

Grain Sorghum Production guidelines

CROP HANDBOOK

Grain Sorghum

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Statistic

TOP SORGHUM PRODUCERS - 2008

Country	(Millions of tons)		
Others	13		
United States	12		
Nigeria	9.3		
India	7.9		
Mexico	6.6		
Sudan	3.9		
Australia	3.1		
Argentina	2.9		
China	2.5		
Ethiopia	2.3		
Brazil	2		
World Total	65.5		

Source: UN Food & Agriculture Organisation (FAO)

ORGHUM PRODUCTION BY COUNTRY		
ountry	(Values in Metric Tons)	
nited States	10,338,000	
thers	6,902,000	
exico	6,900,000	
igeria	6,500,000	
udan	5,500,000	
dia	5,500,000	
rgentina	3,900,000	
thiopia	3,700,000	
hina	3,200,000	
ustralia	2,200,000	
razil	2,000,000	
urkina	1,800,000	
ali	1,300,000	This month (M Department of
iger	1,300,000	that the World
ameroon	1,150,000	will be 63.99 n
had	900,000	Sorghum Prode tons. This year
/ORLD	63,090,000	could represen a 3.78% in sore

ted States DA) estimates ction 2016/2017 ۱s.

as 61.66 million million tons .33 million tons or around the globe.

Production Guidelines

GRAIN SORGHUM					
OPERATIONS	AGRONOMICS AND TIMING				
Crop rotation	After winter wheat, sugar beet or soybeans. Must be turned every 2 years.				
Primary tillage	Minimum tillage (max 15 cm) - Plough - Chisel - Heavy cultivator Or sod seeding				
Secondary tillage	Harrows, spike harrows, light field cultivators				
Planting (Northern Hemisphere)					
Timing	From end of April to end of May (soil temp. 15-18°C)				
Population at harvest	From 15 to 30 plants/square meter depending on annual rainfall				
Distance between rows	45-75 cm				
Distance between plants	6 or 3 cm				
Depth	2-2.5 cm				
Fertilizying (guidelines, to be adjusted	d on soil analysis base)				
Nitrogen (N kg/ha)	60 at planting and 60 top fertilization				
Phosphorus (P ₂ 0 ₅ kg/ha)	50-70 at planting or 70-90 before planting				
Potash (K ₂ 0 kg/ha)	0 in good soils 60 in soils with P< 120 ppm				
Weed control					
Minimum tillage	Before emergence and Post emergence: hoeing				
Sod seeding	Glyphosate before sowing: post emergence as usual				
Pest control	Spraying				
Harvesting	Content of moisture in grains about 14-15%				

DROPLET SIZES FOR DIFFERENT CHEMICALS

ASABE STANDARD S-572.1 DROPLET SPECTRUM CATEGORIES ^{1,2}	CONTACT INSECTICIDE AND FUNGICIDE	SYSTEMIC INSECTICIDE AND FUNGICIDE	CONTACT FOLIAR HERBICIDE	SYSTEMIC FOLIAR HERBICIDE	SOIL-APPLIED HERBICIDE	INCORPORATED SOIL-APPLIED HERBICIDE	RELATIVE SIZE	COMPARATIVE SIZE	ATOMIZATION
VERY FINE (VF) RED							•••••	Point of Needle (25 microns)	Fog
FINE (F) ORANGE	\checkmark						••••	Human Hair (100 microns)	Fine mist
MEDIUM (M) YELLOW	\checkmark	\checkmark	\checkmark	\checkmark			•••	Sewing Thread (150 microns)	Fine Drizzle
COARSE (C) BLUE		\checkmark		\checkmark	\checkmark	\checkmark	•••	Stample (420 microns)	Light Rain
VERY COARSE (VC) GREEN				\checkmark	\checkmark	\checkmark		Stample (420 microns)	Light Rain
EXTREMLY COARSE (XC) WHITE						\checkmark		#2 Pencil Lead (2,000 microns)	Thunderstorm

Droplet sizes are suggestions for each pesticide. ¹ Based on VD0.5, the Volume Master Diameter (VMD) designation. Source: Kansas City University. ² Revision of Stantard S-572.1 also includes extra-fine and ultra-coarse categories for non agricultural users. This droplet guide summarizes suggested droplet sizes for a variety of chemicals, based on the ASABE standard droplet spectrum categories.

