Cold Stress Response of Hosts to Lignin-based Molecular Heaters

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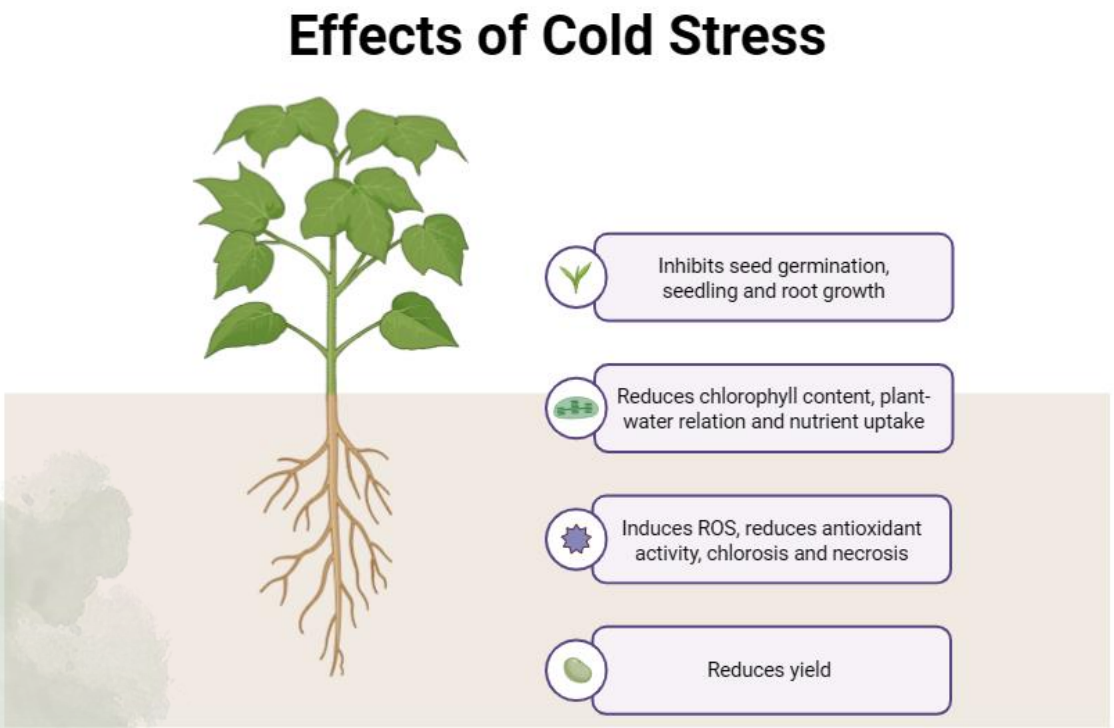
What is cold stress?

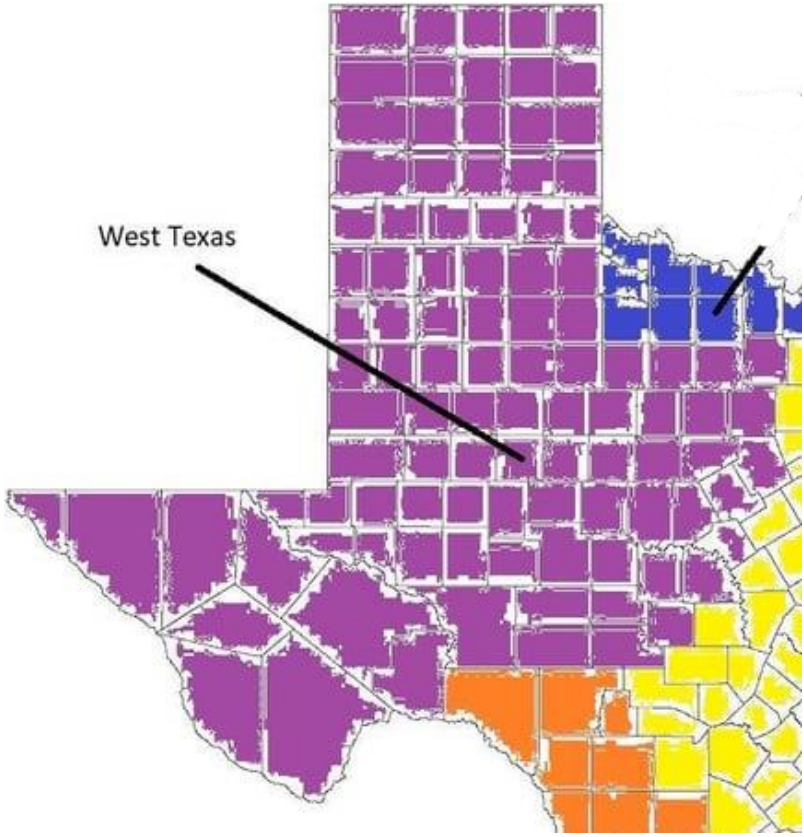
- **When the temperature drops below the optimal range required for the crop.**

