

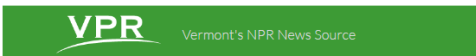
# VERMONT SAFFRON

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## Could saffron be the next big thing for Vermont?

The flower could be an extra source of income for Vermont farmers



## Growing Saffron In Vermont? UVM Researcher Tests Plant's Viability



World's most expensive spice grown in Vermont

Posted: Nov 11, 2016 4:11 PM EST  
Updated: Nov 14, 2016 5:00 PM EST



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



## 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



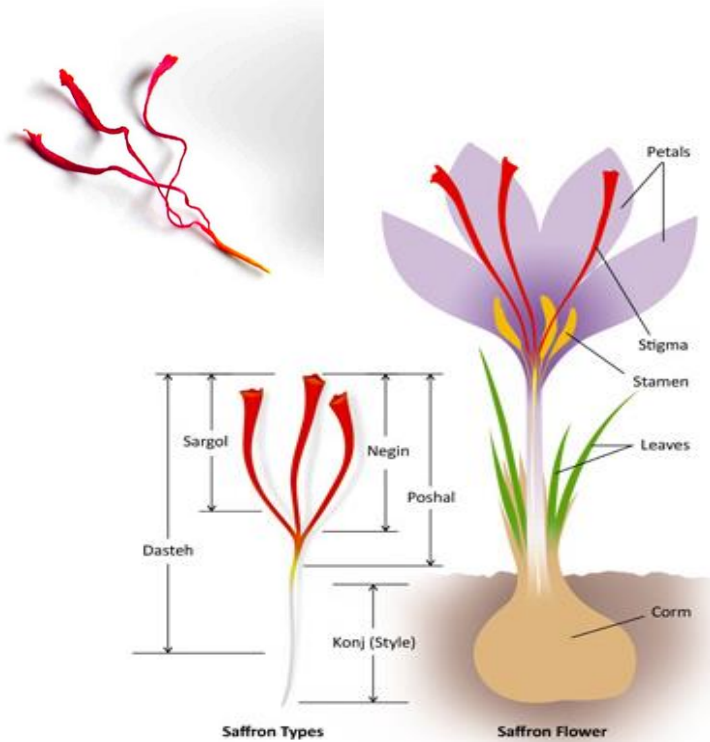
## Exotic spice saffron grown successfully in Vermont



# 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.

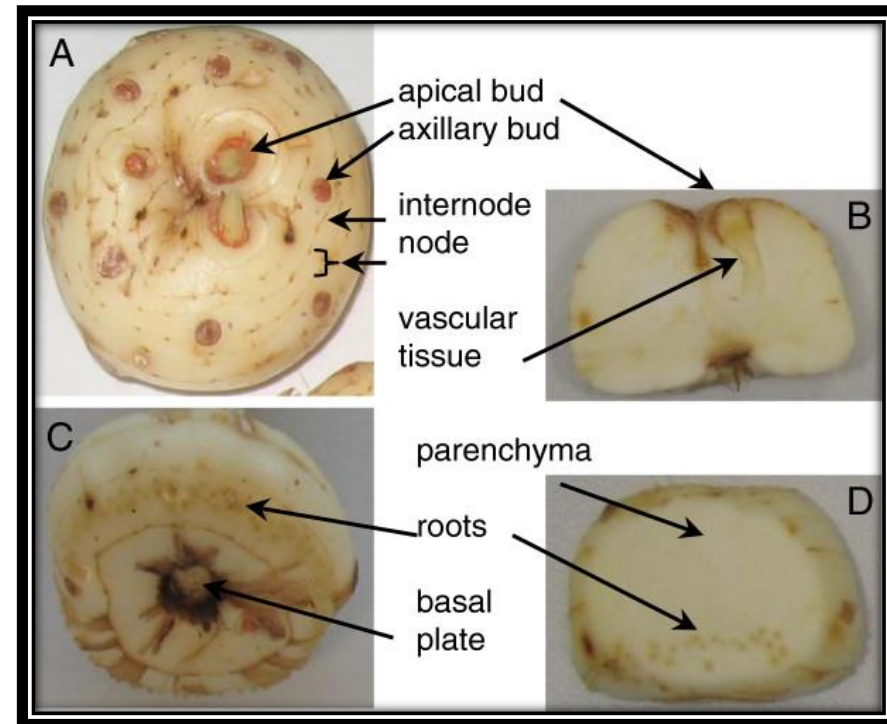


Saffron is adapted to **dry regions**

tolerates a low temperature of around **0 to -4 °F**

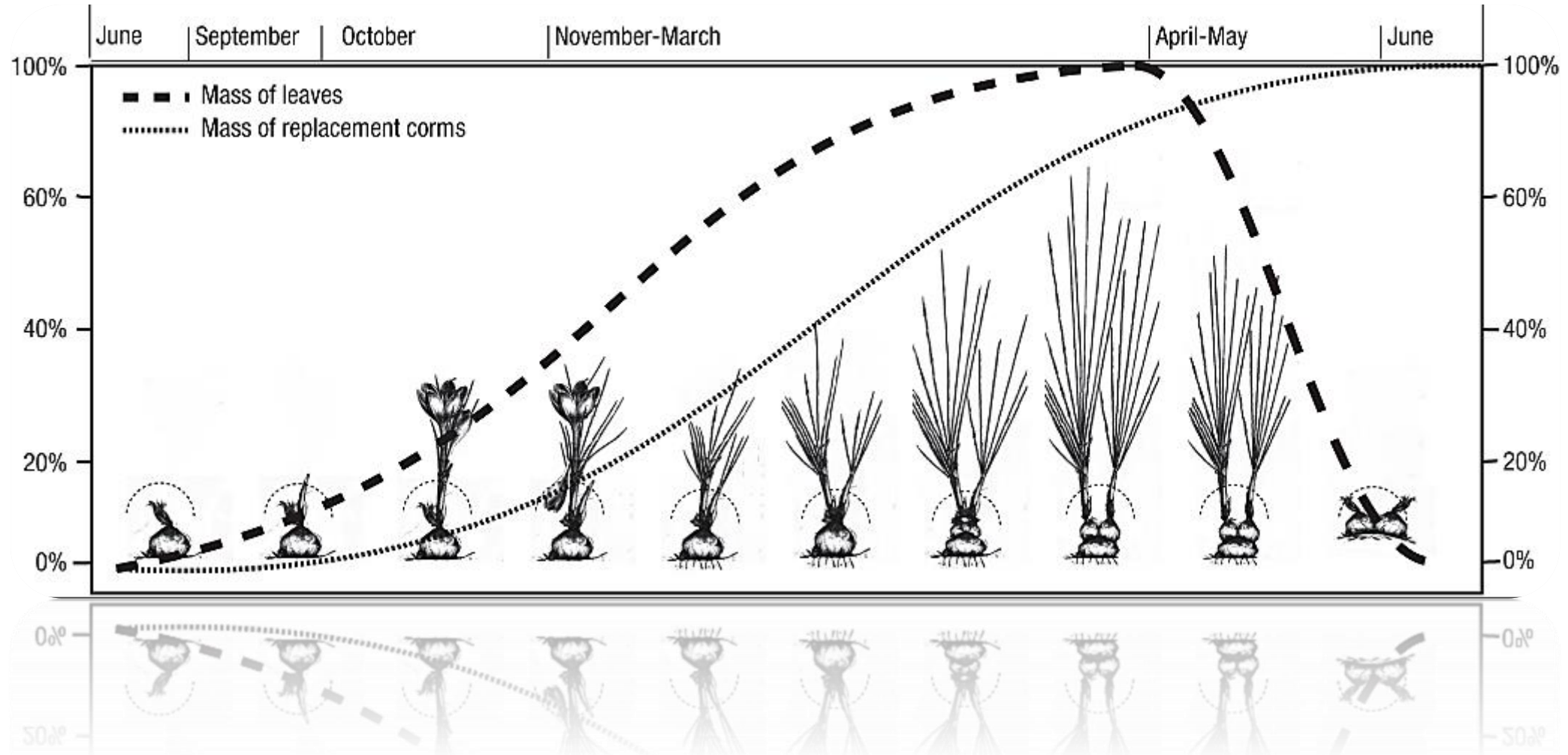
accumulation of reactive oxygen species (**ROS**) that can disturb plant cell metabolism.

