



## Technology for Improving Livestock Production (Patent Pending)

Replicated university studies and in-field strip trials have demonstrated across a wide array of genetic backgrounds that Hi-Gest Hybrid Sudangrass technology offers livestock producers a new option for improving feeding programs. Hi-Gest Hybrid Sudangrass features reduced lignin for improved palatability and digestibility. Cal/West Seeds a world leader in the breeding and development of Hybrid Sudangrass developed Hi-Gest through conventional plant breeding. It was developed utilizing Cal/West's improved Germplasm and the brown midrib (BMR) trait. The gene controlling the BMR trait results in altered chemical composition of the plant; specifically plants that express the BMR gene have lower lignin content in the cell wall (fiber), which improves digestibility, intake, and animal performance. The trait is recognizable in plants that express a brown leaf mid-vein in young leaf tissue and brown coloration in internodes of stems in maturing plants. Hi-Gest offers a new choice for beef, dairy and sheep nutrition in a warm season grass that can be grazed, cut or ensiled.



The Hi-Gest breeding effort began over 17 years ago. Through recurrent cycles of selection focused on improving both male and female inbred lines, Hi-Gest hybrids have been developed that combine high forage yield with the forage quality enhancements.

## Forage Yield

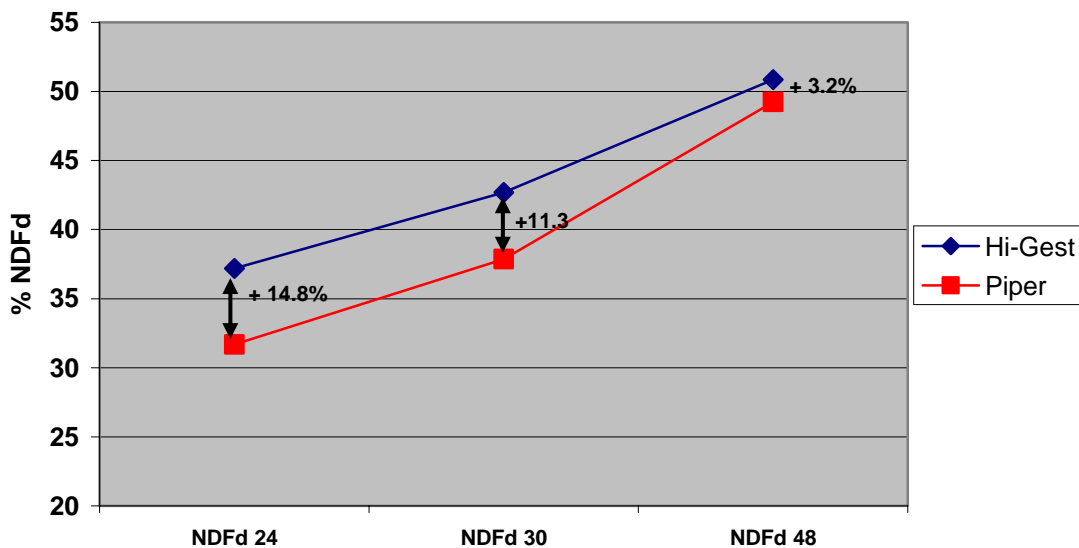
Hi-Gest Sudangrass is broadly adapted. It has been tested in California, Wisconsin, Illinois, Indiana, Pennsylvania, Kentucky, Mississippi, Tennessee, Nebraska, Virginia, and Japan. Productivity is very similar to Piper. In replicated trials averaged across 11 location-years, Hi-Gest has averaged 1.6 % higher than Piper (0.14 Tons/Acre).



