CROPDEFENDERS x NAPPO
North American Plant Protection Organization
Organización Norteamericana de Protección a las Plantas

AI-Driven Phytosanitary Surveillance: A Canadian Greenhouse Perspective

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Ai
Things are about to get weird

- **Moving 100x Faster than Most of Us Realize**

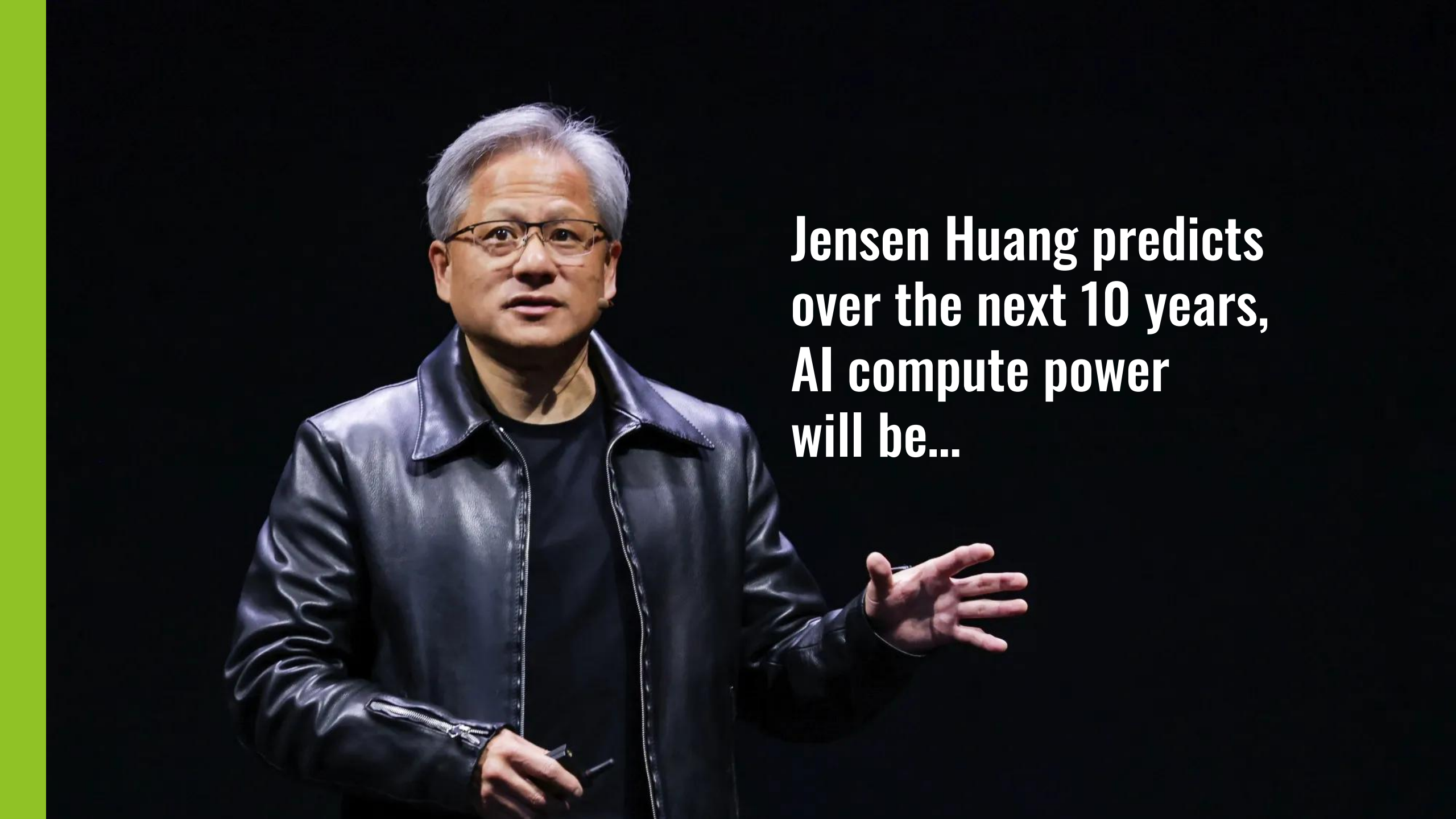
Midjourney

Rowan Atkinson from Version 1 through Version 5 of Midjourney's renderer.

