Can Invisible Forces (Not Ghosts 👻) Help Plants Grow Stronger?

Exploring Magnetism as a Sustainable Tool for Farming

Sloka Inukollu, 4th Grade

“Not everything that helps life grow can be seen.”

Background

- Sloka learned that many **farmers** depend on **chemical fertilizers and pesticides to grow crops faster.**

- These chemicals can increase yield but may also **harm** soil, water, and human health.

- Farmers also face **abiotic stressors** such as drought, heat, and poor soil.

- This raised an important question:

Can a natural force like magnetism help plants grow stronger roots without chemicals?

Earth’s Magnetic Field

- Earth has a natural magnetic field that supports life.
- Plants grow inside this invisible force every day.

Question: Can adding magnets help plants grow faster and stronger?

Purpose: Investigating Magnetic Fields' Effects

To test if magnetic fields affect:

- Germination
- Root growth
- Plant strength

Focus shifted to root development after observations.

Hypotheses

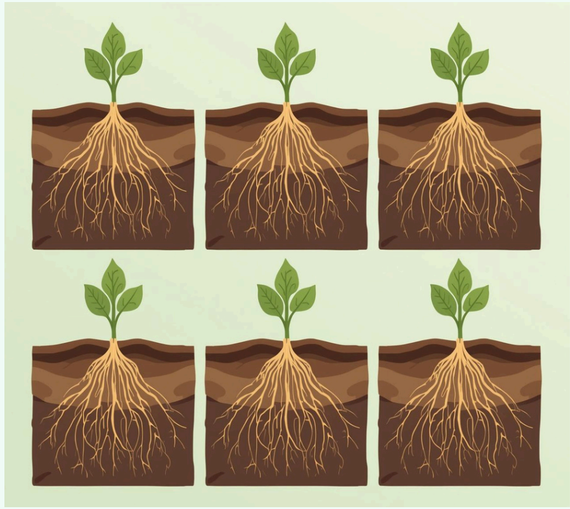
- **H1 - Germination**: Seeds exposed to magnets will germinate faster than seeds without magnets.
- **H2 - Root Strength** : Seeds exposed to magnets will develop thicker and more widely spread roots than the control group.
- **H3 - Magnet Placement:** The position of the magnet (side vs bottom of the pot) will influence the direction and pattern of root growth.
- **H4 - Multiple Seeds Together**: Growing mung beans, chickpeas, and peas together in one cup will produce stronger and more interconnected root systems.

Germination Speed

Magnets may **accelerate seed germination** process.

Root Strength

Increased magnetic exposure may **thicken root systems**.



Root Patterns

Magnet position may **affect root growth patterns**.

Experimental Setup

3 conditions tested:

