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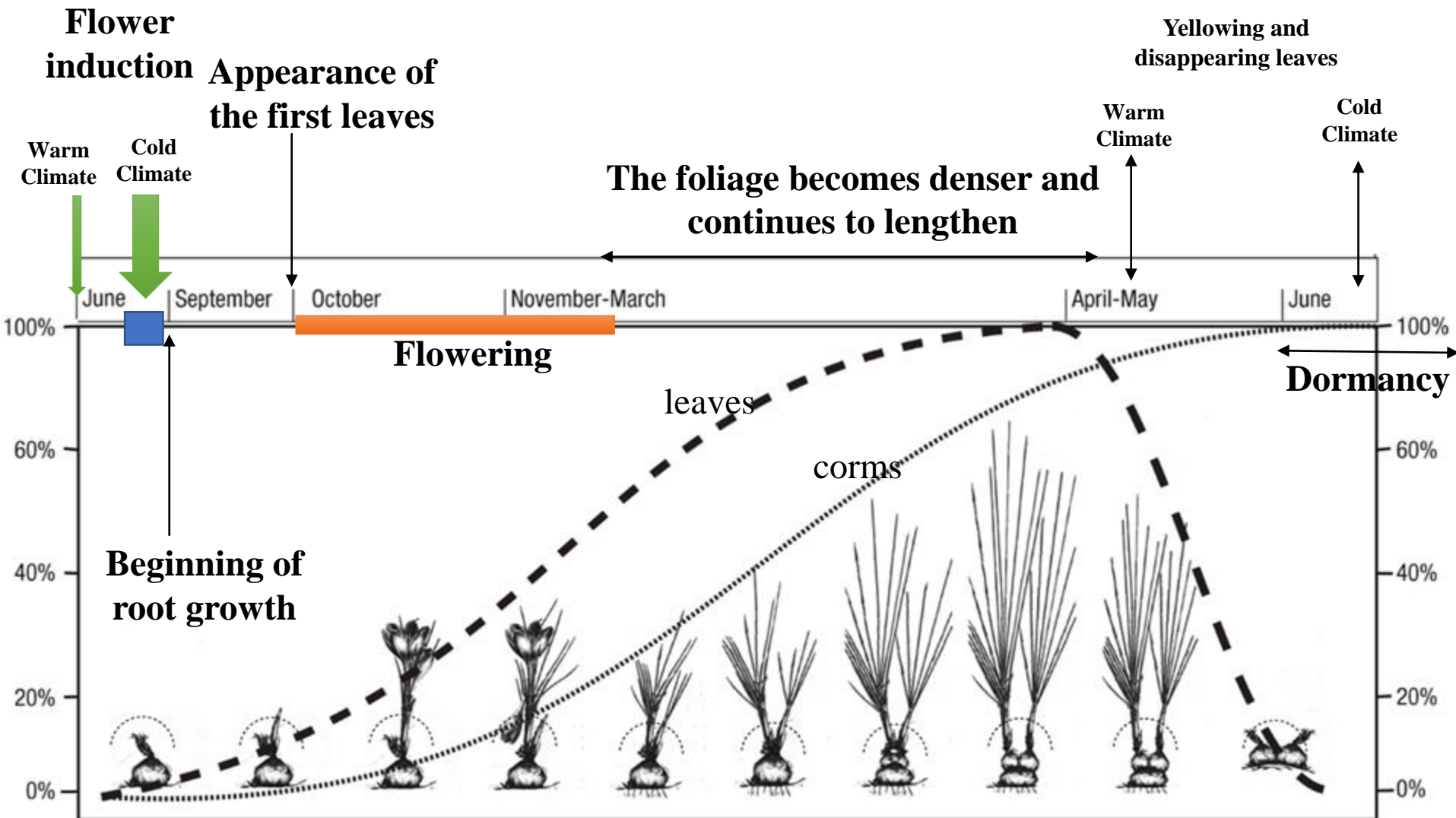
Challenges of cultivating saffron under cold climate

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Scheme of the annual cycle and the principal growth stages of saffron