The same prompt was used, except for replacing the version number at the end of each one. The most 'Rowan'-like image from each group of four was selected.

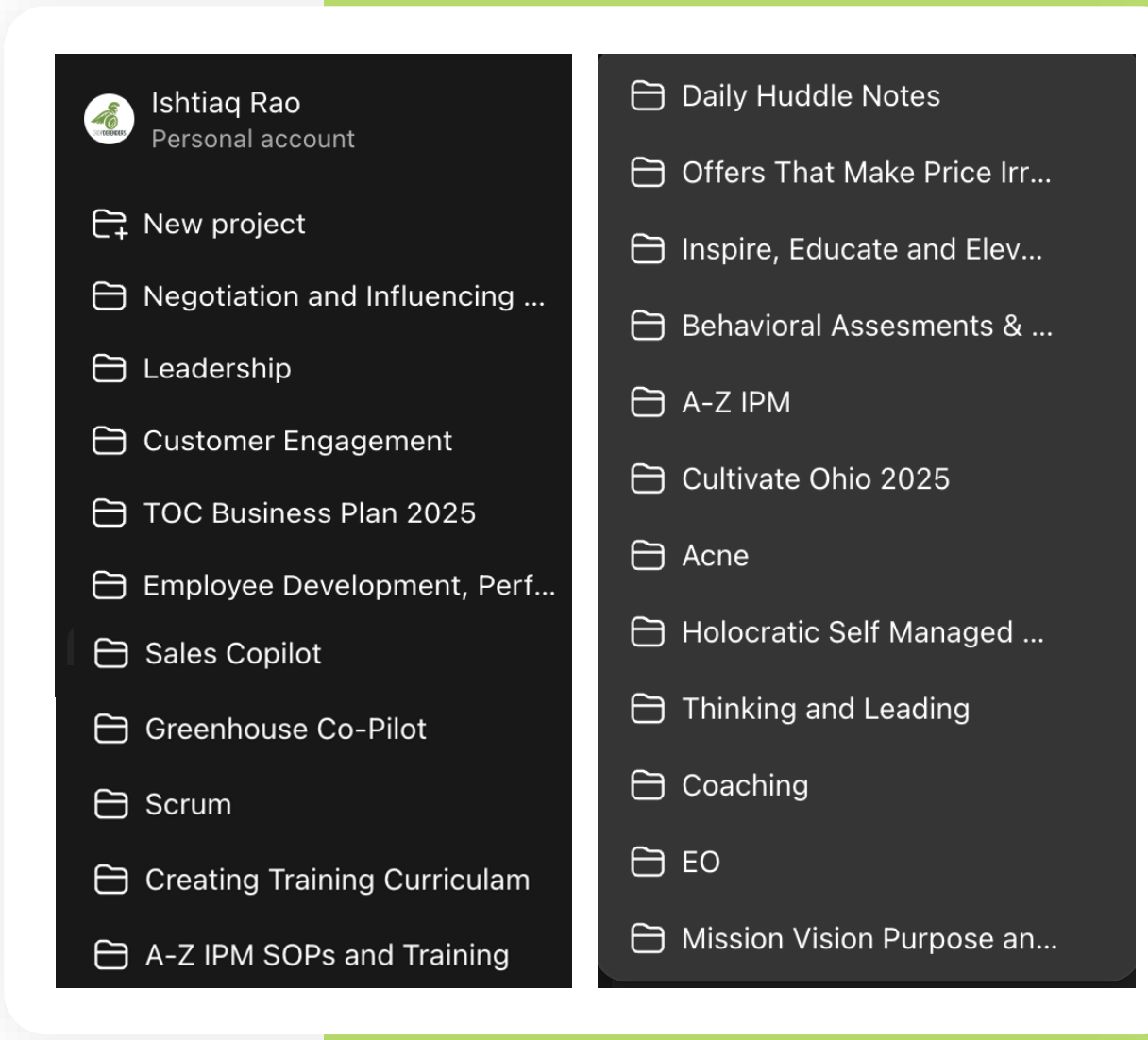
Four Layers of AI Compute Growth (last 10 years)

- **Transistors**: ~100x
- **Hardware**: ~1,000x
- **Software**: ~1,000x
- **Data centers**: ~1,000x


Jensen Huang predicts
over the next 10 years,
AI compute power
will be...