Cotton:
Germination: 59 -64 °F
For growth: 82-86 °F



West Texas is not just hot

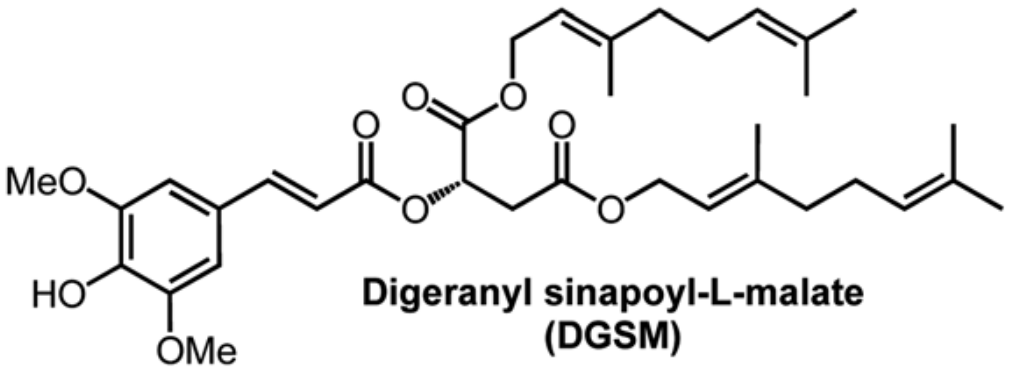
- Unpredictable and sudden temperature drops (Eg. on Sept 6, 2025, the lowest temperature recorded in Lubbock was 55°F).
- Nearly every recent spring (2019, 2021, 2023) has seen at least one episode of damaging cold affecting West Texas crops.
- Cotton, a major crop, is sensitive to Chilling (<59 °F)



Objective

- To find eco-friendly ways to help crops manage cold stress

Regulators from lignin



Digeranyl sinapoyl-L-malate (DGSM)

Ability to absorb UV radiation and convert it into heat, maintaining cellular temperature and protecting against cold-induced damage

An expeditive and green chemo-enzymatic route to diester sinapoyl-l-malate analogues: sustainable bioinspired and biosourced UV filters and molecular heaters†

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Normal temperature (Greenhouse)

16 to 20 days
(Sowing up to 2-true leaves stage)

Cold Stress (Growth Chamber)
[10 °C temperature, 740 µmol m^{-2} s^{-1} Light Intensity and 50% Rel humidity]

Day -1
Foliar spray with
10 mM DGSM
(1 ml per plant)

