

Hacking Hybrid Plants and Seeds

Dr. Art Trese, Ohio University



Presentation Credit: Dr. Art Trese, Ohio University



seeds are
no small thing

Hybrid:

- In biology, hybrid means something different when applied to animals versus plants
- A) hybrid animals... progeny of two different species



Sometimes they are sterile, sometimes not

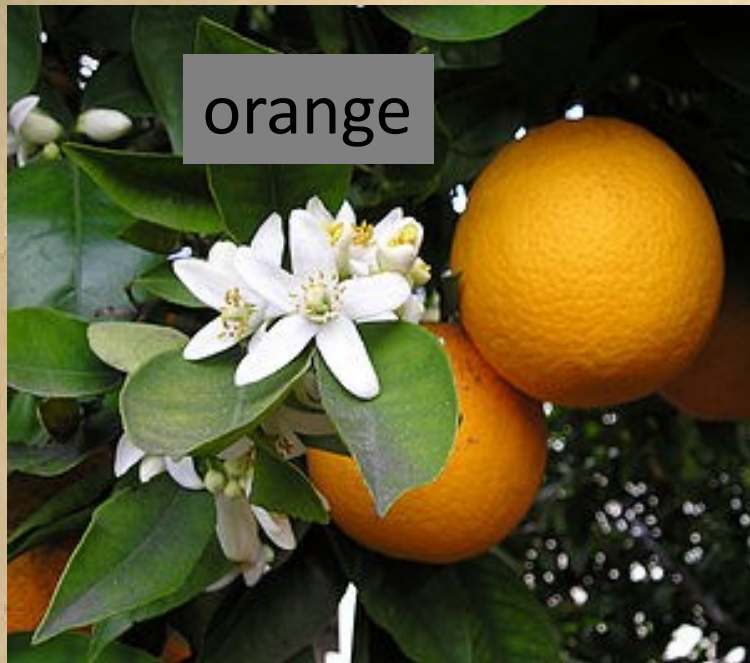


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Hybrid:

- B) hybrid plants... if progeny of two different species =
- ***Interspecific hybrids*** (same as what animal hybrids are)
Examples: Most commercial roses are hybrids between 2 species... at least





orange



pomelo



grapefruit

- C) Or... just a hybrid = progeny of two parents that are the same species, but precisely identified (this is different from animal definition)

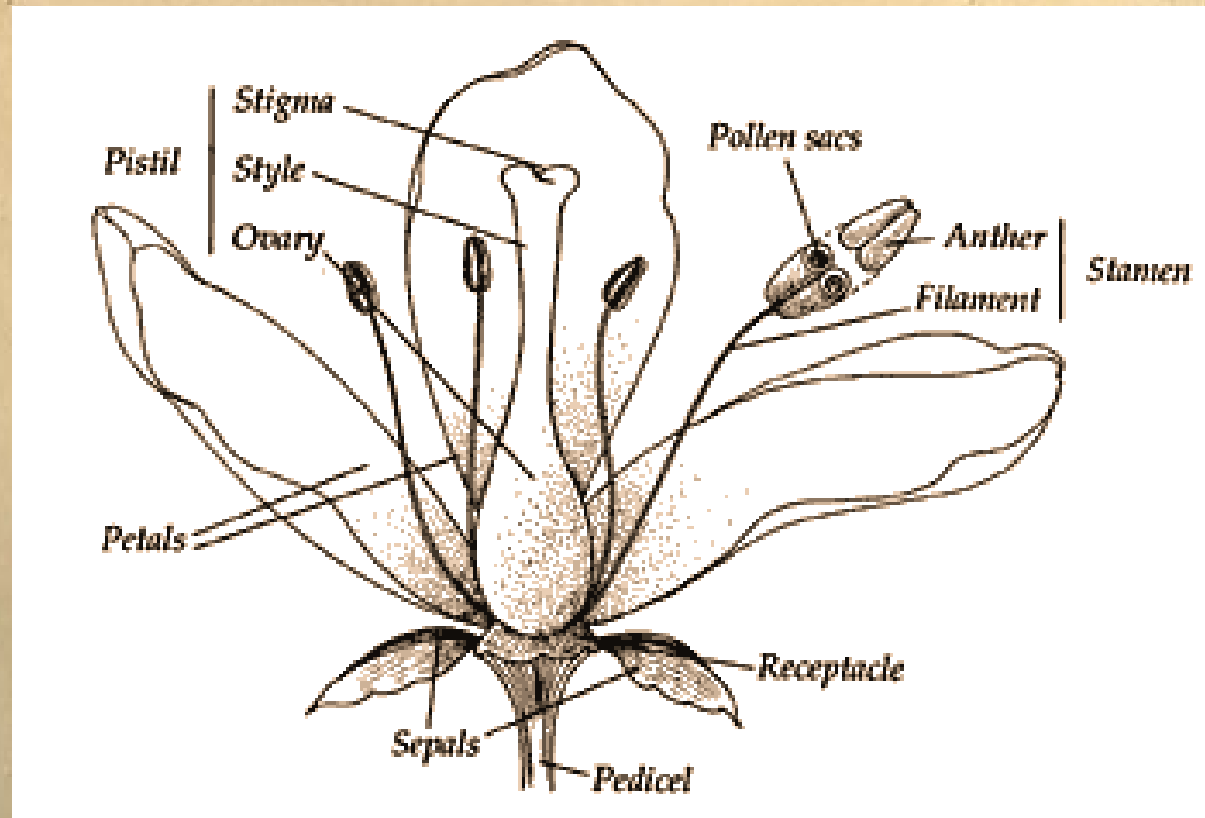
High Mowing Organic Seeds
www.highmowingseeds.com

