



Evaluation of Multi-colored Carrot Varieties 2018

Jensen Uyeda, Joshua Silva, Jari Sugano, Lynn Nakamura-Tengan, Julia Zee, Nancy Ooki,
Sharon Wages, Kylie Wong, Koon-Hui Wang, Theodore Radovich, Amjad Ahmad,
University of Hawaii at Manoa
College of Tropical Agriculture and Human Resources



Carrots (*Daucus carota*) is one of the most widely produced Apiaceae vegetable and is largely known for its alpha and beta-carotene content. Carrots are believed to have originated from Afghanistan, southwest Asia, and the eastern Mediterranean. In the US majority of the carrot production is done in temperate climates and varieties have been bred to adapt to longer photoperiods with cooler temperatures. In Hawaii, short day varieties are recommended for production and typically do not bolt or flower due to the lack of required cold temperature exposure.

The tap root is the part of that carrot that is of economic importance. Carrots usually produce conical roots however they may also be cylindrical or round. Root diameters range from 0.4 to 4 inches in diameter and can range from 4 to 20 inches in length with majority ranging from 4 to 8 inches. Flesh color can be white, red, yellow, orange or purple. Flesh color can be associated with certain phytochemicals such as anthocyanins in purple varieties, alpha-carotene in yellow varieties, beta-carotene in orange varieties, and lycopene in red varieties. Phytochemicals are not distributed uniformly in plants and can be influenced by temperature, plant maturity and cultivar. Carotenoid content in majority of the carrots varieties being grown range from 60 to 120 $\mu\text{g/g}$ of fresh weight. Typically, young roots are pale in color and have low carotenoid content. Roots tend to reach maximum carotenoid content 90-120 days after germination.

This trial evaluated 24 commercially available multicolored carrot varieties for its potential production in Hawaii. Plants were evaluated for root length, root fresh weight and root diameter. Plants were seeded on November 16, 2017 and thinned out to 1 seedling every 3" on November 30, 2017. Plants were planted in a single row on 15' beds for an estimated 60 plants per plot. Beds were prepared using a BCS rototiller to a depth of 12 inches. Plants were



fertilized using 16-16-16 at a rate of 50 lbs of nitrogen per acre and fertilizer with 10-30-10 at a rate of 25 lbs of N using fertigation techniques. Plants were irrigated with a drip irrigation system. To address nematode issues commonly found in soils where the trial was conducted azadirachtin was injected every 10 days from germination for a total of 3 applications. Plants were harvested on February 22, 2018 (98 days after seeding) and evaluated for root length, root weight and root diameter.

Observations:

Purple Varieties

Overall, majority of the varieties evaluated showed potential for commercial production in Hawaii. Varieties 'Deep Purple', 'Cosmic Purple' and 'Dragon Purple' showed significantly higher fresh weights and root diameter from all other purple varieties, with some variability in root length. 'Deep Purple' generally had a uniform purple color throughout the whole root while 'Cosmic Purple', and 'Dragon Purple' was only purple on the outside of the root and had either a yellow or orange center. If peeled, both 'Cosmic Purple' or 'Dragon Purple' would lose its purple color and either yellow or orange colored carrot roots would remain. Poor yield associated with the remaining varieties could have been attributed to the lack of time needed to mature and may not be recommended for commercial production where quick turn over is desired.

Yellow Varieties

Varieties 'Yellow Sun' and 'Solar Yellow' showed significantly higher fresh weights from all other yellow varieties. There were also significant differences in root length and root diameter across all varieties. Although, 'Yellow Sun' had higher fresh weights, it was numerically shorter than all other yellow varieties and may not be desirable in a mixed color bunch. It may be better suited if harvested early as a specialty restaurant variety where short and fat mini-carrots are preferred. For a mixed bunch 'Solar Yellow' may be more preferred for its higher yields and fairly uniform root length and root diameter.

Red Varieties

'Kyoto Red' showed significantly higher fresh weights and root length as well as numerically larger root diameters than all other red varieties. Due to its large size, plants may need to be harvested early to match sizes of other colored varieties if mixed in a bunch. It may also be more preferred as a processed or cut variety. Varieties such as 'Malbec', 'Nutri-red' and 'Red-Samurai' may be better suited for mixed bunches as the size and time of harvest may be more in line with other colored varieties. 'Scarlet Red' and 'Red Samurai' had the highest level of nematode damage observed from all other varieties in the trial and are not be recommended for areas known to have issues with nematodes.