Saffron is a triploid sterile plant and thus propagation is only by clonal **corm** multiplication



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

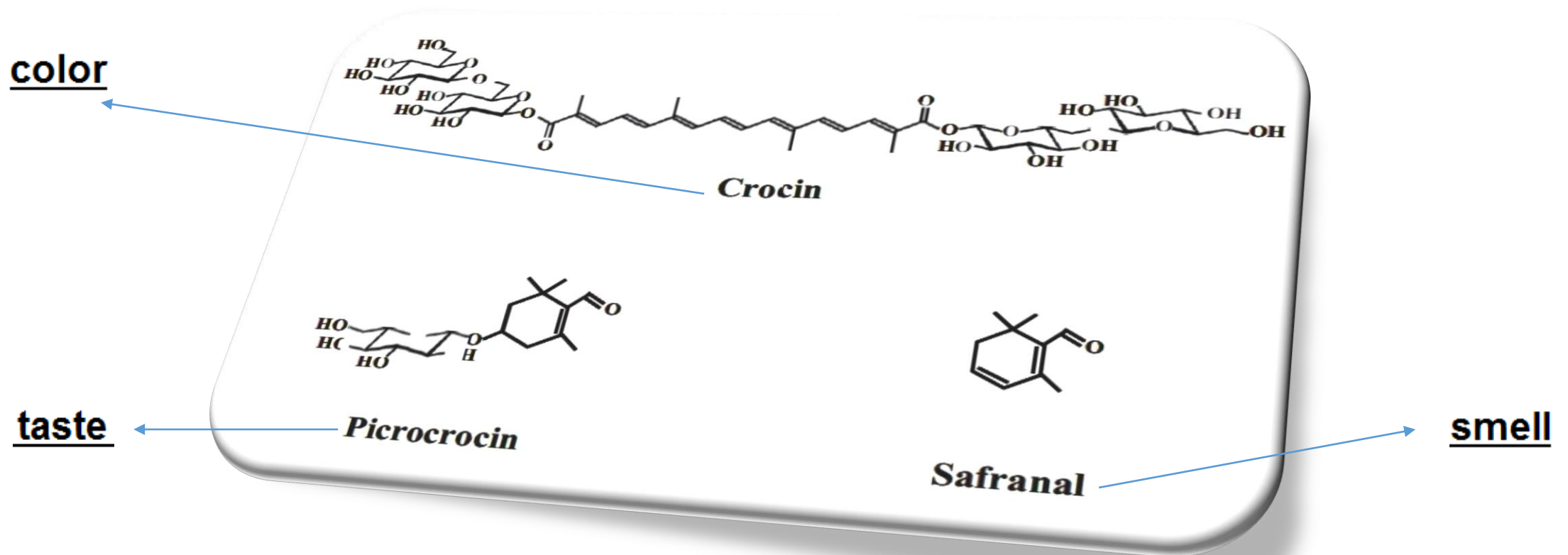
**Heavier and bigger** corms produce more flowers and stigmas.

**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 safranal is a derivative from that during the dehydration of stigmas.

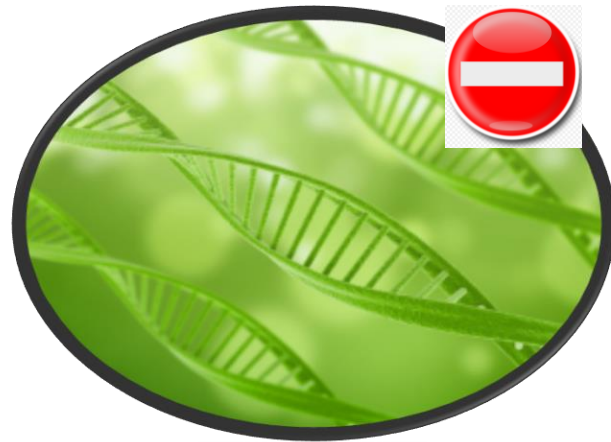
Low yield, using the ancient technology and increasing the labor costs keep the price of saffron high, globally.



The average saffron yield is about 8 lb./ha (less than 4 lb./acre).

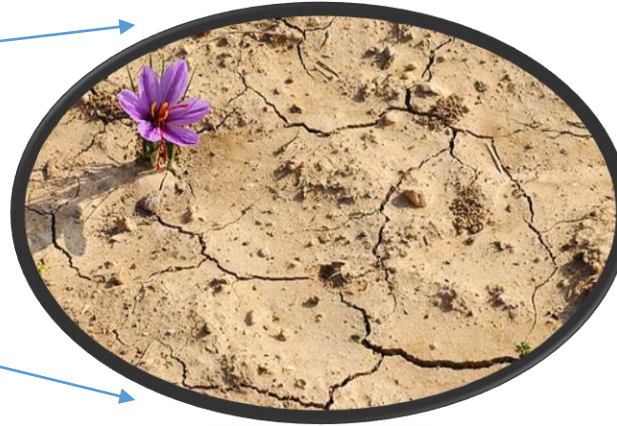


As the *Crocus sativus* doesn't set viable seed, the conventional breeding studies have not been success yet.



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

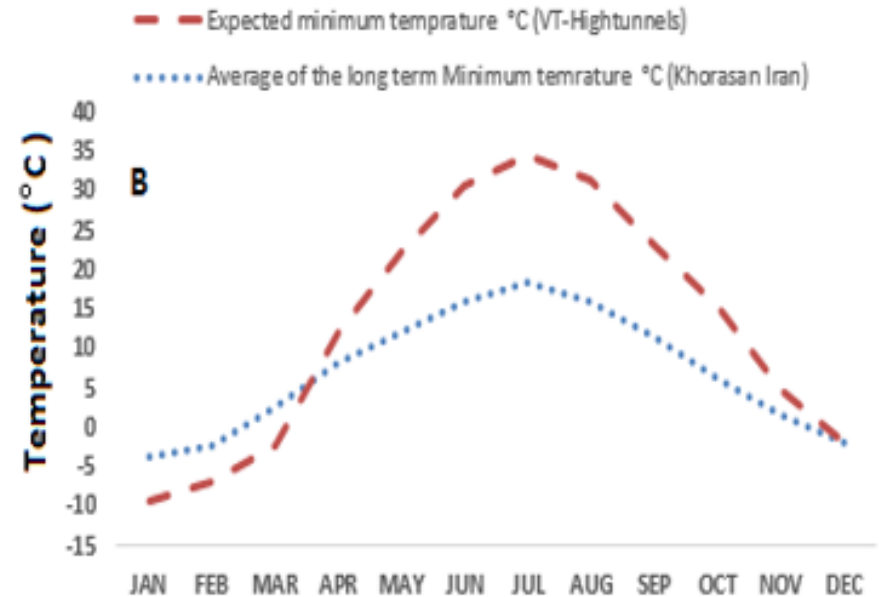
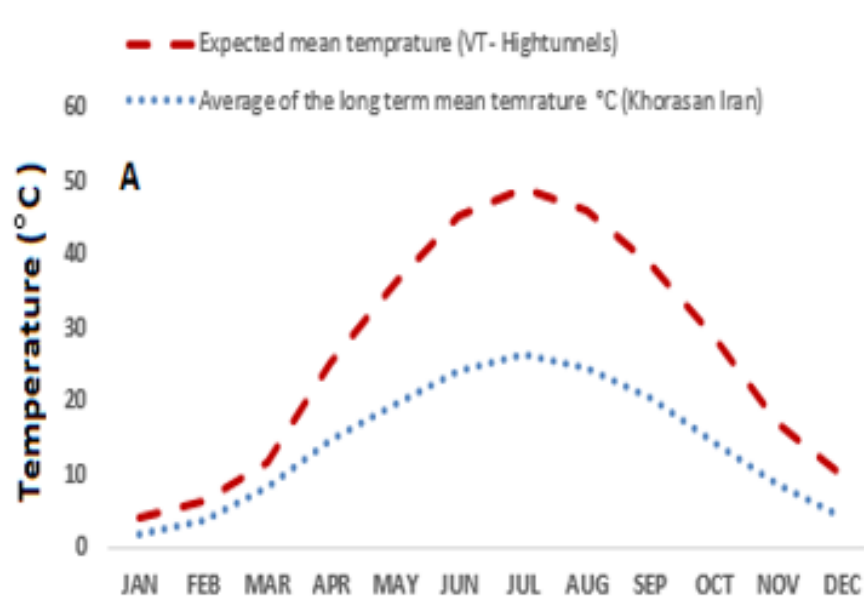


