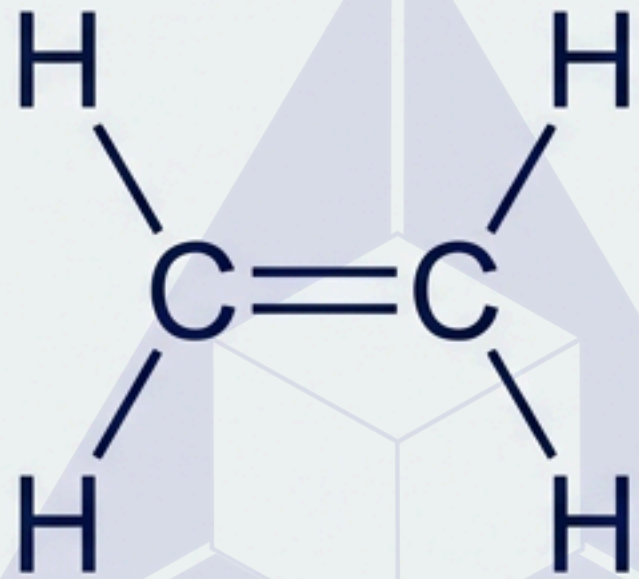


PLANT GROWTH REGULATORS

The Gaseous Hormone of Ripening

A comprehensive dossier on Ethylene—the invisible driver of plant maturity, senescence, and early growth adaptation.

The Anomaly of the Hormone World



Molecule: C₂H₄

State: Simple Gas

Nature: Readily diffuses across tissues

A Dual-Role Regulator: Plant Growth Regulators (PGRs) are typically divided into promoters and inhibitors. Ethylene conceptually fits into both categories, but acts largely as an inhibitor of growth activities.

Historical Context: Discovered by H.H. Cousins (1910) after confirming that a volatile substance released from ripened oranges hastened the ripening of stored, unripened bananas.

Origins: Where is Ethylene Synthesized?

Unlike auxins or gibberellins which are heavily produced in growing apices, ethylene is synthesized in massive amounts by tissues reaching the end of their developmental cycles.



Ripening Fruits

Synthesized during the final stages of fruit maturation, accelerating biological transitions.



Senescing Tissues

Produced heavily in aging plant organs (such as leaves and flowers) that are actively undergoing programmed biological degradation.



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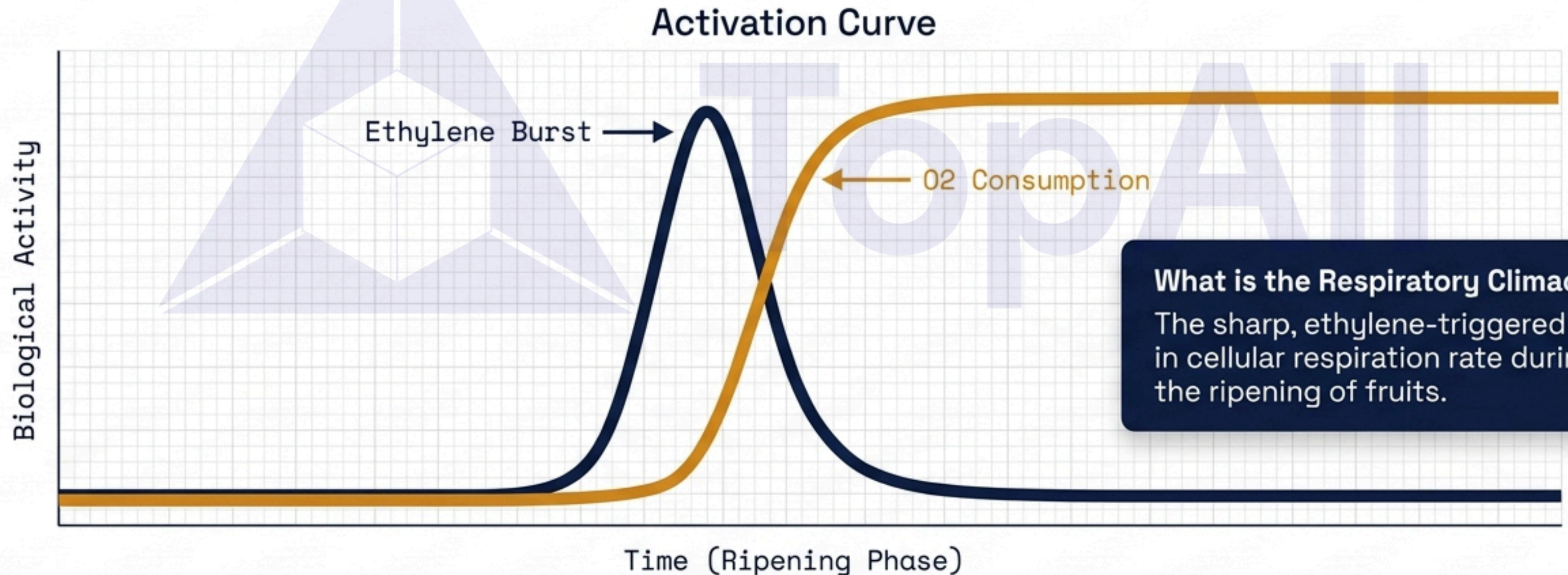
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The Respiratory Climactic

Ethylene's most profound metabolic effect during fruit ripening is a sudden, dramatic enhancement of the fruit's respiration rate.

