




TOPIC LINE-UP FOR HIGH TUNNEL PRODUCTION

- BASIC CONSTRUCTION OF OUR HIGH TUNNELS
- SOILS, BED PREPARATION, SEEDING & TRANSPLANTING
- CROP SPECIFICS
- PRINCIPLES OF WINTER PRODUCTION
- INSECTS AND DISEASES
- HARVEST, WASH, PACK
- TECHNOLOGY



SEASON EXTENSION HAS INCREASED OUR PROFITS SINCE 1992

- STAY ON THE FARM
- LEVEL OUT THE INCOME
- CUSTOMER IMPACTS
- YEAR-ROUND WORKERS

SEASON EXTENSION

- Row Covers
- Field Houses
- High Tunnels



APRIL 10TH

PROS & CONS

HIGH TUNNELS	LOW TUNNELS
• Expensive	• Inexpensive
• 1-2 year payback	• Fast Payback \$\$
• Diverse crops	• Limited crops in Winter
• Long-lived	• Short-lived
• Tractor accessible	• Work by hand
• Sturdy in weather	• Not as sturdy
• Hard to Rotate	• Easy Rotations
	• Yearly labor high

SITE SELECTION

- SOILS
- SLOPE
- ORIENTATION-Winter/Summer
- DISTANCE BETWEEN-Solar Mapping
- WATER INFILTRATION
- SHADING-PROTECTION
- WIND
- SERVICES-Water, Electricity, Access



PRECISION WITH A TRANSIT



TUNNEL ONE 30' X 144'
LAYOUT OF PIPES-INSULATION 2" X12"



HAVE SITE WORK DONE EARLY
HIRE THE PROFESSIONALS!



Polycarbonate knee wall-24" w 6" in ground



Water lines-- 4" drainage--fabric






Automatically raises and lowers every 5 minutes in 5 increments

Benefits of production

Efficiency



12 VOLT DC MOTORS



- MOSTLY SUN DRIVEN SYSTEM
- LIMITED HEAT
- THERMOSTAT 21 DEGREES UNDER COVER
- EMERGENCY HEAT FOR HARVESTING



Soil Management, Bed Prep, and Seeding

HIGH TUNNEL SOIL MANAGEMENT

- Soil Tests
- Fertilizers
- Organic Matter
- Mulching
- Compost
- Cover Crops
- Irrigation
- Greenhouse Amendments



Soil Tests

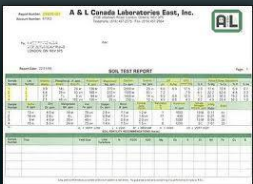
- Take Annually to track progress
- Pick a lab and stay with them — Waypoint Analytics has great a great reference book
- Take sample same time every year
- Be accurate in sampling—Soil probe is a good tool to own



SOIL HEALTH

Soil Tests

- Amend as needed or get custom fertilizers (2 opinions)
- Know how to calculate what is needed
- Know crop needs (Knott's Handbook)
- **Soil Test as Soil Media maybe for high tunnels**



- Each Lab is individual
- Logan-extra micronutrients
- Extension-Resource

SOIL HEALTH

Soil Tests

- Micronutrients important
- Ask for full soil analysis
- Bargain at any price!
- No longer 3 major nutrients
- Spread evenly to get all nutrients up to proper levels
- Side-dressing of Nitrogen is common
- pH must be in proper range (6.5+); Adjust with lime or sulfur per recommendations

SOIL HEALTH

- Large spreaders
- Hand spreading
- Spray on field
- Small spreader
- Through irrigation



APPLYING NUTRIENTS

LIQUID MICRONUTRIENT APPLICATIONS

- Even distribution
- Tank Mix
- Spring or Fall



50 GAL 3 PT HITCH HYDRAULIC SPRAYER W 100' HOSE

LOTS OF ORGANIC FERTILIZERS OUT THERE

No ALFALFA MEAL (Organic) 2.50 0.50 2.20
 No ARAGONITE 0.00 0.00 0.00 33% Ca
 Yes AZOMITE 0.00 0.00 0.00
 No BLOOD MEAL 13.00 0.00 0.00
 Yes BONE CHAR 1.00 20.00 0.00
 No BONE MEAL 6.00 9.00 0.00
 Yes BORON (SOLUBOR 20%) 0.00 0.00 0.00
 Yes CHEEP CHEEP 4.00 2.00 3.00
 Yes CHILEAN NITRATE 16.00 0.00 0.00
 No COBALT (33%) 0.00 0.00 0.00
 No COPPER (25%) 0.00 0.00 0.00
 No CORN GLUTEN 10.00 0.00 0.00
 No COTTON SEED MEAL 6.00 2.00 1.00
 No EPSOM SALT 0.00 0.00 0.00 10% Mg, 13% S
 No FEATHER MEAL 13.00 0.00 0.00
 Yes GREENSAND 0.00 0.00 1.00
 Yes GYPSUM 0.00 0.00 0.00 23% Ca, 19% S
 Yes HUMATE 0.00 0.00 0.00
 No KELP MEAL 0.00 0.00 4.80
 No Manganese (27%) 0.00 0.00 0.00
 No MOLYBDENUM (39.5%) 0.00 0.00 0.00
 No PEANUT MEAL 8.00 1.50 1.80
 No Pelletized Ca Lime 7.00 1.00 2.00
 Yes PHOSPHATE ROCK 0.00 5.00 0.00 22% Total P2O5
 Yes SULF/PTSR 0.00 0.00 51.00
 Yes ELEMENTAL SULFUR 0.00 0.00 0.00
 No SULPOMAG 0.00 0.00 22.00
 No ZnSO4 (35.5%) 0.00 0.00 0.00
 Yes PRO-GRO 5.00 3.00 4.00
 Yes PRO-START 2.00 3.00 3.00
 No PRO-BOOSTER 10.00 0.00 0.00