Crop Rotation - Crop Development

WHY IS IT IMPORTANT?

• In rotation, sorghum takes the place of corn: so ideally it follows a legume (soybean, alfalfa, peas) and is followed by sugarbeet, tomato, potatoes and other crops. When wheat follows sorghum, a lack of Nitrogen can happen and some allelopathic effect is likely: therefore, wheat after sorghum is not suggested. Usually planting dates are later than for corn.

Sorghum is a good alternative to corn where availability of water is not so abundant and general conditions are adverse. Nevertheless, the crop is demanding concerning temperature: minimum soil T for germination is 10°C and for growth is 16°C, optimum is 27-28°C. It is important for high yields that in July minimum be 21°C. Like any other crop, grain sorghum will respond to optimum growing conditions and proper timing of management inputs for maximum yields. Understanding how the grain sorghum plant develops is critical for understanding the crop's needs and planning management inputs for maximum yields.

- As a Rule, Crop Rotation practices improve the performances of crops.
- By varying crops in the same season, farmers can spread equipment demand throughout the season, reducing costs while increasing utilization.
- Exploitation of soil fertility is improved, as different crops roots explore different layers of soil and use different nutrients.
- Structure of soils improves, because residues from crop roots stay at different depths and residues are also different.
- Management of weeds, pests, and diseases get easier because different crops have different pests.
- Sorghum, when in rotation with soybeans, wheat and sugar beet allows for better control of grasses weeds.

A SYSTEM BASED ON AGRONOMY



RESIDUE MANAGEMENT



CROP PROTECTION



BETTER CROPS, HIGHER YIELDS



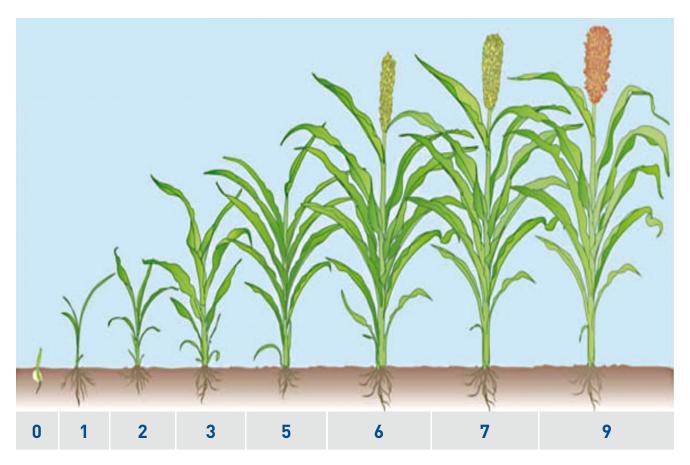
PLANTING & SEEDING



SEEDBED TILLAGE



GRAIN SORGHUM PLANT DEVELOPMENT



GROWTH STAGES

 Grain sorghum has three distinct stages of development after emergence – seedling development, panicle initiation and reproduction. The time required for the plant to go through each stage is dependent upon hybrid maturity and temperatures encountered during the growing season. In warm conditions, the plant will spend approximately 35 days in each stage. Grain sorghum planted early in the season when temperatures are still cool will progress through the stages more slowly than grain sorghum planted later in the season when temperatures are warmer.

GROWTH STAGE I- SEEDLING DEVELOPMENT

• The seedling development stage is characterized by vegetative growth. The plant develops leaves and tillers, which ultimately support grain formation and growth. The duration of the Growth Stage I is largely dependent on air temperature and the hybrid maturity. **The more leaves formed by the plant, the longer maturity.** Early maturity hybrids typically produce 15 leaves per plant, while medium and late maturity hybrids produce 17 and 19 leaves each. The plant can tolerate stress from drought, hail and freezing temperatures in Growth Stage I with little negative effect on grain yields. Sunny days with temperatures below 18°C promote tillering when the plants are in the 4- to 6-leaf stage. Low plant densities promote tillering. Panicles of tillers are often smaller and flower later than those of the main stem. Tillers formed can compensate somewhat for low plant populations.

