

Grow Sorrel at your Farm !

This project was funded by a grant from the **Western Sustainable Agriculture Research and Education Program.**
<http://westernsare.org>



Our Story

Green Skies Vertical Farm is a micro-farm in West Oakland, CA. Green Skies has operated for 6 years as a certified organic farm growing produce on approximately 3,500 square feet of space on a vacant lot. The total bedspace (planted area) is only around 1,000 square feet.

Green Skies grows and sells various types of herbs, microgreens and salad greens. We began cultivating sorrel in 2013 as an experiment in some of our outdoor hydroponic beds. It became an important ingredient in our salad mix and soon after we decided to experiment with selling it as a stand alone product. To our surprise, it was super popular and soon became our leading crop!

Sorrel Cultivation

Sorrel (*Rumex acetosa*) is a member of the Polygonaceae family and comes in two varieties. There is a large green leaf variety and a red veined variety. The green variety is more easily cultivated than the red veined variety.

Sorrel can be direct seeded in the spring (plant $\frac{1}{4}$ " deep) but due to its very small seed size, is more easily started in flats and transplanted when ready. Plugs can be transplanted to soil or hydroponic systems.

Green sorrel is an incredibly vigorous perennial. Plants will spread so it is good to cultivate in a location where containment is possible if needed.

Green sorrel leaves can grow to 10" long while red veined sorrel is much smaller, usually 3-4" long.



Sorrel Cultivation



Green Sorrel Cultivation in a simple plastic tub



Green Sorrel Cultivation in a raised bed

Sorrel Cultivation



Green Sorrel Cultivation in an outdoor hydroponic bed

Sorrel Cultivation



Sorrel is an incredibly heavy yielding crop. Even after it has bolted (gone to seed) it can be cut back again and will re-grow well.



Sorrel Yield & Economics at our farm

Crop	Area (square feet)	Crop Sales Revenue 2018	Revenue/ square foot	Revenue/ square foot / month
Farm Average	1,000	\$16,634	\$1.66	\$0.14
Sorrel	165	\$2617	\$15.86	\$1.32

Sorrel Yield & Economics



Sorrel Yields

Total Saleable Yield	Total Saleable Per square foot	Per square foot/ month
642 lbs	3.89 lbs	0.325 lbs

Most crops are expected to yield an average of 0.5 lbs per square foot per growing season, which is about 3 months long. This translates to a yield of 0.166 lbs per square foot/month which is about 50% of sorrel's yield. (source: <http://sustainable-farming.rutgers.edu/wp-content/uploads/2017/12/urbanfringe-v07n01.pdf>)

Sorrel Outreach : SF Exploratorium



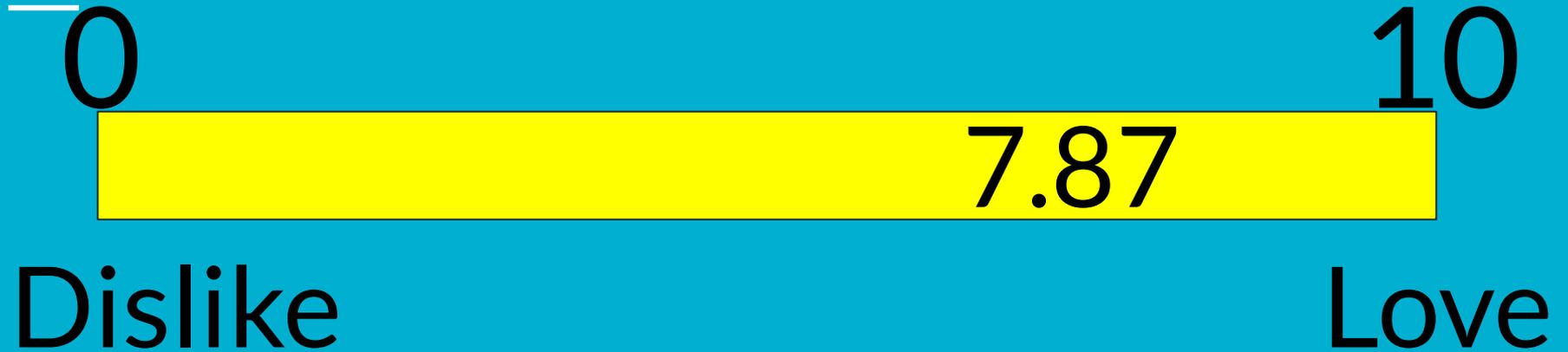
Sorrel Outreach : SF Exploratorium



Sorrel Outreach Results: Familiarity

Total People Interviewed	Had Tasted Sorrel Before	Had NOT Tasted Sorrel Before
131	16 (12%)	115 (88%)

Sorrel Outreach Results: Flavor



People tasting sorrel were asked to rate on a scale of 0-10. 0 expressed strong dislike for the taste while 10 showed they really loved the taste. The average score was 7.87. A score of 5 was neutral. None of the 115 respondents who gave a score graded sorrel below a 5.

