



# Tangerini's Spring Street Farm



## Tangerini's Farm

- 40 acres in production
- Primarily organic with the exception of sweet corn and apples.
- CSA (almost year-round)
- Farm Stand and Nursery from May 1-October 31.
- Ice Cream Shop
- Farmers' Market
- U-Pick Opportunities
- Various Events



Last Day  
Of  
School  
Concert at the Farm



Pesto Making  
Afternoon



Summer Camp  
T-Shirts



Fall Hayrides



Summer Camp  
Watermelon Spitting



Halloween Party  
In the  
Greenhouse



U-Pick Flowers



Lots of U-Pick  
Vegetables and Fruits



Field Trips



# Problem

- Out Grew 7' x 15' Walk In Cooler(Summer)
- Even Out Seasonal Work Load(Peaks and Valleys)
- Winter CSA vs. Winter Farmers' Markets
- Increase Profitability with minimal hours.
- Quality of Life
- Where do we start?

A black sign with white text that reads "Winter Shares Available". The sign is mounted on a wooden structure, possibly a chair or a bench, with wooden slats visible in the background. The sign is framed by a thin white border.

# Winter Shares Available

## Things to Consider

- Kind of Structure- Could we use existing buildings.
- What are we going to store?
- How much do we want to store?
- Storage Requirements
- Energy Requirements
- Energy Costs
- Refrigeration
- APR
- Access
- Cost
- Quality of Life









# What's in Storage?





More to Store

# How Much Storage Is Needed?

Winter Shares 169  
 Deep Winter 116

Winter Distribution 2012-2013

	3-Nov	17-Nov	1-Dec	15-Dec	29-Dec	12-Jan	26-Jan	9-Feb	23-Feb	9-Mar	Total	Amt Harvested
Arugula												0
Baby Bok												0
Beets	2	2	2	2	2	2	2	2	2	2	2850	4735
Bok Choy	0.5	0	0	0	0	0	0	0	0	0	84.5	98
Broccoli	0.75	0.75									253.5	310
Broccoli Rabe												0
Brussel Sprout Tops	0	0	4	4	0	0	0	0	0	0	1352	0
Brussel Sprouts	0	1	1	1	1						676	40
Cabbage	1	1	1	1	1	1	1	1	1	1	1425	900
Carrots	2	2	2	2	2	2	2	2	2	2	2850	4800
Cauliflower						1	1	1	1	1	580	0
Celeriac	0	0	0	0	0	1	0	1	0	1	348	480
Chinese Cabbage	1										169	382
Cilantro												0
French Fingerlings				1		1	1	1	1	1	749	800
Kale			1	1		1	1	1	1	1	918	30
Leeks			1	0	0	0	0	0	0	0	169	75
Lettuce Mix												0
Mustard Greens												0
Onions	2		2	2	2	2	2	2	2	2	2512	9000
Parsnips		1	2	2	2	2	2	2	2	2	2443	3100
Turnip,Purple		2		2		2	2	2	2	2	1836	1500
Turnip,H	0.5										84.5	135
Radishes	0.5	1	0	0	0	0	0	0	0	0	253.5	135
Red Cabbage												0
Red Potato												0
Russian Banana						1		1	1	1	464	1000
Rutabaga	0	0	0	0	2	2	2	2	2	2	1498	1000
Salad Mix	0.5	1									253.5	0
Scallion	0		0	0	0	0	0	0	0	0		15
Shallots					0.5	0.5		0.5		0.5	258.5	500
Spinach												0
Sweet Potato	3	4	4	4	4	4	0	0	0	0	3675	6000
Swiss Chard	0.5										84.5	80
Tokoyo Bekana	0	0	0	0	0	0	0	0	0	0	0	0
White Potato	4	3	4	3	4	4	4	4	4	4	5362	10000
Winter Radish	1	0	1	1	1	1	1	1	1	1	1256	1000
Winter Squash	6	6	6	6	6	6	6				6462	9500

# Calculation for Cold Storage

## Tangerini Farm Crop Cold Storage

Root crops		Squash		Potatoes	
Respiration =	45 Btu/hr-ton	Respiration*	917 Btu/hr-ton	Respiration =	83 Btu/hr-ton
Specific heat	0.9 Btu/lbm-F	Specific heat	0.91 Btu/lbm-F	Specific heat	0.87 Btu/lbm-F
Crop loading	1 Tons/day	Crop loading	10 Tons/day	Loading rate	0.5 Tons/day
Storage Temp	33 F	Storage Temp	50 F	Storage temp	45 F

Assumed 48 hours to remove field heat

Note 1: Root crops loaded-as-dug have a higher respiration rate, e.g. carrots =11,220 Btu/day-ton, gradually dropping until they reach storage temperature.

