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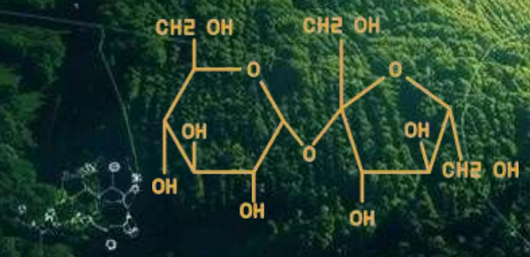
Brix Estimation Using Satellite Imagery

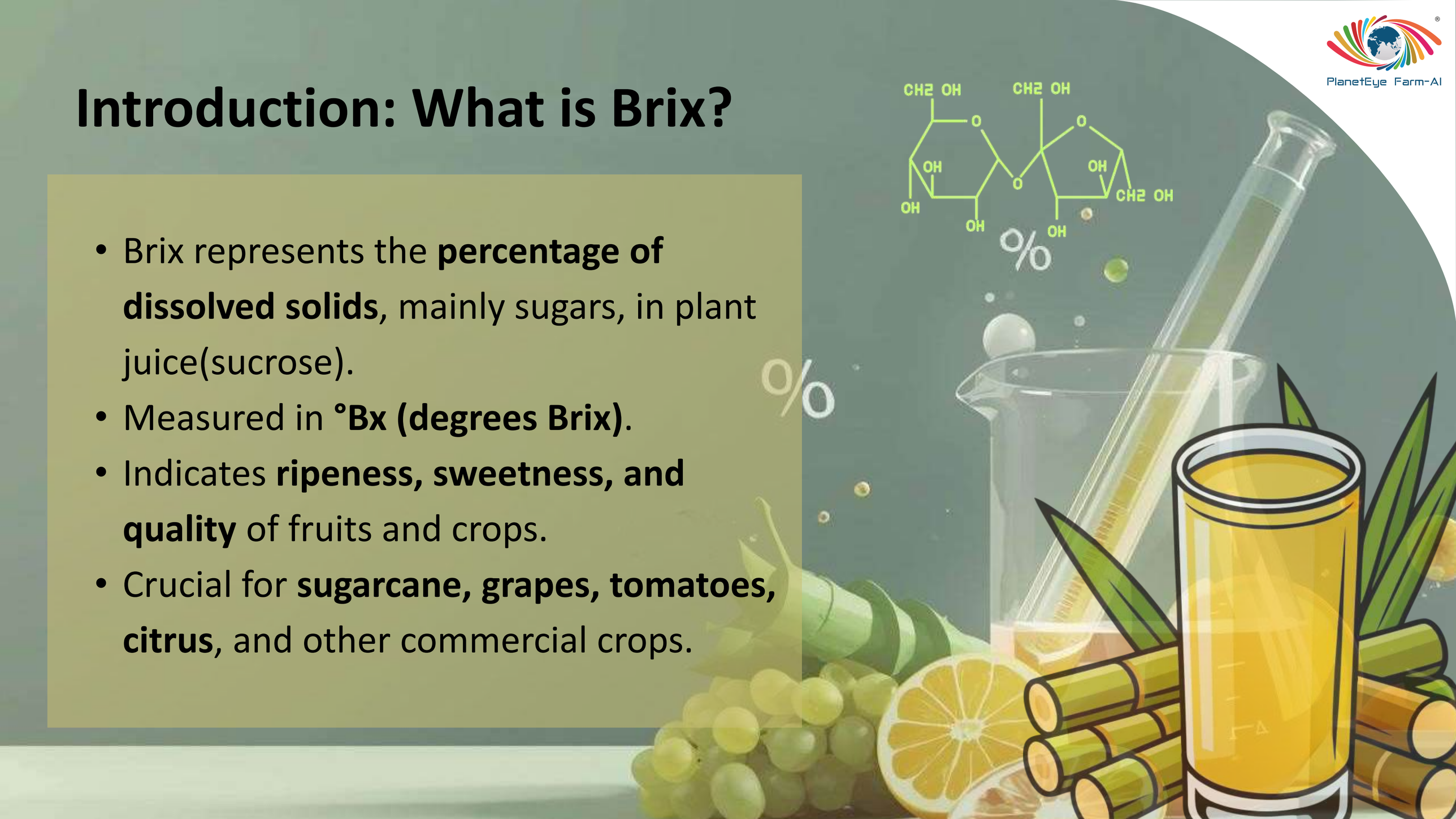
Using Remote Sensing and AI to Predict Crop Quality



Presented by: *PlanetEye Farm AI Ltd*

Introduction: What is Brix?