## Forage Quality

The fiber digestibility of Hi-Gest Sudangrass is significantly improved compared to Piper because of the lower lignin concentration. The normal lignin biosynthetic pathway has been modified so that Hi-Gest plants have about a 20% reduction in lignin content compared to Piper or other non-BMR sudangrass. Hi-Gest Sudangrass also has lower fiber content compared to Piper as measured by both NDF and ADF. The most significant affect of lower lignin content is the increase in fiber (cell wall) digestibility. Lignin is a non-digestible compound that cross-links the cell wall polysaccharides restricting their access to rumen micro-organisms. The less lignified the cell wall, the more access rumen micro-organisms have to digest cell wall polysaccharides, resulting in a faster rate of digestion. Faster rates of fiber digestion result in higher feed intake by the consuming animal and more efficient feed utilization. Higher intake results in increased productivity of the animal whether it is dairy cattle, beef cattle, or sheep.

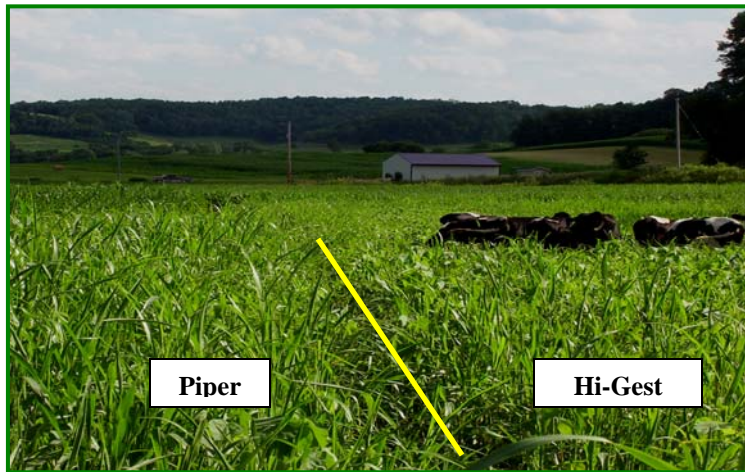
**Fiber Digestibility NDFd of Hi-Gest Compared to Piper in Imperial Valley Sudangrass Hay Trial**



**24, 30, and 48 hour fiber digestibility (NDFd) estimates of Hi-Gest and Piper**

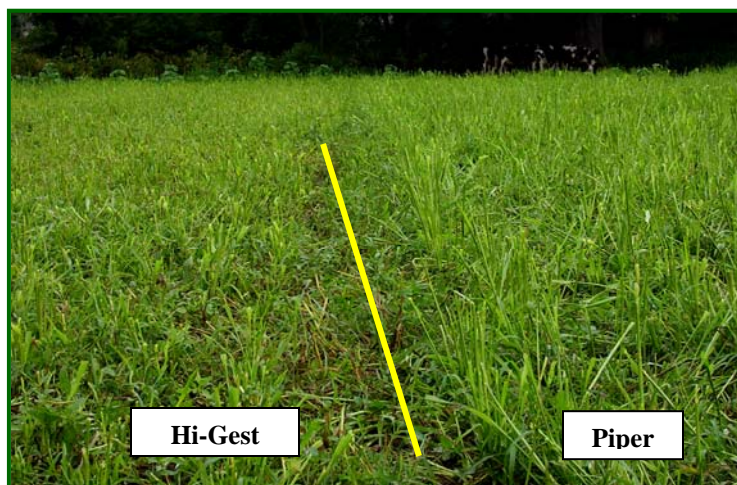
## Animal Preference

Previous research with forage sorghums and sorghum x sudangrass hybrids indicated that the BMR gene was associated with remarkable differences in animal preference. Those results have been duplicated in sudangrass by Hi-Gest. Animals prefer to consume Hi-Gest sudangrass compared to Piper. Animal preference studies using milk and beef cows and sheep in separate grazing experiments in Wisconsin, Kentucky, Illinois, and Mississippi demonstrated that Hi-Gest was grazed preferentially over Piper and some BMR Sorghum x sudangrass hybrids.



In grazing trials, cattle consistently demonstrate a preference for Hi-Gest sudangrass over Piper within the first three days of grazing. The palatability of Hi-Gest is clearly better than Piper.