in the milk crates

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

## Material and Methods.

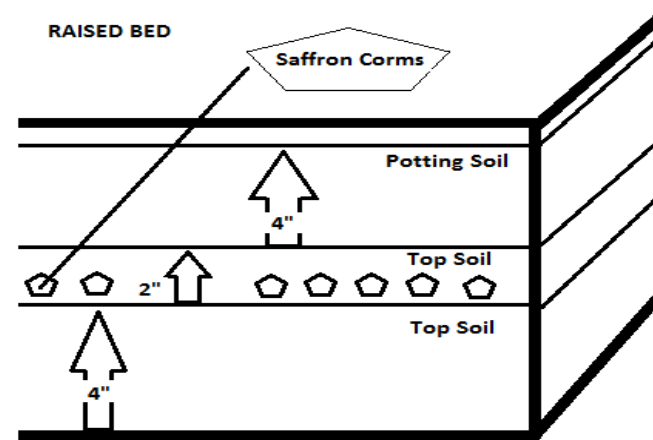
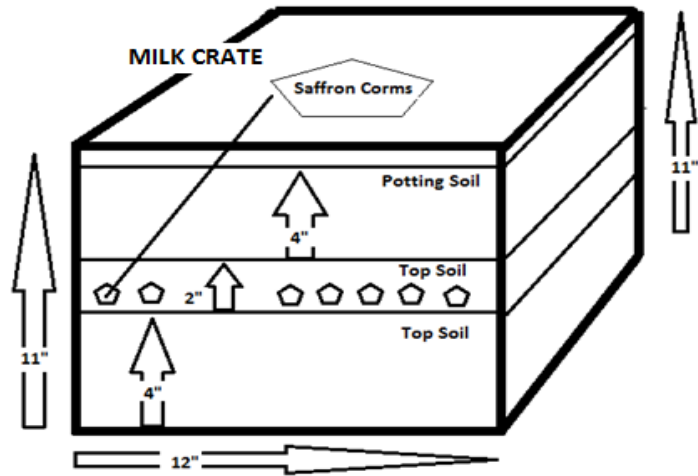
This project is conducted at an organic farm, in northern Vermont (St. Albans (USDA plant cold hardiness zone 5a [-20 to -15 °F])).



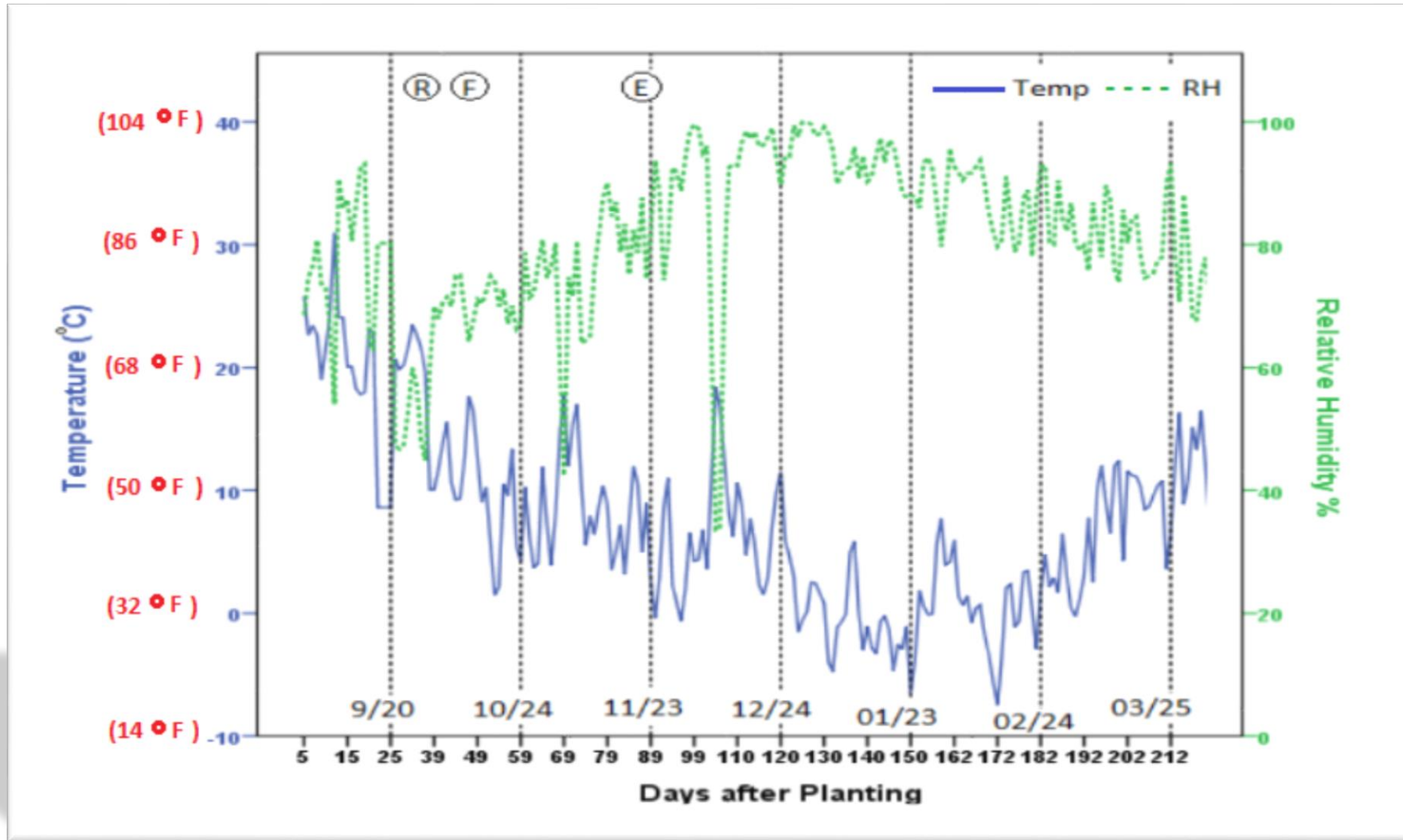
Saffron corms were supplied from a Pennsylvania grower (**R. Martin, Lititz, PA, cold hardiness zone 6b [-5 to 0 °F]**)



