Climate-smart agriculture and the role of carbon

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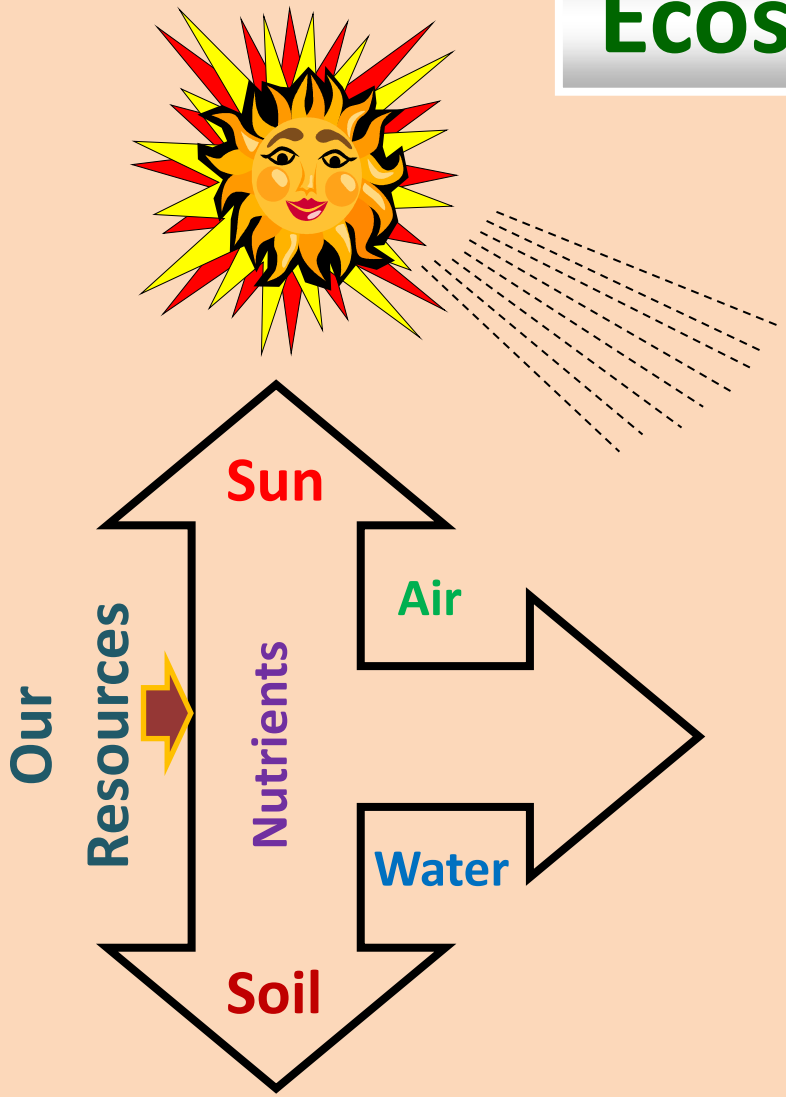
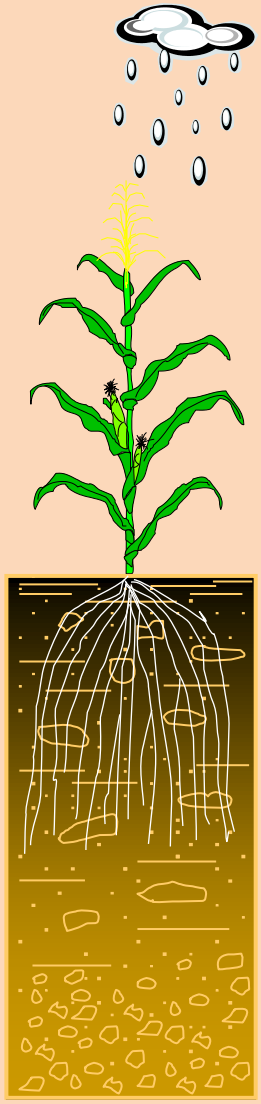
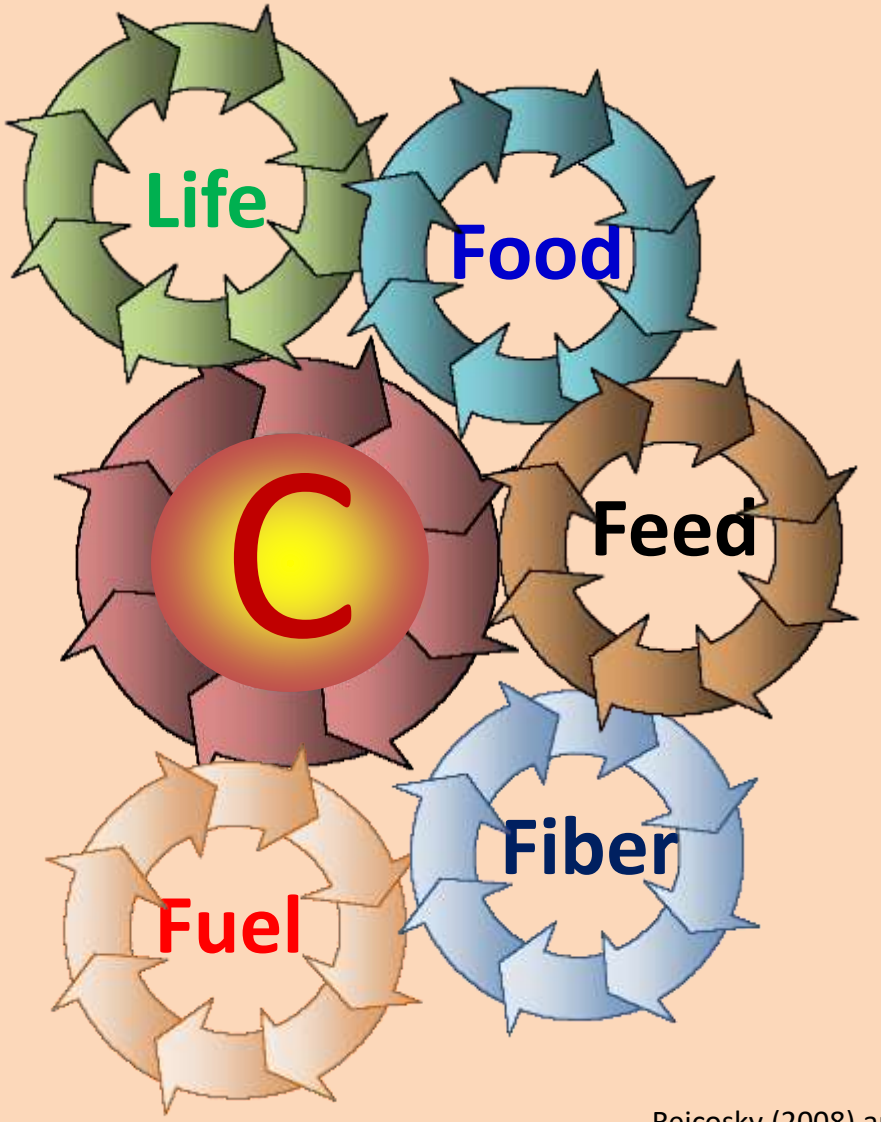
Carbon is the "Lord of the Rings".

