

Crop Rotation and Cover Cropping

CROP ROTATION

Planting different type crops in succession in the same field

Problems with monocultures

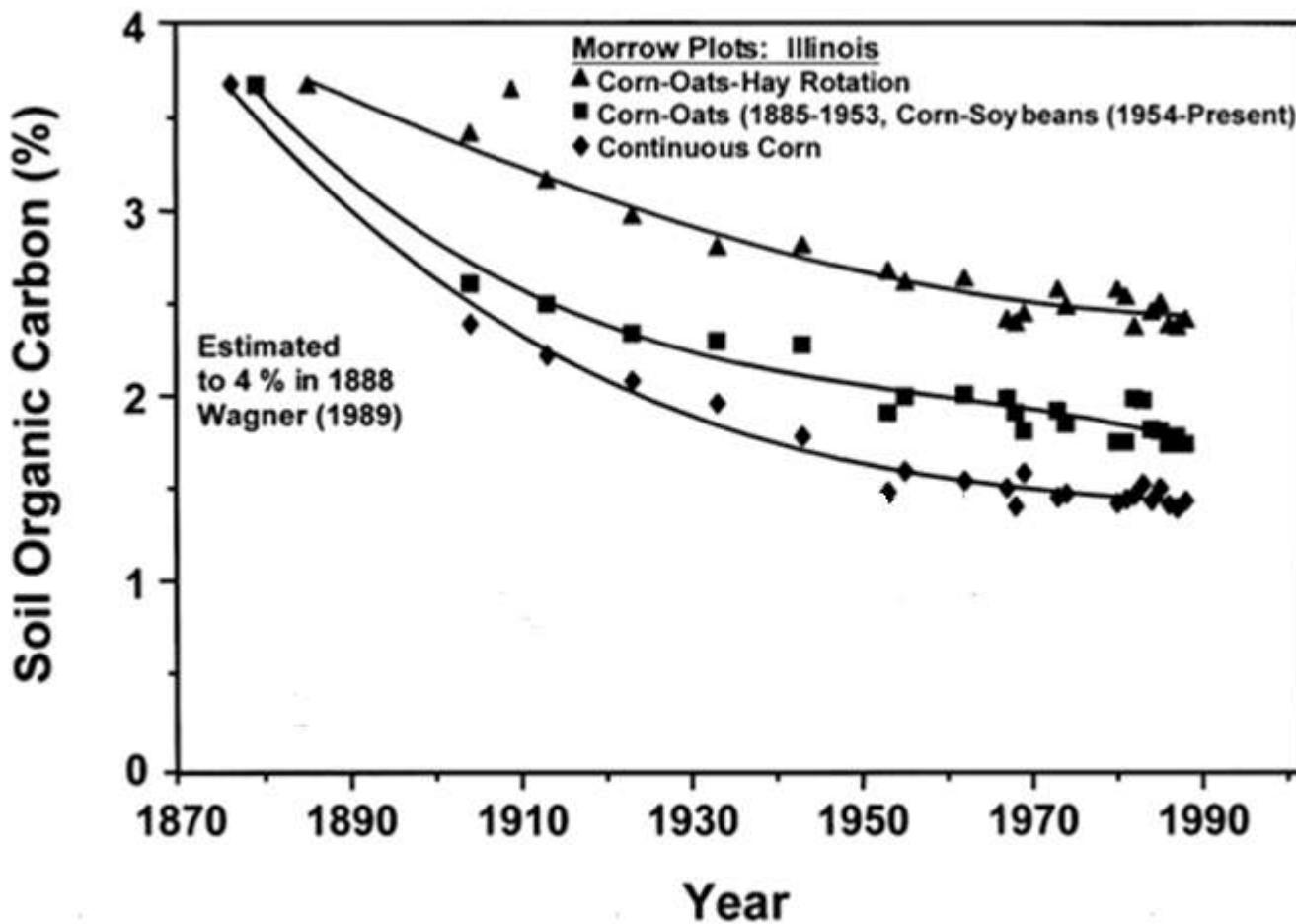
Over time, increases in crop specific pest and disease problems are common