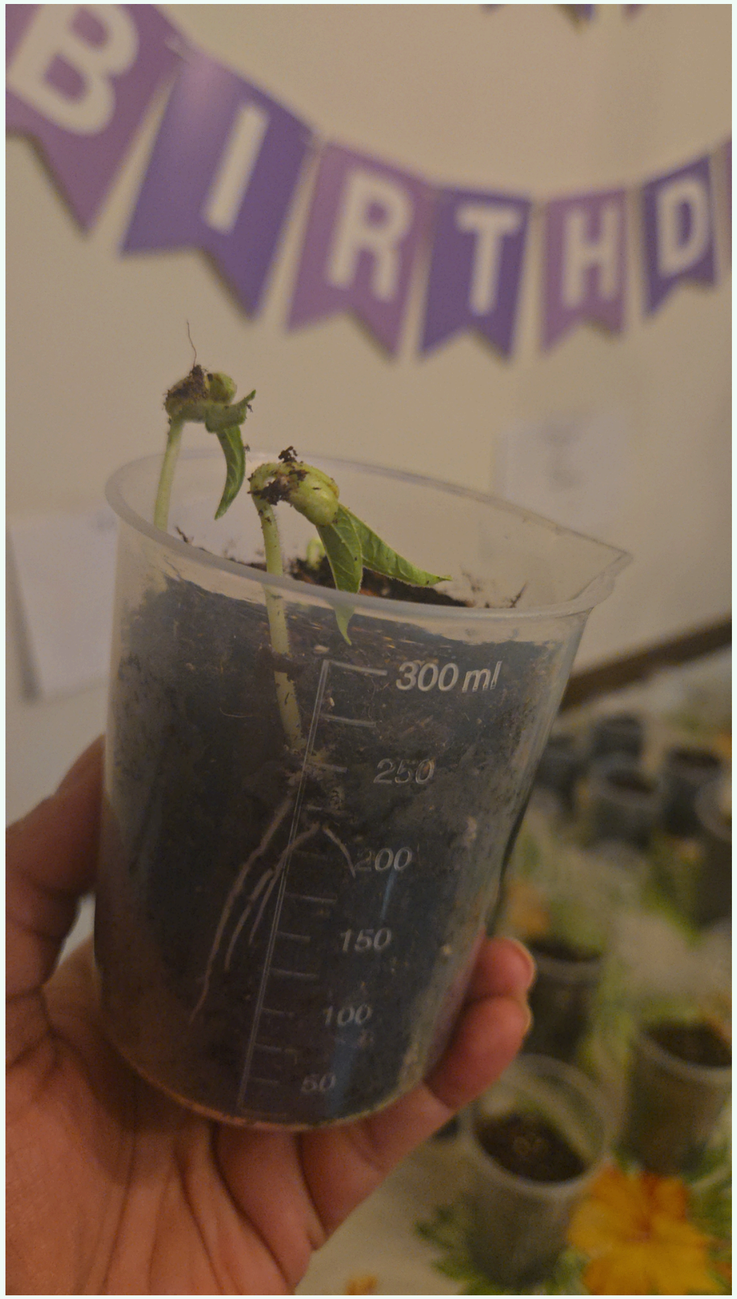
- No magnet (control)
- Magnet at bottom
- Magnet on side

Observed:

- Germination time
- Root growth
- Plant height

Control

Side Magnet



Bottom Magnet

Results of Magnet Impact on Plants

- **Faster germination with magnets**
- **Stronger, thicker roots**
- **Widest root spread** with magnets
- Plant height similar
- Growing **multiple legumes together** in one cup could create stronger root systems that may help plants survive in drought-prone or weak soil conditions. (**Inspired by Three Sisters Farming**)

Magnets mainly **affected roots**, not shoots

Three Sisters Farming

Curiosity Experiment Double Magnets (BIG WIN)

I became curious and added two magnets.

Result:

- Germination in ~6 hours
- Thickest and wildest roots

This showed stronger magnetic exposure may increase effects.

HOW MAGNETS MAY HELP GERMINATION

Magnetic fields may **activate internal seed processes** that start growth.

- **Faster Germination** - Magnetic fields may stimulate metabolic activity, helping seeds begin germination sooner.

- **Enzyme Activity Increases** - Enzymes break down stored food inside the seed, providing energy for the growing plant.

- **Improved Water Absorption** - Seeds may absorb water faster, which activates germination earlier.

- **ROS Regulation (Reactive Oxygen Species)** - Small amounts of ROS act as signals for growth, and magnetic fields may help keep ROS at healthy levels.

- **Ferritin and Iron Use** - Ferritin stores iron in plant cells, and magnetic fields may influence how iron supports early growth.

