

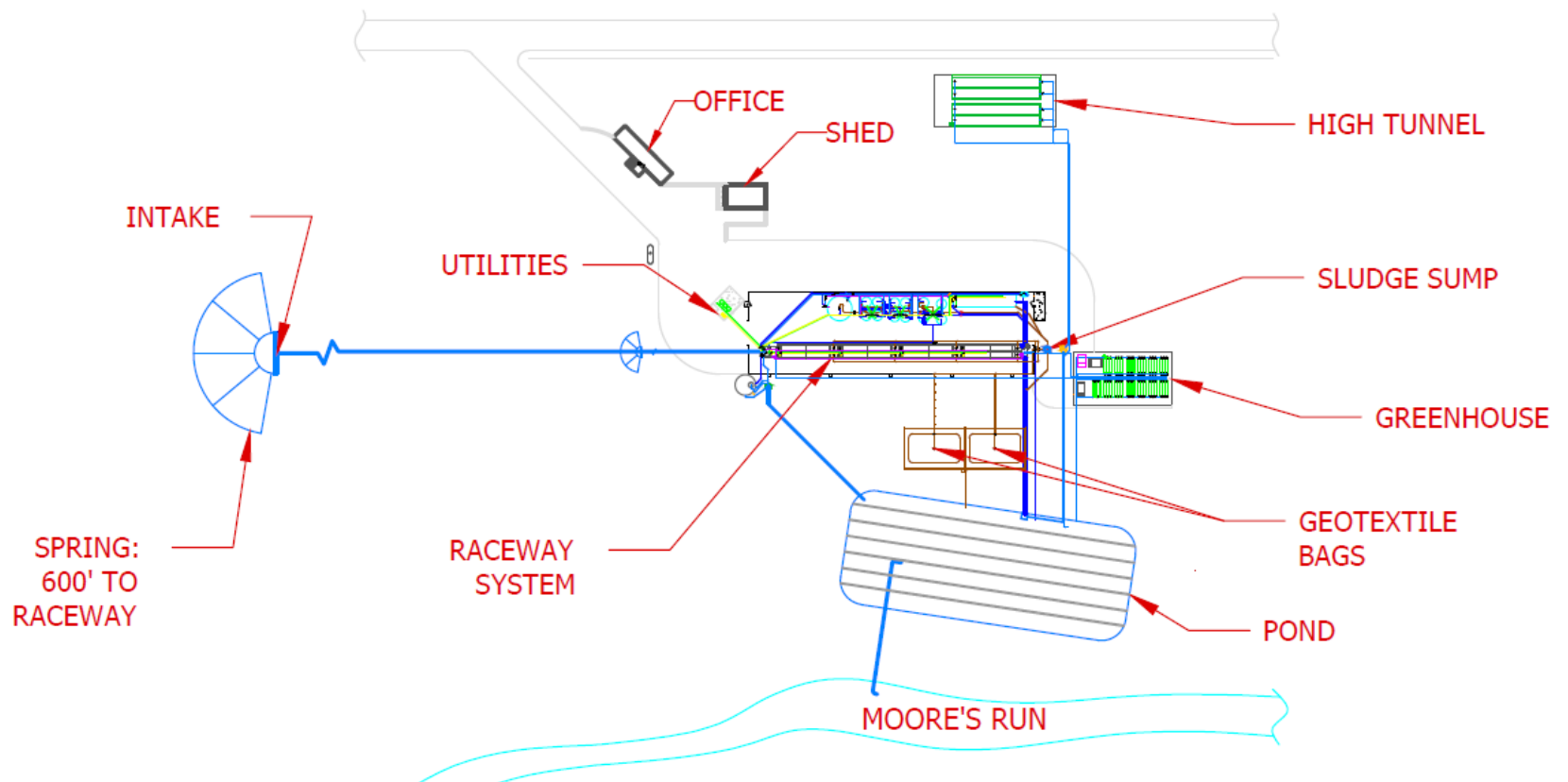
AQUAPONICS IN A COLD FLOWING WATER SYSTEM.

Ken Semmens

Assistant Professor in Aquaculture



Facility Components at Reymann Memorial Farm



Diverse approach to waste management

- Seek income from by-products
- High Feed Efficiency
 - ▣ Nutrient dense feeds
 - ▣ Ration based 85% of growth potential
- Solid waste settles in QZ.
- QZ sludge removed, pumped from sump, into a geotube
- Geotube captures and dewateres manure.
- Aquaponic system removes additional nutrients.
- Polishing pond.

Raceways

- Raceway 30 ft long, 3 ft wide, water 3 ft deep.
- About 5 exchanges/hour.
- Maintain oxygen at 60% saturation or greater.
- Aerate and/or remove fish to keep oxygen levels adequate.
- Normally remove some fish when standing crop reached 1080 lb (4 lb/ft^3 or 6.2 lb/gpm).
- Remove solid waste in Quiescent Zone (QZ) several times/week.

Raceway System



Water quality associated with trout production at Reymann Memorial Farm

Water Quality Parameter	RMF Influent (Before Fish) <small>Buzby et al. 2010.</small>	RMF Effluent (After Fish) <small>Buzby et al. 2010.</small>	Factor
pH	6.8	6.8	
Water Temperature	54 F	54 F	
Total Ammonia Nitrogen (mg/L)	.01	.33	33
Nitrite (mg/L)	0.0	0.03	
Nitrate (mg/L)	0.22	0.24	1.1
Phosphate (mg/L)	0.12	0.15	1.25
Calcium (mg/L)	23.4	24.1	
Specific Conductance (μS/cm)	162	162	

Water quality associated with trout production at Reymann Memorial Farm

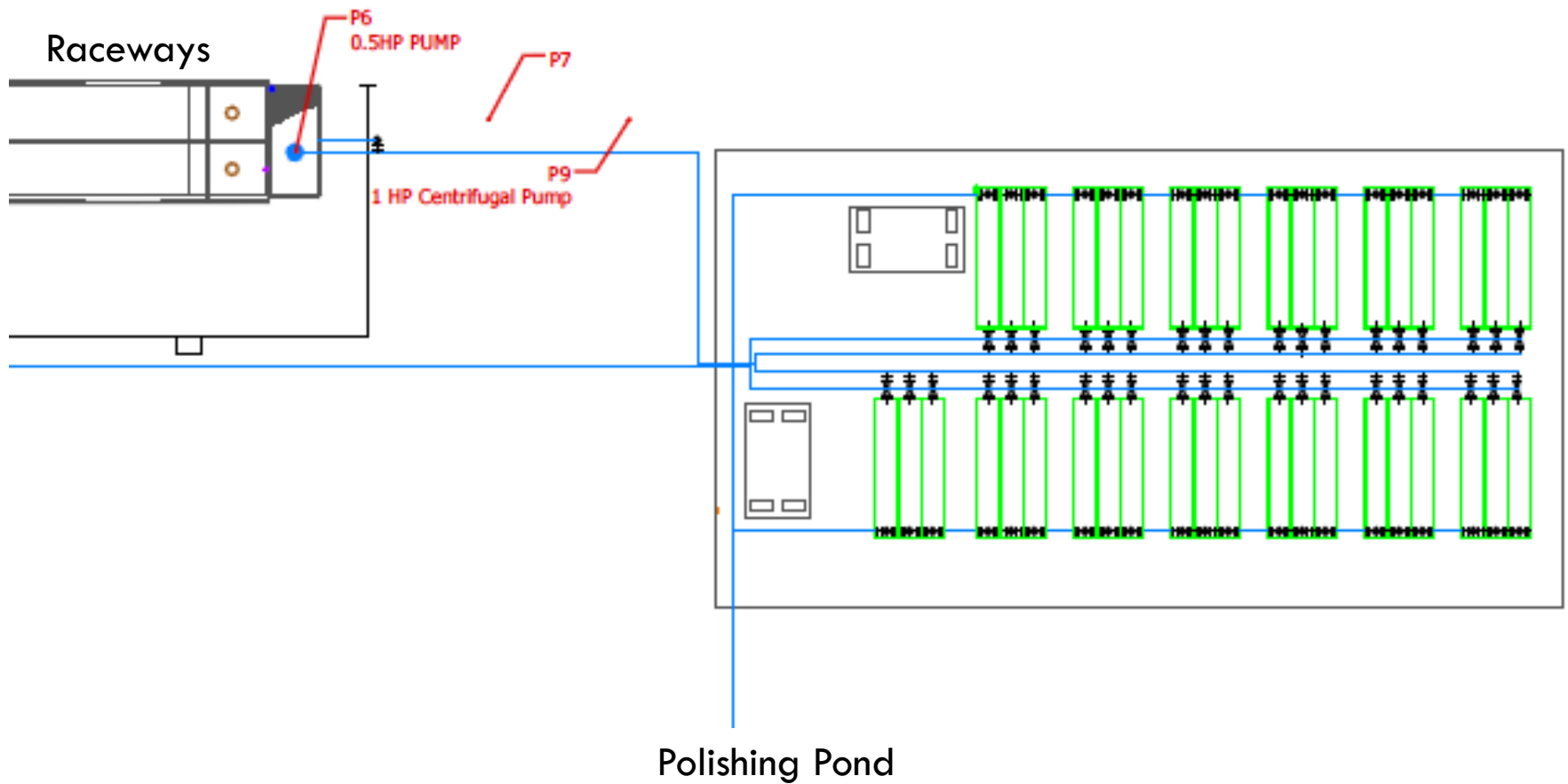
Water Quality Parameter	RMF Influent (Before Fish) <small>Buzby et al. 2010.</small>	RMF Effluent (After Fish) <small>Buzby et al. 2010.</small>	Factor	Recirculating system with Tilapia <small>Rakocy et al. 1997</small>
pH	6.8	6.8		7.2
Water Temperature C(F)	12.5	12.5		26.6
Total Ammonia Nitrogen (mg/L)	.01	.33	4.5	1.47
Nitrite (mg/L)	0.0	0.03		0.52
Nitrate (mg/L)	0.22	0.24	750	180
Phosphate (mg/L)	0.12	0.15	33	5.0
Calcium (mg/L)	23.4	24.1	1.7	43
Specific Conductance (μS/cm)	162	162	2.8	455

A close-up, top-down view of a dense field of watercress. The leaves are small, rounded, and have a vibrant green color. They are packed closely together, creating a textured surface. The lighting is bright, highlighting the natural sheen of the leaves.

