Experimental Demonstration Garden at Hovander Park (XDG@Hov)

Report 2024

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Workshop Date: Sept 4, 2024 10 am

Location: Experimental Demonstration Garden (XDG) at Hovander Park

Audience: Master Gardeners and Home Gardener in Whatcom County, WA

Title: "Hot Tips for Growing Watermelon in a Cold Climate"

Introduction

My name is Juliana. I graduated from WSU Extension Master Gardener Program 2023.

One of our field trips as a student was to the Mt Vernon Washington State University Northwest Washington Region and Extension Center (WSU NWREC), in which I met one of my inspirations, Dr Carol Miles, professor, and Director at MV NWREC. She has a background in international subsistence communities and brought that love and intention to the world of research in Skagit County, WA. She has published numerous foundational and groundbreaking papers in the fields of Horticulture and Agriculture. She started researching growing watermelon (WM) as a possible new market in Skagit in 2003.

My other inspiration was our very own Dave Keller, Master Gardener (graduated 2012) and Lead for Experimental Demonstration Garden (XDG) at Hovander Park, Ferndale, WA since 2014. He has demonstrated "research based" best plant practices for the home gardener, including plastic sheet mulch pros and cons, drip vs gravity irrigation, hügelkultur cold composting, keyhole gardening for water conservation in drought conditions, soil testing and amendments, mycorrhizal quantifiable studies, cover crops, cereals, "chop and drop, no-till, no bare soil, no compaction of soil, drip irrigation" ethics.

The Mission statement of a WSU trained Master Gardener is to educate the public in research based best practices in the "9 Pillars" for home gardening, which are water conservation, soil health, pollinators, local food, plant biodiversity, nearby nature, wildfire preparedness, climate change and clean water.

Our specific mission in the XDG, is to bridge the gap between field-based research and the home gardener by demonstrating "best practices". We annually feature different problem-solving methods for cost-effective and environmentally sound plant production in Whatcom County. In this way, we differ from other demonstration gardens that specialize in a single plant year after year.

For my part, I was drawn to XDG w my background in medical sciences and research as a post-doctoral fellow. Admittedly, I knew nothing about growing watermelons, but I did understand research. Surprisingly, given my dearth of plant expertise, I found myself the 2024 Lead for the XDG. In my optimistic naivete, I chose the crop seedless watermelon to demonstrate a multitude of

best gardening practices. With the expert mentoring of Dr C Miles and Dave Keller I was optimistic and properly supported for the challenge.

Our motto in the XDG is, “There are no bad choices only better ones”.

Seedless Watermelon – what are they and why do we grow them?

What is it? “Citrullus lanatus”

Seedless watermelon are NOT GMO (genetically modified), rather they are a sterile hybrid created by crossing fertile male pollen from a WM w 22 chromosomes (normal diploid) w a female WM flower containing 44 chromosomes utilizing a chemical process using colchicine in the lab. This results in a watermelon that has 33 chromosomes (triploid/3N) and is sterile. A triploid has an ovary so it can produce a melon/fruit but it does not have seeds and its flower pollen is sterile. In fact, the white “seeds” that you find in seedless watermelon are seed coats of aborted seeds.

Regular WM (having normal diploid number of chromosomes) have been identified in the Americas from the 1600’s and were said to originate in Egypt from artifacts found in tombs from thousands of years ago. The first seedless watermelon was developed in 1939 in Japan. We find other Triploids in nature (occurring naturally). In fact, an article on polyploidy reports 47-70% of flowering plants are of polyploid origin (“Understanding polyploidy” httsp://mcilab.ces.ncsu.edu). In general, Triploids are known for being hardier and disease resistant. Their sterility is ecologically and commercially useful. A specific example is utilizing biological control of hydrilla and other noxious aquatic plants w triploid grass carp. (“Grass Carp: A Fish for Biological Management of Hydrilla and Other Aquatic Weeds in Florida” Pinellas.wateratlas.usf.edu). We find commercial use of triploids in bivalves, salmon, rainbow and brown trout, wheat, potatoes, coffee, peanuts, strawberries, bananas, grapes and cucumbers. And, seedless watermelon.

Here in the PNW we find commercially grown WM in the Columbia River Basin OR and Eastern WA. Some locally grown WM from small farms is intermittently found in Whatcom and Skagit Co Farmers Markets.

Seedless WM Pros:

a. Seedless WM are now more popular w consumers than seeded watermelon in US w National WM Promotion Board stated that only 16% of WM sold in 2010 was seeded.

b. Triploids can grow 4-25#; have a firm rind for storage; come in a variety of flesh colors, flavors, textures and sweetness.

c. The “mini melon” of 4-6# has shorter Days To Harvest (DTH) and as a result are more ideal for western WA’s shorter growing season; Also mini melons are more easily stored in refrigerators.

d. US is 4th in world in WM production. Florida, Georgia and Texas have the most production.

e. In 2002 WSU MV NWREC started growing watermelons and performing field trials. I was able to communicate w the director onsite and via email.

f. There is a lot of research on seedless WM in US and in Eastern and Western WA

Seedless WM Cons:

f. Triploids are seed germinated in greenhouse and are not successfully "broadcast" in the field. In Eastern Oregon WM are directly seeded into fields by hand and in Western OR/WA they are transplanted from the greenhouse.

g. Germination rates are 80% commercially.

h. Require tight greenhouse controls to germinate and grow to transplant size (2-6 weeks)

i. A typical seedless WM seed costs 20-30 cents.

j. This results in higher production costs being passed on to the consumer. Currently, a nation wide grocery chain sells seedless mini watermelon $6 each, organic seedless mini watermelons $16 each and regular mini watermelons $4 each.