- Brix represents the **percentage of dissolved solids**, mainly sugars, in plant juice(sucrose).
- Measured in **°Bx (degrees Brix)**.
- Indicates **ripeness, sweetness, and quality** of fruits and crops.
- Crucial for **sugarcane, grapes, tomatoes, citrus**, and other commercial crops.



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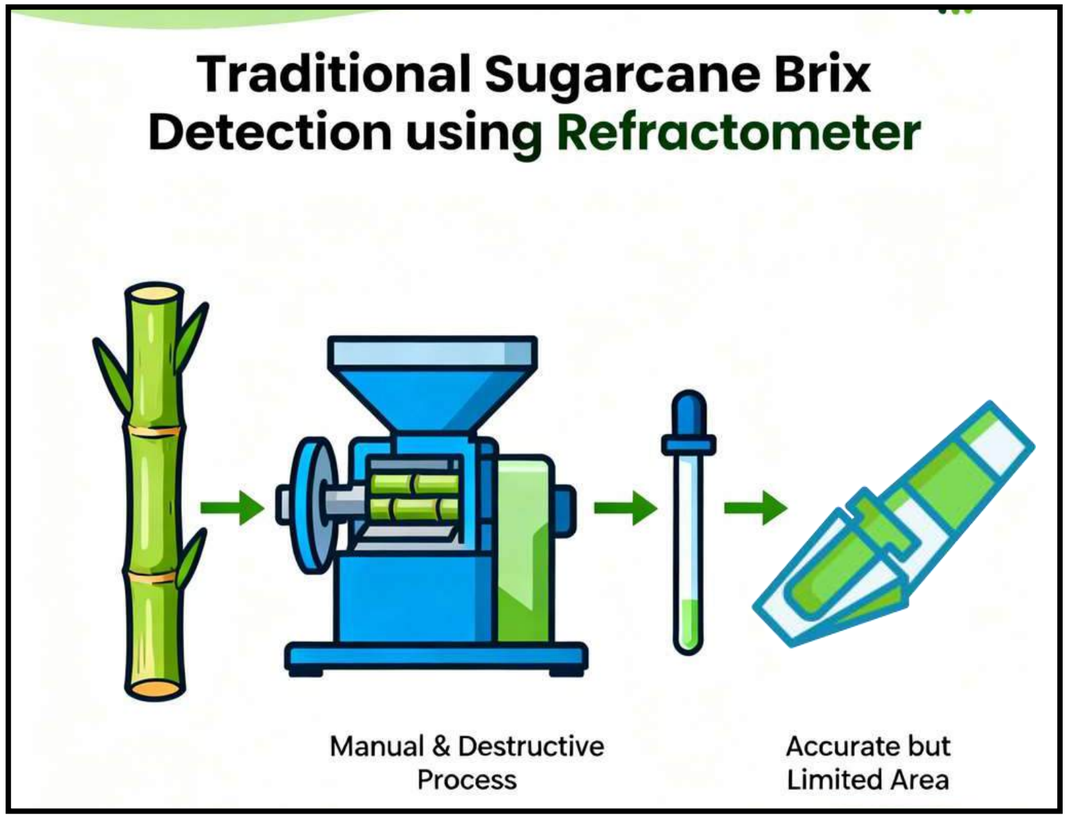
Why Brix Matters in Agriculture

- Determines **ideal harvest time** and **market value**.
- Reflects **photosynthesis efficiency** and **plant health**.
- Helps in **crop quality grading** and **yield prediction**.
- Guides **irrigation, fertilization, and harvest management**.