Sorrel Outreach : How will it taste?

When asked what they thought it would taste like, people who had never tasted sorrel responded with....

“Lettuce” “Arugula” “Basil” “Licorice” “Kale” “Green Beans”
“Minty” “Dandelion” “Cabbage” “Wheatgrass” “Aloe” “Sage”

Sorrel Outreach : How did it taste?

The flavor reminds me of....

“Sour apple” “Candy” “Warheads (candy)” “Rhubarb”

“Apricots just before they are ripe” “Sour grass” “Lime”

Sorrel Outreach : How did it taste?

“Happy to know it tastes like it does!”

“Pleasantly surprised, lemony and bright”

“It’s awesome... it makes me smile”

“Delicious- romaine is the child while sorrel is the cool uncle”

“Like mango... like being back in Africa”

“Thick and lemony” “So yummy” “Nothing like I imagined”

Sorrel & kids

Kids really love sorrel. Here is one story that was submitted to us by a local teacher about her experience with sorrel.

"Pictured below is one of the many students who has grown to love the most favorite of all plants in our garden: sour sorrel, which brings students back to the garden over and over. I cannot keep enough growing to meet the demands. In fact, one parent came into the garden and while looking at the eaten down patch, she asked me, "Do you have rabbits"? I laughed and said, "No, I have students who cannot get enough of these dark leafy greens." "How hilarious is that" she replied.

The Kindergarten student in the picture, brought home a small little recycled pot made out of newspaper into which he enthusiastically planted sour sorrel seeds and took them home. A year later, his mom approached me to say his patch has grown in their backyard to accommodate his whole family.



Sorrel: Nutrition Facts

Sorrel is very high in potassium, fiber, vitamin A and C. Additionally, the protein to calorie ratio is 0.93, which is similar to that of ground beef, tofu, egg yolks, skim milk and many other high protein foods.

Source:

<https://www.nautilusplus.com/the-protein-calorie-ratio-your-partner-in-the-war-against-kilos/>

Nutrition Facts			
Sorrel			
Amount Per 1 cup, chopped (133 g) ▾			
Calories 29			
		% Daily Value*	
Total Fat	0.9 g		1%
Cholesterol	0 mg		0%
Sodium	5 mg		0%
Potassium	519 mg		14%
Total Carbohydrate	4.3 g		1%
	Dietary fiber 3.9 g		15%
Protein	2.7 g		5%
Vitamin A	106%	Vitamin C	106%
Calcium	5%	Iron	17%
Vitamin D	0%	Vitamin B-6	10%
Vitamin B...	0%	Magnesium	34%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher

Sorrel:

Nutrition Facts

Sorrel is also high in Oxalic Acid like many other common foods such as Spinach, Swiss Chard and Chocolate. While research is controversial, Oxalic Acid may lower the body's ability to absorb minerals such as Calcium. Additionally, consuming high levels of Soluble Oxalates may cause kidney stone concerns in some individuals. If this is a concern for you, cooking these greens before consuming or combining with cream or milk will reduce the level of Soluble Oxalates.

Sources:

<https://www.ars.usda.gov/northeast-area/beltsville-md-bhnrc/beltsville-human-nutrition-research-center/nutrient-data-laboratory/docs/oxalic-acid-content-of-selected-vegetables/>

<http://dx.doi.org/10.4236/fns.2013.48109>

<https://www.independent.co.uk/life-style/science-molecule-of-the-month-oxalic-acid-1592018.html><https://www.healthline.com/nutrition/oxalate-good-or-bad>

Vegetable	Oxalic Acid Content (g/100 g)
Parsley	1.70
Chives	1.48
Purslane	1.31
Amaranth	1.09
Spinach	0.97
Sorrel (varies by leaf type and size) ¹	0.27 - 0.95
Swiss Chard	0.7
Beet Greens	0.61
Rhubarb	0.5
Chocolate	0.5

Sorrel Recipe: Pesto, pesto, pesto!

Created by Patricia Santos 3/12/17 (these amounts are for a small batch).

Sorrel- stems removed - 50 grams (weight after stems are removed)

Cilantro- stems removed- 40 grams

Parsley- stems removed- 35 grams

Walnuts- 50 grams

Fresh garlic- 8 grams

Parmesan cheese- 60 grams

Olive oil- 55 grams

Juice from 1/2 lime

Salt & Pepper to taste



Blend all ingredients until they have a pesto texture. Serve immediately or store in refrigerator.