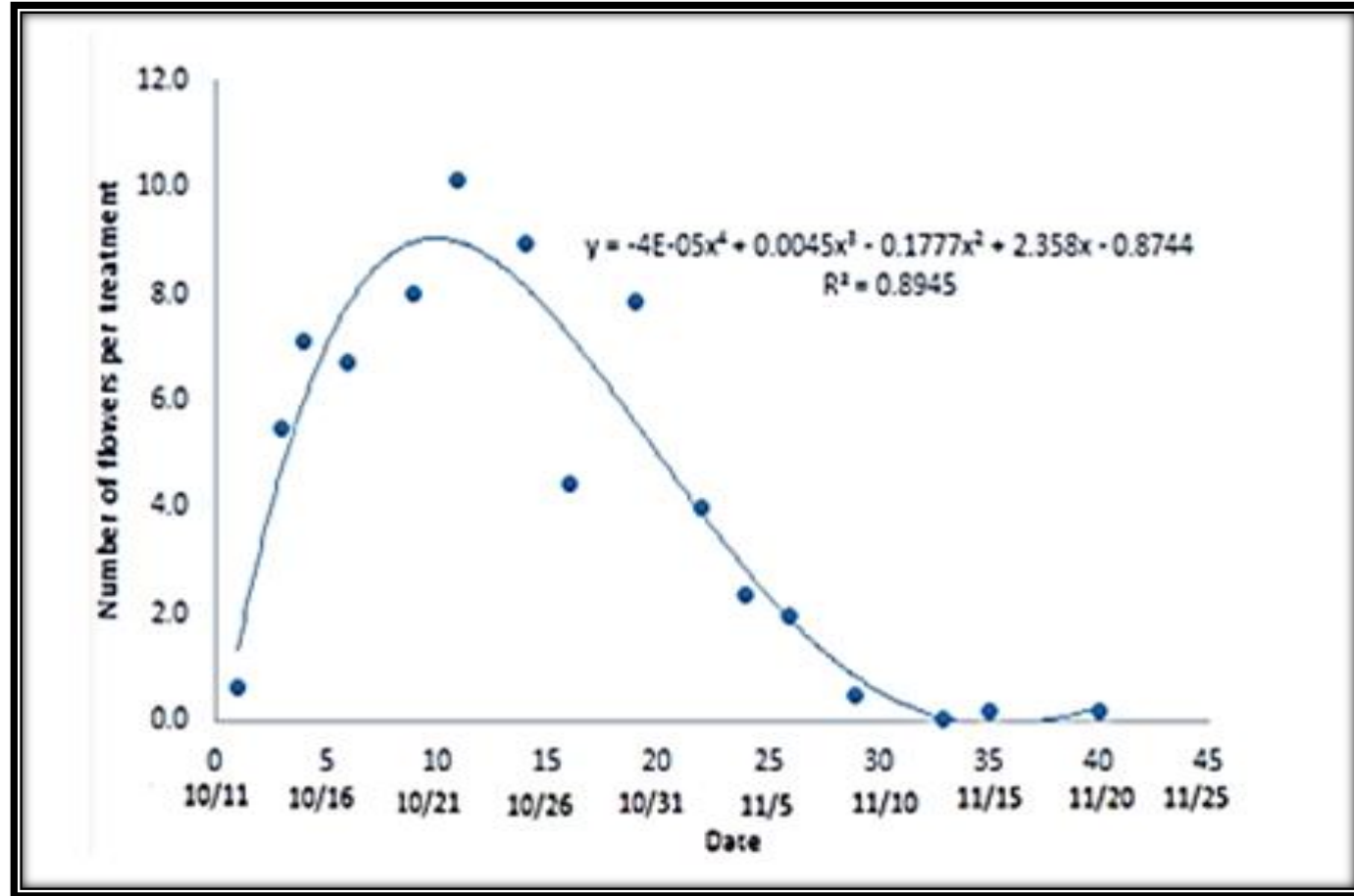
The corms were planted late in August (**August 25, 2015**) at a density of 118 corms per m<sup>2</sup> (11 corms/crate).



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,



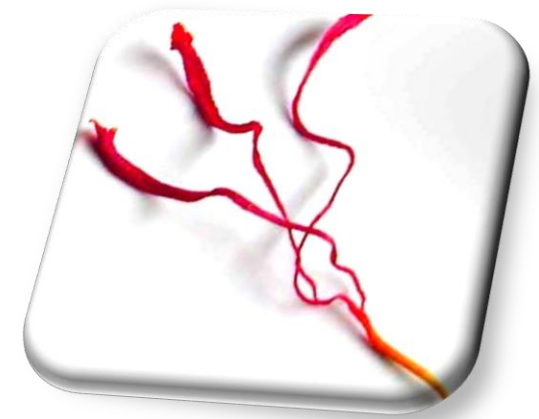
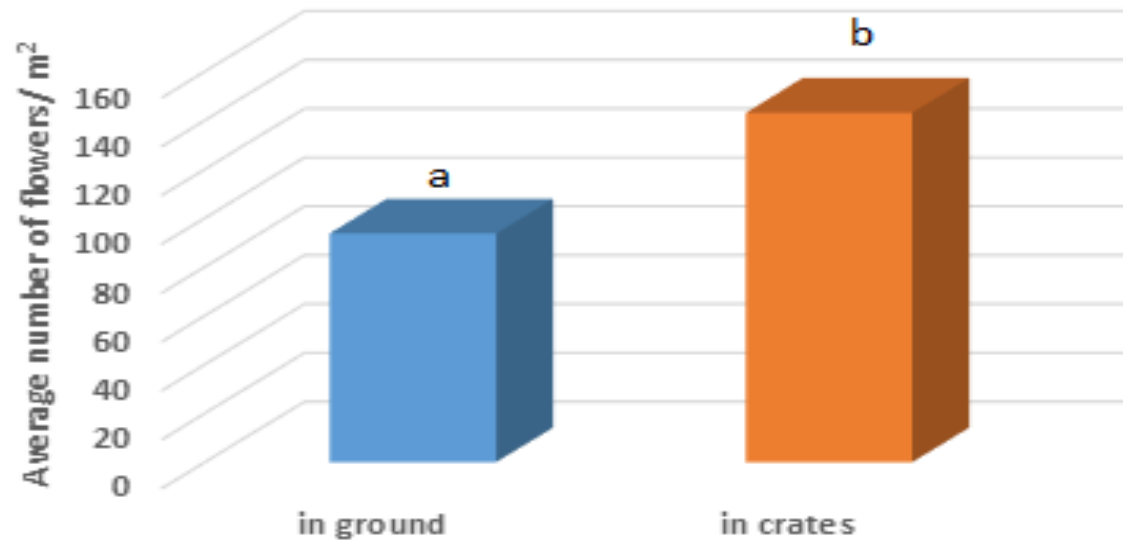
the stigmas and stamens were dried by using **different dehydration methods.**



Number of flowers, stigma and stamen yield in different treatments were recorded



Parameters	Treatment	Mean
Dry Stigma (gr/m <sup>2</sup> )	In-crates	1.3950
	In-ground	0.8657
Dry Stamen (gr/m <sup>2</sup> )	In-crates	1.4717
	In-ground	1.0760