— — — Mass of leaves
 Mass of replacement corms

Senescence



Fall

Winter

Spring

Summer

Flowering

Flower induction
Dormancy

In cold climate

Snow: No photosynthesis

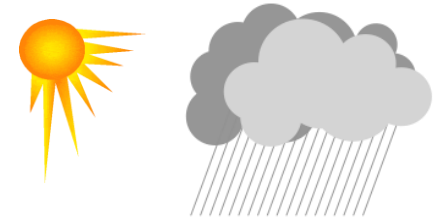
Photosynthesis

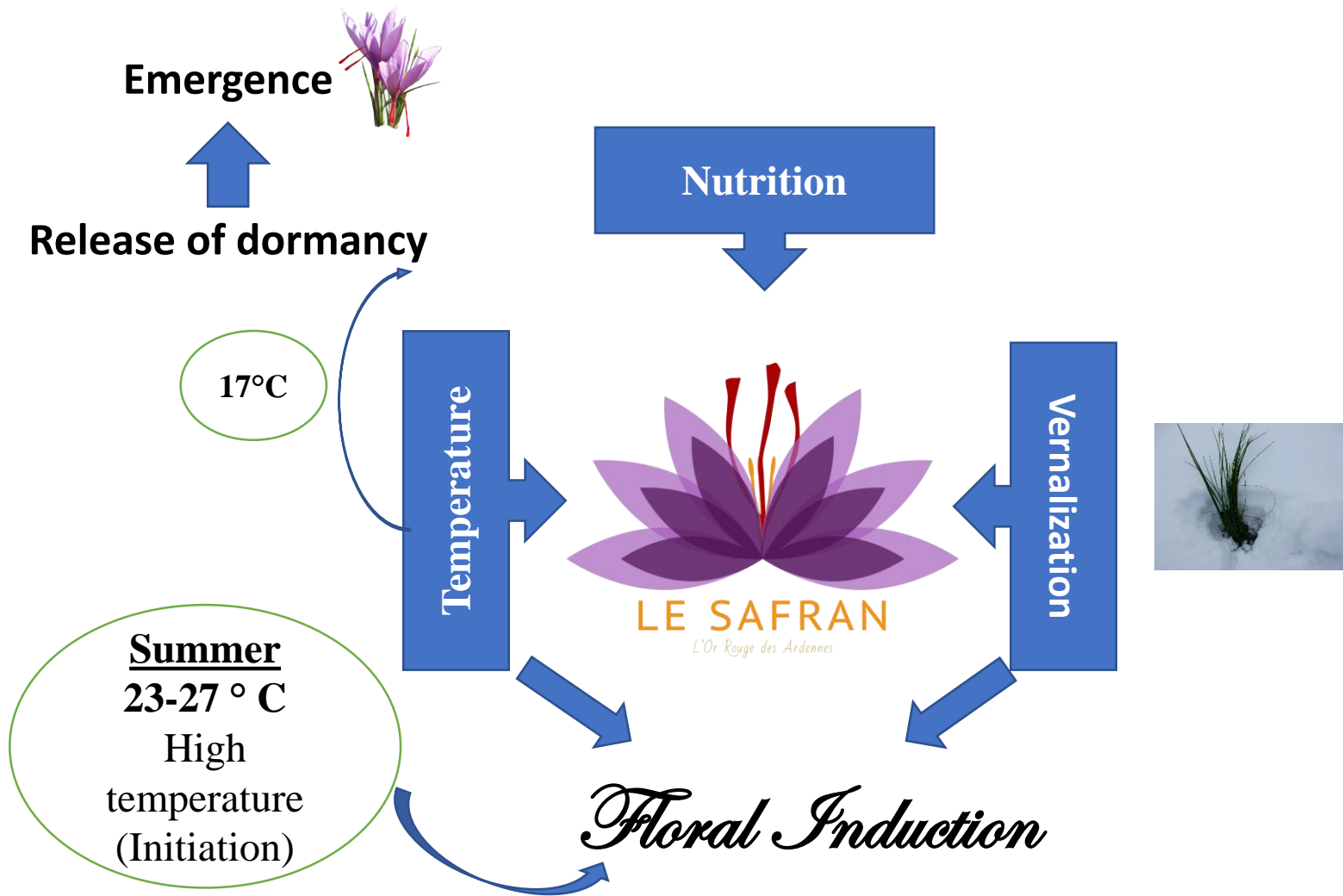
Dormancy shortened

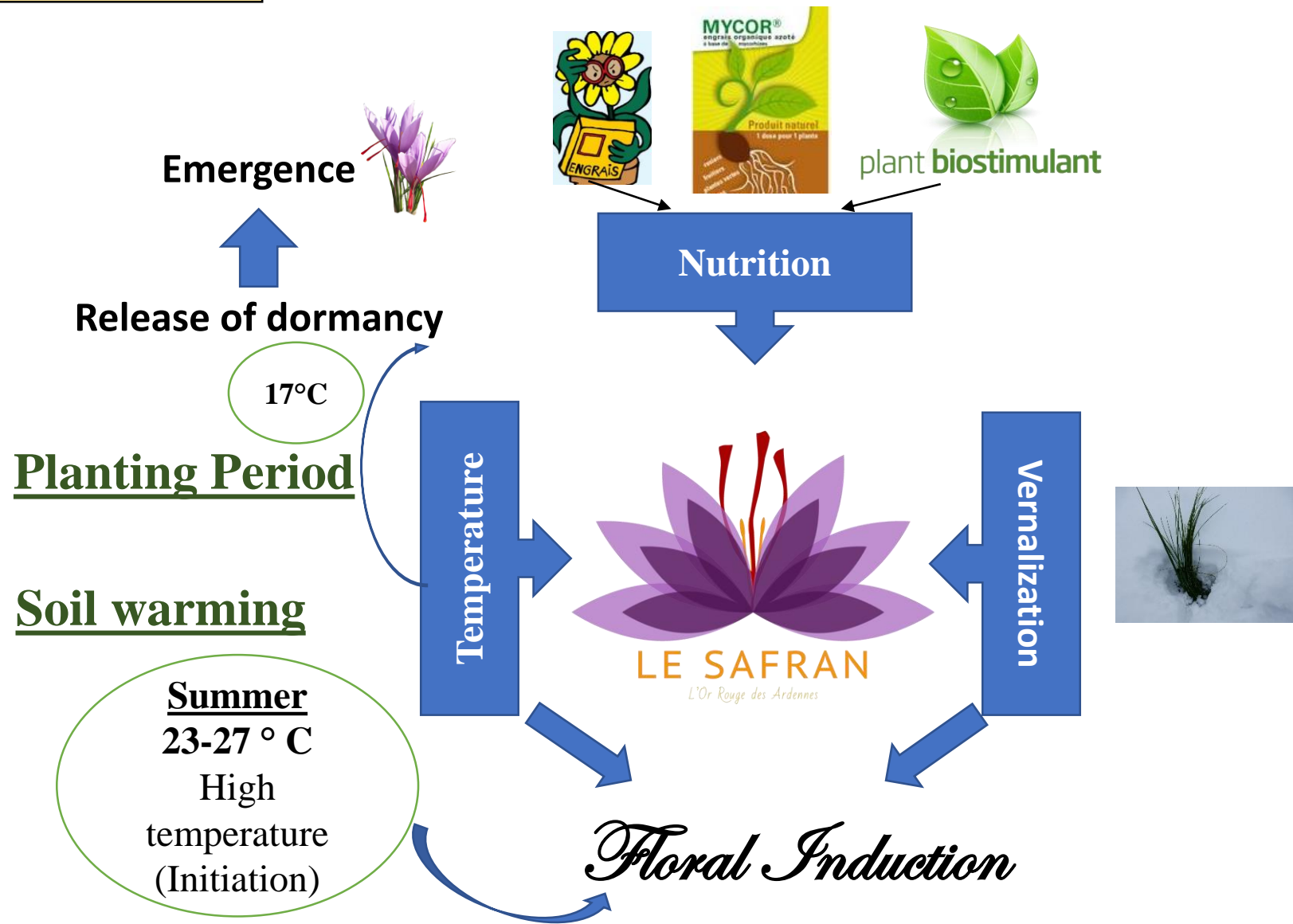


Distinctive features under cold climate

- **Climate:** cooler summer, snow cover for 5 months □
deeper planting (Escape frost in winter)
- **No irrigation needed**
- **Planting:** on ridges and ideally on slopes (to improve drainage),
- **Weeds:** fields overgrown with weeds during second summer









Soil warming effect on floral induction

Soil warming experiment

Objectives:

- Increase soil temperature during the dormancy period using mini-tunnels and mulch to increase floral induction.
- Document the most advantageous method.
- Quantify the impact of these different techniques on weed control.