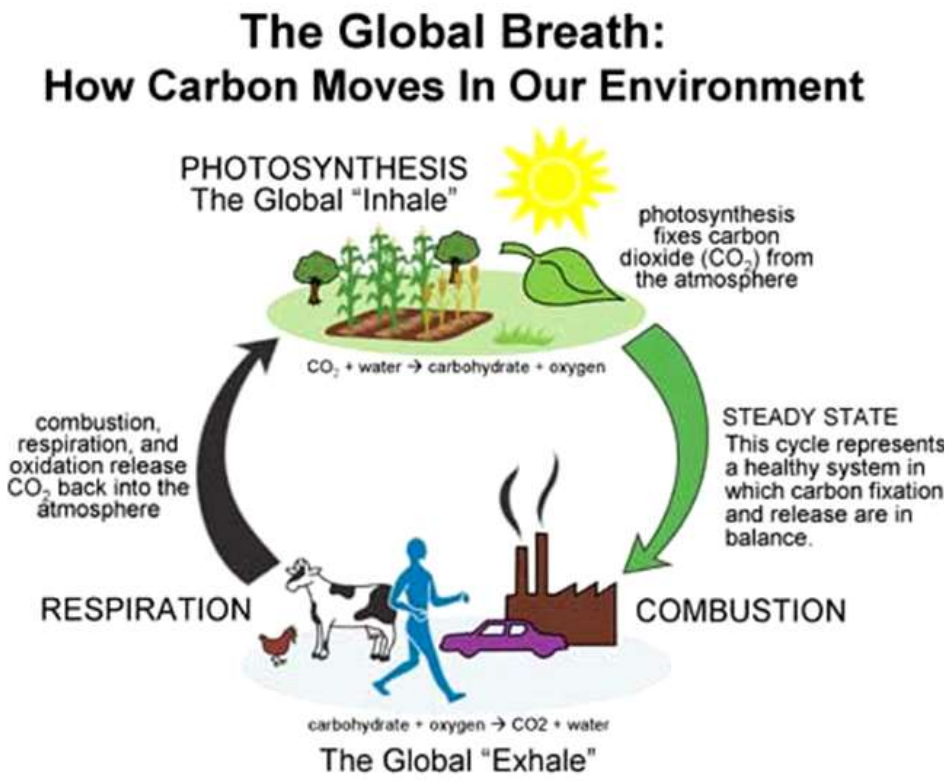
Ecosystem Services



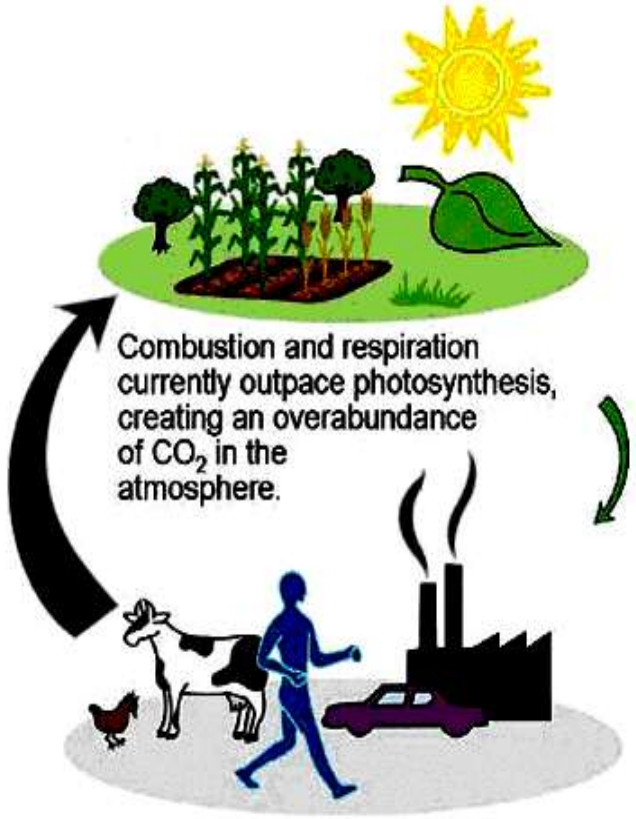




Reicosky (2008) and Islam (2022)



Carbon storage and reactivity in various forms within the ***Earth-atmosphere*** system play a critical role in ***balancing climate change / ecosystem services***.



Potential climate change impacts around the world

https://www.google.com/search?site=climate+change+effects

Crop growth, yield and food quality

- **Corn, millet, sorghum, & sugarcane** are C_4 plants (highly efficient) at current levels of CO_2.

- **Soybeans, rice, wheat, barley, oats, cotton, & alfalfa** are C_3 plants (moderately efficient) at current levels of CO_2.

- The C_3 plants will be **more efficient** at high CO_2 levels. The C_4 plants will be affected – decrease in **crop yield & food quality.**

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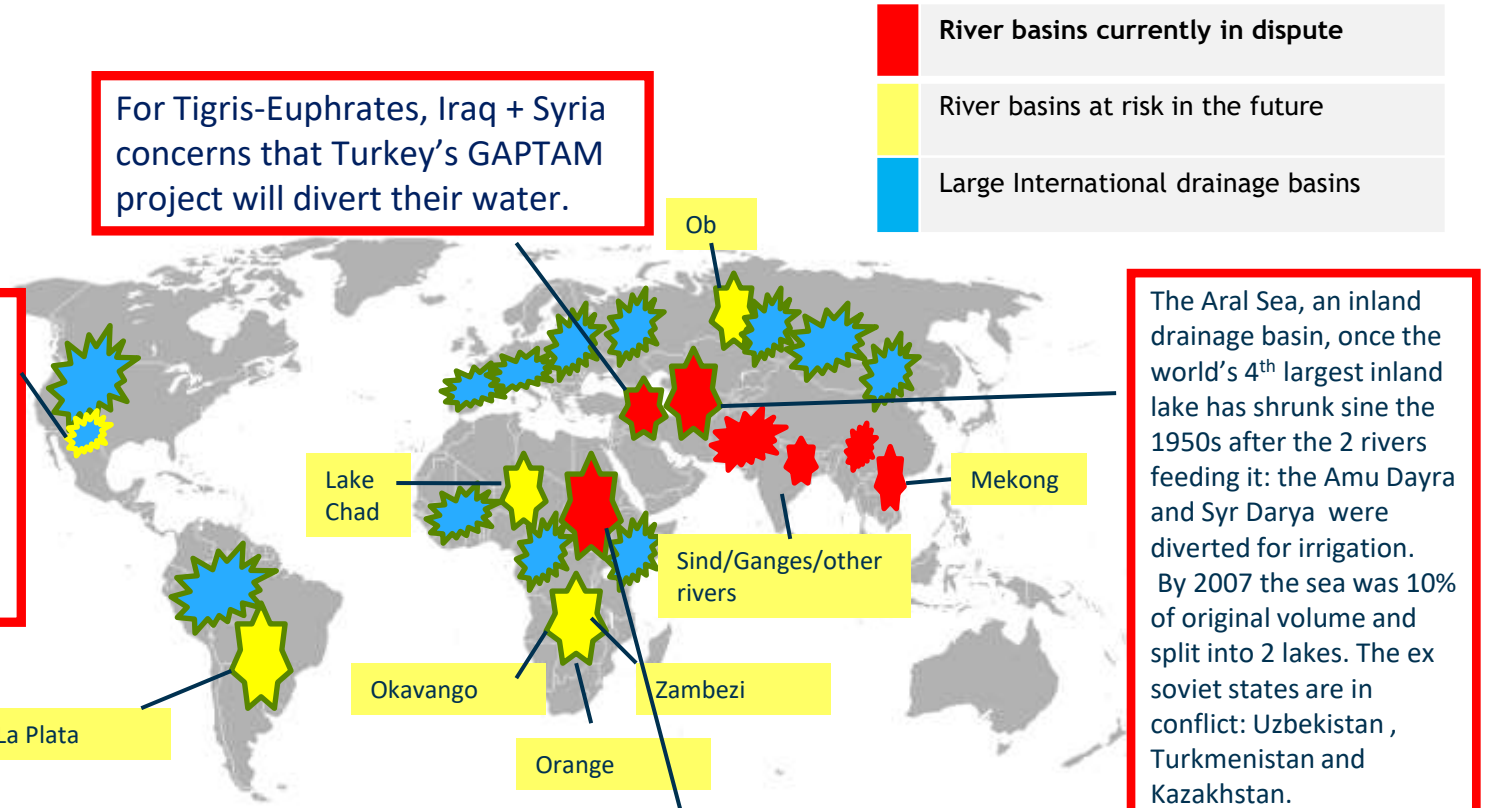
Present and future water conflicts

- **As water supply decreases, tensions will increase as different players try to access common water supplies.**



For Tigris-Euphrates, Iraq + Syria concerns that Turkey's GAPTAM project will divert their water.

