

The background of the slide is a close-up photograph of numerous ginger roots. The roots are light brown, knobby, and have a rough, textured surface. They are piled together, filling the entire frame.

High Tunnel Production of Fresh Ginger Root (*Zingiber officinale*) and Turmeric (*Curcuma longa*)

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What is a High Tunnel?

- Resembles a conventional greenhouse
- Most often unheated, could have supplementary heating
- Crops are grown in the soil
- Season extension
 - Spring earliness
 - Fall extension
- Protects crops from adverse environmental conditions
- Simple structure, inexpensive



Some Benefits of High Tunnel Crop Production



- Extension of the spring and fall growing seasons
 - 5-8 °F
- Reduced temperature and moisture fluctuations during the growing season
- Reduce wind damage
- Reduced disease pressure
- Ability to use biological pest control
- Increased yield

Opportunities

- Season extension and out of season growth
 - Maximum yield and increased quality
 - Less insect and disease pressure
- Organic
- Locally grown
- Specialty crops



Challenges

- Marketing
- Production
 - Unique crop considerations
 - Higher production costs
 - Different production techniques/environment
- Competition





Brace

Purlin

Bow

Ground
Stake

12.12.2002

Single Bay



Multibay



PVC

USDA-NRCS Funding

- Pilot project launched Dec. 2009 to increase availability of locally grown food
- Under “Know your farmer, know your food” initiative
- In Virginia program, over \$190K awarded to farmers



High Tunnel Costs

- Materials = approximately \$3-4/SF
- Construction = \$1-2/SF
- Example
 - 26' x 96' round tunnel
 - materials \$8,735
 - construction \$3,744



High Tunnel



Ginger (Zingiber officinale)

The official name Zingiber derived, using the Indian Sanskrit name for ginger - **singabera**, or shaped like a horn.

Other spices in the same family with ginger are **Tumeric** and **Cardamom**.

http://www.herbs2000.com/herbs/herbs_ginger.htm



Ginger plant

The ginger plant has a long history of cultivation, having originated in Asia. Ginger is considered a tropical plant, has dark-green erect stems and lanced-shaped leaves that produces underground rhizomes. The plant may reach 2-4 ft in height.



Ginger Seed Rhizomes



<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/scm-8.pdf>: Paul Hepperly and Francis Zee

Ginger Seed-Rhizome

- Use only mature, clean, disease-free ginger hands
- Cut the selected hands into 2-4 oz sections, sterilizing the knife after each cut
- Each seed-piece should have two to four well developed “eyes.”
- Surface-sterilize the seed-pieces in a 10% solution of household bleach (1 part bleach in 9 parts water) for 10 minutes
- Cure the seed-pieces in a clean, disease-free area for three days or more before planting

(Hepperly, P. and Francis Zee, 2004)





In April the potted plants are ready to be transplanted in the high tunnel.

In February, plant the seed piece in a one gallon pot $\frac{1}{2}$ - $\frac{3}{4}$ filled with soilless potting mix (2 parts Compost, 2-4 parts Sphagnum Peat Moss, 1 part Perlite, and 1 part Vermiculite). Maintain in a greenhouse.







May



August

September



Fertilizer

- Ginger responds well with adequate fertilizer application.
- For detail of fertilizer need see
- <http://www.ctahr.hawaii.edu/oc/freepubs/pdf/SCM-8.pdf>

Mounding (Hilling)

Is the periodic covering of the upward-expanding rhizomes. It is an important process in ginger production.





