MARYLAND COOPERATIVE EXTENSION
UNIVERSITY OF MARYLAND
COLLEGE PARK•EASTERN SHORE

Fact Sheet

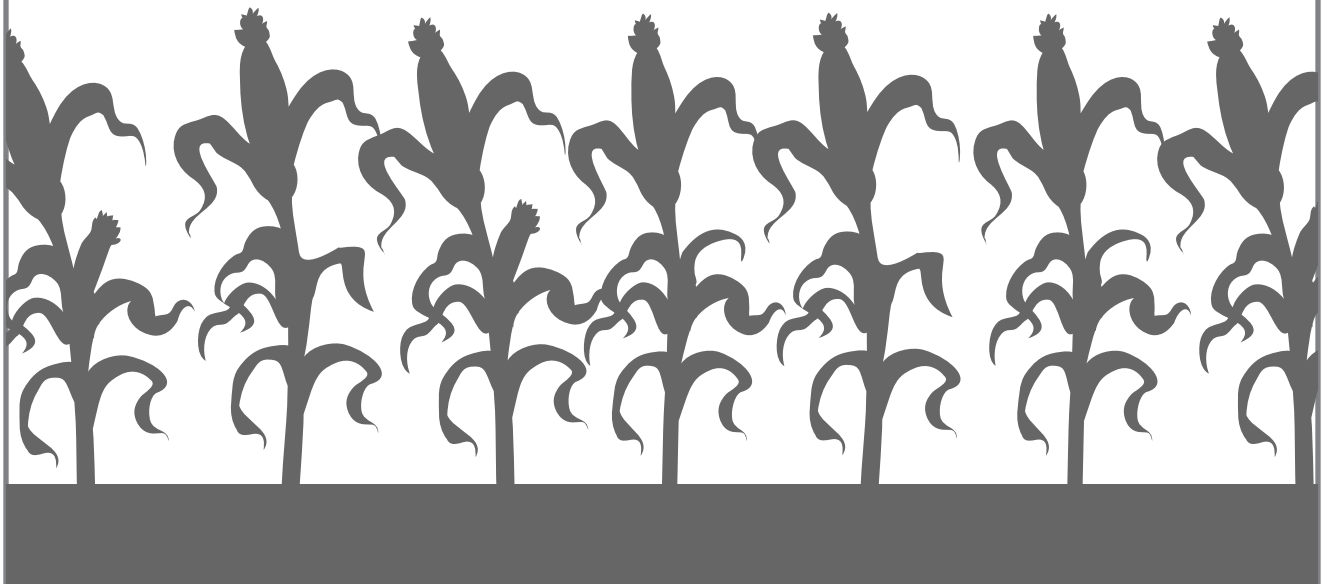
Fact Sheet 784

Crop Rotation

I. Benefits of Rotation

The first year a crop is grown in a field that was previously uncultivated is, many times, the crop's best production year. Many reasons account for this phenomenon. First-year crops have the advantage of being planted into a soil with few pests. However, these pests quickly begin to increase in population once the crop has been planted. Soil fertility benefits of first-season crops compared to crops planted in the second season and beyond can be attributed in part to higher organic matter, greater availability of plant nutrients, and more favorable soil conditions, such as good soil aeration and water penetration.

Crop rotation has long been one of the most important practices you can adopt to be a successful producer. Its benefits have been written about since the days of the Roman Empire. Crop rotation has a positive influence on many important aspects of crop production, such as crop fertility, pest management, and the protection of the environment. This enhancement results in a more natural fertility and pest management program, less dependency on chemical inputs, and retention of healthy topsoil.



Allelopathy is the ability of a plant to chemically inhibit the growth of another plant. Crops such as alfalfa, cereal rye, sorghum, and sunflowers are reported to have allelopathic properties. Cover crops with allelopathic properties are beneficial because these crops reduce weed competition. However, the allelopathic properties of some crop species, such as alfalfa, can inhibit the growth of its own species. This requires producers to rotate to another crop in the field, such as corn for at least one season before replanting the field with alfalfa.

II. Pest Control Benefits

The continuous production of the same or similar plant species supports the development of pests. Many of the pests that attack our agricultural crops are host specific (specific to that plant species). These pests are very particular about what they eat, feeding only on specific plant species. If you continually provide these pests with their preferred food, they will continue to eat it and grow in population. However, if you introduce a totally different crop species to the field, the food source becomes unacceptable, and the pests will either leave or die.

The corn rootworm is an example of a host specific pest that can easily be controlled through crop rotation. This beetle larva is a major pest of corn. Many grain producers use soybeans in a rotation with field corn to control this pest, which would otherwise infest a following corn crop as a result of adult beetles having laid eggs in the soil. The rotation to soybeans eliminates corn rootworm larvae in the field; newly hatched larvae will only feed on corn roots and soon starve to death. The field will also be free of new eggs since adult beetles seek only cornfields for depositing their eggs. Crop rotation is essential to managing many species of nematodes (microscopic roundworms) as well as many other insects, and many weeds and plant diseases that are host specific. Crop producers should become familiar with host-specific pests in order to develop appropriate rotations.

