

Saffron:

A Good Fit for New England

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What is Saffron?

Crocus sativus (=cultivated)

- The most expensive spice in the world
over **\$3,000-9,000/lb!**
- Origin: Probably Greece or Crete
- Flowering: autumn
- Reproduction: Corm
- In cultivation for over 3,500 yr



Why grow **SAFFRON** in the Northeast?

Over 90% of farms in the Northeast are ranked as "Small".

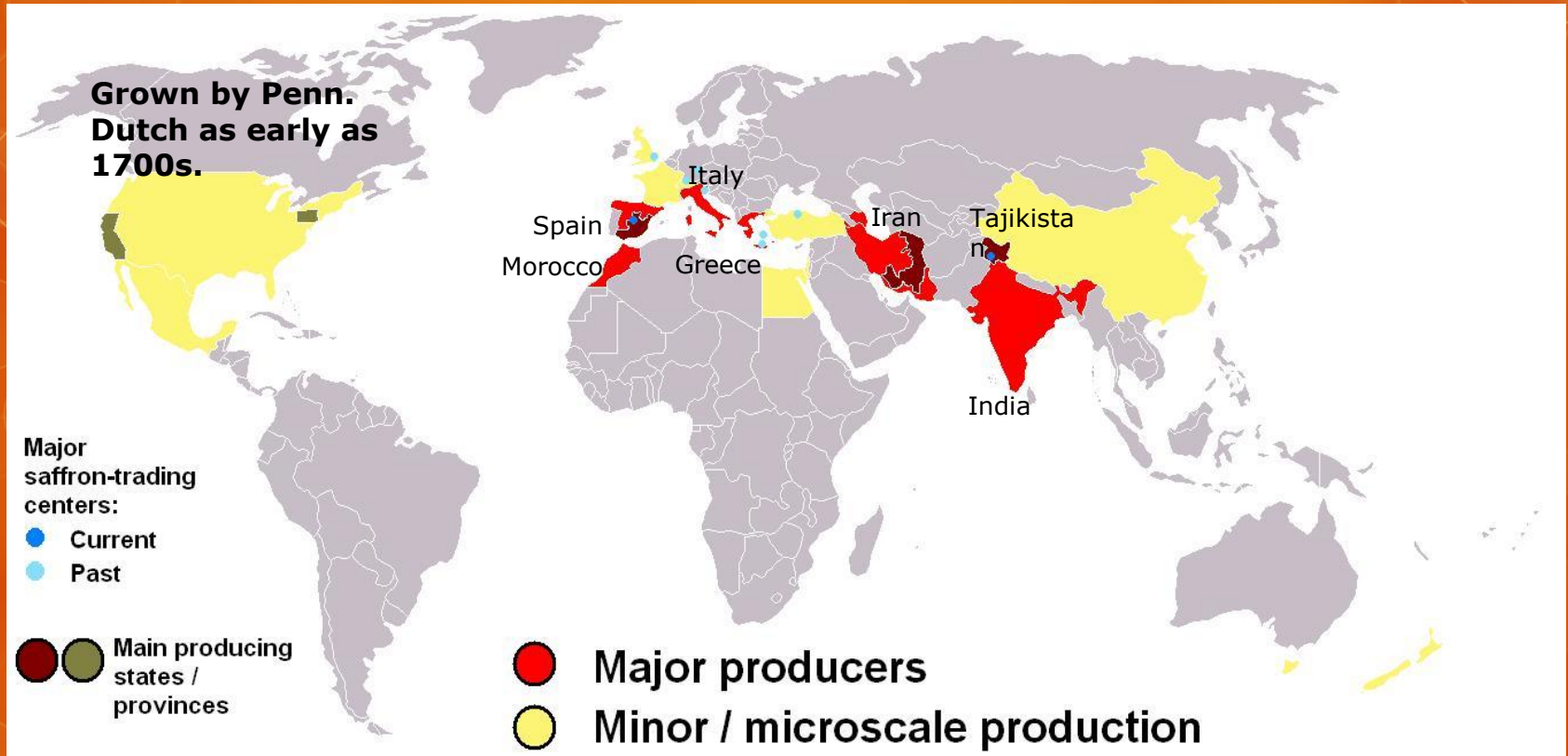
- Small farms = less than \$350,000 gross farm income.
- 82% of all US farms are small FAMILY Farms.
- 40 acres are lost to development every hour in the US.
- 42% of all developed land in the US is in the East.
- **Crop diversification is key to success for small farms.**

What is Saffron good for?