Continuous cropping results in roots being active in the same zone every year, exploiting nutrients in that zone-decreasing plant available nutrients

Advantages of Crop Rotations

- Improve soil fertility:
 - Increase and maintain N levels in the root zone
 - Increase soil carbon
 - Recycle nutrients
- Reduce external biotic stresses:
 - Minimize weeds
 - Reduce pest and disease problems
- Increase farm income
- Enhance household health

Rotations and soil quality



Legumes in rotation

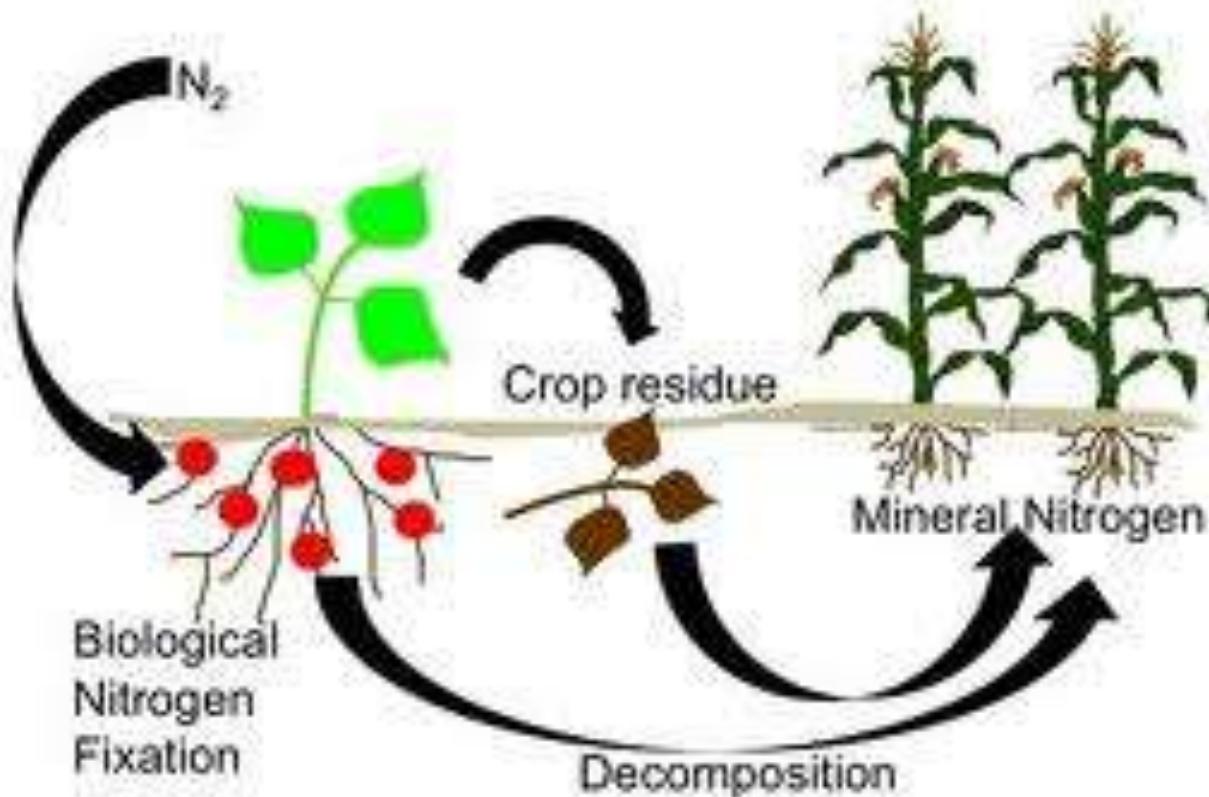
- Legumes fix N through a symbiotic relationship with rhizobia which form nodules on plant roots
 - Rhizobia convert atmospheric N_2 to NH_4
 - Plant provides rhizobia with carbon