- Organic corms from the Netherlands 25 cm deep planted in August 2016

Treatments:

- “**MT**”: Installation of mini-tunnels (30% leaf yellowing)
- “**MT-M**”: Installation of mini-tunnels (30% yellowing), then removal of tunnels and laying of black mulch (2017) or solar mulch (2018) (> 75% yellowing)
- “**M**”: Laying black mulch (2017) or solar mulch (2018) (> 75% yellowing)
- “**C**”: Control



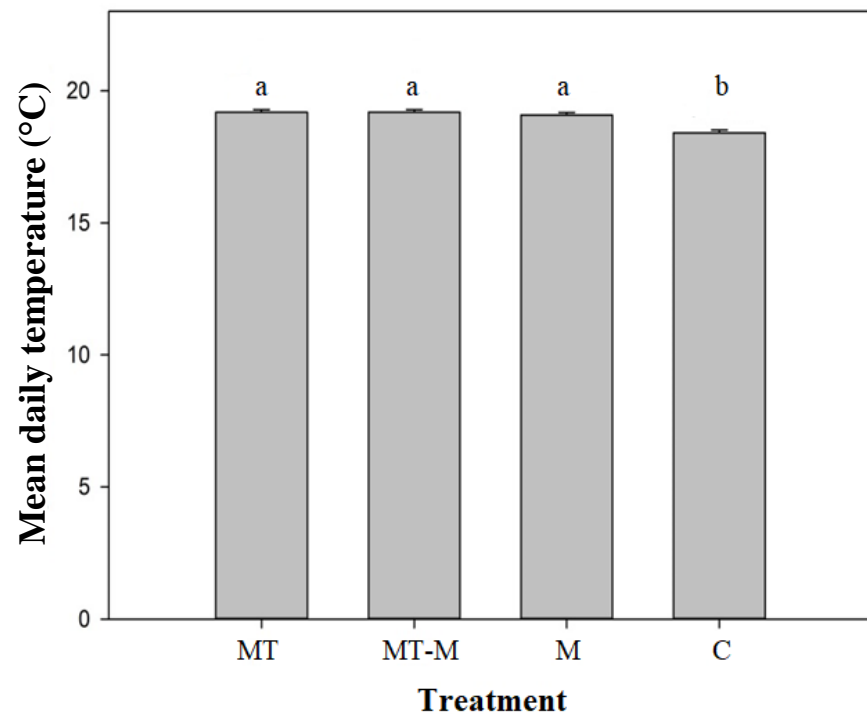
2017



2018



2017



2018

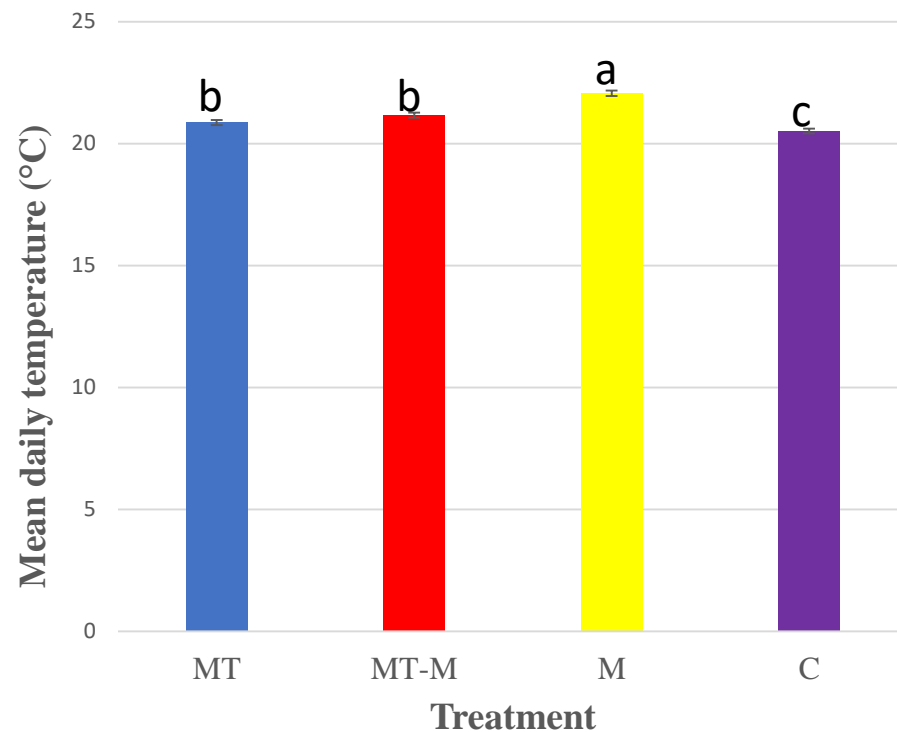
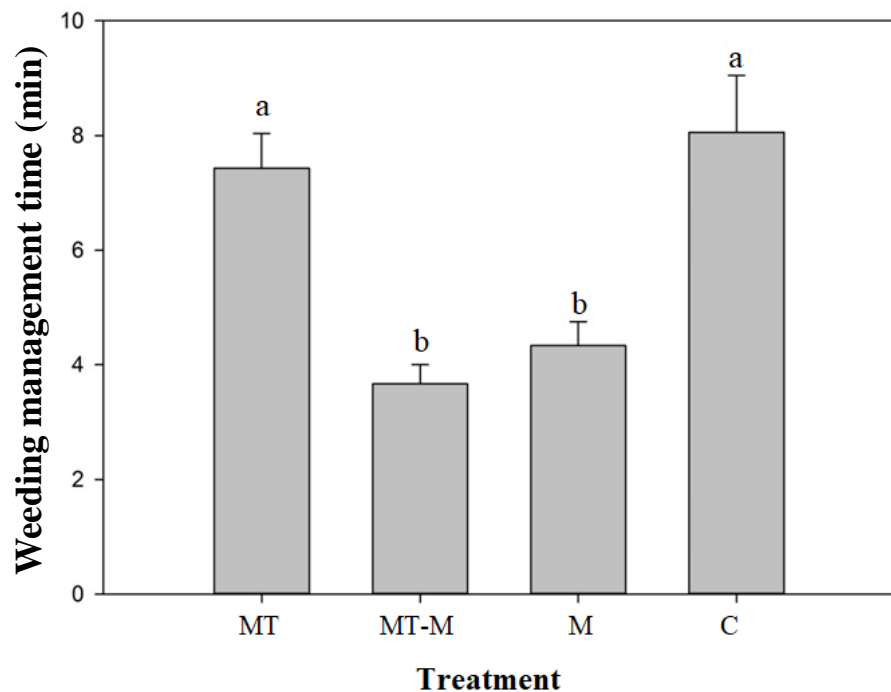


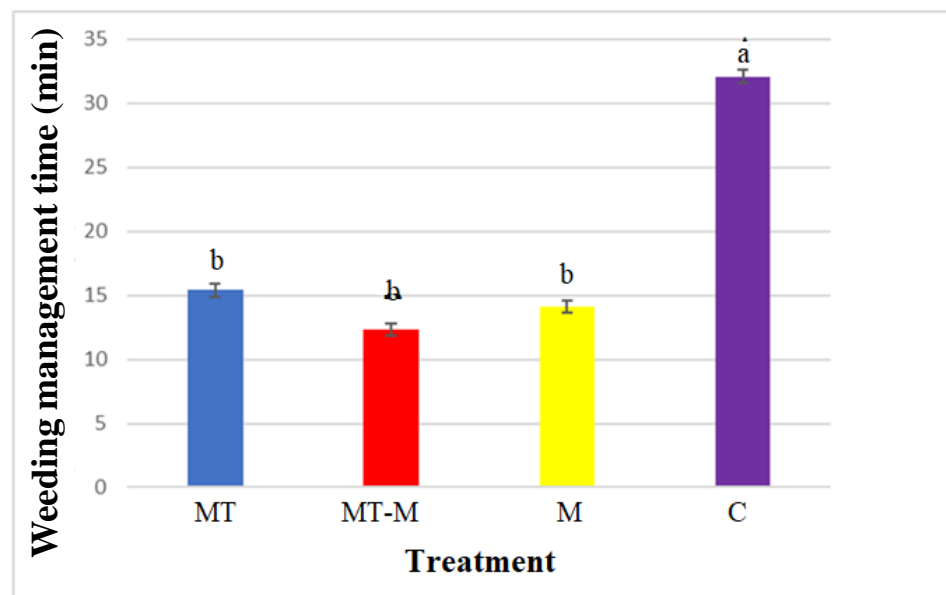
Figure 5. Mean (\pm standard error) of daily temperatures by treatment. Different letters indicate significant differences between treatments.

