

# Saffron:

## A Golden Opportunity for Crop Diversification

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# What is Saffron?

## ***Crocus sativus*** (=cultivated)

- The most expensive spice in the world  
over **\$3,000-9,000/lb!**
- Family: Iridaceae, subfamily Crocoideae
- Origin: Probably Greece or Crete
- Height: 5 - 20 inches tall
- Flowering: autumn
- Reproduction: Corm
- In cultivation for over 3,500 yr



# Saffron in Barcelona Market, 2016



## Price in Spain:

1 g (0.035 oz) for 7.50 Euros (\$8.36)

Equal to: \$3,792/pound

## Price in the US:

~\$20/g

Equal to: \$9,072/pound

**Price of gold: \$42/g**

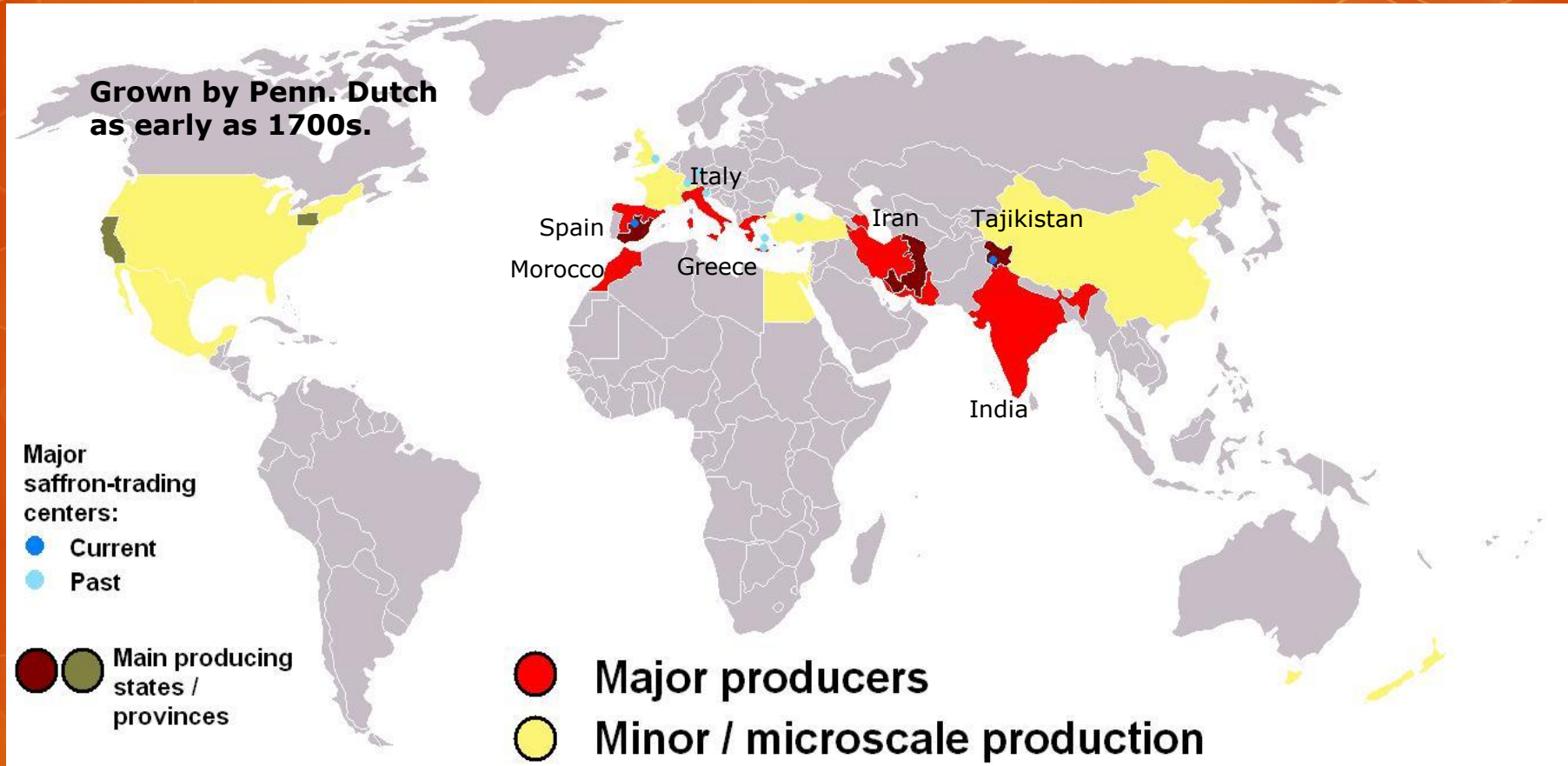


# What is Saffron good for?

- Culinary spice
- Medicinal herb
- Medicinal extract
- Perfume
- Ornamental plant
- Fabric dye
- Liqueur



# World Saffron Cultivation



In 2013 the US imported **25 tons** of saffron!



# Why is Saffron so expensive?

Currently most harvesting is done by hand.

One acre (field-grown) produces about three pounds of saffron.





# Why is Saffron so expensive?

Currently all processing is done by hand.

4,000 blooms = 1 oz of saffron (approx.  