Root nodules

Rotations with legumes

Legume based cropping system



Factors affecting N fixation by legumes

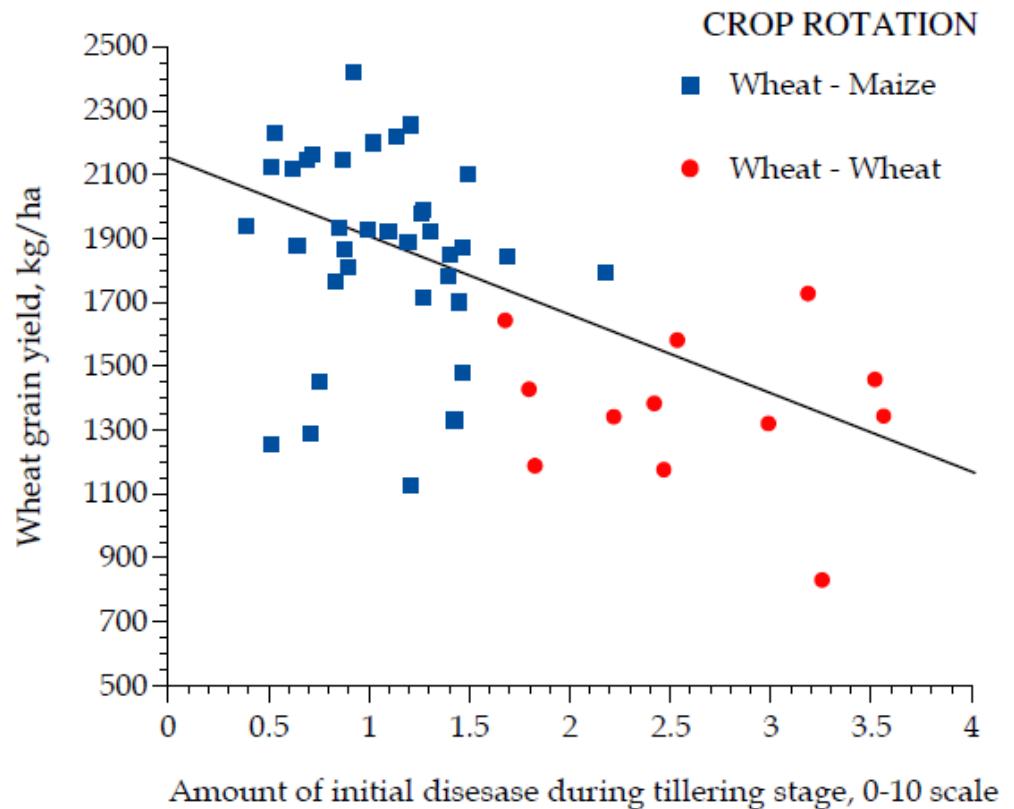
- Nodulation
- Soil moisture content
- Soil temperature
- Soil nutrient content

Improving soil quality with conservation agriculture can improve legume N fixation

Effects of Rotations on Disease

When seedlings come into contact with diseased crop residue, either at the surface or buried, that have not lost their pathogenicity, disease can spread easily