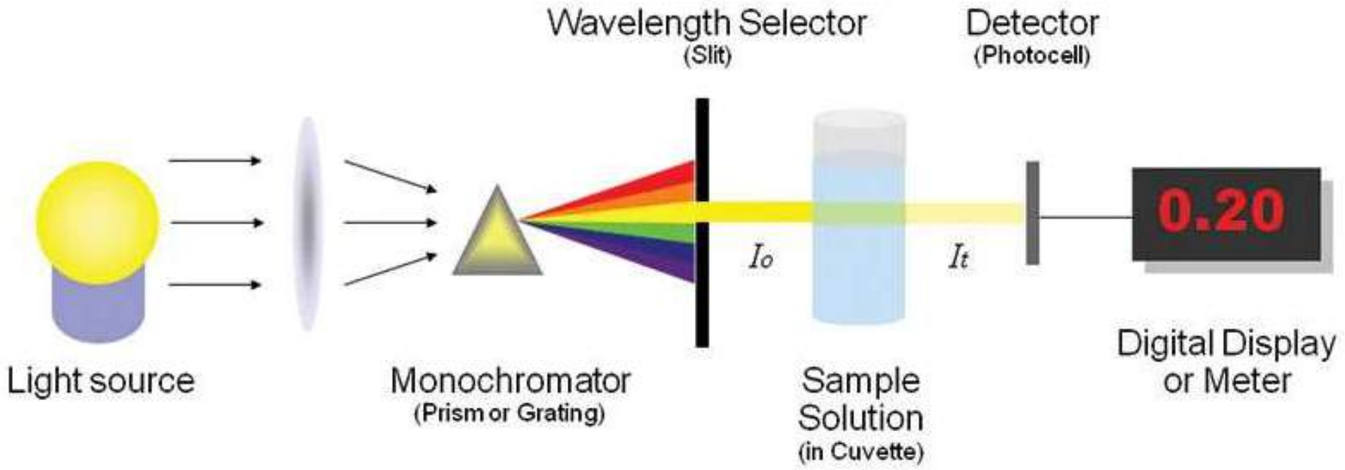
Traditional Brix Measurement

- Manual process using **refractometers.**
- Steps: Extract juice → Drop sample → Measure refraction → °Bx value.
- Accurate, but:
- Labor-intensive and destructive.
- Limited to small areas.
- Not suitable for real-time or large-scale monitoring.



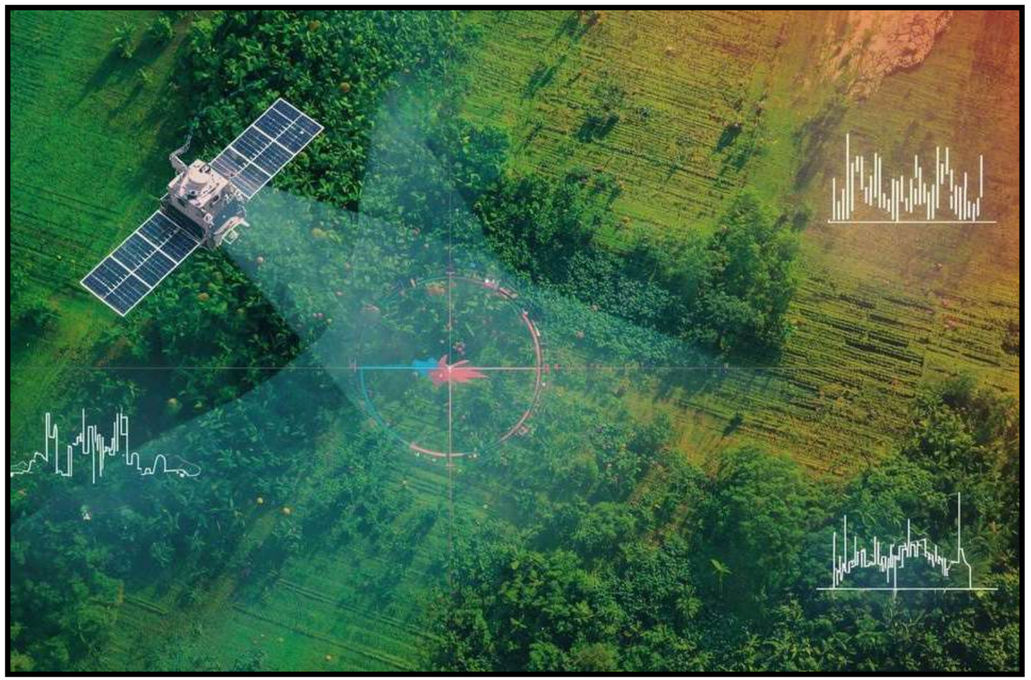
Traditional Brix Measurement

- Principle: Measures how much light a sample absorbs.
- Light Source: Emits UV or visible light.
- Monochromator: Selects a single wavelength.
- Sample: Light passes through the solution.
- Detector: Measures transmitted light and shows the result.