114,000 threads or stigmas).



# Potential of Saffron for Diversified Farmers



- High value crop
- Low input (except labor for harvesting & processing)
- Production is relatively simple
- Labor outputs are mostly 4 weeks in late Oct./Nov.
- Fits into traditional vegetable production cycle
- Lots of possible value-added products



Saffron honey



Saffron flavored oil



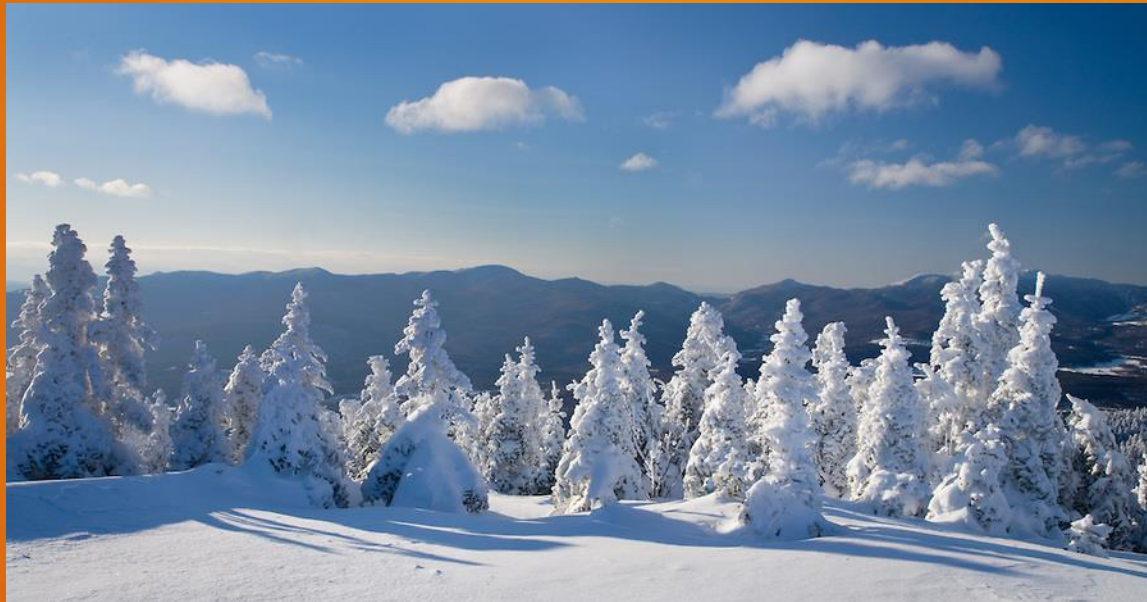
Saffron flavored syrup



Saffron safes



# Can Saffron be grown commercially in Northern Climates (zones 3 & 4)?



Our Hypothesis:  
Probably not outside in the field,  
but perhaps in high tunnels

# High Tunnel Growing Methods Tested



Raised beds



Milk crates





# Why High Tunnels?



- Low cost to erect and operate
- Protected environment but not too hot
- Used for other traditional crops



# Why Milk Crates?



- ✓ They are easy to move so growers can start other high-value crops like tomatoes in spring.
- ✓ They are inexpensive (often free) and readily available.
- ✓ They are the right depth for growing saffron.
- ✓ They are light weight but sturdy and durable.
- ✓ They protect corms from rodent predation.