White Varieties

'White Satin' had significantly higher fresh weight and root diameter than all other white varieties. It was also statistically as long or longer than all other varieties and may be the best choice when used in a mixed bunch. 'Creampak', although lower in fresh weight showed



COOPERATIVE EXTENSION

UNIVERSITY OF HAWAII AT MANOA
COLLEGE OF TROPICAL AGRICULTURE AND HUMAN RESOURCES

uniform roots that may also better match the size and timing when mixing in a bunch with other colored varieties.

Data collected from this trial suggest that carrots are a viable commercial crop for production in Hawaii when nematodes are managed. There is at least one variety from each color group that could be used to mix in a bunch as well as varieties that may be more suited for processing or specialty markets.

To minimize import replacement of food commodities into Hawaii, agricultural Extension agents joined forces with human nutrition Extension agents at the University of Hawaii at Manoa, College of Tropical Agriculture and Human Resources. A collaborative partnership called the 'Get Local' Program was developed to expand the reach of agricultural field research by engaging consumers and food preparers to buy, eat and support local food systems in Hawaii. Young chefs and consumers are educated about crop production as well as the nutritional aspects of the various commodities grown here locally via educational field days, workshops and conferences.

Culinary Partnership

Dr. Lauren Tamamoto and the culinary students from the Kapiolani Community College Culinary Innovation Center partnered with CTAHR's GET Local (Grow Eat Think Local) Program to promote a food systems approach to increase sustainable food production in Hawaii. Students were given the challenge of creating innovative recipes with carrot varieties harvested from this field trial. They were also provided with the opportunity to present their creations to both farmers and consumers at a field day held at the Poamoho Research Station. This partnership helps to increase awareness of the importance of incorporating more locally grown commodities into our human diets.



