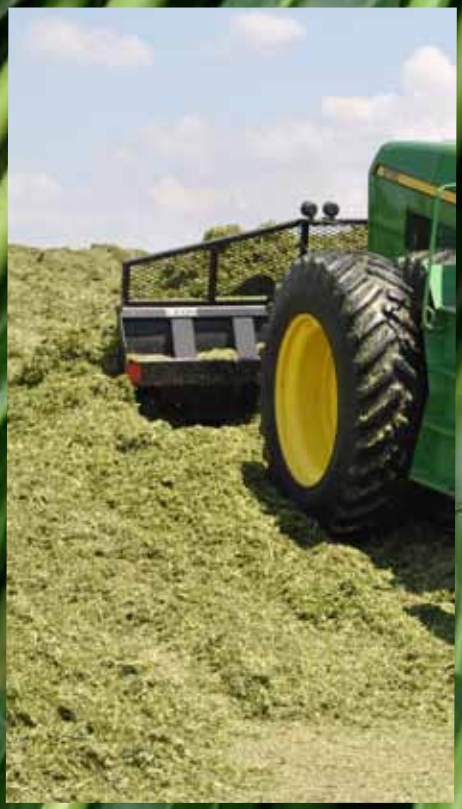
HI-GEST® SUDANGRASS



Crop Overview and Forage Production Guide

A Guide for Producers, Extension Educators and Seed Marketers

HI-GEST® SUDANGRASS

Today's Hi-Gest Sudangrass offers forage growers a unique crop with low input costs, one that is easy to manage and offers multiple harvests each season as pasture, dry hay or silage.

Sixty years of classical plant breeding and the power of the long-known brown midrib trait has moved sudangrass from emergency forage production status to a crop that fits into today's rotations and challenges corn silage for yield and animal performance.

Hi-Gest Sudangrass is a warm season summer annual grass which can be harvested multiple times during the growing season as pasture, hay or silage. Hi-Gest Sudangrass carries the brown midrib trait to reduce lignin in the plant for improved palatability and intake, resulting in enhanced animal performance when fed to dairy and beef cattle or sheep.

Hi-Gest Sudangrass is unique:

- superior forage quality versus hybrid sorghum x sudangrass plus reduced prussic acid risk
- superior forage quality when compared to open pollinated sudangrass
- seasonal tonnage equal to corn silage
- multiple harvests as pasture, hay or silage

Hi-Gest Sudangrass has low input requirements:

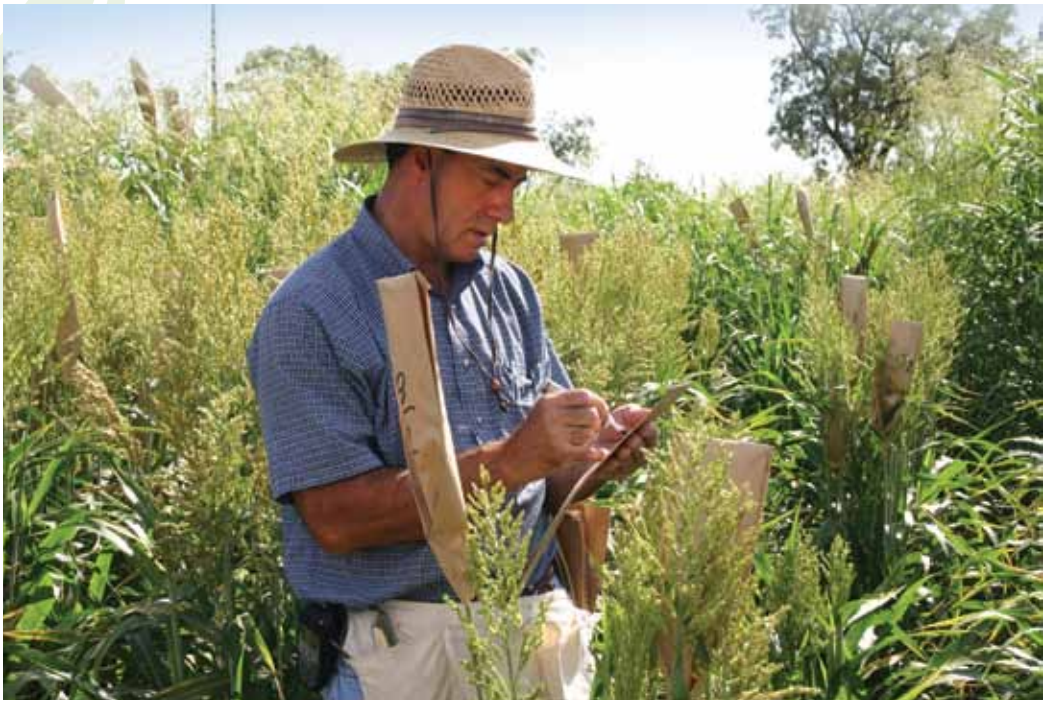
- requires minimum tillage and seed bed preparation
- efficient utilization of applied nitrogen
- tolerates manure applications
- very water-use efficient with few weed or pest concerns

Hi-Gest Sudangrass is easy to manage:

- plant any time from mid-spring through mid-summer
- multiple harvests starting at 24 inches in height
- tolerates heat and moisture stress
- reaches baling moisture 1-2 days sooner than sorghum x sudangrass hybrids

This Crop Overview and Forage Production Guide shares sixty years of agronomic knowledge and experience about this versatile and profitable crop.

