells (figure 3). It is a physical, not a chemical phenomenon. If you were to take a velvety fall blade such as *bakeriana*'s and turn it, you would find that it shows pure colour at every angle. You never see any solid white light bouncing off it as you would if the surface were flat. With Iris petals, you do see a glistening effect when each of a multitude of cobblestone-shaped cells reflects white light. The glistening on the back of a fall is noticeably dull; by comparison, the front of the fall is "alive". This is due to the fact that the depth of the cobblestone cells is less on the back of the fall, where as the front has "hills". Additionally, the light we see is saturated with colour. Before reaching our eyes, it has been bounced around several times due to the papilla-shaped cells, in the process "picking up" more and more colour. This can be seen by the fact that the intensity of colour changes as you change the angle of the blade.

The Retics we know of are just the tip of the iceberg. There are many new strains of *Iris reticulata* sitting unknown in the wild. Unfortunately I tend to find wild forms only survive a few years in my garden. By using them in hybridizing, their genes do carry on in clones with hybrid vigour.

The Future

What does the future hold? As I have come to learn, it holds wonderful, unexpected surprises. It's been amazing to see the unimaginable new beauties as they unfold each spring. I'm keen to break away from *danfordiae*'s singular lemon-yellow. Doing so should add a whole new dimension to my hybrids. I'm also expecting a lot from the injection of the Çat Reticulata's genes: not only adding purple into the current mix of blue and yellow, but more importantly, unlocking potential hidden patterns. It's not that the genes for those patterns aren't in *sophenensis* and *danfordiae*, it's just that they might be homogeneous, and thus couldn't otherwise be turned on (benefits of genetic diversity). The only catch is that it,

like the diploid *danfordiae* I collected, is a bit on the small side. Incidentally, it was my *danfordiae* that Kew Gardens did the cytological study on in late 1980s and laid to rest the mystery of what *danfordiae*'s chromosome count really was[8].

Polyploides (more than 2 sets of chromosomes) can be created in the lab for a moderate price. Their benefits are larger flowers, thicker petals, and sturdier stems.

Hybrids with other Reticulatas should prove to be very interesting, however they will be sterile dead ends. I sense that although I have been able to produce good seed, only a small percentage will germinate and form blooming bulbs. My hybridizing statistics web page gives a breakdown of all the various types of F1 and F2 crosses I've made. Offhand, I can't say whether or not any of the ones from 1997 and prior should bloom soon, or if they have even germinated. I do have a lovely set of hybrids from *I. reticulata* Talish x 88-AX-1 (cross 95-D), where 88-AX-1 is Çat ANM2175 x *danfordiae* ANM2325. 95-D-1 for example is a mixture of blue and purple shades with a number of similarly coloured large spots around its orangish ridge. Their only fault is they have small flowers.

Towards Commercial Availability

Currently there are 40 hectares of reticulatas under cultivation in Holland, which produce some 50,000,000 bulbs for sale annually. Back in 1989 there were only 27 hectares under cultivation. Over the years the cultivar distribution has changed somewhat. Back in 1989 over 10 hectares each were being grown of *danfordiae* and *Iris reticulata* hort., with the next largest variety being 'Harmony' at 3½ hectares. *Iris reticulata* hort. is now under 6, while 'Harmony' is over 11, followed by William van Eeden's 'George' at just over 6. Sales for cultivation in pots has become a significant portion of the market, and hence separates the varieties that sell in large numbers from those that sell significantly less.

I now have 5 Dutch bulb growers testing my hybrids. One, who just started this year, is solely interested in Juno Irises. This is a hobby gone overboard. It's effectively become a second job. It would be nice in the long run to get something back for all of my hard work, plus repay my expenses over the past 20 years. Following this year's bloom, Wim de Goede announced there are four of my hybrids he'd like to go through with. We still have to work out a commercialization agreement, which will be a lot more challenging to negotiate than the original test agreement in 1997. As significant as the commercialisation agreement will be, it has no value if there are only minimal sales. So the real milestone will come many years from now when sales of my hybrids reach a specific target, say a million per year. That figure is not as unrealistic as you might think. Royalties will be low and they will be slow in coming so it's not that I will have an instant fortune. Expenses right now are high, for example for lab work. I'd like to spend more, but can't afford to.