1,000,000x faster

My Experience with ChatGPT Projects



NAPPO’s Evolving Challenge – Global Trade, Local Risks

- New pests & diseases moving faster
- **Pepper weevils, tomato viruses, Tuta absoluta**

Root causes:

- Latent pests
- Hidden infestations
- Limited inspection capacity
- E-commerce pathways
- Climate change

Shifting from Reactive to Proactive

Symptoms:
- pest incursions
- delayed detections
- emergency eradications
- trade disruptions

Impact:
- Economic losses (crop & trade)
- environmental damage
- grower uncertainty

AI & Automation Toolbox

- AI Insight (Big Data/ML)
- Computer Vision
- Drones & Robots
- Electronic Noses
- LLMs (ChatGPT-type)

Mapping Tech to Problems

- Hidden Pests (Eggs/Viruses)

➔ CV + E-nose cameras and sensors catch what eyes cant

- Limited inspectors

➔ Robots + AI triage: automate routine checks, flag high-risk shipments

- New pathways (mail, e-com)

➔ ML risk models: target inspections on likely risky parcel

- Data silos

➔ Knowledge graph & AI assistant: all info connected and queryable by staff

Case Studies

Case Study – Pepper Weevil in Greenhouse

- **2016 outbreak in Ontario:** $67M losses, weevil went unnoticed until widespread
- **Missed early signs:** eggs inside fruit, minor droppings – human scouts caught on late
- **AI Could Have:**
  - Alerted via trade data (“high risk of weevils in pepper imports this spring”)
  - Detected larvae odor or frass with e-nose network (trigger scouting sooner)
  - Identified puncture scars on peppers via smart camera as an “anomaly”
- **Outcome:** Outbreak might have been contained to one greenhouse, saving millions

HOME & GARDEN

Bug off: Identify, monitor, manage the destructive pepper weevil

Dr. Muhammad Haseeb Guest columnist

June 10, 2021, 1:19 p.m. ET

Adult pepper weevil feeding on an unopened pepper flower. *Muhammad Haseeb.*

Case Study – Tomato Virus (ToBRFV)

- **Challenge:** Virus spread via imported seeds, hit greenhouses in NA
- **Response:** NAPPO harmonized testing protocols (all countries on same page)
- **AI Adds:**
  - Smart pooling of seed tests → test more seeds with same resources (catch infection in lot)
  - Traceability graph → if one greenhouse finds it, instantly find all others with same seed batch
  - CV in greenhouse → spots subtle mosaic on leaves before it spreads far
- **Impact:** Fewer infected seed lots planted; quick containment of any intro (saves crops, keeps trade open)

Case Study – Tuta absoluta (Tomato Leaf miner Threat)

- **Not here yet** but spreading globally; could devastate tomatoes
- **Proactive plan:** NAPPO drafting preparedness document
- **Tech as Force Multiplier:**
  - Region-wide network of AI-monitored pheromone traps at borders & farms – catch the first moth if it arrives
  - Drones with night-vision to spot leaf mining in fields at early stages
  - AI simulations of spread → pinpoint the most vulnerable regions to deploy prevention (e.g. greenhouses near airports)
- **Goal:** Prevent establishment entirely, or at worst detect & eradicate at incursion point

Integrating AI into NAPPO's Framework

From Committee to Field

- Expert Groups & AI insights
- Cross-border data sharing
- Capacity Building
- Public-Private Partnerships

Expected Benefits – “KPI Boost”