We hope you find it to be thought provoking and instrumental in maximizing your summer annual program.



"Hi-Gest Sudangrass are unique products for producers. They set the standard for fast-recovery, tillering and response to intense management," explains Dr. Jon Reich, Executive Vice President Research and Development/Plant Breeder.

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INTRODUCTION

Cal/West Seeds has operated the largest commercial hybrid sudangrass breeding program in the US since the 1950's. Early on the company recognized the potential of improved hybrids and their ability as a warm season summer annual to produce multiple crops of high quality forage. During the mid 1970's, the company released the first commercial hybrid sudangrass for worldwide distribution. Through the years additional hybrids have been released with improved geographic adaptation, pest tolerance, and animal performance.

In 1987, Cal/West Breeder Dr. Jon Reich started a breeding program to introduce the brown midrib trait into hybrid sudangrass to further enhance forage quality and animal utilization. After almost two decades of inbred line development, test crosses and wide spread geographic evaluation, Hi-Gest Sudangrass was commercialized in 2007.

CROP ORIGIN & EMERGENCE AS A MODERN DAY FORAGE CROP

Sorghum is a genus of about twenty species of grasses native to tropical and subtropical regions of Africa and one species native to Mexico. Throughout history, cultivated sorghum has been a major human food source as a feed grain, or livestock forage. The genus includes three distinct types that are used as forages. They are forage sorghum, sudangrass and sorghum x sudangrass hybrids. Each type has very different phenotypes and mode of forage utilization. Forage sorghums have coarse stems and wide leaves similar to corn, limited tillering, very slow to regrow after harvest and are primarily utilized as whole plant silage after producing a grain head. Sudangrass in comparison has very fine stems,

This field of Hi-Gest Sudangrass is being grown in Western France where standability is crucial. Multiple crops will be harvested for hay and pasture during the growing season.

narrow leaf blades, tillers profusely, regrows rapidly after harvest and can be mechanically harvested as hay or grazed by livestock at the vegetative stage. Sorghum x sudangrass hybrids result from crossing a sorghum female with a sudangrass male and generally have characteristic expression and performance between the parent species.

Although sudangrass originated in Africa, it is well adapted to the wide range of climates and soils found in agricultural areas around the world. Sudangrass was introduced into the United States in 1909 as an open pollinated crop. Breeding progress during most of the twentieth century focused on regional adaptation, stress tolerance and foliage disease improvements. The open pollinated variety Piper was released by the University of Wisconsin for national distribution in 1950 and quickly became popular due to its higher yield and low prussic acid content versus other varieties of the day. Other open pollinated varieties followed with Greenleaf as a joint release from Kansas State University and USDA in 1953 and the first hybrid sudangrass named Monarch from Cal/West Seeds in 1970. Other hybrids like Imperial, Monarch V and True followed over the next twenty five years from the Cal/West sudangrass breeding program and are distributed around the globe.

The strongest expression of the brown midrib trait is found in newly emerged leaf veins and stem internodes. As leaves mature, the intensity of the trait fades to the naked eye but the lignin percentage does not increase.

Brown midrib is a visible trait associated with the reduction of lignin in corn, sorghum and pearl millet. Plants with the brown midrib trait have been shown to produce modified and reduced amounts of lignin compared to normal plants.

The brown midrib trait was discovered during the 1930's at Purdue University and early breeding work identified reduced vigor and yield concerns. Two decades of intensive Cal/West breeding starting in 1987 overcame these concerns and results show reduced lignification, reduced cell-wall concentration, increased digestibility and increased voluntary feed intake by ruminant animals without the loss of vigor, yield, or standability in the field. The hybrids carrying the brown midrib trait from Cal/West Seeds are identified as Hi-Gest Sudangrass. The trait has been commercially available in the U.S. and around the globe since 2007.

Hi-Gest®
Low Lignin
Hybrid Sudangrass

The traditional hybrid sudangrass performance features of fast growth, stress tolerance, multiple harvests and low prussic acid have been maintained in Hi-Gest Sudangrass while other features important in today's livestock ration have been enhanced.

Seasonal Yield Side-by-side evaluations show Hi-Gest Sudangrass to have a yield and milk per acre advantage over most sorghum x sudangrass hybrids with the brown midrib, photo period sensitive or dwarf traits.

Faster Drying Hi-Gest Sudangrass with its finer stems and leaves dries more quickly in the field than sorghum x sudangrass hybrids which can reduce field drying time by up to two days.

Enhanced Animal Performance University feeding trials show improved milk per ton feed efficiency and weight gains over Piper sudangrass.

Improved Intake Hi-Gest Sudangrass has a 5% advantage over Piper.

Improved Fiber Digestibility Hi-Gest Sudangrass has a 7% advantage over Piper.