Creating unique, distinctly new hybrids, is only the beginning of a long uphill battle to getting them introduced.

unique hybrid ➔ testing ➔ commercial agreement ➔ build up stock ➔ begin introduction

You may find it interesting that when a grower begins testing it means that they have signed a test agreement and the hybridiser has sent them bulbs (for example with Wim in 1997). But it isn't until the following year when the bulbs bloom and go through a growing cycle that testing truly begins. At that point, the bulb grower gets to see the actual flower, can assess how well it increases, etc. Typically however, it's actually 2 years before they are able to start testing, since most of the hybrids I now send only just started to bloom in the year I sent them. I keep the largest bulb(s) so I can use them in the next year's hybridizing, which is critical to the hybrids I'll have 5 years from then. What I'm able to send the Dutch bulb growers are smaller bulbs, which should take one growing season to get up to bloom-size, then bloom in the second spring.

When Wim started testing, he wanted only 2 bulbs for testing. This small number meant that there would be less work involved in replanting. Other growers said they'd like 6 or 12. Originally it seemed like the best thing would be to grow the new varieties myself for 3 or 4 years in order to see which were the best, and only then offer them to Dutch bulb growers for testing. This would give time to build up their numbers so several large bulbs of each variety could be sent to the growers[9], plus during that time I would have all of the flowers available for hybridizing. However, I came to realize the bulbs needed to get into the grower's hands as soon as possible so the evaluation could be done in parallel. Because of the very small number of bulbs I initially had, I was only giving out 2 of each for testing. For example, this year I had 1 large, 1 medium, 6 small, and 15 bulblets of 98-OO-1. In the past I would have given out 1 medium and 1 small. Instead, this year I gave out 5 small bulbs. It will take 2 years for them to bloom, but it means potentially there will be 5 blooms that first year (2005), and 10 the next (2006). Giving out some of the bulblets would be an option, but I tend to feel there's an increased risk they'll be lost due to the likelihood of being planted too deep, etc. With 97-DZ-8 and 98-OK-1 there were 2 large bulbs, 4 small, and 8 bulblets, so I gave out the 4 small bulbs of each.

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[8] The Identity Of Iris 'Katharine Hodgkin' - A Cytological And Morphological Approach, by Margaret A. T. Johnson & Brian Mathew, published in Kew Bulletin Volume 44, #3 (1989).

[9] If a variety were doubling, at the end of 3 years there would only be 8 bloom-size bulbs. At the end of 4 years there would be 16. Normally the numbers are slightly less. Incidentally, at the end of 6 years the number would be only 64, but at the end of 10 years the number could reach 1024, which still isn't really a lot in the Dutch scale of things. This illustrates why it initially seems to take forever to get a reasonable number of blooms.

It is possible to have a lab quickly increase my most promising clones to provide extra bulbs for testing, for hybridising, and for showing. It's cheapest to do the lab work early. If you wait a couple of years, several more cycles are needed to catch up. Although the cost per bulb initially goes down by doing more cycles (due to handling the bulbs in a more efficient / automated way), the total cost goes up significantly as a result of the number of bulbs being produced. After just a few cycles the cost per bulb stabilises since no further efficiency improvements can be made. Thus, if the total bulb count were tripling, then waiting 2 years means costs are slightly less than 9 times what they would have otherwise been. With 3 years it's something less than 27 times. Incidentally, there is an up front cost of €100 for the decontamination and initiation phases.

The reality is that even the smallest increase takes just over a year. The lab bulbs then need to be increased up to bloom-size. I had hopes this would take just one growing season, however there's a suggestion that two will be required. I'll know better in a year since my first batch of bulbs are set to come out of the lab by the time you read this. Shortly thereafter they'll have gone through their first growing season. The biggest risk appears to be in transferring the bulbs from the lab to the field – to give them enough moisture that they don't dry out, while not giving them too much that they rot (i.e. to re-acclimatize them to the field). Some bulbs like muscari are easy, while others like hyacinths are difficult. So far we have no experience with iris.