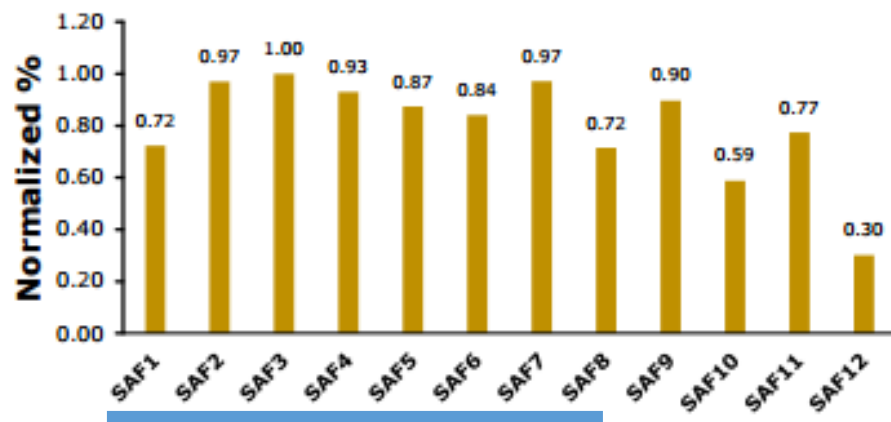


**%65 more flowers in milk crates than in-ground**

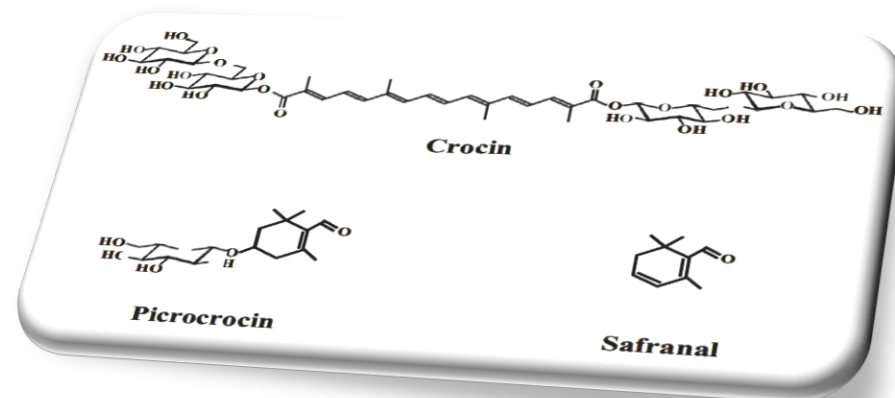
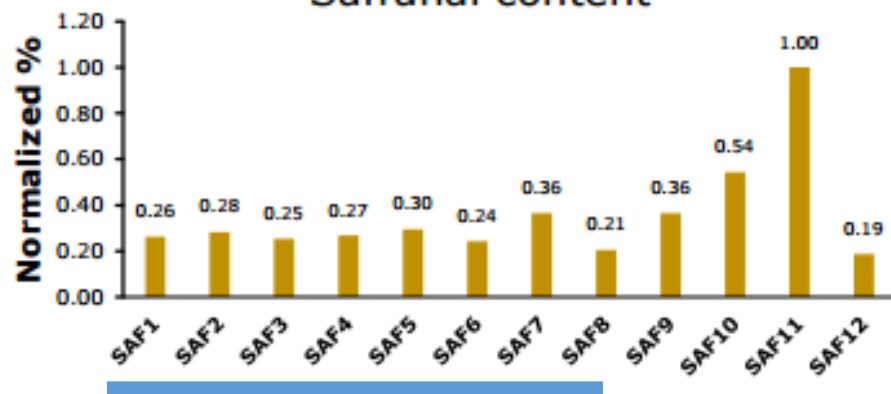


International  
Organization for  
Standardization

### Crocin content



### Safranal 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

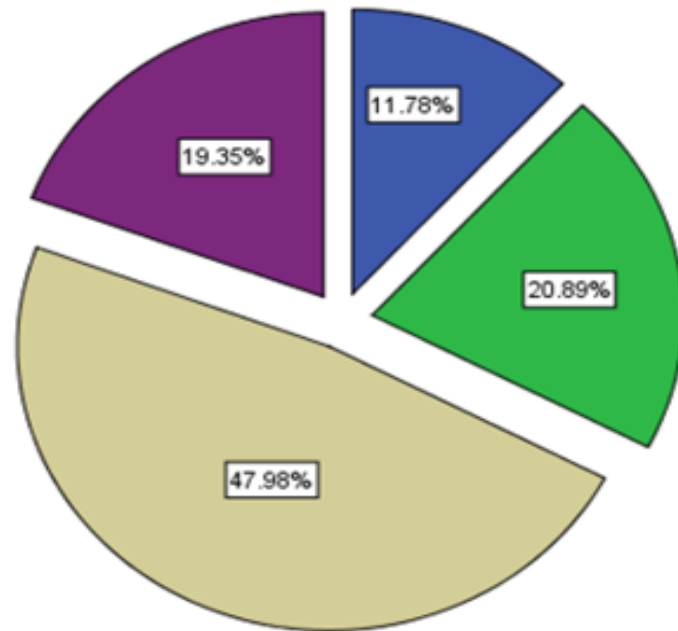
Analyses by Dr. Charles Cantrell, USDA ARS, Natural Products Utilization Research Lab, University of MS

Treatment	Average weight (gr)	Maximum Weight (gr)	Ratio of secondary corm production
In-ground	10.3482	44.50	1.004
In-crates	7.7431	32.00	1.909