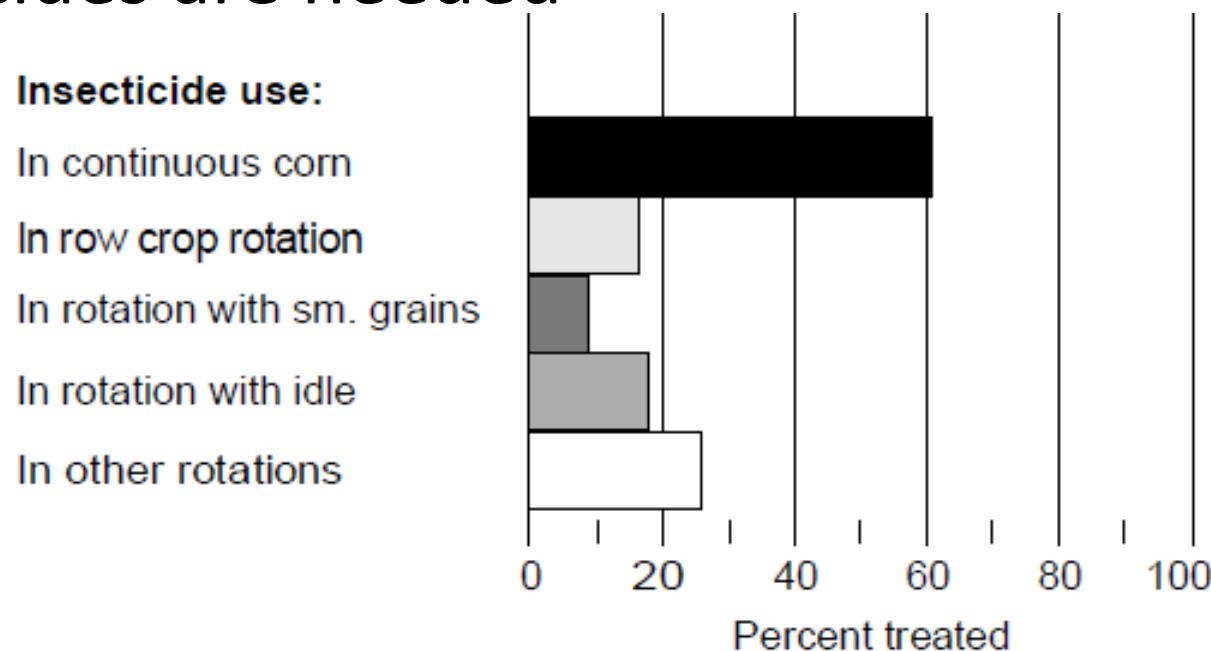
By rotating crops, you allow time for diseased residue to lose their pathogenicity, reducing the spread of disease



Agustin Limon-Ortega (2011). Planting System on Permanent Beds; A Conservation Agriculture Alternative for Crop Production in the Mexican Plateau. In: Godone, D., Stanchi, S., editors, Soil Erosion Issues in Agriculture. InTech, pp183-206