Colorado: disputes between the 7 U.S. states and Mexico it flows through. The river is so overused, that it no longer reaches the sea!. 90% diverted before reaches Mexico

The Aral Sea, an inland drainage basin, once the world's 4th largest inland lake has shrunk sine the 1950s after the 2 rivers feeding it: the Amu Dayra and Syr Darya were diverted for irrigation. By 2007 the sea was 10% of original volume and split into 2 lakes. The ex soviet states are in conflict: Uzbekistan , Turkmenistan and Kazakhstan.

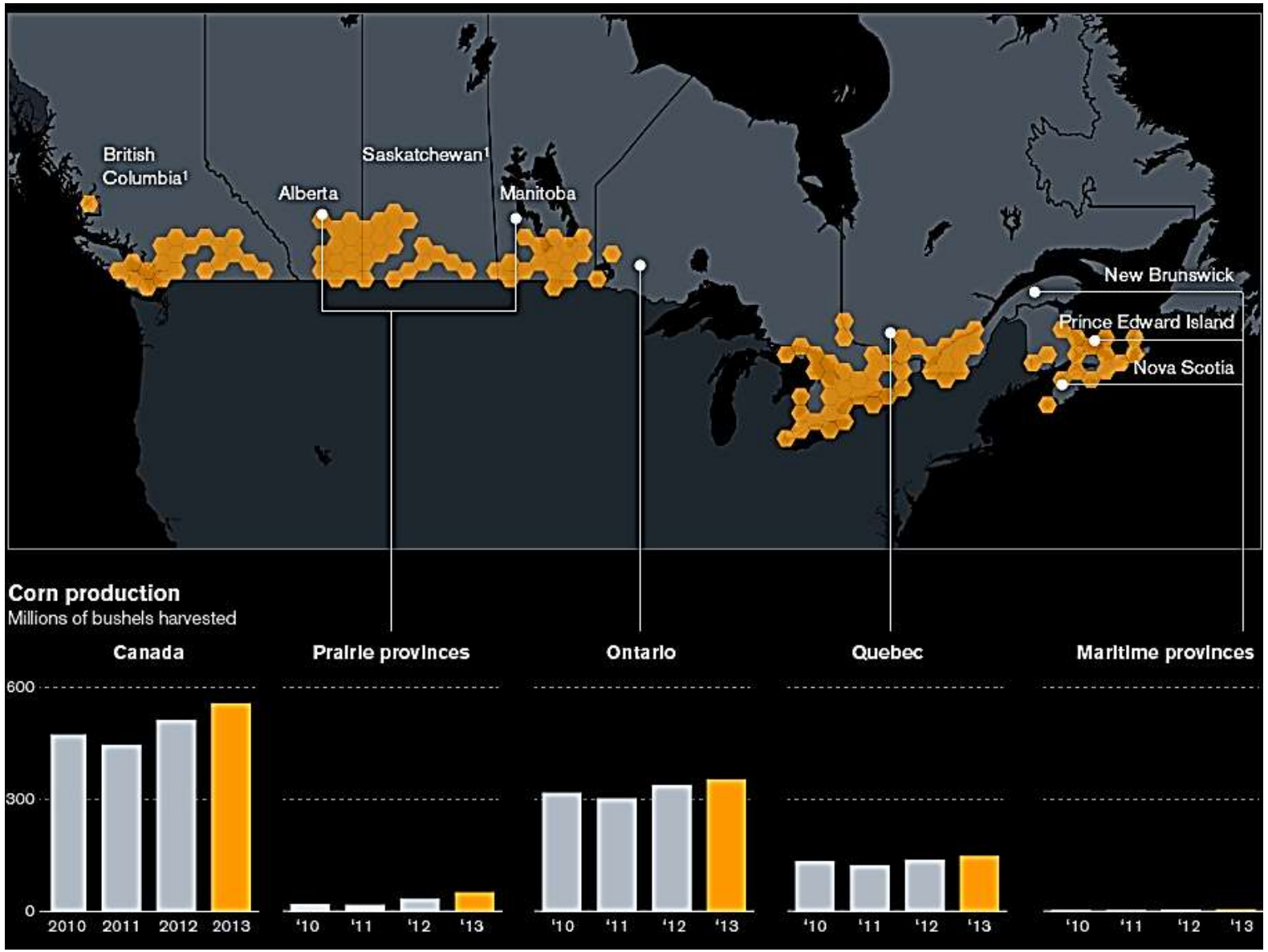
Nile hotly disputed between Ethiopia and Sudan ,who control its headwaters, and Egypt .

Note: although there have been rising tensions globally, many areas demonstrate effective management to diffuse the situation and create more equitable and sustainable demand-supply balance, such as the Mekong River Committee,& the Nile River Initiative