Watercress

This idea was encouraged by the observation that watercress grows in this water source naturally and has been harvested in the early spring by local residents for many years.

Greenhouse



Greenhouse



Summer Crisp



Romaine (Flashy Black Trout)



Oakleaf (Garrison)



Lolla Rossa (Navidad)



Romaine Lettuce (Green Forest)



Oakleaf (Sulu)



Greenhouse



Aquaponic raft culture (greenhouse)

- Utilize high volume effluent from end of trout system.
- Spring flow, water temperature about 54 F (12 C).
- Channel water depth set at 6 inches.
- Speedling trays with vermiculite substrate float on the water surface.
- Plant seeds directly in the trays.
- No weeding or watering.
- Spring water cools plants in the summer and warms in the winter.

Red Sails Lettuce

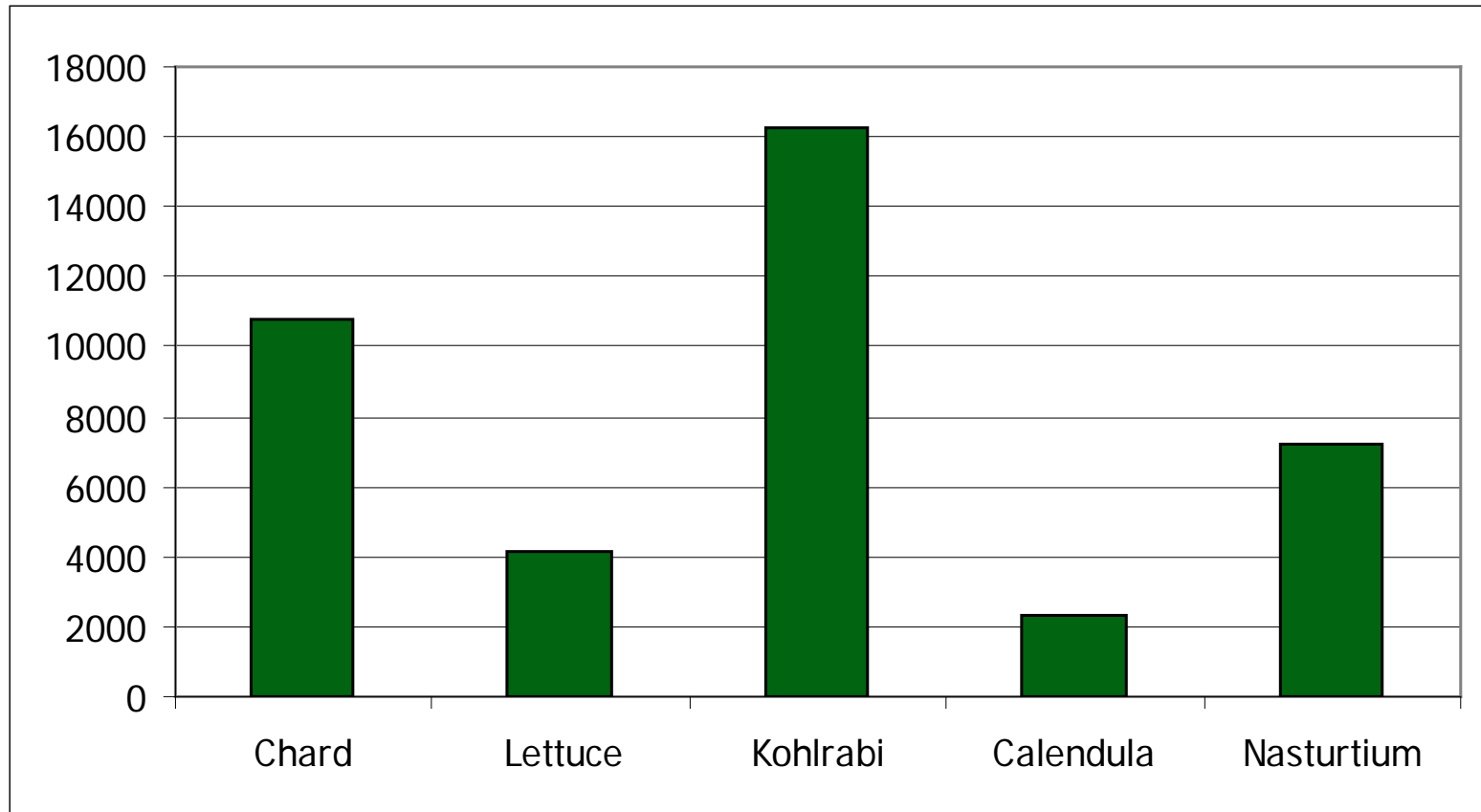


Kohlrabi



Total Channel Biomass (grams)

(Buzby et al 2010)

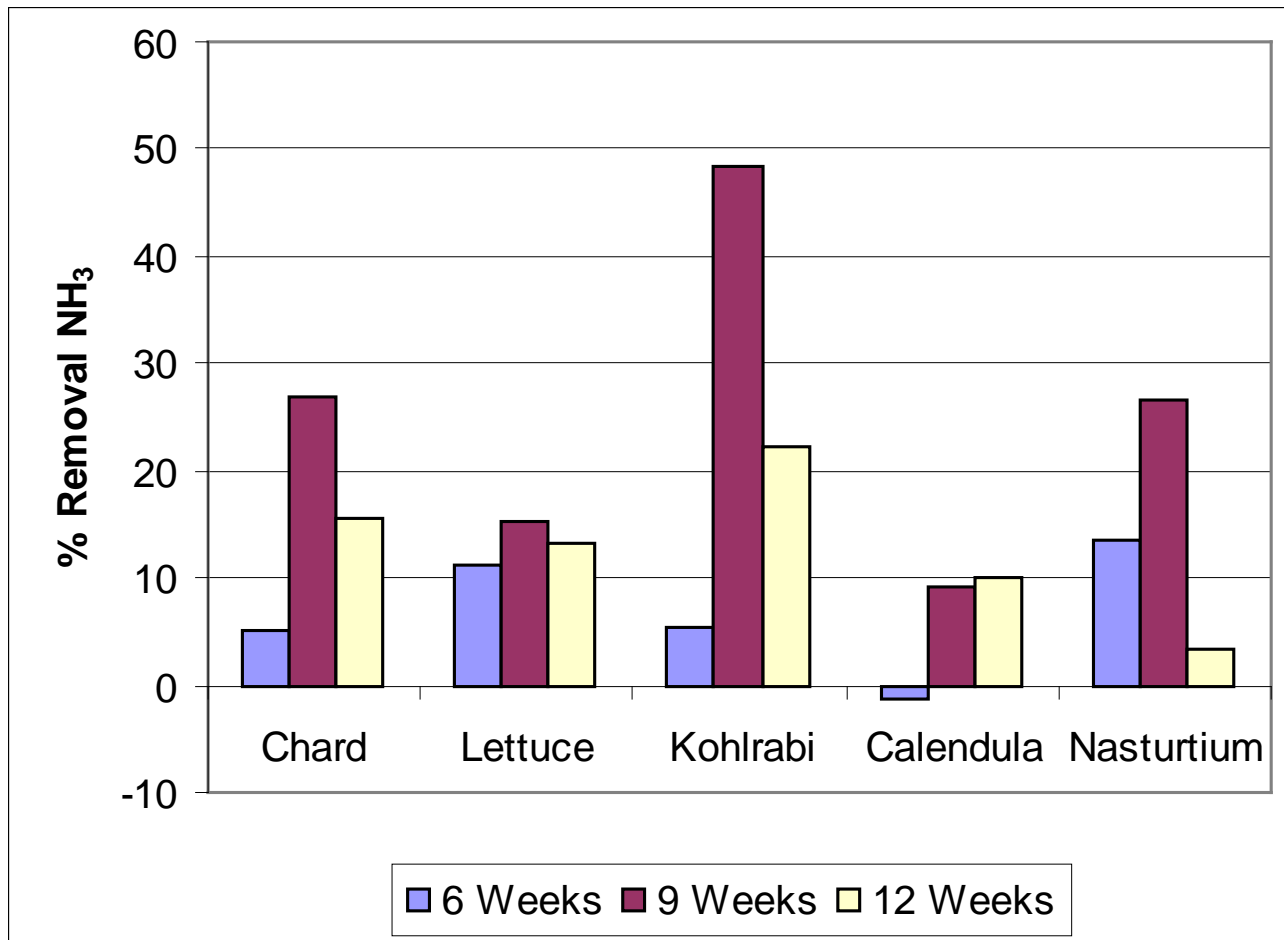


Total Biomass for each cultivar at 12 weeks.

