Agronomic Spotlight

Seminis
grow forward

Importance of Crop Rotation

- Crop rotation is an important strategy for managing some diseases, weeds, and insect pests of vegetable crops.
- Rotating crops also provides nutritional benefits to plants and maintains soil health.
- Plants in the same plant family should be treated as a single rotational group.

Crop rotation involves planting a sequence of different kinds of crops in a location over a number of seasons (Figure 1). Rotating crops helps maintain or improve soil health and maintain or increase the productivity of the farm over time. To get the most benefit from rotation, growers should schedule sequential plantings based on rotational groups of plants belonging to the same plant family (Table 1).[1,2] Vegetables belonging to the same family can be considered as a rotational group because they are susceptible to many of the same diseases and insect pests, share similar nutrient requirements, and are treated with similar pesticides.[1]

Table 1. Plant families of common vegetable crops.

Family	Plants
Alliaceae	onion, garlic, leek, chives, shallots
Apiaceae	carrot, celery, coriander, fennel, parsley, parsnip
Asteraceae	chicory, endive, dandelion, lettuce, Jerusalem artichoke, globe artichoke, sunflower, zinnia, marigold
Brassicaceae	broccoli, brussels sprouts, cabbage, canola, cauliflower, collards, kale, kohlrabi, mustard, radish, rutabaga, turnip
Chenopodiaceae	beets, chard, spinach
Cucurbitaceae	cantaloupe, cucumber, melon, pumpkin, summer squash, watermelon, winter squash, gourds
Fabaceae (legumes)	dry beans, green (snap) beans, soy beans, peas, alfalfa, cowpea, peanut
Poaceae (grasses)	corn, rice, wheat, oats, barley, rye, sorghum
Solanaceae	eggplant, pepper (bell and chili), potato, tomato, tobacco

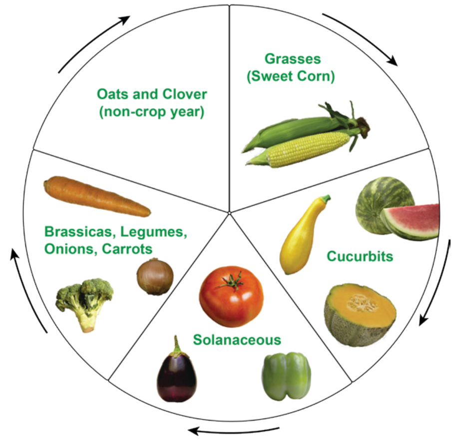

Figure 1. A 5-year crop rotation sequence, including one non-vegetable crop year.[4]

Disease Management

Rotation can be used to help manage diseases caused by pathogens that survive in the soil or in crop debris and pathogens whose populations decline in the absence of a susceptible host.[3] Crop rotation will not be effective against pathogens that primarily enter fields on air currents, by vectors, such as insects, or on seed. Some pathogens (fungi, nematodes, and a few bacteria) are considered to be soil inhabitants and can persist in the soil for many years in the absence of a susceptible crop. The populations of these types of pathogens may not decline with crop rotation, but rotation can help keep the populations from increasing or slow the rate of increase.[3] Some pathogens have wide host ranges that can include crops in different rotational groups. Extra care must be used when designing rotational sequences that will help manage these pathogens. Grass species, such as corn, wheat, and sorghum, are very different from most vegetable crops, and these crops are good rotational partners to include in a vegetable rotation sequence.

The length of time between similar crops needed to adequately manage a disease depends on the pathogen.[3] Some pathogens only remain viable in the soil or infested crop debris for a short time. Rotating away from a susceptible host for 1 or 2 years is adequate for reducing populations of the pathogens that cause leaf blight of onion and bacterial spot of pepper, for example. Other pathogens produce long-term survival structures and require longer rotations to manage. A rotation of 2 to 3 years is recommended for managing Fusarium root rot of beans, and a minimum of 7 years is recommended for clubroot on broccoli and cabbage. The pathogen that causes Verticillium wilt of tomato and eggplant produces survival structures that can remain viable in the soil for many years, and this fungus can infect a wide range of hosts, including many weed species. Therefore, crop rotation is of limited use for managing this disease.[1,3,4]

Nematode Management

Many plant pathogenic nematodes are soilborne and can be managed, in part, with crop rotation. Nematodes, such as

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species of root-knot nematodes, have wide host ranges. Some nematode species can survive as eggs in the soil or as eggs in structures called cysts in the soil for several years. For these nematode problems, it is important to correctly identify the causal agent and to rotate to non-host crops for the amount of time needed to sufficiently reduce the nematode populations.