Weed manual control

2017



2018



Total time (min) spent weeding per plot per m² by treatment for the entire season.

Flowering and harvest



- **In 2017:** 14 flowers / 960 corms (1.5%)
- Attributed to late emergence and flowering (1st flower November 18th, persistent ground snow November 23rd)
- **In 2018:** 7 flowers / 936 corms (0.7%) ..., some problems

Require additional repetitions to determine the impact on saffron yield!





Effect of planting period on saffron yield

Planting Period experiment

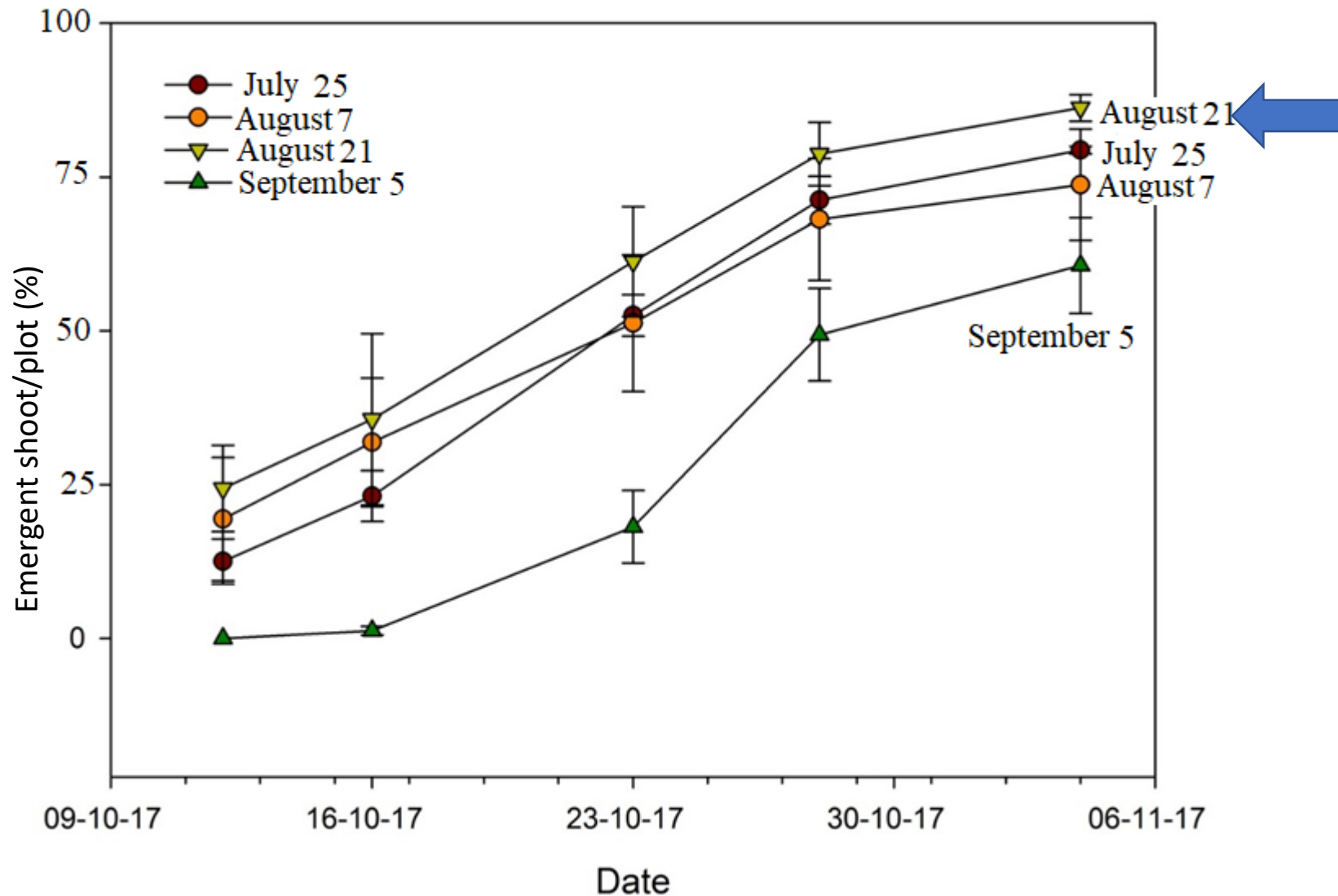
Objective: To test the effect of planting date on plant growth and saffron yield

- Corms grown in Quebec(origin: France) planted in July to September 2017
- Plots of 40 corms

