### Water Treatment Technologies for Specialty Crops

**John Majsztik**, Daniel Hitchcock, David Sample, Sarah White

1. Clemson University Dept Plant & Environmental Science
2. Clemson University Belle W. Baruch Institute of Coastal Ecology and Forest Science
3. Virginia Polytechnic Institute and State University Biological Systems Engineering Hampton Roads Agricultural Research and Extension Center

#### Introduction
- Irrigation runoff at ornamental production operations can range from 2,000 to 10,000 gallons per acre per day (Fruet, 1997)
- Runoff water may include nutrients, pesticides, pathogens, growth regulators and other agrochemical inputs, which can cause harm both at the operation and in the surrounding environment
- Ideally runoff would be cleaned and reused, which would save growers money and reduce their environmental impact
- Growers would like cost and benefit information before making a decision
- There are a number of technologies that ornamental plant producers could implement

#### C & E-Sediment basin and Sediment forebay
**Description**: Areas that allow water to collect before entering channel (sediment basin) or containment pond (sediment forebay) (Fig. 5). Ideally with a concrete base for ease of removal.

**Benefits**
- Allows for easy removal of accumulated sediment
- Reduces sedimentation in channels and containment ponds

**Concerns**
- Must be maintained for maximum effectiveness (sediment removed, debris cleaned out)
- Removed sediment may be contaminated (e.g. diseased)
- Sizing is important for effective sediment removal

**Target removal**: Sediment, phosphorus, soil-bound agrichemicals

#### A-Vegetated Channel
**Description**: Aquatic and/or semi-aquatic plants are placed in channels that lead to recycling ponds or off-site (Fig. 1&2). Plants slow water movement allowing sediment to be removed from the water column.

**Benefits**
- Does not require additional area to be removed from production
- Inexpensive to install and maintain

**Concerns**
- Must be maintained for maximum effectiveness (sediment removed, debris cleaned out)
- Removed sediment may be difficult to dispose of

**Target removal**: Sediment, phosphorus, soil-bound agrichemicals

#### B-Carbon wall
**Description**: Water is plumbed to a trough with wood chips. Water flows through the wood chips, where microorganisms colonize pore spaces.

**Benefits**
- Does not require additional area to be removed from production
- Inexpensive to install and maintain
- Long lasting (10-20 years)

**Concerns**
- Difficult to measure effectiveness over time

**Target removal**: Pathogens, nitrogen, sediment, agrichemicals

#### D-Constructed wetland
**Description**: An engineered system that uses plants and microorganisms to treat water for reuse or release into the environment (Fig. 6). There are multiple types of wetlands that can be installed.

**Benefits**
- Can be designed to remove operation-specific concerns (e.g. pathogens, nutrient loads, agrichemicals)

**Concerns**
- Must be maintained for maximum effectiveness (plant species, water movement)
- Sizing/water retention time is important for maximum effectiveness
- Less effective in colder climates/weather

**Target removal**: Nutrients (especially nitrogen), pathogens, some agrichemicals

#### E, F, & G - Treatment pond (F) and Storage pond (G)
**Description**: Increasing hydraulic retention time (HRT), or the amount of time water stays in a system, increases the effectiveness of removal for many substances. Multi-pond systems are an effective way to increase HRT without necessarily increasing required area.

**Benefits**
- Can be designed to remove operation-specific issues (nutrient loads, pathogens, agrichemicals etc.)

**Concerns**
- Must be maintained for maximum effectiveness
- Sizing/hydraulic retention time is important
- Are less effective in colder climates/weather

**Target removal**: Nutrients (especially nitrogen), pathogens, agrichemicals

### Conclusions
- Specialty crop producers have a number of options for sediment, agrichemical and pathogen remediation
- Recycling water would allow producers to either reduce irrigation costs, or increase production space
- Operations can choose treatment options that will work with their removal needs, budget, and land availability
- Growers would prefer unbiased, current information regarding water treatment options for their operation

---

**Footnote**:

---

**Acknowledgments**:
This material was partially supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2014-51181-22872