Limitations of Manual Brix Estimation

- Requires **physical sampling** across multiple points.
- **Sampling inconsistency** due to uneven fields.
- **Time-consuming** process.
- **Difficult to monitor** changes during crop growth.
- **Not scalable** for large farmlands or regional assessments.



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Satellite-Based Brix Estimation

- Modern satellites like **Sentinel** and **PlanetScope** provide multispectral data.
- Capture crop reflectance in **visible, SWIR, and Red Edge** bands.
- Reflectance correlates with **chlorophyll content, stress, and sugar levels**.
- Enables **remote, non-destructive, and repeatable Brix estimation**.

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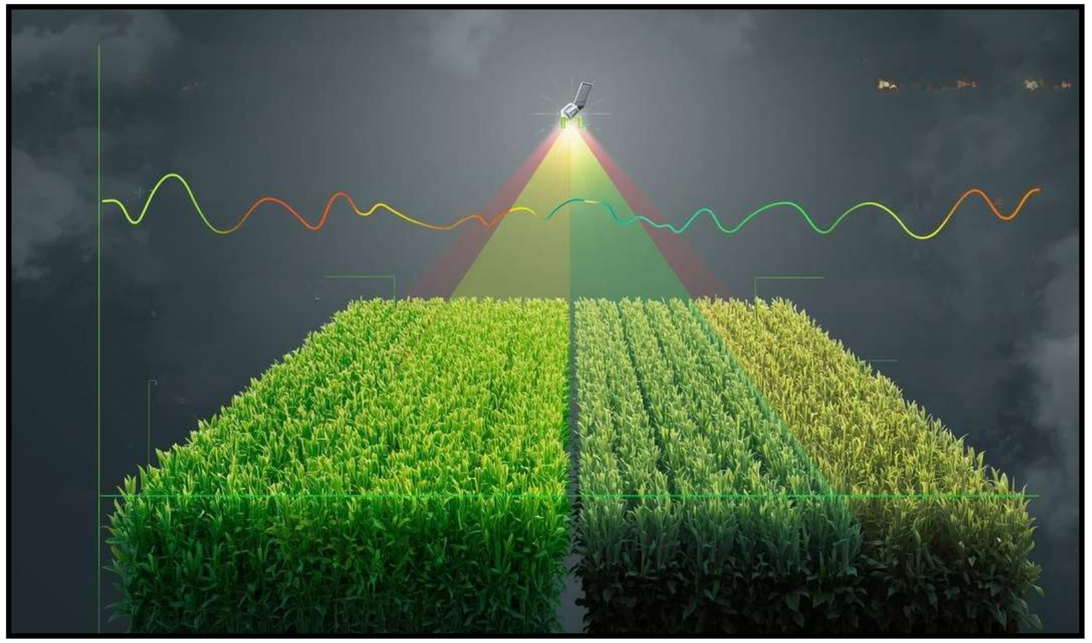
The Science Behind It: Spectral Signatures

- Healthy plants reflect **distinct spectral patterns**.
- More chlorophyll → More photosynthesis → Higher sugar synthesis.
- Stress (pest, drought, or nutrient deficiency) → Reduces chlorophyll → Lowers Brix.
- Satellite sensors detect these variations through **reflectance indices**.



