Indoleamine Mediated Crop Resilient Ornamentals Production Systems

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Overall Objective

Selection of novel varieties and the development of ornamental production systems to enhance the propagation of climate-resilient plants for increasing the industry sustainability and profitability

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Specific Objectives

- Objective 1. Development of new germplasm adapted to drought/salinity and low nutrient environments.
- Objective 2: Development of technologies for propagation of stress-resilient plants through indoleamines treatments.

Micropropagation > Greenhouse > Biochemical intervention

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Trial Gardens at Guelph and Landscape Ontario -Milton

- 400+ Visitors (industry, landscape and public)
- 3 Open Houses (plus several tours)
- Testing sites for new releases of annuals and our advanced selections; ON Perennial Trial

2025 Trial Garden, University of Guelph and Landscape Ontario-Milton

Breeding Efforts – New Variety Development

Goals – Using Canadian native species to create new varieties adapted to drought and low nutritional environments

Ongoing studies:

Liatris aspera
Liatris pycnostachya
Thermposis caroliniana
Baptisia australis
Lobelia cardinalis *
Liatris siphilitica
Helenium autumnale
Physostegia virginiana
Allium cernuum

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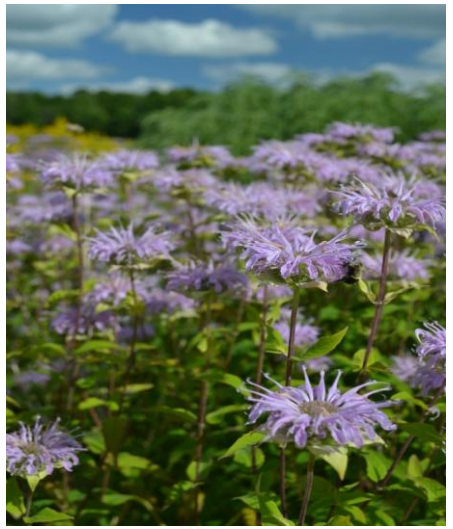
Creating Breeding Populations

Allows maintenance of genetic variation while selecting the best plants to use as parents in crosses or for commercialization



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Screening populations for drought/salt tolerance in greenhouse and field (no irrigation)

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Liatris aspera

-Rough Blazing Star
- height 0.8 to 1.2 m
-long flowering period
-variation in flower time
-drought tolerant
-cut flower potential

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Liatris pycnostachya

- *Prairie Blazing Star*
- *Height 0.7 to 1.1 m*
-*long flowering period*
-*variation in flowering time (mid to late season)*
-*drought tolerant*
-*cut flower potential*
-*multistem*

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Baptisia australis

-Blue False Indigo
-bushy growth habit
-height 0.8 to 1.1 m
-diameter 0.8 m
-small blue flowers
-large black seed pods that persist on plant
-drought tolerant
-stay green character

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Ironweed

- *Upright, vigorous growth habit*
- *-height 1.4 to 1.9 m*
- *-small red/purple flowers*
- *-multi stemmed*
- *-lodging resistant*
- *-drought tolerant*