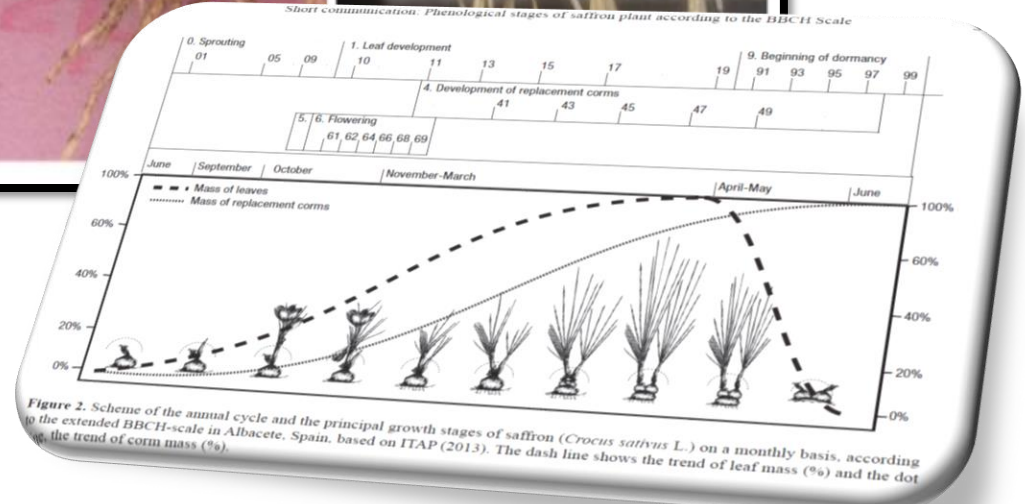
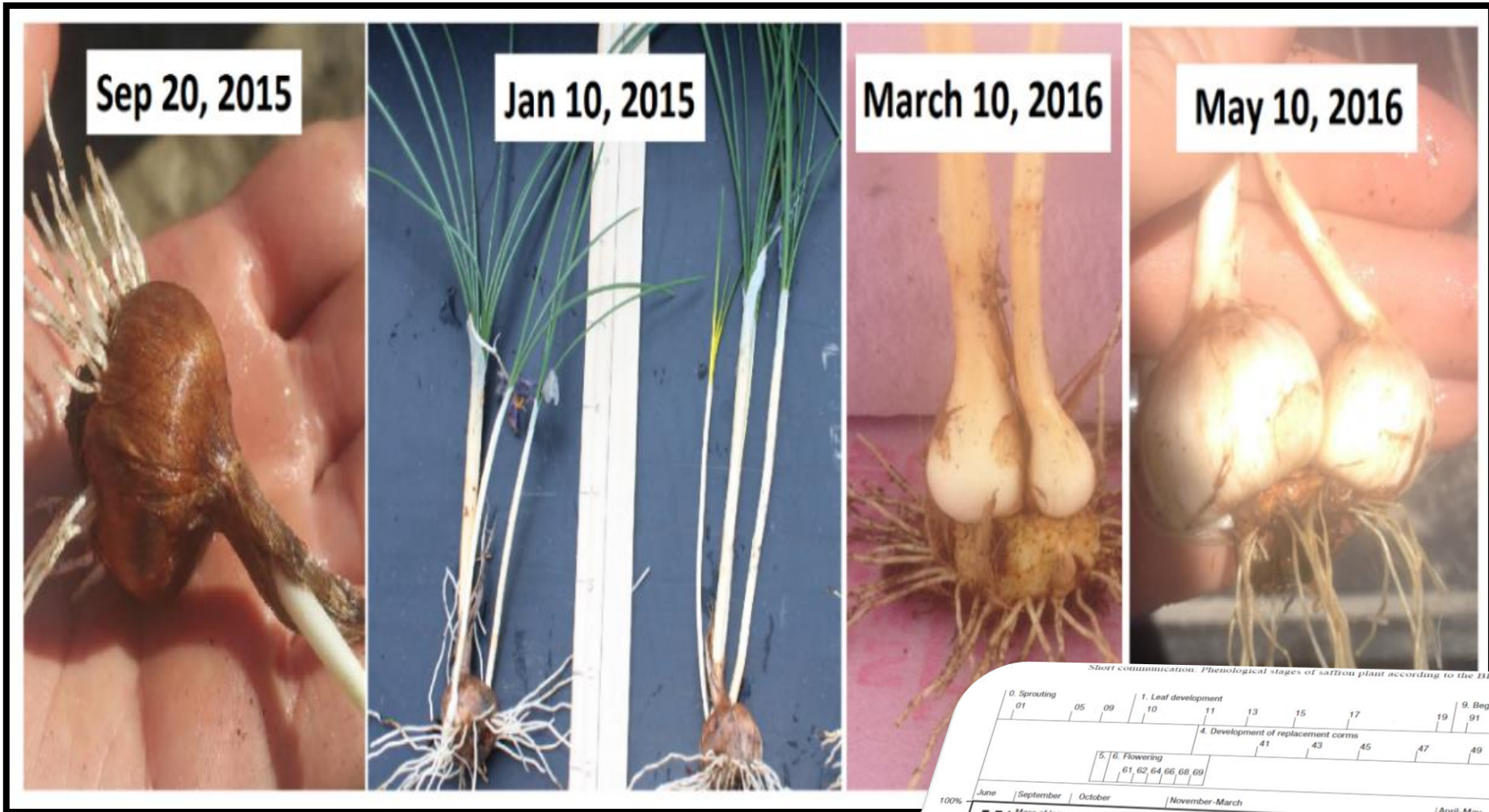


Distribution of corm size categories in the whole experiment

■ Very small   
 ■ Small   
 ■ Medium   
 ■ Large



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



PENN CORM  
(SECOND YEAR)  
IN CRATE

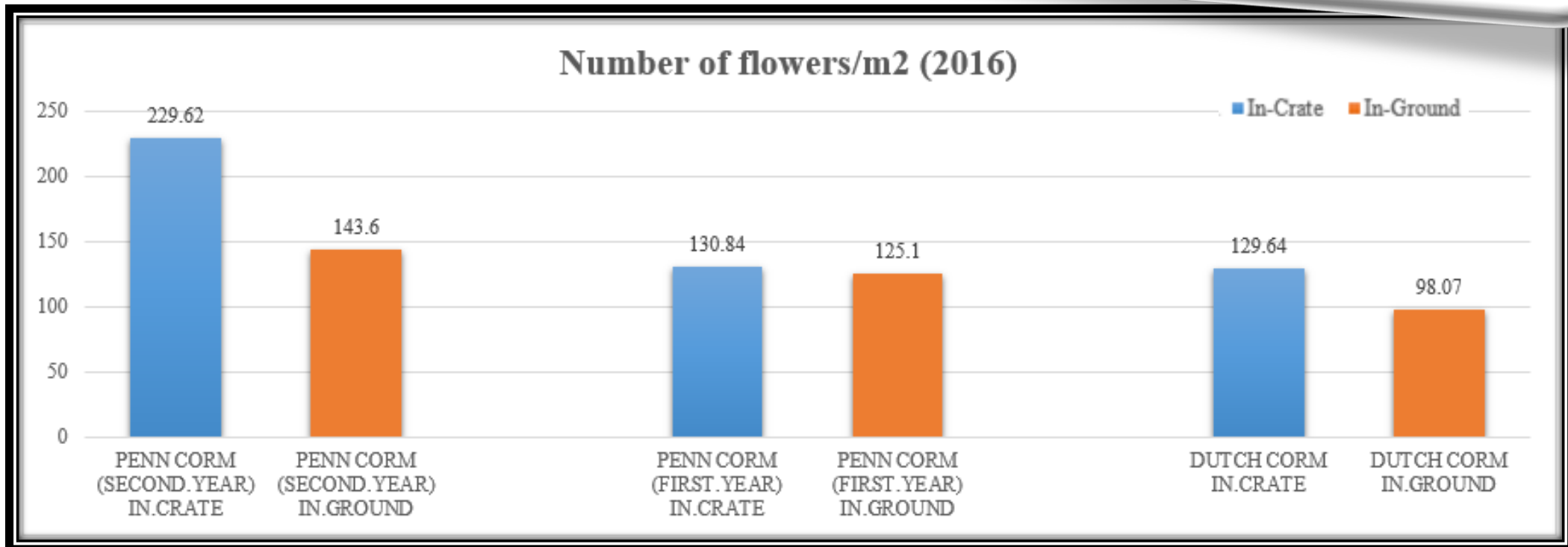
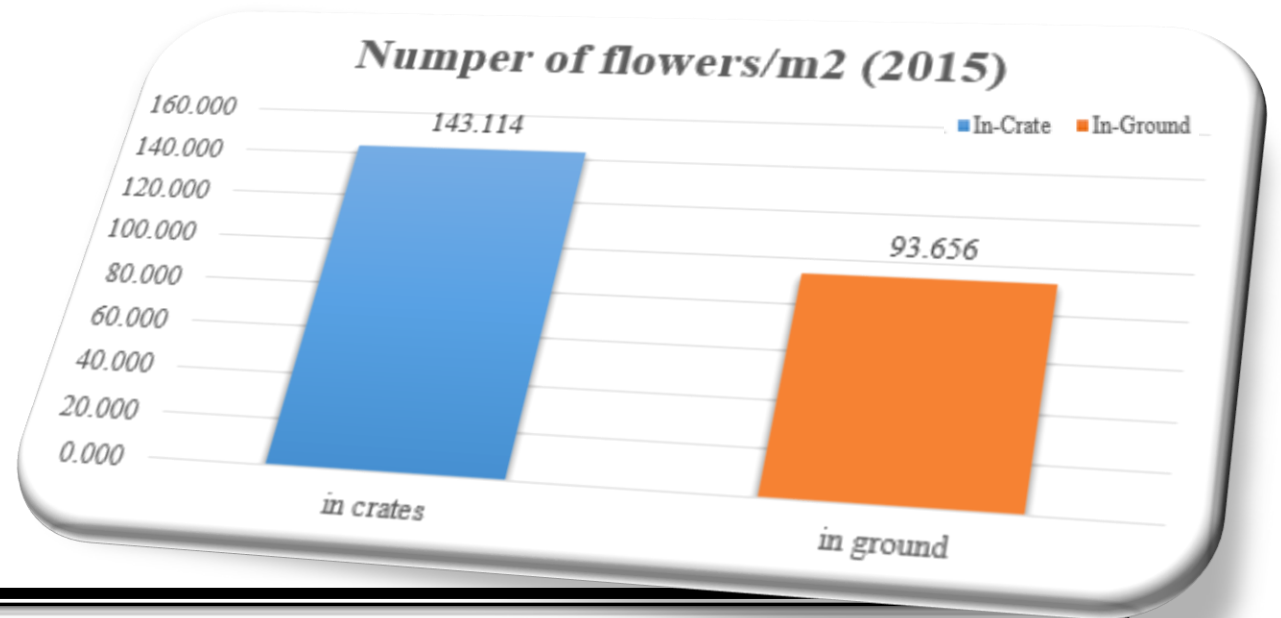
PENN CORM  
(SECOND YEAR)  
IN GROUND