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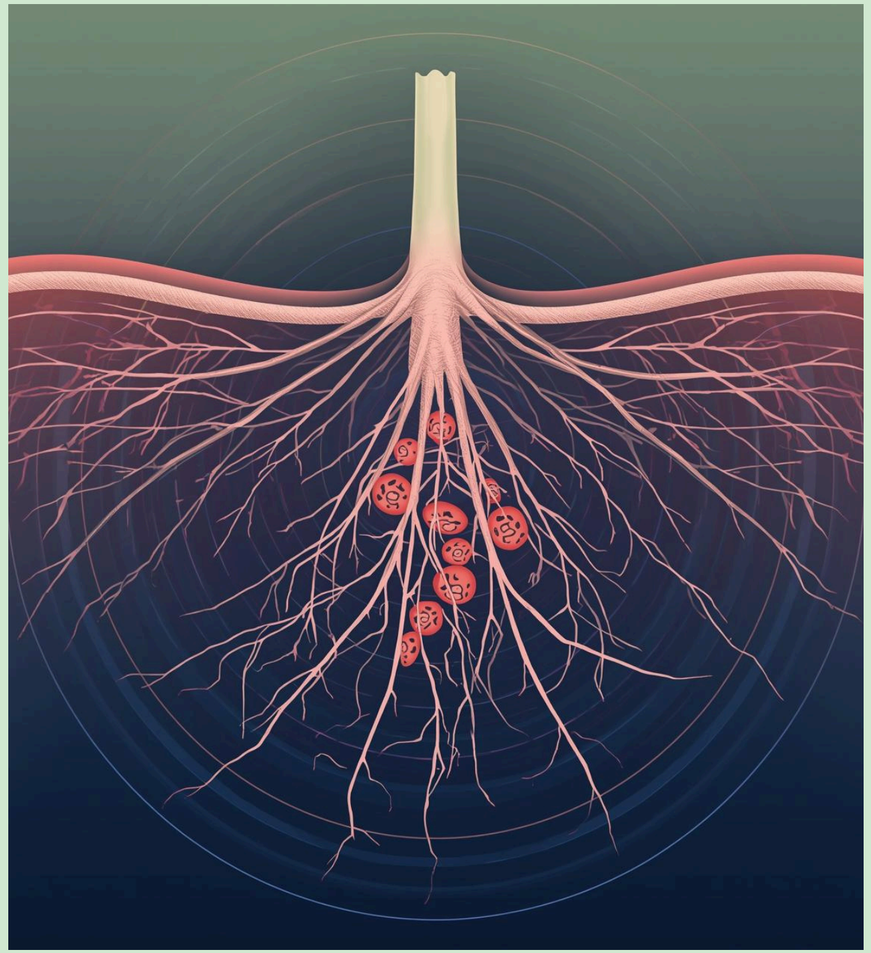

- **Calcium Signaling** - Calcium ions act like messengers telling plant cells when to divide and grow.

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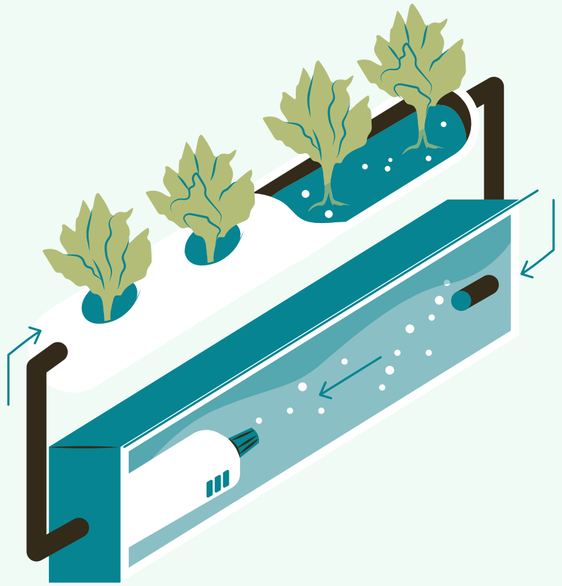
Real - World Impact

- Helps plants survive drought
- Reduces chemical use
- Helps farmers in India and across globe
- Works in poor or salty soil
- Sustainable + reusable +low-cost

Future Work

- Study **root inclination** using larger pots to measure how roots bend toward magnetic fields
- Test different **magnet strengths** and **distances**
- Study plants under **abiotic stressors** such as drought and poor soil
- **Magnets + hydroponics** to test improved nutrient absorption
- **Magnets + biochar** to improve soil health and root strength
- Measure **long term yield**