Crop rotation can be effective for all types of plants, both grasses as well as broadleaf plants. Parasites build up in annual plants as well as perennial plants; as little as one year's rotation can often be enough to knock back a pest's population.

Research the life cycle of the pests that inhabit your fields to know how long a field needs to be out of a plant species before it is safe to be replanted. Also, learn what order crops should be grown in the rotation. Cooperative Extension can help you to learn more about the pests in your fields and the appropriate rotation of crops. For example, a rotation that features a grass crop followed by another grass crop is not a true rotation. A legume crop should follow the grass crop, then the following year a grass crop could be replanted.

Insects, fungi, and even weeds have developed resistance to some of our most popular pesticides. If you are using pesticides to manage pests, you can help minimize the development of pesticide resistance by rotating crops. Crop species vary in the types of pesticides they require; crop rotation, therefore, permits you to alternate your use of different pesticide chemistries.

After soil erosion, weeds contribute to the greatest *controllable* losses of farm income in the country. Crop rotation can directly help to control weeds in two ways. First, some crop species can physically out-compete weeds for light, water, nutrients, and space. The crops simply smother the weeds. For example, crownvetch is grown on steep embankments along highways in many Northeastern states. Crownvetch's vinelike growth and dense root system smother most weed species. Second, some crop species have allelopathic properties, producing chemicals that inhibit the growth of other plants. The allelopathic properties of some plants can be a big contributor to weed control programs. But it should be noted that allelopathy can also work in reverse. Market crops can be affected by the allelopathic properties of other plants. For example, alfalfa will inhibit the growth of other alfalfa plants. Learn what plants have allelopathic properties and where they fit into your rotation.

III. Plant Fertility Benefits

One of the best known features about crop rotation is its benefit to crops that follow a leguminous crop. The primary reason for

this benefit is the nitrogen-fixing ability of leguminous plants. Legumes are able to capture atmospheric nitrogen and convert it into a form that plants can utilize. *Rhizobium* sp. bacteria living in nodules on the legume plant's roots assist this conversion process.

Legumes typically fix much more nitrogen than they need, which often leaves a fair amount of nitrogen available for a succeeding crop. The amount of leftover nitrogen varies with the legume species and the percentage of legumes in the field. The amount of nitrogen can be as much as 100 pounds per acre with hairy vetch, while pure stands of clover (red, white, and crimson) can fix 80 pounds of nitrogen per acre and mixed clover and grass stands can fix 40 pounds of nitrogen per acre. Mixed stands result in residual nitrogen loss because grass utilizes this nitrogen for growth. Other nitrogen-fixing legumes include lespedeza (30 lbs N per acre), cowpeas (40 lbs N per acre), and soybeans (35 lbs N per acre).

Crops vary in their ability to utilize plant nutrients. Some crops use large amounts of specific nutrients while others may use very few nutrients. And some crops add to the nutrient content of the soil. Crop rotation can thereby help to avoid the depletion of an important nutrient in the soil or help to remove an excess nutrient. Many times excess nitrogen leaches down through the soil, beyond the reach of most plants. Leached nitrogen is a major pollutant of groundwater. Deep-rooted cover crop plants can capture nutrients, such as nitrogen, which have leached down through the soil and would normally be lost to shallow-rooted plants. Captured nutrients are no longer a threat to water quality. These nutrients will become available to succeeding crops after the cover crop dies and the crop residue breaks down, releasing the nutrients back into the soil. Both wheat and cereal rye are excellent cover crop choices for recycling nutrients from deep in the soil.

Rotating different crop species helps to maintain good soil structure by introducing different root systems. Fibrous root systems help to loosen the soil, while larger root systems provide channels for air and water to enter the soil. Deep-rooted plants expand the root zone—the area of the soil that supports optimum root growth—making more of the soil available for subsequent crops.

IV. Rotating Cash Crops

If at all possible, you should work crops into your rotations that have value either as a direct cash crop or indirect cash crop. An indirect cash crop would not be marketed, but utilized directly on the farm. For example, red clover can be used as a cover crop and for hay or pasture for livestock producers. The value of the red clover is then twofold. It has value as a cover crop, protecting the soil and producing nitrogen for the following crops, plus, it has value as a feed.

Small farm operators, for the most part, do not have the luxury of surplus acres that can be left fallow for a year or more to rest. Profitability hinges on getting the most out of every acre, every year. Efficient and effective crop rotations exist for whatever crop you choose to produce—field crops, fruits and vegetables, or anything else.

References

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