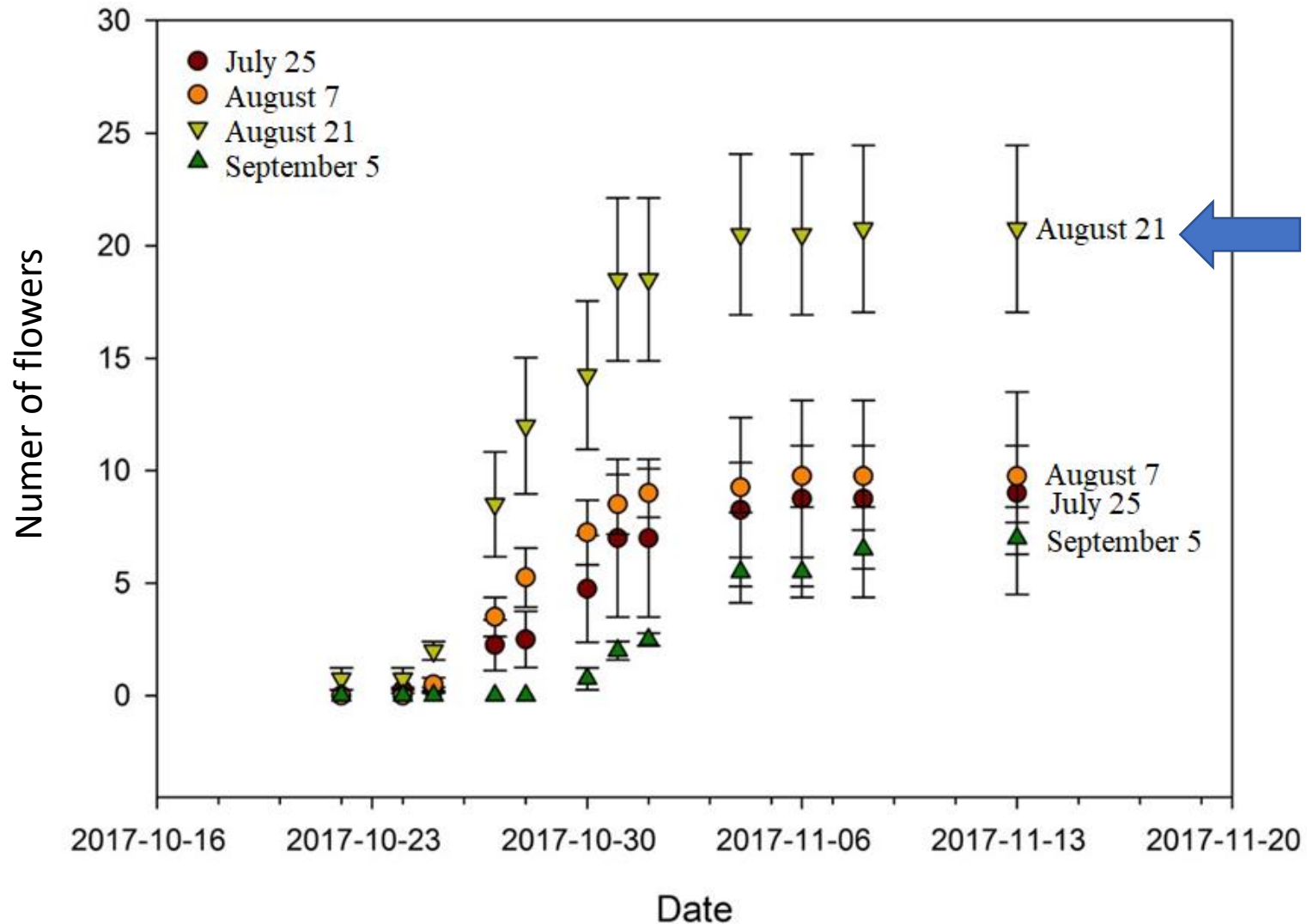
Treatments:

- Planting July 25
- Planting August 7
- Planting August 21
- Planting September 5

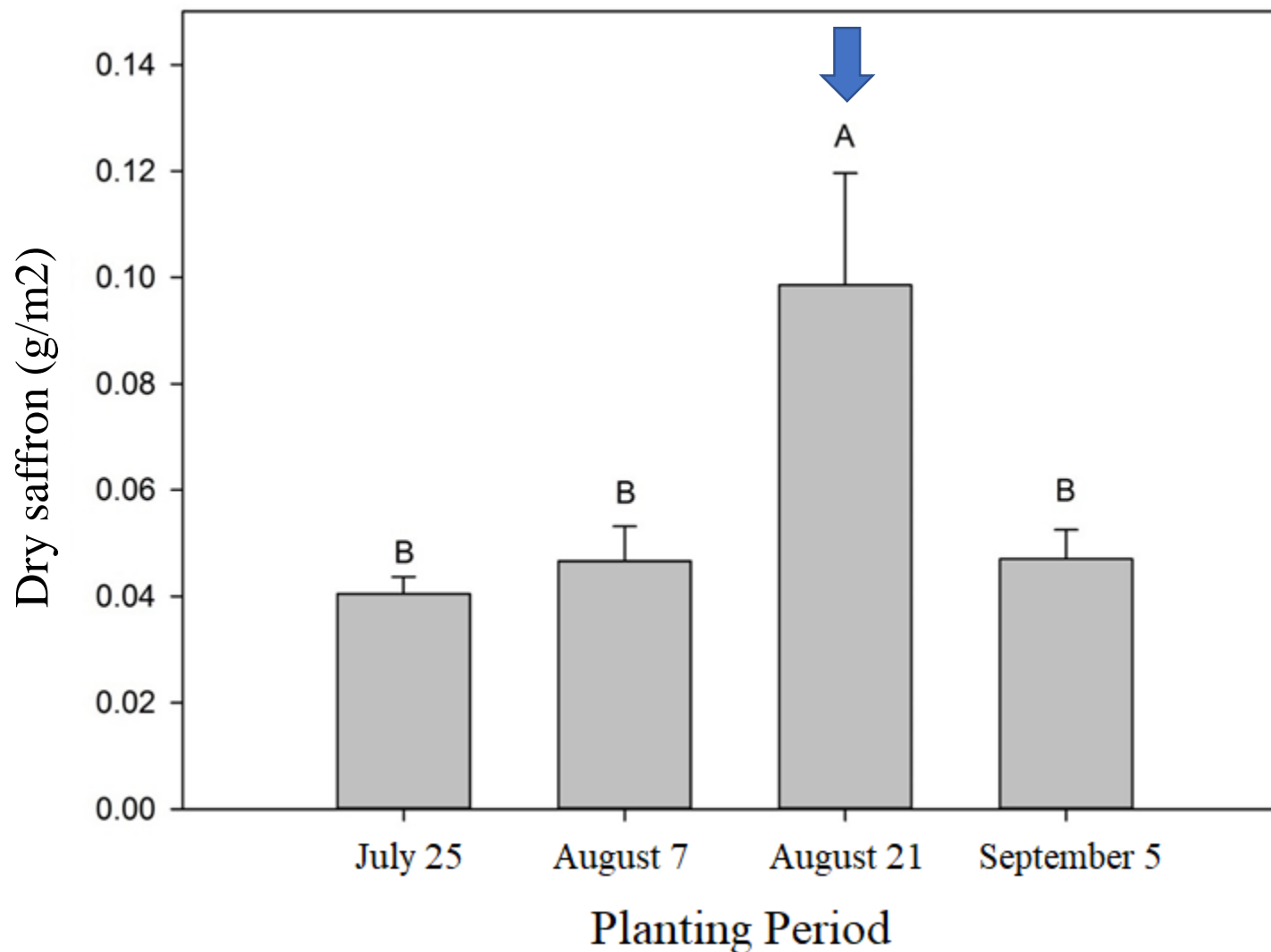
Shoot emergence over time for each treatment



Number of flowers per plot per treatment and date



Dry saffron harvest per plot according to the treatment





Effects of fertilization, mycorrhizas and bio-stimulants on saffron growth and yield

Objective: To test the individual and synergistic effect of organic fertilization, mycorrhizas and various biostimulants on saffron yield and growth,