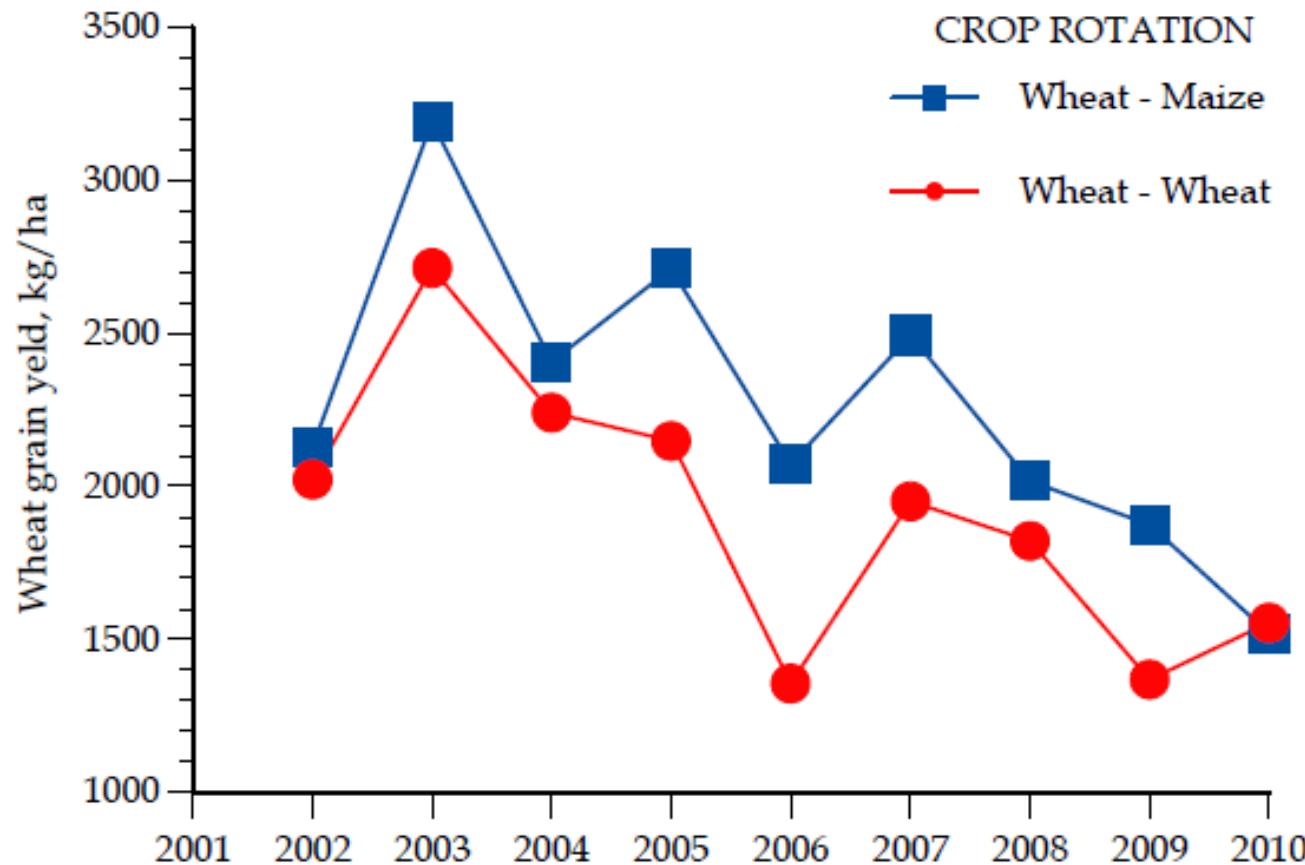
Breaks up pest cycles

Pest pressure doesn't reach level where pesticides are needed



Source: USDA, ERS, 1993 Cropping Practices Survey data.

Reducing pest pressure and increasing soil fertility and quality can lead to increased yields



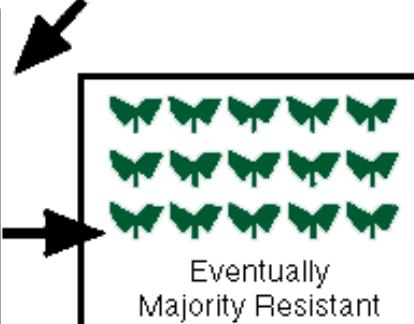
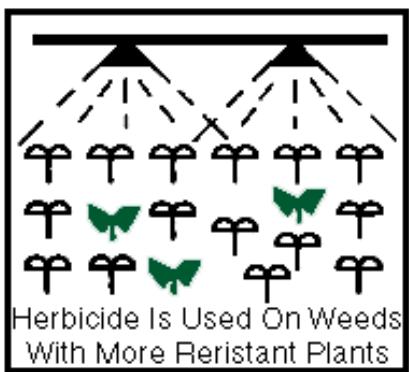
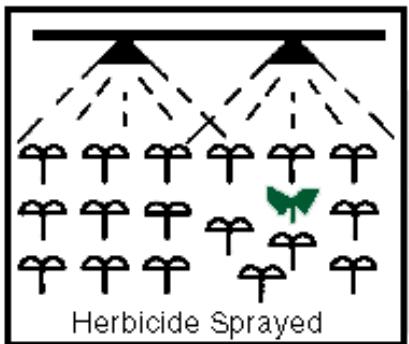
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Crop rotations and weed control

- Planting crops with different life cycles - planting and harvest dates - can discourage weed establishment and seed production
- In zero till and conservation agriculture systems:
 - Herbicides play a major role in weed control
 - Over-use of the same herbicide can lead to herbicide resistance by weeds

Avoiding herbicide resistance

How Does Selection For Herbicide Resistance Occur?



= Resistant Biotype

= Susceptible Or Wild Biotype

- Herbicide resistance can be avoided by rotating herbicides with different modes of action
- Crop rotation allows for herbicide rotation

Crop	Contact herbicide	Residual Herbicide
Wheat	Glyphosate	Targets broadleaf weeds
Mung bean	Glyphosate	Targets grass weeds

Health Benefits

Diversifying cropping systems can lead to diversified diets and increased household consumption of protein and other micronutrients

Economic Benefits

- Diversify income
- Reduce pest and disease damage
- Reduce pesticide use
- Reduce fertilizer N additions (with legumes)
- Spread out labor and income over time
 - different crops are planted, harvested, and marketed at different times
- Increased yields = increased income

Obstacles to Adopting Crop Rotations

- Limited Land Resources
- Farm Specializes in a Few Crops
- Limited Markets for Alternative Crops
 - Both for inputs (seed) and outputs
- Unfamiliarity with Plant Families and Disease Susceptibility

Customized Rotations

Individual growers can customize crop rotations to best fit their resource availability and needs

What are some rotation crops that are,
or could be, grown in Afghanistan?