Improved Palatability Hi-Gest Sudangrass is preferred by livestock in side by side grazing trials over Piper and many sorghum x sudangrass hybrids with the brown midrib trait.

Forage Quality Premiums Improved forage quality can earn a premium in today's domestic and international hay market.

MORPHOLOGICAL DESCRIPTION AND GROWTH HABIT

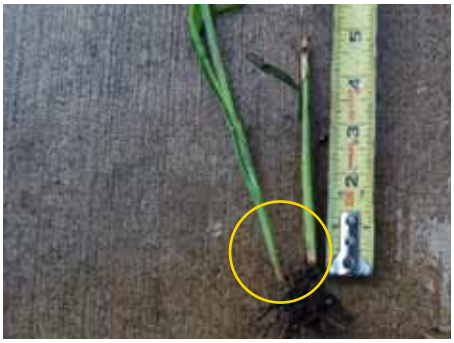
Hi-Gest Sudangrass is a warm season annual grass with the advantage of a C-4 photosynthetic pathway. Optimal stands are obtained when soil temperatures are 65 degrees Fahrenheit or warmer at planting and day time temperatures are above 80 degrees. Combined with adequate soil moisture, emergence is usually completed 5-7 days after planting. Once the seedlings are established growth can average 2-3 inches per day.

For grazing the stand should have a minimum of 18-24 inches plant height before introducing livestock. When used as hay, silage, or late grazing, harvest should begin while the seed head is still in the whorl and not visible. At this stage, plants are usually 5-6 feet in height with fine stems, usually 1/4 to 3/8 inch in diameter depending upon plant population; with long narrow leaves up to 24 inches in length and up to 1.5 inches in width. Hi-Gest Sudangrass will have a central leaf vein that ranges from a light tan to deep brown in color rather than the bright white or opaque vein of open pollinated or non-brown midrib hybrids. Roots are deep and fibrous. Tillering from the ground level crown occurs for each crop, but is most prevalent after first harvest. Hybrid seed averages 34,000 seeds per pound and range in color from tan, brown, mahogany to black.

Hi-Gest Sudangrass seed ranges from tan to black with approximately 34,000 seeds per pound. Seed size is about 30% larger than open pollinated Piper Sudangrass. The seeds per pound is clearly shown for each variety and lot on the seed analysis tags.

Normal stem thickness for Hi-Gest Sudangrass is in the 1/4"-3/8" range. These fine stems contain reduced lignin and express the brown midrib trait while contibuting to improved forage quality without reducing the standability of the crop.

The brown midrib is expressed through the leaf vein to reduce lignin for improved animal intake and performance.



Tillers for multiple crops are initiated from the plant's crown. The energy source for the tillers early growth comes from the sugars and starches stored in the 4-5 inch stubble left from the prior crop.

A fast developing, fibrous root system helps Hi-Gest Sudangrass plants to efficiently absorb nutrients and soil moisture under favorable growing conditions or stress.

GEOGRAPHIC ADAPTATION

Hi-Gest Sudangrass can usually be economically grown for forage where corn, another C-4 crop, can be grown for grain. Areas around the world accumulating a minimum of 2,000 growing degree units (base 50 degrees Fahrenheit) and receiving 20 plus inches of annual rain fall or irrigation can potentially utilize Hi-Gest Sudangrass for forage. Adapted to a wide range of soil types, it tolerates low pH and salinity as well as heat and moisture stress.

CROP UTILIZATION

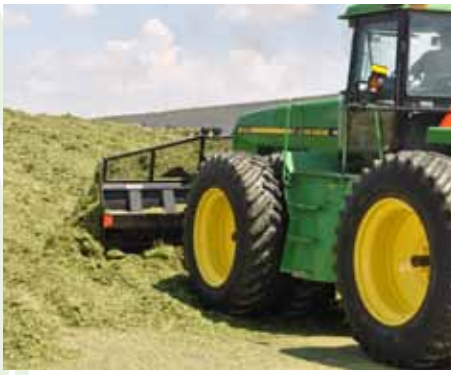
Hi-Gest Sudangrass is a very versatile crop that can be grown as the primary high-value crop, double cropped, used as emergency forage or for other special needs.

Primary High-Value Crop

Hi-Gest Sudangrass with its multiple harvest ability, high seasonal yield and improved forage quality via the brown midrib trait, can be utilized as the season's primary high-value crop. The crop can be fed on the farm or sold as a cash crop hay for domestic or export use.

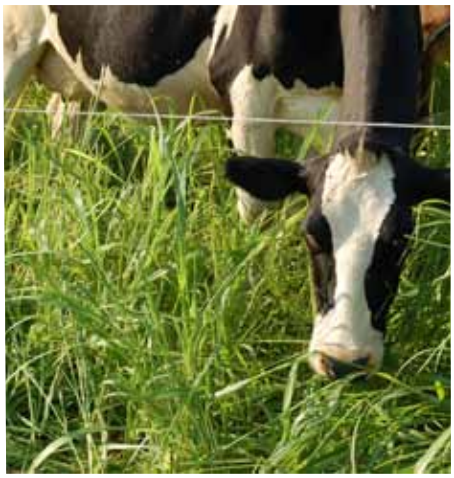
A lush, high yielding crop being cut before heading to maximize milk or beef per acre.