http://tamilmind.files.wordpress.com/2012/01/water_wars-in-future.jpg

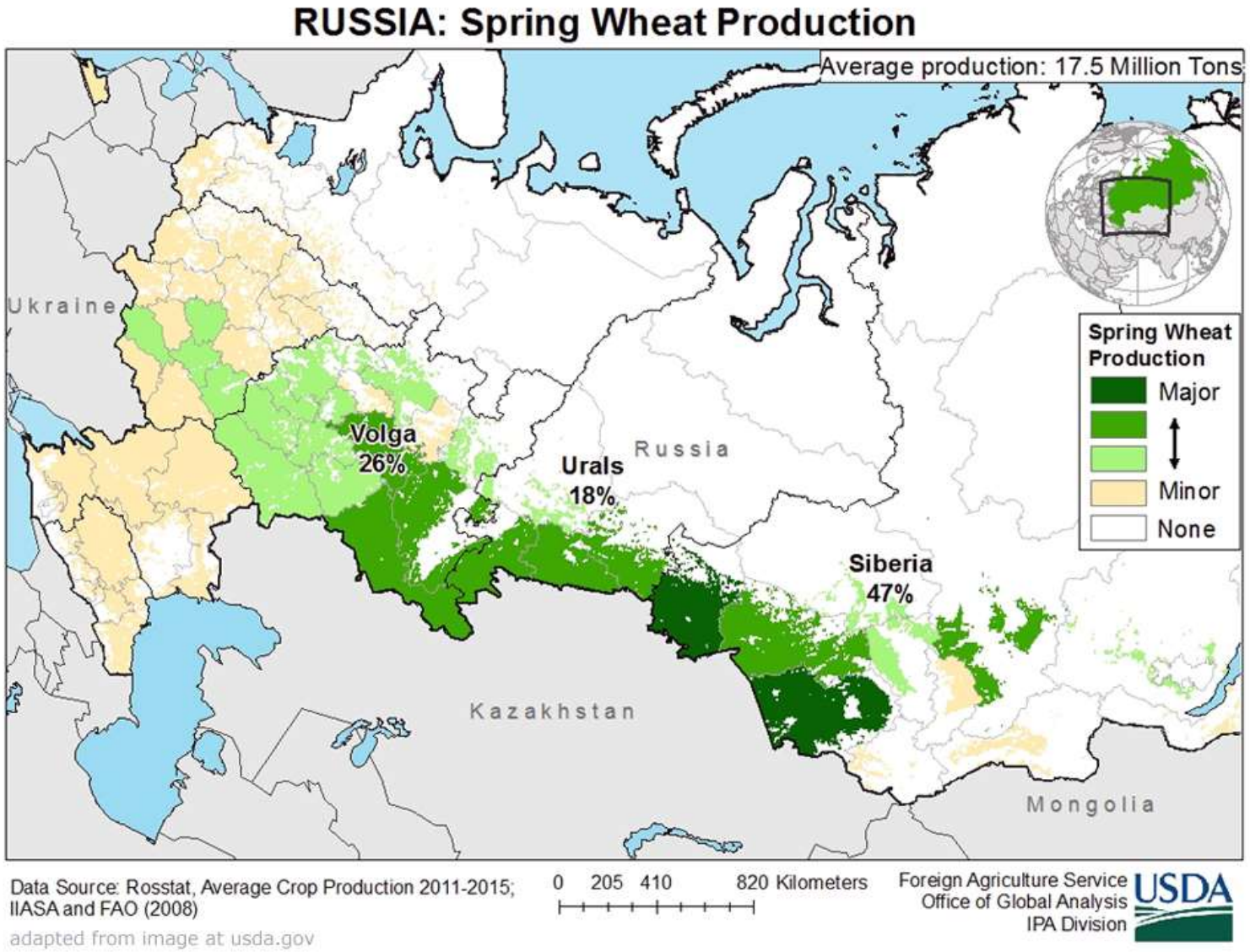
Canada's Climate Warms to Corn and Soybeans as Grain Belt Shifts North (25 years back hardly any corn!!)

Climate change is good !



Russia is an emerging global food superpower. Climate change is in favor of the Eurasian Grain Belt. About 17% of world wheat export (Leonid Bershidsky, Sept. 2017).

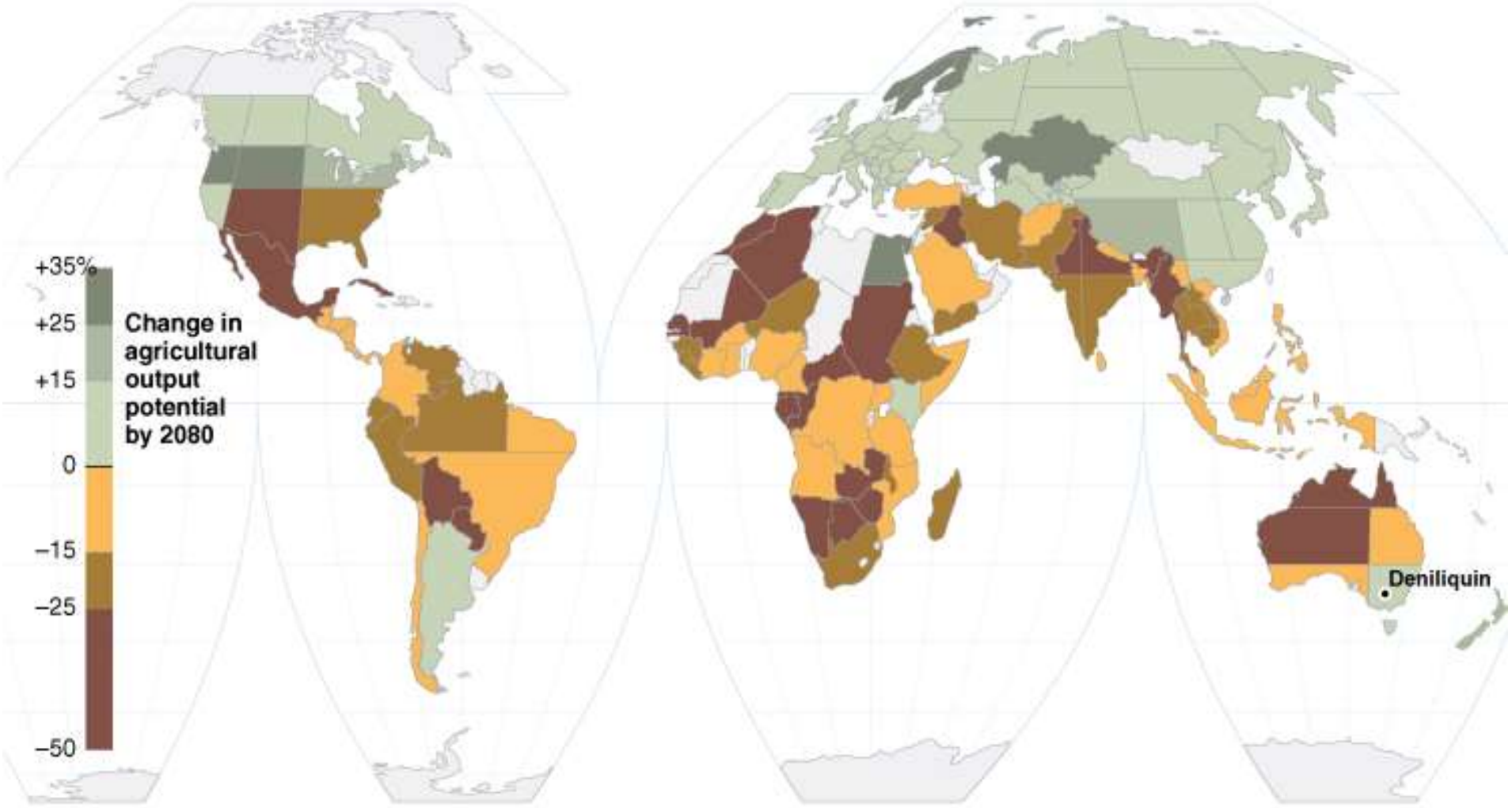
Climate change is good !



Farming in a Warmer World

on Degraded Soil with Water Shortage

Crop forecasts show that some countries farther from the Equator could benefit from a warmer world, but others would be worse off by 2080 if global warming were to proceed unchecked. Long-range forecasts vary widely; the following is a synthesis of available forecasts by country or region.



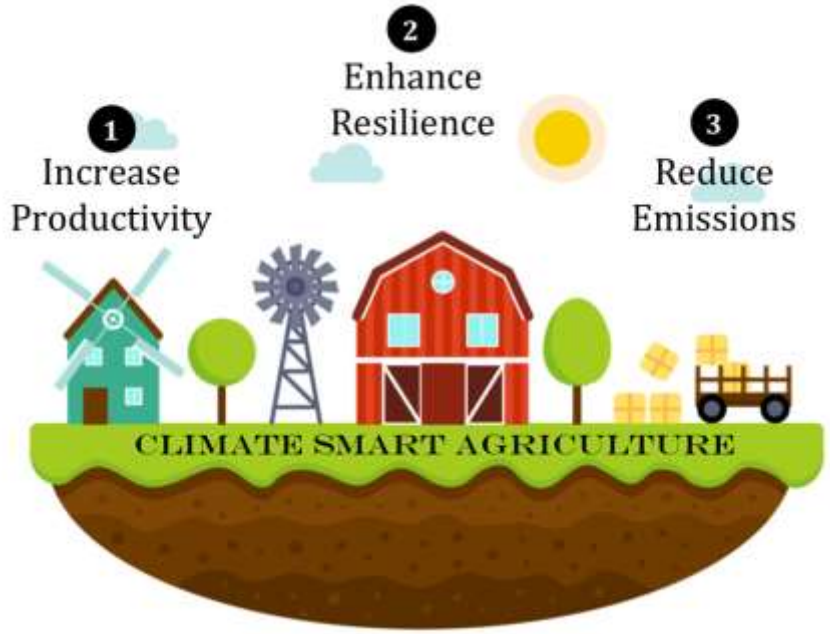
Note: These figures assume that crops grow faster because of higher levels of carbon dioxide in the air. But some scientists say that the actual effects of global warming could be worse than shown here, because the benefits of extra carbon dioxide may not appear if crops lack proper rainfall, proper soil and clean air.