* Planting on August 2017 combination of 12 treatments

Bioprotection

Bioregulation



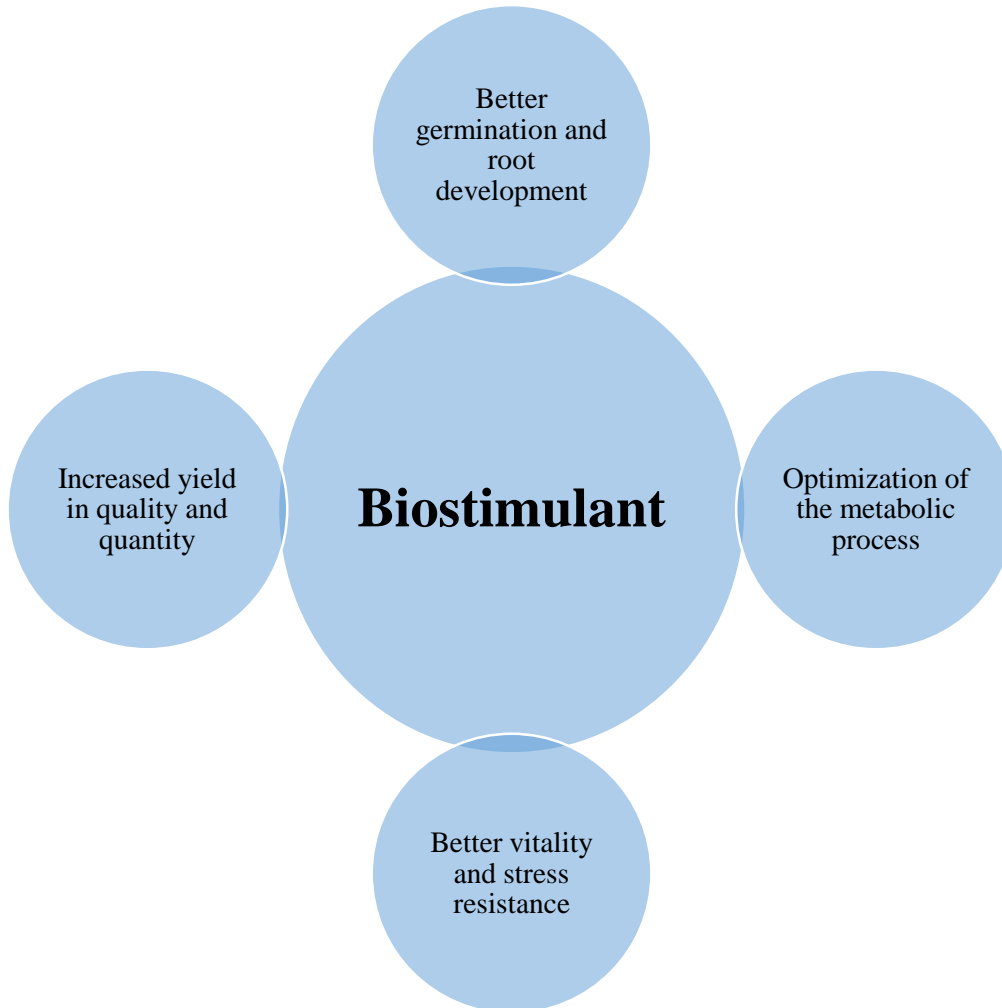
Soil stabilization

Biofertilization

Roles of biostimulants



plant **biostimulant**



Composition of biostimulant:

Algae, microbes, chitin, plant extracts, humic and fulvic acid.

Fertilization	Absence	F0
	Presence	F1
mycorrhizas	Absence	M0
	Presence	M1
Bio-stimulant	Absence	B0
	Earth Alive	B1
	Turitek	B2

Feather meal 13-0-0 (462 kg / ha), fossil bone 0-13-0 (1538 kg / ha) and Sul-Po-Mag 0-0-22 (1136 kg / ha).

Myke Pro Gazon G (Premier Tech):20g/corm



Liquid solution **4 kg/ha**; and **15 ml** on each side of each corm at the time of planting



Soak the corms for 4 hours in 15 ml of Turitek per liter of water

Then, watering every three weeks (0.23 ml Turitek / m²)



Field measures and Harvesting

***Harvesting of roots**

One root / plant; 3 plants / plot



Evaluate mycorrhization rate  **roots were mycorrhized**

***Harvest of 6 corms / plot**

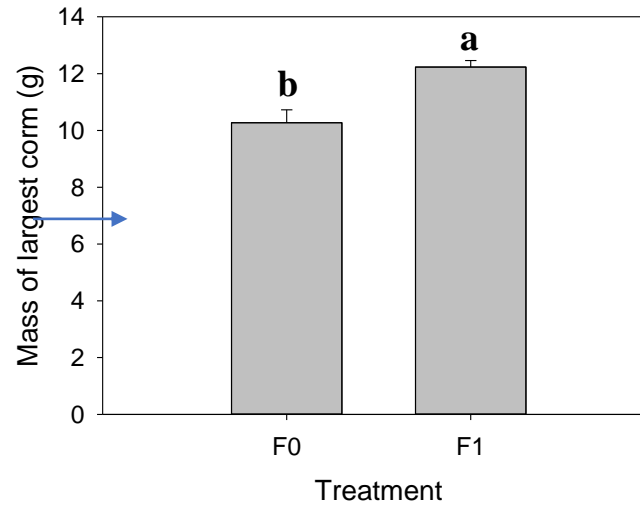
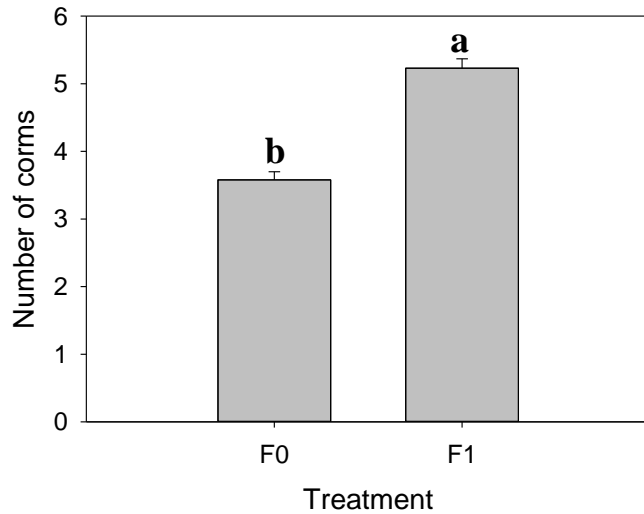
(Annual growth)