Note 2: Tons of refig. capacity = 12,000 Btu/hr and should not be confused with tons of crop.

Note 3: Field temp. assumed to be 70 Deg F except for squash at 50F

Note 4: Envelope gain/loss calculated separately

Month	Root				Squash				Potatoes			
	TonsRC	Resp(Btu/hr)	Loading(Btu/hr)	Total(Btu/hr)	TonsSq	Resp(Btu/hr)	Loading(Btu/hr)	Total(Btu/hr)	TonsPot	Resp(Btu/hr)	Loading(Btu/hr)	Total(Btu/hr)
May	0	0	0	0	0	0	0	0	0	0	0	0
Jun	4	180	2,775	2,955	0	0	0	0	0	0	0	0
Jul	7	315	2,775	3,090	0	0	0	0	0	0	0	0
Aug	14	630	2,775	3,405	0	0	0	0	0	0	0	0
Sep	14	630	0	630	0	0	0	0	5	4.4	906	911
Oct	12	540	0	540	10	9,170	0	9,170	4.5	3.9	0	3.9
Nov	10	450	0	450	9	8,253	0	8,253	4	3.5	0	3.5
Dec	8	360	0	360	8.5	7,795	0	7,795	3.5	3	0	3
Jan	6	270	0	270	7	6,419	0	6,419	3	2.6	0	2.6
Feb	4	180	0	180	5	4,585	0	4,585	2.5	2.2	0	2.2
Mar	0	0	0	0	0	0	0	0	1	0.9	0	0.9
Apr	0	0	0	0	0	0	0	0	0	0	0	0

\* No applicable data for winter squash respiration in ASHRAE "Refrigeration" 1998, used "Pumpkin and Winter Squash" by J.K. Brecht, Univ. of Florida, Gainesville,FL

### Max cooling loads:

	Btu/hr	Tons of A/C	Evap. Coil cfm
Root Crops =	3,405	0.28	350
Winter squa:	9,170	0.76	960
Potatoes =	911	0.08	65*

\* fan only between root crop bay and potato bay



## Storage Requirements

- High Moisture Storage Units- 32 degrees
- Low Moisture Storage Unit for Sweet Potatoes and Butternut Squash-55 degrees
- Low Moisture Storage for Potatoes- Reduced from 45- 38 degrees over time
- Basement (dirt floor)- Onions