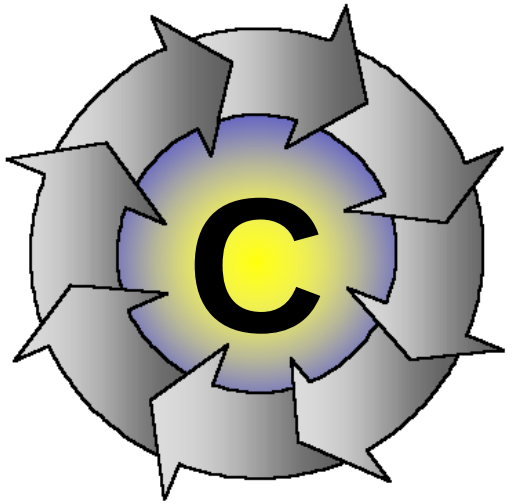
Source: "Global Warming and Agriculture: Impact Estimates by Country," by William R. Cline, Peterson Institute,

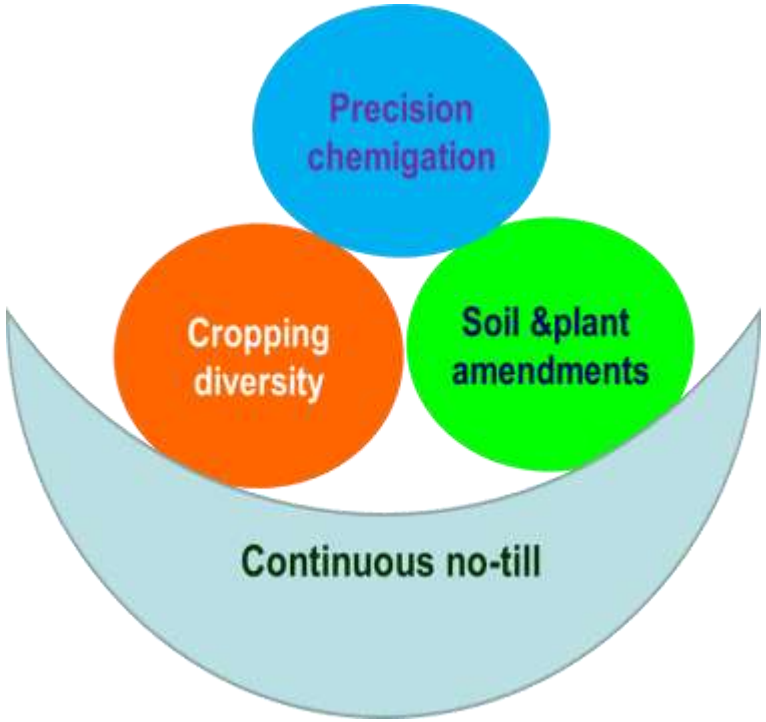
By 2050, **global food security needs to be doubled,** which will make existing farming practices increasingly dependent on more ***chemicals, water, and energy*** inputs (Islam 2018).

Such **intensification** of farming under ***climate change*** will have adverse **consequences** on ecosystem services.

Agricultural practices must be *Carbon* proactive ……







https://minnesota.agclassroom.org/matrix/lesson/746/

No-Till, Zero-Till, Direct Seed

No “flow”

No “blow”

No “glow”