Primary Objectives of Growing Seedless WM in XDG@Hov 2024

a. Measure yield and size of a variety of Diploid and Triploid WM plants grown

b. Investigate potential for growing Seedless WM in Whatcom Co.

c. Educate the home gardener in Whatcom County in growing seedless watermelons and best practices.

d. Evaluate Home Gardener interest in growing WM in their gardens

e. Provide information to inform 2025 XDG focus

Phase 1 – Seed Selection and Greenhouse Germination

1. Winter planning 2023-2024

    a. Identify educational modes for master gardeners and home gardener: Install permanent and 2024 garden signs; Update XDG@Hov sections in WSU Extension Master Gardener and Whatcom Co Master Gardener Foundation websites; Initiate Facebook Blog on Whatcom County Master Gardeners Only; Plan end of year report for Master Gardeners and workshop for public.

    b. Order, organize and gather greenhouse and field supplies

    0 Greenhouse supplies: clean and sharpen tools, 4 inch cells, trays and covers, sterile potting soil (1/3 peat/coir, 1/3 organic mulch, 1/3 vermiculite), fans, greenhouse or cloche, thermometers, hygrometers,

1 Field supplies: drip irrigation components, plastic sheet mulch, hoops and floating row covers, cloches, plant tags, Nitrogen (fish fertilizer and alfalfa) pellets/meal); Calcium Nitrate

c. Garden structures: raised beds, hills hummock, vertical gardening w farm panels trellis, collapsible 25 gallon cloth pots

d. Seed Selection and ordering - Consider DTH (70) and Growing Zone (8a); package may say 80 DTH but actual may be longer w colder temps in early spring and late summer slowing growth in PNW.

Goal for XDG@Hov: greenhouse seed planting mid-April and transplant mid-May, no later than June 1.

i. Triploid WM

1. Ocelot F1, Triploid hybrid, treated, plant variety protected, 70 days, 3-5#, Tiger Stripe (wide lite stripe w a narrow dark stripe), "This mini tiger striped WM is high quality w high sugar content. Has a nice crips texture w an extremely sweet flavor. Flesh color is a beautiful intense deep red color. Early maturing makes for a good start to your season." Osborne, Mt Vernon, WA

2. Serval F1, hybrid untreated, 70 days, 4-6#, Crimson Sweet (narrow lite stripe w a wide dark stripe), "Another personal size WM from the producers of Ocelot. Serval is sweet w fantastic internal color and texture, Excellent uniformity and good shelf life." Osborne Mt Vernon, WA

ii. Pollinator WM

1. Ace Plus F1, untreated hybrid Charleston Grey (light green background w grey/green mottling), (Resistance IR: Co1, Fon 1); "Ace Plus is an exceedingly early flowering pollinizer planted to support the first flowers of Triploid hybrids. Continuous flowering supports a long pollination period, small explosive fruits w light green Charleston rind pattern have a red interior. For pollination only." Osborne, Mt Vernon, WA

2. Wild Card Plus F1, untreated hybrid, Tiger Stripe, (Resistance IR: Co1, Fon 1), "Wild Card Plus has an early and extended flowering period ensuring early pollen availability when yr triploids start flowering. Long thin internodes radically extend pollen to female flower locations. Small, explosive frit allow for early harvest. Tiger-striped rind w yellow interior. For pollination only, not a harvestable crop." Osborne, Mt Vernon, WA

3. Jet Ski - PWM

4. Amarillo - PWM

iii. Regular WM – "off the rack", readily available to consumers/home gardeners but usually lower quality seeds

1. Blacktail Mountain – " one of the earliest WM we know; superb for the North, but it also grows well in heat and drought. The flesh is red and deliciously sweet. Fruit has a dark rind and weighs 8-12# each. 70 DTH. Ideal temps: 70-95dg." Baker Creek Heirloom Seeds

iv. Sugar baby – Baker Creek Heirloom Seeds *(Ours died in greenhouse and did not make it to the field.)*

v. Pollinator Flower seed mix – found in local stores

vi. Winter cover crop seeds – found in local stores

vii. In-between rows "cover crop" seeds – found in local stores

b. Soil composition for WM – sandy loamy soil that is well draining; high in organic matter; pH 6.0-6.8; *In April, we amended the soil w "Garden Soil Mix" from Green Earth Technologies*.

c. Hügelkultur – Established 2022 for purpose of

i. Provides location to cold compost plant debris from garden

ii. Provides soil source for XDG,

iii. Location of pollinator garden to attract pollinator animals and provide habitat

d. Space planning

i. WM generally require 20 sq ft/plant or one plant per 2 square feet

ii. Space plant Q3 ft

iii. 6 ft spacing between rows

iv. XDG@Hov rows were 20 ft long and 6 ft wide on-center

e. Triploid/seedless to Pollinator Ratios:

i. 3 triploids:1 Diploid/PWM or alternate rows

ii. We planted 3 rows alternating one triploid w one PWM; 4th row was entirely Blacktail WM, a regular WM; Total: 24 plants of 9 Triploids, 9 Pollinator WM and 6 Regular Diploid WM

f. In between Crop "cover crop"

i. Pros: keep weeds down; discourages compacted soil from walking on soil; can attract pollinators to yr WM crop; chop and drop – good for soil architecture and provides nitrogen as cover crop plants decompose.

