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Best Management Practices for Bioenergy Crops: Reducing the Invasion Risk

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Introduction

The bioenergy industry is pursuing low-input crops to be grown on marginal lands across the Southeast to support the growing bioeconomy. Successful development of renewable power and liquid fuel in Virginia will require cost-effective and environmentally responsible production of new biomass crops. These cellulosic crops share many traits with invasive plants (e.g., drought tolerant, fast growing, low pest pressure). Thus, it is important that all parties engaged with biomass production, harvest, transport, storage, and conversion in Virginia take an active role in mitigating the unintentional introduction and spread of potentially invasive species.

Background Information

The bioenergy industry (renewable liquid fuels and electricity derived from biomass) is rapidly expanding as growers adopt new crops to support growing demand. Unlike corn or other food crops, the so-called second-generation bioenergy crops are grown specifically for biomass production. Therefore, bioenergy crops are being selected to be maximally productive with minimal inputs while grown on less productive land. Unfortunately, many of the candidate bioenergy crops in the Southeast are harmful invasive species in other parts of the U.S. or are suspected of having a high risk of surviving outside the cultivated environment.

Invasive species cause tremendous economic and environmental damage and are cited as the second-leading threat to biodiversity. Most of our worst invasive plant species were intentionally introduced for agronomic, ornamental, forestry, or soil stabilization purposes. Many have since escaped their planted boundaries and are threatening our desirable cropping systems and natural ecosystems. The best tactic to fight invasive species is to prevent their introduction in the first place.

The task of minimizing the risk of bioenergy crop escapes should be managed at several points along the bioenergy supply chain. The following guidelines are recommended best management practices at each of these steps, as diagrammed in figure 1. Any public or private enterprise engaging in the bioenergy industry should adhere to the following practices to reduce the invasion risk.

1. Crop Selection: Do Not Cultivate Crops of High Concern

The federal government and most states maintain lists of noxious weeds, which are regulated species within that jurisdiction. Virginia is reworking its noxious weed regulations and species list; consult it before choosing a bioenergy crop. Nox-

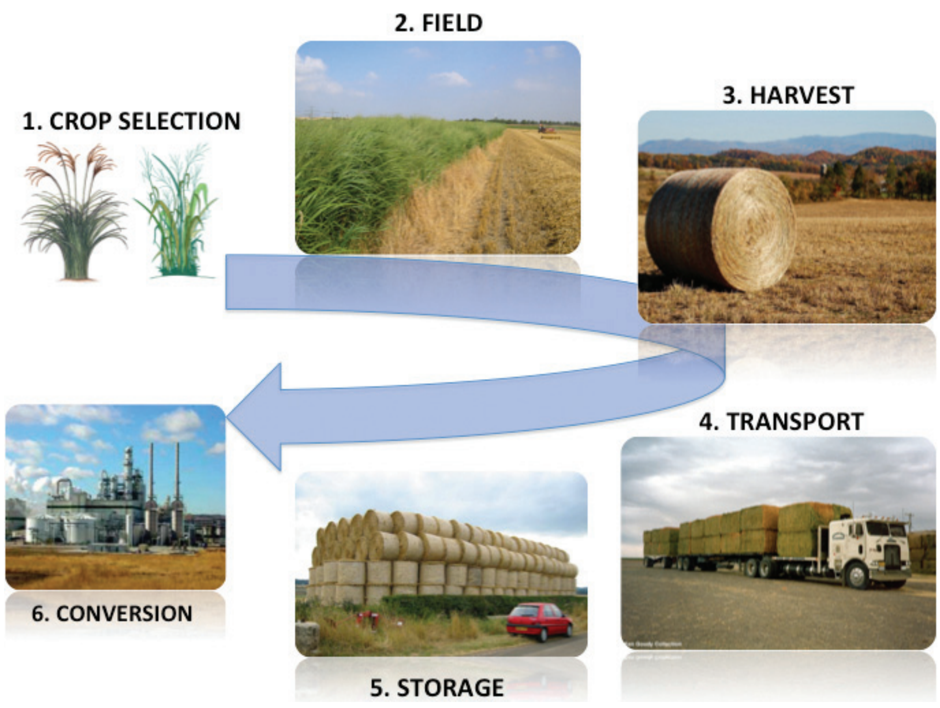

Figure 1. Bioenergy supply chain

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ious weed lists from surrounding states should also be consulted because Virginia shares many ecological features with our neighbors that could support similar species. Invasive plant lists — unofficial lists with no regulatory authority generally maintained by state and regional invasive plant councils or exotic pest plant councils — should also be consulted.