No-till cropping diversity with cover crops

Cover crop

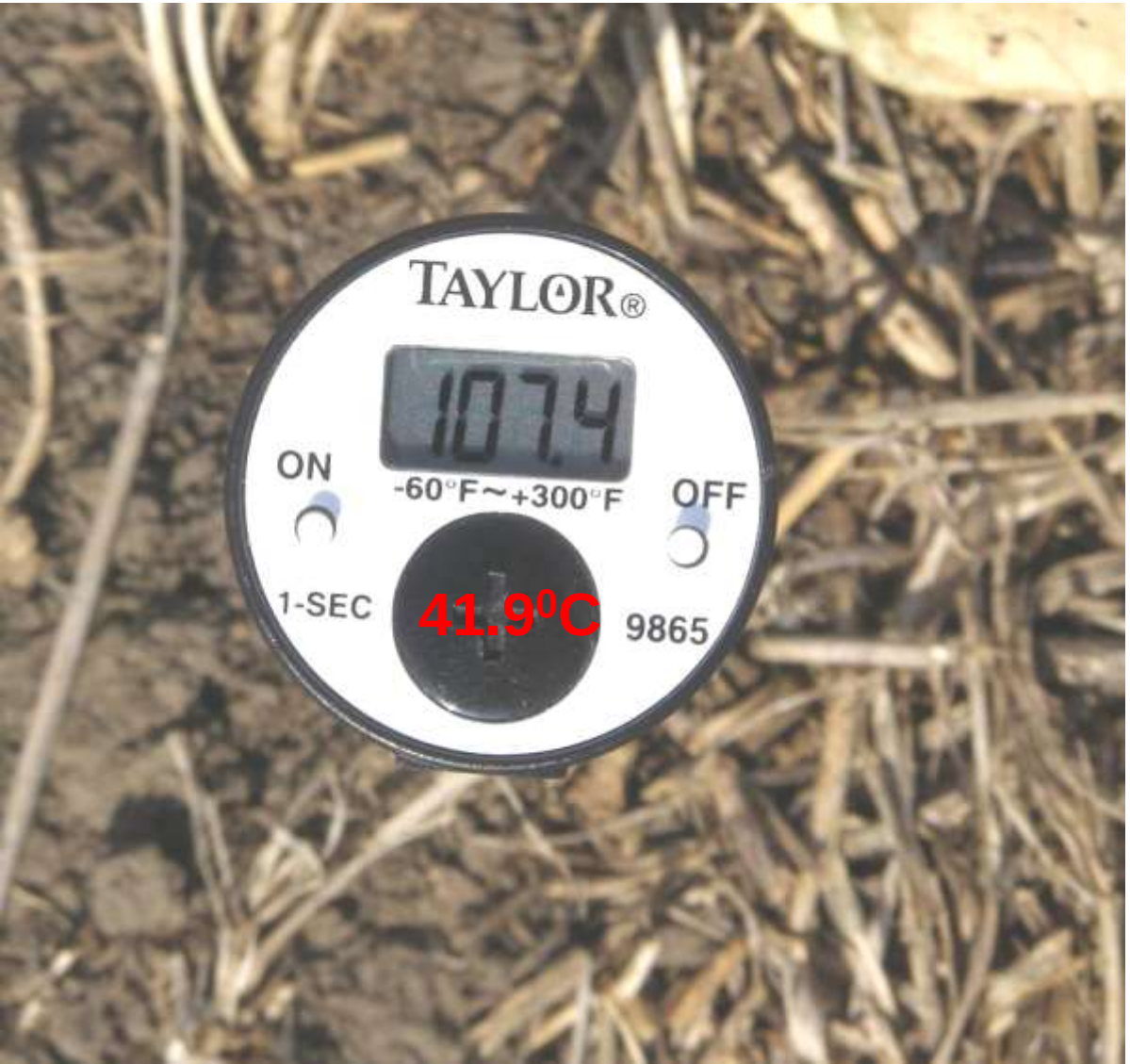
Cover crop

Conservation tillage and cover crops

Radish controls soil-borne diseases and reduces SOIL COMPACTION

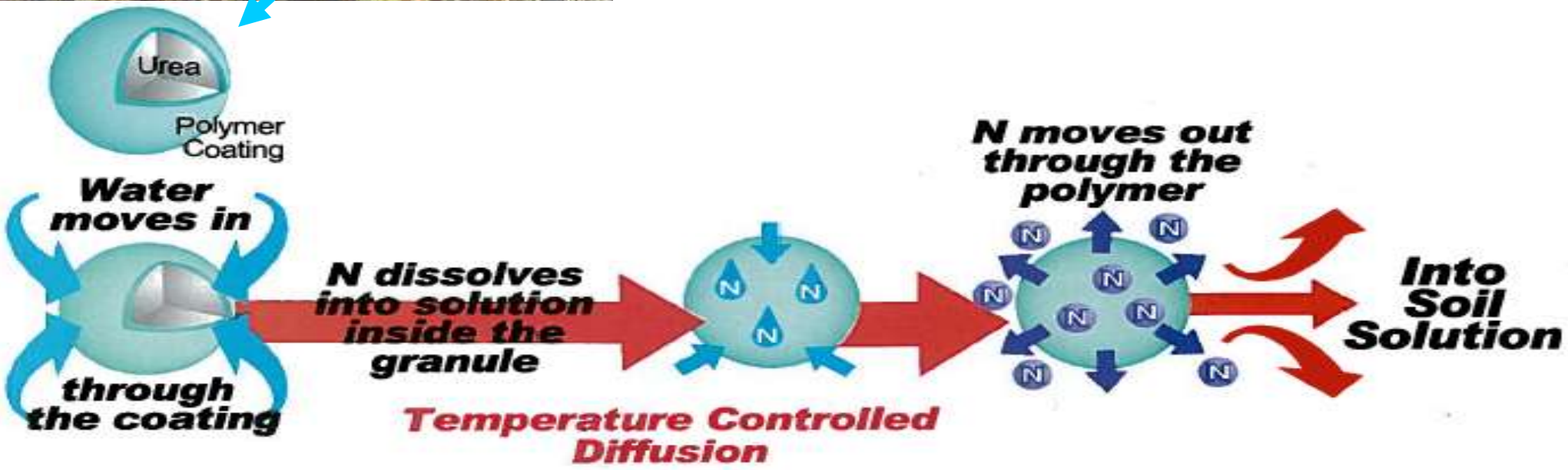
Soil temperature and drought control

Conventional tillage



No-till + cover crops

ESN
SmartNitrogen



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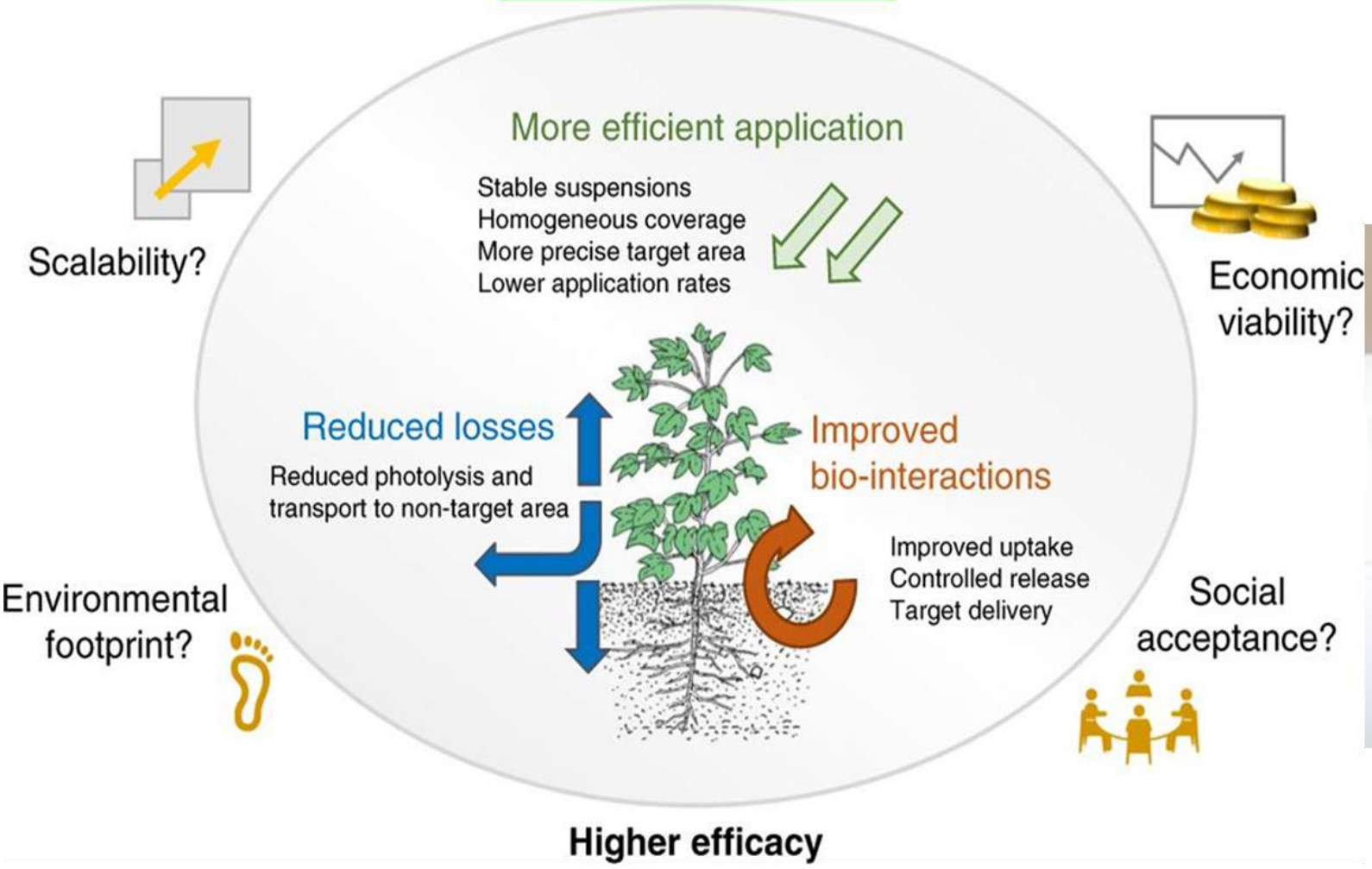
Nano-fertilization Technology



7. Chemical Fe fertilization
8. Chelate Fe fertilization
9. Nano Fe fertilization

Use improved crop varieties

Drought tolerant, efficient water & nutrient user, and salt-resistant crops.