Red Ace F1 Hybrid Beet

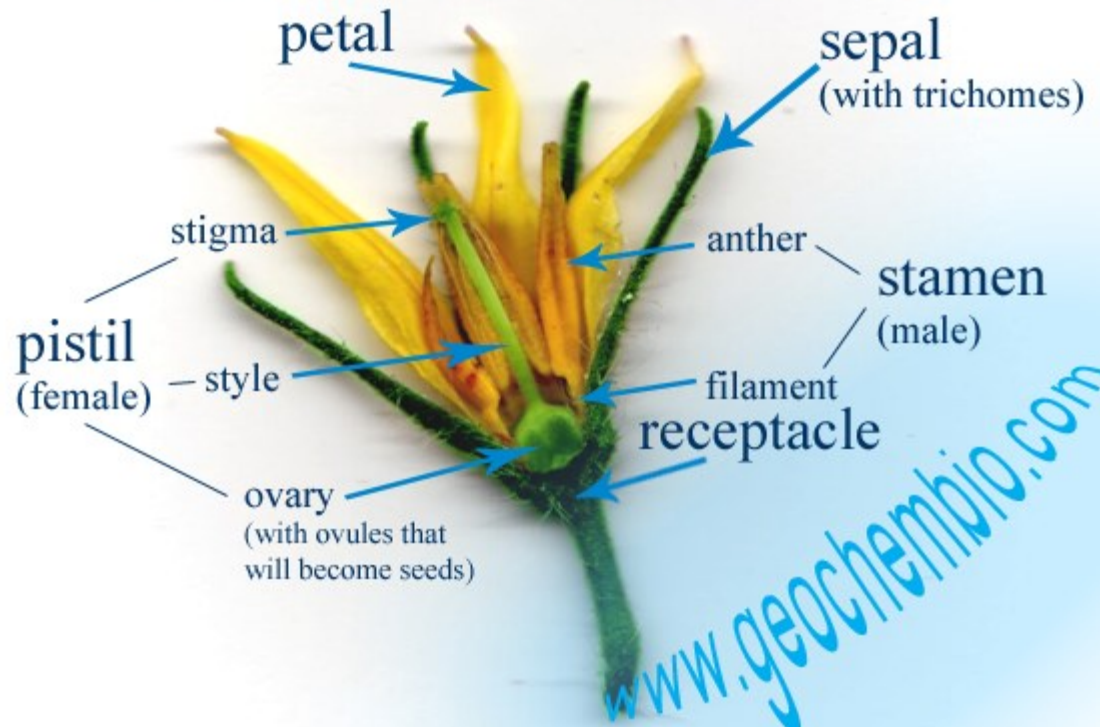


- Leading Red Globe Beet Variety
- Solid Red Interior, Uniform Round Shape
- Reliable in a wide range of conditions

- How do you know who the parents of the seeds are in a plant population? Many plants produce both male and female reproductive parts in each flower.. Can't they self fertilize?



Tomato flower



- In tomatoes, for example, each flower contains both male and female reproductive structures, so one flower can fertilize itself... this would not make a hybrid seed
- to make a hybrid, one has to remove the male parts from a flower, and then bring over some pollen from the intended male parent.



Complete flower,
yellow tube is
male anthers

“emasculated” tomato flower, now it is female only..



- Hmm that sounds like a lot of work, if you were trying to make thousands of hybrid tomato seeds you'd have to emasculate a lot of tomato flowers... with tiny little tweezers, but maybe it is worth it?





[MORE DETAILS AND SIZES](#)

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Keep in mind the value of hybrid seeds



Big Beef (F1)

Product ID: 2063

[Vegetables](#) > [Tomatoes](#)

Nice combination of size, taste, and earliness.