Lettuce biomass reflects the sum of harvests at 6, 9 and 12 weeks.

Aquaponic Nutrient Removal

(Buzby et al 2010)

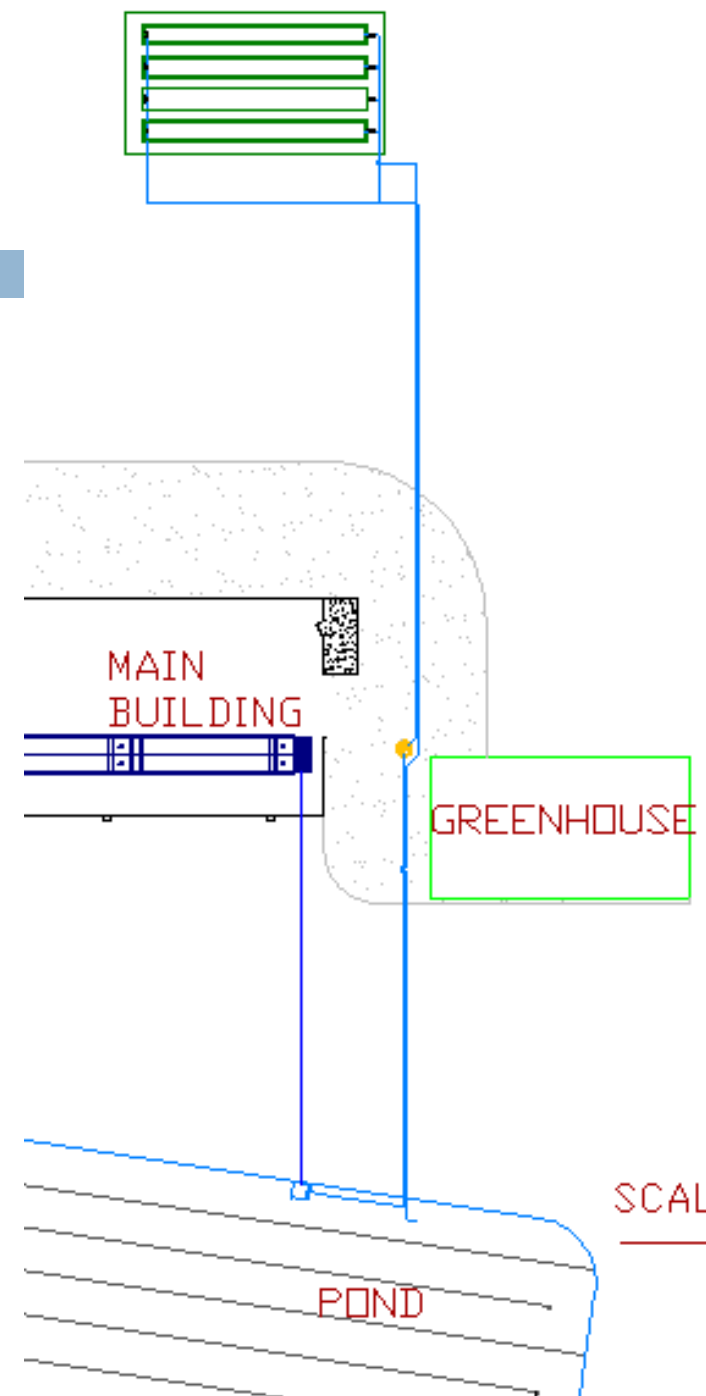


Useful concepts.

- Plants acquire nutrient when they are increasing biomass. Greater biomass increase results in greater nutrient removal from the system.
- Nutrient removal will vary with type of plant and its growth phase.
- Lettuce will utilize ammonia nitrogen directly.

High tunnel

- First season
- Channels 41" wide by 40 ft long
- Deliver flow of 20 gpm/channel
- 25 min/exchange @ 6" depth
- Production trial
 - ▣ Leaf Lettuce for an full year
 - ▣ Harvest and replace with newly planted trays.



Red Sails Leaf Lettuce



Red Sails (OG)

(*Lactuca sativa*)

Product ID: 431G

Vegetables > Lettuce



See Image Larger +

★★★★★ (1 review)

[Read 1 Review](#)

[Write a Review](#)

Standard red baby leaf.

Attractive, ruffled, fringed leaves of deep burgundy red over green. AAS winner. MT0-30. Organically grown. Avg. 400,000 seeds/lb. Packet: 500 seeds.

Plant Cycle: (A) Days to Maturity or Bloom: 27



OG



MT0-30

Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

[See #431N as a substitute](#)