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



World Saffron Cultivation



In 2016 the US imported **46 tons** of saffron!
Imports are estimated to **triple** by 2025.

Why is Saffron so expensive?

Currently most harvesting is done by hand.

One acre (field-grown) in Iran 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



Saffron in Spain, 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 = \$9,072/pound

Price of gold: \$40/g



40 flowers (120 threads) = ¼ gram = ½ teaspoon

Potential of Saffron for Diversified Farmers

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



Saffron honey



Saffron flavored oil

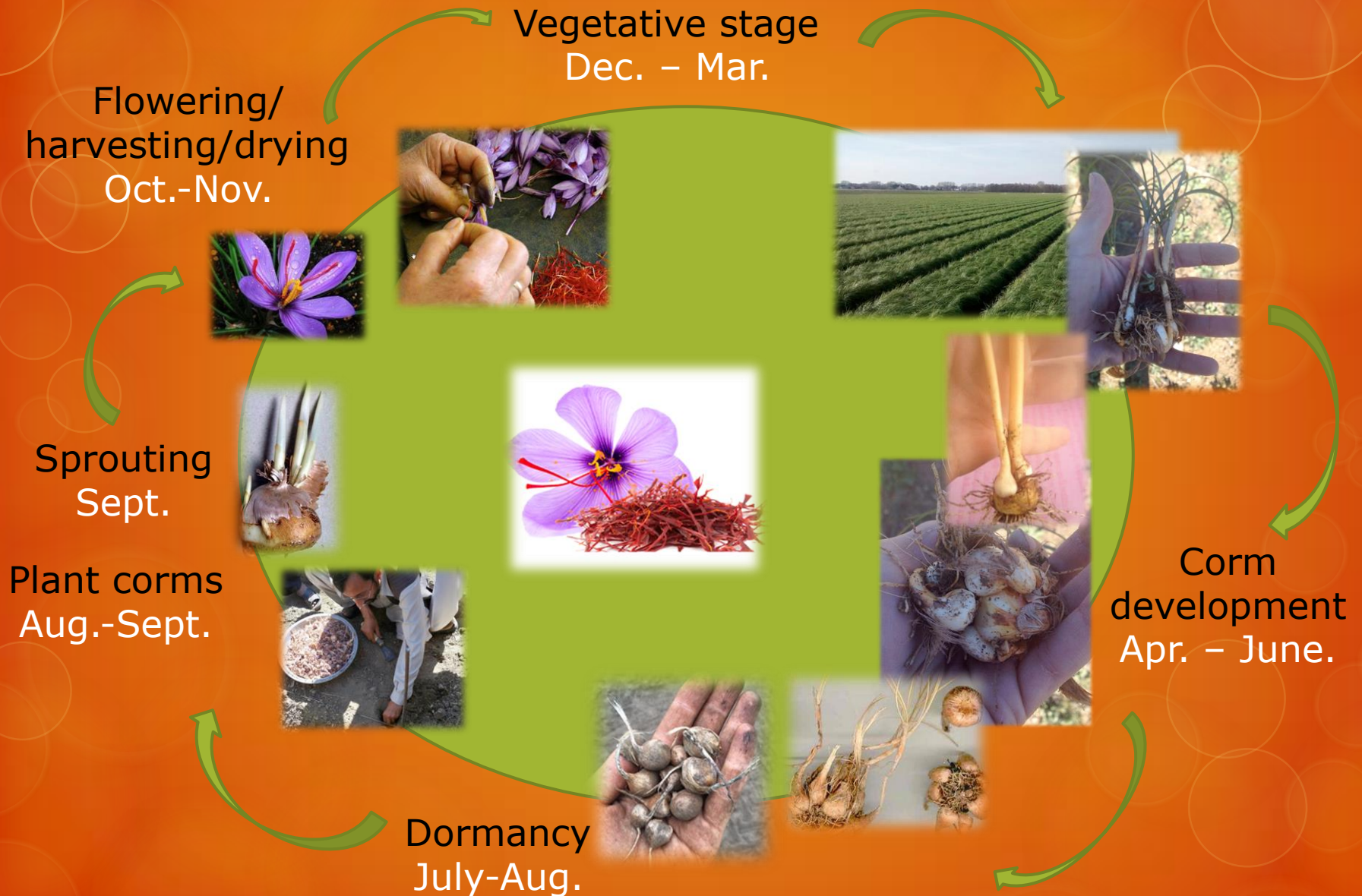


Saffron flavored syrup



Saffron safes

Saffron Production Cycle



Where can Saffron be grown commercially in New England?



Zones 4-5?



