VERMONT Saffron
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Could the world's most expensive spice help farmers in Vermont?

The Boston Globe

Could an exotic spice from Iran help Vt. farmers?

A Spice Grows in Burlington
Small farmers in Vermont could benefit from research that discovered how to grow an exotic -- and lucrative -- spice during the winters.

Rare saffron could thrive in VT, prof says

exotic spice saffron grown successfully in Vermont
What is the origin of saffron idea?
**Saffron** is the dry stigma of *Crocus sativus* L. flowers which is the most expensive spice in the world.

**Phytogeographically**, the majority of these species occur within the Mediterranean region extending eastward into the Iran-Turanian region.
Saffron is a triploid sterile plant and thus propagation is only by clonal corm multiplication.

Saffron is adapted to **dry regions** tolerates a low temperature of around **0 to -4 °F** accumulation of reactive oxygen species (ROS) that can disturb plant cell metabolism.
The life cycle of saffron is similar in all producing regions.

The timing is related to the **air and soil temperature and also moisture**.
Saffron Corm Properties

**Heavier and bigger** corms produce more flowers and stigmas.

**Bigger corms can generate better secondary corms**
Saffron marketing is strongly related to **the quality of dry stigmas**.

Quality depends on several key characteristics such as **color, taste and smell**.

**Picrocrocin** is an important component which **saffranal** is a derivative from that during the dehydration of stigmas.
Low yield, using the ancient technology and increasing the labor costs keep the price of saffron high, globally.

The average saffron yield is about 8 lb./ha (less than 4 lb./acre).
As the *Crocus sativus* doesn’t set viable seed, the conventional breeding studies have not been success yet. Therefore, the most recent studies on saffron production emphasize on new methods of cultivations, soil properties and water demands.
More than 110,000 acres of the saffron cultivated area which is more than 80% of the whole area, are located in Khorasan province, northeast Iran.

Low soil organic matter (less than 1%) is the characteristic of the soil in this region.

The humic acid that is released from the organic matter and compost, can increase the saffron productivity up to 50%.

The high level of organic matter in Vermont and northern New England (more than 5%), potentially, makes this area as a productive region for saffron.
The Project Goals in the first year

Due to the short growth season and **cold winters in Vermont**, where growers use **high-tunnels**

and also **cold resistance properties of Crocus sativus**, assessing the potential of saffron growing was the main goal of this project

Two methods of saffron cultivation were tested:

- in milk crates
- &
- in the ground

**in the milk crates**

This would allow growers to use the high-tunnel for other crop from April to September.
Material and Methods.

This project is conducted at an organic farm, in northern Vermont (St. Albans (USDA plant cold hardiness zone 5a [-20 to -15 °F])).

![Greenhouse and garden plots](image)

![Temperature graphs](image)
Saffron corms were supplied from a Pennsylvania grower (R. Martin, Lititz, PA, cold hardiness zone 6b [-5 to 0 °F])

The corms were planted late in August (August 25, 2015) at a density of 118 corms per m² (11 corms/crate).
The ambient temperature (°C) and relative humidity (%) in the VT high tunnel.

**R:** Emergence of root, **F:** Start of flowering, **E:** End of flowering period.
Abundance distribution of saffron flowers and yield (dry stigmas) over the blooming period in the high tunnel.
Over the blooming season, flowers were **harvested on a daily basis**. The different parts of saffron flowers (stamens, stigmas and petals) were separated, the stigmas and stamens were dried by using **different dehydration methods**. Number of flowers, stigma and stamen yield in different treatments were recorded.
<table>
<thead>
<tr>
<th>Parameters</th>
<th>Treatment</th>
<th>Mean</th>
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</thead>
<tbody>
<tr>
<td>Dry Stigma (gr/m²)</td>
<td>In-crates</td>
<td>1.3950</td>
</tr>
<tr>
<td></td>
<td>In-ground</td>
<td>0.8657</td>
</tr>
<tr>
<td>Dry Stamen (gr/m²)</td>
<td>In-crates</td>
<td>1.4717</td>
</tr>
<tr>
<td></td>
<td>In-ground</td>
<td>1.0760</td>
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</tbody>
</table>