Larger dairies are finding that Hi-Gest Sudangrass for silage is a perfect fit for their operations. Since Hi-Gest Sudangrass is usually planted after corn, these acres can provide a place to apply dairy manure later in the spring and through the growing season following multiple cuts. The multiple cuts can also provide summer-long fermented silage to supplement corn silage short falls. Hi-Gest Sudangrass competes favorably with corn silage for seasonal dry matter yield, though corn silage has more energy. Dairymen and their nutritionists find they can easily balance their ration to accommodate this cost effective forage.



Multiple crops of forage that easily packs and ferments can provide a consistent silage supply on large commercial liverstock operations.

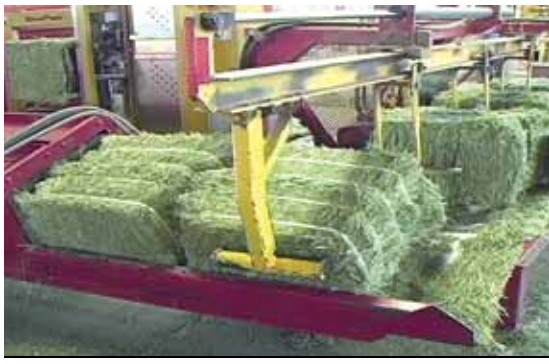
Dairies that seasonally graze use Hi-Gest Sudangrass to supplement permanent pasture during the "summer slump" period to maintain production and preserve stored feed supplies. Hi-Gest Sudangrass can also be used to inter-seed into weak hay fields to improve dry matter yields.



Multiple crops for rotational grazing by dairy, beef or sheep provide producer flexibility.

Arizona and California commercial growers have used sudangrass for hay production and sales to international markets for many years. There are established brokers, compressors and exporters who deal with this specialized business and new growers are urged to consult with them before committing acres. The domestic dairy market is more flexible with opportunities for additional tonnages to move to dairies throughout the region.

Hybrid sudangrass under intensive, irrigated management in the Imperial Valley of California. Seeding rates of 100 to 150 pounds per acre are used to reduce stem size and maximize yield by commercial growers.

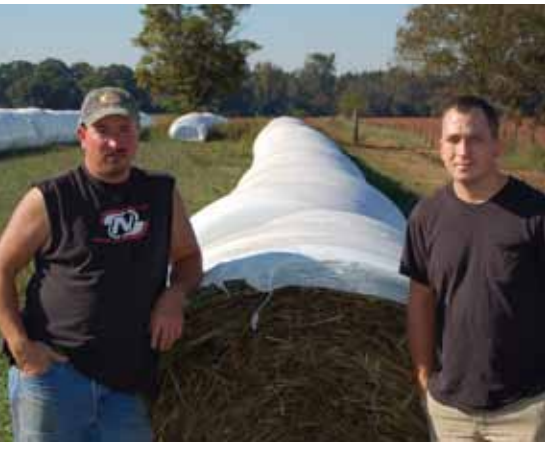


Large square bales of hybrid sudangrass are compressed to fill containers for export to Asia - a premium livestock feed in that part of the world.

Double Cropping

Hi-Gest Sudangrass following winter forages, winter wheat, or early season vegetable crops can produce valuable forage for operations with livestock while providing effective mid and late season weed control. Following winter wheat, it is recommended to remove the straw if possible and no-till as quickly as possible after the spring crops harvest to protect soil moisture. Many growers wait until after the stand is established and look at rainfall expectations before top-dressing nitrogen fertilizers. If multiple harvests are planned, the first crop height and growth progress should be monitored closely.

Hi-Gest Sudangrass following winter wheat. A great way to produce extra forage for on-farm or cash sales.



H-Gest Sudangrass following annual rye grass provides silage for David and Josh Moss's dairy farm near Madison, Georgia. In their area stress tolerance during the long and usually dry summers is very important.

Emergency Forage

Hi-Gest Sudangrass is an excellent choice as an emergency crop when weather delays the timely planting of grain crops or as a rescue crop when perennial hay or pasture have failed. Depending upon planting date and expected length of the growing season, fast-growing Hi-Gest Sudangrass can produce high quality forage for grazing or haying. If the crop is to be used for prevented planting purposes, all federal crop insurance and state regulations must be followed which usually restricts harvest until late fall. In these situations Hi-Gest Sudangrass can provide weed control and wild game protection, as well as soil improvement benefits.

Special Uses

Since Hi-Gest Sudangrass is widely adapted, fast growing, and stress tolerant, it can accommodate a wide range of special uses such as erosion control, improving organic matter levels and remediating soil borne issues such as nematodes.

Whether part of the annual crop plan or as an emergency crop when weather doesn't cooperate, Hi-Gest Sudangrass provides high yields and superior forage quality.

A fast-growing crop that responds to timely harvest management. When chest tall, growers should begin monitoring maturity and prepare for harvest just as the head begins to emerge to maximize tonnage and forage quality.