ii. Cons: choose cover crop that does not out compete yr crop for the sun, space, nutrition and pollinator attention.

iii. *Nasturtium and daikon radish seeds grew; However, our alyssum, crimson clover seeds did not germinate; red shank and phacelia reseeded from past years competing w WM; Frequent thinning, "chop and drop" occurred throughout July and August*.

g. Pollinator animal attraction to yr garden

i. We used our hügelkultur mound for pollinator flowers and attracting bees, butterflies and birds; we maintained a "bee fountain" which had its own drip irrigation and timer.

ii. XDG@Hov is located between the Dahlia, Vegetable, and Pollinator Gardens. There is a field bordering the northern aspect.

iii. *We Installed a mason bee box but did not obtain any pupae. Next year, we are considering using improved materials, including mason bee tubes and house w early bloomer plants, e.g. willow and dandelions*.

2. Greenhouse Germination of WM Seeds

a. Materials

i. Greenhouse to control air and soil temperature, humidity, and light:

1. LEDS, fans, heating mats, 4-inch cells w draining trays and lids, watering can, thermometer and humidity tester, timers, plant tags/labels

ii. Sterile Potting soil: 1/3 peat/coir, 1/3 vermiculite, 1/3 organic mulch.

iii. *We used a variety of diverse types of greenhouses, including outdoor permanent, indoor mini greenhouses, trays with covers, and cloches.*

b. Dates of planting seeds:

i. Plan for seed planting in a greenhouse based on transplant date, DTH and weather considerations. The last day of frost in Bellingham, WA calculated by Farmers Almanac is Average April 8. Transplanting is dependent on soil temps >70dg and age of WM seedlings. Seedlings should be no older than 4-6

weeks and should have ~2-4 leaves beyond cotylons for best transplanting success.

*XDG@Hov planted seeds **April 15** for planned transplanting **mid-May, no later than June 1***.

c. Special Care of Triploid seeds and best germination practices:

   i. Buy seeds from reputable sources. Triploid seeds are recommended to b treated w a fungicide at the factory. Diploid seeds should b tested for bacterial disease.

   ii. Triploid seedless WM requires Pollinator WM which are hybridized to flower b4 triploids.

   iii. Prep cells and potting soil b4 seeding by thoroughly wetting potting soil and heating to 90-95dg F 1-3 days b4 planting seeds.

   iv. Plant seeds, one per 4-inch cell when soil, air, humidity measures are met.

   v. *I used 3 trays holding 18x4 inch cells: each tray holding a different variety. 18 Triploids, 18 Pollinator WM and 18 Diploids*.

   vi. Reduce soil temps to 80-90 dg once seeds have germinated.

   vii. Keep soil temps above 80-95dg during period of seed germination through transplant; recommended humidity 90%.

   viii. Water enough to keep soil moist but do not water excessively (must pass squeeze test);

   ix. Fans are necessary to prevent "dampening off" and to create a sturdy seedling for transplant. Keep fans on 24/7.

   x. Keep greenhouse sealed for consistent air temps and humidity

   xi. Seeds should germinate w/in 3-5 days; Triploid have "poor" germination rates commercially at ~ 80%

      1. *Our seed germination team had over 95% germination rates in each of our 3 Master Gardener personal greenhouses*.

   xii. Consider fertilizing at 3-4 weeks

      1. A weekly application of a weak solution of Osmocote Plus is recommended by WSU Mt Vernon NWREC.

   xiii. Potential Greenhouse issues:

1. Potting soil: *A possible vector for pathogens in the potting soil is that the MG source for peat is not sterile and stored peat bales were flooded repeatedly*.
2. Treated triploid seed shells are quite hard. Some folx recommending "nicking" the rounded edge to facilitate germination. Also, the hard seed shell sticks to the cotylons sometimes and that may damage the plant; monitor but do not automatically remove seed shell unless absolutely necessary.
3. "Dampening off" common and fatal; mold, fungal and bacterial sources from infected tools and garden soil (reminder: use only sterile potting soil mixes); thrives in cold wet mediums; window is usually short; appearance of seedlings w thin white stem near soil line which usually fall over and die. *Yes, I killed 50% of my seedings (and all the Sugar Babies) from dampening off in my greenhouse. It was a brand-new greenhouse, and the cells and seed trays were treated w 10% bleach prior to use. I was suspicious of overwatering and of nonsterile peat*
4. Transplant timing – OK to transplant if 2-3 leaves are present on seedlings beyond the cotylons; if plants get too old >5-6 weeks old, they are less vigorous and have lower yield; *Our plants were flowering and vining in the greenhouse and right on that age cusp; However out of 24 total transplants we got over 90 melons (normal ratio is 2-3/plant), so melon production was not affected by our "older transplants"*

Phase 2 – Garden Prep Schedule b4 transplant:

a. Previous **Fall 2023**:

   a. **Sept 2023** *XDG activities: Chop and drop of previous crop of melons and squash and in-between row cover crop*. "Chop and drop, no-till, no bare soil and no soil compaction" techniques aid in providing a source of nitrogen as plants decompose and preserve soil structure. These best practices positively affects soil aeration, permeability and water holding capacity. Cover crops facilitate carbon sequestration.