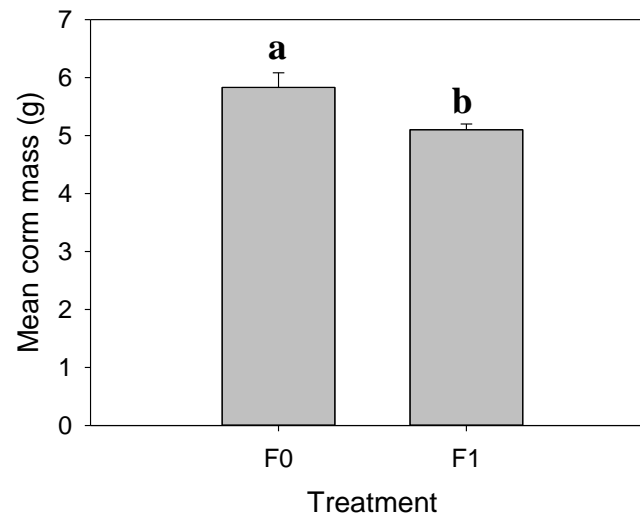
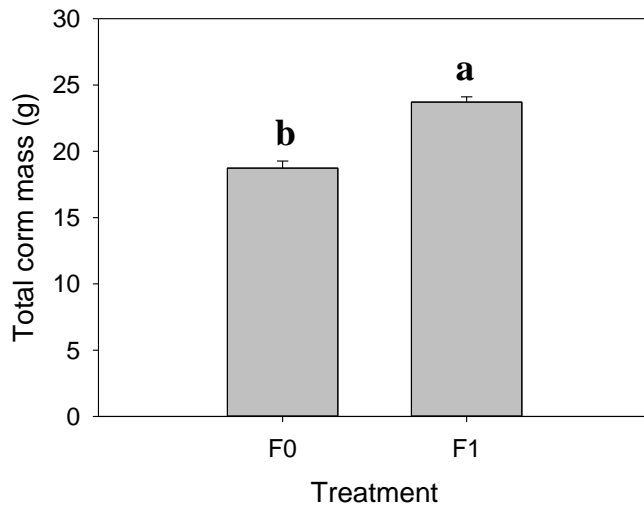
***Drying of corms for
nutrient analyses and
weight**

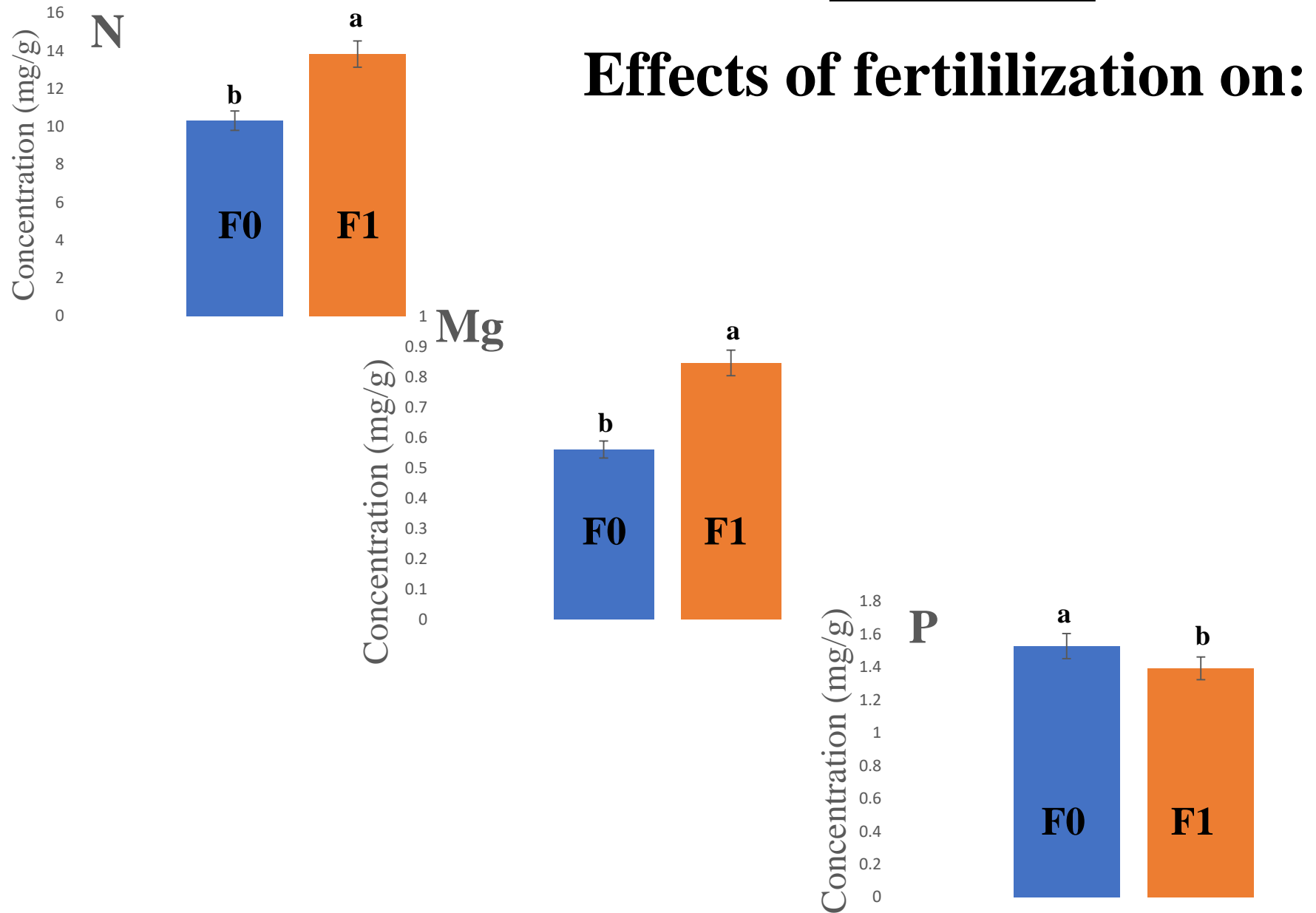
Measure of the diameter and dry weight of corms

Effects of fertilization on number of corms, total mass, mean mass and mass of largest corm (g)