Day 0 Day 1
Plant height
Chlr. content

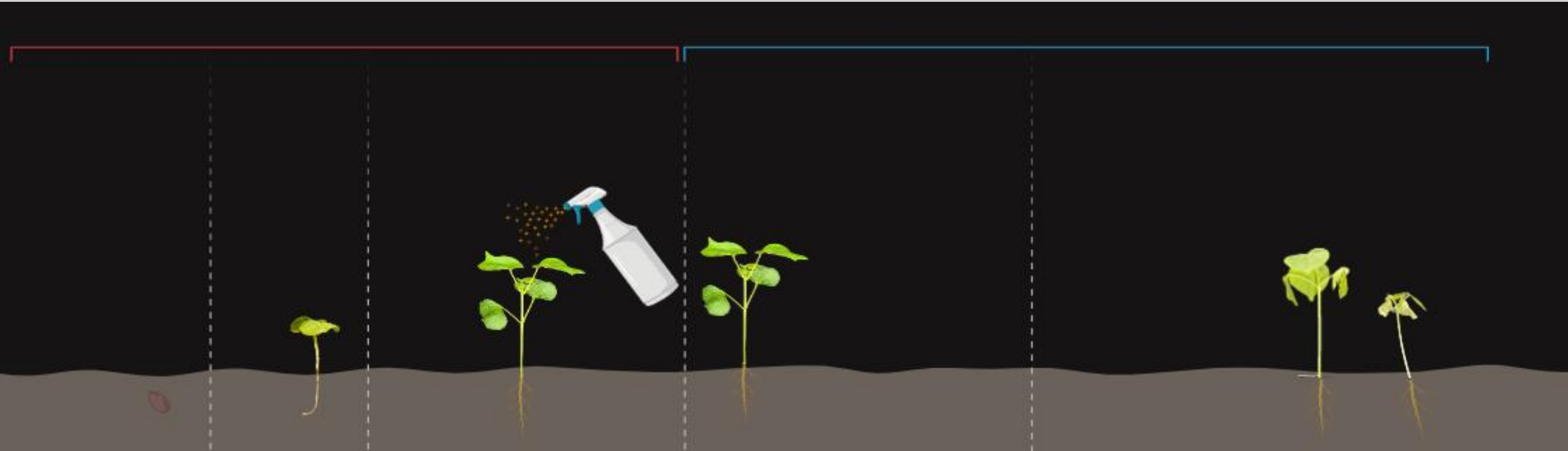
Day 2

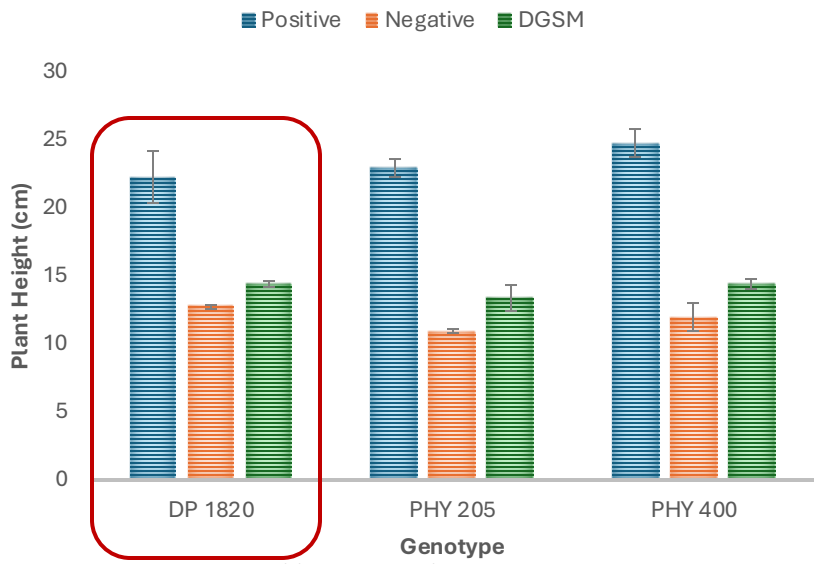
Day 3
Plant height
Chlr. content

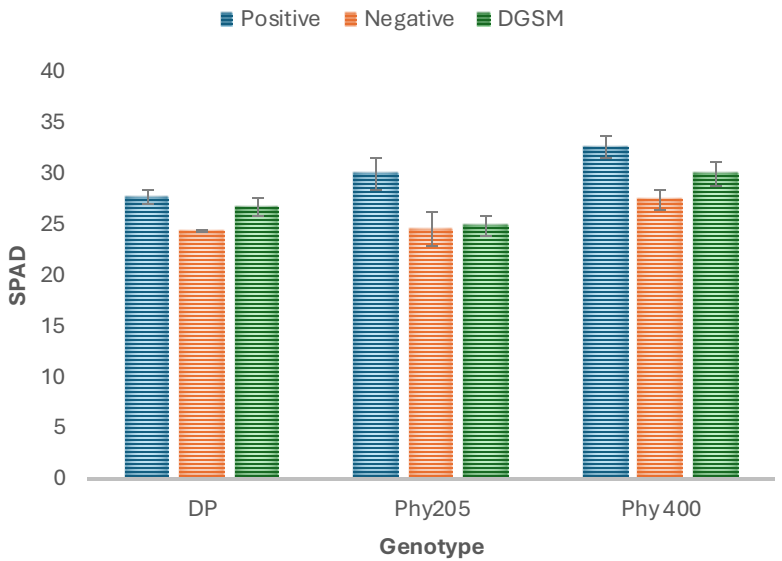
Day 4

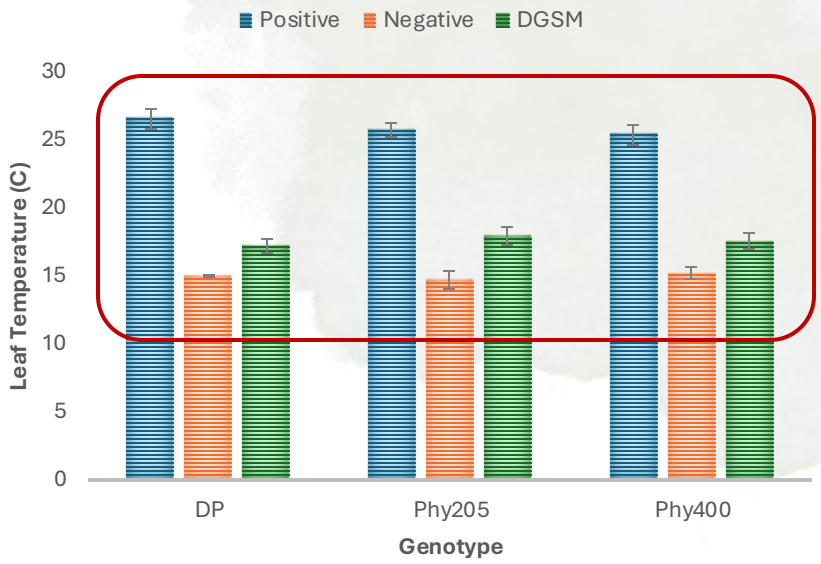