CROP MANAGEMENT

Temperature Requirements

Hi-Gest Sudangrass should not be seeded into soils below 65 degrees Fahrenheit. Premature plantings may reduce seedling survival and slow early plant development. Competitiveness against early season weeds may also be hindered.

Like other C-4 crops, Hi-Gest Sudangrass grows most efficiently with day and night time temperatures in the 80-90 degree range and adequate moisture. This range maximizes growing degree unit accumulation and plant growth.

Hi-Gest Sudangrass has been effectively grown in desert locations with day time temperatures exceeding 110 degrees Fahrenheit. The plants are efficient users of water under heat stress and leaves may wilt to conserve available moisture.

Hi-Gest Sudangrass is not tolerant to frost at establishment or at season's end. Temperatures below 32 degrees Fahrenheit will injure seedlings and leaf tissue. A freeze of 28 degrees or lower for a four hour duration will usually kill the plant and growers must be aware of nitrate and potential prussic acid (HCN) concerns when this occurs.

Seed Bed Preparation, Row Width and Planters

Hi-Gest Sudangrass can be successfully established into tilled or no-tilled seed beds when best management practices are followed. Seeds should ideally be placed approximately 1-2 inches deep in a moist, firm seed bed. Expect reduced emergence when planting to moisture below a depth of 2.5 to 3.0 inches.

Best results are usually achieved when Hi-Gest Sudangrass is drilled in

6-18 inch narrow rows with a conventional grain or no-till drill. Wider row widths maybe used in low rain fall areas but usually limit forage yield and hamper weed control. Hi-Gest Sudangrass seed averages about 34,000 seeds per pound and most drills accurately meter the seed. Set the desired planting depth and verify in the field. Press wheels help assure firm soil-to-seed contact. Broadcasting Hi-Gest Sudangrass seed via cyclone seeders is usually not successful due to uneven seed placement after the light tillage to cover the seed.

Press wheels, especially for no-till seeding helps produce full, uniform stands, especially when soil moisture may be limited.

With soil temperatures 60˚ degrees and warming, Hi-Gest Sudangrass normally is fully emerged in about a week. Higher soil temperatures and adequate soil moisture will accelerate emergence and days to first harvest.

Seeding Rates

Seeding rates for Hi-Gest Sudangrass depend upon the area grown, moisture availability, fertility levels and the intended crop use. The chart below provides general seeding rates for North America that have been developed over the years by growers and extension personnel. When Hi-Gest Sudangrass is planted as a full season crop, agronomists recommend the higher seeding rates for the geography to maximize season-long yield and forage quality. These rates should serve a starting point for other production areas around the world.

SEEDING RATE CHART

Geographic Area	Annual Rainfall in Inches	Recommended Seeding Rate/Acre 6"- 18" Drilled Rows
Northeastern, Southeast Midwest and MidSouth	30+	30 - 60 + pounds
Eastern Great Plains Minnestoa to East Texas	20 - 30	20 - 30 + pounds
Western Great Plains North Dakota to West Texas	Less than 20	15 - 30 + pounds
	Irrigated	30 - 50 + pounds
Pacific Northwest and InterMountain States	Irrigated Domestic Hay	40 - 60 + pounds
	Irrigated Export Hay	80 - 120 + pounds
California and Southwest States	Irrigated Domestic Hay	50 - 100 + pounds
	Irrigated Export Hay	100 - 150 + pounds

Fertility Requirements

Seasonal soil fertility requirements for Hi-Gest Sudangrass are similar to corn being grown for silage. Both are C-4 grasses and produce similar seasonal dry matter tonnages. A soil pH of 6.0 is adequate and Hi-Gest Sudangrass will use nitrogen, phosphorous, and potassium in about the same 3-1-2 ratio as corn. Hi-Gest Sudangrass is very responsive to fertility and best management practices. Usually micro nutrients are not limiting.

Apply approximately 100 pounds of actual nitrogen per acre preplant and an additional 40 to 60 pounds after each harvest in most production areas. On many livestock farms nitrogen will be applied in the form of dairy manure preplant or top dressed. Experience has shown Hi-Gest Sudangrass to be tolerant of top dressed liquid dairy manure when applied at rates detailed in the farm's nutrient management plan.

Weed Control

Since Hi-Gest Sudangrass is planted after soil temperatures reach 65 degrees Fahrenheit, the first flush of weeds is usually controlled during seed bed preparation. When planted in narrow rows and at the high end of the recommended seeding rate, hybrid sudangrass usually outcompetes most grass and broad leaf weeds and herbicide application isn't required. If an herbicide is needed for broadleaf control, Buctril may be applied post- emergence. However, consult your state recommended list and read all labels closely before applying. Many herbicides labeled for grain or forage sorghum cannot be used for hybrid sudangrass and may cause serious crop loss if applied.