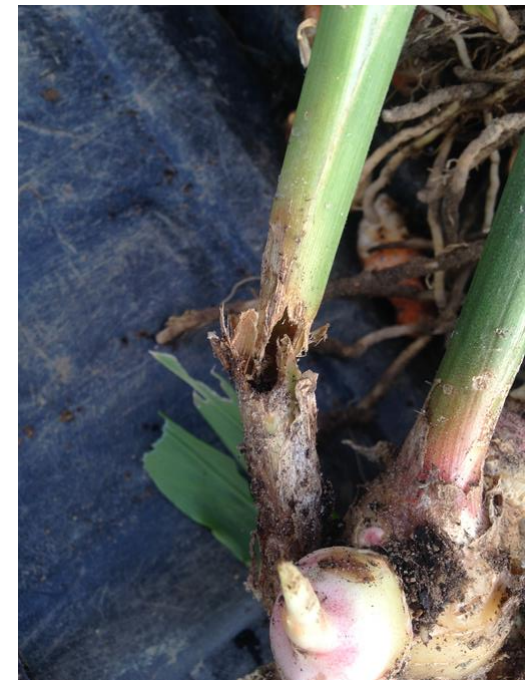




Mature Ginger



Baby Ginger



Armyworm, *Pseudaletia unipuncta* potential problem with high tunnel ginger production



leaf-spot *Phyllosticta zingiberi*



Diseases

- Bacterial wilt (*Pseudomonas solanacearum*) - wilt of entire plant, rhizome rot.
 - spreads by infested soil adhering to hands, boots, tools, vehicle tires and field equipment, water from irrigation or rainfall, and infected ginger rhizomes (Janse 1996).
 - Infects ginger roots and rhizomes through openings where lateral roots emerge or wounds caused by handling, parasitic insects or root-knot nematodes (Swanson et al. 2005).
 - The pathogen survives in soils within infected plant debris in soils and as free bacteria.
 - Crop losses: Crop loss can be complete in heavily infested soils.



Milky, bacterial ooze forming the cut surface of a discolored, infected ginger rhizome



Bacterial streaming from an infected ginger rhizome suspended in water. The streaming begins only a few minutes after placing the cut rhizome in water

Diseases

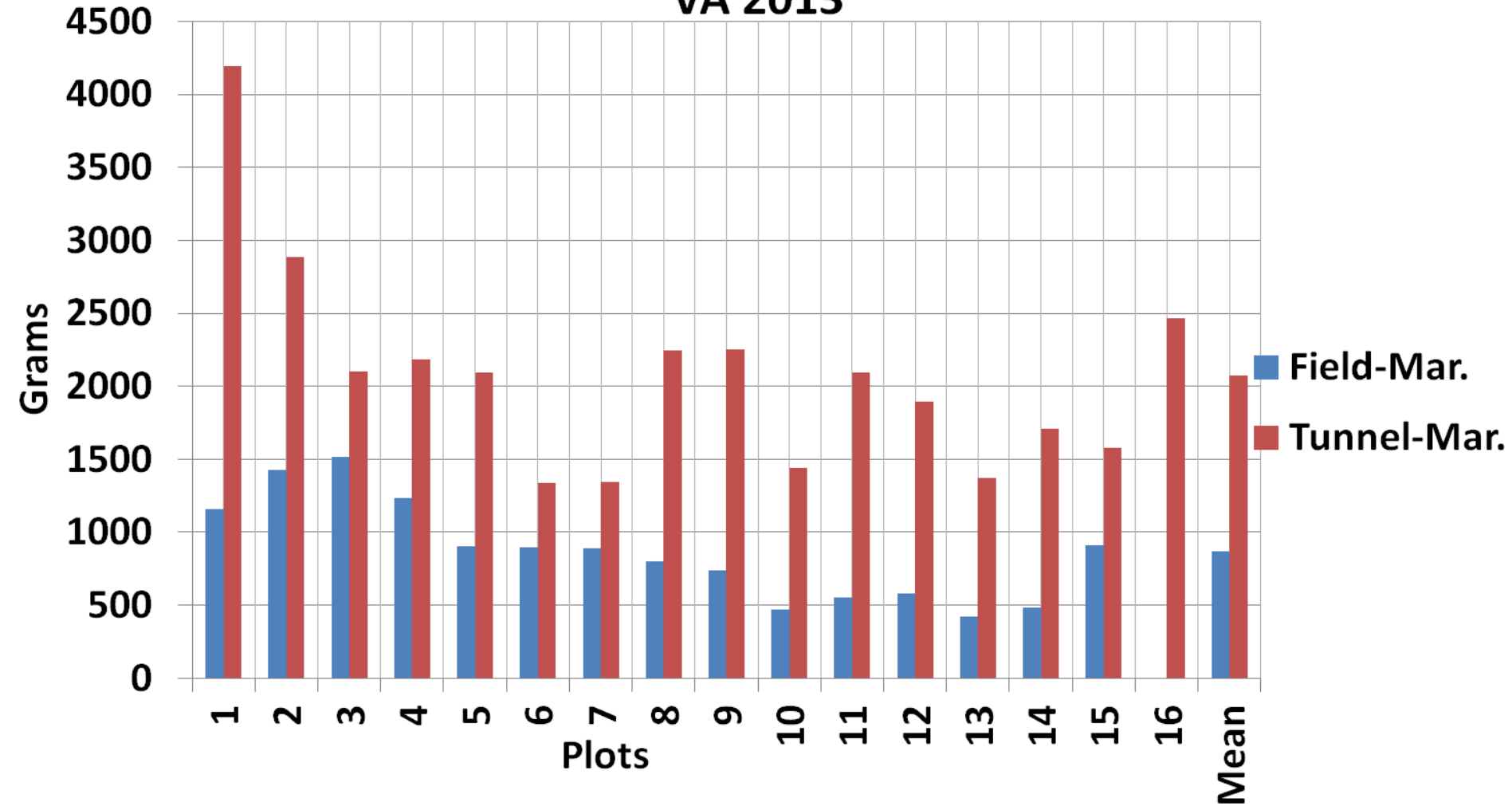
- Bacterial soft rot (*Erwinia* sp.) - Leaf, pseudo stem and rhizome rot.
- Bacterial leaf blight (*Xanthomonas* sp.) - Leaf blight.
- Fusarium yellows and rhizome rot (*Fusarium oxysporum* f. sp. *zingiberi*) - Wilt of entire plant, rhizome rot.
- Pythium soft rot (*Pythium graminicola*, *P. splendens* and *P. aphanidermatum*): root rot, and soft rot of rhizomes.