Day 5

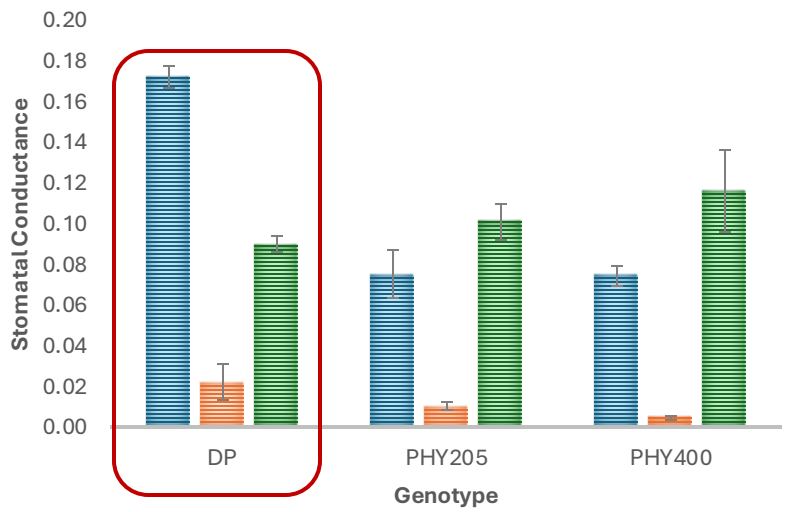
Day 6
Plant height
Stomatal conductance
Chlorophyll content (SPAD)
Photosynthetic assimilation (A)
Tissue collection for Biochemical assessments (APX, CAT, MDA)