For example, giant reed (*Arundo donax*) is a bioenergy crop candidate in much of the Southeast, including Virginia. Despite the obvious advantages that giant reed possesses for bioenergy production (large biomass production, vigorous growth), it is a noxious weed in four states that is generating concern from Florida to Virginia. The Virginia Department of Conservation and Recreation considers the giant reed an invasive species, but it is not regulated. Thus, extra caution should be taken when considering cultivation of giant reed because we do not have enough information to consider giant reed a low or high invasion threat.

The potential for many species to become invasive is relatively unknown, and reduced risk should not be assumed if your chosen crop is not on a noxious or invasive list.

2. Field Management

One of the primary sources of propagule escape is the production field. The following practices are recommended to reduce propagule dispersal and establishment from field sources.

- Production fields should not be located directly adjacent to major dispersal corridors such as streams, irrigation canals, and utility rights-of-way.
- If viable seeds are produced, measures should be taken to minimize their dispersal, such as choosing late-flowering cultivars or harvesting prior to seed maturation.
- Access to the fields should be controlled.
- Establish a 20-foot buffer area surrounding the production field that should be maintained with a perennial cover (e.g., alfalfa, tall fescue) or herbicide-tolerant crops (e.g., glyphosate-resistant corn).
- Field boundaries, buffer areas, and adjacent areas should be inspected regularly for propagules/seedlings.
- Barriers should be installed downslope of production fields to intercept crop fragments (inflorescences, stem fragments, etc.) if the field is sloped by 5 percent or more.
- Prior to planting, an eradication plan (100 percent control) should be prepared that provides treatment recommendations and procedures to follow after confirmation of escapes. Currently, very little information exists on bioenergy crop weed management, let alone how to eradicate the crop. Much research is needed to determine the difficulty (or ease) in eradicating these crops in managed and natural systems.

3. Harvesting

Harvesting methods should eliminate or reduce viable propagules.

- All planting, harvesting, and transport vehicles and equipment should be cleaned of all plant material prior to moving vehicles and equipment from the harvested field.
- If viable seeds are produced, harvesting/baling methods should be used to reduce propagule spread (e.g., wrapping bales).
- If stem fragments are known propagule sources, harvest practices should reduce or eliminate propagule viability (e.g., shredding aboveground material to kill stem buds).

4. Transportation

The harvested biomass will likely be moved from the production field to either a designated storage location or directly to the end user. Depending on the transportation method (e.g., covered or open bales), the land adjacent to the route from field to storage sites could be susceptible to invasion. Susceptibility will range from extremely disturbed areas to less-susceptible habitats. As such, transporting feedstock material should be done in a manner that reduces unintentional propagule loss.

- Trucks and trailers should be covered when possible.
- Routes that minimize crossing of highly sensitive habitats (e.g., riparian areas) should be utilized.
- Rights-of-way along transport routes should be visually inspected to ensure no escapes.

5. Storage

Storage sites act in many ways like the production field — propagule reservoirs. Therefore, many of the same precautions outlined above also apply to storage locations. However, a few additional precautions are noted.

- Feedstock materials should be stored in locations that are not adjacent to sensitive habitats.
- Storage sites should be inspected for seedlings on a regular schedule.

Adoption of the practices outlined here will reduce the probability of unintentional propagule escape along the bioenergy supply chain. Mandatory regulations that would add procedures (e.g., bond payment for eradication) are being implemented or considered in several southern states. Bioenergy enterprises should check with the local department of agriculture for current regulations and changes to noxious weed lists.

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