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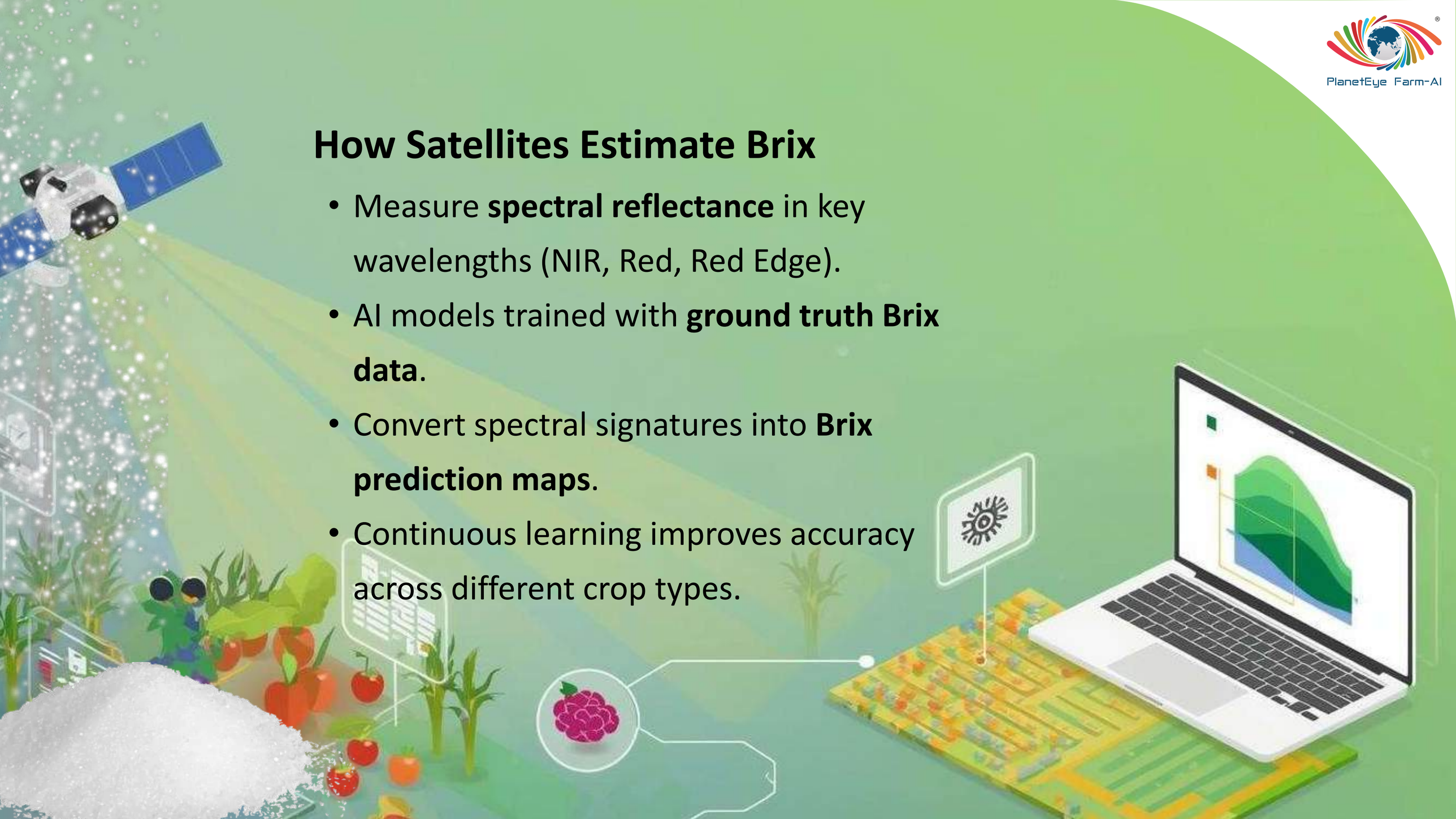
How Satellites Estimate Brix

- Measure **spectral reflectance** in key wavelengths (NIR, Red, Red Edge).
- AI models trained with **ground truth Brix data**.
- Convert spectral signatures into **Brix prediction maps**.
- Continuous learning improves accuracy across different crop types.



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Role of AI and Machine Learning

- AI integrates **satellite data, weather data, and field samples**.
- ML algorithms (Regression, CNNs, Random Forests) predict °Bx.
- Enables **real-time and scalable quality monitoring**.
- Self-improving models through **field feedback and seasonal updates**.

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Advantages of Satellite-Based Brix Estimation

- **Non-destructive and real-time** monitoring.
- Covers **thousands of hectares simultaneously**.
- Enables **frequent temporal monitoring** throughout crop stages.
- Reduces **sampling errors and operational costs**.
- Scalable and repeatable for **regional and national-level analytics**.

