Agronomic Spotlight

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Managing Lettuce Diseases

- Effective management of lettuce diseases requires the integration of several management strategies.
- Diseases resistance is one of the best ways to manage a disease, and resistant varieties are available for some important lettuce diseases.
- Cultural practices and the appropriate use of pesticides can be important components of disease management programs.

Avoidance

Avoidance is "a principle of plant disease control in which plants are grown at times or locations where the pathogen is inactive or not present".[1] In other words, avoid the disease by growing a crop where there is no pathogen, or where conditions do not favor disease development. For soilborne diseases, such as **Fusarium wilt**, **Verticillium wilt**, **lettuce drop**, and **lettuce dieback**, this avoidance entails growing the crop in fields with no history of the disease.[2] Avoidance also involves keeping the pathogen from being introduced into a field on infested soil or plant debris. Therefore, cleaning equipment and tools when moving from an infested field to a non-infested field is well worth the effort.[3] For a disease that requires specific conditions for disease development, avoiding areas where those conditions occur will also effectively manage the disease. Both **corky root** and **lettuce dieback** require wet soil conditions for infection, and disease severity can be minimized by not planting in low areas or in areas with heavy soil that do not drain well.[1] Avoiding fields with poor air circulation can also help manage diseases, such as **downy mildew, lettuce drop**, **gray mold**, and **varnish spot** that require high humidity and extended periods of leaf wetness for infection and spread.[2,3]

Figure 1. Symptoms of lettuce drop. Gerald Holmes, California Polytechnic State University at San Luis Obispo, Bugwood.org.

The use of disease-free seeds and transplants are also methods of avoidance, as they are also meant to prevent the pathogen from becoming established in the planting. The fungi that cause both **Fusarium wilt** and **Verticillium wilt** can be seedborne and introduced into the soil on infected lettuce seed. Some foliar diseases, including **bacterial leaf spot** and **lettuce mosaic** are also seedborne, and the use of pathogen-free seed is an important component of disease management. Most commercial lettuce seed is tested for the presence of the Lettuce mosaic virus (LMV), and only seed lots that have no virus detected in samples of 30,000 seed are certified as pathogen-free, sometimes designated *mosaic tolerance zero* (MTO).[4]

Inoculum Reduction

Another major category of disease management focuses on reducing the amount of pathogen inoculum present. Practices such as sanitation (getting rid of crop debris) and crop rotation are undertaken to lower the amount of pathogen inoculum, thus lowering the amount of disease that develops. These methods are effective for diseases that overwinter (survive the off-season) in the field, such as **downy mildew**. The length of a crop rotation sequence will depend on the length of time a pathogen can survive in the absence of a host plant. The two species of *Sclerotinia* fungi that cause **Lettuce drop** can survive in the soil in the absence of infectible host plants for several years. However, deep plowing can reduce the effective inoculum level. The bacterial pathogens that cause **bacterial leaf spot**, **corky root**, **and varnish spot**, can only survive in soil or infested crop debris for a year or so, and a one to two year rotation away from lettuce is usually sufficient to manage these diseases. Some pathogens, such as the fungi that cause **Fusarium wilt** and **Verticillium wilt** can survive in soils for many years, and while rotations to non-host crops, such as grass crops, can prevent inoculum levels from increasing and may help lower levels somewhat, even long term rotations will not eliminate the presence of the pathogens in the soil.

Sometimes more intensive and costly methods are used to lower inoculum levels of soilborne pathogens. Soil fumigation, soil solarization, flood fallowing, and anaerobic soil disinfestation can be used to lower or eliminate soilborne inoculum of the pathogens that cause **Fusarium wilt**, **Verticillium wilt**, and **lettuce drop**, but the use of these methods may not be economically feasible.

Many pathogens survive in infested crop debris, and the rapid destruction of crop debris at the end of the season helps to lower inoculum levels for the following seasons. Prompt incorporation of lettuce debris after the final harvest can help in the future management of diseases such as **gray mold** and

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bacterial leaf spot. Rapid destruction of lettuce debris can also minimize the spread of **lettuce mosaic** from an older planting to younger plantings nearby.[2]

Inoculum levels can also be reduced by eliminating weed and volunteer crop plants that serve as reservoirs of inoculum. The pathogens that cause **bacterial leaf spot**, **lettuce mosaic**, and **tomato spotted wilt** can survive in weed and volunteer plants, and weed management in and around a lettuce planting can help eliminate this source of infection.[2,3]

Preventing Infection and Spread

Some disease management methods work by lowering the rate of infection or by slowing the spread of the disease. Lowering planting density allows for better air circulation and lowers humidity levels in the canopy, making conditions less favorable for the development of diseases such as **downy mildew, lettuce drop** and **gray mold**. Minimizing damage to transplants and avoiding the use of overgrown transplants helps lower infection by the **gray mold** fungus, while preventing root injury from cultivation can lower infection of the roots by the viruses that cause **lettuce die back**.