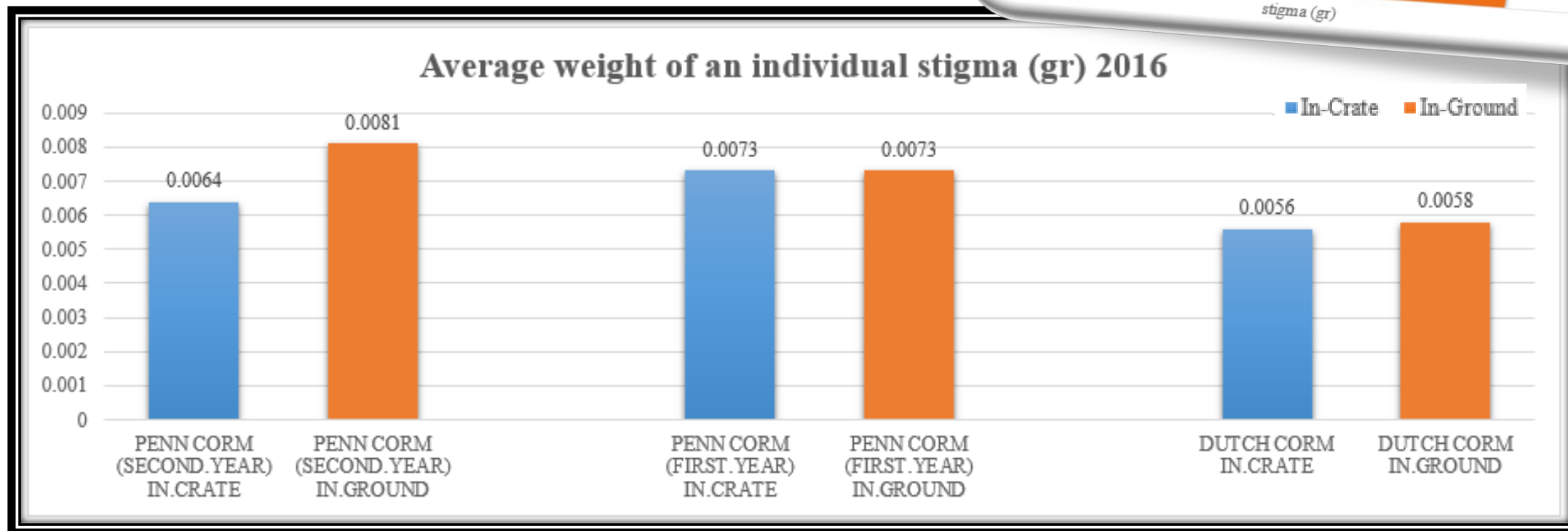
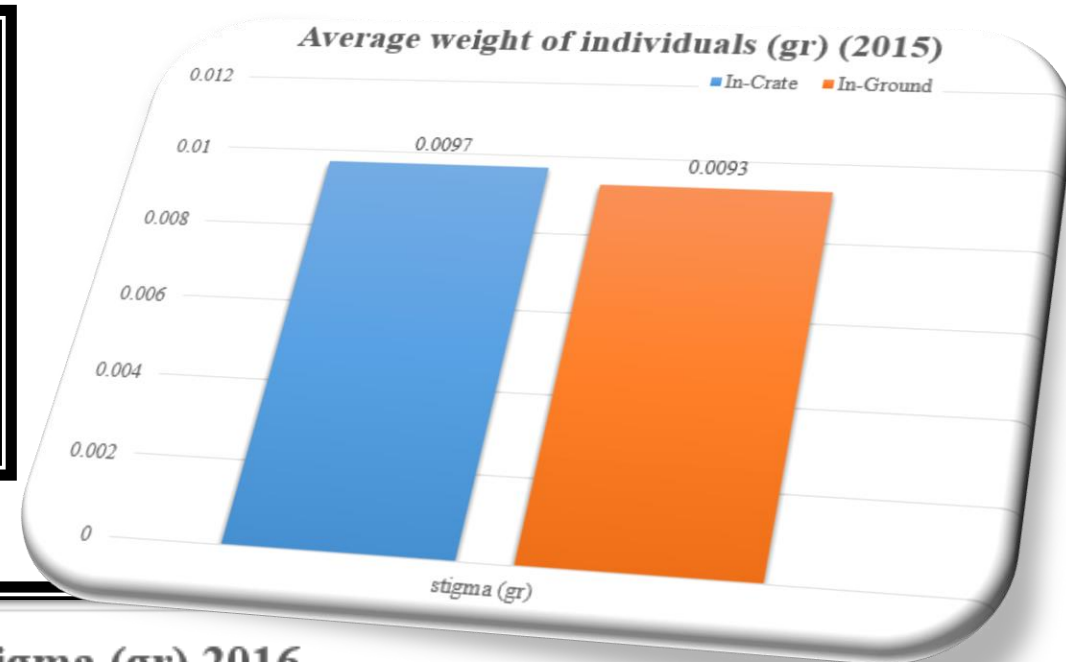
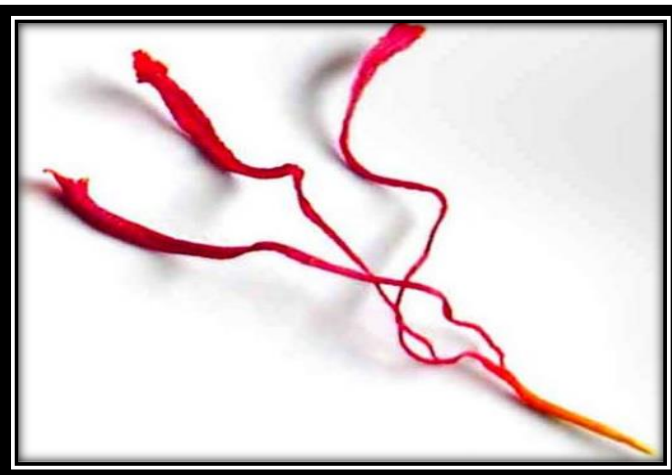
PENN CORM  
(FIRST YEAR)  
IN CRATE