Seed Selection

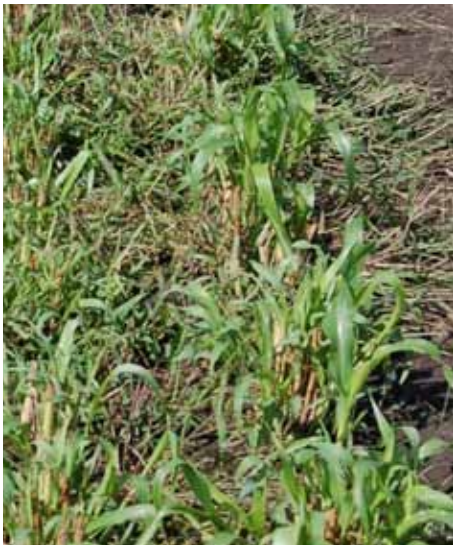
The genus Sorghum includes three distinct types that are used as forage crops. They are sudangrass, forage sorghum and sorghum x sudangrass. When selecting between them, a grower's number one criteria must be which type will fill the forage need the best! The information below points out the features and benefits, as well as shortcomings of the three types.

Hybrid Sudangrass

- Very fine stems and long narrow leaves
- Profuse tillering maximizes yield
- Rapid regrowth after cutting or grazing
- A lower prussic acid risk than hybrid sorghum x sudangrass
- Multiple harvests for intensive grazing, dry hay, or silage
- Established commercial market channels for domestic and export hay sales
- Available as Hi-Gest Sudangrass with brown midrib trait for reduced lignin, improved digestibility, increased intake, and improved animal performance
- Hi-Gest Sudangrass is the premium product that sorghum x sudangrass hybrids are compared to.

Forage Sorghum

- Coarse stems and wide leaves
- Limited tillering
- Normally 6-8 foot tall with a grain head
- Usually one crop as silage and very little regrowth
- Yield and silage quality compete favorably with corn silage with reduced inputs
- Not well adapted as dry hay or grazing
- Most popular as an irrigated silage crop in the western United States



The two photos above are from the same location. They contrast the recovery and tillering response of Hi-Gest Sudangrass and hybrid sorghum x sudangass. Hi-Gest Sudangrass is on the left.

Hybrid Sorghum x Sudangrass

- Moderately coarse stems and wide leaves with a harvest height similar to hybrid sudangrass
- Less tillering then hybrid sudangrass
- Moderately slow regrowth after harvest
- Primarily used for pasture but can be harvested as hay or silage. Field drying may be slower than hybrid sudangrass
- Handles extreme stress well
- Available as hybrids with or without the brown midrib trait. Also available with photo period sensitive and dwarf traits

Rapid recovery after harvest and profuse tillering are characteristics associated with Hi-Gest Sundangrass. Note the 5 inch stubble left at harvest.

Disease and Insects

Leaf blights and rust may affect hybrid sudangrass. Most hybrids have resistance and if infection does occur it is usually at the tail end of the growing season with limited economic loss.

The most common pest of Hi-Gest Sudangrass is the greenbug aphid, which also is a pest of grain sorghum. The insects inject a toxin into sudangrass plants which is a vector for dwarf mosaic virus and can stunt growth. Most hybrids carry genetic resistance, but under severe pressure an insecticide application may be required. Most soil insects aren't a serious concern for Hi-Gest Sudangrass. Hi-Gest Sudangrass like all other crops can be damaged by army worms, grasshoppers and other large foliage feeding insects when locally present.

HARVEST TIMING AND CUTTING MANAGEMENT

When Hi-Gest Sudangrass is seeded into a 65 degree Fahrenheit and warming seed bed, first harvest at the late vegetative stage can be expected in 50-60 days. If soil temperatures are 75 degrees Fahrenheit or warmer with adequate soil moisture, days to late vegetative harvest can be reduced to 40-50 days. Midsummer soil temperatures and adequate soil moisture can further reduce recommended harvest maturity to 30-40 days. In each of the three scenarios, the minimum height for grazing is achieved much sooner.

The number of harvests during the growing season is dependent upon planting date, latitude, soil moisture, fertility and maturity stage at harvest. In the Pacific Northwest and InterMountain irrigated valleys, and the upper Midwest and Northeastern states when grown as a full-season crop, growers should normally expect 2-3 crops before frost. Growers across the central and eastern Corn Belt, mid South and Southeast growers should manage for 3-4 crops before frost with full-season plantings and 2-3 if double cropping. Commercial hay growers in California and the Southwest can normally expect 3 or 4 crops plus pasturing the fall regrowth.

An average cutting of Hi-Gest Sudangrass harvested at the late boot stage during the growing season, normally ranges from 1.5 to 3.0 tons of dry matter per acre (6-12 tons per acre green weight). Seasonal yields can range from 3.0 to 7.0 tons of dry matter per acre (12-28 tons per acre green weight) depending upon number of cuts, location and growing environment.

When grazing, do not over graze. However, undergrazing of too many acres with too few livestock may require a clip-back to restore uniformity for the next crop.

For optimum forage quality, Hi-Gest Sudangrass should be harvested prior to seed head emergence in the late vegetative stage. Plant heights are usually 5-6 feet tall at this stage. For grazing harvest, livestock can enter fields when plants are a minimum of 18-24 inches in height up to the late vegetative stage. Dry matter yield will continue to increase after heading but forage quality will decline rapidly. Harvest delays will potentially reduce the total number of multiple harvests for the season.