      Our *Pollinator Garden was left to overwinter and to continue to provide habitat for animals. After chopping and dropping last years crop, we sowed crimson clover as a winter cover crop, however it did not germinate. Organic material was added to Hügelkultur and field. This*

was obtained from other Hovander Demonstration gardens "end of the year" plant debris.

b. **Spring 2024**:

a. **March 2024** - *Soil test came back high in organic matter and nutrient mineral; the only recommendation was nitrogen*.

b. **April 2024**

Added "garden soil mix" from Green Earth Technology which was a mix of sand and organic matter. I called to make sure it had the correct pH of 6.0-6.8.

Formed rows and hillocks; 4x 20 ft rows w 5-6 ft between centers of each row.

Added nitrogen fertilizer in the form of alfalfa meal to tops of each row and worked it in

Installed drip irrigation with manifold, timer, pressure regulator, filter. We ran 4 dedicated lines w separate timers for WM, Hügelkultur/Pollinator Garden, perimeter pots and bee/bird fountain. Drip irrigation was monitored/adjusted on a biweekly basis throughout the growing season. The irrigation timer was adjusted from QD x 5 min to Q6hrs x 15 min based on weather and hygrometer readings.

<u>Special Note</u>: While our drip irrigation was installed and running in April, Hovander Park installed irrigation main pipes for all the demonstration gardens in May. Our Drip Irrigation was disrupted for one week d/t construction. Then, later, a main line pipe burst going to our dedicated spigot, again weakening our early transplants.

In July and August vandals repeatedly turned off our drip irrigation spigot and timers. Signs and painters' tape were ineffective deterrents..

Various plastic sheet mulches were re-used from previous years in our XDG, including black, green, brown and silver/reflective. This was their third year in the garden. The black and silver appeared to work best for us regarding increasing soil temps and keeping weeds down. We found the black and silver plastic sheet mulch increased soil temperatures up to 5 dg. The silver sheet mulch was used on the outside row nearest the field to further deter insects and small creatures. The brown sheet mulch row had quite a bit of weed growth under it which was d/t too loose on soil and sunlight permeation.

We addressed space saving techniques by setting up Vertical Structures (3x6 ft farm panels as trellises) and perimeter cloth pots (25 gallons).

A 3 ft barked garden perimeter was added after first laying down brown paper mulch to prevent weeds and improve garden access/borders.

XDG sowed cover crop seeds between each crop row. We broadcasted daikon radishes, alyssum, nasturtiums. Redshank and phacelia reseeded itself from prior year.

2 bags of generic Pollinator flower seed mixes were sowed to attract pollinator animals and later supplemented w a variety of other seeds. Phacelia and buckwheat germinated from last years plants. A mason bee house was installed in the pollinator garden.

Harden off greenhouse plants for several days b4 transplanting seedlings into garden. Return to greenhouse at night until transplanted in field.

3. *Ordered from Master Gardener Foundation permanent and 2024 signs, which included information for the public on Drip Irrigation, Bee/Bird Fountain, Hügelkulturs, Regular Watermelons, and Seedless Watermelon.*

Phase 3 – Transplanting and melon growth support

1. Transplant

   a. Determine dates of transplant keeping in mind DTH and after last frost; XDG***@Hov transplanting dates: May 22 & May 29, 2024***

   b. Only after seedlings have 2-4 leaves beyond cotylons.

   c. Requires soil temps above 65 dg and is usually 75-80 dg in southern states

   d. Use black plastic sheet mulch to raise soil temps.

   e. Use good technique w roots and avoid damaging vines

   f. Transplant 3-5 feet apart

   g. Alternate 3N plants w PWM; or other Diploid; In-row: 3:1 ration; or alternate rows of 3N and Diploids/PWM.

   h. Water transplants immediately

   i. Tag clearly each variety of Triploid WM and PWM; *We discovered that the WM vines interwove w other varieties and across rows. We were not able to identify melon varieties by rind coloration only.*

j. Hoops and floating row covers/cloches to protect vulnerable transplants from frost or pests; remove row covers/cloches when female Triploid flowers begin to open for bee access.

2. Melon Growth Support

a. Monitor drip irrigation weekly or as indicated.

i. Watermelon is 90% water. Critical watering event horizons are:

1. Immediately after seeding and transplanting for first 2 weeks.
2. When vines begin to bloom.
3. Consistent and adequate watering helps w sweetness
4. Reduce watering the week b4 harvest.
5. Rate recommended: 1–2-inch depth, 2x/week (2003 Research Study Report; Icebox Watermelons: New Crop for New Markets, Dr Carol Miles).
6. Water slowly, deeply and consistently. Foliage and roots need time to dry out so best times to irrigate are between 4-6am. Irrigate when top ½-1 inch of soil is dry to touch, ("Watering the Vegetable Garden", gardeningsolutions.ifas.ufl.edu)

We had vandals turn off our spigot, timers and disconnect hose at manifold; They also stepped on/bent ½ inch drip irrigation tubes which plugged and collapsed them.