Rhizome Rot

Fusarium oxysporum



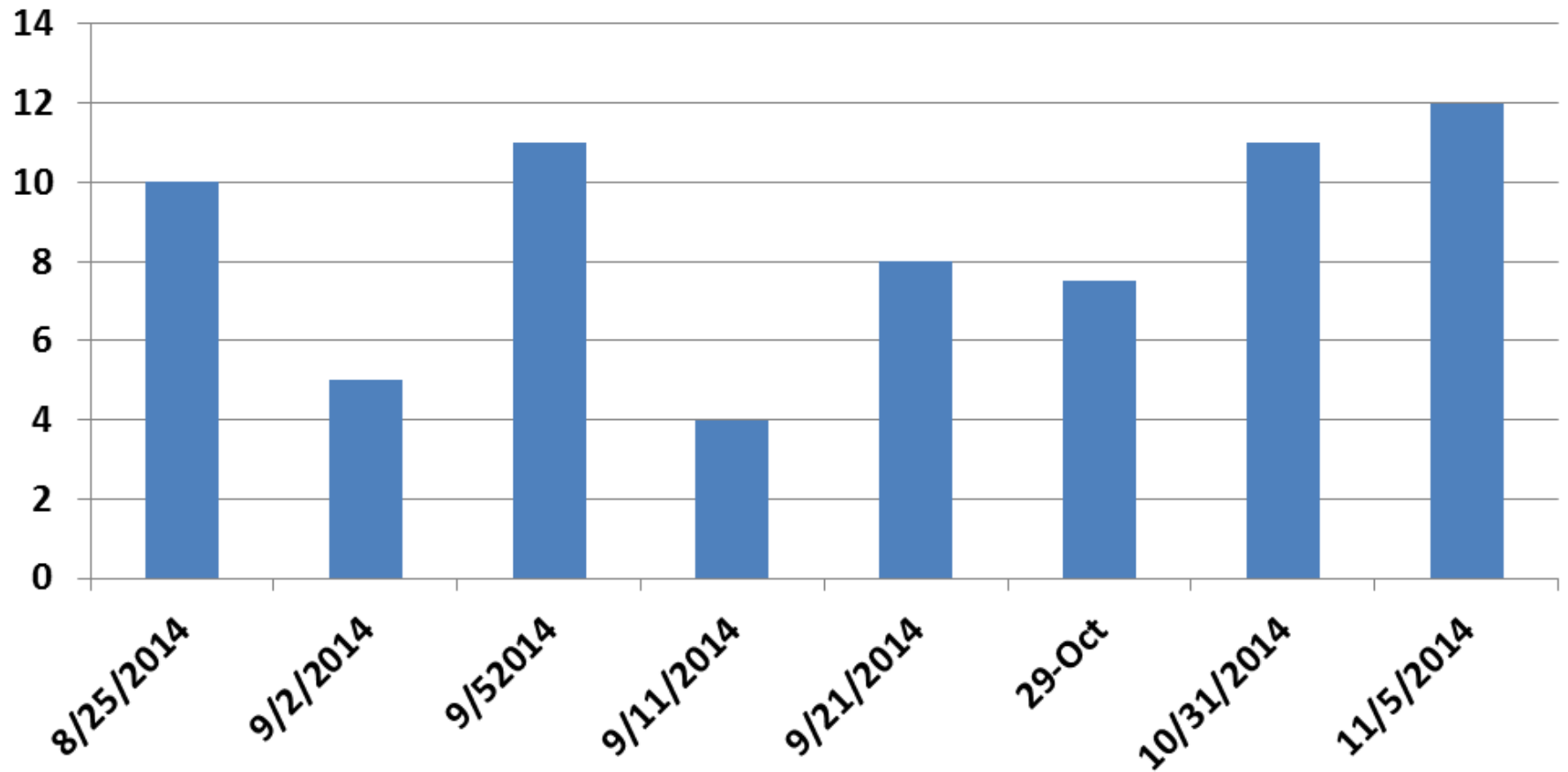
Marketable yield comparison of ginger root (gr.), grown under high