GROWTH STAGE II - PANICLE INITIATION

- The stage begins with panicle initiation and continues to flowering. This growth stage is the period when reproductive structures of the panicle form and the maximum number of seeds per panicle is set. During this period, plants are especially sensitive to any type of stress such as temperature extremes, nutrient deficiencies or water deficits or excess. any of which may reduce the potential seed numbers. It is considered the most critical period for grain production since seed number per plant accounts for 70 percent of the grain yield. The rate of water uptake increases rapidly during this period. If the crop is irrigated, it is important that the crop not be allowed to stress at the beginning of this stage when the potential number of seeds per plant is being set.
- At the boot stage (5) all leaves are now fully expanded, providing maximum light interception. The head has now developed to nearly full size and is enclosed in the flag leaf sheath. Peduncle elongation is beginning and will result in exertion of the head from the flag leaf sheath. Potential head size has been determined. **Moisture stress at the boot stage may prevent the head from exerting completely from the flag leaf sheath, which may cause harvest difficulty.** The crop will respond favorably to irrigation at this stage. Following the boot stage, the peduncle grows rapidly extending the head through the flag leaf sheath.

GROWTH STAGE III- REPRODUCTION

• The final growth stage begins with flowering and continues until physiological maturity. Flowering begins when yellow anthers appear at the tip of the head five to seven days after head exertion. Over the next four to nine days, anther development progresses down the head. The plant is considered at half bloom when flowering has progressed half way down the head. Many grain sorghum hybrids grown in warm regions require approximately 75 days from emergence for the plant to reach half bloom. The most critical time for water begins about one week before head emergence or the boot stage and continues through two weeks past flowering.

> from "Grain sorghum production handbook", University of Arkansas (modified)



Tillage

PRIMARY AND SECONDARY

- Grain sorghum needs a warm, moist soil well supplied with air and fine enough to provide good seed-soil contact for rapid germination.
- A number of different tillage and planting systems can be used to get these conditions.
- These systems may involve primary or secondary tillage or no tillage operations prior to planting.
- An ideal seedbed should accomplish these goals:
 - Control weeds
 - Conserve moisture
 - Preserve or improve tilth

- Control wind and water erosion
- Be suitable for planting and cultivating with available equipment. A good seed bed is important, because plant roots require water and oxygen from the soil roots pore space for sprouting.
- The right soil-air-water balance helps in limiting plant stress during drought periods and enables the plant to fully explore the soil profile for nutrients. Plants with a good soil-air-water balance are able to use water efficiently reducing watering needs and grow strong roots for good anchorage.

WATER MANAGEMENT THROU TILLAGE

Sorghum is a good alternative to corn in areas where rainfall is reduced during the spring and summer. Although sorghum requires almost the same amounts of water and nutrients as corn, the plants can better endure periods of stress also in the flowering phases. Particular physiologic and morphologic proprieties allow for plants to interrupt their growth during drought periods, and re-start quickly when water is available again.

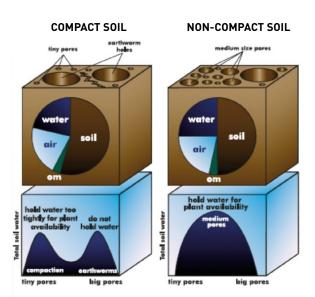
We can not manage nor water neither texture of soil. But we can manage tillage.

PONDING

MISCONCEPTION: PONDING IS A RESULT OF TOO MUCH RAINFALL

Not necessarily. Usually ponding is a result of poorly managed soil. When soil is compacted, it cannot absorb water. Compacted soil is like a sponge that is squeezed tight: there is no space for air and water. To make matters worse, compacted soil forms an impenetrable layer that prevents excess water from draining through. The result is ponding.





Planting

Producers have a broad choice of hybrids.