Vegan alternative 2019: add nutritional yeast instead of parmesan cheese, to taste.

Another pesto recipe... “spicy sorrel pesto”

80 g large green sorrel leaves
40 g garlic cloves
40 g ground walnuts
8 g chili sauce
1/2 cup (60 g) grated parmesan
cheese
10 g olive oil
6 g salt and
2 g pepper

All the ingredients were placed in a blender and processed for one minute.

Notice the formal wording of the instructions above? That’s because this recipe comes from a scientific article on the oxalate levels of sorrel in sorrel-based food! Read it here:
https://file.scirp.org/pdf/FNS_2013072516554383.pdf

Enjoying sorrel: Pesto, Pesto, Pesto!



Sorrel Recipe: Backyard Slurry Dip or Glaze

Created by Kristine Anstine (longterm Berkeley resident), acquired in March 2019

kristine@microcosmpublishing.com

1 cup ea fresh mint leaves & sorrel leaves

1 TBSP ea sweet meyer lemon juice and greek yogurt

(I usually add some parsley, a little lemon zest, and a pinch of salt.)

Pulse/grind in a blender/food processor.

Optional: add a scant teaspoon of honey for sweetness. This could make a great glaze for roasted/baked food, too!



Sorrel Recipe: Daiquiris — (bottoms up!)

Ingredients:

2 ounces white rum

1 ounce fresh squeezed lime juice

1 ounce fresh sorrel simple syrup (see previous slide)

Combine ingredients and shake vigorously with ice for about ten seconds. Strain into chilled flute glass (or recycled mason jar).

Garnish with a leaf of sorrel. Enjoy!

Adapted from Food Republic -

<https://www.foodrepublic.com/recipes/sorrel-daiquiri-recipe/>



Sorrel Recipe:

Mini Frittatas with Sorrel Pesto

Recipe provided by Nick Huggins

Ingredients

2C spinach, chopped (loosely packed into measuring cup)

1 small zucchini, diced

1 roasted red bell pepper

2 cloves garlic, minced

2 tsp salt OR to taste

1 tsp freshly cracked black pepper

1 dozen eggs

1C whole milk

3/4C SORREL PESTO

Method

1. Preheat oven to 350F and place cupcake parchment into a lightly greased cupcake baking tray.

2. Put the first 4 ingredients into a large mixing bowl and season with salt and pepper to taste.

TIP: Over-season the veg by a little in order to provide sufficient seasoning for the egg-milk mixture.

3. Evenly distribute the veg into the cupcake tray and set aside.

4. Next, place 3-4 eggs in a food processor or blender and scoop the sorrel pesto teaspoon by teaspoon into the blender trying to break it up into small pieces.

5. Crack the remaining eggs into the blender or food processor then pulse 2-3 times to achieve a chunky mixture, stopping far short of blending it into a pale green homogenous mixture.

6. Pour the egg-milk mixture into a bowl then use a ladle or large spoon to spoon the mixture evenly over the veg.

7. Place into oven and bake for 10-25 minutes, depending on size of cupcake well used. Check for fineness every few minutes after around 7-8 minutes.

Chef Nick created the frittata and sorrel pesto recipe in the previous slide. Here is Nick (left) and a crew of his friends enjoying the frittatas! (right)



Sorrel Recipe: Cream of Sorrel Soup

Provided by Mariquita Farm, original recipe from Joy of Cooking

Clean, shred from the midrib and chop:

1/2 cup sorrel leaves

1 1/2 cups leaf lettuce

Sauté them until wilted in:

1 to 2 tablespoons butter

When they are sufficiently wilted, there will be only about 3 tablespoons of leaves.

Add 5 cups poultry or vegetable stock and simmer about 2 minutes.

Remove from the heat and add a small amount of the soup to:
1/2 cup cream, 3 beaten egg yolks.

Combine all ingredients and heat until the soup thickens slightly, but do no boil. Makes 5 to 6 cups. We recommend salt and peppering to taste, with some hot pepper flakes for spice!