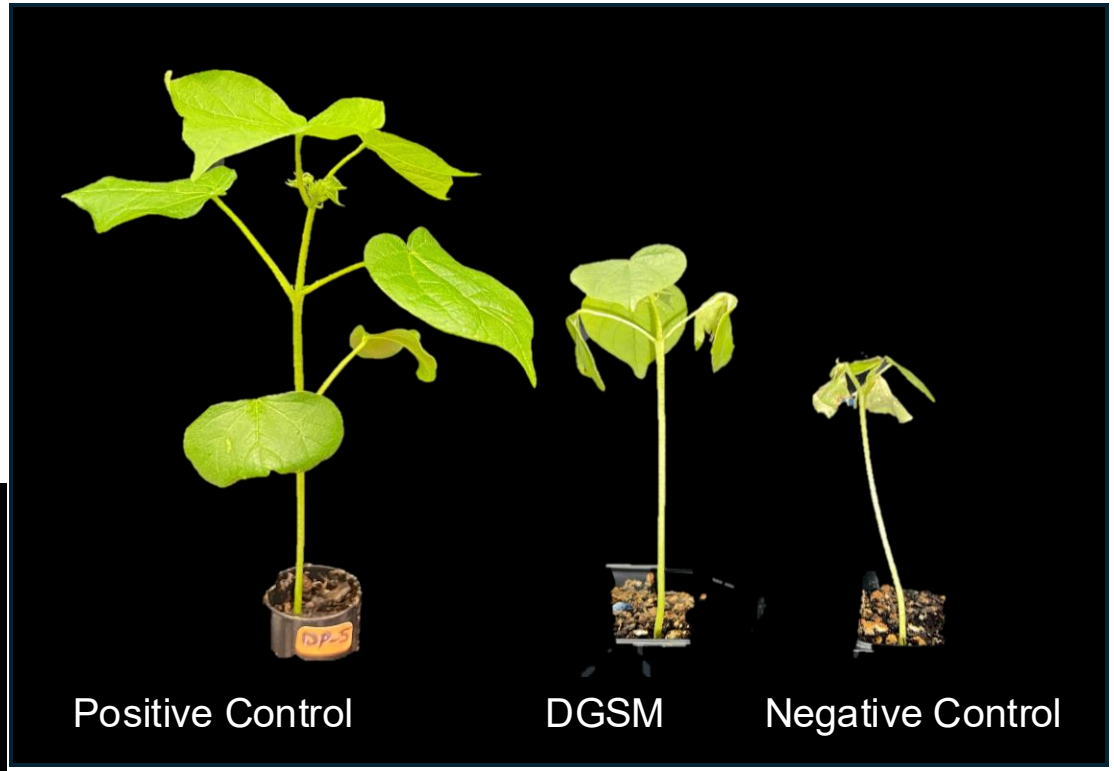






Conclusion

Cold stress for a week severely reduced cotton performance, but DGSM treatment improved plant performance, but the effect is partial.



FUTURE WORK

- Physical/ molecular change
- Biochemical/RNA seq
- Optimize the formulation dosage to make plants normal.

Thank you & Questions?

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