Product

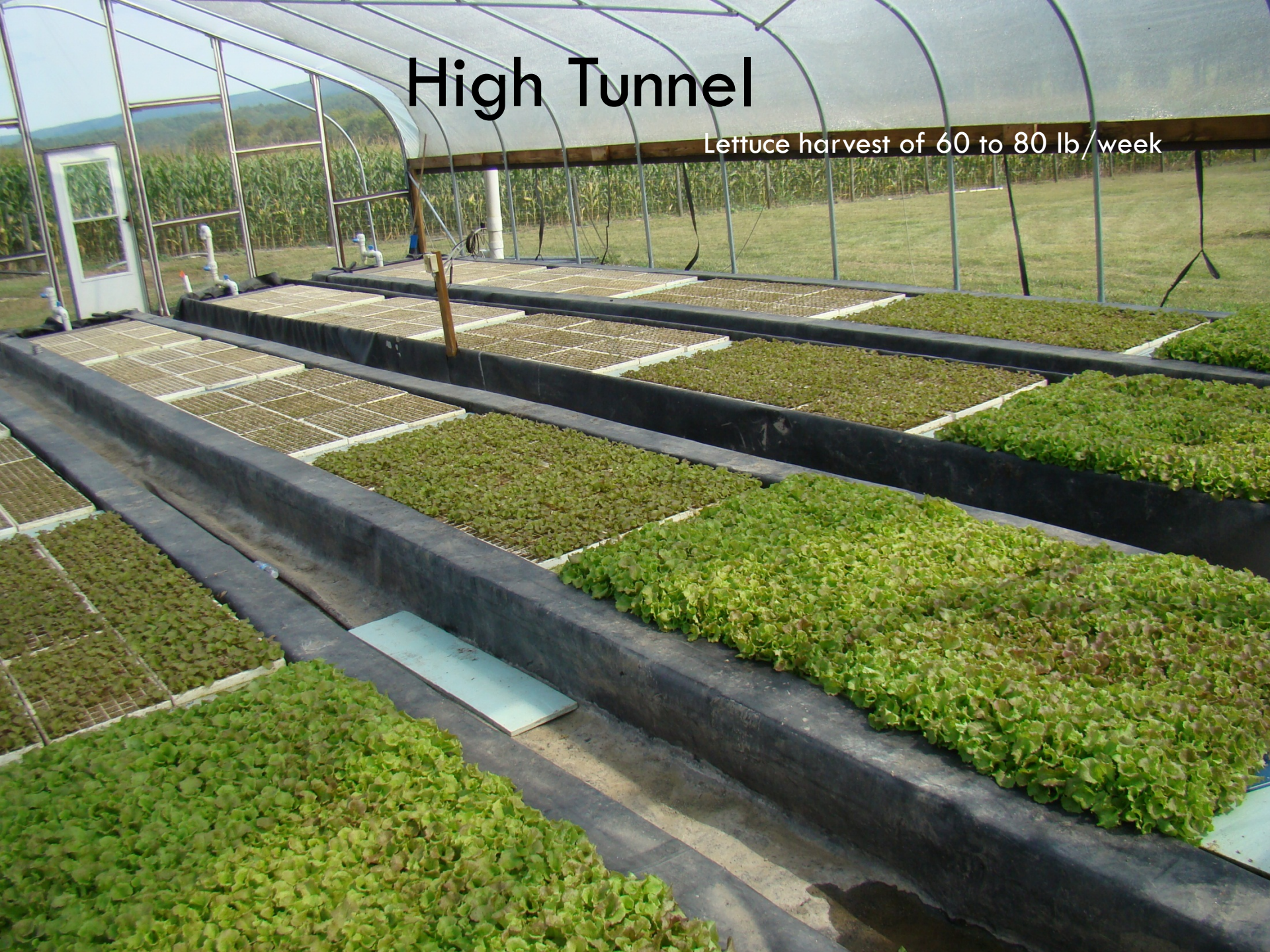
Packet

Price Quantity

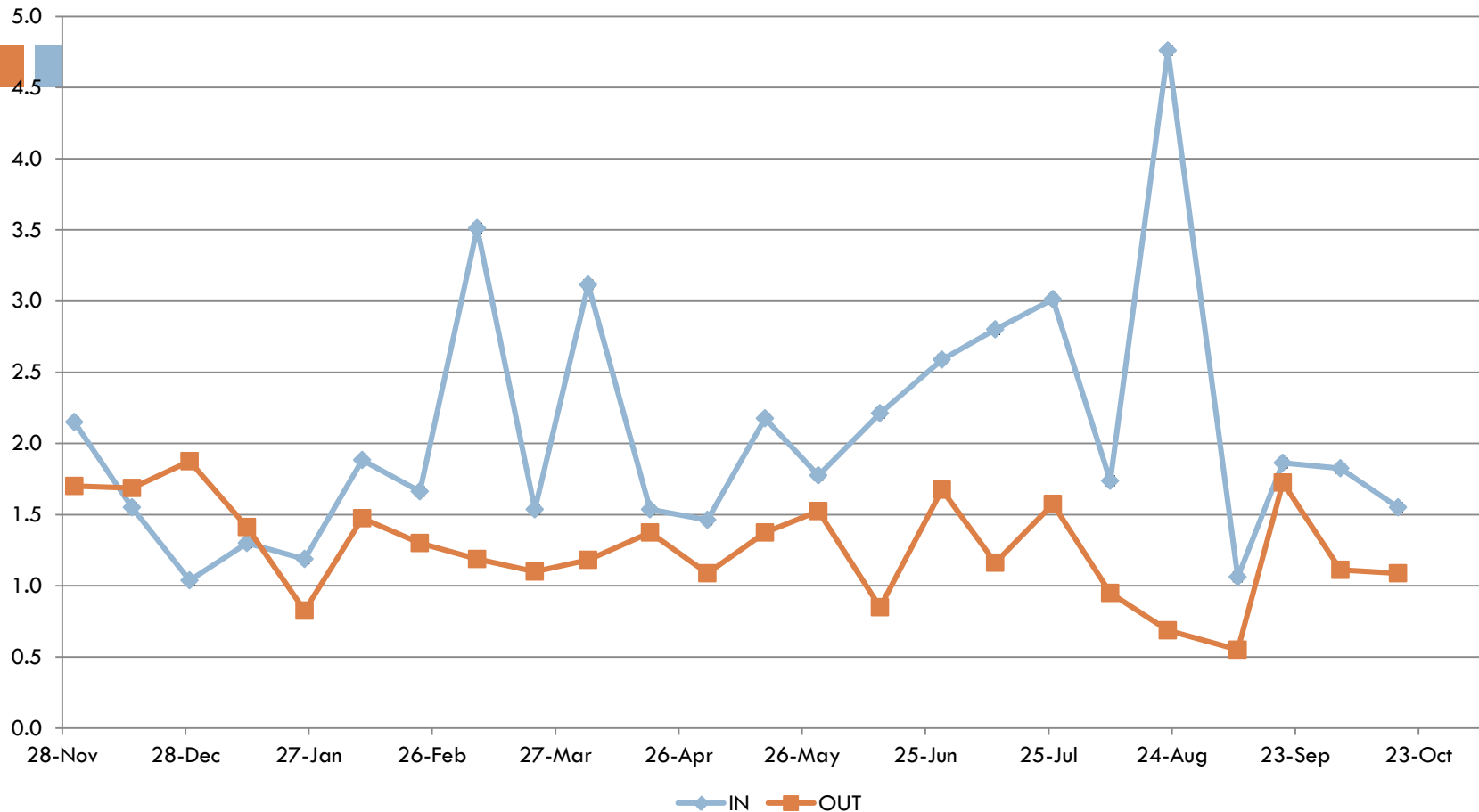
\$3.95

High Tunnel

Lettuce harvest of 60 to 80 lb/week



Total Suspended Solids



Mean Influent Concentration: 2.1 ± 0.9 mg/L

Mean Effluent Concentration: 1.3 ± 0.35 mg/L

Mean Removal : 38%

(Data courtesy of Karen Buzby)

DO change 0.2 mg/L
No change in water temp.

Second Season Screening plant varieties 2013

56" width 8" depth 46 minutes/exchange

Vermiculite, hi flow

Vermiculite, low flow

Vermiculite & FM
hi flow



Other salad Greens

Spring Raab

at 32 days



Spring Raab

(*Brassica rapa* (Ruvo Group))

Product ID: 137

[Vegetables](#) > Broccoli



[See Image Larger](#) +



(No reviews)

Be the first to [Write a Review](#)

Best for main season crops.

The most versatile broccoli raab variety for growing throughout the season. Especially for spring and summer harvest, and overwintering in mild climates. Big plant, relatively late maturity. Avg. 17,700 seeds/oz. Packet: 250 seeds.

Plant Cycle: (A) Days to Maturity or Bloom: 42



Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

Product

Packet

1 Ounce

Price Quantity

\$3.45

\$6.95

A close-up photograph of a dense patch of young arugula plants. The leaves are bright green, lobed, and have a slightly serrated edge. They are growing closely together, filling the frame. The lighting is bright, highlighting the texture of the leaves.

Arugula
at 33 days

Arugula (OG)

(*Eruca sativa*)

Product ID: 2891

Vegetables > Greens



See Image Larger +



(No reviews)

Be the first to [Write a Review](#)

The standard arugula.

Long, dark, lobed leaves are suitable for salad mix or bunching. White flowers with dark pink veins make attractive spicy additions to salad mixes. **Choose organic or nonorganic seeds.** Organically grown. Avg. 18,100 seeds/oz. Packet: 500 seeds.

Plant Cycle: (A) Days to Maturity or Bloom: 21 baby, 40 full size



Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

Product

Packet

Price

\$3.95

Quantity

Mustard (Red Splendor)

at 26 days





Red Splendor

Product ID: 3051

Large, dark red and green serrated leaves.

Moderately frilled leaves have a hot mustardy taste. Plants are very slow bolting. Red Splendor makes an excellent bunched mustard alone or combined with others such as Suehlihung and Green Wave. Avg. 21,700 seeds/oz. Packet: 250 seeds.

Quick Facts

Latin Name: Brassica juncea

Days to Maturity or Bloom: 21 baby, 45 full size

Plant Cycle: (A)

Product Symbols:



Mustard (Suehlihung no 2)

at 26 days



Suehlihung No. 2

(Brassica rapa (Japonica group))

Product ID: 2458

Vegetables > Greens



See Image Larger +

★★★★★ (No reviews)

Be the first to [Write a Review](#)

Versatile Green Wave-type with serrated leaves.

Medium-green plants are well-branched and slow bolting. Harvest from micro to baby leaf to full-size bunched mustard greens. Avg. 454,000 seeds/lb. Packet: 250 seeds.

Plant Cycle: (A) Days to Maturity or Bloom: 21 baby, 45 full size



Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

Product	Price	Quantity
Packet	\$3.45	<input type="text"/>
1 Ounce	\$6.45	<input type="text"/>

Kale (Toscano)



Toscano (OG)

(*Brassica oleracea*)

Product ID: 2123G

Vegetables > Kale



See Image Larger +



(2 reviews)

[Read 2 Reviews](#)

[Write a Review](#)

Italian heirloom.

Lacinato or "dinosaur" type. Unique leaf type: extra-dark green, noncurled but heavily blistered (savoyed). Rich, tender leaves have a softer texture than curly green kales. Tolerant of hot and cold weather. Tested for Black Rot. **Unsize seed.** Organically grown. Avg. 150,000 seeds/lb. Packet: 100 seeds.

Plant Cycle: (A) Days to Maturity or Bloom: 30 baby, 65 mature



Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

Product

Price Quantity

Packet

\$3.95

1 Ounce

\$11.25

1/4 Pound

\$26.25

Minutina
at 27 days



Minutina

(*Plantago coronopus*)

Product ID: 2016

Vegetables > Greens



[See Image Larger +](#)



(No reviews)

Be the first to [Write a Review](#)

Especially for winter salads.

A cold-hardy salad plant for fall, winter, spring, and summer production. Small plants with rosettes of slender green leaves. Adds a crunchy texture to salads without fiber. Flower buds are edible. Re-grows after cutting, but succession sow for best quality and appearance. Sow about 30 seeds/ft., covering 1/4" or sow in plugs and transplant; thin to 4-6" apart if desired. Avg. 93,500 seeds/oz. PKT: Avg. 500 seeds, sows 20'. Packet: 500 seeds.

Plant Cycle: **(A)** Days to Maturity or Bloom: **50**



Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

Product	Price	Quantity
Packet	\$3.45	<input type="text"/>
1 Ounce	\$8.15	<input type="text"/>



Herbs

Cilantro (Santo)

at 53 days



Santo

(*Coriandrum sativum*)

Product ID: 919

Herbs > Cilantro/Coriander



See Image Larger +



(No reviews)

Be the first to [Write a Review](#)

Standard cilantro.

Santo is a slow-bolting selection grown for its leaves. Direct seed every two weeks for a continuous supply of fresh leaves. Avg. 2,000 seeds/oz. Packet: 200 seeds.

Plant Cycle: (A) Days to Maturity or Bloom: 50-55 to leaf harvest, 90-105 to seed



Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

Product

Packet

Price

\$3.45

Quantity

Lovage

at 62 days



Lovage

(*Levisticum officinale*)

Product ID: 927

Herbs > Lovage



See Image Larger +



(1 review)

[Read 1 Review](#)

[Write a Review](#)

Specialty culinary herb.

Young leaves taste like celery and are used in spring tonic salads and with potato and poultry dishes.

Medicinal: Aromatic stimulant; warming digestive tonic. Roots have similar activity to "Dong Quai". 90 days to harvest when started indoors. Avg. 8,700 seeds/oz. Packet: 200 seeds.

Plant Cycle: **(P)** Days to Maturity or Bloom: **90**

In stock

Product	Price	Quantity
Packet	\$3.45	<input type="text"/>
1/2 Ounce	\$7.15	<input type="text"/>

Persian Cress

at 32 days



Persian Cress (OG)

(*Lepidium sativum*)

Product ID: 2779G

Vegetables > Greens



(1 review)

[Read 1 Review](#)

[Write a Review](#)



[See Image Larger +](#)

Mild cress flavor.