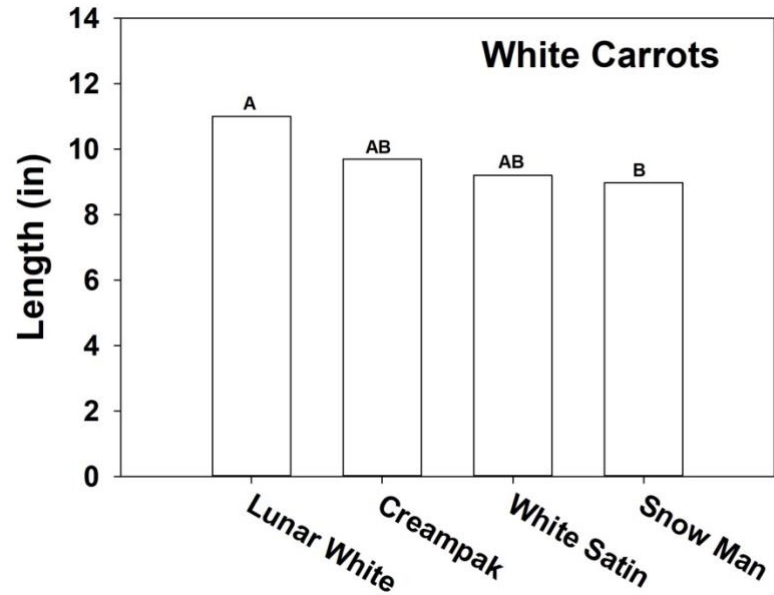
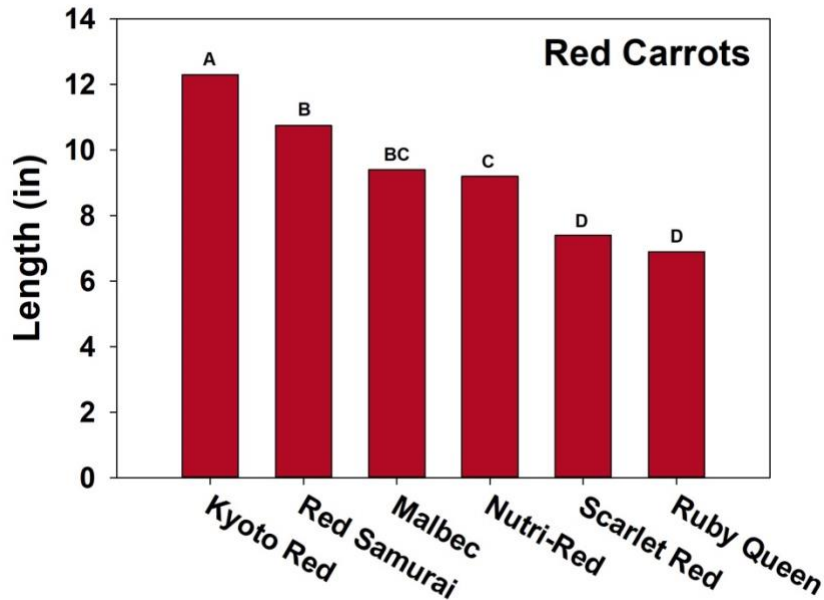
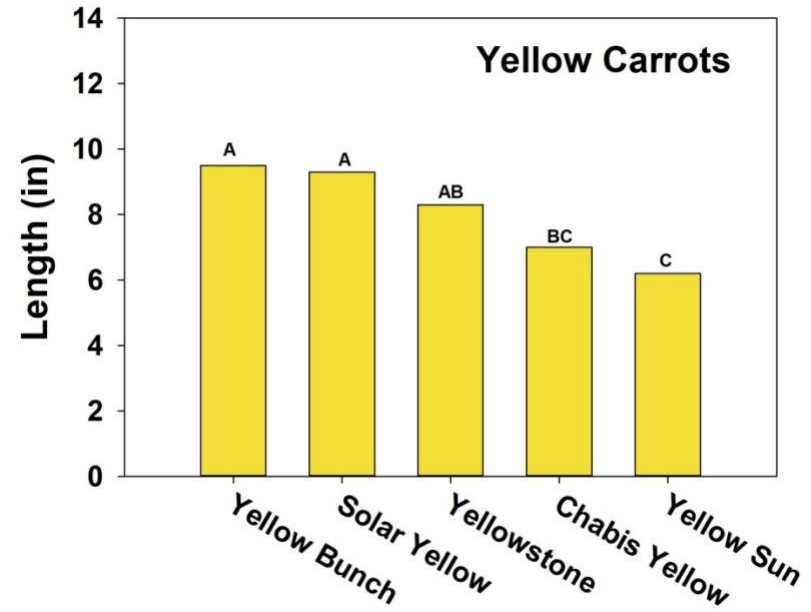
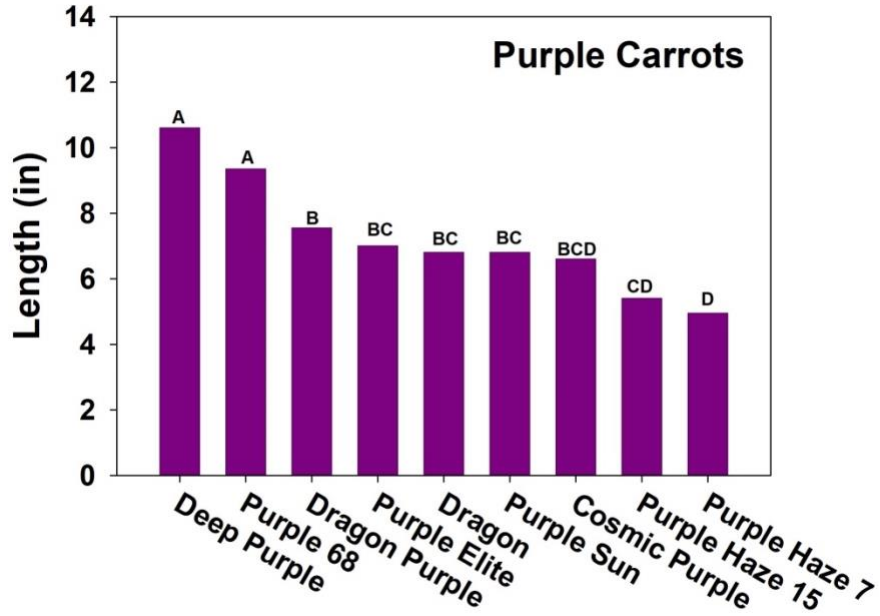