Sorrel Recipe: Russian Sorrel Borscht

Provided by Barbara Rolek on The Spruce Eats recipe website

1 pound young sorrel leaves,
washed, stemmed as for spinach
and chopped
2 tablespoons butter or margarine
or oil
1 large minced onion
6 cups water or chicken stock
1 teaspoon kosher salt or to taste
2 tablespoons sugar
Juice of 1 lemon
2 large beaten egg yolks
Sour cream to taste



1. In a large saucepan or Dutch oven, melt 2 tablespoons butter or margarine or heat the oil. Sauté 1 pound young washed and stemmed sorrel leaves and 1 large minced onion for about 10 minutes or until sorrel is wilted and onions are translucent.
2. Add 6 cups water or chicken stock and 1 teaspoon kosher salt or to taste. Bring to a boil. Reduce heat and simmer 30 minutes.
3. Remove from heat and stir in 2 tablespoons sugar and juice of 1 lemon a little at a time, tasting after each addition of lemon juice, until your desired tartness is achieved.
4. Temper 2 large beaten egg yolks with a few tablespoons of hot soup, then stir tempered egg yolks back into the soup.
5. Return the saucepan to the heat and cook until slightly thickened and simmering but do not boil as the eggs will curdle. Serve hot or cold with sour cream.

Sorrel Recipe: Curry

Recipe graciously provided by Mona Rideout, one of our best sorrel customers!

Ingredients

3 bunches Sorrel, finely chopped
1 cup semi cooked split chickpea(chana daal)
1/2 tsp Mustard seeds
1 tsp Cumin seeds
2 Thai green chilli peppers
1 whole dry red chillies
2 cloves garlic crushed
cayenne pepper for added heat(optional)
1 tsp Turmeric
2.5 Tbsp sunflower oil
Salt (to taste)

Method

1. Heat 1 tsp of oil in a wok
2. When oil starts to smoke lower the heat and first add mustard seeds, the cumin seeds, thai chillies, dry red chilli, and garlic. when these fry a bit, lower the heat and add turmeric.
3. Add chopped sorrel, cook till it until it softens.
4. Add cooked split chickpeas. add 1/4 cup water and bring it to a boil. Add Salt to taste.
5. Cook till most of the water evaporates and curry starts releasing oil from sides.
6. At this time taste the curry for spices, if you like it more spicy add cayenne pepper and stir.
7. Remember that the split chickpea shouldn't be completely mushy, it should have a slight bite to give the curry some texture.
8. Serve with warm bread/roti.



Sorrel Recipe: Sorrel and Goat Cheese Quiche

Provided by Mariquita Farm;
adapted from Luna Circle Farm
recipe

2-3 cups sorrel, coarsely chopped
3 green onions, chopped
3-4 ounces goat cheese or other
soft cheese
3 eggs
1 1/2 cups milk
salt to taste
Parmesan cheese

Preheat oven to 375
degrees. Spread cheese
in the bottom of a pie
crust. Cover with
chopped sorrel and
scallions. Beat eggs,
salt and milk together.
Pour over greens.
Sprinkle with
parmesan cheese. Bake
for 35 to 40
minutes or until top is
golden brown.



Sorrel Recipe: Simple Syrup

1 Tbsp. granulated sugar

3 Tbsp. water

1 tsp. chopped sorrel

Add sugar and water to a small saucepan set over medium high heat. Heat the mixture until the sugar dissolves, stirring occasionally with a wooden spoon until fairly thick, about 2 minutes. Transfer to a small bowl. Stir in sorrel and set aside to cool.

Good for mixed drinks and desserts! Tip: this makes a small batch. Multiply the recipe and store any extra in fridge!



Farmer Outreach: Taken to the Stands

We conducted outreach at four local farmer's markets with farm vendors coming from the broader bay area.

There was some interest in sorrel cultivation among producers, particularly those growing leafy greens or microgreens.



Photo of Lifefood Gardens, a farm that expressed interest during our farmer's market outreach

Farmer Outreach Example: Riverdog Farm

When spoken to at the farm stand, the farm stand sellers for Riverdog said they do not currently grow or sell sorrel, but they do sell a lot of leafy greens. Later in our survey, the owner of Riverdog noted that she's heard of sorrel but never cultivated it for market. We are hopeful a farm like Riverdog could benefit from our sorrel research in the future.

Riverdog Farm is located in Guinda, CA and spans 450 acres.



Photo of a customer peering into Riverdog's leafy green bins at a Berkeley farmer's market.



Bustling North Berkeley farmer's market. Vendor pictured: Happy Boy Farms.

Farmer Outreach: Online

Outreach was conducted via an online survey which was sent to hundreds of farmers, gardeners and agricultural organizations in California and as a follow up to our in-person stand outreach.. There was active interest in sorrel cultivation among gardeners and some interest in sorrel cultivation among commercial producers.

Farmer Survey: Sorrel Cultivation

Green Skies Vertical Farm is an urban farm in Oakland, CA. We received a grant from Western Sare to promote sorrel and we are partnering with UCANR on this project. Sorrel is an important part of the economy of our farm and we are hopeful that it can be a solid source of income for other farms as well.