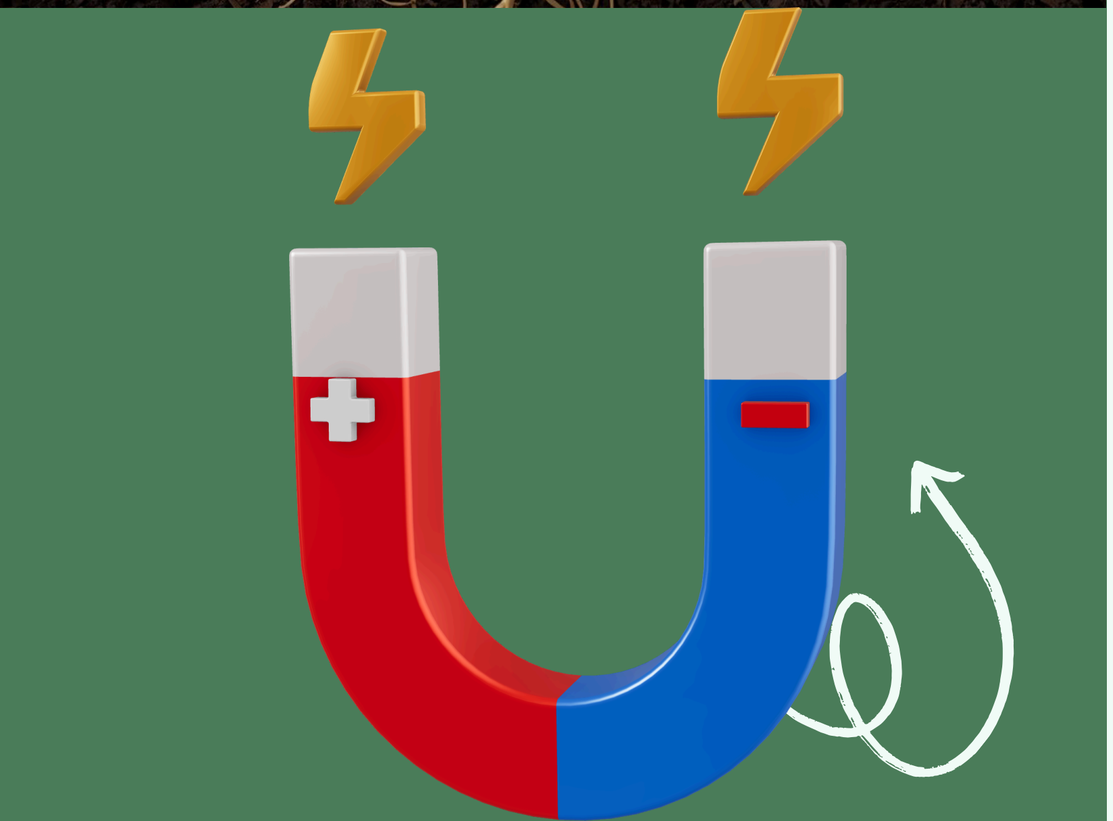
Hydroponics + BioChar

Hydroponics:

- No soil → roots are EVERYTHING
- Magnets may:
- Improve nutrient absorption
- Strengthen roots
- Speed growth

Biochar:

- Improves soil structure
- Holds water + nutrients
- Magnets + biochar → stronger root environment



CONCLUSION

Magnetic fields **promote stronger root systems**, aiding plants in overcoming drought, poor soil, and abiotic stress.

This **sustainable**, chemical-free method offers a promising approach for improving plant resilience and health.

Key Finding

Magnets did NOT make plants taller. They made roots **STRONGER** and more **RESILIENT**

BIBLIOGRAPHY

Radhakrishnan, R. (2019). Magnetic field regulates plant functions, growth and enhances tolerance against environmental stresses. Physiology and Molecular Biology of Plants, 25(5), 1107–1119. https://doi.org/10.1007/s12298-019-00699-9

This article explains that magnetic fields can stimulate plant metabolism, improve germination, and increase resistance to abiotic stress by influencing enzyme activity, antioxidants, and nutrient uptake.