



Voluntary Best Management Practices for Energy Crops *Minimizing the Risk of Invasiveness*

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The North Carolina Department of Agriculture and Consumer Services, North Carolina Cooperative Extension, and the Biofuels Center of North Carolina have developed the following guidelines or best management practices to help bioenergy feedstock growers and processors reduce the risk of unintentional escape and spread of potentially invasive species. The following document is not intended to be utilized as a regulatory document and, as such, the recommended best management practices outlined below are completely voluntary.

OVERVIEW AND PURPOSE

North Carolina is engaged in two significant initiatives that have the potential to transform how the state's energy needs for both electricity and transportation are met. One of the initiatives establishes new mandates for the generation of renewable electricity and the other sets a state policy goal for the production of liquid biofuels. Both of these new initiatives will require substantial amounts of biomass, including the production of energy crops.

North Carolina's bioenergy initiatives have the potential to increase jobs, strengthen our agricultural sector, and enhance our environment. The best management practices outlined in this document should serve to develop the industry in a responsible manner. The practices were developed in a collaborative process and embody the idea that addressing concerns about potential invasiveness from the outset will lead to a greater understanding and awareness that these new energy crops will one day be a significant piece of North Carolina's agricultural sector.

Successful development of the bioenergy industry in North Carolina will require cost-effective and environmentally responsible production of new energy crops. Some energy crops or feedstocks may have some of the same traits (e.g., drought tolerance, rapid growth rates, etc.) which are found in invasive plants. Invasive plants are generally considered those species that are non-native whose introduction does, or is likely to, cause economic or environmental harm.

It is imperative that the introduction of new energy crops does not cause economic or environmental harm through unintended consequences. As such, it is important that the bioenergy industries in North Carolina take a strategic approach to these issues by utilization of responsible practices.

The best management practices outlined in this document serve as a first iteration and will be continually updated and modified as new information from research and experience is gathered.

BEST MANAGEMENT PRACTICES TO MITIGATE THE INVASION RISK

The task of minimizing the risk of escapes by potentially invasive feedstocks can be managed at several steps in a process that ends with production at the manufacturing facility. The guidelines following *Figure 1* suggest reasonable actions at each of these steps.



Figure 1. Flow chart showing progression of energy crop production from the point where species are selected to the point where the crop is utilized at the bioenergy manufacturing facility.

Any private or public enterprise cultivating crops for the purpose of bioenergy production (e.g., liquid fuels such as ethanol or power from combustion) should adhere to the following practices to reduce the unintended propagation of energy crops.

1 Information Gathering

Prohibited or Restricted Plant Check

The first step taken by growers and landowners before the planting of any energy crop is to identify whether any prohibitions or regulatory restrictions exist for the species in question. Those species subject to regulation are identified by listing and designation at the state and federal level. For more information about the regulations governing noxious weeds in North Carolina, please contact the N.C. Department of Agriculture and Consumer Services Plant Industry Division (NCDA):

<http://www.ncagr.gov/plantindustry/plant/index.htm>

Right Plant, Right Place

It is important to note that even when a plant is not prohibited or restricted by law or regulation, the plant may still be identified as having some level of risk for invasiveness. Consequently, growers and landowners should educate themselves about the energy crop in question and make a determination as to whether the risks of potential unintended spread can be managed through the implementation of safeguards or best management practices. Growers and landowners can learn more about the plant in question through the N.C. Department of Agriculture and Consumer Services or North Carolina Cooperative Extension. After checking on the plant in question, the grower can then make an informed decision as to whether that particular plant is well suited to be planted in the region in question.

2 Planting and Management in the Field

One of the main sources for propagule escape is the production field. In horticulture, a propagule is any plant material used for the purpose of plant propagation. The following practices are recommended to reduce propagule dispersal and establishment:

- Production fields should not be located directly adjacent to major dispersal corridors, such as streams, irrigation canals, major roads, or utility right-of-ways;
- 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;
- Human access to the fields should be controlled;
- Establish a buffer area surrounding the production field of 20 feet, which should be maintained with a perennial cover (e.g., legumes, bermudagrass, tall fescue);
- Field boundaries, buffer areas, and adjacent areas should be inspected regularly for propagules/seedlings;
- Excess planting material should be killed by drying out on an impermeable surface or by burning;
- Barriers (e.g., silt fences or berms) should be installed down slope of production fields to intercept crop fragments (inflorescences, stems, etc.) if the field is sloped $\geq 5\%$; and
- An eradication plan should be prepared prior to planting that provides treatment recommendations and procedures that are followed after confirmation of escapes or abandonment of the field.

3 Harvesting

Harvesting methods should eliminate or reduce viable propagules.

- All planting, harvesting, and transport vehicles and equipment should be cleaned (e.g., air gun, water) of all plant material prior to moving off site;
- If viable seeds are produced, harvesting/baling methods should be used to reduce propagule spread (e.g., wrapping bales); and
- If stem fragments are known propagule sources, harvest practices should reduce/eliminate propagule viability (e.g., shredding above-ground material to kill stem buds).

4 Transportation

Land along the route from harvested fields to the bioenergy facility could also be susceptible to inadvertent escapes. The susceptibility of the areas will range from a high likelihood of energy crop propagule surviving and establishing to an area very unlikely to support an introduced propagule. As such, the transporting of feedstock material should be done in a manner that reduces unintentional propagule loss.

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

5 Storage

Storage sites are analogous to production fields in serving as a stationary source of propagules.

- Storage sites should be placed in locations not adjacent to sensitive habitats;
- Storage sites should be inspected on a regular schedule for seedlings; and
- Stored plant material should be covered.

CURRENT AND FUTURE CONSIDERATIONS

As noted above, invasive plant species are generally considered those species that are non-native whose introduction is likely to cause economic or environmental harm. Although a federal Executive Order is in place that provides some framework for guidance on management and risk mitigation, much of the

regulatory structure governing invasive species is found at the state level.

In North Carolina the primary state agency with jurisdiction over invasive species issues is the N.C. Department of Agriculture and Consumer Services. This agency administers the State Noxious Weed Regulations under the Authority of the Plant Pest Law (N.C.G.S. 106-419 et seq.). The implementation of these regulations is the primary mechanism for addressing the threat of invasive species in North Carolina. A portion of that regulatory structure is the agency's responsibility to maintain the state's noxious weed list. Designation on the state's noxious weed list may prohibit the movement into or within the state of that species.

Although none of the energy grasses being trial grown in North Carolina for biofuels purposes is listed on the state's noxious weed list, some of these grasses have been designated as invasive in certain regions of the United States. Consequently, the practices outlined in this document are a safeguard to limit any unintended consequences from the development of the bioenergy sectors.

At the federal level, both the U.S. Environmental Protection Agency and the U.S. Department of Agriculture (USDA) are focusing increased attention on issues related to energy crops and potential invasiveness concerns. For example, the USDA recently released a technical guide to growing and managing Giant Miscanthus. Included in the document are a number of recommendations to minimize the risk of invasiveness. For more information on the USDA technical guide, see:

<http://plant-materials.nrcs.usda.gov/pubs/NPMtechnotes/npmptn4.pdf>





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