To put the timing in perspective, if I gave the lab a clone to increase in late summer 2003, they will be able to produce roughly 100 bulbs by January 2005. Some would possibly bloom in 2006, but more likely it would be 2007. Thus, it would take three years to go from one bulb to 100 bloom-size bulbs (fall 2006). If we were talking about 98-OO-1, by that time it could have increased to approximately 26 large bulbs, 21 medium, 24 small, and 108 bulblets for a total count of 179. Analysis shows the lab work saves only about one year in getting to market. Had it taken just one growing season to get up to bloom-size the savings would have been 2 years, and had 300 bulbs been produced it would save an additional year. Each further tripling in number saves another year. The benefit of the lab is greater if the hybrids undergoing increase are typical Reticulatas which don't increase in the field as fast as the sxd hybrids.

94-HW-1 ('Starlight') is one of the hybrids Wim is wanting to through with. When it first bloomed I wrote, "I couldn't have asked for a more stunning first F2 bloom!" "It's absolutely gorgeous." It is continuing to do well and has nice 60 mm tip-to-tip flowers. I had planned to have the lab create 2200 bulbs of 94-HW-1, however the cycles took longer than expected so only 500 were produced before having to go on to the bulb formation stage. At this point I'm waiting to see how the actual costs compare to the estimates before I decide how to proceed further. I also need to know clearly how long it takes to get the lab bulbs to bloom, and be confident that we can harden them off with minimal losses.

My aim had been to start sales in 2007 with 10,000 bulbs (which incidentally would have tied in nicely with the earliest possible retirement date from my day job). Having only 320 lab bulbs means introduction will be delayed 2 years. Based on my current analysis, if everything goes according to plan 20,000 bulbs would be available in 2009, doubling to 40,000 in 2010, 100,000 in 2011, 400,000 in 2012, and 1,000,000 in 2013. I'm sure Wim would say I'm dreaming, but if you don't aim high you're not going to get anywhere. I wanted to make this happen sooner rather than later, which is why I invested money in the lab work.

What I did last year is re-doubled my efforts to see that each of the growers had several things I believed would be successful commercially. I am using the John Nash approach (from the movie "A Beautiful Mind"). By working together with several growers there's a greater chance of being successful than by working with just one grower exclusively. Each is being given varieties different from the others, which do not overlap with what the others have. It will be up to each grower to decide which ones they believe will sell well. Then they'll need to put their best foot forward and "make it so!"

One difficulty is to get them to see beyond the idea that another grower has possibly been given something better. Better is relative not absolute. My goal is to partner with each of them. If they are successful, then I'm successful. If they aren't, then I'm not. They also need to realize that although I may have even better things next year, but what I have today is pretty darn good, and we should do our best to start selling those, then go from there. Last year I wrote, "I particularly like the two whites 94-HW-1 and 96-DZ-1. Which is the best? I tend to favour 94-HW-1, but maybe the market will favour 96-DZ-1." As you've read above, there are now another four whites I would seriously consider introducing.

I hear that to some degree the growers all sell into the same market. My vision is that you will be able to buy my hybrids from your local garden centre. Here in Toronto, most garden centres only sell *danfordiae* along with a blue variety, such as 'Harmony' or *I. reticulata* hort. Even speciality mail order bulb firms only have the same few varieties available year-after-year. I don't expect all of my hybrids will become widely available, but I believe there is a lot of room in the market for them. The general public needs to see what's available... to see that there are exciting new hybrids. If I partnered with just one grower he might be willing to introduce one, two, or three varieties. By partnering with several I may be able to get six, eight, or more marketed initially[10]. Yes, they will take away some market share from older, existing varieties... what's wrong with that? This should also create additional demand from people buying who wouldn't have

[10] Actually introduction of the initial selections would occur over several years, and therefore seem a bit random due mainly to how quickly stock of each can be built up.

otherwise. Then perhaps they'll buy more a year or two later if the first ones did well. I expect even more of my hybrids will be introduced over time. Look at what I've created so far, then realize close to 40,000 of the 87,000 seeds I've planted to-date still have to bloom over the next 5 years.

As stock is built up, a point will be reached when some of the bulbs can be drawn off in order to develop the market. It's an up hill battle to create the demand... to make people aware of what's available. Who knows which ones will do best? We may have an idea, but ultimately it will be up to the buying public. From my point-of-view we need to get some out there and see how things go. That's still years away.