tunnel and field conditions, VSU, Petersburg, VA 2013



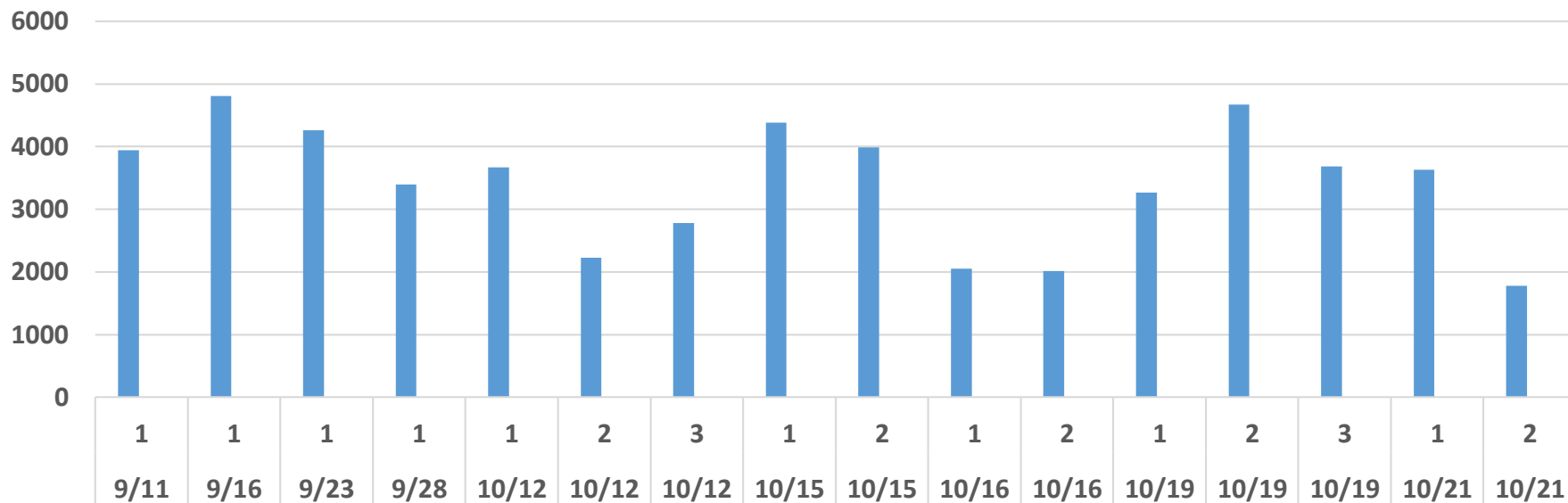
Harvest begun: Field and High tunnel 10/8/2013