In the early cold and stormy summer, we started w timers at 10 min q 12 hrs. As temps rose to above 80dg we increased watering to Q 6hrs and 15 min; Later, when we encountered an August return of the colder wetter "La Nina", we turned the water volume down again.

ii. Heat and water bring out watermelon sweetness.

iii. Back off water volume week b4 harvest. Too much water in the final stages of ripening will cause melons to split wch can b a source for pathogens to move in.

iv. WM do not like their leaves to get wet wch increases susceptibility to disease, hence drip irrigation is valued over overhead irrigation.

b. Fertilizing or Nutrient management

i. Note: if the soil test is normal, the only supplement needed for watermelon is nitrogen1-2x/month and later Calcium/Potassium Nitrate for melon development.

ii. Apply Fish fertilizer Q2 weeks to support vegetation and flowers; application as side dressing w immediate and thorough watering.

iii. To support later melon growth, apply Calcium Nitrate, 1-2 tsp side dressing f/b thorough watering; distribute it 1-2 inches away from stems to prevent burn; Used in late melon growth stages to maintain fruit fill and sugar content and to avoid blossom end rot and skin blemishes; Back off all other sources of Nitrogen to keep energy in melon growth

c. Pollination of Female Triploid flowers

i. Male flowers from fertile pollinator watermelons are cultivated to blossom early, before Female Triploids bloom. (reminder **male seedless WM flowers** have **sterile pollen**) Choose PWM that are specifically hybridized for this purpose. They will flower early and frequently. Regular diploid WM are sometimes sufficient and more cost effective.

ii. Since Pollen in Seedless WM male flowers are sterile, bees foraging in a seedless WM garden will b carrying non-viable pollen unless there are viable male pollinator or diploid flowers nearby. This is why we plant 3 Triploid(sterile) plants to 1 Diploid(fertile) in each row. Furthermore, bees tend to fly up and down a row and are less likely to cross over to different rows.

iii. A Diploid WM female flower will require an average of 8 visits by a bee to fertilize. A Triploid WM female flower will require 16-24 visits to set fruit.

iv. Bee Boxes, if used should be placed before 10% of plants are blooming. This ensures a good crown set wch is WM fruit that is growing on one of the first 8 nodes on a WM vine. A good crown set creates the greatest commercial yield, the earliest ripening WM, and reduces hollow heart.

v. Bees are less active in winds that are 15 mph or greater, cloudy skies, and temperatures less than 55 dg. As a result, during cold mornings bees stay close to their hives. What little pollination that does occur to WM crops on these cold mornings can be seen in greater yields in plants closest to bee hives and fewer yields further away from hives.

vi. Bumblebees are sturdier and able to work longer in colder, wetter, windier conditions than bees. They are up to 10 times more efficient as a pollinator. They prefer a shaded hive and are well placed in hedges and/or in the middle of a field w a shade canopy. They will also get distracted by any flower and not spend as much time on WM plants if WM are further than any other flower from their hive.

vii. Quick Field test for adequate pollinators in yr garden:

1. Perform on a sunny windless day between 9-12 Noon.

2. Stand 3 ft from a WM row (to avoid disturbing bee flight path since they fly up and down rows and not side to side as much)
3. Count number of bees in 60 sec.
4. Adequate number of bees is 1-3 bees/10 ft in 60sec
5. It is recommended to take an average of counts over several days and in several parts of yr garden. (Modified from Xerces Society)

viii. **A special reminder to consider for success**: **Female WM flowers open early in the morning and are most receptive before 10 am, then close in the afternoon.** (udel.edu)

ix. Plant a variety of pollinator attractor plants, to attract bees, wasps, flies, and birds to the garden.

1. *XDG@Hov planted a pollinator flower garden on the Hügelkultur, using "Pollinator seed garden mix" x2 bags, last years phacelia and buckwheat.*
2. *We installed a bee/bird fountain and put it on a drip timer*
3. *We added nasturtiums, alyssum and flowering "cover crop" in between crop rows*
4. *We added 9 perimeter cloth pots w various flowers including asters, marigolds, echinacea and tomatillos*
5. *Our WM Garden was located between the Pollinator Vegetable and Dahlia Gardens @ Hovander, with an open field bordering the North.*

d. Methods of growing WM, other than field rows

Vertical trellis – We used 2 3x6 ft farm panels and secured 6 WM vines to the panels. Later, we added slings to the hanging melons. We unfortunately underestimated the space required and overcrowded the hanging fruit, wch decreased vine vigor and harvestable melons.

Cloth Pots – We had 9 x 25-gallon cloth pots surrounding the perimeter of the garden originally for the purpose of growing a few WM in them. However, I did not find an "edu" source for container gardening of WM. Also, their extensive and shallow root characteristics, I thot were not ideal for containers: taproot (12 inches) and many lateral roots (2-3 feet in length). Therefore, I didn't try it. Nevertheless, there references on google searches. Many folx grow personal size WM successfully in containers that are >10 gal, have plenty of drainage holes, sandy soil, trellised and pruned.

e. Integrated Pest Management (IPM)

Definition of Integrated Pest Management (IPM) – multifaceted; incorporating several different strategies and the judicious use of pesticides for management of disease and other pests. Better and more economical control is usually achieved when IPM is practiced, compared to reliance on a single management practice such as pesticide applications. Strategies include crop rotation, site selection, sanitation, disease resistant varieties, grafting, pathogen-free seed and transplants, irrigation chemical control and scouting. ("Watermelon Diseases", extension.okstate.edu)

i. Common WM Pests – cucumber beetle, aphids, deer, coyotes, raccoons, mice, crows

We did not encounter these pests in our garden, except perhaps a few slugs drilled a hole in a few of our WM.

ii. Watermelon Diseases – fungal and bacterial, anthracnose, gummy stem blight, mildews.