What would be helpful is a clear indication from each bulb grower which hybrids they believe are the most interesting. This affects how I distribute the bulbs for testing. It doesn't make sense give a grower several smaller hybrids for example, when in fact they aren't interested in small ones. That would be a waste of our time, and would result in a significant set back for that clone. It makes sense to ensure the hybrids are in the hands of the grower most likely to introduce it. One of the reasons I posted pictures to my web site as the new hybrids bloomed was to let the growers see right away what exciting results I was getting. I had expected each would be keen to let me know which ones they were interested in trying[11]. Only one grower provided this in a timely fashion; and it was a different one from the one who did so last year. I tried to get the information numerous times from the other growers and tried to impress upon them why it was important, but their promises kept coming up short. It makes me wonder just how interested they really are. I point this out only to let you know things aren't as easy as you might think they are. I feel I have too many good hybrids to know clearly which are the ones the growers will want to introduce. If it were up to me, I'd want to introduce all of the 98-NP clones, plus a dozen if not more of the others.

Two of the growers told me they weren't interested in small clones, unless of course they were an unusual colour. Does that mean they are they interested in any of my new small ones or not? I provided measurements that included all of the small ones. 98-OO-1 is small, and in my eyes fits in the category of having an unusual colour. I have to presume however, that since they didn't specifically say that they liked it, and they would have seen it on my web site, that means they didn't consider it unusual.

Growers have made several other contradictory statements. Normally they speak about needing something different than what's already in the market. To me that makes sense. However one time I was told by one of those same growers, that a hybrid wouldn't sell well unless it's blue, since people expect iris to be blue. I've also been told that my hybrids won't sell well because they don't have standards: "People expect irises to have standards." Hog wash. And, "the market wants big flowers," where the implication was anything smaller than *histrioides* is too small. J.S. Dijt, Gordon, etc. are smaller, though their sales and significantly lower than that of 'Harmony' and 'George'. Perhaps that's the distinction the grower was trying to make, but then why is it *histrioides* sales are so minuscule when it has such big flowers? That's a question I've always wondered. There must be something difficult about it's cultivation, but I have no idea what. For this very reason I've actually given one Dutch bulb grower two of my more robust *histrioides* selfed seedlings. The grower may not want to introduce them even though they're good, since they're "just blues."

I still very much believe several of the F1 clones should be introduced. As I wrote in 2000, "I feel now, as I did several years ago, that a number are particularly vibrant and strong, and consequently should be introduced into commerce. What I need is to find a commercial grower who feels similarly." They may be "just blues", but I expect a number of other people would also like them, plus they are good doers. Given they originated in Toronto they should do well in other North American gardens, which to me is important since I hear of people buying Reticulatas only to have them die out after a few short years. Consequently those people say they aren't going to try Retics ever again. From a Dutch perspective they're "just blues". Why would anyone pay a premium when the wholesale price of clones like 'Harmony', 'George',' Springtime', 'Purple Gem', etc. is only about €0.02 per bulb? Someone who wants a blue or purple, will simply buy one of those (assuming they can find a source for them). Perhaps once I'm successful with other colours there will be an interest to try some of my F1 sxd blues.

The price you and I pay is a lot more once middlemen and retailers add their mark up. You might wonder how much supply and demand comes into play when the retail price isn't tightly tied to the wholesale price. Sometimes it's no wonder a particular variety isn't being sold in large quantities – the retail price is too high. A local mail order bulb firm in Toronto currently charges an incredible $10.95 Canadian for two 'Katharine Hodgkin' (approx. £5 or €7), plus shipping (at least 12%) and 15% taxes. The price is $23.95 for 5. Dutch growers only get €0.21 to €0.32 depending on bulb size. Just a couple of years ago they got 1 Guilder (about €0.50). That was when they were selling for $8.95 for a single bulb. You would think a retail company would get a lot more sales and still make a good profit if they sold 5 bulbs for the $10.95 price (more affordable, rather than something just a few connoisseurs would buy).

It's interesting to realize much of the reticulata crop, and for that matter other bulbs, is pre-sold. This actually makes sense when you think about it. For example, when we start to sell one of my new hybrids, it will need to be listed in wholesale and retail catalogues. These are printed up early in the year. That means prices need to be set well in advance

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[11] Except perhaps for Wim who, having decided on several to go through with, should understandably be more interested in those, rather than trying to evaluate additional ones; unless of course one or two in particular caught his eye.

of the actual bulbs being available. It also ensures growers have a specific known price for most of their crop. It's not just a case of harvesting your crop and then putting it up for sale and seeing how high, or low prices will go. You might do this with a small portion of the crop, particularly if yields were higher than expected and you have extra bulbs left that you don't want to plant.

