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
Rotations with legumes
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.

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.

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

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

<table>
<thead>
<tr>
<th>Crop</th>
<th>Contact herbicide</th>
<th>Residual Herbicide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>Glyphosate</td>
<td>Targets broadleaf weeds</td>
</tr>
<tr>
<td>Mung bean</td>
<td>Glyphosate</td>
<td>Targets grass weeds</td>
</tr>
</tbody>
</table>

How Does Selection For Herbicide Resistance Occur?

Herbicide Sprayed → Resistant Plant Survives And Sets Seed → Herbicide Is Used On Weeds With More Resistant Plants → Eventually Majority Resistant

= Resistant Biotype  = Susceptible Or Wild Biotype
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
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

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
Management

Organic matter

Water holding capacity

Soil quality

Soil organisms

Infiltration

Soil structure

Air quality

Water quality

Productivity

Reduced tillage

Cover crops

Prescribed grazing

High biomass rotations

Fewer pollutants

Less dust

Less sediment

Drought and disease resistance
Questions?