When Hi-Gest Sudangrass is waist to chest high, the seed head is already developing in the whorl. Plan to graze or harvest before it emerges to maximize forage quality.

A stubble height of 4 inches is recommended to promote vigorous regrowth and profuse tillering of the next crop. Hi-Gest Sudangrass should never be cut or grazed below a four inch stubble height to ensure adequate plant reserves for quick recovery after harvest. Plants have tolerance to wheel traffic but when making dry hay from the prior crop, growers are encouraged to remove the drying crop as quickly as possible to avoid injury to the next crop's growth.

Set swathers to leave a minimum of 4 to 5 inches of stubble after cutting. Also, don't over-graze. The energy for regrowth after harvest is stored in this remaining stubble.

MANAGEMENT CAUTIONS

While livestock losses from nitrate and prussic acid rarely occur, growers must be aware of this risk and be proactive with their cropping and livestock management decisions to avoid loss when growing any kind of sorghum.

Nitrate Poisoning

When plant growth is slowed or stopped by stress conditions such as low soil moisture, heat stress, cold cloudy weather, frost, etc., nitrate can accumulate in the plant, which is toxic to many classes of livestock. Plants normally take up nitrogen from the soil in the nitrate form at about the same rate as it is converted to proteins by the plant. However, when plant growth stalls or is stopped, nitrate levels can increase significantly. Nitrate levels are usually the highest in the stalks and lower leaves and are usually higher in young plants and decrease as the plants mature. This is the reason for the general recommendation to not turn livestock into sudangrass pastures that have less than 18 inches and preferably 24 inches of growth. Usually, once the stress is passed and normal growth resumes, the nitrate accumulation disappears.

For growers who have experienced plant growth stresses or frost and are concerned about potential nitrate poisoning, laboratory tests are available for the growing crop or harvested forage.

The following harvest and forage handling tips along with specific recommendations from your states Extension Service and veterinarian can help reduce the nitrate risk:

- Postpone harvest as long as possible after the stress to allow additional plant conversion of the accumulated nitrates.

- Harvest as silage or hay verses grazing. Fermentation during ensiling helps dissipate the nitrate.
- Leave more of the lower stalk and leaves in the field.
- Blend forage with nitrate concerns with grains and other forages in the TMR.
- **When in doubt, test**.

Prussic Acid Poisoning

As with nitrate accumulations, some stress usually triggers hydrocyanic or prussic acid (HCN) increase. This stress in hybrid sudangrass is usually caused by a frost for most areas of the United States. Prussic acid can cause death in livestock by interfering with the oxygen transferring ability of the red blood cells, causing animals to suffocate. Symptoms usually occur quickly after consuming forage with high levels of prussic acid and death can occur within minutes of exhibiting the first symptoms. Ask your veterinarian for a prussic acid fact sheet to detail these symptoms for your livestock species. Low levels of prussic acid can reduce milk production and animal growth.

Most problems with prussic acid, like nitrate poisoning, can be avoided with proper management of the hybrid sudangrass crop and livestock.

- During the growing season do not graze hybrid sudangrass until new growth is at least 18-24 inches tall.
- Limit top dress nitrogen applica tions to less than 60-80 pounds of actual N. Split applications are the best choice.
- Do not graze frost damaged sorghums until all regrowth has stopped and the stalk and leaves are dried for 7 to 10 days. Sheep are more tolerant than cattle. The best approach for frost damaged sorghums is to harvest as silage or hay to salvage maximum dry matter and have the prussic acid dissipated during the fermentation process or during storage.
- When selecting a sorghum for grazing or pasture at any stage during the growing season use a hybrid sudangrass to reduce prussic acid poisoning risk.
- **When in doubt, test**.

MANAGEMENT KEYS REVIEWED

- ***Soil temperatures at planting should be at least 65° fahrenheit and warming***
- ***An ideal planting depth is 1-2 inches into a firm seed bed***
- ***Select a sorghum type that meets your forage utilization need***
- ***Choose a seeding rate that will maximize yield for your geography and management***
- ***Never graze or harvest if growth is less than 18 to 24 inches***
- ***Always graze or harvest by the late vegetative stage before seed heads are visible to maximize forage quality and num ber of seasonal harvests***
- ***The minimum harvest stubble height is 4 inches***
- ***Hi-Gest Sudangrass responds to aggressive, best manage ment practices***
- ***Monitor nitrate and prussic poisoning risk***

ON FARM UTILIZATION

Placing a value on the seasonal yield of Hi-Gest Sudangrass forage is much more complicated than the bushels or pounds per acre of corn, soybeans, cereals and other commodity crops. On most livestock operations value is created when the forage is available in the proper quantity and the right time to maintain peak milk production and steady weight gain. Most forage is utilized on the farm or locally, except for the Hi-Gest Sudangrass grown in the southwestern United States for the export hay market.

Productive, high-yielding Hi-Gest Sudangrass fits the highly-mechanized modern liverstock operation.

