Grass pellet bioenergy in the Northeastern USA

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Introduction Grass pellets are a renewable energy supply that combines low technology/small-scale with local production/consumption for a cost effective energy system. There have been significant recent advances in pellet furnace technology and some pellet stove manufacturers now claim their stoves are capable of burning biomass with 5-6% ash content. Cool-season grasses have not been considered acceptable for pelleting and direct combustion in the past due to high ash content. Rain after harvest, however, has been shown to leach significant amounts of potassium and chlorine from grass (Sander, 1997). High yields are possible under lax harvest management (Cherney et al., 2003), producing grass biomass with potassium content as low as 0.5%. Ash content of cool-season grasses is dependent on species, plant maturity, soil type, leaching before and after cutting, loss of high-ash plant parts, and soil contamination. Our objective was to develop a strategy for practical commercial production of relatively low ash cool-season grass biomass.

Materials and methods A series of experiments were conducted. 1) Reed canarygrass (*Phalaris arundinacea* L.) primary growth (3 replicates, 6 m x 30 m plots) was overwintered in 2003 and evaluated the following spring, 2) Reed canarygrass (3 replicates, 6 m x 30 m plots) was evaluated for effects of delayed harvest following cutting on ash contents in 2003, 3) Twenty-one tall fescue (*Festuca arundinacea* L.) varieties (3 replicates, 1.8 m x 6.1 m) were evaluated for ash content during the spring growing season of 2003, and 4) Four fields of mixed cool-season grasses were cut on Aug. 3, 2004, tedded as needed, and harvested Aug. 17, 2004 using commercial hay equipment in 2004 to evaluate ash reduction strategies. All four soils were silt loams. Primary species were timothy (*Phleum pratense* L.), reed canarygrass, tall fescue, alfalfa (*Medicago sativa* L.), tall oatgrass (*Arrhenatherum elatius* L.), and bedstraw (*Galium aparine* L.).

Results 1) Reed canarygrass overwintered in the field in 2004 in New York State became lodged flat with 100% loss of harvestable yield. Ash content of hand-harvested samples in April, 2004 averaged 3.78% ash (0.58 SD). 2) Reed canarygrass (7.15% ash) was cut and left in the field up to 29 days during the summer of 2003, and ash content of the forage declined to 4.19%. 3) There were no significant differences in ash content among 21 tall fescue varieties during the spring of 2003, and ash content declined during spring growth (Figure 1). 4) Three bales (320 kg each) were sampled from each field and forage from all four fields was less than 4% ash (Table 1). This ash value includes any soil contamination due to the use of field-scale harvest equipment and is therefore a practical value. Gross energy values were somewhat higher than barley (Hordeum vulgare L.) straw (4.59% ash, 17.7 MJ/kg) from adjacent fields.

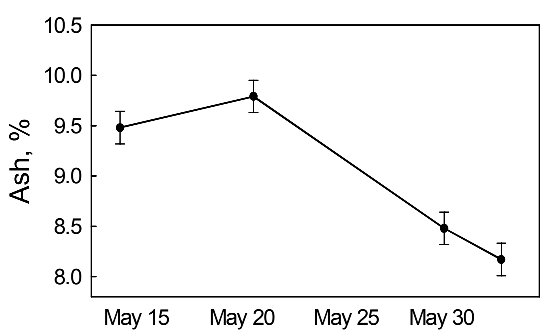

Figure 1 Change in ash content over time for 21 varieties of tall fescue (SED = vertical lines)

Table 1 Ash and gross energy content (DM basis) of mixed grass meadows harvested for pellet fuel

Field	Primary species (% of stand)	Total forage ash content, %	Energy, MJ/kg
A	Timothy (90%)	3.77	21.1
B	Timothy (56%) Alfalfa (32%)	3.84	19.9
C	Bedstraw (42%) Mixed grasses (58%)	3.85	19.6
D	Tall oatgrass (41%) Mixed grasses (59%)	3.78	18.7
	SED	0.30	0.76

Conclusions Mixed species meadows in the Northeastern USA can be managed to produce biomass with less than 4% ash content.

References

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