# Production Methods

**Source of Corms:** Ruth Martin, PA (2015)  
American Meadows (2016)

**Corm size:** 10-40 mm diameter

**Planting date:** Aug. 25-Sept. 1

**Irrigation:** top watering



## **MILK CRATES**

- ✓ Milk crates (11 in. tall) covered inside with 2 strips of weed cloth.
- ✓ Crate filled with 4 in. top soil.
- ✓ Corms placed tip end up on top soil, covered with 2 in. of top soil and then 4 in. of a perennial potting mix containing compost.
- ✓ 11 corms planted/crate (=100 corms/sq meter)

# Production Methods

## RAISED BEDS

- ✓ Raised beds (12 in. tall) with bottom covered with hardware cloth (2016 only).
- ✓ Corms planted 2 in. deep in top soil, covered with 2 in. top soil, and then 4 in. potting mix.
- ✓ Planting density: 100 corms/ sq meter





# Harvesting and Drying Methods

**Harvest Period ~35 days: October 12-November 20**

- ✓ Harvested by hand every 2 days.
- ✓ Stigmas, stamens and petals separated and dried.
- ✓ Fresh and dry weight of each part recorded.
- ✓ Drying methods tested:
  - Air dried 48 hr.
  - Air dried 24 hr, oven 1 hr at 35°C.



# Post Harvest Methods

- ✓ Check for rodent damage.
- ✓ No watering.
- ✓ Corms reach dormancy by March (leaves turn brown)



Secondary corm

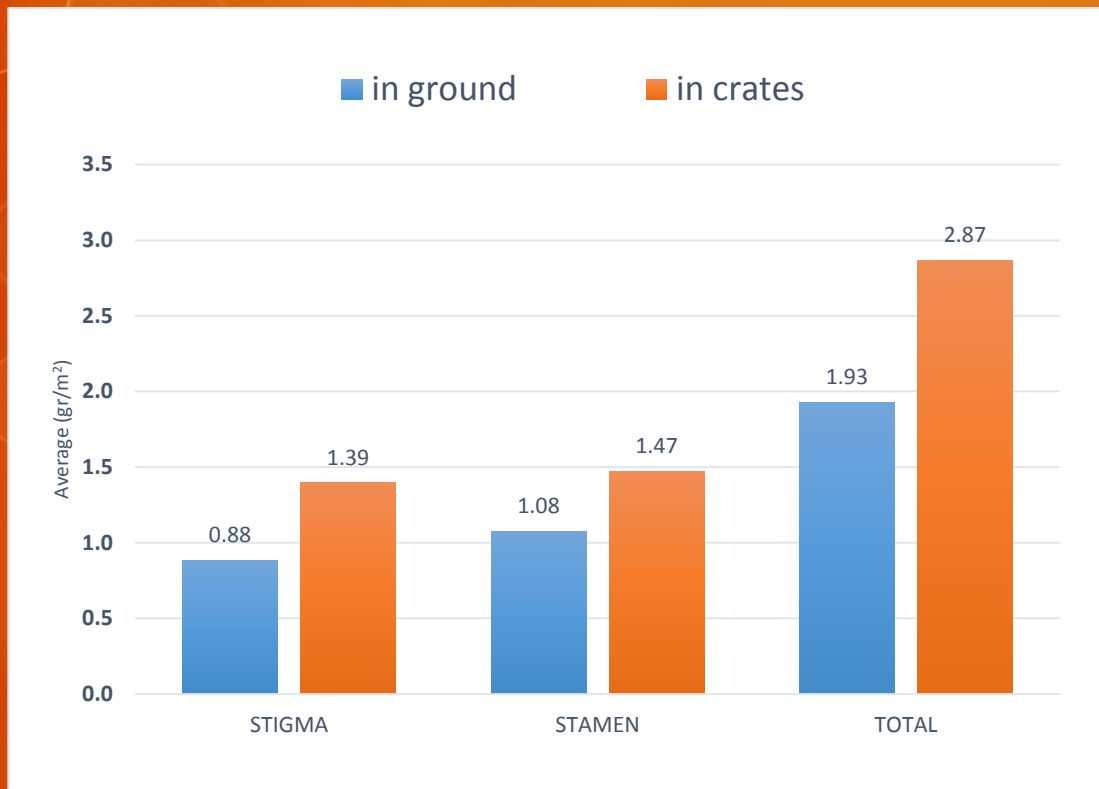
Primary or mother corm



# Factors We Assessed

- ✓ Saffron yield
- ✓ Saffron quality
- ✓ Corm yield/survival
- ✓ Cost of production