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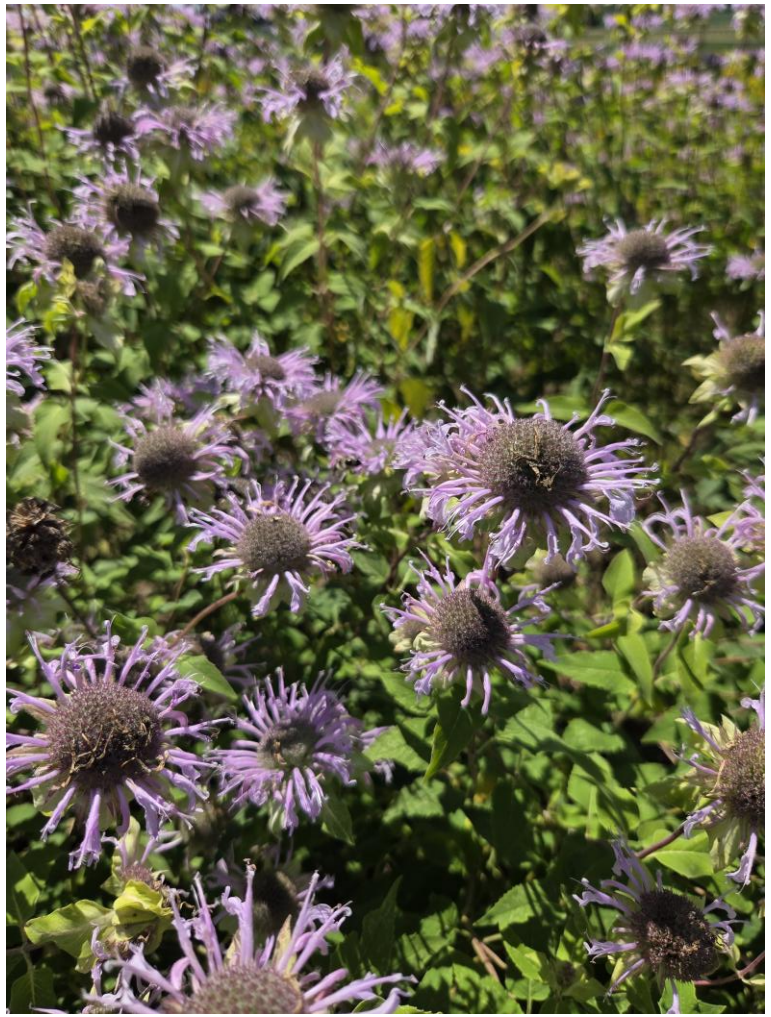
Monarda

- *Upright, vigorous growth habit*
-*height 1.1 to 1.2 m*
-*purple flowers*
-*multi stemmed*
-*lodging resistant*
-*drought tolerant*
- *Mildew Resistant*



Future Activities for Breeding

- Screen populations for drought tolerance and continue to work with existing populations of species
- Establish progeny of selections at Elora in 2026

- **Identify opportunities/partnerships for testing and commercialization**

- Continue to make selections within progeny planted at Elora
- Giant Trillium – tissue culture
- Continue with Trial Gardens

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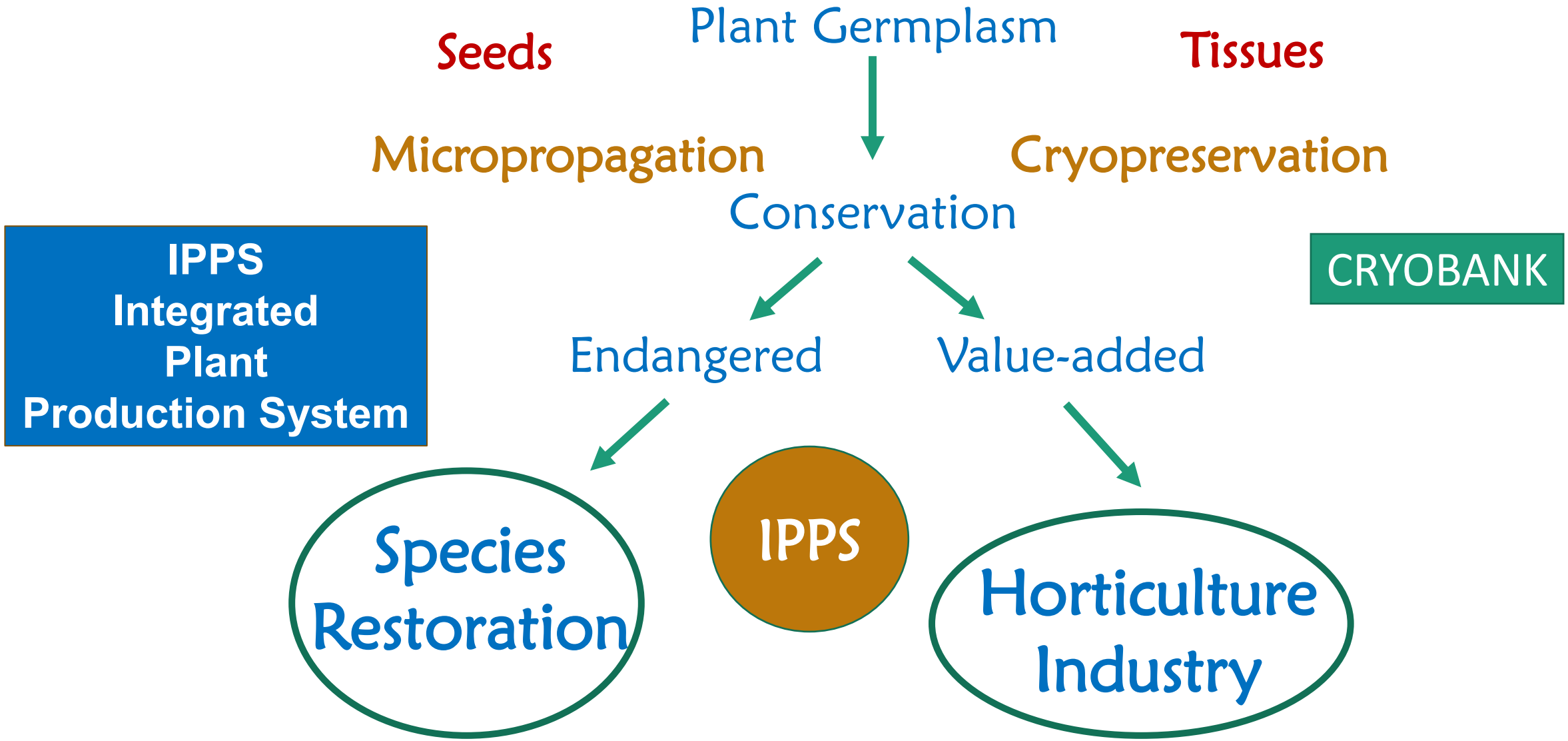
GRIPP Conservation-Propagation-Restoration (CPR) Model