Yield

Seasonal yield may range from 1.5 to 7.0 tons of dry matter per acre depending upon planting date, latitude, available moisture, fertility and maturity state at harvest. For most of the United States with three seasonal cuts harvested as hay or silage an average yield would be in the 4.0 to 6.0 tons per acre dry matter range. This range of yields puts hybrid sudangrass on par with corn silage when compared on a dry matter basis plus the advantage of a multiple harvest supply stream.

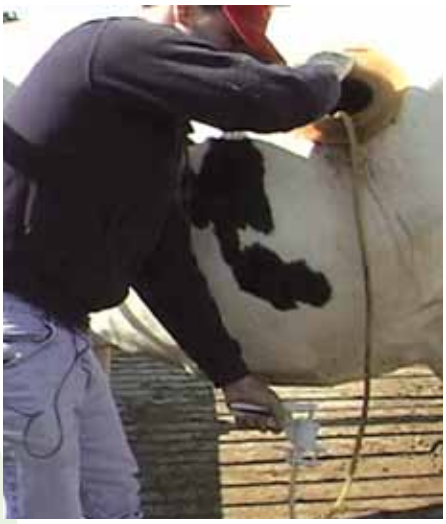
Hi-Gest Sudangrass planted by midsummer after winter wheat harvested for grain can produce 2 to 3 tons of dry matter during late summer and into mid fall. Growers can use this tactic to maximize grain sales while producing forage for the livestock operation on their farm.

The total seasonal yield of Hi-Gest Sudangrass usually is higher than open pollinated sudangrass, conventional or brown midrib, photo period sensitive or dwarf hybrid sorghum x sudangrass varieties. The Hi-Gest Sudangrass also has the advantage of lower prussic acid risk. Irrigated forage sorghum with a grain head usually out yields both hybrid sudangrass and hybrid sorghum x sudangrass on a dry matter basis.

Hi-Gest Sudangrass is well adapted to baleage storage situations. Packs tightly and ferments quickly.

Forage Quality

When compared to corn silage, Hi-Gest Sudangrass compares favorably for dry matter yield and forage quality. Generally, Hi-Gest Sudangrass would be higher in crude protein, slightly lower for energy due to lack of grain, and comparable to corn silage for fiber digestibility. Calcium, phosphorus, and potassium are higher than corn silage. Dairy nutritionists have found that rations containing Hi-Gest Sudangrass forage can be easily balanced for lactating cows, dry dairy cows, calves and heifers with an accurate feed test and sufficient quantity for an extended feeding period.



Hi-Gest Sudangrass has been a feed source in several public and private feeding trials around the US since 1997. Each has confirmed the reduced lignin, improved animal performance and intake; and verified the early-on improved animal performance observations. Go to www.hi-gest.com for summaries of these trials for dairy, beef and sheep.

SUMMARY

Hi-Gest Sudangrass offers producers an opportunity to produce more and higher quality forage from fewer acres for their livestock operation. The crop offers wide agronomic and management flexibility to fit almost every geographic area, harvest system, livestock type and special cropping needs around the world. Hi-Gest Sudangrass is not the open pollinated Piper or the SUDAX hybrid sorghum x sudangrass used for emergency forage back in the 1950s. It is a new full season annual crop that can compete with corn silage for yield, deliver improved animal performance and complement the bottom line!

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The information and recommendations contained in this brochure are based on average performance of Hi-Gest Sudangrass over a wide range of growing conditions, climate, soil types and management systems. Actual performance may be adversely affected by extreme conditions or grower negligence.

Hi-Gest® Sudangrass. A pathway to improved animal nutrition.

Hi-Gest Sudangrass offers livestock and hay producers a summer annual with superior forage quality and management flexibility.

Hi-Gest Sudangrass has reduced lignin which improves animal intake and fiber digestibility for enhanced animal performance. Hi-Gest Sudangrass is the result of sixty years of plant breeding, inbred line development and university and on-farm evaluation.

Beef Cattle – Grazing studies document a 20% greater weight gain per day and a 20% greater weight gain per acre versus Piper sudangrass.

Dairy Cattle – A milk output study documented a 5% increase in feed intake and a 12% milk gain per day with Hi-Gest Sudangrass in a TMR ration.

Beef and Dairy – Grazing trials all across the area of adaptation demonstrate Hi-Gest Sudangrass is preferentially grazed over Piper sudangrass and many brown midrib sorghum x sudangrass hybrids.

Hi-Gest Sudangrass is a fast growing summer annual with multiple harvest flexibility that competes with corn silage for yield and quality. It features aggressive tillering, fine stems, leafiness, rapid recovery after cutting or grazing, and is adapted to areas where sorghum x sudangrass hybrids or open pollinated sudangrass are grown. It's well suited for direct pasture, baled hay, green chop and silage.

Put Hi-Gest Sudangrass in your summer annual cropping plan. Visit our website for complete Hi-Gest Sudangrass information. Do it today.

www.hi-gest.com

CAL/WEST Seeds

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Low Lignin
Hybrid Sudangrass