EVALUATION OF FORAGE SORGHUMS FOR ETHANOL PRODUCTION

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SUMMARY:

Forage and sweet sorghum potential for future ethanol production looks like a possible solution to the energy crisis and production yields show tonnage from 20.6 - 51.1 tons/acre which could produce around 400 gallons of ethanol per acre depending on sugar levels and juice expression.

OBJECTIVE:

To evaluate various types of sorghums for their sugar and biomass production potential for either sugar or cellulosic ethanol production.

MATERIALS and METHODS:

Twenty-six forage type sorghum varieties were planted March 8, 2007 using a John Deere MaxEmerge 7100 planter. Varieties were planted in two row plots (110' long) and four row plots (75' long) on 38" rows. The seeding was rate 10 - 15 seeds per foot.

Fertilizer applied at planting included 440 lbs/acre of 24-6-2 plus micro-mix. The sorghums were hand cut at 4 - 6 inches from the ground and a green weight was recorded. Brix levels were noted on the sweet sorghum varieties.

RESULTS and DISCUSSIONS:

The sorghums grew well reaching heights from 79 to 111 inches. Excessive rains prohibited the last harvest until August 6. Quality and yields were lowered, and several plots were lost due to lodging.

BMR noted in several entries are plants that have the Brown Mid-Rib characteristic. This results in a lower lignin content in the cell walls and the interior of the stalks are brown. This characteristic makes the cell walls break down easier and ethanol extraction should require less effort. The plants are also more palatable to livestock.

The “headless” variety notation is a characteristic that causes the plants not to head out as long as they are planted after the day length is over 12 hours and 15 minutes. If planted before days are this long, then the plants will head out.

BRIX is a reading taken on plant juices and is an indication of percent sugar in the juices. This reading was taken only on the sugar sorghums. BRIX levels ranged from 15.3 - 18 percent sugar.

Overall, yields ranged from 20.6 - 39.9 tons of green plant material per acre with the hybrid silage producing the most in one cutting followed by the sweet sorghums. Cutting the forage sorghums twice verses once did increase yield from 4 - 51 percent depending on the sorghum, but this did allow for the highest tonnage to be produced (around 50 tons/a). See Table 1 for all results.

Prior research indicates that a 17% sugar content and a yield of 25 tons/acre could yield approximately 400 gallons of ethanol per acre depending on the expression of the juices from the plant. Thus with the yields recorded at this demonstration, there is a potential for around 400 gallons ethanol to be produced per acre. With the future leading to cellulosic ethanol production, some research has shown a potential conversion rate of about 90 gallons ethanol per dry ton or possibly up to 900 gallons per acre.

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DISCLAIMER CLAUSE:

Trade names of commercial products used in this report are included only for better understanding and clarity. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the Texas A&M University System is implied. Readers should realize that results from one experiment do not represent conclusive evidence that the same response would occur where conditions vary.

Table 1. Evaluation of forage and sweet sorghums for potential ethanol production. Dr. Leon Clement, Sorghum Partners, Cooperator. Victoria County, Texas, 2007

HYBRID/VARIETY	TYPE	DAYS TO BLOOM	HARVEST PLANT HEIGHT (inches)			BRIX	YIELD (b) Green Wt Tons/Acre			YIELD (b) Green Wt Tons/Acre	% Yield Increase due to two harvests
			Multiple Cuts		One Cutting		Multiple Cuttings			One Cutting	
			May 17	Aug 6	Aug 6	% SUGAR	May 17	Aug 6	Total	Aug 6	
Trudan 8	H ybrid Sudangrass		90	80	(a)		12.8	13.7	26.5	(a)	-
BMR Headless Trudan	Hybr id Sudangrass		51	75	91		12.0	16.5	28.5	27.5	4
Headless Trudan	Hybr id Sudangrass		67	75	89		14.8	16.5	31.3	26.1	17
Headless Sordan	Hybrid (Sorghum X Sudan)		75	89	110		18.3	31.6	49.9	33.0	51
BMR Headless Sordan	Hybrid (Sorghum X Sudan)		57	74	93		16.0	35.8	51.8	37.2	39
Hi Kane II	Hybrid Silage	72			83					20.6	
Sucro Sorgo 405	Hybrid Silage	90			111					39.9	
Della	Sweet Sorghum	70			81	18.0				23.4	
M81-E	Sweet Sorghum	82			101	16.6				38.5	
Dale	Sweet Sorghum	76			81	15.3				27.5	
Top 76-6	Sweet Sorghum	72			87	17.1				28.9	
Theis	Sweet Sorghum	80			79	16.0				28.9	
Tracy	Sweet Sorghum	78			82	16.8				27.5	
Rio	Sweet Sorghum	75			82	17.8				26.1	

(a) Lost due to lodging, rain

(b) An approximate tons per acre dry weight can be obtained by multiplying by 0.25. Prior research indicates that a 17% sugar content and a yield of 25 tons/acre could yield approximately 400 gallons of ethanol per acre depending on the expression of the juices from the plant.