Windbreaks Manage Odor, Improve Appearance Around Poultry Houses

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A windbreak will foster good neighbor relations. ***Photo provided by USDA-NRCS***

While poultry producers are increasing the efficiency of their operations, Mid-Atlantic states have been losing farmland, in most cases to development. From 1997 to 2002, Maryland, Delaware and Virginia, on average, have lost 5 percent of their state's farmland. This loss of farmland totals almost 300,000 acres.

The trend of farmland loss is at a rate almost four times that of the nation as a whole. The encroachment of houses on farmland in the Mid-Atlantic, combined with the trend toward more concentrated poultry operations, points to a much greater need for vegetative buffers.

Tree and shrub buffers absorb gaseous ammonia, precipitate out dust by slowing the air speed from exhaust fans, and deflect the odor plume into the atmosphere above the buffer, all in a very cost-effective way. With odor management, the buffer becomes part of the overall management of the farm operation.

Odor from poultry houses typically travels downwind, along the ground, in a concentrated plume. By planting trees and shrubs around poultry houses, farmers can disrupt the plume and mix it with the prevailing winds to dilute odor.

Ammonia is the gas of greatest concern to the poultry industry. Plants have the ability to absorb aerial ammonia. This translates into higher growth rates, as plants located in front of exhaust fans have higher amounts of nitrogen and dry matter weights compared to control plants. Plant growth is increased with the right amount of ammonia; however, there is a critical threshold where too much ammonia will cause tissue death, reduced growth and greater frost sensitivity.

During the summer, trees reduced air velocity by 99 percent, dust by 49 percent and ammonia by 46 downwind of the trees, according to recent studies. The direction of the wind strongly influenced these results; wind blowing toward the fans "increased" the efficacy of the buffer while wind blowing in the opposite direction "decreased" this efficacy.

The primary benefit from plant buffers installed near the poultry production facility is the improved visual perception of the facility, but they also can reduce noise by up to 50 percent. This is extremely important to good neighbor relations where residential housing exists near poultry farms. These benefits are especially important in the Mid-Atlantic, with its booming housing market.

Windbreaks/buffers may also reduce the spread of specific infectious diseases in poultry operations by blocking, intercepting or diverting wind-borne infectious organisms away from buildings. However, producers should use care to select windbreak plants that do not produce large amounts of seed or fruits that attract birds which may spread these diseases. Fruiting can be avoided by using male cultivars of dioecious plants (such as hollies) or fruitless cultivars.

Windbreaks help filter and capture nutrients from runoff and ground water through root absorption of up to an estimated 80 percent of the nitrogen and phosphorus in certain environments. Nutrient uptake by plants helps reduce the amount of nutrients that are available to enter adjacent water courses.

Windbreak/Buffer Design and Maintenance

Plant selection will vary depending on the site. Select plants based on the following factors:

- mature height and spread of the plant
- soil type
- drainage and moisture conditions
- wind conditions
- precipitation
- USDA hardiness range
- growth rate
- whether it is a native or introduced species
- location and distance from exhaust fans
- farm layout (location of roads and neighbors)

To maximize particulate trapping, select plants based on the following factors:

- high leaf surface roughness (plants with leaf hairs, leaf veins, and small leaf size)
- complex leaf shapes
- large leaf areas
- medium to rapid plant growth rates.

It is usually best to select several different species of trees and shrubs for use in windbreaks. This helps prevent the loss or destruction of the entire windbreak if insect pests or tree diseases occur on certain species. Having diversity also offers a better chance for tree survival during alternating seasons of drought and/or wet soil conditions.

Deciduous shrubs are generally planted in the perimeter rows, followed by deciduous trees towards the middle or along the downwind side where they can grow more efficiently.

Deciduous plants planted near the tunnel ventilation fans will accumulate dust particles during the growing season when the fans are operating. Those leaves will then drop off in the autumn when the fans are not being used. The plants will then leaf out in the spring repeating this process.