Water management can be used to effectively reduce the rates of infection and spread of several plant diseases. High moisture levels at the soil surface induce the formation of spores by one of the fungi that cause **lettuce drop**, and the use of sub-surface drip irrigation can keep the soil surface dry and reduce spore formation and infection. Avoiding the use of overhead, sprinkler irrigation reduces the amount of time that films of water are present on plant surfaces, needed by pathogens causing **bacterial leaf spot, downy mildew, gray mold**, and **varnish spot** for infection. The splashing water from sprinkler irrigation also spreads these pathogens from plant to plant. Using drip or furrow irrigation minimizes leaf wetness and splash dispersal. If sprinkler irrigation is applied early in the day, plant surfaces can dry during the day, lowering the amount of time that leaves are wet.[2,3]

Disease Resistance

Using disease resistant varieties is one of the most effective methods for managing some diseases, and it also works by reducing (or preventing) infection and plant to plant spread. High levels of resistance can essentially make plants immune to a disease under normal circumstances. With partial forms of resistance (or intermediate resistance) plants can still become infected and show disease symptoms, but the severity of the disease and resulting yield losses are less than those seen with fully susceptible varieties. Commercial lettuce varieties with high levels of resistance to **downy mildew** are available, and resistance can be highly effective in managing the disease. Resistance to **Fusarium wilt** is available mostly in leafy and romaine types of lettuce. Resistance is also available to **Verticillium wilt** but only to one of the two races of the pathogen. Resistance to **lettuce dieback** is conveyed by the *Tvr1* gene, which has been used successfully since the 1940s. There are two genes, ***mo1***^{1} and ***mo1***^{2}, that convey resistance to **Lettuce mosaic virus**, but some resistance breaking isolates of LMV have been found in Europe. Lettuce varieties with identified resistance to **bacterial leaf spot** or **varnish spot** are not available. However, there are differences in susceptibility among lettuce varieties to both, and using less susceptible varieties can help manage the disease, especially if combined with other management strategies.[2,3]

Chemical Control

Fungicides can be used to manage some of the foliar diseases of lettuce, including **downy mildew, lettuce drop,** and **gray mold**.[4,5] For **downy mildew**, treatments should start when conditions are favorable for infection but before symptoms appear. For **lettuce drop** caused by *Sclerotinia minor*, applications should begin immediately after thinning (the four to six true leaf stage), while for ***S. sclerotiorum***, applications should begin during the rosette stage.[2,3] Fungicide resistance has developed in some populations of the gray mold fungus, so it is important to combine or alternate the use of fungicides belonging to different mode of action (FRAC) groups. Fixed copper compounds, such as copper hydroxide, can be applied to help reduce the severity **of bacterial leaf spot**. Adding a dithiocarbamate fungicide enhances the effectiveness of the copper against the bacterium. Insecticides and herbicides can also be used for plant disease management. Insecticides can be used to manage aphid and thrips populations, which can help manage the viruses they vector, **LMV** and **TSWV** respectively. Using herbicides to eliminate weeds that serve as reservoir hosts for diseases such as **bacterial leaf spot**, **lettuce mosaic**, and **tomato spotted wilt** can be a useful tool for managing these diseases.[4]

Sources:
[1] Darcy, C., Eastburn, D, and Schumann, G. 2001. Illustrated glossary of plant pathology. The Plant Health Instructor. DOI: 10.1094/PHI-I-2001-0219-01.
[2] Subbarao, K., Davis, R. M., Gilbertson, R., and Raid, R. 2017. Compendium of lettuce diseases and pests; Second edition. American Phytopathological Society, St. Paul.
[3] Koike, S. and Turini, 2017. T. How to manage pests: Lettuce. UC IPM. http://ipm.ucanr.edu/PMG/selectnewpest.lettuce.html
[4] Reiners, S., Wallace, J., Curtis, P., Helms, M., Landers, A., McGrath, M., Nault, B., and Seaman, A. 2018. Cornell integrated crop and pest management guidelines for commercial vegetable production. Cornell Cooperative Extension.
[5] Egel, D., Foster, R., Maynard, E., Weller, S., Babadoost, M., Nair, A., Rivard, C., Kennelly, M., Hausbedk, M., Szendra, Z., Hutchinson, B., Orshinsky, A., Eaton, T., Welty, C., and Miller, S. 2017.
Websites verified 11/26/2018

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

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