[MORE DETAILS AND SIZES](#)

Packet - \$3.65 ▼

Quantity:

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Granadero (F1) (OG)

Product ID: 2584G

[Vegetables](#) > [Tomatoes](#)

Organic plum tomato with a good disease resistance package.

[MORE DETAILS AND SIZES](#)

250 Seeds - \$50.25 ▼

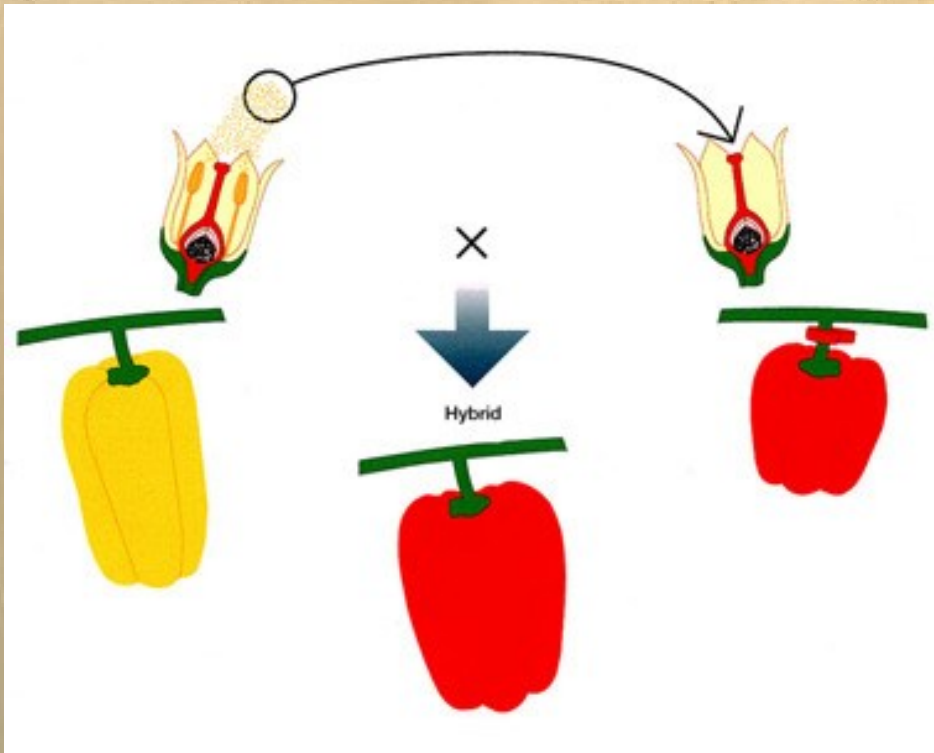
Quantity:

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Benefits of hybrids...Part A

The ability to predictably combine traits from different parents into one plant... = better yield, resistance to disease, shipping, appearance, novelty, etc.



“By understanding the laws of heredity, plant breeders can cross a large yellow pepper and a small red pepper to create a hybrid that is large and red. “

Benefits of hybrids...Part B

With hybrids, because you know they all have the same parentage, all the seeds produce plants that are very similar to each other... increased uniformity! This is one of the most important commercial aspects....



SUNFLOWERS FIELD - ITALY
Presentation Credit: Dr. Art Trese, Ohio University



← hybrid



heirloom





Uniformity increases
Total production....
If the hybrid seed
produces plants that are
above average in yield,
then the entire field will
increase in yield



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'Carmen' Pepper

My wife, Janika Eckert, was managing the pepper breeding at Johnny's. But it had been my program, and I was staying involved. One early summer day in 2001, I was walking through the sweet pepper nursery with Janika, and I got an idea.

In 1973, the first year of Johnny's, I had visited Fred Herbst, a seedsman in Brewster, NY, and Fred gave me seeds of an Italian bull's horn pepper. It was early and tasted great, but the plant sprawled. Janika had plants in the nursery. She also had plants of another bull's horn line that we had selected from a hybrid from Italy, that had a tall, strong plant form, nice fruits, and good taste, but later maturity. Janika made hand-crosses between the two, and in 2002 we grew the F1 hybrid — "F1" standing for "first filial," or first generation after the cross. It was wonderful. During 2002 she also made several more of the same hand-crosses, so we would have seeds to sample to others.

We entered it in the 2003 All-America Selections (AAS) trials, the only independent North American trials for newly-bred vegetables and flowers. Enough trial judges scored it highly that AAS chose it as an AAS Winner. Happy day when we heard that.

To get it on the market, we grew a lot of plants of the parents in 2003, to build up seed supply. From those seeds, we produced a commercial quantity of hybrid seeds in 2004.