Mild flavor and alternative leaf shape can be used as an addition to salad mixes or soups. 2-6" long, dark green, strap leaves with serrated margins.

Organically grown. Avg. 200,000 seeds/lb. Packet: 250 seeds.

Plant Cycle: (A) Days to Maturity or Bloom: 21



Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

Product

Packet

1 Ounce

Price Quantity

\$3.45

\$7.65

Sorrel
at 37 days



Sorrel

(*Rumex acetosa*)

Product ID: 383

Vegetables > Greens



(No reviews)

Be the first to [Write a Review](#)



[See Image Larger +](#)

Bright, lemon flavor.

Produces some of the earliest greens of spring and the latest of fall. The tender, fresh green leaves grow to about 8" long and have an intense lemony flavor. Use sparingly in salads or generously in soups and sauces, especially with fish. French type. Perennial in Zones 4-9.

Choose organic or nonorganic seeds. Avg. 30,000 seeds/oz. Packet: 250 seeds.

Plant Cycle: **(TP)** Days to Maturity or Bloom: **35**
baby, 60 full size



Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

Product

Packet

1 Ounce

Price Quantity

\$3.45

\$6.50

Cutting Celery

at 50 days



Cutting Celery

(*Apium graveolens* var. *secalinum*)

Product ID: 922

Herbs > Cutting Celery



★★★★★ (No reviews)

Be the first to [Write a Review](#)

Leafy herb with bold celery flavor.

Use fresh in salads, cooked in soup, stew, and mixed vegetables. 80-85 days to harvest when started indoors. Avg. 69,500 seeds/oz. Packet: 200 seeds.

Plant Cycle: (A) Days to Maturity or Bloom: 80-85

M S

Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

Product	Price	Quantity
Packet	\$3.45	<input type="text"/>
1/2 Ounce	\$4.25	<input type="text"/>

Green Shiso

at 48 days



Green Shiso

(*Perilla frutescens*)

Product ID: 948

Herbs > Shiso



(No reviews)

Be the first to [Write a Review](#)

Spicy Oriental favorite.

Distinct cinnamon/clove flavor and aroma, with the spiciness of cumin. Used in oriental cooking, sushi and salad mix. **Choose from red- or green-leaved varieties.** 80-85 days to harvest. Avg. 27,000 seeds/oz. Packet: 200 seeds.

Plant Cycle: (A) Days to Maturity or Bloom: 80-85



Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

Product

Packet

Price Quantity

\$3.45



Asian Greens

Mizuna



Mizuna (OG)

(*Brassica rapa* (Japanese group))

Product ID: 2883

Vegetables > Greens



See Image Larger +



(1 review)

[Read 1 Review](#)

[Write a Review](#)

Essential salad mix ingredient.

Unique mustard green of Japanese origin. Mizuna produces dozens of pencil thin white stalks with deeply cut, fringed leaves. Mild flavor. Continues to produce for several weeks from one planting as a cut and come again product. Organically grown. Packet: 250 seeds.

Plant Cycle: (A) Days to Maturity or Bloom: 21 baby, 40 full size



Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

Product

Packet

1 Ounce

Price Quantity

\$3.45

\$5.95



Red Rain
at 27 days

Red Rain (F1)

(*Brassica juncea*)

Product ID: 2510

Vegetables > Greens



★★★★★ (No reviews)

Be the first to [Write a Review](#)

Dark red Mizuna-type mustard.

Deeply toothed leaves are similar in appearance to a mustard but with a mild rather than hot taste. Excellent for full size bunching or baby leaf. Holds well. Avg. 225,000 seeds/lb. Packet: 250 seeds.

Plant Cycle: (A) Days to Maturity or Bloom: 21 baby, 40 full size



Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

Product

Packet

Price Quantity

\$3.45

Tokyo Bekana

at 32 days



Tokyo Bekana

(*Brassica rapa (Chinensis group)*)

Product ID: 2251

Vegetables > Greens



See Image Larger +



(2 reviews)

[Read 2 Reviews](#)

[Write a Review](#)

Mini Chinese cabbage for bunching or baby leaf.

Bright, light green leaves are curly and ruffled leaves add loft and weight to salad mixes. Regrows for multiple cuttings. At full size, tender ruffled leaves on narrow white petioles can be sold as a bunched green. Thin to 4-6" for full-size heads for bunching. Packet: 250 seeds.

Plant Cycle: **(A)** Days to Maturity or Bloom: **21 baby, 45 full size**



Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

Product

Packet

1/2 Ounce

Price Quantity

\$3.45

\$8.25

A photograph of a hydroponic garden with three rows of leafy greens. The plants are growing in white channels separated by grey concrete blocks. The background shows a grassy area and a metal fence. The text "at 27 days" is written in yellow in the center of the image.

at 27 days

Tokyo Bekana

Mizuna

Red Rain

Shungiku

at 32 days



Shungiku

(*Glebionis coronaria*)

Product ID: 514

Vegetables > Greens

★★★★★ (No reviews)

Be the first to [Write a Review](#)



[See Image Larger +](#)

Aromatic, edible chrysanthemum greens.

Cut greens when about 4-8" tall for a flavorful addition to salads, vegetables, pickles, and sushi. Plant more thickly than other greens. Small orange and yellow chrysanthemum flowers appear later on unharvested plants. This is the preferred "fine" or "small" leaf strain. Avg. 17,500 seeds/oz. Packet: 250 seeds.

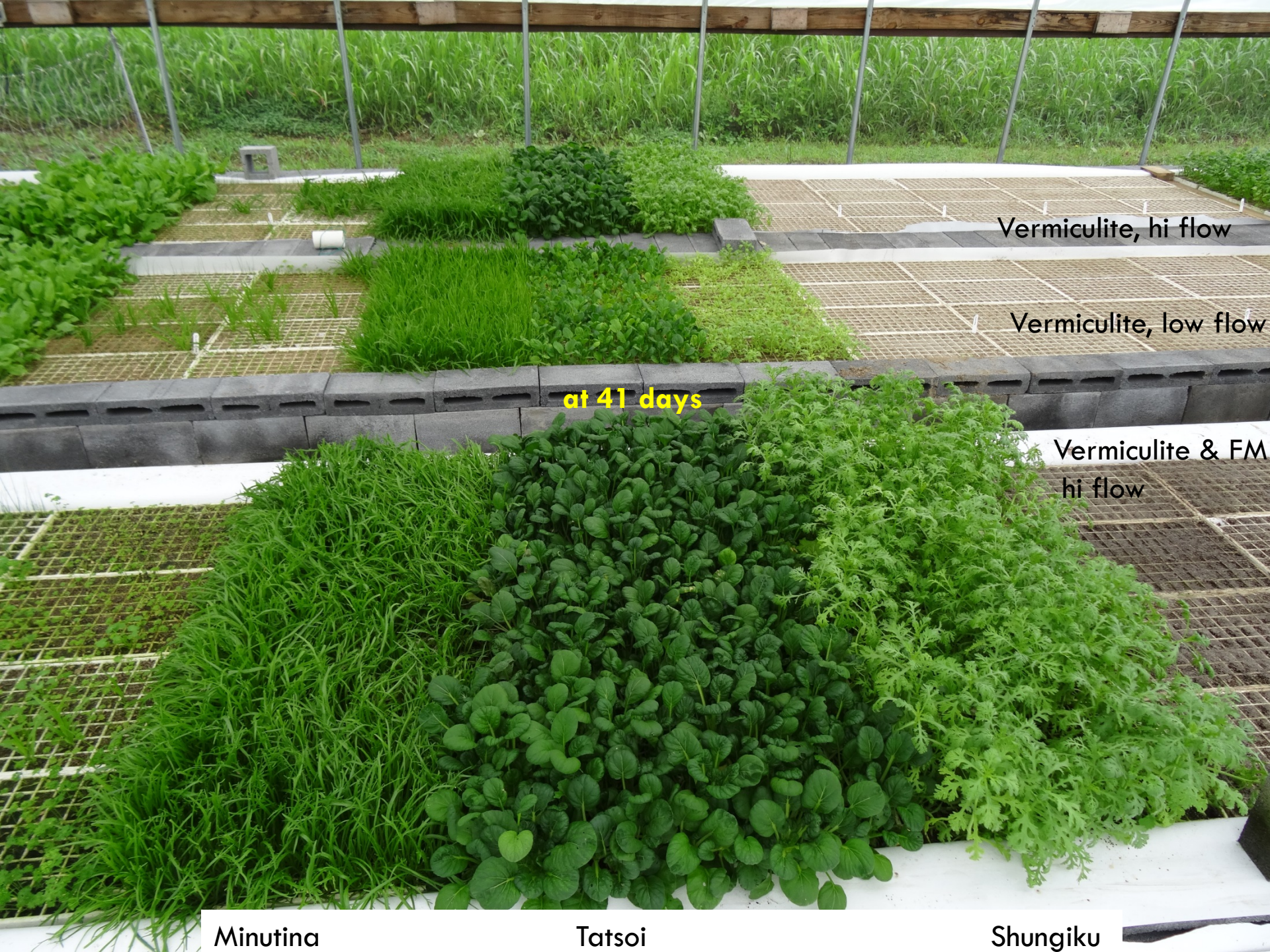
Plant Cycle: (A) Days to Maturity or Bloom: **21 baby, 45 full size**



Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

Product	Price	Quantity
Packet	\$3.45	<input type="text"/>
1 Ounce	\$5.95	<input type="text"/>



Vermiculite, hi flow

Vermiculite, low flow

at 41 days

Vermiculite & FM
hi flow

Minutina

Tatsoi

Shungiku

Tatsoi (OG)

(*Brassica rapa* (Narinosa group))

Product ID: 2897

Vegetables > Greens



See Image Larger +



(1 review)

[Read 1 Review](#)

[Write a Review](#)

Smooth leaves for salad mixes.