# Where???? APR and CR Concerns





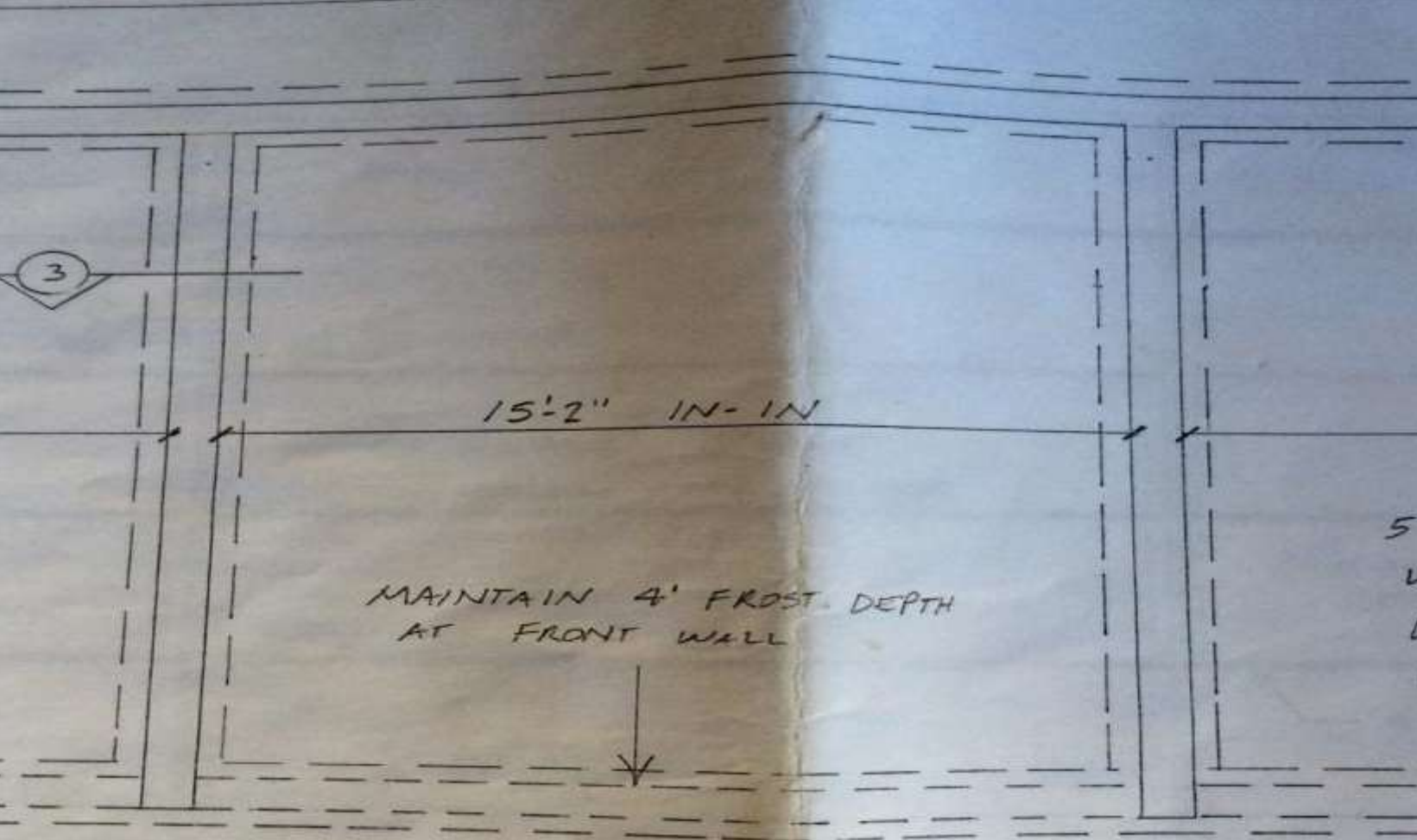
Use Hill to Bury Part of Structure

Good Access

Not Usable for Crops



48'-0" OUT-OUT



Structural Engineering

4" SLAB  
4" RIGID INS.  
6" PLANK

1/8" x 3" KORDLATH BEARING PAD  
2- #5 CONT.  
LAP 24" AT SPLICES  
BENT BARS AT CORNERS.

#5 @ 32" O.C.  
BARS TO PROTRUDE  
4" ABOVE TOP OF  
WALL

10" POURED  
CONCRETE WALL  
ON 10" x 20" FTG.

#5 @ 32" O.C.  
2- #5 CONT.

24"  
8"