Insect Management

Unlike soilborne pathogens, many insect pests of vegetables are able to move easily from field to field. Crop rotation is not effective for managing these pests. However, crop rotation can be used to break the life cycle of insect pestSs with limited mobility and narrow host ranges. Corn rootworm adult females lay eggs in the soil in corn fields in late summer and early fall. The eggs overwinter in the soil, and larvae emerge in the spring to feed on corn roots if the field has been replanted to corn. If the field is rotated to a non-host crop, the larvae do not have corn roots to feed on and they die, breaking the cycle. Other vegetable insects for which crop rotation is useful include wireworms on root crops, sweet corn, and melons, and Colorado potato beetles on solanaceous crops (eggplant, pepper, potato, and tomato).[1,5]

Weed Management

Crop rotation can also be used to help manage weed problems because different crops compete with weed species in diverse ways. Crops vary in their time of planting, rate of canopy development, canopy height, row spacings, fertility management, and harvest times. This creates varied environmental conditions that favor different weed species each year, preventing the buildup of a few species. The diversity of weed management strategies used with different crops also increases weed diversity and reduces the prevalence of problem weeds that can build up over time. Crop rotation allows the use of herbicides with diverse modes of action, which can prevent the development of herbicide-resistant weed populations. Different cultivation practices can also disrupt the buildup of problem weed species.[6,7]

Herbicide Carryover

When using selective herbicides, it is critical to consider the effect that herbicide carryover may have on subsequent crops. Many herbicide labels include plant-back restrictions, indicating the amount of time that must pass before planting a specific crop following application. For example, if DuPont™ Canopy® Herbicide is used on a crop of soybeans in the central region states, the listed label rotation guidelines indicate the following recropping intervals: tomato (transplants) – 10 months, snap bean and peas – 12 months, cucumber, sweet corn, watermelon, and cabbage – 18 months, carrot, onion, and potato – 30 months. Always check pesticide labels for instructions on recropping restrictions and follow label directions. Keep crop rotation sequences in mind when selecting herbicides and vice versa.[3]

Nutrient Use

Crops differ in their nutrient requirements and their abilities to extract nutrients from the soil. Tomato plants are heavy feeders. Celery, by contrast, is not as efficient at extracting soil nutrients, and celery can have problems with nutrient uptake when planted following tomato.[1] Legumes (alfalfa, beans, peas) can fix atmospheric nitrogen and be used to increase soil nitrogen levels. However, legumes that are harvested for seed (soybeans) do not provide much added nitrogen to the soil. Growing alfalfa in a field for several years can provide enough nitrogen to meet the needs of the following vegetable crop.[3]

Example Rotation Sequences

Crop rotation sequences can be simple, alternating between 2 crops each year (Figure 2) or more complex. Longer, more complex sequences (Figures 1 and 3), especially those that include a year or two of forage crops in the rotation, usually provide the most benefit to production. However, they may not be feasible in all situations, depending on growing conditions and market forces.

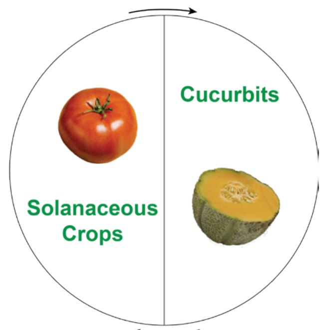

Figure 2. A simple 2-year crop rotation sequence.

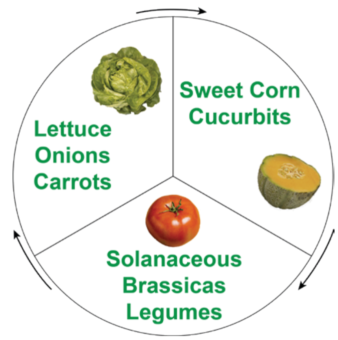

Figure 3. A 3-year crop rotation sequence.

Sources:
[1] Roberts, E. Vegetable rotations-successions and intercropping. Texas A&M Extension. https://lubbock.tamu.edu/programs/crops/vegetables/vegetable-rotations-successions-and-intercropping/. [2] Fake, C. 2013. Vegetable plant families and their characteristics. University of California Cooperative Extension, Publication Number 31-141C. [3] Rudolph, R., Pfeufer, E., Bessin, R., Wright, S., and Strang, J., 2020. Vegetable production guide for commercial vegetable growers, 2020-2021. University of Kentucky. [4] Magdoff, F. and van Es, H. Crop rotations. In Building Soils for Better Crops, 3rd Edition. SARE. https://www.sare.org/Learning-Center/Books/Building-Soils-for-Better-Crops-3rd-Edition/Text-Version/Crop-Rotations. [5] Stoner, K. Management of insect pests with crop rotation and field layout. SARE. https://www.sare.org/Learning-Center/Books/Crop-Rotation-on-Organic-Farms/Text-Version/Physical-and-Biological-Processes-In-Crop-Production/Management-of-Insect-Pests-with-Crop-Rotation-and-Field-Layout. [6] Cultural weed management. 2013. NC State Extension. https://soybeans.ces.ncsu.edu/cultural-weed-management/. [7] Pittman, K. and Flessner, M. Crop rotations. GROW Integrated Weed Management. https://integratedweedmanagement.org/crop-rotations-and-planting-date/. Websites verified 5/6/2020

For additional agronomic information, please contact your local seed representative.

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