Leaves form a compact, thick rosette. Long harvest period. Mild flavor for salads, stir-fries, etc. Thin to 6-8" apart for full-sized rosettes. Unique and easy to grow. NOTE: Suitable for late spring through autumn sowing. Spring sowings should be made after last frost date to eliminate risk of premature bolting. Organically grown. Packet: 250 seeds.

Plant Cycle: (A) Days to Maturity or Bloom: 21 baby, 45 full size



Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

Product

Packet

1 Ounce

Price Quantity

\$3.45

\$5.95

Summerfest Komatsuna

at 32 days



Summerfest Komatsuna (F1)

(*Brassica rapa* (Perviridis group))

Product ID: 323

Vegetables > Greens



(No reviews)

Be the first to [Write a Review](#)



.....

Mild, tender greens.

Japanese greens for salad and braising mixes. Uniform, upright plants with slender, fleshy, rounded green stems and dark green, rounded leaves. Good heat tolerance. Packet: 250 seeds.

Plant Cycle: (A) Days to Maturity or Bloom: 35



Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

Product

Packet

1/4 Ounce

Price Quantity

\$3.45

\$9.35

Vitamin Green

at 32 days



Vitamin Green

(*Brassica rapa (Narinosa group)*)

Product ID: 392

Vegetables > Greens



See Image Larger +

★★★★★ (No reviews)

Be the first to [Write a Review](#)

For salad mix and bunching.

An entirely different and delicious leafy green brassica crop. Band-sow thickly for baby leaf mix. For bunching, mature leaves, avg. 12" x 4", are smooth and brilliantly deep green. The plants are slow-bolting and will grow for a second harvest. The tender leaves are flavorful, but not at all mustardy. Tolerant to both cold and heat. Avg. 12,750 seeds/oz. Packet: 250 seeds.

Plant Cycle: **(A)** Days to Maturity or Bloom: **21 baby, 45 full size**



Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

Product	Price	Quantity
Packet	\$3.45	<input type="text"/>
1/2 Ounce	\$8.25	<input type="text"/>

Red Radish (Rover)

at 35 days



Rover (F1)

(*Raphanus sativus*)

Product ID: 664

Vegetables > Radish



See Image Larger +

★★★★☆ (3 reviews)

[Read 3 Reviews](#) | [Write a Review](#)

Extra early radish.

Rover is extra early, holds well in the field, and has less of a tendency to produce oval radishes under heat stress than other varieties. The smooth, dark red roots are extremely uniform and attractive with crisp, white flesh. Very widely adapted. Rover is our best round red radish. Avg. 40,000 seeds/lb. Packet: 250 seeds.

Plant Cycle: (A) Days to Maturity or Bloom: 21



Learn more in the 'Symbols Explained' and 'Diseases Resistance' tabs!

In stock

Product	Price	Quantity
Packet	\$3.45	<input type="text"/>

Considering the available water flow:

