

FREEDOM™ GIANT MISCANTHUS FOR BIOFUEL

From the ground up, it just makes sense:

- Produces up to 25 harvested tons per acre at maturity
- Moisture content at harvest of 10-15%
- Around 8,000 BTU/lb, 16 mm BTU/ton, on dry matter basis
- Reliable feedstock source, with stable quality year-to-year
- Highly efficient at carbon storage
- Low ash content & mineral content—very clean burning

PERENNIAL. COST-EFFECTIVE FEEDSTOCK.

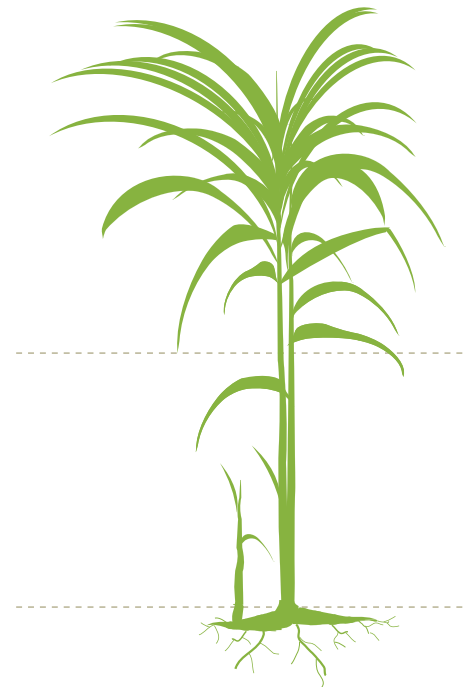
Because FREEDOM is a perennial energy crop, it provides a persistent, steady annual supply of biomass. At full maturity, it yields up to 25 harvested tons per acre at less than 15% moisture content. The stand life is expected to be at least 15-20 years. This provides for unmatched energy yield density for land utilization and transportation logistics.

At harvest, FREEDOM is baled and stored. Because of its low moisture content it can be reduced and sized very efficiently. The straw is easily densified into pellets or briquettes. Freedom requires less energy to reduce, saving on pre-treatment energy costs. And at 10-15% moisture content, drying requirements are significantly reduced or eliminated.

LIQUID FUEL PRODUCTION OF FREEDOM (assuming 100 gallons per ton production)

Gallons produced per acre: 2,500

Acres required per million gallons: 400



COMPOSITION OF FREEDOM

Because FREEDOM goes dormant before harvest, the resulting crop contains more fuel and less mineral content. In the late fall, after a killing frost, the plant is senescing—it begins moving minerals, nutrients and moisture to the roots for storage over the winter. This results in an above-ground harvested crop that contains mostly cellulose. The specific composition of Freedom at harvest, as it would be delivered, is compared to other biomass crops:



Feedstock	Yield tons/acre per year*	Moisture Content at harvest	Gallons per acre/year	Acres required per million gallons
FREEDOM Giant Miscanthus	20-25	10-15%	2,500	400
Giant Miscanthus (Public variety)	10-15	10-15%	1,500	666
Switchgrass	4-10	10-15%	1,000	1,000
Wood (pine on 24 year rotation)	4-8	40-55%	240	4,166 (in 24 year rotation)

**Yield information based on public data*

MINERAL ANALYSIS OF ASH

Silicon Dioxide	53.78 wt%
Aluminum Oxide	2.53 wt%
Titanium Dioxide	0.21 wt%
Iron Oxide	1.60 wt%
Calcium Oxide	25.33 wt%
Magnesium Oxide	3.60 wt%
Potassium Oxide	2.41 wt%
Sodium Oxide	0.17 wt%
Sulfur Trioxide	3.85 wt%
Phosphorous Pentoxide	4.00 wt%
Strontium Oxide	0.08 wt%
Barium Oxide	0.16 wt%
Manganese Dioxide	0.13 wt%
Undetermined	2.15 wt%

FUEL PROPERTIES

Moisture % as harvested	10-15%
BTU/lb as received	6,800-7,500
BTU/lb, dry-matter basis	7,800-8,200
Ash content	2.5-4%
Sulfur %	0.02-0.05
Lignin content	3-5%
Bulk density, bales	10 lb/ft ³
Bulk density, shredded	5 lb/ft ³
Bulk density, pellets	45 lb/ft ³

CHEMICAL COMPOSITION OF FREEDOM

	Moisture Free	As Received
Carbon	47.69 wt%	40.55 wt%
Hydrogen	5.69 wt%	4.81 wt%
Nitrogen	0.23 wt%	0.19 wt%
Oxygen	42.93 wt%	36.30 wt%
Volatile Matter	77.98 wt%	65.93 wt%