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Application: Real-Time Crop Quality Monitoring

- Continuous observation across **growth stages**.
- Detects **sugar variations** between plots and seasons.
- Tracks **ripening trends** and **spatial variability**.
- Helps identify **best-performing zones** in the field.

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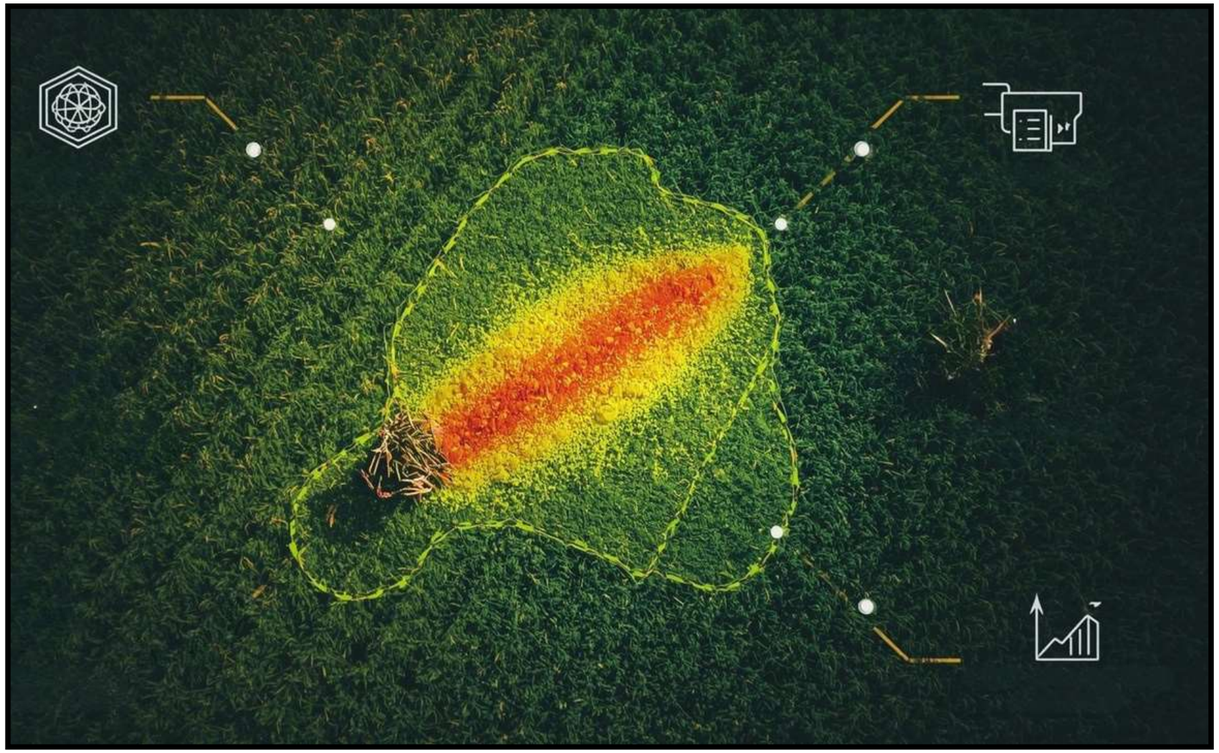
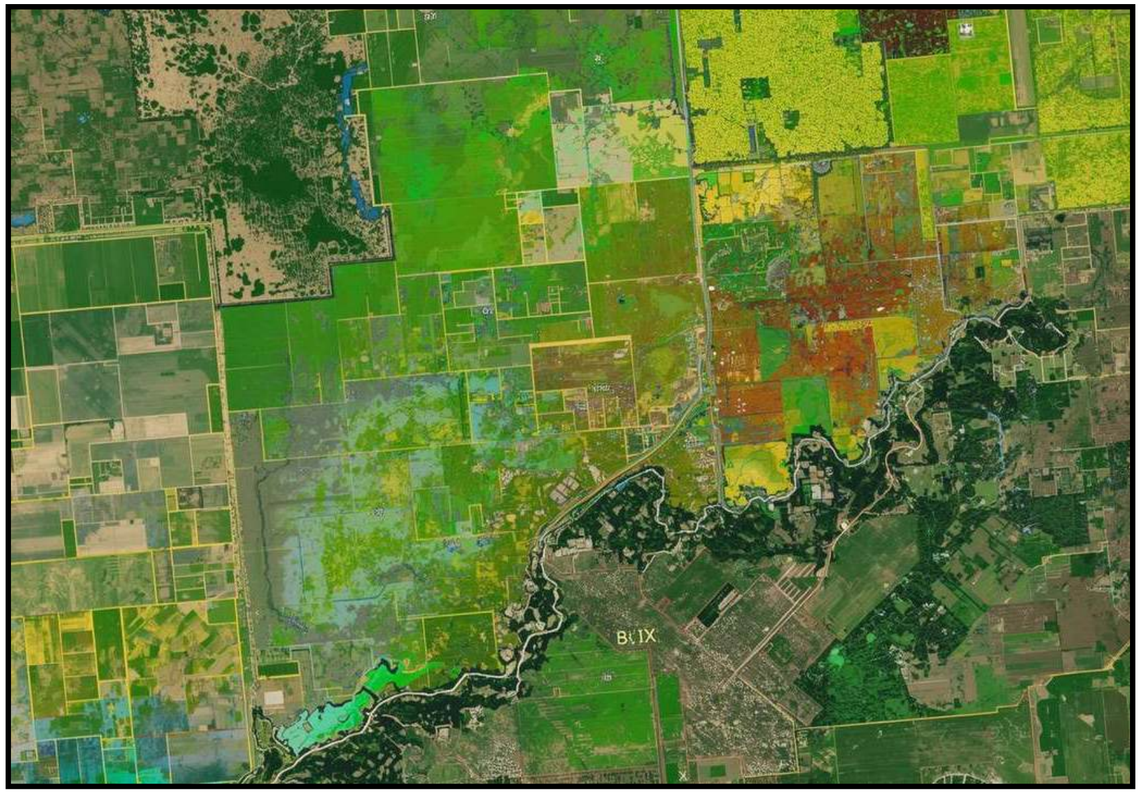
Application: Early Stress & Nutrient Detection