Zones 6-7?

Our Hypothesis:

In high tunnels in colder zones
In the field in warmer zones

High Tunnel Growing Methods Tested 2015-2016



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?



- ✓ Easy to move so growers can start other high-value crops like tomatoes in spring
- ✓ Inexpensive (often free) and readily available
- ✓ Suitable depth for growing saffron
- ✓ Light weight but sturdy and durable
- ✓ Protect corms from rodent predation

Production Methods

Source of Corms: PA (2015); Holland (2016)

Corm size: 9-10 cm circumference

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 4 in. perennial potting mix with compost.
- ✓ 11 corms planted/crate (=118 corms/m²)

Production Methods

RAISED BEDS

- ✓ Raised beds (12 in. tall), bottom covered with hardware cloth (2016 only)
- ✓ Corms planted 2 in. deep in top soil covered with 4 in potting mix
- ✓ Planting density: 118 corms/m²



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.



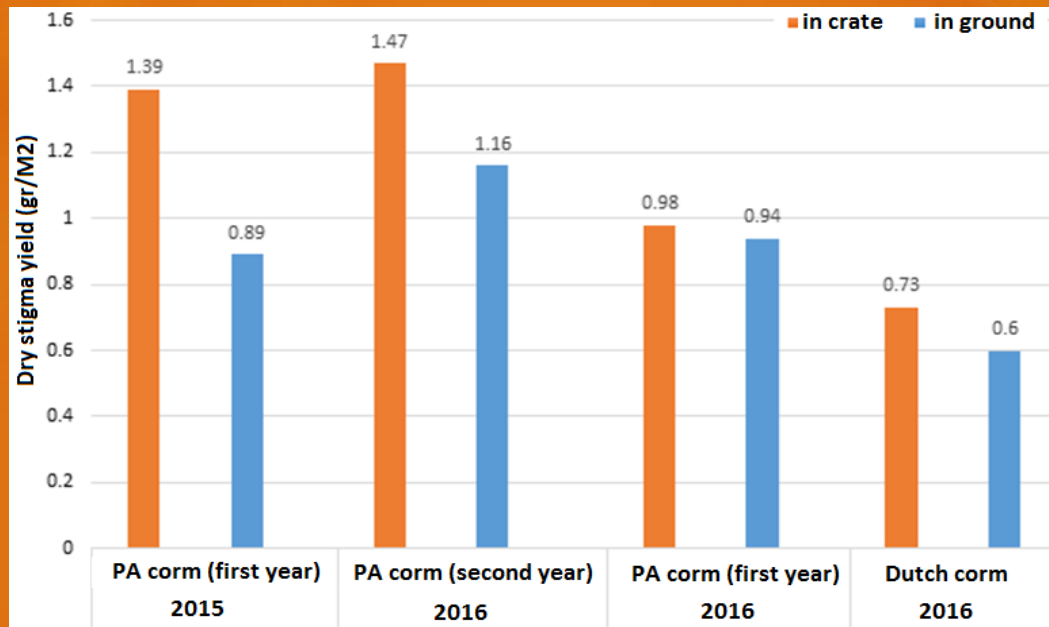
Post Harvest Procedures

- ✓ Check for rodent damage
- ✓ Weed beds
- ✓ Water as needed
- ✓ Corms reach dormancy by June
(leaves turn brown)

Factors We Assessed

- ✓ Saffron yield
- ✓ Saffron quality
- ✓ Corm yield/survival

2015 & 2016 Stigma Yield



- Greater yield in crates than in raised beds (rodent damage)
- Yield increased in Year 2
- Our estimated saffron net revenue = \$4.03 – 5.25/ft²
- Estimated yield/acre: 5,624 gr [12.6 lb] = \$112,480
- Greater yield than Iran (0.34 gr/m²) and Spain (0.60 gr/m²)
- **Greater revenue per sq ft than tomatoes (\$3.51) or winter greens (\$1.81)**

Why was our yield higher than Iran and Spain?

- Soil fertility
- Soil moisture
- Protection from rain and wind damage



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 in raised beds
- Corms from raised beds were 1/3 heavier than those from crates.
Major factor: soil moisture deficit in crates



Rodent Damage



Rabbits



Voiles & Moles

2016 flowering patterns

Raised beds



Crates



All that Glitters is NOT Gold!