With a new variety it would seem you actually need to start promoting it slightly in advance of it becoming available. That way you can get an idea of how many bulbs are needed initially. If sales were to start slowly, maybe only 2,000 or 5,000 bulbs would be needed. If it were something really good, and it looked like things would really take off, you might want to have 50,000 bulbs and start off selling only 10,000 or 20,000 with the rest used to build up stock.

It's taken quite a number of years to get to this point, and it will still be a number more before these hybrids are available commercially, but one day they will be! It's quite possible that once initial sales start, additional sales will come quickly. I expect it will take a while – at least 10 years - before these reach your local nursery. I am looking forward to the day I can go into local nurseries and see my hybrids being sold.

I have a lot to learn about the bulb industry. I've heard it said that the reticulata market is a small one. I don't know how it compares to tulips or daffodils, but 50 million bulbs seems like a reasonable market to me. I wonder how many bulbs of each of the different tulip varieties are sold compared to varieties of reticulatas. Perhaps wholesales prices and profit per hectare are lower for retics. Years ago William van Eeden mentioned that reticulata prices had become quite depressed. I suspect this is still true today from his perspective. Perhaps too many are being produced. Production methods may have improved so that the growers can still make a profit from the lower prices. One way of creating additional demand is by creating new varieties that are significantly different from what is currently available. I wonder for example what is happening in the tulip market to improve it?

I'm pleased to announce my pure white reticulata was registered this year as 'White Caucasus'. It's from the lake Sevan region of the Armenian SSR, hence the reference to the Caucauas mountains. The typical form is purplish; I tend to refer to it as pinkish-purple since various clones contain differing hues and tones. It will still be a number of years before there is enough stock to introduce my lovely white form commercially. In order to make this happen sooner, I started it off in the lab late last year. Its rate of increase was on the low side. Only a few hundred bulbs will be delivered at the end of this year. Assuming all goes well in 2004, I have asked the lab to aim to produce between 3,000 and 6,000 small bulbs for delivery in early January 2005.

Did you know that in Holland large bulbs tend to give two blooms per bulb? Some of my F1 bulbs I got back from Wim in 1999 were even large enough to give three, though the third flower was much, much smaller than the first two. In my own garden, I find I get just one flower per bulb. There was a point-in-time when I did get two blooms per bulb from some of my typical reticulata hybrids. These days my bulbs are planted too close together, plus I never give the soil a rest from growing the same the same type of bulbs over and over. I don't have the space to practice crop rotation. In Holland, reticulatas are planted in the same soil only every seven years.

Reticulata Culture

Reticulata irises like well-drained soil (sandy loam/sandy topsoil), with lots of moisture in the early spring (i.e. snow melt). However the soil should be fairly dry around the time the leaves are starting to turn brown. They should have at least half a day of sun. It's a good idea to replant them every two years or so, ideally into a new spot in the garden. In Holland they are treated as crops, and only planted in the same area every 10 years.

In Toronto, Canada, reticulata iris generally start blooming at the end of March. They last for about three and a half weeks, with individual flowers lasting seven days or longer, depending on temperatures. *Sophenensis* x *danfordiae* hybrids tend to bloom at the beginning of the season. This year's bloom was a record: starting early on the 23rd of February and running right to April 21st, as it normally would. Flowers were opening almost every day during that time.

I suggest planting several varieties, both where snow first melts, and in a shaded area where it's the last to leave. That way, you'll extend your bloom season, and even get to enjoy those particular hybrids twice.

Remember, the bulbs need to regenerate, so the last thing you want to do is disturb them while they're in growth. I know some people find daffodil leaves messy so they either cut them shorter or tie them up. I certainly don't advise that for reticulatas. Wait until the leaves start to turn brown, then do what you will. Otherwise, you're ruining next year's bloom. A little bit of low nitrogen fertilizer at the beginning of the bloom season is good for bulb regeneration. Flowers form in late summer.

Conclusion

I have opened up a whole new world for reticulata irises. The words "success is a combination of good luck, knowing what you're doing, and a lot of hard work," are just as true today as they were when I wrote them in 2000.

I have the late Frank Kalich to thank for sending me *Iris sophenensis*.