- Know the numbers
- OMRI-approved & listed
- Multiple nutrients
- What's needed in your soil

CUSTOM BLEND FERTILIZERS

- 20# Solubor (20% B)
- 16# Copper Sulfate (25% Copper)
- 400# Feather Meal
- 200# Humates
- 1214# Peanut Meal
- 100# Elemental Sulfur (90% S)
- 50# Zinc Sulfate (20% ZN)

GIVE SPECIFICS-POUNDS/ACRE & CUSTOM MADE
 BASED ON SOIL TEST

CUSTOM BLEND FERTILIZERS

- Consider cost at \$800 per ton
- Spread at rate of 500# per acre to add 60# of N per acre
- Covers 4 acres and cost is \$200 per acre
- One acre on our farm grosses approximately \$30-65,000 per acre
- GREAT VALUE & Deals with all Nutrients

OUR FERTILIZER IN TUNNELS

- NO ANIMAL PRODUCTS
- THEREFORE NO SALTS
- Use plant-based for tunnels
- Nitrogen: Peanut Meal, Soybean Meal, Cottonseed Meal, Peanut Meal
- Leaf Compost or Peat Moss



COMPOST

- Can be good
- Can be bad
- Critical to be weed-free
- Good if need nutrients and organic matter
- Can be expensive
- Must be properly finished
- Use caution for soil mixes
- 1 to 2 year old compost best



SOIL HEALTH

COMPOST

- Know your rates
- Use manure spreader designed for compost, like H&S
- Adding other types of organic matter are an option, like peat moss




SOIL HEALTH




PEAT MOSS VS COMPOST

CROPS ARE PACKED IN AND NEED EXTRA FERTILITY



BENEFITS

- Smother Weeds
- Hold Nutrients
- Maintain Organic Matter
- Source of Pollen for Bees
- Food for Beneficials
- Break up hardpan



COVER CROPS & ROTATIONS



PLASTIC OFF



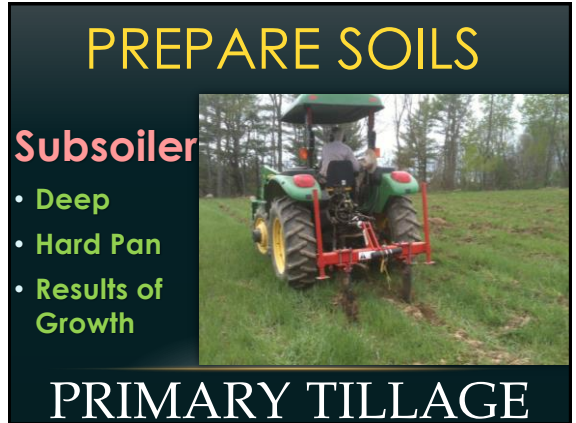
- 90#/ACRE RATE
- BROADCAST
- DROUGHT & HEAT TOLERANT
- 100-150# N/ACRE

COVER CROP -COW PEAS



- 90-100#/ACRE RATE
- BROADCAST
- SMOTHERS WEEDS
- ATTRACTS BENEFICIALS
- ATTRACTS POLLINATORS
- FAST: 70-90 DAYS
- PHOSPHORUS SCAVENGER
- CAN MOW