Estimating Production Capacity

with

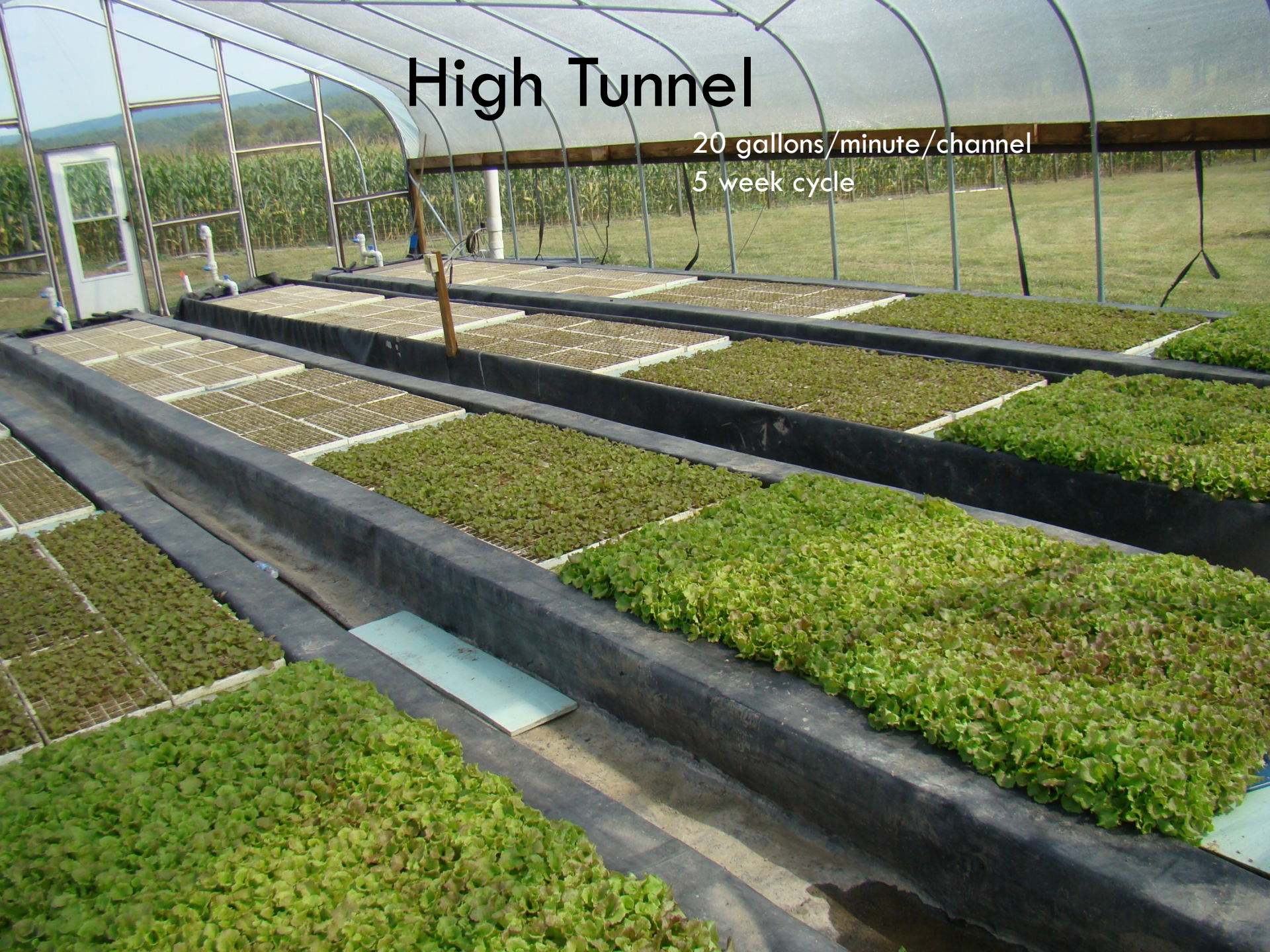
Red Sails

Leaf Lettuce

High Tunnel

20 gallons/minute/channel

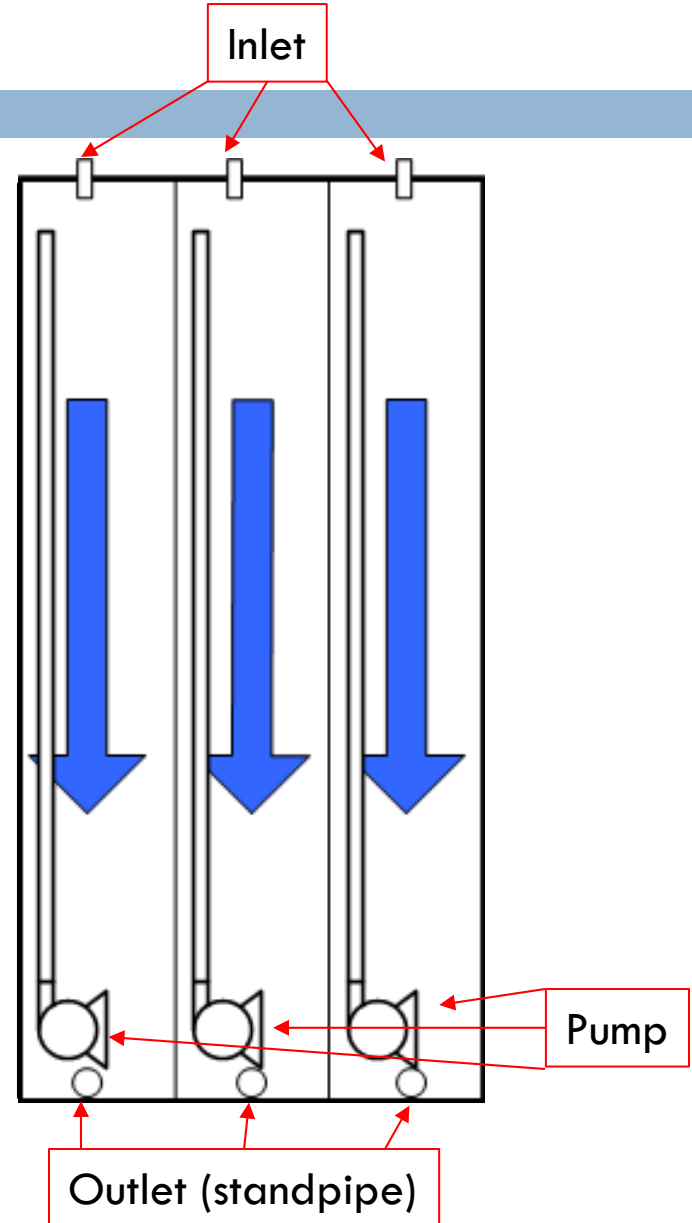
5 week cycle



Quantifying Nutrient Removal

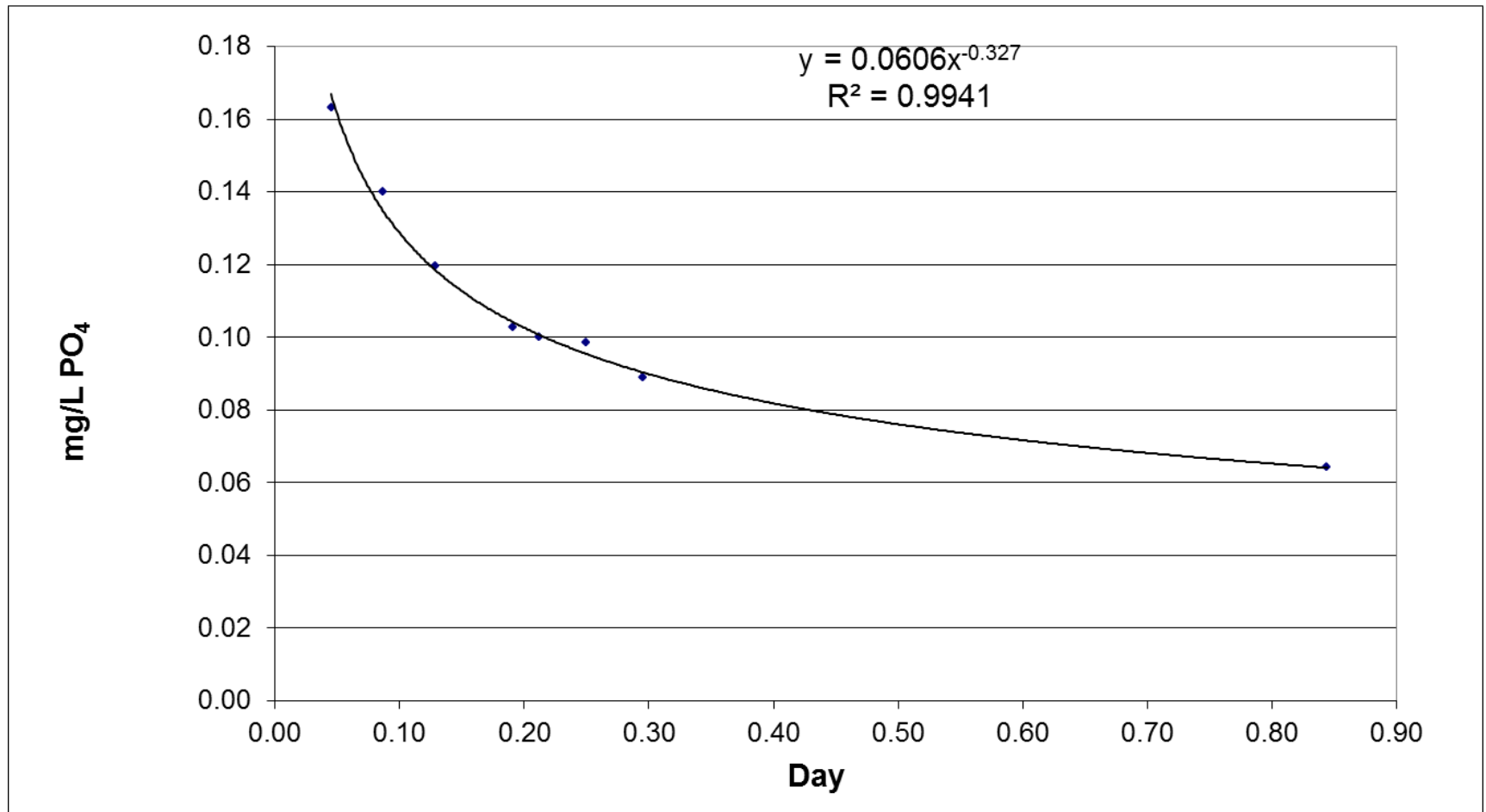
(from Buzby & Lin 2014)

- Unfiltered raceway effluent flows in at the top of the channel, through the channel under rafts supporting plants, and flows out a standpipe at the end of the channel.
- When quantifying nutrient removal, the raceway effluent was turned off and a pump was placed at the end of the channel. Water was pumped to top of the channel creating a recirculating system.
- Samples were taken at $\frac{1}{2}$ to 1 hour intervals for up to 4 hours.



Removal of soluble phosphate

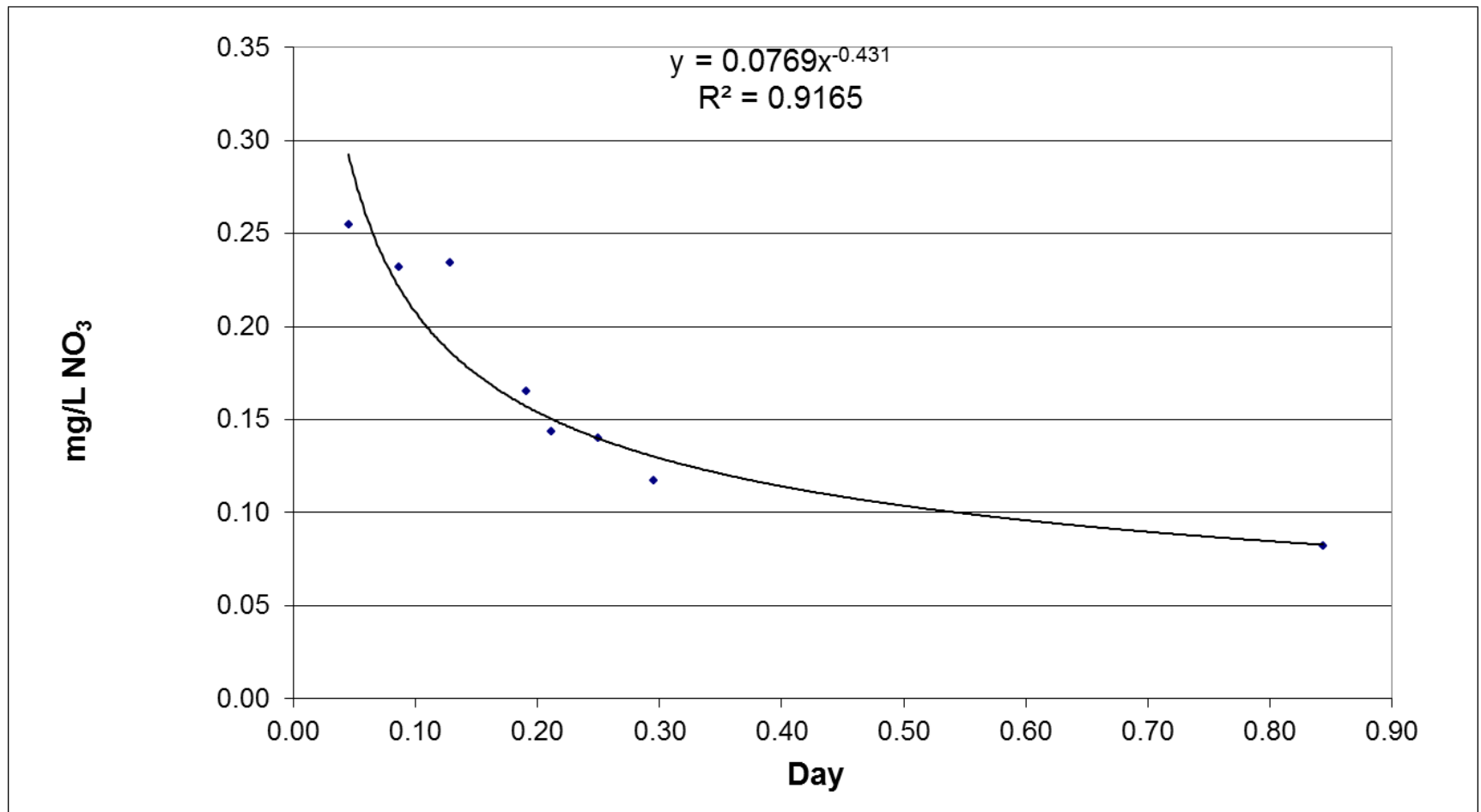
(red sails lettuce)



(Buzby et al. 2011)