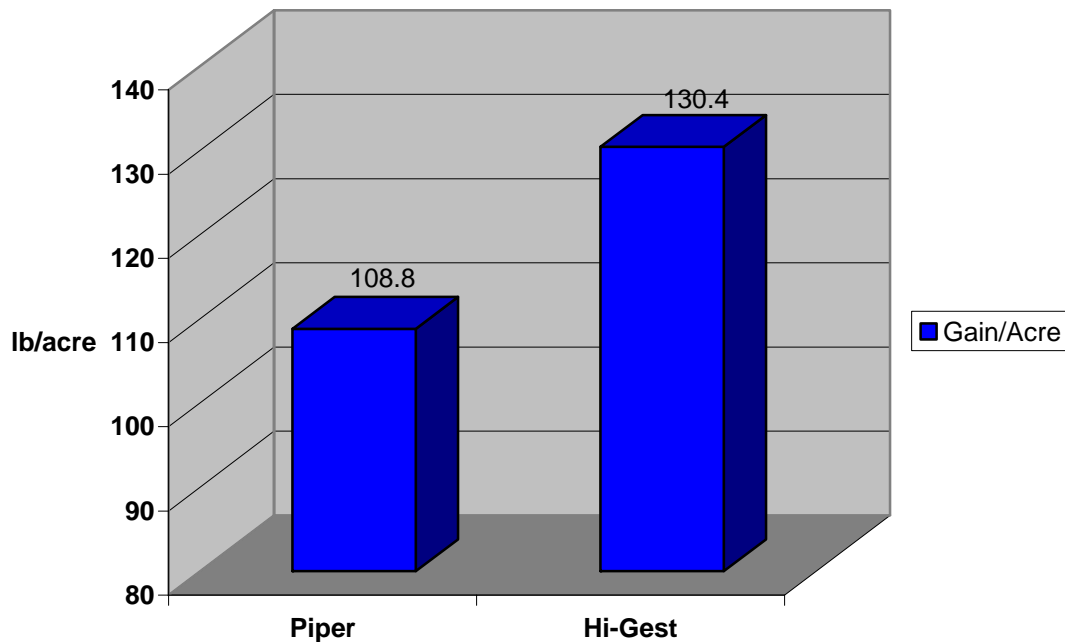
The photo to the right shows how cattle grazed Hi-Gest to a height of 6-inches within 7 days while leaving a residual of 18-inches of Piper stems.



## Beef Cattle

Replicated grazing studies documented a 20% greater weight gain/head/day and 20% greater weight gain per acre for beef cattle grazing Hay King BMR sudangrass compared to Piper. This data was collected from a 50-acre grazing study that utilized intensive rotational grazing and a stocking rate of 2-8 head/acre depending on feed availability.