Natural selection
Breeding & genetics research

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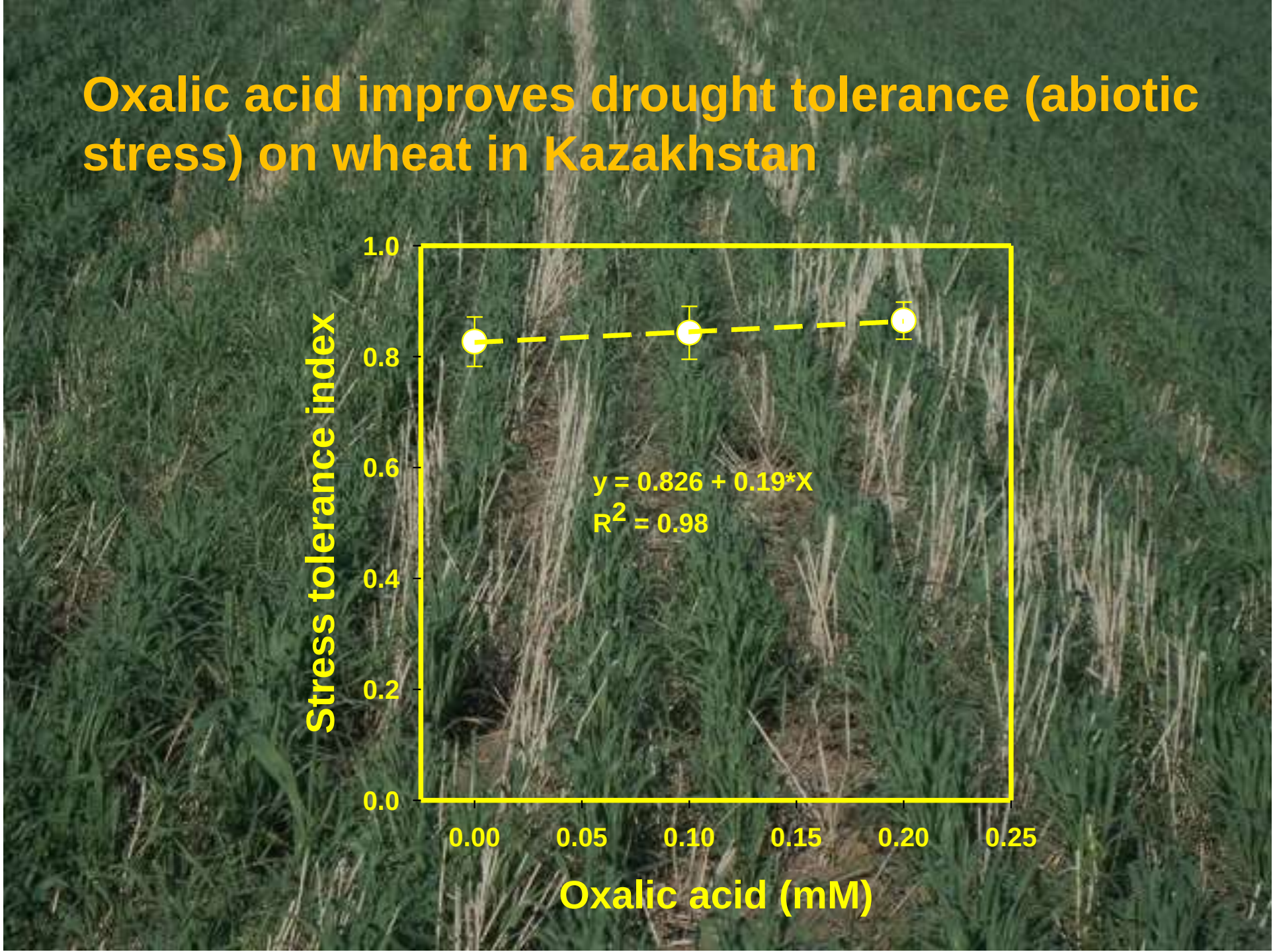
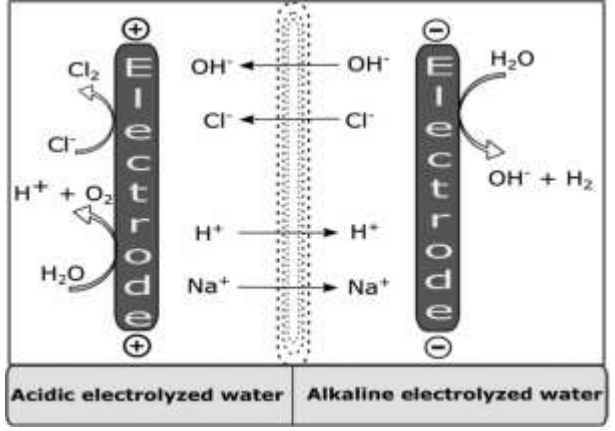
Our research has shown that mixing ***salicylic acid (aspirin)*** in irrigation increased ***soybean-wheat-corn-sunflower yield*** by 14, 5, 10, and 12%, respectively, with ***higher water- and nutrient-use efficiency*** in **Ukraine,** 2018-2021.

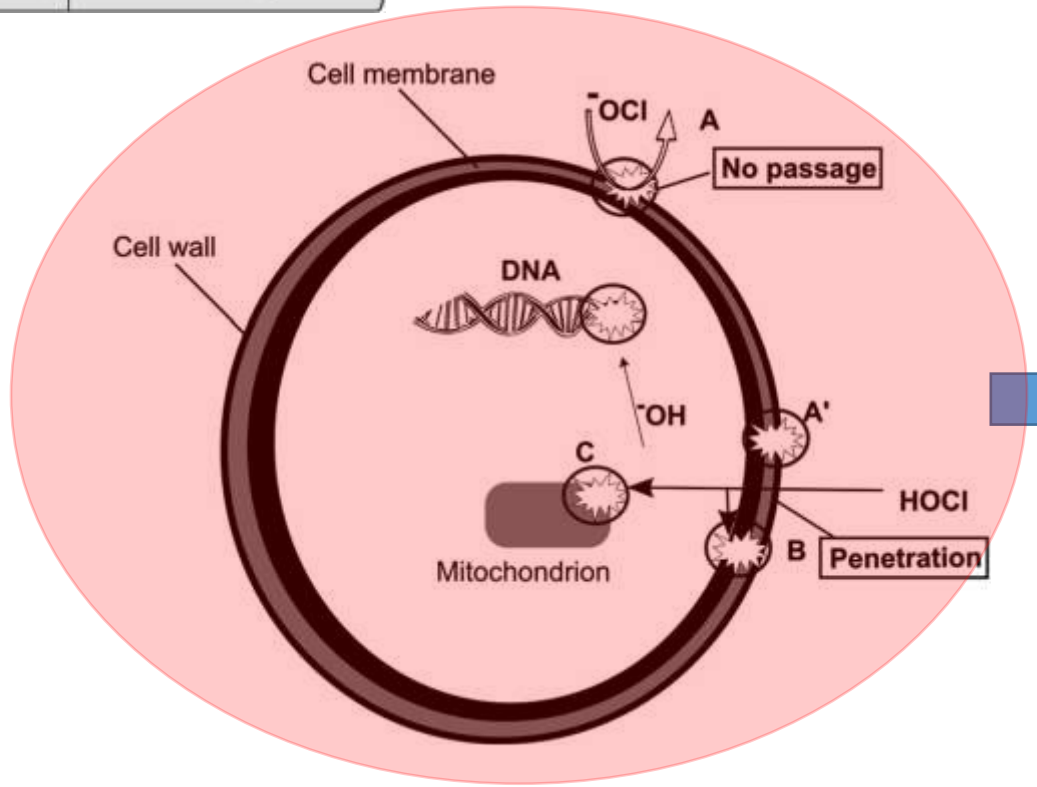
Islam & Didenko (2021).