Janika named it 'Carmen.' Nice name. It was announced in 2005 as a 2006 AAS Winner.

'Carmen' Sweet Specialty Pepper »



Each Carmen pepper seed requires hand crossing two parent lines



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Home > Vegetables > Peppers > Carmen



Carmen (F1) Pepper Seed

Product ID: 2993

Best-tasting sweet Italian frying pepper.

A beautiful pepper of the Italian "bull's horn" (corno di toro) type from Johnny's plant breeders Janika Eckert and Rob Johnston. Carmen has a lovely, sweet taste for salads and roasting, especially when partially or fully red-ripe. Tapered fruits avg. 6" long x 2 1/2" wide, 5 oz. (142 gm), and ripen from green to deep carmine red. Maturity is early on an upright, medium-size plant. Suitable for outdoor or indoor production. AAS winner. **Also available organic (2993G).** Avg. 3,600 seeds/oz. Packet: 25 seeds.

PRODUCT	PRICE	QTY
Packet	\$3.95	<input type="text"/>
100 Seeds	\$12.15	<input type="text"/>
250 Seeds	\$21.60	<input type="text"/>
500 Seeds	\$38.40	<input type="text"/>
1,000 Seeds	\$71.10	<input type="text"/>
5,000 Seeds	\$300.65	<input type="text"/>
25,000 Seeds	\$1,324.75	<input type="text"/>

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> **Is there money in this?**

 SHIPPING INFORMATION & NOTES

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Quick Facts

If I save seeds of Carmen, those plants will be some mixture of tall/short, early/late, few/many fruit...



But for me, maybe that is OK?



Maybe I'm OK with the variation I expect to get...

I can select the fruit from the best plants, (keeping them isolated) and save these seeds....

How about sell them?



Tiburon

(F1) Pepper Seed

Product ID: 2893

Vegetables > Peppers

Large, dark fruits.

[MORE DETAILS AND SIZES](#)

Packet - \$3.95 ▼

Quantity:

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Joe's Long Cayenne

Pepper Seed

Product ID: 2344

Vegetables > Peppers

Long, slender cayenne with medium heat.

[MORE DETAILS AND SIZES](#)

Packet - \$3.95 ▼

- Packet - \$3.95
- 250 Seeds - \$4.75
- 500 Seeds - \$5.60
- 1,000 Seeds - \$9.80
- 5,000 Seeds - \$32.40
- 25,000 Seeds - \$134.00**

[ADD TO WISH LIST](#)



Yankee Bell

Organic Pepper Seed

Product ID: 566G

Vegetables > Peppers

Open pollinated bell for Northern growers.

[MORE DETAILS AND SIZES](#)

Packet - \$4.95 ▼

Quantity:

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If the hybrid seed is produced by hand.. Physically emasculating a perfect flower,

or by planting separate male and female parent lines (spinach, asparagus)

you can save and plant the seeds and use them as you wish

Unless it is patented.... (PVP is OK)

Seeds saved from a hybrid fruit with multiple seeds, such as squash, pumpkin, tomato, or pepper, were likely produced by hand emasculation, and the next generation will be fertile.



These saved seeds will not produce a generation just like the hybrid, but they can be used in your breeding efforts to incorporate their traits



Sunpeach (F1) Tomato Seed


Product ID: 3084

Delicious, pink cherry tomato.


Sunpeach, sister variety to Sun Gold, is not as tangy and acidic as its famous orange relative, but is very sweet with excellent flavor. Deep pink, shiny, 15-20 gm., cherries are borne on long trusses. Vigorous, healthy, high-yielding plants. High resistance to leaf mold helps it stay healthy in high tunnels; also has high resistance to tomato mosaic virus. Resistant to cracking. Indeterminate. Avg. 10,000 seeds/oz. Packet: 15 seeds.


[Less ▲](#)

This hybrid squash will produce seeds, and they will produce some variety of plants you can select grow and select from.



MY GROW ZONE: 6 | SIGN IN

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 0
Cart

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MIX AND MATCH | **SUMMER SUPPLIES SALE**

Vegetables | Flowers | Perennials | Herbs | Heirloom | Fruit | Organics | Gardening Supplies | Garden Advice & How-To

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Squash, Winter, Atlas Hybrid

★★★★★ 5.0 (2) [Write a review](#)

Early, with excellent flavor and high sugar content.

Cook's Garden Favorite. A butternut with a very little bulb—and a big-time yield. Growing on hardy, full vining plants, the 5-7 lb. cream-skinned fruits with dark orange flesh stand out for easy preparation and maximum meat yield. Early maturing variety.