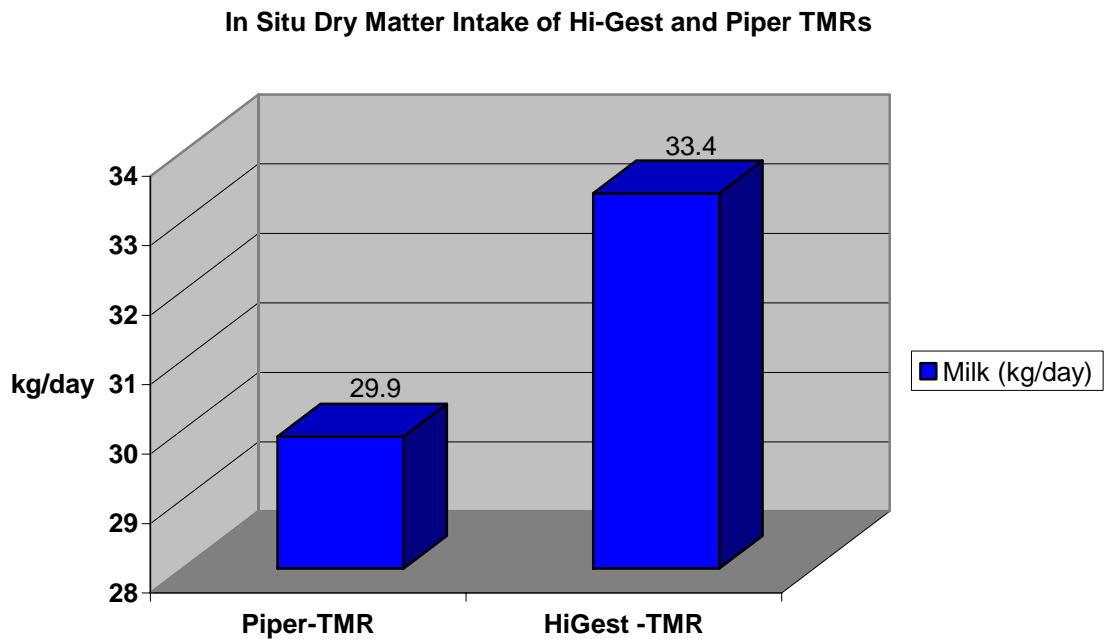
**Beef weight gain per acre under intensive rotational grazing**



## Dairy Cattle

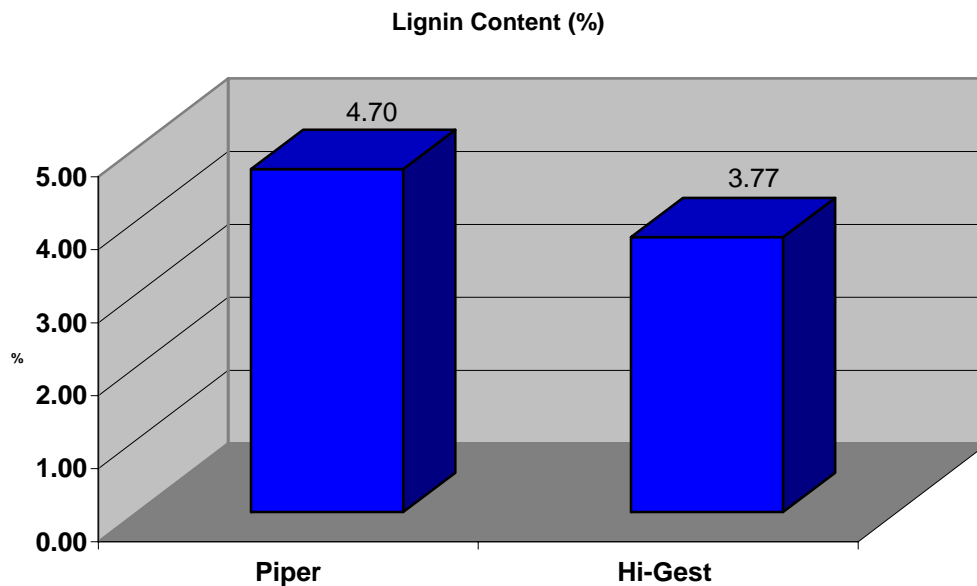
A replicated milk output study was recently completed where sudangrass was included in a Total Mixed Ration (TMR) diet. The rations were comprised of 36% forage, with Piper or Hi-Gest sudangrass at 18% and alfalfa at 18%; the typical diet for a high producing dairy cow uses 36% alfalfa as the forage component. Chemical analysis of the TMR rations indicated that, even at 18% of the diet, the difference in hay quality between Hi-Gest and Piper had a significant affect on overall feed quality. The TMR ration with Hi-Gest was 8% lower in NDF and ADF and 16% lower in lignin compared to the TMR ration with Piper. The difference in feed quality of TMR rations had a significant affect on in situ digestibility, intake, and productivity.