Oxalic acid improves drought tolerance (abiotic stress) on wheat in Kazakhstan



Electrolyzed oxidized water irrigation for biocontrol services





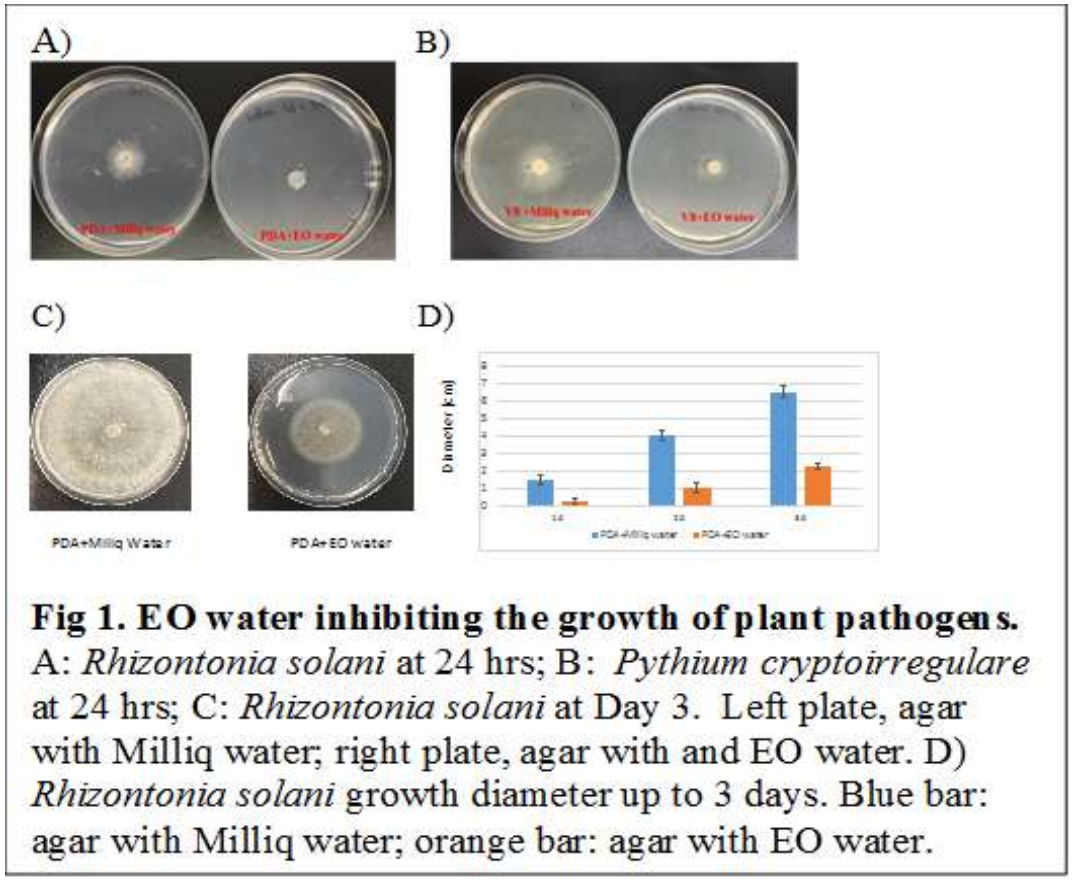
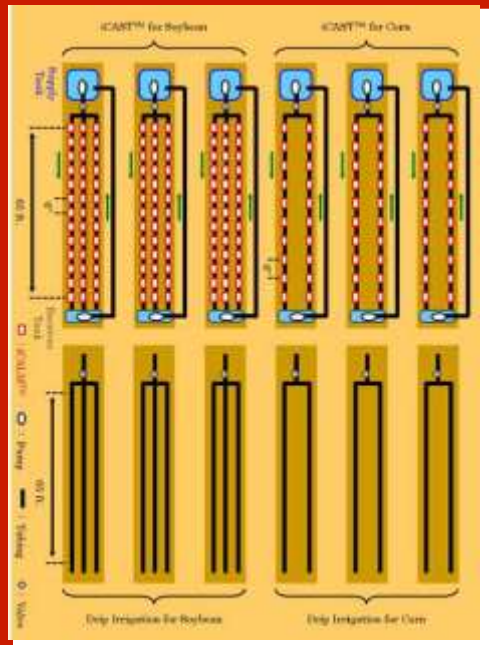


Fig 1. EO water inhibiting the growth of plant pathogens. A: *Rhizontonia solani* at 24 hrs; B: *Pythium cryptoirregulare* at 24 hrs; C: *Rhizontonia solani* at Day 3. Left plate, agar with Milliq water; right plate, agar with and EO water. D) *Rhizontonia solani* growth diameter up to 3 days. Blue bar: agar with Milliq water; orange bar: agar with EO water.

Model representing the germicidal activity of EW. The –OCl attacks on the outer membrane of the cell (circle A), where as the HOCl diffuses through the cell membrane. The HOCl attacks on the outer membrane (circle A') and also inside the cell (circle B and C).

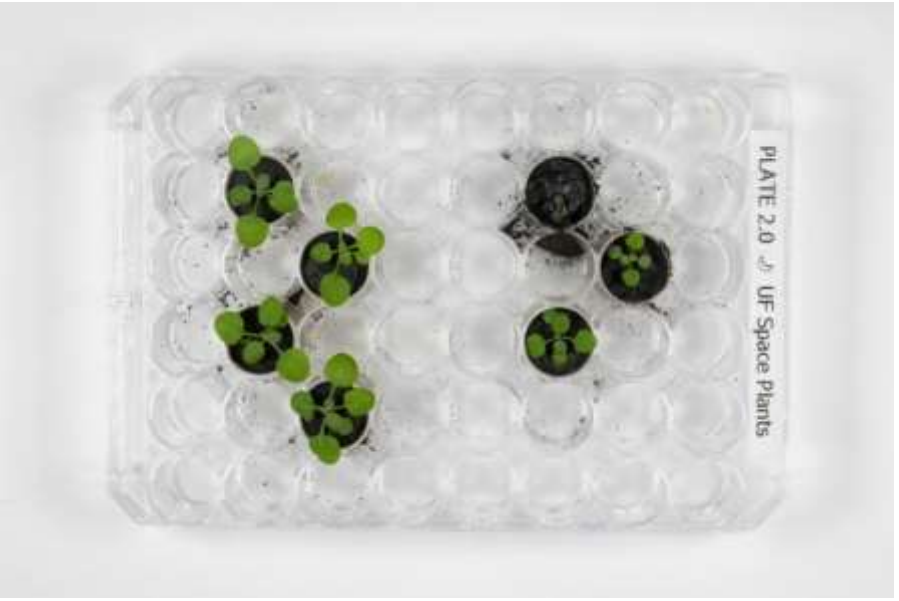


Climate-smart fertigation (iCAST®) – Future Technology

Growing corn and soybeans under ***simulated desert-like conditions*** with re-circulating fertigation.

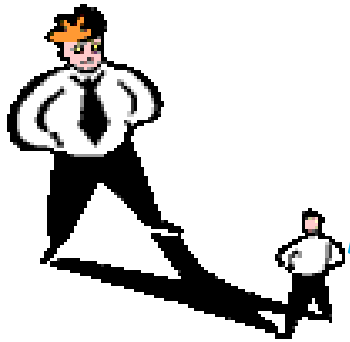
Five-year results showed: 45% less water & 50% less nutrients use than drip irrigation

Recently, U.S. researchers were able to grow a **flowering plant,** called ***Arabidopsis thaliana, on*** **regolith material (soil?) collected from moon** during the Apollo missions in 1969 / 1972. It offers hope that **earthly plants** can be grown in space to **support food security**.



In giant leap forwards, scientists grow plants in Moon soil | Space News | Al Jazeera

One Health Vision



Healthy People

Healthy Plant/Food

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