1. Integrated Pest Management (IPM) – multifaceted; incorporating several different strategies and the judicious use of pesticides for management of disease and other pests. Better and more economical control is usually achieved when IPM is practiced, compared to reliance on a single management practice such as pesticide applications. Strategies include crop rotation, site selection, sanitation, disease resistant varieties, grafting, pathogen-free seed and transplants, irrigation chemical control and scouting. ("Watermelon Diseases", extension.okstate.edu)

a. *Fusarium/Verticillium Wilt* (Fusarium oxysporum f. sp. niveum/Verticillium dahliae) is a soil borne fungus that forms resistant survival structures that persist in soil for many years (up to 15 years). The highest number of fungal inoculum/pathogens are found in sandy, acidic soils at 75-80 dg F temperatures w high humidity. Plants worsen during fruit set or 4-6 weeks after fruit set. The infection turns foliage dull gray/green. Affected vines wilt, turn brown and may die. Triploids are especially susceptible. Mitigation occurs by purchasing fumigated seeds from a reputable source. Crop rotation out of the cucurbits for 5-7yrs is recommended. Also grafting WM onto squash root stock has been shown to b effective ("Grafting watermelon prevents disease, WSU study shows", https://news. wsu.edu/news/2020). *Our triploid seeds were treated w fumigants and purchased from Osborne Seed Company, Mt Vernon.*

b. *Bacterial Watermelon Blotch (Acidovaorax avenae sugsp.citrulli)* is a serious disease that can significantly affect crop yields by affecting the melon more than the foliage. Reported yield loss of up to 50%. ("Watermelon Diseases", extension.okstate.edu); "The normal cycle begins w an infected seed,..." (extension.missouri.edu), first seen as water-soaked areas a few mm in diameter on cotyledon leaves. This infection is exacerbated by temperatures over 90dg, high humidity and overhead watering. Triploids are less susceptible than diploids. It is usually first observed as an "oily" water-soaked area/blotch w a yellow halo on the melon. The blotch can dry up and become black. Mitigation occurs by purchasing seeds from labs that test their seeds for Blotch, proper watering techniques in greenhouse and field, and crop rotation.

1. Resources available to the home gardener for plant diagnosis include:

a. WSU Extension Diagnostic Plant Clinic, 600 Dupont Str, Ste A, Bellingham, WA 98226. 360.778.5808. mg.whatcom@wsu.edu

b. WSU Department of Plant Pathology, Plant Pest Diagnostic Clinic. For more information contact: plant.clinic@wsu.edu

c. NOTE: Soil testing companies that are available to home gardeners do not test for pathogens.

2. *Presence of disease in XDG WM:*

Fungus: We encountered (best guess) a fungal wilt in late July/August, after our prolonged drip irrigation issues, observed as an infection spreading from roots/crown spread outward down the vine.

Bacteria: Another MG suggested the presence of a secondary infection from a bacterium in late August, observed as an infection spreading from periphery and moving in towards the crown.

The outside row of diploidy Blacktail appeared affected initially. The disease spread row-by-row thru August until most of our plants were affected.

3. Mitigation

The fungal and bacterial infection was treated by pruning and/or removing whole diseased plants and disposing of the infected plant debris in garbage to inhibit spread of disease (do not compost; its not a guarantee of eradication). Application of fertilizer boosted plant health. Monitoring and management were ongoing.

For the fungal disease, we plan to incorporate crop rotation away from cucurbits next year.

For bacterial diseases, we plan to more closely scrutinize the seed companies that we buy from to see if they inspect for bacteria in their seeds.

Crop Rotation is by far the best and most economical IPM. However proposed rotations of 5-7 years may not b long enough to effectively eradicate fungal spores/pathogens wch have been known to live >15 years.

Cultivar resistance is another technique of IPM, but the fungal pathogen has many variants; Triploid seeds can b treated w a fungicidal coating at factory b4 being sold. *Our Triploid seeds were treated for Fungus, but not the regular Diploids or Pollinator WM seeds.*

Soil solarization management significantly delays the onset of fusarium infection and wilt symptoms. Does not provide complete control or eradication. It requires extended periods of uninterrupted hot sunny weather and clear plastic sheets to achieve lethal soil temperature (>140dgx 6-8 weeks). *It is not considered effective in Whatcom Co.*

Grafting onto squash rootstock is another technique that has resulted in a reduction of Fusarium by 88% in SE regions of US (Keinarth and Hassell 2014) and here in PNW.("Vegetable Grafting Watermelon Fact Sheet", (s3wp.wsu.edu), Dr Carol Miles, WSU Mt Vernon NWREC)

"Fruit pruning in WM should begin as soon as defective melons are noted. Remove misshapen and blossom-end rot affected fruit to promote additional fruit set and larger growth of remaining melons. If a market demands larger melons, remove all but two or three well-shaped melons from each plant. To avoid disease spread, do not prune melons when vines are wet." (Watermelon Production, 2.2027, ID: HLA-6236, extension.okstate.edu)