In vitro culture of selected ornamentals

Initiation and optimization of in vitro cultures:

- Petunia, Impatiens, Coleus and Chrysanthemum, Creelman Lily
- Dendrobium orchids, *Salvia farinacea* (**ornamedicinals**)

Dendrobium orchid

Creelman Lily

Salvia farinacea

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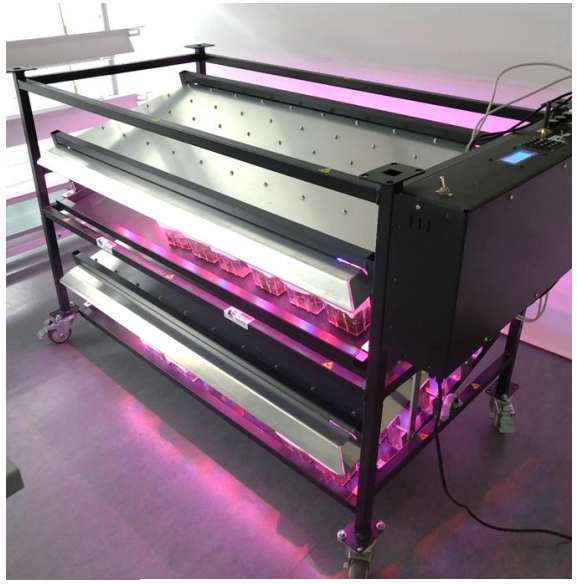
Bioreactor based protocols for mass propagation

Optimization of the in vitro culture conditions and growth medium for various ornamentals for mass propagation:
Nutrition and Light



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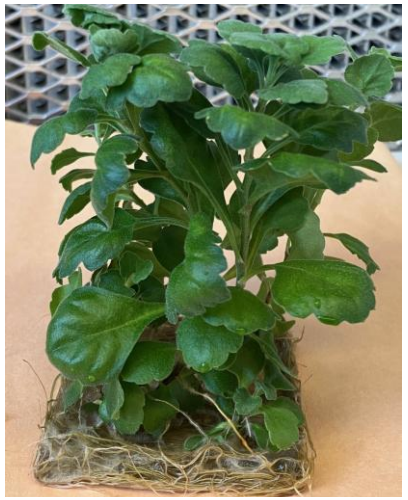
Enhancement of stress resilience: Tryptophan treatment

- Application at different stages during shoot multiplication and root development.
- No significant differences in shoot multiplication or rooting but overall plant growth and quality improved.
- Hyperhydricity was reduced in the liquid culture system



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Application of tryptophan during greenhouse acclimatization

- Tryptophan applied with mycorrhizae.
- Significant differences were observed in numbers of flower over the season.
- Overall plant growth quality improved.