- Earlier Detection
- Higher Interception Rate
- Cost Savings
- Trade Stability

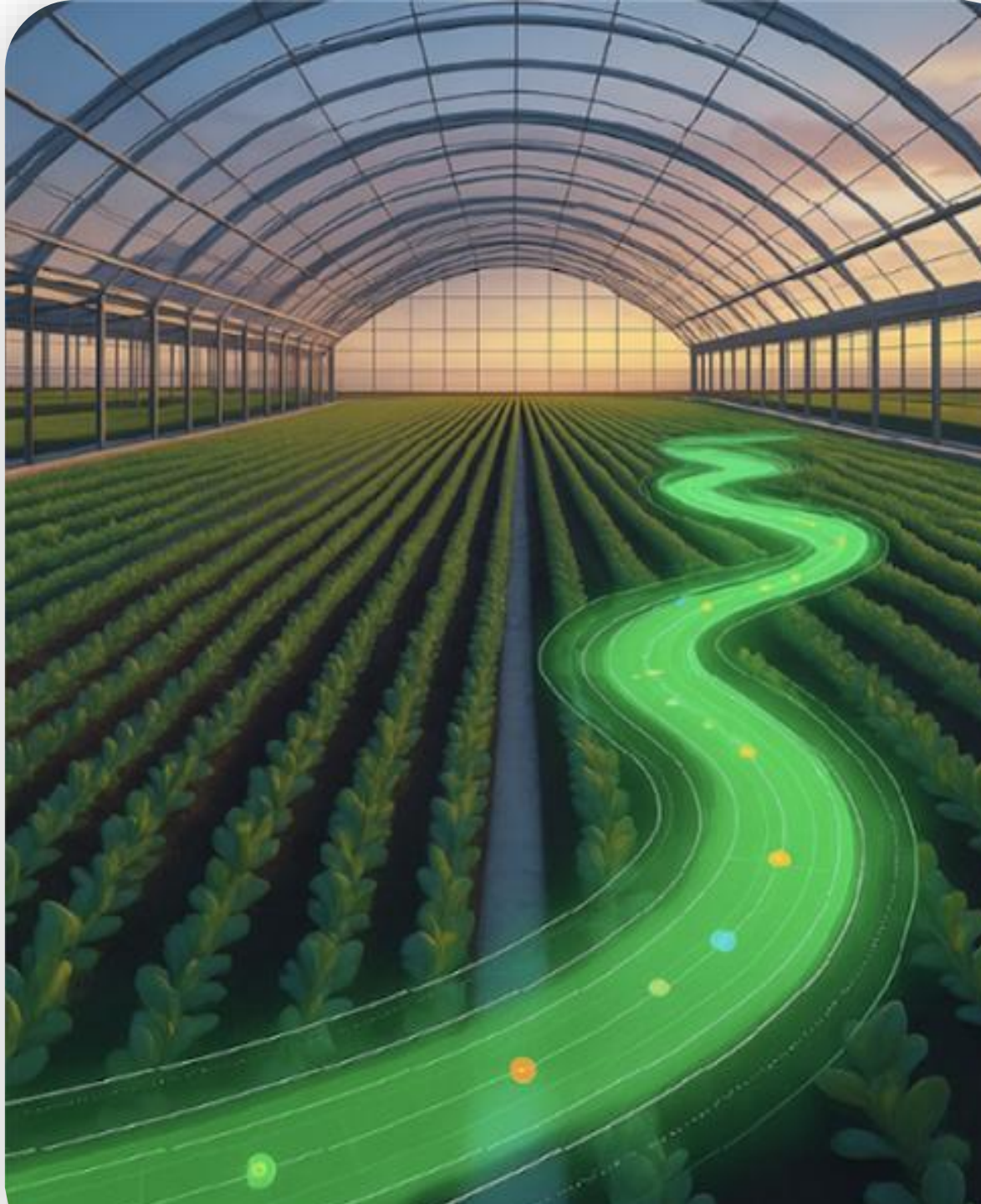
Addressing Risks & Ensuring Success – Challenges and Mitigations

- AI accuracy & trust
  - use verified data & human-in-loop
- Cost & scalability
  - begin with high-risk hotspots to maximize ROI
- Privacy & data security
- Adaptation
  - pests and trade evolve – keep AI models updated

Next Steps for NAPPO & Stakeholders

- Pilot Projects (2025–26)
  - Greenhouse Sentinel pilot
  - AI Border Scout pilot
- Joint Funding & Collaboration
- Training & Outreach 2025
- Policy Integration

Conclusion



Protecting Plant Health in the 21st Century

Key Message

- Harness AI and automation
- Shift from a reactive stance to a predictive, preventive force
- Augment (not replace) the expertise

Vision

- Fewer surprises
- Faster responses
- Stronger cross-border collaboration

Call to Action: Let's pilot these solutions together – the technology is here; the time to innovate is now, to safeguard our agricultural future.

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Thank you