Carrot Seed List

<u>Entry</u>	<u>Company</u>	<u>Variety</u>	<u>Color</u>
1	Johnnys Seed	Malbec	Red
2	Johnnys Seed	Nutri-Red	Red
3	Johnnys Seed	Deep Purple	Purple
4	Johnnys Seed	White Satin	White
5	Johnnys Seed	Yellow Bunch	Yellow
6	Johnnys Seed	Yellow Sun	Yellow
7	Johnnys Seed	Purple Haze	Purple
8	Johnnys Seed	Purple 68	Purple
9	High Mowing Seed	Yellowstone	Yellow
10	High Mowing Seed	Cosmic Purple	Purple
11	High Mowing Seed	Dragon	Purple
12	Stokes Seed	Ruby Queen	Red
13	Stokes Seed	Creampak	Yellow
14	Stokes Seed	Snow Man	White
15	Stokes Seed	Purple Haze	Purple
16	Stokes Seed	Purple Elite	Purple
17	Kitazawa Seed	Scarlet Red	Red
18	Kitazawa Seed	Chablis Yellow	Yellow
19	Kitazawa Seed	Purple Dragon	Purple
20	Kitazawa Seed	Kyoto Red	Red
21	Holmes Seed	Solar Yellow	Yellow
22	Holmes Seed	Lunar White	White
23	Territorial Seed	Red Samurai	Red
24	Territorial Seed	Purple Sun	Purple

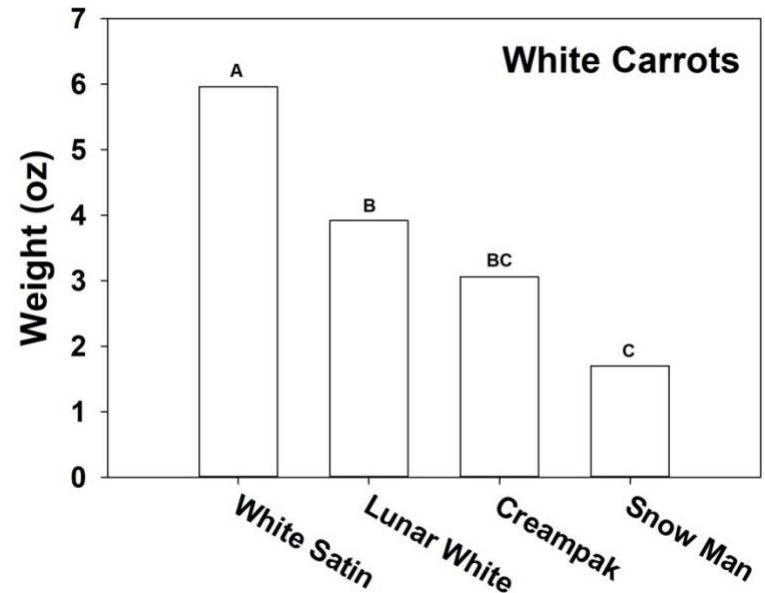
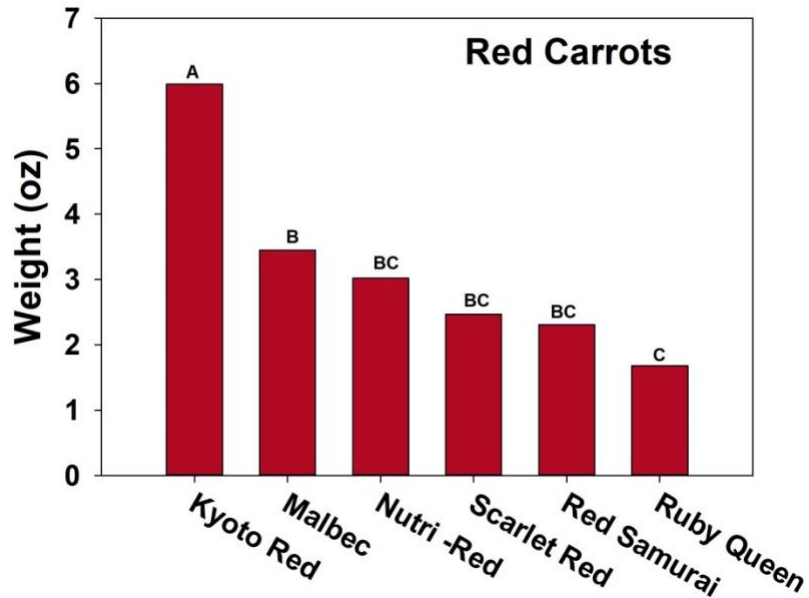
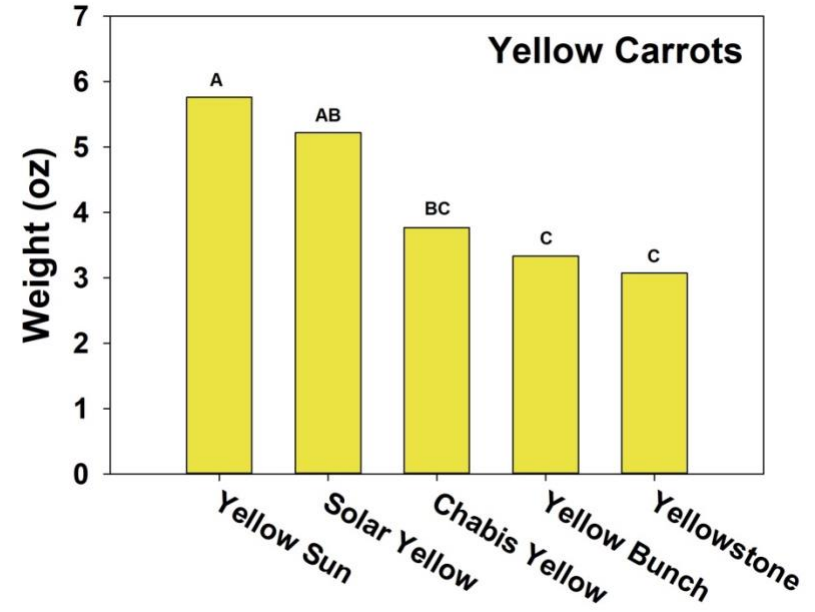
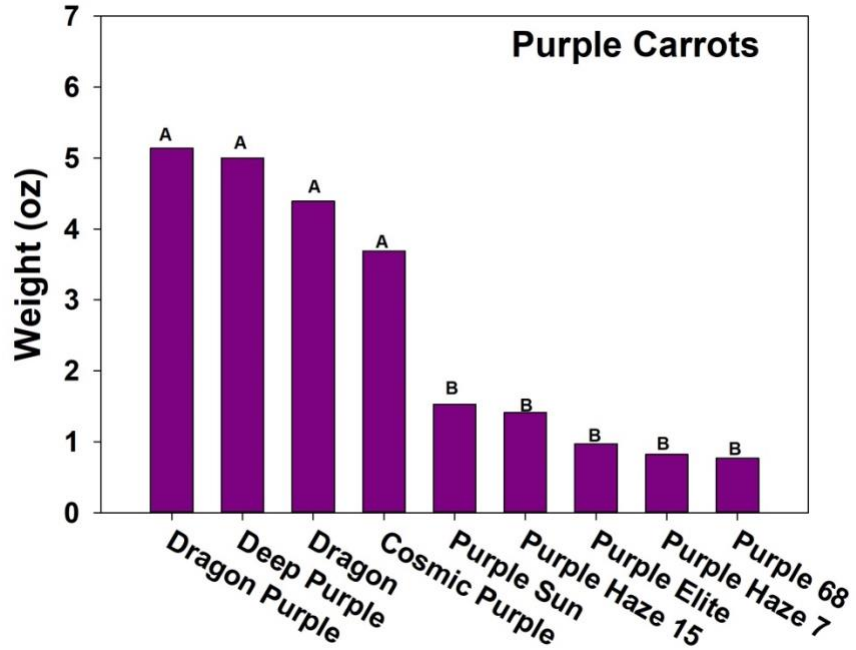