Item #	Order	Quantity	Price
69035A	1 Pkt. (30 seeds)	- <input type="text" value="1"/> +	\$5.95

ADD TO CART

Cucumber, squash, and pumpkin hybrids now have resistance to powdery mildew



Diva Cucumber Seed

Product ID:

Especially flavorful when harvested small.

Diva produces distinctly tender, crisp, sweet, bitter-free, and seedless cukes. Adapted to open-field production and protected cropping. Harvest at 5-7". Gynoecious and parthenocarpic. High resistance to scab; and intermediate resistance to cucumber vein yellow virus, downy mildew and powdery mildew. AAS winner. **Select 2198T (Treated) or 2198 (Untreated)**. Avg. 18,800 seeds/lb. Packet: 30 seeds.

Les

In corn biology, the ear is a grouping of female ovaries.. Each producing one egg, that if fertilized, becomes a kernel. So, here, all the female parts are in one package...





At the top of a corn plant is the tassel, where all the male parts are.. the anthers

Pollen is shed in the breeze, and spreads all over the field

Hybrid corn ??

- You should know that in a traditional corn field because the eggs in an ear are almost always fertilized by a male cell from another plant. However, because we can't identify, or define, both of the parents, these are not considered hybrid seed



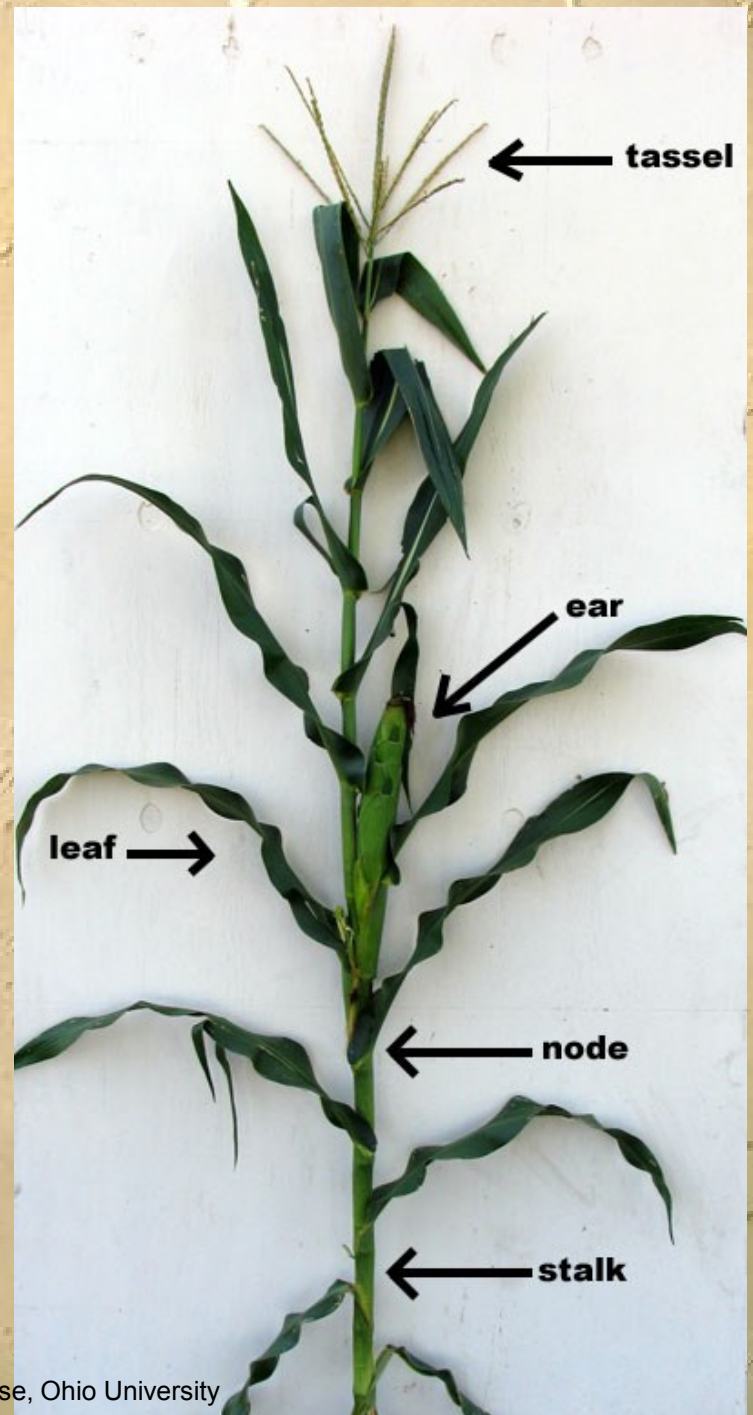
- Instead, if the breeding between parents is random, as is typical of a field of corn plants, the seed is considered “open pollinated” or sometimes “heirloom”