IPM for fungal/bacterial/viral diseases start w prevention wch includes,

a. Good greenhouse and tool sterilization techniques.
b. Start w sterile potting soil.
c. Using fungicidally treated and bacterium inspected seeds.
d. Utilizing sandy, well drained fertile soils w proper fertilization.
e. Avoid watering late in the evening and reduce extended periods of leaf wetness.
f. Scouting on a regular basis and attending to adverse findings immediately,
g. Identify proper disposal technique for disease.
h. Follow crop rotation protocol

i. Misshapen fruit and/or Hollow Heart – caused by inadequate pollination; *XDG observed 2 misshapen fruit and no hollow heart (out of 90 melons)*

ii. NOTE: use of pesticides, fungicides and other chemicals decrease pollinator populations and activity.

iii. Soil Contaminants from **Flooding** - *Hovander Park is annually flooded from the Nooksack overflowing. The XDG soil has never been tested for toxicity*. Soil tests are available to home gardeners tests for micronutrients and organic matter and (some) heavy metals. It does NOT determine fungal/viral/bacterial inoculants. Flood contaminants may include chemicals (salt, lead, heavy metals, pesticides) and biologicals (salmonella, E. coli, hepatitis A, norovirus, Listeria and Cryptosporidium.) ("Soil Contaminants from Flooding", content.ces.nscu.edu).

iv. Soil Contaminants from **Wildfires**: contaminants from wildfires can enter the soil from runoff and/or particulate matter in the air. Of concern is higher levels of mercury, copper, lead and zinc (Soil Contaminants from Wildfires, ncb.,nim.nih.gov), as well as chromium 6, wch is cancer-causing and readily airborne. Dangerous air pollutants include gases, organic aerosols and fine particulate matter. Chemical contamination of soil from run-off and smoke can cause serious health risks and decrease pollinator populations and effectiveness. (news.stanford.edu); *This year and for a few years past Whatcom*

County has periodically had "unhealthy" levels of air quality d/t smoke from wildfires. (see Appendix 1)

Phase 4 – Harvest

1. *XDG@Hov hoped to begin harvesting Aug 7 based on our 70 DTH from transplant date May 22(29). Harvest was delayed by only 2 weeks from:*
    a. *irrigation interruption and inconsistency*
    b. *cold stormy early spring and a brief return of "La Nina" mid-August*
    c. *presence and spread of disease from weakened plants*.
2. Ripe melons can occur as early as 5-6 weeks after pollination.
3. Melons should b cut from the vine, not torn, twisted or pulled to reduce chances of stem damage and decay. Healthy vines may continue to fruit set as melons are harvested off the vine.
4. Each plant can expect to produce 2-3 ripe melons.
5. Harvest melon when proximal tendril is completely brown (Edu); other methods are just confirmation; if using the knock test, it is most reliable in early morning (ipm.ucanr.edu); Check for a yellow patch on bottom (not white);
6. Harvest WM as soon as observed to b ripe; they do not benefit from staying on the vine once ripe and do not further ripen once harvested.
8. Store uncut WM 7-10 days at room temp and 2-3 weeks in refrigerator; does not last long; Do not freeze as flesh becomes mealy/mushy and rind softens.
9. Do not leave ripe WM on vine as this will cause excessive vine load, melon split and/or decay; vines may continue to fruit set as melons are harvested off vine.
10. *Note: we had 5 other master gardeners that grew our WM transplants in their personal gardens. They reported healthy but less vigorous vines and a total of only one harvestable WM. This may b d/t differences in location of the garden, soil condition, irrigation and fertilization*.
11. *Harvest to date from 24 WM plants XDG@Hov:*

    a***. Aug 14*** *Over 80 melons in various stages of maturity w continuing blooms*.

    b. ***Aug 21*** *3 ripe Seedless WM harvested, and taste tested (excellent);*

    c. ***Sept 4*** *– Total: 10 ripe seeded and seedless WM harvested*.

    d. *Note: Exact data of each variety was not obtained b4 printing. This was partly d/t the low total yield d/t disease and irrigation issues and partly d/t difficulty identifying variety w/o cutting open melon*.

Weather

WM requires warm and consistent temperatures throughout their growing season, over 80dg to maximize yield. In Western WA, smaller "mini melons" do well in our cooler temperatures, but have difficulty w the length of time it takes to warm the spring soil to 70dg, as well as, the shorter DTH from cooler late summer temperatures.

XDG@Hov encountered a cold and wet May w many windy storms rolling in keeping soil temps low and bees slow.

The July/August heat wave saw our best growth in our WM.

Mid-August we had a few days of poor air quality from wildfire smoke wch may have affected bee flights and energy to pollinate.

Late August return of LaNina dropped temperatures into lows of 40s w highs barely topping 70 for weeks.

See Appendix I Weather graphs for Bellingham, WA 2024

Results and Discussion

*Overall, we were able to **succeed** through several critical phases of seedless watermelons. These include:*

Our soil health was a great start for success, using composted soil from our hügelkultur and "no till, chop and drop, no bare soil and no soil compaction" best practices. Our excellent soil health for pH, micronutrients and organic matter was confirmed by a soil test.

We utilized 3 (personal) greenhouses for seed germination supervised by our Master Gardener Team.

Our seed germination rates (95%) were significantly higher than industry standards (80%)

All 24 Seedlings survived transplantation in the field.