Harvest ended: Field, 10/31/2013 and High tunnel, 12/05/2013

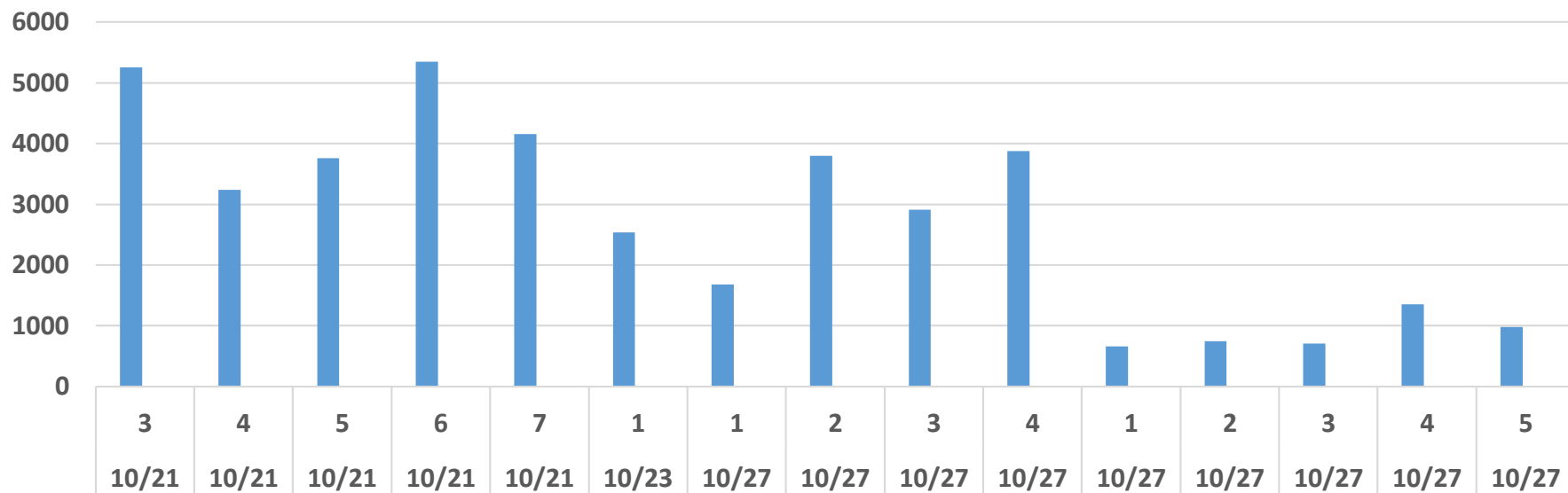
High tunnel grown ginger yield/plant 2014 season, VSU Randolph Farm (lbs.)



Ginger weight per plant (gr.), September 11- October 21, 2015, VSU Randolph Farm



Ginger weight (grs.) per plant, October 21-October27, 2015, VSU, Randolph Farm





Turmeric, *Curcuma longa*

- Is a rhizomatous herbaceous perennial plant of the ginger family, Zingiberaceae.
- It is native in Southeast Asia. Growing turmeric requires 9-11 month from planting the rhizome seed pieces until the harvest.
- In temperate zones as in Virginia, where the growing season is 7-8 month, there is a need to grow turmeric in high tunnel structure





Turmeric







Leeks
Tomates sur vigne
Cluster tomatoes

www.pholemers.com

Turmeric weight (grs.) per plant, September 16-October 27, 2015, VSU, Randolph Farm.