Carrot Average Root Length



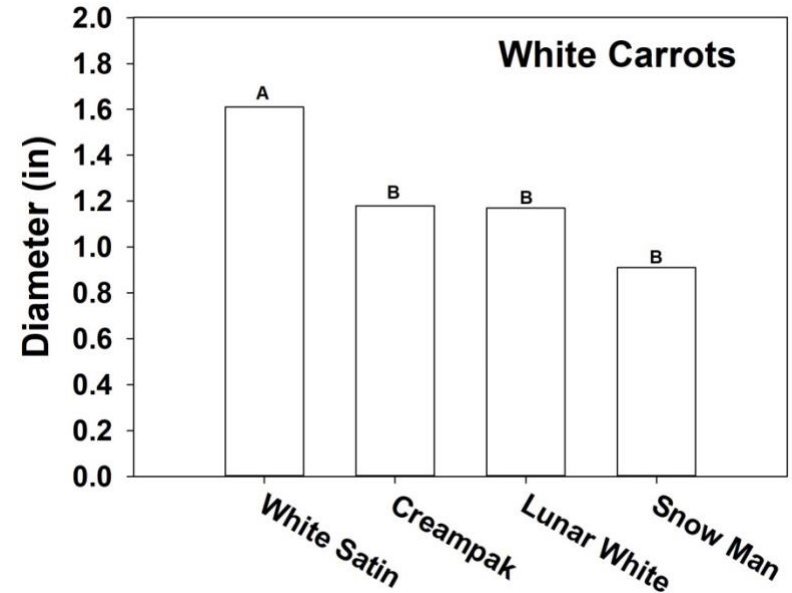
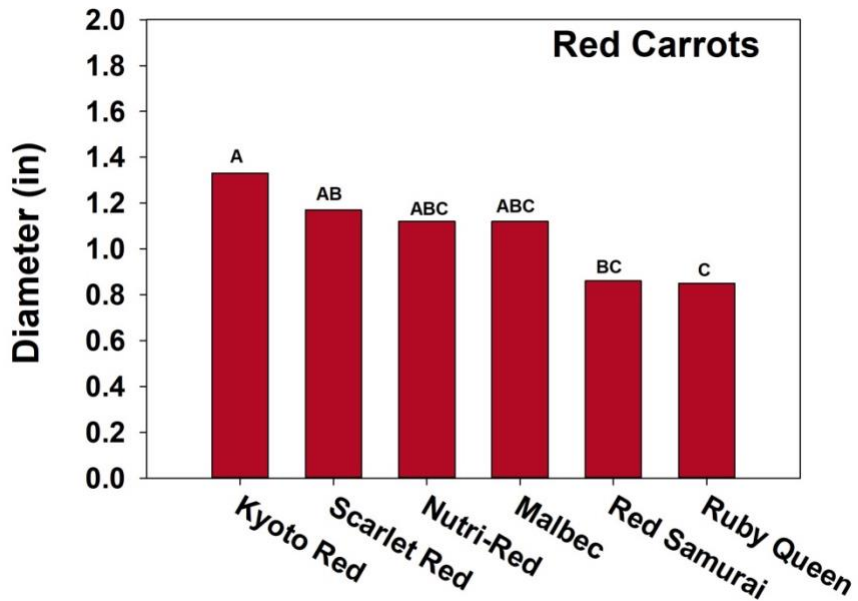
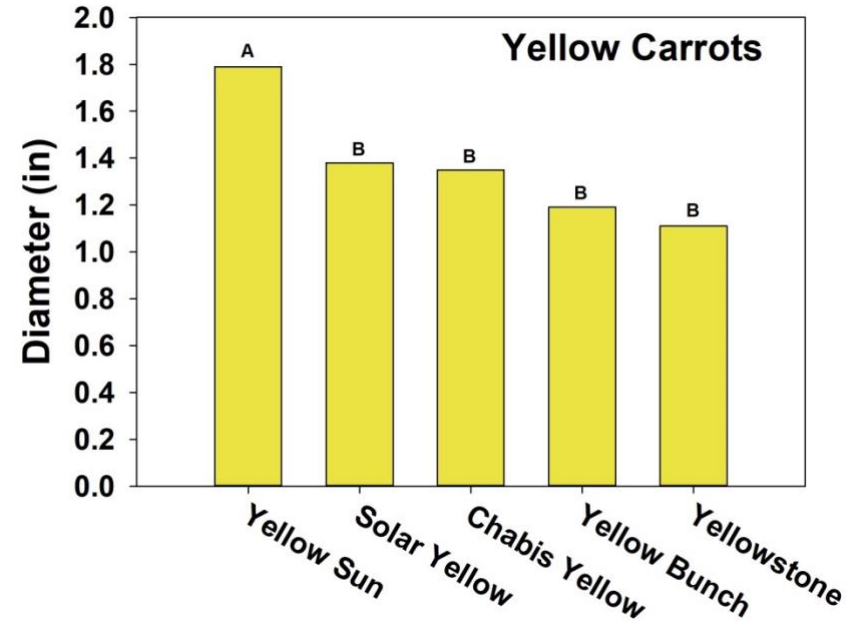
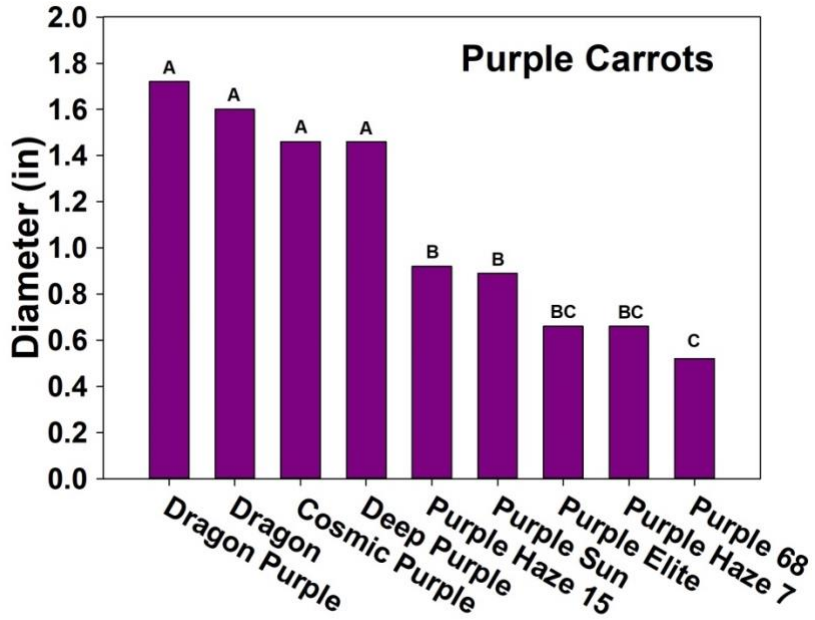