We are surveying farms in Northern and Central California to understand if they cultivate this vegetable and how they use/market it. We believe that the results of this project will be valuable to farmers and they will be distributed once the project ends in mid-2019.

Please leave blank any questions that do not relate to your farm/garden.

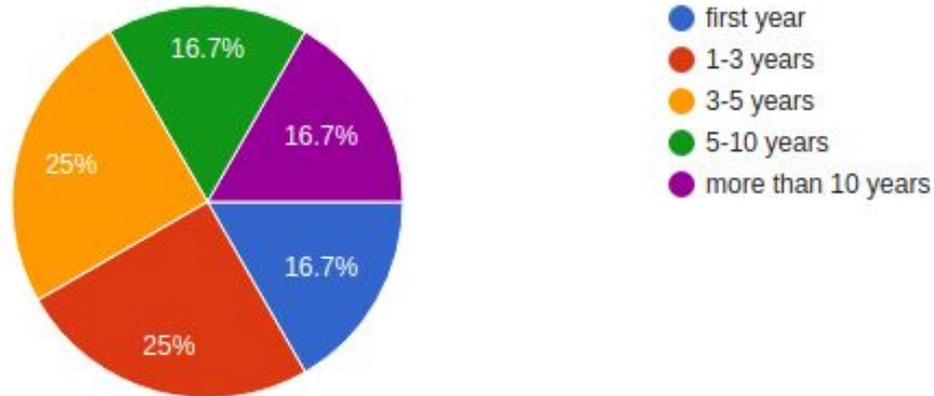
If you have any questions or would like more information, please contact David Ceaser via phone or e-mail: (510) 978-1347 or farmer@gsvfarm.com. Thank you very much for your support of this project.

<https://docs.google.com/forms/d/1SFfscr2Z75Js4k4wCISp8L27L6GI0R-Ud8pgm75RFh0/>

Farmer Outreach: Online

5. How many years has your farm grown sorrel?

12 responses



Twelve growers who filled out our online survey were cultivating sorrel.

Farmer Outreach: Online

6. I like growing sorrel because....

10 responses

It's easy to grow

It grows without effort and is beautiful in the garden.

It is SO easy and I have some great recipes for it

I used to be a chef in London many years ago and wanted to sell it to restaurants

its a perennial

Grows wild, tasty salad green

it is a unique taste

Good cover crop in perennial beds. Tasty and easy to grow.

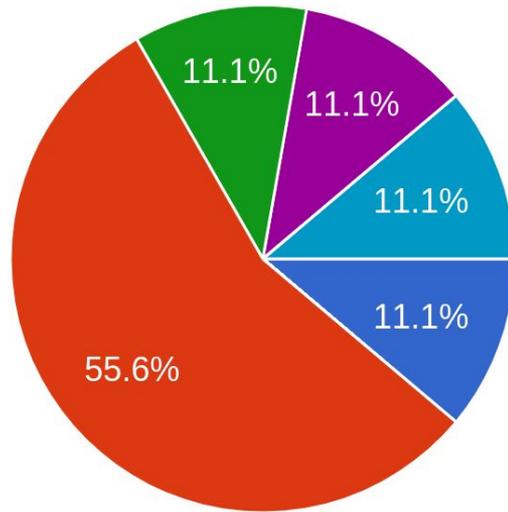
It is a lemony herb and lettuce replacement

Sorrel is a great for backyard farms with chickens. I can harvest large bundles and its back within a few weeks. Fast growing food!

Farmer Outreach: Online

19. IF you do not grow sorrel, why not?

9 responses



- I have never heard of it,
- I have heard of but never cultivated it for market
- I tried to grow it but it didn't grow well
- I grew sorrel successfully but couldn't sell it
- high in oxalic acid
- not really of interest to preschool age children

Sorrel: Great Opportunity!

We encourage producers to grow a small amount of sorrel on their farms and promote it with their customers. If it is well received, then cultivation can be expanded. Tastings are critical or else potential customers will think it tastes like other greens.

Our farm originally marketed it as “kid spinach” and that was a great way to get started in the market. Your farm should do the same. Having recipes available is also critical. Please use the ones in this presentation as a place to start.



Sorrel: Great Opportunity!

We'd love to hear more stories about sorrel on your farm and your marketing efforts. Or, if you have questions or comments, don't hesitate to reach out.

Please contact David Ceaser at:
farmer@gsvfarm.com



Thank you very much!

This project was funded by a grant from the Western Sustainable Agriculture Research and Education Program. <http://westernsare.org> We also appreciate the support we received from UCANR and Rob Bennaton.