Around 7.5 g
for the grade
8







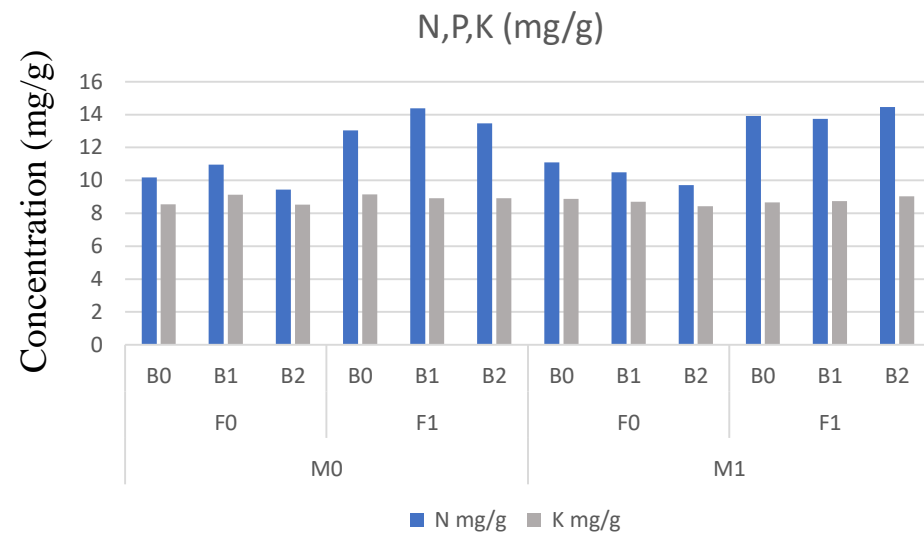
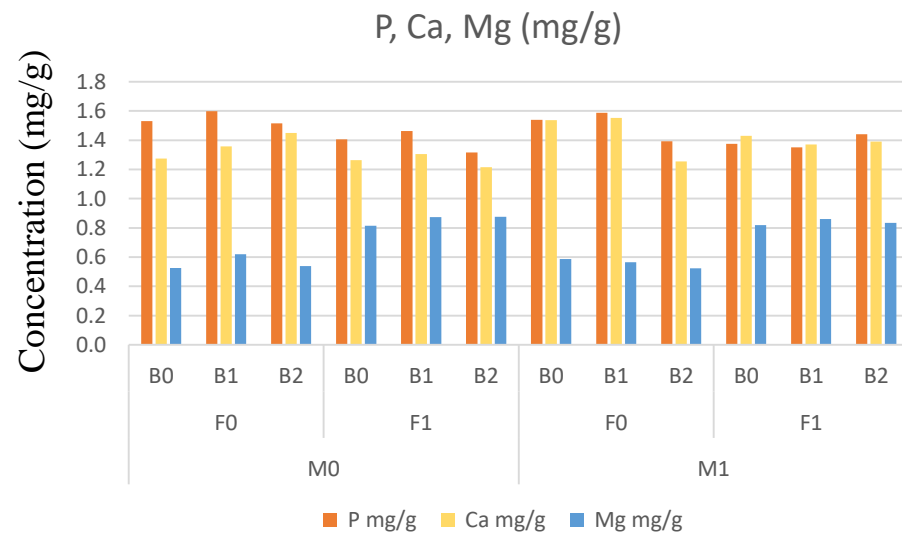
Conclusion

- The use of the mini-tunnels and mulch helped us to control weed and to reduce the time of hand weeding
- The most advantageous method to increase the **soil temperature** is the solar mulch
- The best **period of planting** is August 21.
- **Fertilization** improve saffron growth.



**Thank you for
your attention**

Corm nutrient concentrations



Plan

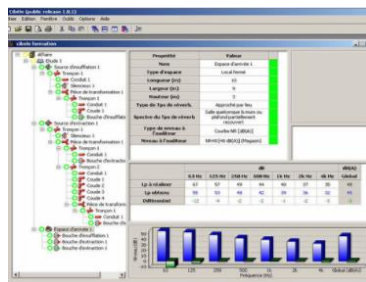


- Introduction
- Soil warming
- Planting Period
- Fertilization
- Conclusion

Field measures

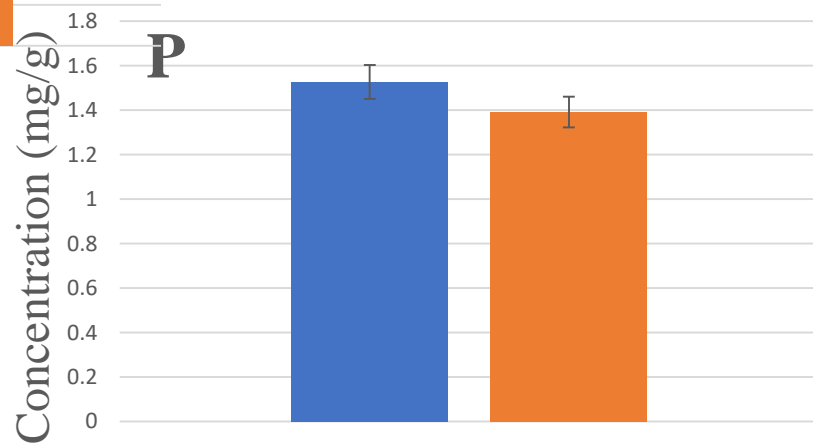
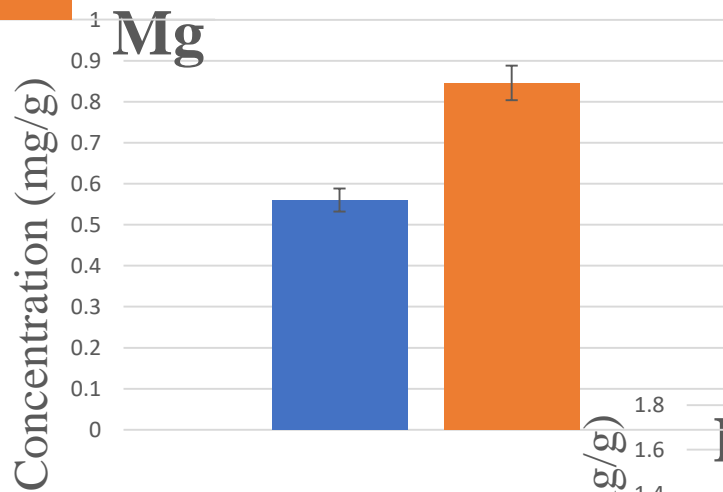
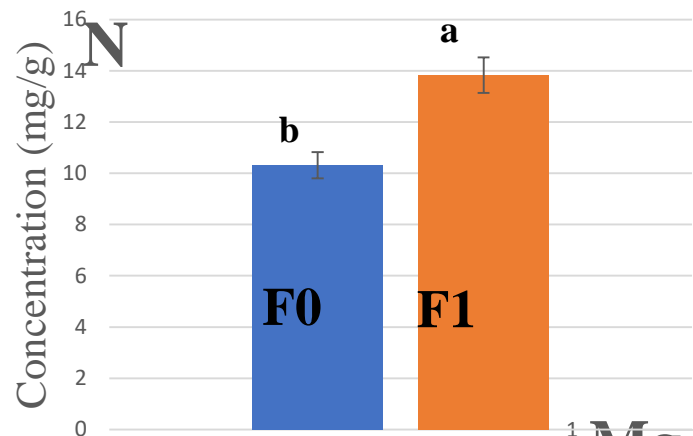
1 probe / plot

20cm deep



Probe Thermochron
iButton

Impact of the treatments
on the growth and
development conditions of
corm



Effects of
fertilization on