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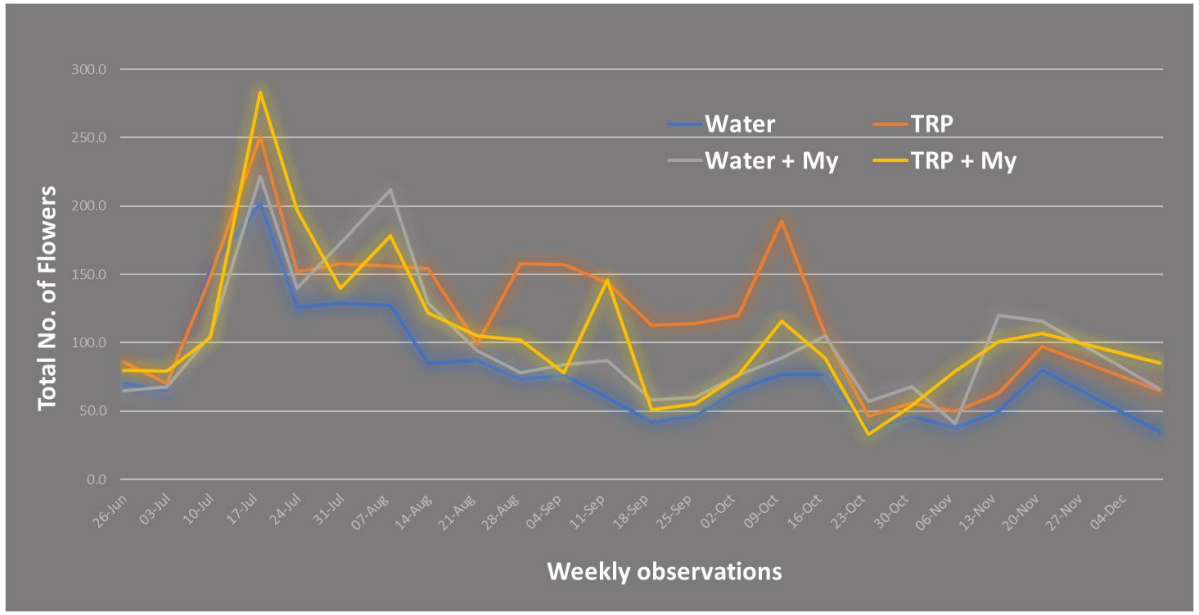
Application of tryptophan (Trp) in greenhouse conditions

- T1: Water T2:Trp(100mg/L); T3:water + mycorrhizae; T4:Trp + mycorrhizae.
- Plants treated with **Trp** and **mycorrhizae** remained healthy.
- In Petunia, significant differences were observed in the number of flowers over the season.



Petunia plants in July

In November following treatment with water

Trp with mycorrhizae

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Phytochemical analysis and profiling for the treated samples will be used to select treatment concentration

- Plant tissue samples were collected from in vitro conditions and greenhouse conditions. All samples will be analyzed for Indolamaines

- Indolamines such as Tryptophan, Serotonin, Melatonin and their intermediates, such as Tryptamine, 5-Hydroxytryptophan, N-Acetylserotonin, and 2-Hydroxymelatonin