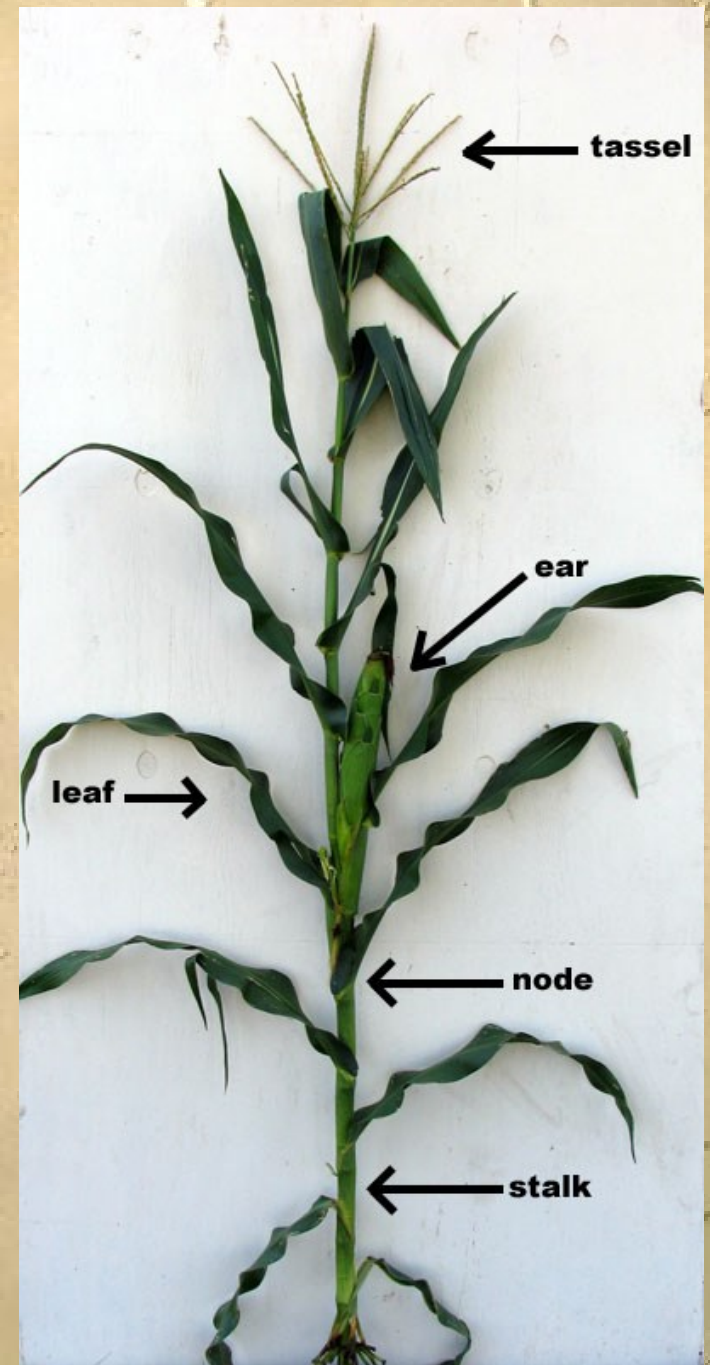
Heirloom is a term invented to describe seeds from plants, or clones of plants (like apples) that are not hybrid, and have been saved by someone, for a long time,,, generations sometimes.



- Commercial scale hybrid seed production started with corn, because in corn the tassel is the male part, while the ear produces the female parts (the ovaries, with the egg cells.)
- This is not commonly the case in plants... that the male and female reproductive organs are separated on different parts of the plants



To make hybrid corn seed, the tassel can be easily removed from a plant, leaving only the female ear... making the corn plant more like an animal system. Now one simply has to provide pollen from the intended male parent



If you plant alternating rows of parent lines, and emasculate one line at tasseling, that line becomes your female parent all seeds from that line will be hybrids



