Sustainable Nursery Irrigation Management Series

Part III. Strategies to Manage Nursery Runoff

Amy Fulcher
Assistant Professor
Department of Plant Sciences, University of Tennessee

Tom Fernandez
Associate Professor
Department of Horticulture, Michigan State University

Part III discusses the significance and causes of nursery irrigation runoff and offers strategies to manage runoff.

Extension publication, "W 278: Part I. Water Use in Nursery Production," discussed the importance of and competition for water use in nursery production. "W 279: Part II. Strategies to Increase Efficiency" covered techniques that growers can use to refine scheduling (volume and timing) and delivery of irrigation water. This final publication in the series discusses the significance and causes of nursery irrigation runoff and offers strategies to manage runoff.

As discussed in Part I of this series, irrigation can contribute to nursery runoff. While growers generally aim to apply 1 inch of water per day, field studies show that growers actually apply as little as 0.3 and as much as 1.3 inches per day. The greater the volume of water applied, the greater the potential for runoff. Runoff, or more precisely, surface runoff, is defined as water moving over the surface of saturated soil. Runoff can cause erosion and carry pathogens and pollutants, such as pesticides, petroleum products, soil, fecal contaminants and nutrients that may contaminate ground and surface water. Agricultural runoff and its link to eutrophication in surface waters led to legislative action affecting agriculture producers in recent years, including the Neuse River watershed in North Carolina and the Chesapeake Bay (Figure 1).

Figure 1. Eutrophication, the nutrient enrichment of water, can occur in nurseries. Eutrophication is often followed by an algal bloom. Photo credit: Amy Fulcher

Erosion

Erosion is a serious threat to agriculture and contributes to reduced soil productivity. Moving water is often a culprit of erosion, because it concentrates as it moves, following the path of least resistance. Field and container producers may experience gully erosion (i.e., erosion by water moving so forcibly that it creates a furrow or gully) (Figure 2). Sheet erosion occurs when water moves over the ground as a sheet, dislodging soil particles without creating a gully.

Figure 2. Erosion can easily occur when there is bare ground, especially sloping ground. Photo credit: Amy Fulcher

Erosion Prevention Measures

Reducing the runoff from nurseries can minimize or eliminate the displacement of soil and the contamination of water. Refining irrigation applications so that excess water is not applied is one strategy to prevent runoff. However, even with sophisticated irrigation scheduling, heavy rain, even when infrequent, is sufficient to cause erosion. Erosion can be prevented or reduced by a number of techniques that slow the flow of stormwater, water that collects on land due to rain events. It includes runoff from impervious surfaces, such as roads, parking lots, compacted soil and roofs.

There are many best-management practices and techniques that may be used to minimize the effects of stormwater runoff and erosion, including contour plantings, filter strips and constructed wetlands. Contour plantings can be used to reduce erosion in hilly areas (Figure 3).

Figure 3. Planting rows perpendicular to the slope, contour planting, can slow the flow of water. Contour planting is being use to reduce erosion in this field. Photo credit: Amy Fulcher

This practice is accomplished by placing rows of plants perpendicular to the slope of the land, forming a barrier to surface runoff and slowing the movement of water. Filter strips are plantings that are placed strategically to intercept sheet flow runoff. Filter strips slow the water and can trap soil particles and contaminants before entering surface water. The benefits of filter strips are marginalized when sheet flow becomes concentrated and water flow is diverted from the full filter strip. In some cases, land may be too hilly to grow crops without risking erosion.

Constructed wetlands are artificially created wetlands that can serve many purposes (Figure 4). They can reduce erosion by slowing surface drainage, as well as remove nutrients, pathogens and heavy metals from stormwater runoff. Wetland vegetation and saturated soils provide a substrate on which microorganisms can live. Microorganisms are a key component of wetlands. They serve a critical function in changing and breaking down contaminants. Wetland plants filter water, stop the movement of sediment particles and allow sediments to settle before the flow is discharged into streams.

Stormwater Basins

Growers may have a need for two types of stormwater basins: retention basins and detention basins. A retention basin (wet basin) is designed to retain water in a permanent pool. Retention basins can be used to capture, contain and treat nursery effluent from irrigation and excess rainfall so that it remains on-site, protecting fresh water supplies (Figure 5). Retention basins are often lined with a polyethylene liner to avert runoff from infiltrating the soil and, thus, prevent it from being available for irrigation. Annual maintenance of basins includes removal

Figure 4. Constructed wetlands can remove nutrients, pathogens and heavy metals from runoff. Photo provided by Sarah A. White.

Figure 5. Collecting irrigation water in a retention basin and reusing it increases irrigation efficiency. Here, fresh water is blended with captured runoff water for reuse.
Photo credit: Amy Fulcher

of excess vegetation and sediment. A detention basin (dry basin) is dry during many months of the year, refilling only during peak rainfall events. Detention basins are designed to hold stormwater temporarily and release it slowly over time, which decreases water velocity and, therefore, erosive energy on stream banks.

Smaller nurseries and those with only one grade (i.e., nearly level) often need only one basin, although an additional sedimentation basin can improve water quality if the water will be recycled. Sedimentation basins should be designed to allow periodic cleaning to remove sediments that have accumulated. Larger nurseries and nurseries with multiple gradients need more basins. Impervious concrete runways or vegetated waterways can be used to direct water from the production area to the basin without contributing to erosion.

Conclusion

Nursery runoff can be caused by excessive irrigation, poor production area design and heavy rainfall. Runoff can lead to environmental concerns since it can carry biological and chemical contaminants; nursery effluent can contain pesticides, petroleum products, pathogens and nutrients and can cause erosion. Numerous strategies can be used to decrease nursery runoff and slow or prevent erosion. Retention basins can be used to capture runoff and provide a source of irrigation water while protecting nearby rivers, streams and groundwater.

Glossary of Terms

Constructed Wetland — Artificially created wetland that can reduce erosion by slowing down surface drainage, as well as removing nutrients, pathogens and heavy metals.

Contour Planting — Planting rows of plants perpendicular to the slope of the land.

Detention Basin — Designed to hold stormwater temporarily and release it slowly over time.

Erosion — Soil loss due to wind, water, ice or gravity.

Eutrophication — Nutrient enrichment of water, often followed by algal growth.

Filter Strips — Plantings that are placed strategically to intercept and reduce sheet flow runoff.

Retention Basin — Designed to retain water in a permanent pool.

Sedimentation Basin — Basins that capture water initially and allow sediments to settle out of the water stream.

Glossary of Terms *(continued)*

Sheet Erosion — Soil is moved with water as it flows over the ground without creating a gully.

Stormwater — Water that collects or moves across land due to rain events and may turn into stormwater runoff if it falls on impervious surfaces.

Surface Runoff — Water moving over the surface of saturated soil.

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