Carrot Average Fresh Weight





Carrot Average Root Diameter





COOPERATIVE EXTENSION

UNIVERSITY OF HAWAII AT MANOA
COLLEGE OF TROPICAL AGRICULTURE AND HUMAN RESOURCES



1 Malbec



2 Nutri-Red



3 Deep Purple



4 White Satin



5 Yellow Bunch



6 Yellow Sun





COOPERATIVE EXTENSION

UNIVERSITY OF HAWAII AT MANOA
COLLEGE OF TROPICAL AGRICULTURE AND HUMAN RESOURCES

7 Purple Haze



8 Purple 68



9 Yellowstone



10 Cosmic Purple



11 Dragon



12 Ruby Queen





COOPERATIVE EXTENSION

UNIVERSITY OF HAWAII AT MANOA
COLLEGE OF TROPICAL AGRICULTURE AND HUMAN RESOURCES

13 Creampak



14 Snow Man



15 Purple Haze



16 Purple Elite



17 Scarlet Red



18 Chabis Yellow





COOPERATIVE EXTENSION

UNIVERSITY OF HAWAII AT MANOA
COLLEGE OF TROPICAL AGRICULTURE AND HUMAN RESOURCES



19 Purple Dragon



20 Kyoto Red



21 Solar Yellow



22 Lunar White



23 Red Samurai



24 Purple Sun



Whiskey Glazed Carrots

Ingredients:

- ¼ cup Carrots, Medium Chopped
- 1 Tbsp. Butter
- 3 Tbsp. Whiskey
- 1 (14g) Tbsp. Butter
- 2 Tbsp. Brown Sugar
- Salt - To Taste
- Cayenne Pepper (Optional) – To Taste
- Pepper - To Taste
- Cilantro, chopped – Garnished



Directions:

1. In a sauce pan, melt butter and sauté carrots over medium heat. Cook the carrots so that its soft but still has a crunch when bitten (About 1-2 minutes on high heat). When finished remove the carrots and set aside.
2. In a clean sauté pan melt butter over a medium high heat and allow it to brown, when the butter starts to brown pour in the whiskey and burn off all the alcohol.
3. Add brown sugar and stir until well combined.
4. Add in the carrots and turn the heat down to a low medium. Coat the carrots in the glaze and season with salt, pepper, and cayenne.
5. Once the carrots are well glazed, remove from heat and place in a serving platter. Garnish with cilantro and serve.

Important Please Read: Whiskey contains alcohol which is flammable, be sure that the area is clear of anything that can catch on fire. Also, do not pour the whisky straight out the bottle and into the pan as it can lead to serious injury. It is highly recommended to have the whiskey proportioned in a separate container. If a flame is to accrue, it is advised to turn off the heat as a precaution. The flame can be brought back up again after the alcohol has been burned off.