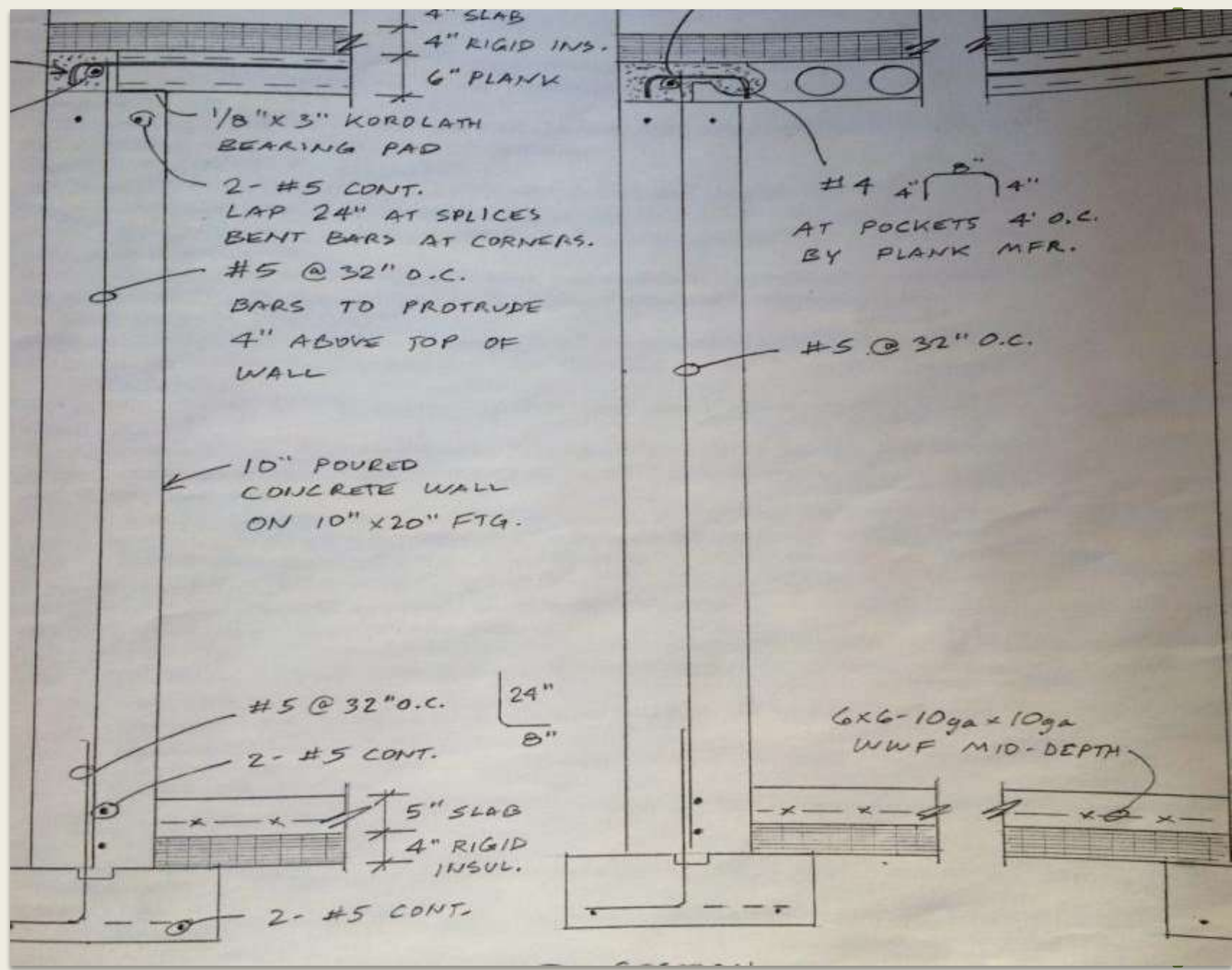
5" SLAB  
4" RIGID  
INSUL.

2- #5 CONT.

#4 4" 4"  
AT POCKETS 4' O.C.  
BY PLANK MFR.

#5 @ 32" O.C.

6x6-10ga x 10ga  
WWF MID-DEPTH



48'-0" OUT-OUT 10" CONCRETE WALLS

3

48-E6704 6"x48"  
HOLLOW CORE PLANK

#4  
IN

EAR  
PLANK

2" GAP

15'-2" CLEAR  
15'-10" PLANK

2" GAP

Items That Reduce Net Income  
 Reduced Returns:

	Total	\$0
Added Costs:		
Produce Bins: 96 Bins * \$22	\$21,696	
Used Forklift:	\$5,000	
Cold Storage:		
1. Building Permits:	\$740	
2. Structural Work:	\$14,350	
3. Excavation:	\$3,350	
4. Concrete:	\$5,600	
5. Engineering:	\$1,500	
6. Contracting	\$30,000	
7. Electrical:	\$5,000	
8. Doors	\$3,500	
Total Cost of Construction	\$64,040	
Seed Cost	\$5,500	
Labor	\$15,000	
Depreciation	\$1,768	
Repairs = 64,040 * .02	\$1,280.80	
Opportunity Cost	\$1,613.36	
Total Reduced Returns & Added Costs	\$115,898	
		\$115,898

## Cost of Structure?

Once we had the structural requirements and the storage requirements we could start to calculate the cost of the of the project.



# The Foundation

- Excavated into Hill
- Formed and Poured Reinforced Concrete Foundation
- 4' Frost Wall



## The Forms

- 10" Walls



Walls in Place



## The Floor

- Insulated Floor- 4" Rigid
- Slightly Pitched Towards Front



Built into the hill and insulated on all sides.





Building the Apron

# Pouring the Floor and Apron





## The Roof

- Precast Concrete Panels
- Slight Overhang on to Accommodate a Greenhouse in the Future.
- Need to Caulk Between Planks with Foam Tubing and Flexible Grout





A person in a green shirt and blue jeans is standing on top of a large concrete panel, using a long-handled tool.

A black forklift is positioned behind a large concrete panel.

A yellow CAT backhoe loader is visible, with the text "CAT" and "ICEE" on its arm. The model number "1E10-655-800" is also visible.

