

The fertility of NNNX daffodil varieties

NNNX varieties have three chromosome sets (NNN) from standard daffodils and one (X) from a species. The species for the plants in the table are N. viridiflorus (VVVV), N. jonquilla (JJ) and N. tazetta (TT). In most cases, the varieties arise from crosses of standard daffodils with viridiflorus hybrids, jonquilla hybrids or tazetta hybrids. Of special interest is the use of split corona or double daffodils as parents. For the generation of NNNV it is reasonable to use the standard daffodils as seed parents, for NNNJ a big success is possible only with the jonquilla hybrids as seed parents and for NNNT both parents are feasible as seed parents.

NNNX varieties

Parent 1	Parent 2	Variety	Flowers /Stem	
Emerald See	Ashmore x (Calleen x Placid) (S)	Autumn Beauty	1	
	((Cascade x (Lingering Light x Gisela)) x Audubon (S)	Autumn Charme	1	
	Elfin Dell (S)	Autumn Dell	3	
	Loch Loyal (S)	Autumn Grace	1	
	Elfin Dell (S)	Autumn Jewel	3	
	Loch Loyal (S)	Autumn Splendor	3	
	Habit (S)	Herolds Legacy	2	
	Pure Joy (S)	Pacific Joy	5	
	Evenlode x N. viridiflorus Grace Note x N. viridiflorus* Dallas x N. x N. viridiflorus* N. poeticus x N. viridiflorus* Vermillion x N. viridiflorus	Misquote (S)	Mesquite	1
		Ashmore (S)	Mesa Verde	2
Lollipop (S)		Anazazi	1	
Chatmoss (S)				
Lollipop (S)				
Quick Step	Top Notch (S)	American Frontier	1	
	Daydream (P)	Autumn Gold	1	
	Foundling (P)	Baby Kaitlyn	3	
	Daydream (P)	Cloud Nine	1	
	Cool Flame (P)	Cool Pink	1	
	(Falaise x Debutante) x Polonaise (P)	Diatone	2	
	Daydream (P)	High Note	3	
	Daydream (P)	Lemon Tarts	3	
	Magician (P)	Magic Step	1	
	Daydream (P)	Misty Meadow	1	
	Ambergate (S)	Mogley's Favorite	3	
	Ambergate (P)	New Day	1	
	Misty Glen (P)	Oakwood Delight	2	
	Cloud's Rest (P)	Our Jess	3	

	Silken Sails (P) Daydream (P) Okarino (P) Daydream (P) Daydream (P) Daydream (P) Daydream (P)	Punchline Repose Siberian Pink Songster Step Forward Wind Chimes Wishing Well	3 1 1 1 3 1 1
Quick Step op	Fragrant Rose (P) Fragrant Rose (P) Fresno (P)	Interlace Problem Child Sevorange	1 1 1
Hillstar	Lemon Sails (P) Lemon Sails (P) Pink Holly (P) Pink Holly (P) Amadeus (P) Pink Holly (P) Shrike (P) Elfin Dell (P) (Hicol x Value) x Obsession (P)	April Joy Chromite Chlavichord Harpsichord TS 990 Lemon Honey New Magic Star Cluster	1 1 1 1 1 1 1 3
Limequilla	Elfin Dell (P) Elfin Dell (P) Elfin Dell (P) Inishmore x Brierglas (P) Elfin Dell (P) Elfin Dell (P) Inishmore x Brierglas (P) Elfin Dell (P)	Cascade Dawn Deltone Elfina Onota Quedelle Queue Jumper Stacey Humm Yellow Dellow	3 3 3 2 3 3 2 3
Matador	Unknown Division 2 (S) Altruist (S) Stylish (P) Tahiti (P) Sabine Hay (P) Unknown Division 2 (S) (Crescendo x Tarmina) x (Marksman x Narvik) (S) Unknown Division 3 (S) Tahiti (P) Festivity (S) Carita x Precedent (P) Tamar Fire (P)	Areyla Carra Crazy Horse Deluna Green Fire Jessie Jane Kahurangi Kait's Favorite Kaysea's Kiss Koshare Pink Pirouette Sunface	2 2 2 2 3 2 3 2 2 3 2 1
Bright Spot	Altruist (S) Ambergate (S) Unknown 3W-R (S)	JoJo Kimmey's Favorite Tara's Favorite	2 2 3
Bright Spangles	Cardinal Knowledge x Flora Brava (P)	Legendary	4
?	?	Albany	3
Jaune a Merveille	Chaucer (S)	Chinita	2
?	?	Highfield Beauty	3
?	Poetaz (S)	Martha Washington	3