# 2015 Saffron Yield



453.6 gr = ~1 lb

Estimated VT Retail Price:  
\$20/gr (\$9,000/lb)

- Our saffron estimated revenue per sq ft = \$4.03/sq ft
- Estimated yield/acre: 5,624 gr [12.6 lb] = \$112,480
- Greater yield than Iran (0.34 gr/sq m) and Spain (0.60 gr/sq m)
- **Greater revenue per sq ft than tomatoes (\$3.51) or winter greens (\$1.81)**



Threads in  $\frac{1}{4}$  gram = 40  
threads =  $\frac{1}{2}$  teaspoon



# Why was our yield higher than Iran and Spain?

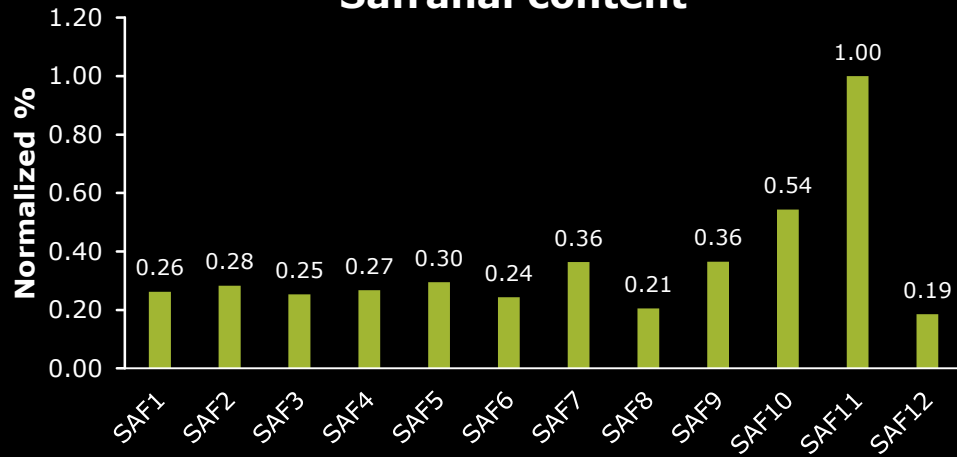
- Soil fertility
- Soil moisture
- Protection from rain and wind damage
- Saffron cultivar?



