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# W235-D Increasing Farm Biodiversity

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# Increasing Farm Biodiversity

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A major tenet of sustainable agriculture is to mimic diversity that is commonly found in natural ecosystems but may be lost in agricultural terrain. Biodiversity refers to the variety of plants, animals and microorganisms above and below the soil that interact within an ecosystem. Plants and animals are consistently integrated into diverse landscapes. As a result, these systems are typically more stable, withstanding disturbances and recovering better than less diverse systems. Organic cropping systems promote a diverse, balanced ecosystem as a practice to enrich the soil and prevent weed, insect pest and disease problems. Crop diversity, crop rotations, intercropping, cover cropping, conservation tillage and incorporation of organic matter are all important components of farm biodiversity.

**Benefits of encouraging diversity:**

- Improves soil quality
- Enhances insect, weed and disease control
- Encourages beneficial organisms
- Spreads economic risk

**Benefits of Diverse Cropping Systems**

**• Improves soil**

Diverse crop rotations improve soil, increase farm biodiversity and boost crop yields. High-quality soils encourage dense populations of micro organisms, enhance natural biological control of pathogens, slow turnover of nutrients, encourage communities of beneficial insects and improve soil aeration and drainage. Crop rotations, management of crop residues, conservation tillage, incorporation of animal manures and the use of nitrogen-fixing crops can increase soil health and productivity.

**• Breaks insect, disease and weed cycles**

Diverse plantings often decrease insect pest populations. Specialized herbivores are more likely to find and remain on pure crop stands where food sources are concentrated. Fields containing a variety of crops are often rich in above- and below-ground beneficial organisms that naturally control insects, inhibit growth of disease organisms, boost a crop's natural defenses and suppress some weeds. The use of crop diversity, crop rotations, scattered fields, adjacent uncultivated land and a perennial crop component are methods that can be used to reduce pest pressure.

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**• Encourages beneficial organisms**
Planting crops that support natural enemies or directly inhibit insect attack helps to stabilize insect communities. Spatially and temporally diverse plantings ensure that natural enemy populations are provided continuous availability of resources. Beneficial insects can also be provided food and habitat by including areas of adjoining, uncultivated land and wild vegetation. Further, using ground covers and surface residues can enhance the abundance and efficiency of predators and parasitoids.

**• Spreads economic risk**
Increasing farm diversity offers the opportunity to increase profits while decreasing production costs. Adding new crops that fit the climate, geography and management requirements can increase profits by providing the opportunity to exploit niche markets, expand marketing opportunities and offset commodity price swings.

**Strategies for increasing biodiversity:**

- Plant crop mixtures and multiple crop varieties.
- Include beneficial flowers, perennials, hedgerows or areas of uncultivated land.
- Provide nesting areas for pollinators.
- Incorporate cover crops.
- Reduce tillage.
- Increase organic matter.

**How to Increase On-Farm Biodiversity**

**• Diversity plant species**
Increasing within-field biodiversity can be achieved through planting crop mixtures and multiple crop varieties. The establishment of diverse plantings at field margins should also be considered. Planting strips of beneficial flowers, incorporating perennials, establishing hedgerows (a row of trees or shrubs separating fields) and leaving areas of land uncultivated are methods of increasing diversity on non-cropped land. To increase diversity of native pollinators, establish nest blocks and allow access to areas of soil, such as soil piles, for nesting. Branches of trees and shrubs, such as those in hedgerows, will also provide nesting sites for pollinators.

**• Crop rotation**
Crop rotation refers to the sequence of crops and cover crops grown in a specific field. Rotation designs should include multiple crop families, manage short- and long-term crop fertility needs, reduce weed pressure, disrupt weed and disease cycles and optimize crop production.

**• Intercropping**
Two or more crops grown in close proximity can produce beneficial interactions. Intercropping can be achieved by growing crops in alternating rows (row intercropping), growing crops in larger alternating strips (strip intercropping), growing crops together with no distinct row arrangement (mixed intercropping) or by planting a second crop into a standing crop at the reproductive stage (relay intercropping). Special attention should be given to the spatial arrangement, plant density and expected maturity dates of selected crops.

**• Cover crops**
Cover crops are used to protect the soil from erosion during times when a field is not under production. Crops that are easy to plant, establish and control or kill should be selected. Suitable varieties provide reliable ground cover and have no negative impact on the following crop. It is important to evaluate rooting depth and crop characteristics, such as weed and disease suppression, nitrogen fixation and the attraction of pollinators and natural enemies. Planting

dates and climate requirements are also important for consideration, as suitable crops vary by geography and climactic conditions.

• **Conservation tillage**
Conservation tillage requires minimal soil disturbance, keeping at least 30 percent of the soil covered by crop residue. After harvest, crop residues are left or cover crops are established until the next crop is planted. Several methods of conservation tillage have been established. No-till planting uses specialized equipment, disturbing only a small area where the seed or transplants are set. Strip- or zone-tillage creates a tilled seedbed 5 to 7 inches wide along the plant-rooting-zone, leaving the rest of the field undisturbed. Ridge-tillage creates permanent soil ridges on top of which crops are grown.

• **Incorporation of organic matter**
Increasing organic matter provides harbors for soil microbes and intensifies soil biological activity, helping to lessen the risk of disease. The breakdown of organic matter by soil microbes returns nutrients to the soil removed during crop production. Animal manures, cover crops, crop residues and organic amendments can be incorporated into the soil to increase organic matter content over time.

For more information on increasing farm biodiversity, visit http://organics.tennessee.edu.

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