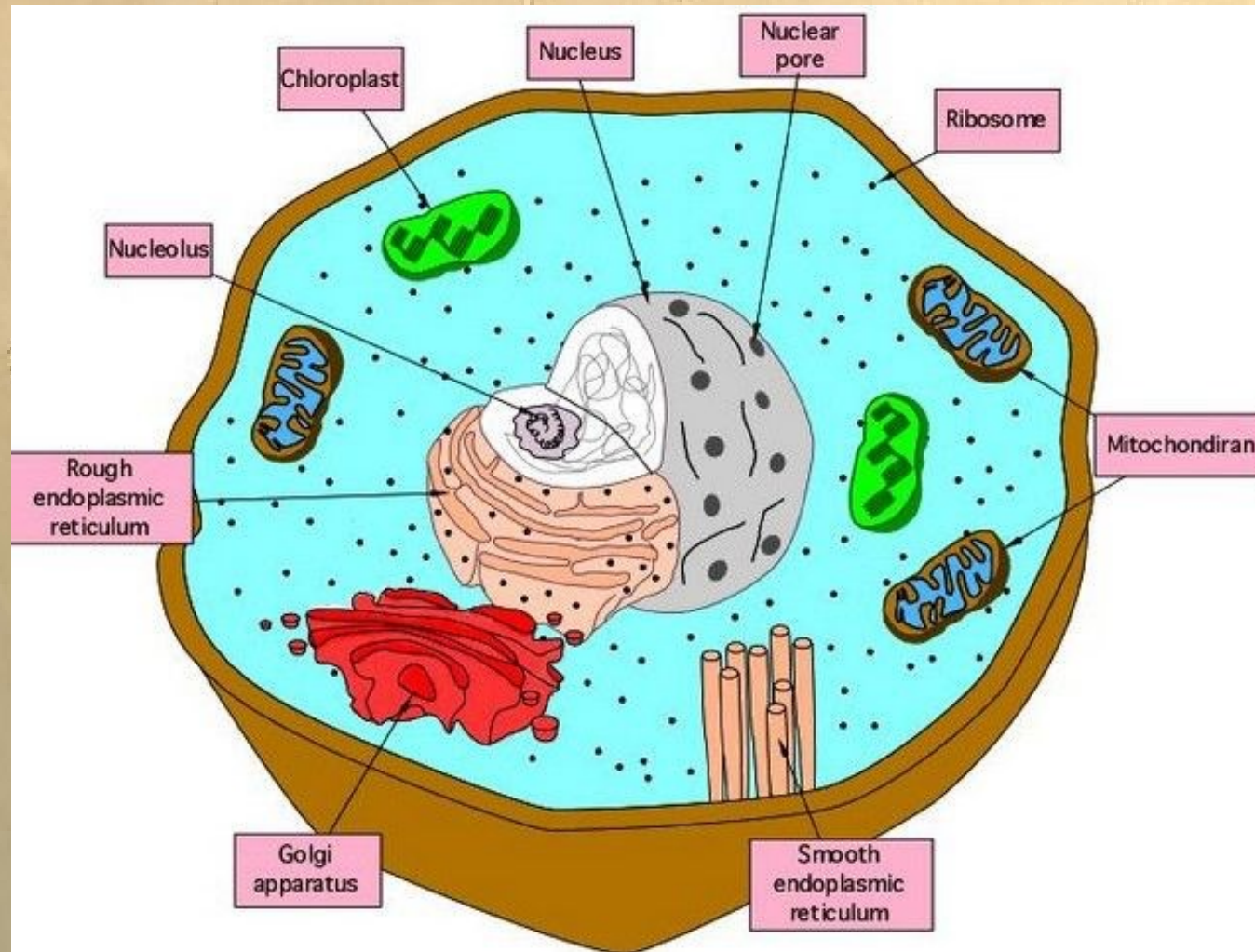
But how can one make hybrid sunflower, or radish, or beets, or carrots?