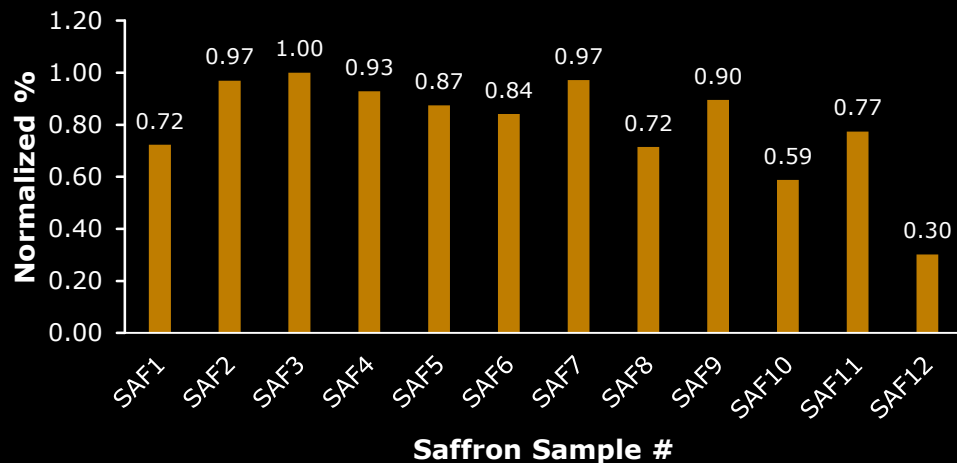


# Saffron quality

## Safranal content



## Crocin content

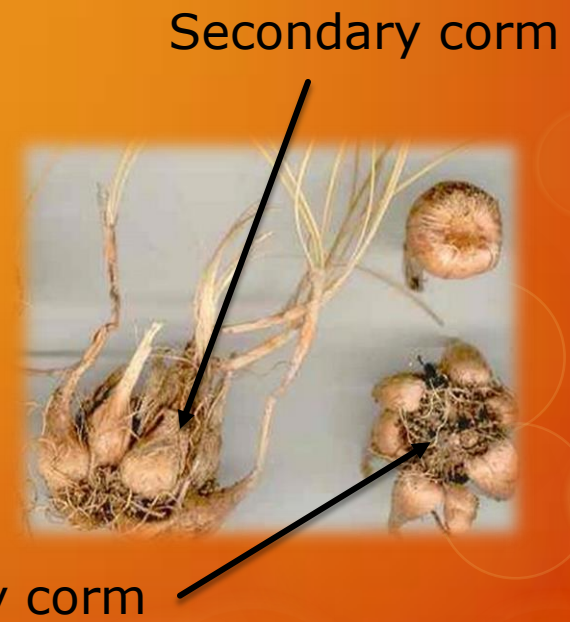


Sample #	Source	Growing method	Harvest time
1	VT	HT In-crate	Early season
2	VT	HT In-ground	Early season
3	VT	HT In-crate	Late season
4	VT	HT In-ground	Late season
5	VT	HT In-crate	Late season
6	VT	HT In-ground	Late season
7	VT	HT In-crate	Late season
8	VT	HT In-ground	Late season
9	PA	In-ground	Late season
10	Iran	In-ground	Unknown
11	Spain	In-ground	Unknown
12	Italy	In-ground	Unknown

# Corm Yield

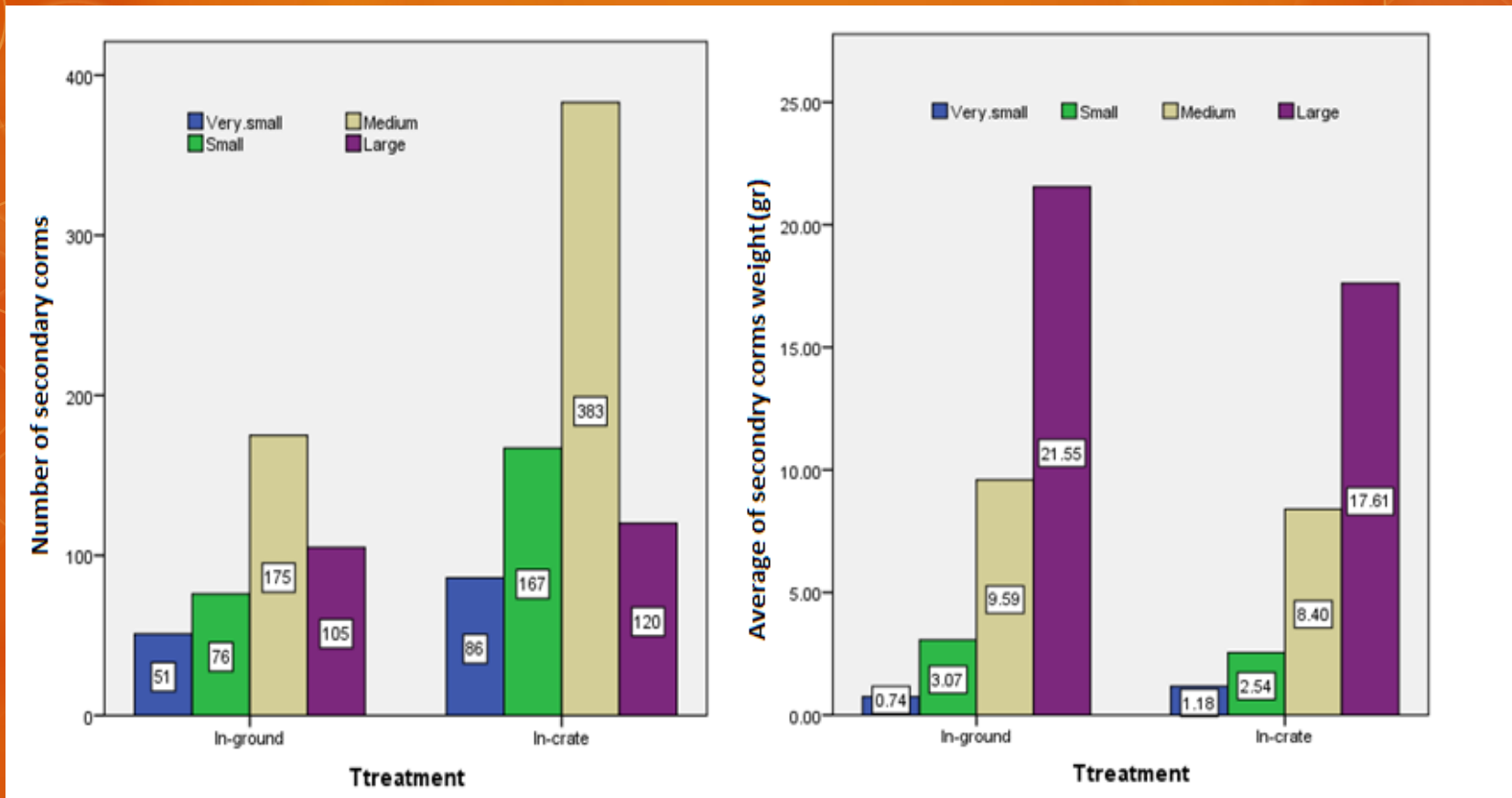
Treatment	# primary corms 2015	# secondary corms in 2016	Average wt/corm 2015	Average wt/corm 2016
In ground	465	407	11.2 grams	10.3 grams
In crates	465	756	11.2 grams	7.7 grams