A large, rectangular concrete panel with a textured surface.

A large, rectangular concrete panel with a textured surface, similar to the one on the left.

A stack of precast concrete slabs on a wooden pallet. The slabs are light gray with a textured surface. Blue straps are used to secure the stack. Small white labels with green logos are attached to the slabs.

A stack of precast concrete slabs on a wooden pallet, similar to the one in the middle ground. The slabs are light gray with a textured surface. Blue straps are used to secure the stack. Small white labels with green logos are attached to the slabs.



Energy

Solar  
3-Phase





# Used Insulated Panels and Doors



**American Wholesale Refrigeration Co.**

**Invoice**

**4001 Hamilton Ave  
Cleveland, OH 44114  
Phone: (216) 426-8882  
Fax: (216) 426-8883  
www.awrco.com**

Terms	Rep	Date	Invoice #
	EM	9/13/2010	1337

<b>Bill To:</b>	Charles Tangerini
<b>Attn:</b>	Charles Tangerini
<b>Phone:</b>	(508) 667-6362
<b>Fax:</b>	
<b>Email:</b>	tangerinifarm@verizon.net

<b>Ship To</b>
Will Advise

Quantity	Description	Price Each	Amount
1	48' of Used 10' Camlock Panels	2,000.00	2,000.00T
3	New 5' X 7' Hinged Pallet Door	2,000.00	6,000.00T
1	Shipping Charges	350.00	350.00T
<p>All of this is in stock and can be ready to ship in a couple days. If you are in a hurry, send us a certified check, since we hold company checks for up to 10 days for them to clear. Let me know if you need anything else.</p> <p>Thanks, Eric</p>			

## Cold Storage Unit

- Three Separate Bays
- Temperature Controlled
- Additional Humidity #2
- Heater is #1 and #3
- Other Possibilities during the Main Season
- Ability to Support a Second Story



# Sweet Potato and Winter Squash



Low Velocity Refrigeration  
Digital Thermostats  
Foam Insulation  
Additional Rigid Insulation



CAUTION: HIGH TEMPERATURE. RISK OF FIRE - KEEP ELECTRICAL CORDS, DRAPERY, FURNISHINGS, AND OTHER COMBUSTIBLES AT LEAST 3 FEET (0.9 M) FROM THE FRONT OF HEATER AND AWAY FROM THE SIDES AND REAR.  
ATTENTION: HAUTE TEMPÉRATURE. RISQUE D'INCENDIE - GARDER CORDONS ÉLECTRIQUES, DES MEUBLES, ET AUTRES COMBUSTIBLES AU MOINS 3 PIEDS (0.9 M) À L'AVANT DE CHAUFFAGE ET LOIN DE LA CÔTÉS ET L'ARRIÈRE

Wall Heater in Sweet Potato and Potato Units

Shares a Thermostat with the Refrigeration Unit

Monitoring Temperatures



Low Velocity Fans Reduce Water Loss



Refrigeration in Each Bay



Almost Finished



## Smart Fog

Automatic Humidity Control  
96% Humidity at 33-34 degrees

## Alternative Water Source

- 10 PSI
- Valves



## Low Temperature, High Moisture Storage

- Beets
- Carrots
- Cabbage(purple and red)
- Celeriac
- Chinese Cabbage
- Kohlrabi
- Parsnips
- Rutabaga
- Winter Radish
- Turnip
- Greens of All Kinds







**infrsave**

**BURDA**  
WORLDWIDE  
TECHNOLOGIES

CAUTION: HIGH TEMPERATURE, RISK OF FIRE - KEEP ELECTRICAL CORDS, DRAPERY, FURNISHING  
ATTENTION: HAUTE TEMPÉRATURE, RISQUE D'INCENDIE - GARDER CORDONS ÉLECTIQUES, DES M



## Bulk Bins

- Sweet Potatoes
- Butternut Squash
- Heater Connected to Thermostat
- 55 degrees
- Humidity 80%



## Cold Storage

- Harvesting in late October, November and early December
- Prewashed Roots Crops
- 15" x 30" vented bags for carrots, beets, parsnips, winter radish and turnips
- Bulk Bins for cabbage, rutabaga, celeriac and kolhrabi
- High Humidity-32 degrees. Can go lower

Bins can hold 750 lbs of Bagged Product

P

1250lb Pallets Can Be Stacked on Bins





November-December Distribution





## Deep Winter Distribution





Spring Dry Storage



Perfect for Tomatoes



Melons







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