Grains

Legumes

Others

COVER CROPPING

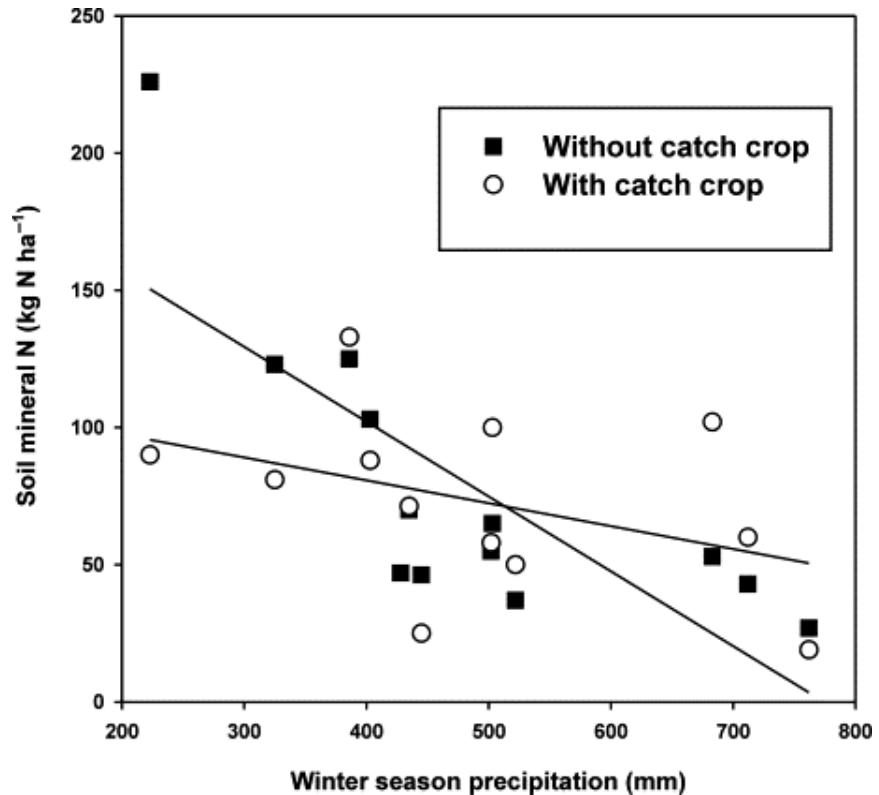
Cover crops can:

- Increase water storage
- Suppress weeds
- Improve nutrient management:
 - Add carbon to the soil
 - Reduce N leaching
 - N fixation
- Minimize erosion
- Reduce pest and disease pressure

Types of cover crops

Catch Crops

- Fast growing crops that are grown for short time periods between crops
- Better suited to areas that grow only 1 crop per year
 - Example: plant post-harvest in the fall and remove before planting in the spring
- Primary purpose is to take up N remaining from previous crop
- Get incorporated prior to planting next crop
- Usually done in tillage systems



Thorup-Kristensen, K., Magid, J., Jensen, L.S., 2003. Catch crops and green manures as biological tools in nitrogen management in temperate zones. *Advances in Agronomy*, 79, 227-302

Types of cover crops

Green manure crops

- High biomass producing crops that serve to restore soil fertility by adding carbon and nitrogen to soil
- Can be grown between crops, like catch crops, or instead of grain crops
- Legume crops
- Can be grown to harvest grain, or for biomass only
- Also called improved fallows
- Can be done in tillage and zero till systems