Removal of soluble nitrate

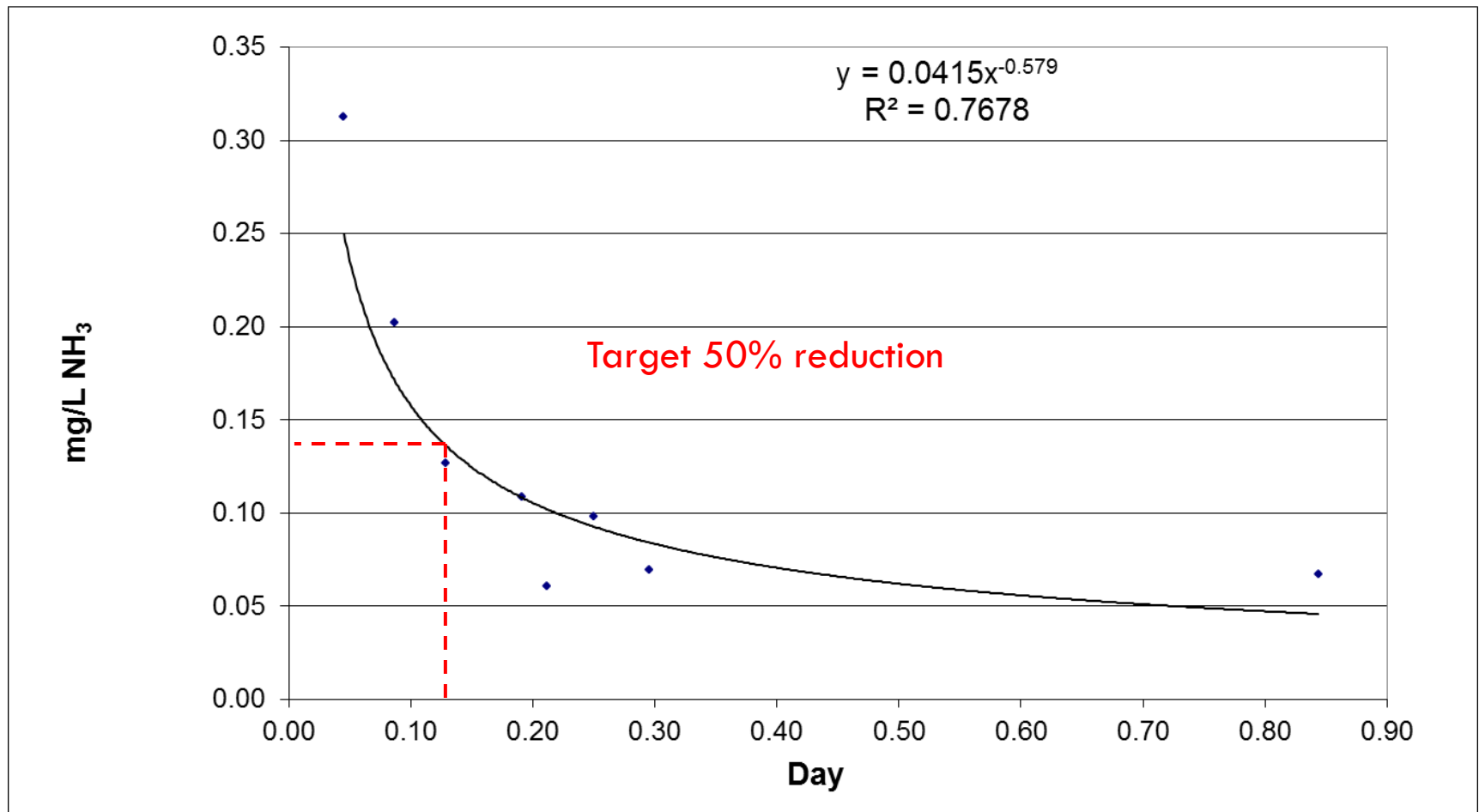
(red sails lettuce)



(Buzby et al. 2011)

Removal of soluble ammonia nitrogen

(red sails lettuce)



(Buzby et al. 2011)

Channel 160 feet long

(0.13 days, 200 ft High tunnel)

Input:						
	20	gallons/minute	2.67	cu ft/minute		
	0.33	gallons/second	0.04	cfs		
	15	seconds to fill a 5 gallon bucket				
Channel Dimensions:						
	41	Inches wide	3.42	ft		
	11	inches deep	0.92	ft		
	160	ft long	3.13	sq ft		
			501.1	cubic ft		
	187	minutes/exchange				
	0.32	exchanges/hour				
	0.0142	ft/second average velocity in the channel				

Estimate Nutrient Removal

Apply Equations featured above for each of the nutrient categories:

Nutrient	slope	exp	Target minutes/ exchange	Time (days)	Nutrient concentration out (mg/l)	Initial nutrient concentration (mg/L)	Change (mg/L)	Change (%)
Ammonium	0.0415	-0.579	187	0.13	0.1353	0.32	0.18	58%
Nitrate	0.0769	-0.431	187	0.13	0.1854	0.25	0.06	26%
Phosphate	0.0606	-0.327	187	0.13	0.1181	0.16	0.04	26%
Suspended Solids								38%

Using same basic format, but increase high tunnel length

Using same basic format, but increase high tunnel length

[illegible]

Estimating annual revenue potential for Reymann Memorial Farm

- Trout production – 20,000 lb @\$2/lb = \$40,000
 - ▣ Flow-through, 350 gpm
 - ▣ 4 levels, paired tanks.
 - ▣ Gravity flow, aeration only
- Plant production – 40,000 lb @\$3/lb = \$120,000
 - ▣ 228 day season (3/1 to 10/15)
 - ▣ Flow-through raft system.
 - ▣ 4 High tunnels 200 ft by 30 ft. (0.55 acre)
- Changes the jobs picture for a small operation

Production and Crop Revenue

Crop	Growing period		lb/yd ² /wk	Price/lb	\$/yd ² /wk	Relative to Red Sails
	Days	(wks)				
Red Sails loose leaf lettuce from seed	35	(7.0)	1.6			
Kohlrabi	84	(12)	3.0			
Swiss Chard	84	(12)	1.5			
Komatsuna	50	(7.1)	3.0			
Red Radish (whole plant)	54	(7.7)	2.5			
Transplanted Bibb lettuce plug. (common practice)	28	(4.0)	2.0			

Crops other than lettuce.

- How much can you sell?
- What price is associated with each crop?
- Given production and price, potential revenue/unit area/unit time may be higher than for the primary crop.
- Developed a software tool using seasonal production data to allocate production area to maximize revenue/area/time.

Production and Crop Revenue

Crop	Growing period Days (wks)		lb/yd ² /wk	Niche Market Price/lb	\$/yd ² /wk	Relative to Red Sails
Red Sails loose leaf lettuce from seed	35	(7.0)	1.6	6.00 ?	9.60	100%
Swiss Chard	84	(12)	1.5	4.00 ?	9.00	93%
Komatsuna	50	(7.1)	3.0	6.00 ?	18.00	188%
Transplanted Bibb lettuce plug. (common practice)	28	(4.0)	2.0	6.00 ?	12.00	125%

Conclusions

- ❑ Cold flowing water system producing trout can support production of a variety of leafy greens and herbs.
- ❑ Deep water raft culture may reduce TSS and remove soluble nitrogen even at low levels.
- ❑ Experimental plant production was 1 to 3 lb/yd²/week for various crops.
- ❑ Value of estimated production of both fish and plants for RMF increased by a factor 3 or more.
- ❑ Must yet validate numbers in a full scale system.

M L Aquaponics, Quebec

(<http://www.cultures-aquaponiques.com/index.htm>)

- Marc Laberge grows rainbow trout and lettuce in a **recirculating system**. He sells about \$1000 worth of smoked trout a week and 6,800 heads of lettuce.
- Trout is sold as smoked trout fillets to restaurants in the region. Both hot-smoked and cold-smoked varieties are produced each week.
- Since its first sales in June 2005, his company has produced over 2.6 million heads of lettuce and has firmly staked its share of the Quebec Boston lettuce market despite having the world's largest traditional chemical hydroponic lettuce producer only half an hour away.





Citations.



Buzby, K. M., T. West, X. Wei, and K. Semmens. 2010. Integration of Aquaponics into a Flow-through Fish Culture System Improves Water Quality. Abstract and Poster. American Fisheries Society 2010 Annual Meeting, 9/13-16, Pittsburgh PA.

Buzby, K. M., X. Wei, and K. Semmens. 2011. A procedure to optimize the size of a flow-through aquaponics system. Abstract. Aquaculture America 2011, 2/28 – 3/3, New Orleans, LA.

Buzby, K.M., and L.S. Lin, 2014. Scaling aquaponic systems: Balancing plant uptake with fish output. Aquacultural Engineering 63 (2014) 39-44.

Rakocy, J E, D S Bailey, K A Shultz, and W M Cole, 1997. Evaluation of a Commercial-Scale Aquaponic Unit for the Production of Tilapia and Lettuce. University of the Virgin Islands, Agricultural Experiment Station, St. Croix, U.S. Virgin Islands.

Questions, Comments ?



Aquaculture Research Center
103 Athletic Road
Frankfort, Kentucky 40601
www.ksuaquaculture.org

Ken Semmens, Ph.D.

*Assistant Professor in Aquaculture
Division of Aquaculture
& Land Grant Program
KSU's Program of Distinction*

(502) 597-6871


Fax: (502) 597-5088

ken.semmens@kysu.edu



Inspiring Innovation. Growing Leaders. Advancing Kentucky.

Eat fish twice a week

- 
- This material is based on work supported by
 - the Cooperative State Research Education and Extension Service, U.S. Department of Agriculture under agreement
 - number 2008-34601-19205, 2009-34386-20055,
 - and 2010-34386-21745. Any opinions, findings,
 - conclusions, or recommendations expressed in this presentation
 - are those of the authors and do not necessarily reflect the view
 - of the U.S. Department of Agriculture.

**It's the healthy
thing to do**