S = seed parent, P = pollen parent/ *for these varieties it is not quite sure that they have the chromosome constitution NNNV. They can be also NNV or lay between these two extreme cases

The value of flowers per stem is often one. Because of the little flower diameter these plants can be introduced as intermediates. Two or three flowers per stem are also possible. It is likely that the hybridizers selected preferably the types with most flowers per stem. Generally, crosses have more flowers per stem if the part of X within the chromosome constitution becomes higher. The order is NNNX, NNX, NX (NNXX), NXX and NXXX.

If standard daffodils have many genes of *N. poeticus* the value can become greater. In a field with *N. poeticus* some plants can be found with two flowers per stem. This character also appears as far as I know for Elfin Dell, Liebeslied, Altruist and Young Blood. NNNJ crosses with Elfin Dell obviously have in all cases of the table three flowers per stem.

Concerning the fertility you find in (1): 'These plants form trivalents and univalents during meiosis, which is thus very disturbed, resulting in a high level of sterility' (NNNV and NNNJ) and 'All of these 10 + 7 + 7 + 7 plants would be highly sterile, with triploid meiosis made more irregular by the presence of ten more univalents' (NNNT). That the plants are highly sterile is not the truth.

Already in 1982 Bill Welch published in (2) that Chinita and in (3) that Highfield Beauty created many pollen. In 1995 Bob Spotts got twelve seedlings of Lollipop x (Vermillion x *N. viridiflorus*) and used the pollen of Chatmoss x (*N. poeticus* x *N. viridiflorus*) for fertilizing standard daffodils (4). In 2010, Richard and Elise Havens registered Universal Charme, which is Limequilla x American Frontier. American Frontier comes from Top Notch x Quick Step. It has one flower per stem. In (5) it is described that seedlings of Oregon Cedar x Emerald Sea, Hillstar x Amadeus and Symptom x Matador have viable pollen as well as Cool Pink, Harpsichord and Clavichord. In (6) it is specified that Magic Step and Problem Child have fertile pollen. In 2016 John Hunter registered Mottles (3-6 flowers/stem), Starcloud (3-5 flowers/stem), and Wishing Star (5-8 flowers/stem). The seed parent is Hillstar x ((Hicol x Value) x Obsession)), the pollen parent Emerald Sea. John Hunter wrote in summer 2019 within a personal message that he intends to look for the fertility of the varieties and that he has selected another very good group from Regeneration x Starcluster. I got in 2018 and 2019 many seeds from a white jonquilla hybrid of my own as seed parent and Magic Step, Harpsichord and TS 990 as pollen parents.

It is without doubt that many NNNX plants are fertile and useful for crosses. A great part of the few seedlings I possessed, before I lost them during an

extreme frost period in 2011/2012, was pollen fertile as well as all NNNJ varieties are that I grow. Compared to NNX plants, that often have fertile pollen, you find still more varieties of NNNX with this character.

The question is what chromosome constitution have the pollen grains and the generated seedlings. Theoretically N, NN, NX, NNX and NNNX pollen with some variation for the last four groups concerning the value of chromosomes per chromosome set. For twelve varieties and seedlings, I calculated the pollen volume. I found very different values and think that the constitutions NN, NX, NNX and NNNX are possible. Often the plants produce more than one kind of pollen. Magic Step, TS 990 and Harpsichord seem to generate NJ pollen. If you look at the flowers per stem, it is likely that Mottles, Starcloud and Wishing Star were generated by NJ or NNJ pollen and Universal Charme by NN pollen.

The NNNX plants have a great value for back crosses with viridiflorus-, jonquilla-, and tazetta hybrids. The diversity and quality of these hybrids can be increased by colour, split coronas and doubles. Moreover, they can be combined with different hybrids, for example Matador (NNTT) x NNNJ. Combinations of NNNX with XX or other diploid species can also have interesting results.

Literature

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- (4) Spotts R. December 1995. Hybridizing verdant daffodils. *The Daffodil Journal*. 118-124
- (5) Sanders T. 2013. Pollen volume and chromosome content of daffodils – possibilities for hybridizing 2. www.theo-sanders-daffodils.de
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