In temperate climates, better result are obtained planting middle late hybrids (120-125 days) which deliver a full maturation by the end of September. Resistance to birds' damage is a very important character. Digestibility of grains is a very important parameter, which is influenced by tannin content in kernels. Today several hybrids are available with low tannin content and digestibility comparable with corn. At the end, better choice would be to plant hybrids of 400- 500 maturity class, with low content in tannin, white kernels, resistant to lodging. Hybrid must be suitable for combine, and this means that the peduncle supporting the head must be long enough to allow for combining. Grain sorghum hybrid selection is important. Several companies have grain sorghum hybrids that have been tested multiple years in different regions and have performed well.

Most important factors when choosing an hybrid are:

- maturity group
- productivity
- grain quality
- resistance to bird damages
- suitability for easy combining

• Concerning maturity group, hybrids are classified as very early (100 days from planting to physiological maturity), early (105 days), middle (about 120 days), late (130-140 days).

The length of the cycle from planting to maturity can be better estimated in the same way as for corn, with the sum of temperatures or Days Degrees System: daily temperatures to be summed are calculated with the formula:

Day degrees = $\sum (Tmax^{\circ}C+Tmin)/2)-10$

- Productivity depends on maturity group: later hybrids are more productive than early ones.
- Quality of grains improves as tannin content decreases.
- As a rule, planting starts when soil temperature reaches 12°C. In temperate zones, it means a period between the end of April and middle May. Grain sorghum is not nearly as cold-tolerant as corn, but relatively early planting is needed to maximize yields and reduce impacts of insects later in the season. Planting is usual performed with precision planters, suggested depth is between 3 (heavy soils) and 5 centimetres (very light soils). Interrow spacing from 30 to 75 centimetres, more frequently 50 centimetres: the trend is toward narrower spacings. Rate of seeds depends on availability of moisture during the cycle and size of plants: as a rule, later hybrids are larger than earlier.

GUIDELINES	
Moist conditions, late hybrid	30 seeds per square meter
Dry conditions, late hybrid	15 seeds per square meter
Moist conditions, early hybrid	40 seeds per square meter
Dry conditions, early hybrid	25 seeds per square meter

Because of the differences in 1000 seeds weight, seeds rates expressed in kg per hectare are as follows:

SEEDS RATE, PER SQUARE METER	WEIGHT OF 1000 SEEDS, GRAMS				
	20	25	30		
10	3.3	4.2	5		
20	6.6	8.4	10		
30	9.9	12.6	15		
40	13.2	16.8	20		

UNIFORMITY IS EVERYTHING

- Producers should consider six agronomic drivers of seed placement accuracy at planting time.
 Depending on the type of seed and field conditions, certain drivers may have more or less importance:
 - 1. Proper and accurate seed depth
 - 2. Uniform and accurate seed depth throughout the field
 - 3. Good soil-to-seed contact
 - **4.** Uniformly correct soil pressure all around the seed
 - 5. Accurate seed population
 - 6. Accurate in-row seed spacing
- Uniformity in sorghum emergence is an important factor for high yield crops. Producing a high yield

crop starts with the right balance between healthy, productive plants and the plant's ability to utilize available resources.

- Uniformity begins with a well-prepared seed bed.
- Plants that emerge uniformly and progress at the same rate of development throughout the growing season – also known as "photocopy plants," – deliver improved yield potential. Two bad plants will not produce the same yield as one good plant.
- Uneven emergence introduces inefficiencies and adds competition within the stand. Larger, early emerging plants obtain a greater proportion of available resources (light, water, nutrients) than smaller, later-emerging plants.

In extensive conditions, seeds rate is lower. Grain sorghum has a tremendous ability to compensate for thin stands. Given grain sorghum ability to tiller and compensate for thins stands, it is generally more desirable to keep a perceived thin stand of early-planted grain sorghum than to replant later in the season, provided plant stands are uniform.

PLANT AND SEED SPACINGS						
RECOMMENDED POPULATION AND SPACING	AVERAGE ANNUAL RAINFALL (IN INCHES)					
	<20	20-26	26-32	>32	Irrigated	
	PLANT POPULATION'					
	24,000	35,000	45,000	70,000	100,000	
WITHIN-ROW SEED SPACING AT PLANTING ²						
15"	11.3	7.8	6.0	3.9	2.7	
30"	5.7	3.7	3.0	1.9	1.4	

¹ In plants per acre. Plant populations may increased or decreased by at last 25 percent from the values given, depending upon the expected growing conditions, without significantly affecting yields.