COVER CROP-BUCKWHEAT

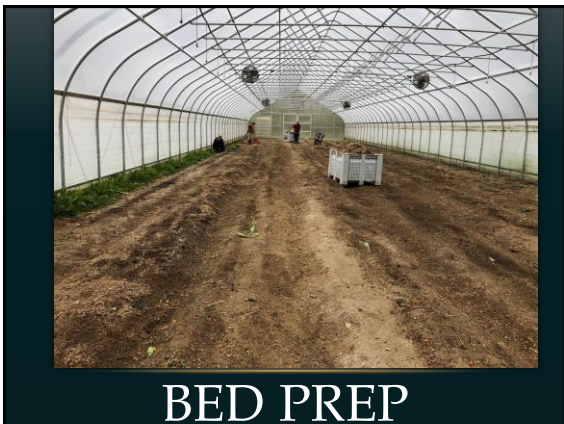


PREPARE SOILS

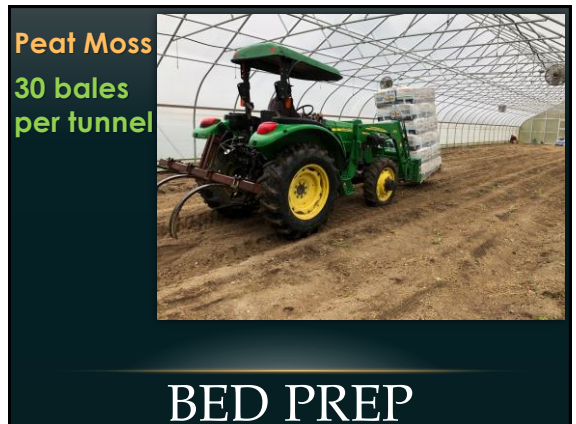
Subsoiler

- Deep
- Hard Pan
- Results of Growth

PRIMARY TILLAGE

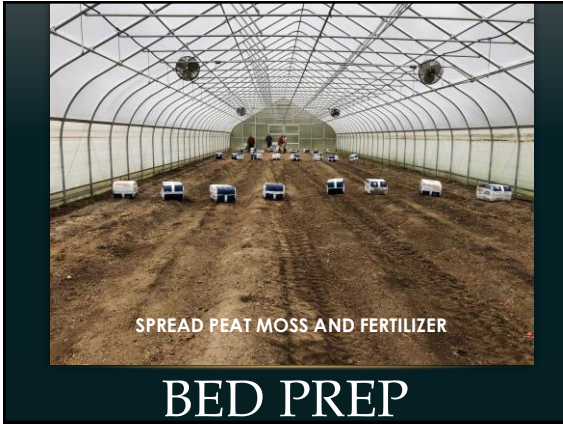


BED PREP



Peat Moss
30 bales
per tunnel

BED PREP



BED PREP



Chisel Plows

- Fast
- Better for soil
- 2 foot
- Every year
- Different points



PRIMARY TILLAGE

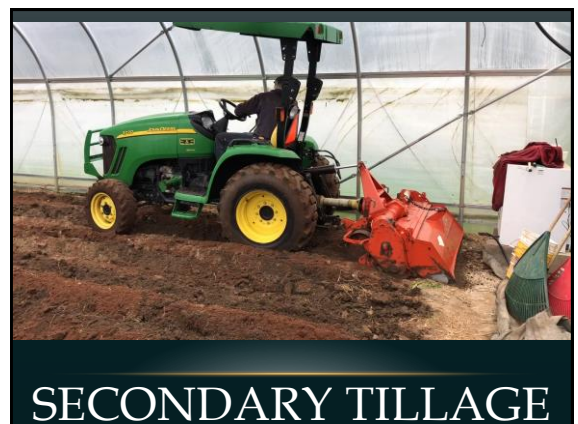


Kuhn 5 ft Rototiller

- One pass-fine seed bed
- Quality brand
- Commercial
- Extended sides of tunnel

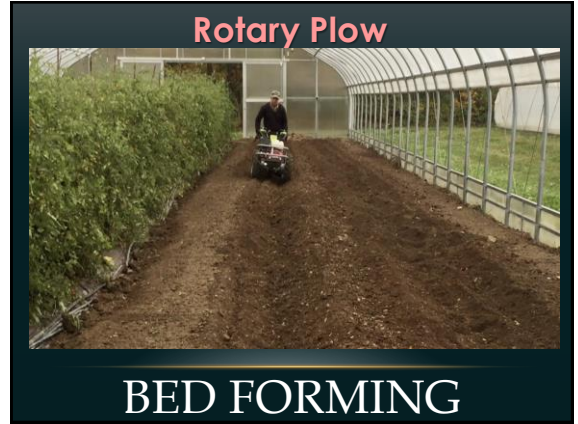


SECONDARY TILLAGE





BED FORMING



Rotary Plow

BED FORMING



BED FORMING



Raking out

PREPARE TUNNEL MID-LATE SEPTEMBER

Rake tops of bed level
 Direct seed using Jang seeder or Earth-way seeder

PREPARE TRANSPLANT BEDS

- 7 BEDS IN 30' WIDE TUNNEL
- 8 BEDS IN 34' WIDE TUNNEL
- ROTOTILL AND FORM BEDS (BY HAND WITH A SHOVEL...TAKES APPROX 5 HOURS)
- BEDS ABOUT 3 FT WIDE
- LAY BIOTELLO BY HAND TO SAVE SPACE

ROCK DOWN BIOTELLO



Waterwheel axel for marking



PLANT TRANSPLANTS

- 5 Rows per bed
- 3 Rows of Kale or Swiss Chard with 2 rows of Asian Greens in-between

MUST PLANT BY OCT 5th



ADD STRAW TO PATHS

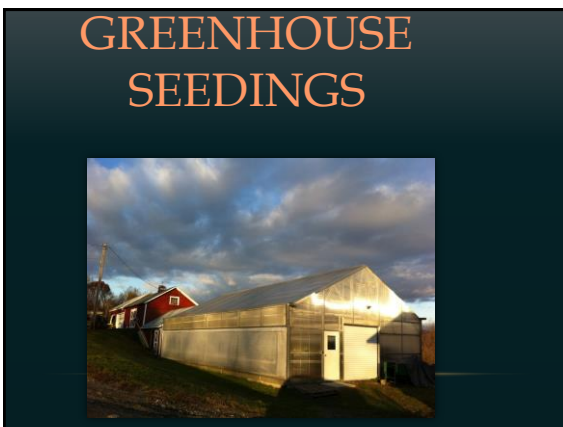
- Paths weed-free
- Cushion on knees
- Clean & neat
- Organic matter
- Row-cover stays cleaner
- Install via buckets or plastic
- Note-tape measure

TRANSPLANTING OCT 1, 2018



PLANTING DATES – MATURITY – OCT 26

- Guessing game
- Critical to yield



GREENHOUSE SEEDINGS



SEEDS

GOOD SEEDS ARE CRITICAL TO SUCCESS
QUALITY SEEDS
DISEASE FREE

GREENHOUSE

SEEDS

CONSIDER HOT WATER TREATING




GREENHOUSE

Organic Soil Mix-Cornell:

- 2 bales horticultural grade peat moss (3.8 cu ft)
- 1 bag of perlite (21# bag course)
- 6# organic fertilizer 5-3-4 (not animal based)
- 2# lime



- *Test soil mix for pH and salts and nutrients
- *Test greenhouse water for pH
- *Work with professionals if issues



GREENHOUSE

- Diseases-Root Shield and Root Shield Plus
- Actinovate-Fusarium
- Biological Stimulants
- Humic Acids






TRANSPLANT SOLUTIONS

Water in

GREENHOUSE CARE

KALE & SWISS CHARD



SEEDED JULY 15TH

- Asian Greens- Aug 25th to Sept 1st
- Spinach- Sept 20th to Oct 1st




GREENHOUSE SEEDING DATES

TRANSPLANT UP



- TRANSPLANTS ALLOW SUMMER PRODUCE TO CONTINUE PRODUCING IN TUNNELS
- CAN POT UP IF NECESSARY DEPENDING ON VALUE OF TUNNEL CROPS LIKE TOMATOES

HAVE READY TO PLANT IN TUNNEL ABOUT OCTOBER 5TH

RADIANT HEATED BENCHES



UTILIZE ALL WINTER



Varieties, Spacing- How We Grow Them

WINTER PRODUCTION



IN HIGH TUNNELS

CROPS WE GROW

- Kale
- Swiss chard
- Spinach
- Asian Greens
- Lettuce Mix
- Arugula
- Broccoli Raab



DECEMBER TO MAY

VARIETIES

- Kale: Winterbor
- Swiss chard
- Spinach
- Lettuce
- Arugula
- Mustards



Asian Greens: Tokyo Bekana, Yukina Savoy, Vitamin Green, Tetsui, Red Choi, Black Summer, Mei Qing Choi, Jai Choi


DECEMBER TO MAY

- | | |
|--------------|------------|
| AMERICA | TYEE |
| BAHAMAS | QUEEN |
| CORVAIR | RACCOON |
| CROCODILE | RED KITTEN |
| DONKEY | REFLECT |
| EMILIA | REGIMENT |
| EMU | SAMISH |
| ERSTE ERNTE | SEVEN GRN |
| GIANT WINTER | SPACE |
| LAZIO | SPARGO |
| LOMBARDIA | ST HELENS |
| MENORCA | TARPY |

SPINACH—ALWAYS DOING TRIALS! CHANGING!
24 VARIETIES FOR 2011-12

FEB 16	MAR 8	MAR 8
1 SPACE	1 SPACE	11 EMILIA
2 LOMBARDIA	2 LOMBARDIA	11 SAMISH
3 LOMBARDIA	3 REGIMENT	11 LOMBARDIA
4 REGIMENT	4 LOMBARDIA	11 LOMBARDIA
5 ST HELENS	5 ST HELENS	11 RACCOON
6 REFLECT	6 SAMISH	11 QUEEN
6 LOMBARDIA	7 DONKEY	11 SPARGO
6 GIANT WINTER	7 EMU	12 RED KITTEN
7 SAMISH	8 GIANT WINTER	12 TYEE
7 DONKEY	8 REFLECT	12 LOMBARDIA
7 EMU	9 SPACE	12 GIANT WINTER
7 ST HELENS	10 BAHAMAS	12 CORVAIR
8 GIANT WINTER	10 TARPY	12 ERSTE ERNTE
9 LOMBARDIA	10 ST HELENS	13 REGIMENT
9 EMILIA	10 7 GRN	13 ST HELENS
9 ERSTE ERNTE	10 LOMBARDIA	13 GIANT WINTER
9 REGIMENT		13 CORVAIR
9 CORVAIR		14 SPACE
10 7 GRN		15 CORVAIR
10 RACCOON		16 EMU
10 GIANT WINTER		TYEE
10 TYEE		

YIELDS CAN VARY!! OPERATING FRM 6



NOT A SIMPLE LIST!!

- SOME EARLY
- SOME LATE
- UPRIGHT
- FLAT
- SPACING
- DIRECT SEED
- TRANSPLANT
- DISEASE RESISTANCE

SUMMARY



TOP WINTER NOW:
ESCALADE
CARMEL
GAZELLE
SPACE
REFLECT

TOP SUMMER:
BANJO
SEASIDE
WOODPECKER

SUMMARY

PLANT TRANSPLANTS



- 5 Rows per bed
- 3 Rows of Kale or Swiss Chard with 2 rows of Asian Greens in-between

MUST PLANT BY October 5th

FRENCH INTENSIVE METHOD



Asian Greens for Braising Mix

- Tokyo
- Bekana
- Yukina
- Savoy
- Vitamin Green

Swiss Chard and Asian Greens

FRENCH INTENSIVE METHOD



- Asian Greens also named "Large leaf mesclun mix"!
- Start harvesting December/January...love cold
- Kale & Swiss Chard dormant till late Feb unless warm!

Kale and Asian Greens



FRENCH INTENSIVE METHOD

Asian Greens love the cold weather and flourish in Dec and January



FRENCH INTENSIVE METHOD

Kale and Chard take off in February and produce like crazy all Spring

SPACING

8 x 12 for

- Kale
- Swiss chard
- Asian Greens
- Happy Rich Broccoli

4 X 14 for

- Broccoli Raab





**Herbs: Parsley-
Cilantro-Rosemary++**

- Scallions
- Escarole
- Onions
- Turnips



OTHER TRIALS

DIRECT SEEDING DATES

OCTOBER 1st
OPTIMUM FOR US
(some years!)
SUCCESSIVE

- Salad Mix LETTUCE
- MUSTARDS-Reds, Greens
- SPINACH
- ASIAN GREENS- Mizuna, Tatsoi, etc



WINDOW OF OPPORTUNITY
SEPTEMBER 20TH TO OCT 5TH

SPACING

- Spinach-Transplant 3-4 per cell: 5"x8"
- Spinach-Seeded 8"

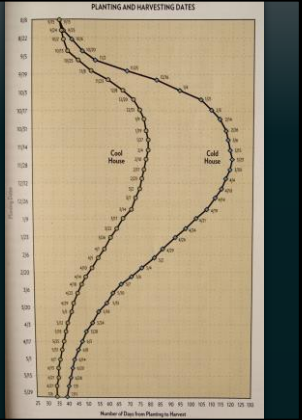


FIND YOUR DATE!

THE WINTER HARVEST HANDBOOK BY ELIOT COLEMAN

Time of seedings are critical...Successive seedings gives consistency

Weather is a changing factor



SPACING

Lettuce, Asian Greens & Mustards for Salad Mix and Arugula

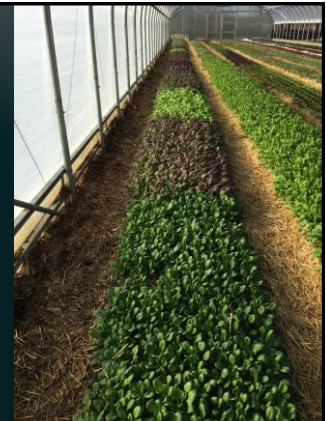
- 2 1/2 inches
- Separate varieties
- Earthway or Jang



SPACING

Mustards are seeded in small blocks

Arugula to the right in successive plantings



ARUGULA

- Successive seedings
- Oct 1st & Nov 15th
- Astro & Regular



- LETTUCE ALL WINTER**
- ❖ DISEASE RESISTANCE
 - ❖ NOW SEED SEPARATELY
 - ❖ HAPPY CUSTOMERS

- New 2012
- Trialed Winter 2012-13
- Seeded 9/30
- Not ready until March
- Small plants cold tolerant
- Few disease issues



SALANOVA LETTUCE

- Fantastic efficiency for harvest
- Cut 8 pounds in 5 minutes



SALANOVA LETTUCE


- Makes a great quality mix
- Same length leaves
- Can recut
- Slower to grow



SALANOVA LETTUCE

PERCENT USE & VALUE

Map for efficiency
 Value per square foot high:
 Usually about \$4-\$5 gross income




LATE WINTER/EARLY SPRING PRODUCTION

JANUARY SEEDINGS

- Broccoli Raab
- Happy Rich
- Asian Greens
- Salad Mix Greens



IN THE GREENHOUSE



Seeded in January, transplanted into the tunnel in February, will produce in spring/summer

BROCCOLI RAAB



- GH Seeded in early January, transplanted to tunnel in March
- Produces all year till October+

HAPPY RICH BROCCOLI



- GH Seeded in early January, transplanted to tunnel in March
- Produces for April & May

ASIAN GREENS

NEW SYSTEM



- STRIP TRAYS
- DIRECT PLANT

IN THE GREENHOUSE



LETTUCE

- GH SEEDED FEB 15+
- SPEEDLING VS WINSTRIP
- TRANSPLANT IN MARCH into TUNNEL



LETTUCE

- FULL SIZE HEADS
New Red Fire, Green Star, Carmona, Nancy and Romaine++
- MINI HEADS-Many from Johnnys
- HARVEST IN MAY
- Mini Heads make the salad mix or are \$1




Transition to Summer



Principles of Winter Production

Principles Outline

- Venting
- Temperature Acclimation
- Row covers & Hoops
- Weeding
- Watering




VENTS OPEN 24/7 TO KEEP HUMIDITY DOWN



**HAF FANS CRITICAL
KEEP ROW-COVERS DRY**

PROTECTION

- ROWCOVER**
- 1, 2, 3
- Height
- Hoops
- Fold into center



- Lots of tools out there
- Everyone has a favorite

Johnnys Wire-Weeder

HAND WEEDING

TWO BAD CATS CO. TINEWEEDERS, POPPERS, ETC

- Stand-up Wire Weeders work great
- Two Bad Cats

HAND WEEDING

Our Favorite:
Dutch Push Hoe
Walking pace
Incorporate fertilizer
[www. Earthtoolsbcs.com](http://www.Earthtoolsbcs.com)

WINTER MAINTENANCE

BED STEAMING

NEW SYSTEM FOR WEED CONTROL

BED STEAMING

BED STEAMING

- Uses 4-5 gallons per hour of diesel
- Hand weed vs steaming
- Pros and Cons

TARPING??



HAND WATERING

- In winter—spot water when needed
- Even watering
- Seed starting & Transplant watering in
- Row covers can be left in place



WINTER MAINTENANCE

DRIP TAPE WATERING

- Great for BioTelo beds
- Can use on all beds year-round
- Don't get row covers wet



WINTER MAINTENANCE

WATERING OVERHEAD

- Good for seed starting
- Use nozzles that empty water out so don't freeze
- Out of way



WINTER MAINTENANCE

TEMPORARY HEATING GREAT RESULTS!



- LB White
- Johnson A421
- Nema 4
- Crop Value



- Harvest time
- Emergency night time
- Thermostat
- Value of crops
- Forever learning

LEARNING NEW TRICKS EVERY YEAR



- ❖ Aphids
- ❖ Crown Mites
- ❖ Cabbage Looper
- ❖ Army Worm
- ❖ Voles
- ❖ Rabbits
- ❖ Downy Mildew
- ❖ White Mold
- ❖ Fusarium
- ❖ Powdery Mildew
- ❖ Cladosporium
- ❖ +++






WINTER PESTS

Aphids

Ladybugs:

- Buy Early
- Spread weekly

WINTER INSECTS

Aphids

Aphidoletes

- Predaceous mite

Safer Soap



WINTER INSECTS




CROWN SPINACH MITE

- Monitor to catch early!


SPINACH CROWN MITE

Mites

- Ragged edges on leaves/ Irregular leaves
- Microscopic
- Predatory Mites- IPM Labs
- Aza-direct




WINTER INSECTS



CABBAGE LOOPER & ARMY WORM

- Monitor to catch early!
- BT Effective

PESTS



Voles and Rabbits

- Traps
- Cats
- Dogs
- Feet
- Lead

Secure perimeter

PESTS



MANAGE FOR DISEASES.. OR IS IT DISEASE?

- Actinovate
- Regalia
- Cease
- Double Nickel
- **LOTS OF TRIALS!**



Downy Mildew in Lettuce and Greens

WINTER DISEASES

Lettuce - Downy Mildew



Spinach Downy Mildew



The 'late blight' of spinach re-emerging in NE. Found in high tunnel crops.
See it? Report it! Manage it!!!

Images cf. Teresa Rusinek, Cornell

- Maybe in seed
- Hot water treat?
- Variety selection for resistance
- Eliminate by spring plantings
- Major concern
- 16 Races




Downy Mildew in Spinach-NEW IN EAST

WINTER DISEASES

POWDERY MILDEW on Lettuce

- **CONTROL:** Milstop & Stylet Oil (JSS)



WINTER DISEASES

WHITE MOLD
Sclerotinia Drop
Lettuce Drop

- **Causal Agent:** *Sclerotinia sclerotiorum*
- **3 year rotation**
- **Sclerotia**
- **Ascospores**
- **CONTROL:** Contans\$\$\$



WINTER DISEASES

Fusarium & Mildews

- **Root Shield Plus**
- **Actinovate**
- **Soil Serenade**




WINTER DISEASES

- **Venting most important!**
- **Temperature fluctuations**
- **+/- 20 degrees**
- **65% or less RH**



Cladosporium leaf spot

WINTER DISEASES



HAF FANS CRITICAL HUMIDITY & DISEASE DOWN

DISEASE PREVENTION

- Venting
- Sides Up
- Fans
- Variety
- Spacing
- Biologicals



WASHING STATION



1990 EARLY YEARS: PUTTING \$10,000 EACH YEAR
BACK INTO THE FARM – SPEND \$ TO MAKE \$



MORE WINTER WORK – LOOK AHEAD



**1995 REVISION 2:
Heated Washing Station
Insulated Overhead Doors**

**THINK AHEAD & PLAN FOR
THE FUTURE! GAPS – FSMA**





Floor Mats
Smooth and washable walls **Roll Carts**
Stainless Steel



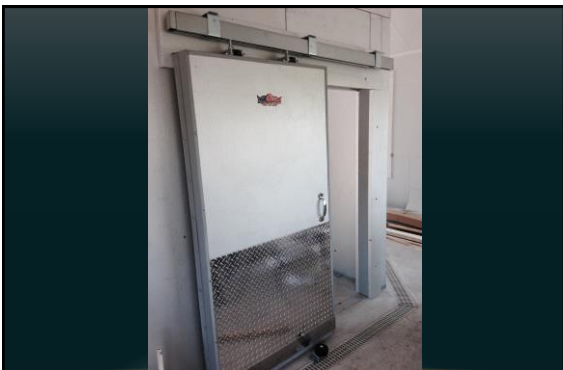
FINAL REVISION!! 2015



12x14 cooler-Insulation-Radiant Heat



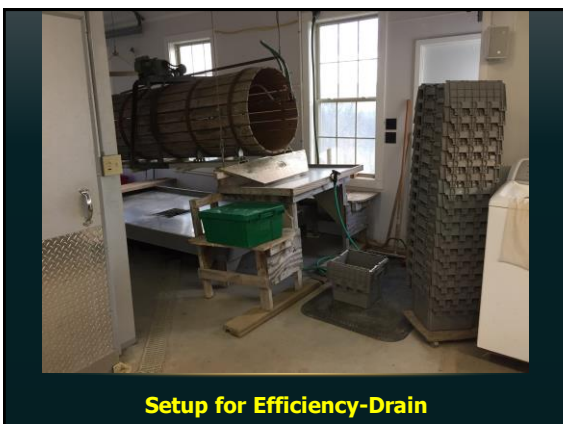
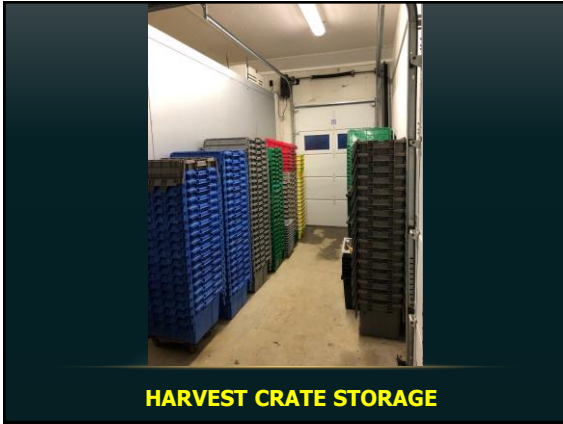
Drains-Cooler Insulation



American-Slider Doors



ACCESS DOORS-Auto keypad openers





- Keep area clean and neat—no debris
- Clean up bed after cutting
- Many re-cuts



WINTER HARVESTING

- Weigh as we go
- Keep records!



WINTER HARVESTING

USE SEPARATE CONTAINERS FOR HARVESTING VS MARKETS



Custom Harvest Wheelbarrows
Goes direct from field or tunnel to wash station

ONE OF OUR FAVORITE THINGS!

GOLF CARTS

- We now have 3
- Easy to drive
- Inexpensive
- Great for kids



GOLF CARTS



- Move lots quickly from field to wash area to maintain produce quality



SYSTEMS-READY TO GO FOR WASH/PACK DAY!



HOSE RETRACTOR-NEAT & TIDY



BUBBLER

- 200 gallon Milk bulk tank
- Jacuzzi Motor
- Efficient
- 400 bags spinach in 90 minutes=\$1200
- OR \$800/hour with 4 workers

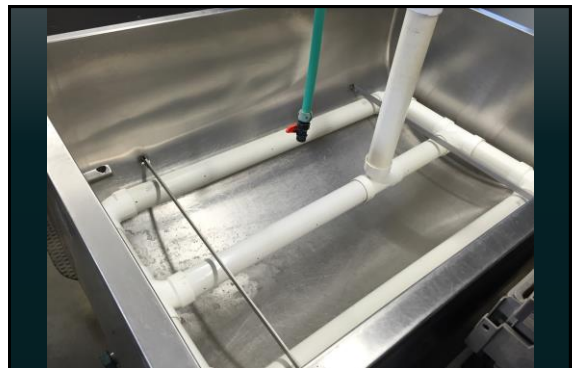


BUBBLER GREENS WASHER



3" PVC PIPE WITH 1/4" HOLES FACING UP

SPECIAL BARS WELDED IN



Motor in attic-Warm water



Liz.Cashman@ecolab.com

\$97 for 5 gal pail shipped

Test Strips

SANITIZE? STORAGE LIFE

BUBBLER GREENS WASHER



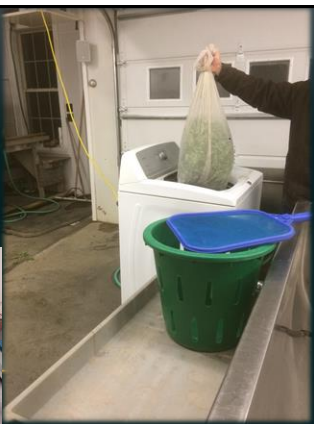
Efficient assembly line

Load vented baskets...

Then netted bags



- Washing machine
- Spin cycle on switch 8 Sec
- Arugula, Salad Mix & baby spinach



- Washer on wheels
- Retractable cord



- Everything at hand
- Vented bags
- Standard count per crate
- Market crates never on floor



- Wash Greens first
- Cleanest to start



- Use test Strips to retest if more sanitizer needed




- Crates on wheels
- Floor Drains
- Knife racks
- Auto front door
- Cement to cooler




EFFICIENT SYSTEMS IN THE WASHING STATION

- Rubber bands pre-bunched
- Backup Scales
- Two per market

WARM WASH WATER

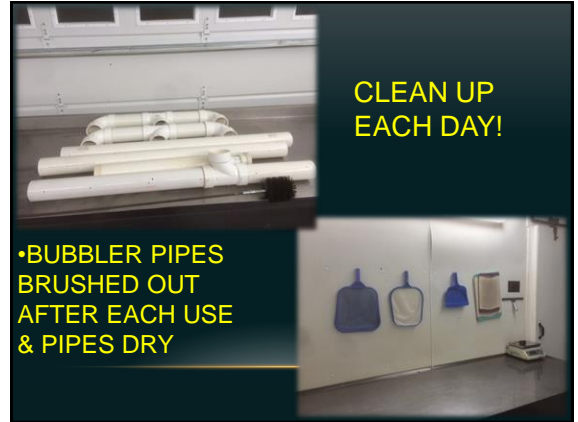
Hand-washing Sink-Instant Hot Water-Stiebel

- WHITEWASH BOARD
- LABOR POSTERS



Scale for weighing central for records





- ❖ EMPLOYEE HANDBOOK-MARKET & FARM
- ❖ SAFETY REQUIREMENTS
- ❖ BATHROOM & HANDWASHING RULES
- ❖ SICKNESS
- ❖ WASH STATION PROTOCOL
- ❖ ATTIRE REQUIREMENTS
- ❖ SHOE/BOOT RULES
- ❖ FIRST AID/CUTS
- ❖ POSTERS & REGULATIONS POSTED
- ❖ NEW HIRE SAFETY TRAINING
- ❖ ANNUAL REVIEWS
- ❖ ++++++ FSMA+++GAPS
- ❖ <http://producesafetyalliance.cornell.edu>
- ❖ **HAVE A FARM SAFETY PLAN**



TECHNOLOGY ON PVF



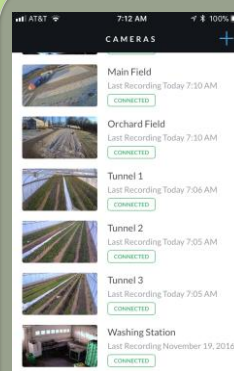
Increases Efficiency-Prevents Disasters

WHY TECHNOLOGY ON PVF?

- Avoid Disasters
- Peace of Mind
- Notifications when away
- Training
- Improvement of systems
- Efficiency of time
- Checking on status
- Improves communication
- Increases accuracy of growing data

WHAT TECHNOLOGY ON PVF?

- Monnit Monitoring system
- Cameras
- Davis Weather System
- Farm Truck Monitoring- "Automatic"
- Ipad usage-Market
- Ipad usage-Washing Station
- CC reader
- WiFi



CAMERAS



- Security
- Monitoring
- Safety
- Travel check
- Record
- Training
- Camera \$150
- 1 Controller ~\$400

SEVEN CAMERAS—LIVE FEED 24/7 CAN RECORD WITH MOVEMENT




MONNIT SYSTEM



- Wireless ~1,000ft
- Alarms to text or email (calling extra)
- Records all data
- Batteries last 2+ years
- Easy to move around

\$80-\$375 per sensor (most common Temp sensor \$185), \$200 sensor manager, \$150 per year subscription



- 25+ sensors
- Temperature
- Water pressure,
- Humidity (limited)
- Voltage
- CO
- Wetness (flooding)

Sensor: Greenhouse Pressure 8 PSI
Greenhouse Pressure Too Low
Network: PVF 2

Sensor: Root Cellar (Temp) 44.2 F
Root Cellar Temp Too High
Network: PVF 2

Sensor: Main Electric Monitor 124.1
Volts AC RMS Electric Voltage is too high, check right away Network: PVF Sensors

WEATHER STATION

Davis Vantage Pro II
Remote sensors
Repeaters
Computer Data Backup
Scientific Sales, Inc




**SOLAR-TEMP
HUMIDITY
WIND RAIN**

\$650 Main, \$250 Repeater, Extra Station \$180

Every year—Something new to learn to increase profits



10 degree temp difference during 15 degree night-hoops vs no hoops

- WHITEWASH BOARD
- LABOR POSTERS
- ORGANIZED CHARGING STATIONS
- HARVEST RECORDS



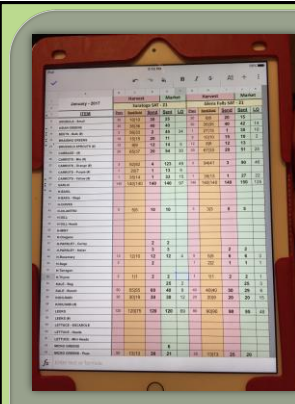

- IPAD
- SCALE
- CAMERA
- SPEAKERS

iPad + Google Sheets for Record Keeping

Columns:

- What you want to harvest
- What you harvested last week
- What was Leftover

Custom Google sheet that creates each week from template and populates data week to week



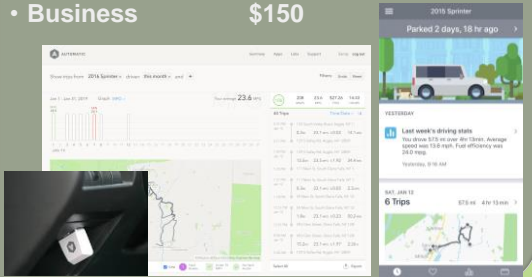
USE IPAD AT MARKETS (Square)



Benefit: Tells sales during/right after, ave sales, # cust

AUTOMATIC Vehicle Tracking

- Gadget that Monitors & tracks vehicles
- Location, Mileage, Engine Codes
- Business **\$150**



Internet & WiFi

- WiFi on 80% of main farm
- Allows all tech to function, it's the backbone
- iPads can function anywhere
 - Only need cell plan for markets
- Makes installing new tech easy (ex: WiFi thermostat in high tunnel? Easy)
- Better communication between workers
- Can view cameras without internet from most of farm (saves mobile internet)

MORE INFORMATION CONTACT:

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QUESTIONS/DISCUSSION?