- Almost 2 times more corms harvested from crates than from raised beds.  
Major factor: rodent feeding and predation in raised beds
- Corms from raised beds were 1/3 heavier than those from crates.  
Major factor: soil moisture deficit in crates





# Corm Size and Weight



- 43-51% of the harvested corms were medium size.
- 26% of in-ground corms and 16% of in-crate corms were large.

- In-ground corms were heavier (more dense) than those from the in-crate treatment.

Very small= <10 mm; Small=10 -20 mm  
Medium=20-30 mm; Large=>30 mm

# Rodent Damage



Rabbits



Voies & Moles

2016 flowering patterns

Raised beds



Crates





# Ruth Martin's home saffron bed Central Pennsylvania





# All that Glitters is NOT Gold!

Mexican Saffron is not the real thing.

It is safflower (*Carthamus tinctorius*), a frequent filler or fraudulent product.





# Local Market Opportunities: Product Quality & Authenticity

Present certification  
of Greek Organic  
Saffron.



Can processing be mechanized to  
reduce labor costs?  
Necessity is the Mother of Invention.



Blue Monkey Gathering Saffron  
Fresco from the Palace of Knossos on Crete (1500 BC).





# Summary

- Saffron yield was higher in crates than in the ground.
- Saffron yield was greater when grown in high tunnels in VT than outside in traditional saffron-growing areas.
- Saffron quality in general was not significantly different from other commercial products.
- Corm yield was less for the in-ground than the in-crate treatment. Rodent damage and water availability were major factors.
- Corm size and weight was higher for the in-ground than the in-crate treatment.
- Revenue from saffron per sq ft was greater than tomatoes or winter greens.

# Future Research

- Repeat high tunnel trials in crates and in ground to determine patterns in survival, yield and corm production.
- Compare saffron yield in Year 1 and 2.
- Continue to assess saffron quality relative to harvest date and drying methods.
- Test different ways to minimize rodent damage.
- Market analysis.
- Develop other value added products.





Drinking saffron tea is said to bestow the gift of clairvoyance.



I have been imbibing, and have visions of a strong Saffron industry in Northern New England in the future!

This will test saffron's powers!

# Thanks for the Support!

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