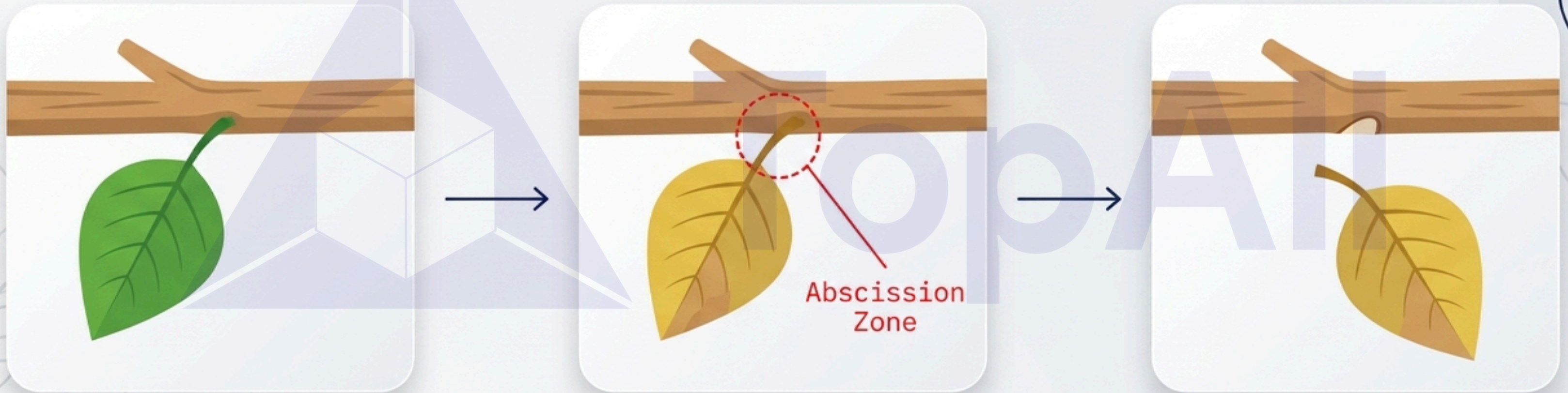


What is the Respiratory Climactic?

The sharp, ethylene-triggered rise in cellular respiration rate during the ripening of fruits.

Driving Senescence and Abscission

Ethylene acts as the primary chemical signal for programmed aging and organ shedding.



Senescence: Actively promotes the aging process in leaves and flowers.

Abscission: Stimulates the premature dropping of plant organs (leaves, flowers, fruits) by weakening cell walls specifically within the abscission zone.

Paradoxical Effects: Seedling & Root Growth



While primarily considered an inhibitor, ethylene is crucial for early life survival and morphological adaptation.

Apical Hook Formation:

Protects the delicate shoot tip as it pushes upward through rough soil.

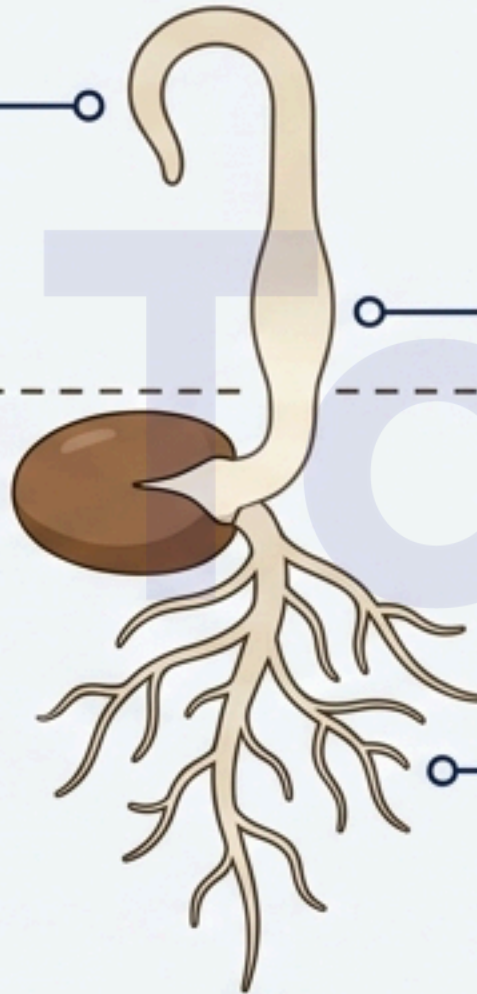
Dormancy Breaking: Initiates germination in peanut seeds and sprouting in potato tubers.

Horizontal Growth & Axis Swelling:

Thickens the stem of dicot seedlings to overcome physical soil resistance.

Root Hair Formation: Promotes root growth, massively increasing the total absorption surface area.

Survival Adaptation: In deep-water rice, ethylene promotes rapid internode/petiole elongation, keeping leaves safely above rising water.



Harnessing Ethylene: Ethephon in Agriculture

Applying raw ethylene gas to open fields is impractical. Agriculture relies on Etephon—an aqueous solution that is readily absorbed and slowly releases ethylene gas from inside the plant tissue.

TARGET CROP	PRIMARY PHYSIOLOGICAL EFFECT	AGRICULTURAL BENEFIT
Tomatoes & Apples	Hastens fruit ripening	Synchronized, early harvesting
Cotton, Cherry, Walnut	Accelerates abscission	Efficient thinning of flowers and fruits
Cucumbers	Promotes female flowers	Significant increase in total crop yield
Pineapples & Mangoes	Initiates flowering	Synchronizes fruit-set

The Master Switch of Transition

Ethylene is the anomaly of the plant world—a simple gas dictating profound changes. While widely known for inducing fruit ripening and organ drop (abscission), it serves as a universal transition signal: breaking seed dormancy, altering seedling anatomy for survival, and gracefully dictating the end of a plant organ's lifecycle.

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