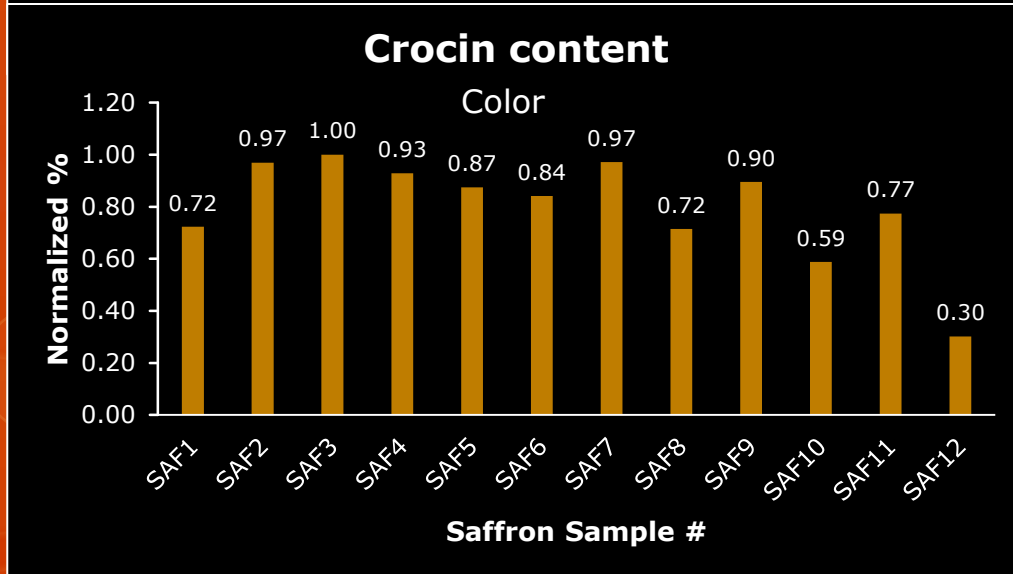
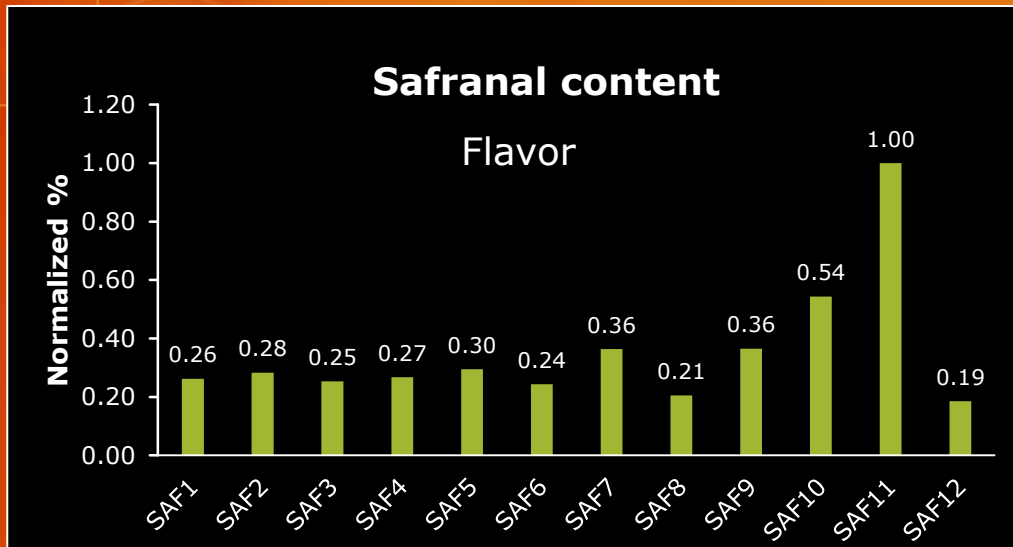
Mexican Saffron is not the real thing.

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



Saffron is the most frequently adulterated spice in the world.

Saffron quality



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

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 higher in crates** than in raised beds.
- Saffron **yield greater in high tunnels** than in fields in Iran and Spain.
- In 2015 saffron **quality similar** to other products.
- **Corm yield greater in crates** than raised beds. Rodent damage and water availability were factors.
- **Corm size and weight greater in raised beds** than in crates.
- **Revenue from saffron greater** than tomatoes or winter greens.

Current Research & Outreach

- Field production in different VT coldhardiness zones.
- Compare saffron yield over time (years).
- Assess saffron quality relative to coldhardiness zones.
- Test different ways to minimize rodent and bulb mite damage.
- Workshop in March 2018.
- Moderate Saffronnet (internet listserv).



Future Research

- Field vs high tunnel vs low tunnel production in different coldhardiness zones.
- Market analysis and production cost study.
- Determine factors affecting saffron quality.



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