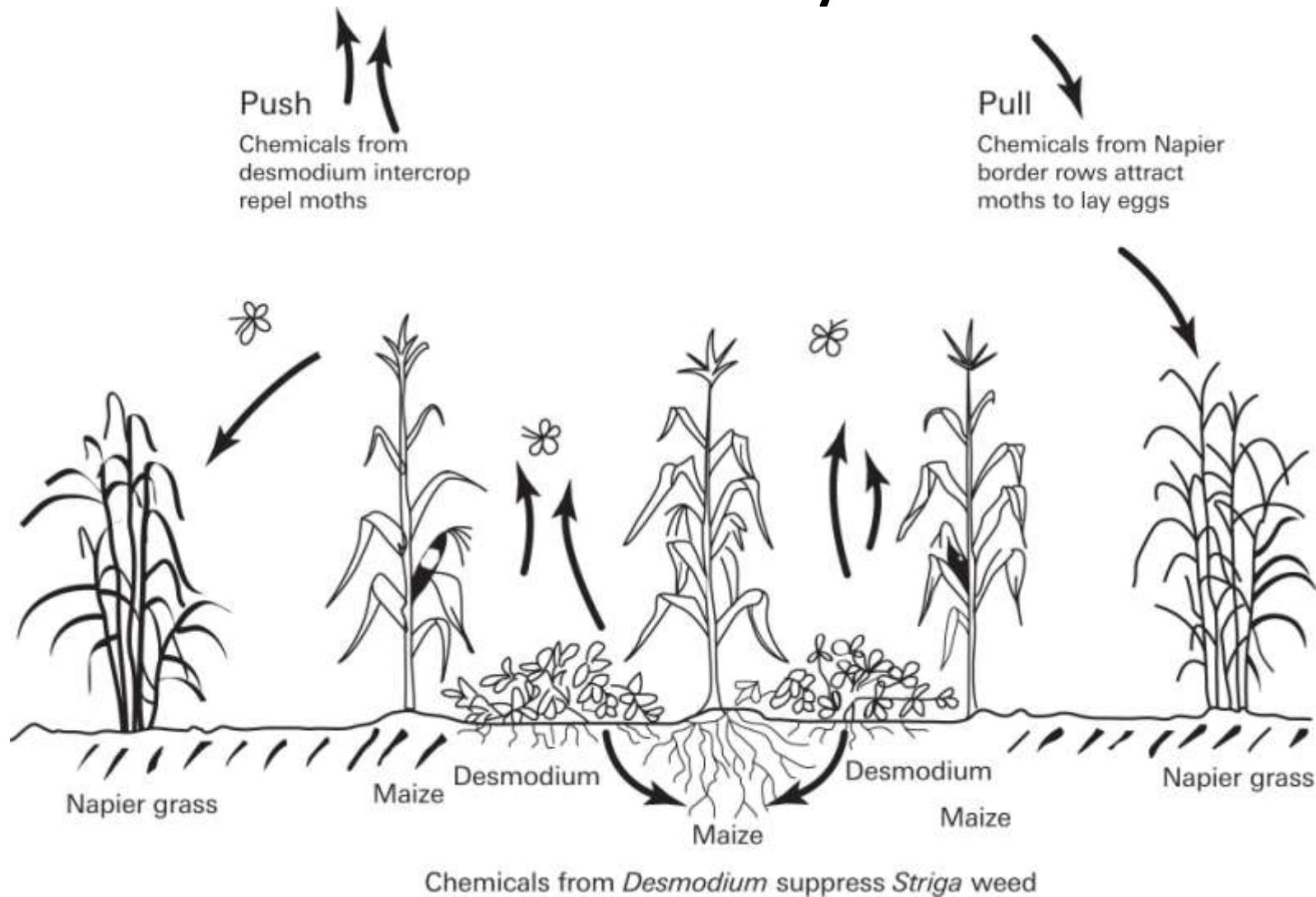
Types of cover crops

Intercrops

- Planted at the same time as another crop
- Often legume crops
 - ‘doubled-up’ legumes: two legumes planted together to increase N fixation, biomass production, and protein yield
- Can be done in tillage and zero till systems
- Difficult in mechanical systems



Intercrops for pest control: The Push-Pull System





Questions?