Plastic sheet mulch increased our soil temperatures so we were able to transplant w/in our DTH window (but earlier would have been better)

The early April set up of our field drip irrigation into 4 separate systems for our WM rows, peripheral pots, hügelkultur/pollinator flower garden and bee/bird fountain demonstrated best practices and flexibility. In addition, we used hygrometer readings biweekly.

Bee/bird fountain was used by multiple pollinator animal species.

The use of a pollinator flowers in the hügelkultur and peripheral pots may have helped the bees pollinate our WM

We had no issues w 4 legged pests (yes, the bat colony is still present in the Hovander House and a beneficial IPM)

Our fruit set and crown set were significantly higher than expected, over 90 melons for 24 plants.

Our vertical WM garden of 4 plants on farm panels produced 8 WM.

5 other Master Gardeners grew our Transplants in their personal gardens for comparison.

We began our harvest of ripe and healthy WM mid-August. Despite disease and irrigation issues, we harvested 10 ripe watermelons.

Education of the public occurred as folx walked by and asked Q, brief presentations to field tripping children, and various signs in the garden.

Education of master gardeners occurred verbally at MG and Lead meetings, via blogging on the facebook "Master Gardeners Only" page and updating the Foundation and WSU websites.

Presentation of a workshop to master gardeners and public on "Hot Tips for Growing Watermelon in a Cold Climate"

Final Report 2024 presented to WSU Master Gardener Program and the Foundation for publication on their websites.

*The notable **areas to improve** or mitigate include:*

Soil health was not closely monitored w multiple vectors and/or pathogenic inoculants.

Potting soil was not sterile as the master gardener peat source has been sitting in a field and flooded frequently.

"Dampening off" killed many of my greenhouse seedlings. My personal greenhouse (wch was sterilized w 10% bleach) included indoor wire shelving covered w Athena greenhouse sealed and ventilated cover, heat mats, LEDs, fans, cells and trays. I believe the dampening came from overwatering.

The XDG field location is on top of the former compost demonstration area at Hovander Park. Also, we gathered end of season plant debris from other Demonstration Gardens and incorporated it into our Hügelkultur cold compost last fall. Possible plant diseases came from these sources.

Tools – we did not clean and sanitize tools before and after each use every time until the disease was identified.

Late spring cold temperatures and windy storms in early May/June delayed transplanting and decreased (early morning) pollination.

Irrigation interruption from May to August from Hovander Park broken water main pipes and from vandals turning off our drip irrigation. We were unable to mitigate effectively. This significantly weakened the WM plants.

Knowing that pollination is critical to the success of our sterile seedless WM, I was concerned about attracting pollinator animals and not distracting them. I think our potential yield was on par, so it appears that we had adequate pollination of our seedless WM. Apparently being located next to the Pollinator, Vegetable and Dahlia Gardens, w an open field bordering our northern aspect, is NOT a distraction for our pollinator animals to achieve success w our female WM flowers. Next year, I wud consider improving my attention to the care and feeding of early mason bees and bumblebees.

Crowding of our WM crop from the "cover crops" caused competition w sunlight and pollinators. In the future, I would grow a low, 2–4-inch, cover crop. We attempted that by sowing alyssum seeds, but they got crowded out by germination of last year's redshank seeds in the soil. Next year we may have to plastic sheet mulch the in-between row areas to inhibit growth of seeds in the soil.

Cloth pots (25 gallon) were originally going to b a demonstration of growing WM in small spaces. It appears that home gardeners w small growing spaces do this w some success. However, since I couldn't find an Edu source, as a master gardener, I talked myself out of growing WM in the cloth pots. I think in the future I will try to use a large cloth pot, prune and grow the WM vertically.

Improve field scouting and plant disease/pest recognition.

Onset of fungal and bacterial disease starting in early July w our Blacktail WM wch then spread across the garden affecting many plants. Next year in addressing the fungal disease, we will have to implement crop rotation out of cucurbits (gourd family). And, to address the bacterial disease, we will have to more thoroughly inspect the seed company for quality seed inspection practices.

Late summer LaNina returns causing cooler temperatures in August w mornings in 40s and highs low 70s. This affected the health of WM plants and pollinator energy.

Some theft and vandalism of melons and plants.

Conclusion

Growing seedless watermelon in the XDG@Hov provided a great medium for demonstrating best practices for the home gardener meeting our education goals. The "mini melon" sized seeded and/or seeded watermelon can b grown by the home gardener in Western WA. It is a worthy endeavor for the home gardener who has some experience and access to resources for some of the special needs of WM.

A special note of appreciation and gratitude to Dr Carol Miles and David Keller and Sharen Sandell for their mentoring and "hands-on" field support, for without your contributions and candor I never would have seen this 2024 season through.

Thank you to all the Master Gardeners that took the time to join our experiment and grow some of our watermelons in their personal gardens.

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APPENDIX 1. Weather Bellingham WA 2024

APPENDIX 2. XDG@Hov garden photographs

NOTE: any errors are entirely mine and unintentional. Please contact me with Questions or comments at bohn_juliana@yahoo.com

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Watermelon Workshop Survey 9.4.2024

1. Did you find the workshop helpful? Y N

Comments:

2. Would you consider growing watermelons in your home garden? Y N

   Comments:

3. Would you consider growing watermelons? Y N

   Comments:

4. What suggestions do you have for next year's Experimental Demonstration Garden focus?

   4. Other comments that you would like for us to know: