



ARGYLE, NY ZONE 4

- ❖ Land purchased in 1988-60 Acres
- ❖ Rent Neighbors 120 Acres



2019 PRODUCTION

- ❖ 5 Acres Mixed Diverse Vegetables
- ❖ 1/2 Acre Large Fruits
- ❖ 1/4 Acre Small Fruits
- ❖ 3-4 Acres Cover Crops
- ❖ Hay fields used by Beefalo farmer
- ❖ CNG certified



2019 MARKETING

- ❖ Sell at 3 local weekly farmers' markets in summer & 2 Saturday winter markets -82%
- ❖ Wholesale: Restaurants 12% Other 6%



TOPIC LINE-UP FOR TODAY

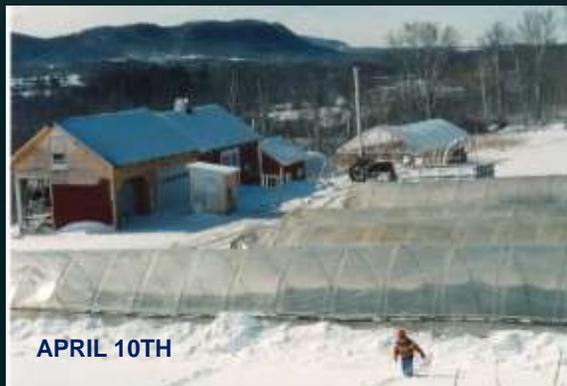
- **INTRO & OVERVIEW: HIGH TUNNEL STRUCTURES**
- **SOILS, BED PREPARATION, SEEDING & TRANSPLANTING**
- **CROP SPECIFICS-Varieties**
- **PRINCIPLES OF WINTER PRODUCTION-Venting, Row-covers, Weeding, Watering, Heating**
- **INSECTS AND DISEASES**
- **HARVEST, WASH, PACK**
- **TECHNOLOGY**
- **RECORD KEEPING & ECONOMICS**
- **MARKETING**

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



PROS & CONS

HIGH TUNNELS

- Expensive
- 1-2 year payback
- Diverse crops
- Long-lived
- Tractor accessible
- Sturdy in weather
- Hard to Rotate

LOW TUNNELS

- Inexpensive
- Fast Payback
- Limited crops in Winter
- Short-lived
- Work by hand
- Not as sturdy
- 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

**RIMOL GREENHOUSES
BUILT FOR SNOW**



**TUNNEL #2 34'x144'
NO WOOD!**



POWER & PROPANE & 2 WATER SOURCES

POLYCARBONATE & SLIDER DOORS



TRICKS TO PUTTING 150' OF PLASTIC ON??





Learning How to put on plastic! Consider 1 vs 2 layers



- 2006, 2008, 2012
- Aluminum Double Track
- Roll Curtain & Wiggle Wire

3 TUNNELS 1-30'X144' 2- 34'X144'



**AUTOMATIC
ROLL-UP
SIDES \$1200**

**PAY FOR
THEMSELVES
WITHIN A
YEAR**



**Automatically raises and
lowers every 5 minutes in
5 increments**

Benefits of production

Efficiency



12 VOLT DC MOTORS



NEXT NEW IDEA FOR US WAS GREAT!



**ALLOWS MORE HARVEST TIME WITH AN
INEXPENSIVE STRUCTURE – DEC TO APRIL 20'X150'**



GREENS & KALE NOV TO APRIL!



**SUN DRIVEN SYSTEM
LIMITED HEAT**



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

Report Number: 201908 A & L Canada Laboratories East, Inc. 402 HURON ROAD, SUITE 100, WINDSOR, ONT. N9A 6K5
 Report Number: 201908

Soil Test Report

Element	Unit	Result	Reference Range
Nitrogen	ppm	15	10-20
Phosphorus	ppm	25	10-30
Potassium	ppm	150	100-200
Calcium	ppm	1500	1000-2000
Magnesium	ppm	100	50-200
Sulfur	ppm	50	20-100
Zinc	ppm	5	2-10
Copper	ppm	1	0.5-2
Manganese	ppm	10	5-20
Boron	ppm	1	0.5-2
Iron	ppm	100	50-200
Molybdenum	ppm	0.1	0.05-0.2
Chloride	ppm	10	5-20
Fluoride	ppm	0.1	0.05-0.2
Silica	ppm	100	50-200
Organic Matter	%	5	3-10
pH		6.5	6.0-7.0

Fertilizer Recommendations

Element	Unit	Recommended Level
Nitrogen	ppm	15
Phosphorus	ppm	25
Potassium	ppm	150
Calcium	ppm	1500
Magnesium	ppm	100
Sulfur	ppm	50
Zinc	ppm	5
Copper	ppm	1
Manganese	ppm	10
Boron	ppm	1
Iron	ppm	100
Molybdenum	ppm	0.1
Chloride	ppm	10
Fluoride	ppm	0.1
Silica	ppm	100

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**

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**

OUR FERTILIZER

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



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



BED PREP

Peat Moss
30 bales
per tunnel



BED PREP



SPREAD PEAT MOSS AND FERTILIZER

BED PREP

PEAT MOSS



PREPARE SOILS

Subsoiler

- Deep
- Hard Pan
- Results of Growth



PRIMARY TILLAGE

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

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 axle 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



Mulching Benefits

- Organic Matter
- Weed Control
- Moisture Retention
- Prevents Soil Erosion
- Clean Crops
- Disease Suppression
- Workers and crates clean

**Teagle Tomahawk
Round Bale
Bale Chopper**



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 TO MATURITY?

OCT 26



- Guessing game
- Critical to yield

GREENHOUSE SEEDINGS



SEEDS

GOOD SEEDS ARE CRITICAL TO SUCCESS
QUALITY SEEDS
DISEASE FREE



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

Lots of seeding tray options



SEEDING TRAYS

- 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



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 **Mustards**
- Arugula



Asian Greens: Tokyo Bekana,
 Yukina Savoy, Vitamin Green,
 Taisai, Red Chai, Black Summer,
 Mei Qing Chai, Joi Chai

DECEMBER TO MAY



NOT A SIMPLE LIST!!

- **SOME EARLY**
- **SOME LATE**
- **UPRIGHT**
- **FLAT**
- **SPACING**
- **DIRECT SEED**
- **TRANSPLANT**

SPINACH



**TOP WINTER
NOW:
ESCALADE
CARMEL
WHALE
SPACE
REFLECT**

**TOP SUMMER:
BANJO
SEASIDE
WOODPECKER**

SPINACH

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

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



Parsley-Italian vs Curly

- Cilantro
- 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



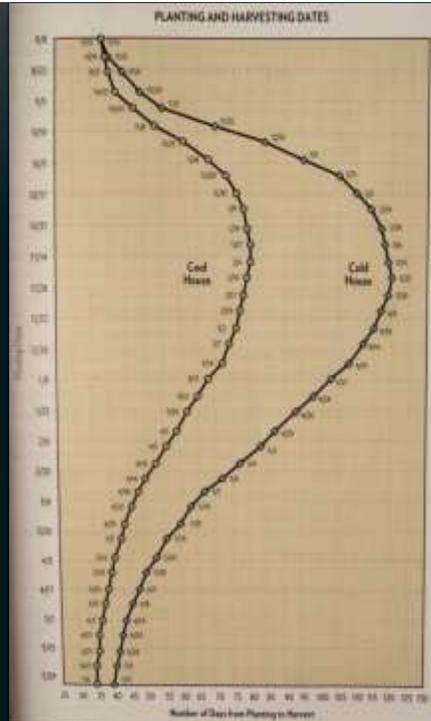
WINDOW OF OPPORTUNITY
SEPTEMBER 20TH TO OCT 5TH

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

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



**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



LETTUCE

GH SEEDED FEB 15TH

- FULL SIZE HEADS
New Red Fire, Green Star, Carmona, Nancy and Romaine++
- MINI HEADS-Many from Johnnys
- HARVEST IN MAY



Transition to Summer

QUESTIONS ON GROWING IN WINTER TUNNELS??