- Variations in Brix reveal **hidden plant stress**.
- Detects **nutrient deficiencies**, **pest damage**, and **moisture stress** early.
- Enables **timely intervention and input optimization**.
- Enhances **crop resilience and recovery**.



Example Visualization

- Example: Crop zones classified by estimated Brix.
- High °Bx = Green/Yellow zones; Low °Bx = Red zones.
- Visual representation of **ripeness and sugar concentration**.
- Enables actionable insights for farmers and mill managers.



Integration with PlanetEye FarmAI Platform

- Integrated into **CropEye dashboard**.
- Links **Brix estimation**, **stress mapping**, and **growth tracking**.
- Supports **real-time alerts** and **quality reports**.
- Customizable for **sugar mills, cooperatives, and agritech partners**.

Case Study / Example

- Region: [Nashik area, e.g., Nashik Sugar Belt]
- Crop: Sugarcane – 1.2 hectares
- Outcome:
- ±17.46 °Bx accuracy vs lab tests.
- Harvest planning improved by 18%
- Reduced sampling cost by 70%.

Brix Value (In degree)
Maximum : 20.59
Minimum : 15.73
Average : 17.46

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Comparative Analysis

Parameter	Manual	Satellite + AI
Scale	Limited	Large-scale
Cost	High	Low
Accuracy	High (small area)	High (regional level)
Time	Hours or days	Minutes
Destructive	Yes	No
Real-Time	No	Yes

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PlanetEye’s Vision

- Revolutionizing **crop quality intelligence** using AI & SpaceTech.
- Empowering **farmers, cooperatives, and sugar industries**.
- Advancing toward **data-driven, sustainable agriculture ecosystems**.
- “From Space to Sweetness — Precision for Every Harvest.”

Key Takeaways

- Satellite imagery enables **real-time, scalable Brix estimation**.
- AI enhances accuracy and interpretability.
- Drives **precision, sustainability, and profitability** in sugarcane farming.
- A true **game-changer for crop quality monitoring**.

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Thank you for joining !

Visit us at :

www.planeteyefarm.ai

Contact no : +91 82758 30454