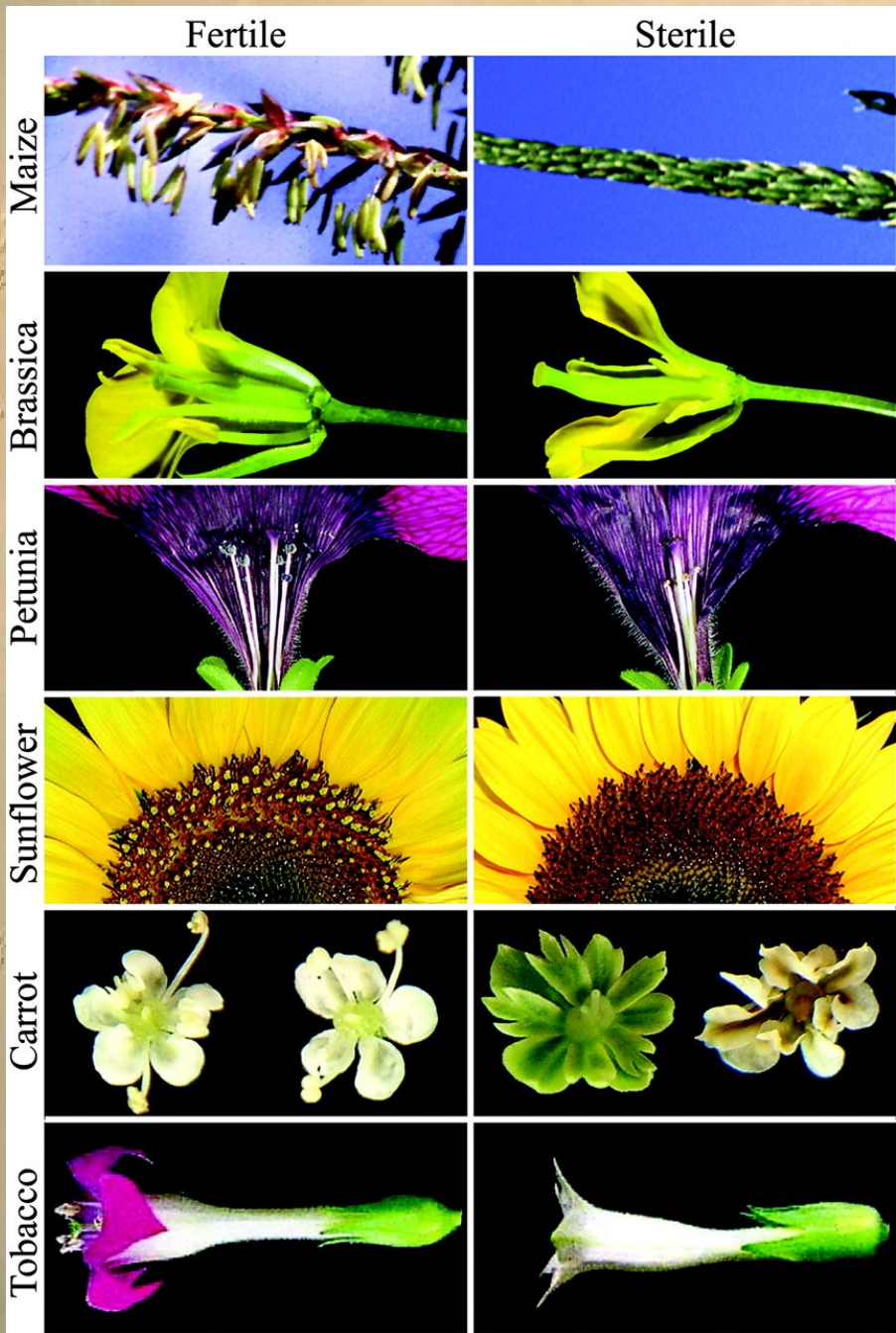




Back to corn
Instead of
removing the
tassles by hand
A variety of corn
with genetic male
sterility was
substituted as the
female parent

Important note... the male sterility trait results from a genetic defect in the mitochondria, in the cytoplasm, not the nucleus





Mitochondria are typically inherited only from the female parent

So male sterile plants always have male sterile offspring, unless a restorer gene is provided by the male parent

In plants with perfect flowers... unlike corn, breeders have been able to find genetic mutants that are sterile males but fertile females. The male sterile plants are used as the female parent and another, male fertile line, as the male.



What does this mean for seed saving
or crop improvement projects?



In plants where each flower produces only a single seed, such as onion, beets, carrots, fennel, radish, turnips, and some broccoli, cauliflower, cabbage and related, the plants from hybrid seed will not be able to produce seeds.



Why does it matter? With CMS derived hybrids, their unique and valuable traits can not be incorporated into landraces, or new, locally adapted varieties....

Sugarsnax 54

Pelleted (F1) Carrot Seed

Product ID: 2322

Long, slender roots. Conventional seed with NOP-compliant pelleting.

Dark orange, tapered roots are sweet and tender, smooth, and a uniform 9-10" long. High in beta-carotene, an antioxidant and important source of provitamin A. Strong, medium-tall tops. High resistance to *alternaria* blight. Emperor type. Avg. 29,200 seeds/lb. Packet: 250 seeds.

SIZE

PRICE

QUANTITY

AVAILABILITY

Even if you use the CMS hybrid as a female parent in a cross with another variety, the progeny will, again, be male sterile.



Candy Hybrid Onion

Grows Well Anywhere, Stores Well

★★★★★

Sorry Cannot Ship to: AE AK GA GU HI ID PR WA

Product Details

85 DAYS Versatile and great for storage, this disease resistant onion grows well in both northern and southern climates. A strong root system allows Candy to grow jumbo-colossal size bulbs that are well formed and deliciously sweet.

15300	Candy Hybrid Onion - 2 bunches per offer.
\$19.99	Out of Stock

This restriction is not a legal decision... it is biological

High Mowing Organic Seeds
www.highmowingseeds.com

Red Ace F1 Hybrid Beet



- Leading Red Globe Beet Variety
- Solid Red Interior, Uniform Round Shape
- Reliable in a wide range of conditions

Patents [explained](#) by “Johnny”

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