To provide an effective windbreak, a combination of plant growth rates should be used in the overall design. Within each row, select species with similar growth rates to provide an even height. Faster growing plants, which provide quick visual screening, generally are short lived and will need to be replaced sooner than slower growing species.

Where site conditions allow, place plantings around the entire perimeter of the odor source. A curved planting is easier to cultivate and offers a more pleasing appearance than one with squared corners.

The closer the windbreak is positioned to the poultry house, the better the odor, dust and ammonia will be trapped and dispersed. However, the windbreak should be placed a minimum of 50 feet from the sidewalls and 80 feet from the ends of the houses for access. Any closer to the ventilation fans will cause the plants to become desiccated from the higher wind speed. The nearest row of windbreak plantings should be set back from buildings and waste storage areas by a distance that is at least 10 times the exhaust fan diameter.

For example, if the tunnel ventilation fan has a diameter of six feet, then the first line of plants should be planted 60 feet away. In those cases where multiple fans are used in one location, this planting distance formula will need to be modified.

Consider mounding the soil to create berms with plants located on top of the mound. When using evergreen plants, consider that winter snows will be heavily deposited down wind at a distance of 10 times the total height of the plants. Be sure that roads or other buildings are not located in this area where additional snow will be deposited.

Evergreens

Evergreens are useful for providing year-round visual screening and particulate trapping, but tend to become overloaded with particulates if planted too close to ventilation fans. Poultry house particulates do not wash off easily and thick coatings of particulates on evergreens will result in early mortality.

Best results will be achieved when evergreens are placed on the downwind side of deciduous trees, which will intercept significant amounts of particulates during the growing season. The exception to this rule is for evergreen hollies, which have a thick, waxy leaf surface that will tolerate the thick coatings of particulates that will be washed off by the rain. This characteristic allows evergreen hollies to be used in the high particulate load areas directly behind ventilation fans.

White and loblolly pines have been used with poor results and are not tolerant of high levels of ammonia. They are not recommended for planting in areas opposite ventilation fans, but may be an option for use in non-discharge areas.

Number of Rows

The proper number of rows in a windbreak will depend on the space available, and the species to be used. When possible, windbreaks should consist of three or more rows of deciduous and evergreen species of plants. Additional rows of plants may be needed near the tunnel ventilation fans as those plants will be growing in a more stressful environment and plant death will be more frequent.

Selecting the correct species for the situation, and then following up with proper care is much more important than the number or rows.

Spacing Within, Between Rows

The spacing between the plants within the row will vary depending on the size and growth rate of the plants. Faster growing plants should be placed further apart than slower growing plants.

Overall, spacing within the windbreak should be closer than the spacing typically used for landscape plantings. This will promote quicker vertical growth which will shade out weed competition and decrease the amount of time that it takes for the windbreak to become functional. Greater crown and root spread can be expected from hardwoods than from evergreens.

Spacing between rows depends on the amount of moisture available, the species planted in each row, and the width of implements used for cultivation or maintenance.

Planting rows too closely together is a common mistake. After a few years of growth, severe competition for moisture and nutrients begins and faster-growing trees overtop others. Machinery often cannot move between the rows, the windbreak falls into disrepair and eventually becomes ineffective.

In most cases, a spacing of 16 to 20 feet between rows is recommended depending on site conditions and species selected. If the site is dry, more space is necessary to minimize competition. More space would also be needed for species which are sensitive to shade.

The distance between the shrub row and the tree row does not need to be as great as the spacing between tree rows. Adequate spacing between deciduous and evergreen rows in necessary because faster growing deciduous trees tend to overtop and suppress evergreens if planted too close. Evergreen and deciduous trees should not be mixed in the same row for this same reason.

For an entire report, which includes more detailed information on windbreak establishment and maintenance, contact Shawn Belt of USDA Natural Resources Conservation Service (NRCS) at Shawn.Belt@md.usda.gov or (301) 504-8175.