Hot Cheesy Carrot Dip

Ingredients:

- Carrot (shredded, and peeled) - 3 Cups (9 oz)
- Cream Cheese - 1/2 cup (5 oz)
- Sour Cream - 1/2 Cup (5 oz)
- Shredded Parmesan Cheese - 1/4 Cup (3 oz)
- Shredded Mozzarella Cheese - 1/4 Cup (3 oz)
- Minced Garlic - 3 cloves (15 grams)
- Butter - 1 Tablespoon (14 grams)
- Onion Powder - 1 Teaspoon (6 grams)
- Kosher Salt - 2 Pinches
- Pepper - 1 Pinch
- Red Chili Pepper Flakes - 1 Pinch or to taste



Serving Size: 2 Tablespoons (about 40 grams)

Directions:

1. Preheat oven to 375 F
2. Melt butter in a sauté pan on medium heat
3. Sauté half the minced garlic until golden brown
4. Add about 1 cups of the carrots to the pan and sauté in garlic and butter until slightly tender
5. Remove carrots to a separate pan. Add another cup of carrot mixture to pan and add water and cover to allow carrots to steam for about 4 minutes.
6. Remove carrots and set on side.
7. In a mixing bowl, mix sour cream and cream cheese until smooth
8. Add the rest of the minced garlic, sautéed, steamed, and raw carrots, along with the remaining ingredients to the bowl and mix together well.
9. Place in a backing dish and bake for about 12 -15 minutes or until the top layer is near a golden color and the cheese is completely melted.

Carrot Bars

Serving Size - Makes 16 bars

Ingredients:

Crust

- 1/2 C (4 oz.) Butter
- 1/4 C (52 g) Sugar
- 1-1/2 C (180 g) Flour

Filling

- 1 C (8 oz.) Steamed and mashed carrots (buy about 3 carrots)
- 3/8 C (80 g) Sugar
- 1/4 tsp Salt
- 1/8 tsp Cinnamon
- 1/4 tsp Ground Cardamom
- 1/4 tsp Ground Ginger
- 1/8 tsp Cloves
- 1/2 can (6 oz.) Large can evaporated milk (12 fl. oz.)
- 1 Large egg

Directions:

1. Peel, cut and steam carrots. In clean bowl, mash up steamed carrots.
2. Place mashed carrots into non-stick pot and cook on medium heat for 10 minutes to evaporate moisture, constantly stirring to prevent carrots from burning. Mashed carrots shouldn't have a wet look, and no moisture should slide around the bottom of the non-stick pot.
3. Cut in ingredients for the crust and flatten in 8x8 pan.
4. Bake crust at 350°F for 10 minutes, turning halfway.
5. Mix first 8 ingredients of filling. Using immersion mixer, blend till carrot mixture is pureed. Add egg and whisk until completely mixed in.
6. Pour filling over crust and bake at 425°F for 11 minutes.
7. Reduce heat to 350°F and bake for 45 minutes (turning halfway) or until knife comes out clean in center.



Carrot Tops and Fruits Smoothie

Serving Size: 4 – 8 ounce cups

Ingredients:

- 1 cups water (240 ml)
- ½ cups ice (360 ml) (roughly measured)
- 2 cups (16 ounces) assorted fruits of your choice depending upon your taste:

1 ripe banana, apples, strawberries, blueberries, watermelon

Sweetener Options:

- 3 seeded dried dates or 4 ounces of seedless grapes
- 4 cups (4 ounces) packed carrot top leaves, washed (about half a blender full)

Additional Ingredients:

- Slice Ginger
- Mint leaves
- Chia/Flax seed
- ¼ inch (.5 ounce) slice of lime, skin and all

Directions:

1. Fill a Vitamix or heavy-duty blender with ½ cup of ice.
2. Add water up to the 1 cup measure.
3. Add two cups of fruit.
4. Fill the blender to the top with greens.
5. Add any of the optional ingredients.
6. Blend until smooth.



CARROTS CHIPS

Ingredients:

- 4 Small Carrots washed and Peel
- 2 Teaspoon extra-virgin Olive Oil
- ¼ Salt



Directions:

1. Preheat oven to 350 degree F.
2. Peel carrots into thin strips using a vegetable peeler; put into a large bowl. Drizzle olive oil over the carrots strips and toss to coat. Season with salt: Toss again. Spread carrots onto 2 baking sheets in a single layer, preventing overlap.
3. Put one baking sheet on the top rack and the other on the bottom. Bake carrots in the oven for 6 minutes, switch racks, and continue baking until the carrots are crisp, about 6 minute more. Cool chips until cool enough to handle before serving.