Biomass production systems – exploring the options

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Any biomass production system should be

1) environmentally responsible,

2) agronomically feasible and

3) economically viable

Biomass systems might be one or more of the following

1) low input – CRP/residue

2) medium input - dedicated crop

3) hi-input – dedicated crop

Low-input System

Expected output - low

Example: CRP in Western Oklahoma
Soil: Berda loam: Selman Silt loam 1-3%
Fertility: low; fertilizer – none
Rainfall: 20”
Sites: 3 Mixed native; 3 Old World Bluestem
3 harvest dates; 3 years

Results:

Low diversity out yielded high diversity 2:1
- Mean Old World bluestem **2 tons/acre DM**; mixed native **1 ton/acre**
- Annual harvest not conducive to maintaining wildlife cover
- 1,000,000 tons of biomass/year* would require annual harvest of most of Oklahoma’s 1,000,000 acres of CRP
- a single harvest every 3 years (current NRCS policy) would greatly reduce total available biomass from this resource

Best option – leave CRP as is; lease land to hunters; plant more windmills!

Medium-input System

Expected output - moderate
Example: Perennial grass – switchgrass, Miscanthus
Soil: Brewer silt loam
Fertility: high; fertilizer – 0, 100, 200 N, legume
Rainfall: 30-35”
Single harvest; multiple years

Results:
- Switchgrass > Miscanthus
- After 3 years, no observed N fertility affect?
- Yield range **8 - 12 tons/acre DM**
- 1,000,000 tons of biomass/year* would require about 100,000 acres

Switchgrass Gamagrass Miscanthus Sorghum/Sudan

Agronomics comparisons

10 yr yield projection based on GRL data

	Sorghum	Legume	Grass	Total
	Dry tons/acre			
CS	178	0	0	178
SAL (pp)	89	29	0	118
SAL (sb)	89	14	0	103
SPL (alf)	71	42	0	113
CPG	0	0	96	96
CRP (OW blue)	0	0	20	20
CRP (Mixed)	0	0	10	10

CS = continuous sorghum; SAL = Sorghum annual legume; SPL = sorghum perennial legume;
CPG = continuous perennial grass; CRP = Conservation reserve program
pp=pigeon pea; sb=soybean, alf=alfalfa.
pp=pigeon pea; sb=soybean, alf=alfalfa. Yields for pp and sb provided by Dr. Srinivas Rao

Economics?

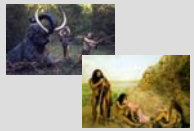
Economics - Based on projections
Currently projected payment of $30 to $50 delivered

Yield range	Production costs $/ac	Cost per ton
6 to 9 tons/ac	$215 to $280	$31 to $36

Does not include transportation costs (50 mile radius?)

Sustainability?

Nitrogen inputs?
Wildlife habitat?
Soil and water loss?
Energy balance?



High-input System

Expected output - high
Example: Sorghum
Soil: Brewer silt loam
Fertility: high; fertilizer – high N
Rainfall: 30-35”
Two harvest schedules; 21 entries; 3 years

Results:
- Mean yields across 3 years and 21 cultivars = **11.8 tons/acre DM**
- Top yielding cultivar in single cut system = **17.8 tons/acre DM**
- Large cultivar by harvest management interaction
- Extent of available cultivar variation increases management flexibility
- annual crop does not limit management options
- value as forage or biofuel feedstock
- rotation with annual or perennial legumes is a viable option
- At maximum yield, acreage to supply 1,000,000 tons of biomass/year* would require less than 60,000 acres

Value-added System

Example red cedar removal for biofuel
- defray removal cost of invasive species
- wildlife habitat improvement
- water conservation/increased flow
- rangeland improvement

Removal of red cedar from North Canadian River

** Estimate of 1,000,000 tons of biomass/year is based on supplying a 70 to 80 million gallon/year ethanol plant*

Use less stuff!

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