%65 more flowers in milk crates than in-ground
Analyses by Dr. Charles Cantrell, USDA ARS, Natural Products Utilization Research Lab, University of MS
<table>
<thead>
<tr>
<th>Treatment</th>
<th>Average weight (gr)</th>
<th>Maximum Weight (gr)</th>
<th>Ratio of secondary corm production</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-ground</td>
<td>10.3482</td>
<td>44.50</td>
<td>1.004</td>
</tr>
<tr>
<td>In-crates</td>
<td>7.7431</td>
<td>32.00</td>
<td>1.909</td>
</tr>
</tbody>
</table>

**Distribution of corm size categories in the whole experiment**

- **Very small** = <10 mm; **Small** = 10-20 mm; **Medium** = 20-30 mm; **Large** = >30 mm
The experiment in year 2 (2016)

Different sources of saffron corm
Average weight of an individual stigma (gr) 2016

- **Penn CORM (Second Year)**
  - In Crate: 0.0064
  - In Ground: 0.0081

- **Penn CORM (First Year)**
  - In Crate: 0.0073
  - In Ground: 0.0073

- **Dutch CORM**
  - In Crate: 0.0056
  - In Ground: 0.0038
Preliminary Market Analysis

There are several commodities that can be generated from one crop.
The estimated cost per corm is $0.30-1.20 each.

Mother corms generally produce 2-8 new corms every year, depending on growing conditions.

It is generally recommended that planting density in year 1 is 118 corms/m² or ~11/ft².

Projected corm yield after 1 year, if @ 2 additional secondary corms/year: 47,520

Projected gross revenue from corms @ $0.30/corm: $14,256 (in the high tunnel)
The highest yield we obtained in year 1 of production was

Dry saffron yield: 1.39 g/m² = 0.13 g/ft² (~280 g in the high tunnel, 5,624 g/acre)

This yield was obtained in the crates

The estimated retail price for dry saffron is ~$20/g or $794/oz ($9,071.8/lb)

We checked locally and found the retail price ranged from $10 - $36/gram.

Projected gross revenue from dry saffron ($20/g): $5,600 in the high tunnel, $112,000/acre
The estimated price for dry stamens is $27/g based on a sale to a Buddhist order for dying robes (reported by a grower in the Boston area).

Dry stamen yield: 1.47/m², 295 g in the high tunnel, 5,948 g/acre

Projected gross revenue from dry stamens ($27/g): $7,965
The estimated price for dry petals is $0.33/g

**Dry petal yield:** 1,585 g (in the high tunnel); 31,963 g/acre

Projected gross revenue from dry petals:
**$523 (in the high tunnel); $10,548/acre**
**Gross Revenue**

$28,335/ high-tunnel; or $572,083/acre

<table>
<thead>
<tr>
<th>Expense</th>
<th>Unit Cost</th>
<th>Amount needed</th>
<th>Total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crates</td>
<td>$4.00/crate</td>
<td>1,920</td>
<td>$7,680</td>
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<tr>
<td>Compost</td>
<td>166/cubic yard</td>
<td>8.13</td>
<td>$1,500</td>
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<tr>
<td>Corms</td>
<td>0.3/corm</td>
<td>21,600</td>
<td>$7,128</td>
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<tr>
<td>Weed cloth</td>
<td>$60/roll</td>
<td>4</td>
<td>$240</td>
</tr>
<tr>
<td>Labor for bed and crate prep</td>
<td>$12/hr</td>
<td>79.75</td>
<td>$957</td>
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<tr>
<td>Labor for general management</td>
<td>$12/hr</td>
<td>11.25</td>
<td>$135</td>
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<tr>
<td>Labor for harvesting</td>
<td>$12/hr</td>
<td>155.25</td>
<td>$1,863</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>$19,503</strong></td>
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Thanks for your attention

Questions?