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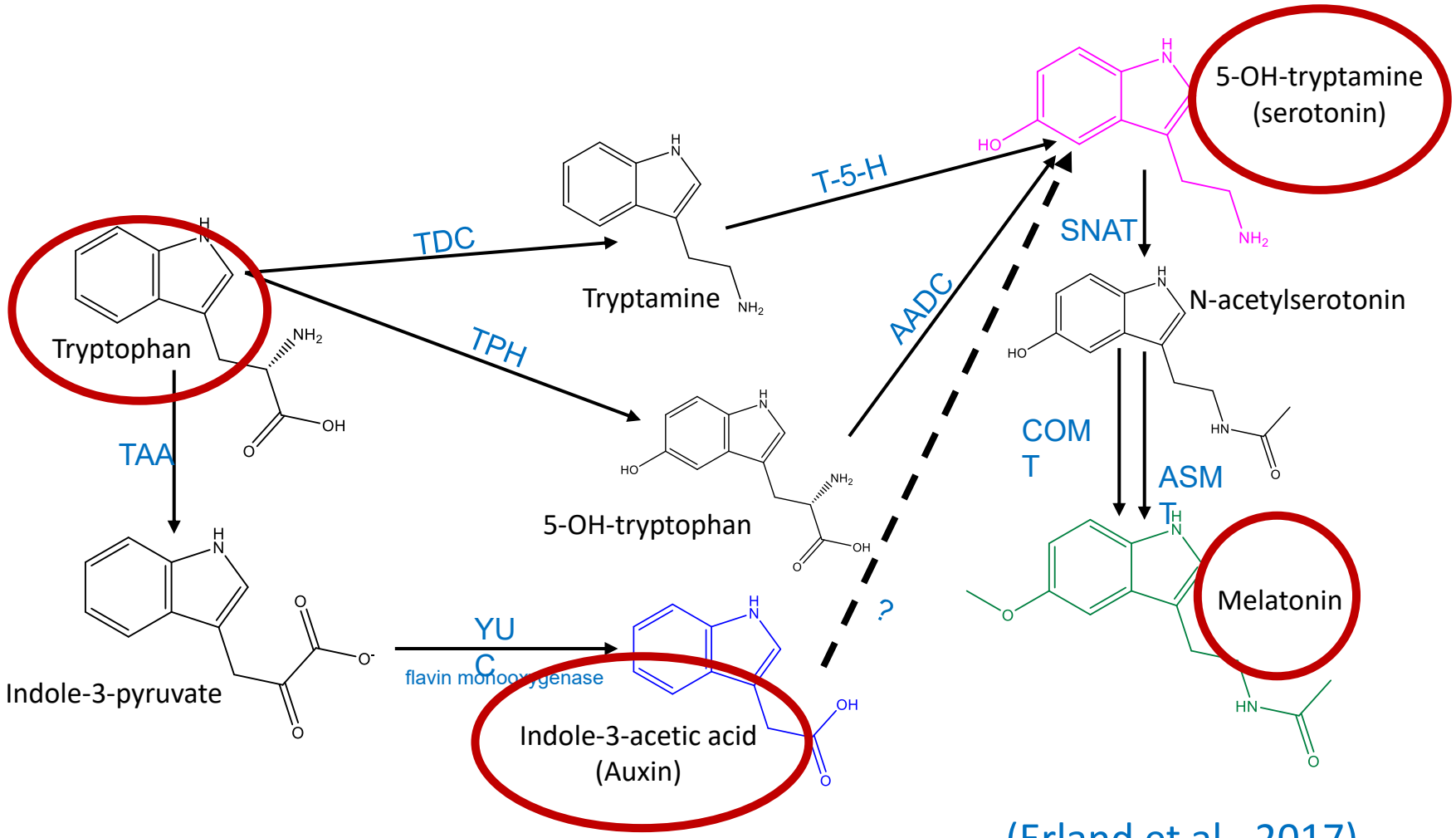
Role of indoleamines in plant morphogenesis and stress resilience



(Erland et al., 2017)

Most research focused on IAA & Melatonin

Intelligent light modulation during greenhouse acclimatization

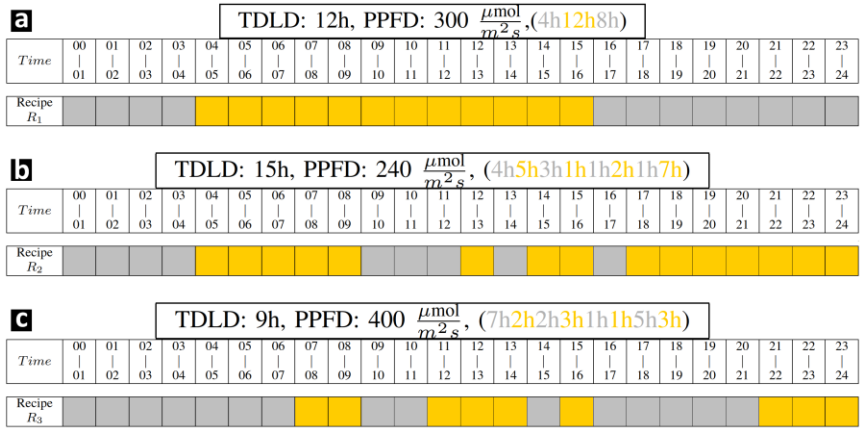


Figure: Trial recipes for plant growth experiments. Yellow cells are light intervals while grey cells are dark intervals. (Abbaspour et al., 2026)

- Plants can tolerate short interruptions in light without compromising growth.
- Intelligent lighting control has strong potential to improve the sustainability of greenhouse production
- Simulation results (1-hectare greenhouse, Ontario electricity data) show 20.9% reduction in energy costs (~$318,400 annually)

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