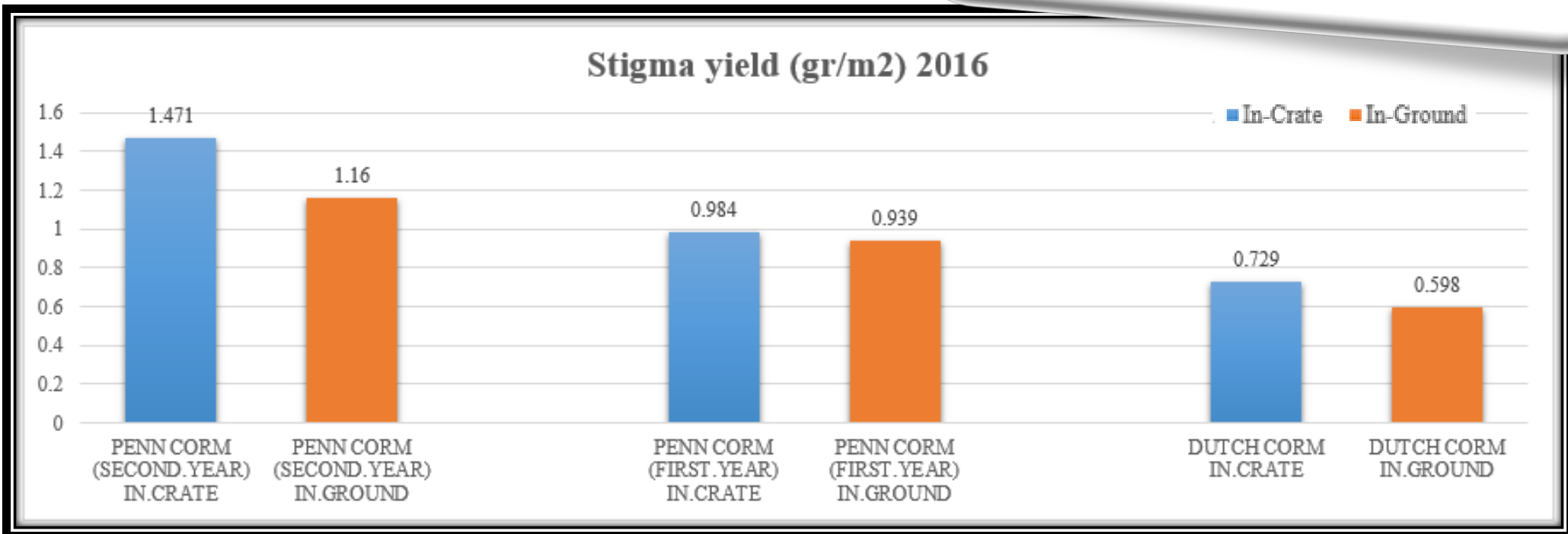
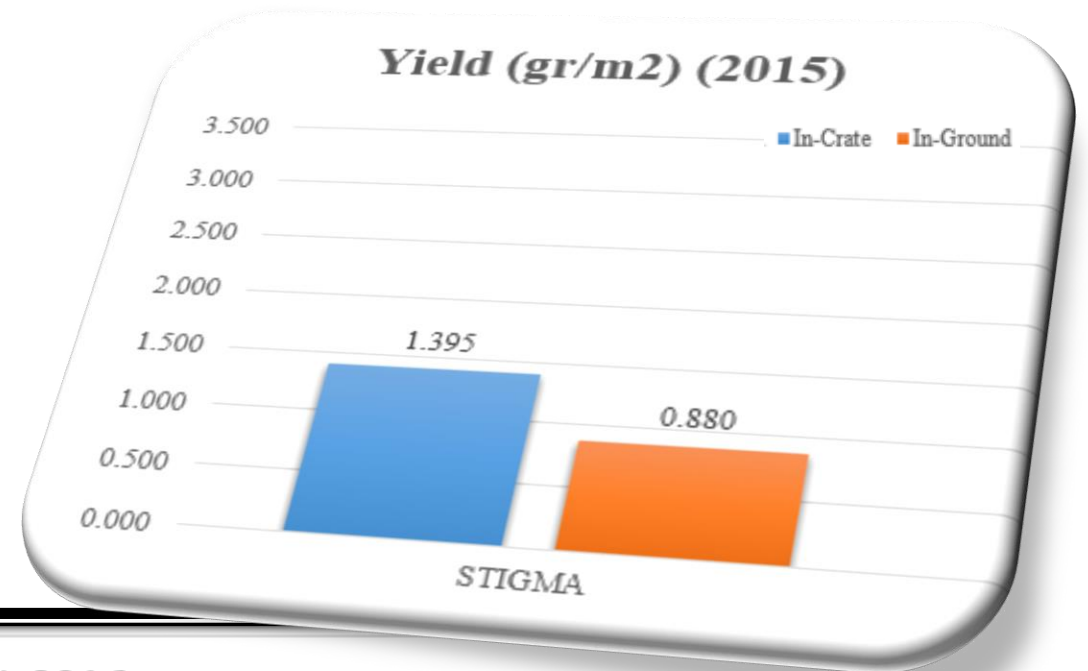
PENN CORM  
(FIRST YEAR)  
IN GROUND

DUTCH CORM  
IN CRATE

DUTCH CORM  
IN GROUND





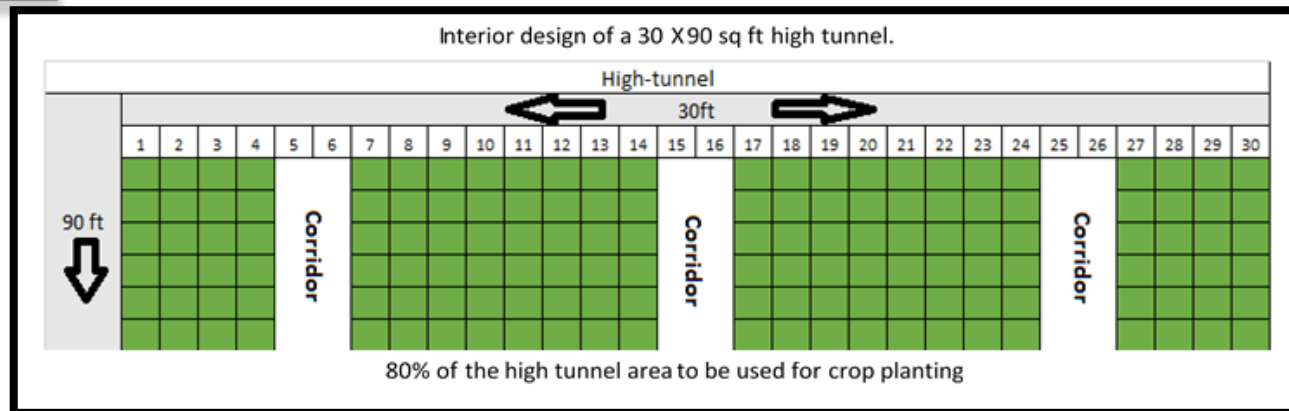






## Preliminary Market Analysis

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/m<sup>2</sup> or ~11/ft<sup>2</sup>.**

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 1 year 1 of production was

Dry saffron yield:  $1.39 \text{ g/m}^2 = 0.13 \text{ g/ft}^2$  (~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/m<sup>2</sup>, 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**

Approximate costs for producing saffron in a 30 x 90 ft high tunnel in milk crates.

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

**Thanks for your attention**

**Questions?**