This study documented a 5% increase in feed intake per day and a 12% increase in milk production per head per day when the 18% sudangrass component was Hi-Gest compared to Piper.

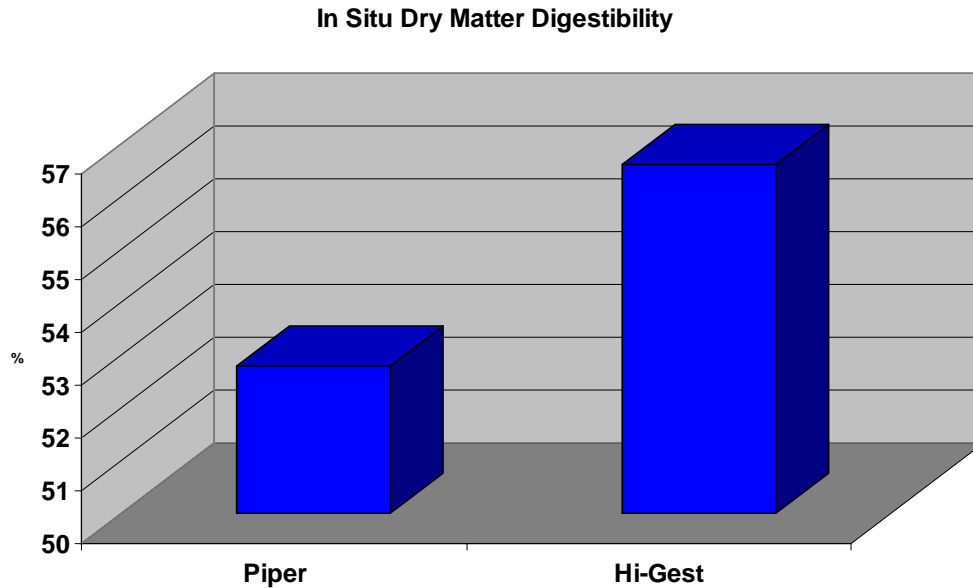


## Sheep

Digestibility of Hi-Gest and Piper sudangrass pelleted hay was compared in a controlled feeding study with total fecal collection bags. Chemical analysis of pelleted hay indicated that pelleted Hi-Gest had approximately 20% lower lignin content compared to pelleted Piper.



Pelleted hay consumed was calculated as the amount of feed offered minus the amount of feed refused. Digestibility was measured as the difference between feed consumed and fecal collection. In Situ dry matter digestibility of the pelleted Hi-Gest was more than 12% higher than the pelleted Piper hay.



## Summary

Hi-Gest® Hybrid Sudangrass is the first commercially available sudangrass with improved forage quality. Hi-Gest utilizes the  $bmr_{12}$  gene which improves forage quality by reducing lignin content thereby increasing fiber digestibility, intake, and animal performance. Total mixed ration (TMR) feed with Hi-Gest was 16% lower in lignin than TMR feed with Piper sudangrass. Digestion kinetic studies on dry hay produced in the Imperial Valley indicate that Hi-Gest is nearly 15% higher in 30-hour fiber digestibility compared to Piper. In Situ digestibility of Hi-Gest TMR was 4% higher than Piper-TMR in trials with dairy cattle and pelleted Hi-Gest was 7% higher than pelleted Piper in sheep trials. Dry matter intake of Hi-Gest-TMR was 5% higher and milk production 12% higher (3.5 kg/day) than Piper-TMR.

Cal/West Seeds acknowledges that these data represent realistic and attainable levels of animal response and production. The reader must recognize that data from both animal performance trials and actual on-farm production are subject to variation from many sources including but not limited to the following: crop variability due to the production environment, ration formulation variability from batch to batch, animal genetic variability both between and within herds or flocks, and animal response to climatic variability (temperature, humidity, day length, etc). For these reasons, data presented in this paper should not be considered as absolute values, but achievable levels of animal response and production.