² Assuming 65% field emergence. Calibration of planters should be based on seed spacing. Seeding rates based on pounds per acre have little meaning since seed size commonly varies from 13,000 to 24,000 seeds per pound.

1 ACRE=0.404 HECTARES 1 INCH=2.54 CENTIMETERS 1 POUND= 0.453 KILOGRAMS

(Kansas State University)



Crop Protection

WEED CONTROL

- As in other crops, weed competition in grain sorghum reduces yields, causes harvesting losses and increases seed content of the soil seed bank. Even light weed infestations in the early growing season will reduce yields significantly. Grain sorghum seedlings are a bad competitor with weeds especially in the first stages of growth. Research data have shown that one piqweed plant per 90 centimeters of row left uncontrolled until sorghum reaches the three-leaf stage will reduce yields by 10 percent. Heavy infestations of grassy weeds may cause up to a 20 percent yield reduction in the first two weeks after sorghum germination. Late season weed infestations have less effect on produced yields, but reduce harvesting efficiency and may reduce harvested vields.
- The first thing to do for planning a weed control strategy is to know the weeds. The most troublesome weeds in grain sorghum include monocotyledons as Johnson grass, barnyard grass and other grasses. There are fewer control options for weed control in grain sorghum than in corn, cotton and soybeans, because grain sorghum lacks tolerance to many of the commonly used grass and broadleaf herbicides, and is occasionally injured even by herbicides labeled for use in sorghum. Unfavorable weather conditions such as cool, wet soils, delayed crop emergence, deep planting, seedling diseases, poor soil physical conditions and poor quality seed may contribute to seedling stress and herbicide injury. Residue of herbicides from previous crop can also damage sorghum.
- All the facts reported above mean that a combination of cultivation and chemical weed control is usually most effective in grain sorghum. Cultivation can prune roots and cause plant stress if sweeps are too close to established plants.
- Broadleaf weeds may be controlled in postemergence, but there are few options for postemergence grass control. Grassy weeds are most effectively controlled with preemergence herbicide applications. Johnsongrass (Sorghum halepensea) and grain sorghum (Sorghum

vulgare) are genetically very similar and there are no approved herbicides that will selectively remove Johnson grass from grain sorghum. Even light infestations of Johnson grass in other crops planted the previous year often turn into heavy infestations in grain sorghum due to lack of selective control. Fields with a history of Johnson grass or Bermuda grass should not be planted to grain sorghum.

- Effective weed control programs start with clean fields at planting. It is critical to remove existing cool season weeds with cultivation or herbicides prior to planting. Glyphosate or glyphosate in combination with 2,4-D are very effective preplant herbicides.
- Preemergence herbicides are applied after the sorghum has been planted and prior to emergence. The Chloroacetamides such as Dual II Magnum are taken into the weedy plants through the emerging coleoptiles and have little or no activity on emerged weeds. These herbicides must be applied before targeted weeds germinate. Dual II Magnum, Lasso and Outlook primarily control grasses such as crabgrass, barnyard grass and broadleaf as yellow nutsedge and offer some control of pigweeds. In dry weather, these herbicides do not form a film on the soil surface and, therefore, do not work or work very bad; thus, rainfall or irrigation is required to incorporate the herbicides with the soil for good activity. This is often referred to as "activation" of the herbicide. On the other hand, large rains immediately after application may move some of the herbicide into contact with the germinating sorghum seedling and may actually be taken into the germinating seed as it imbibes water. This usually results in delayed emergence and some crop injury. Under good growing conditions, the symptoms are usually only cosmetic and the sorghum resumes normal growth seven to ten days after emergence.
- Other herbicides, such as 2,4-D, Dicamba, Sulfonylureas and Bromoxynil are effective postemergence broadleaf herbicides for use in sorghum.

INSECT CONTROL

- Sorghum is cropped in a variety of Regions, and more than 100 insects are reported to be harmful for the crop. First thing to do, it's to be sure that seeds have been treated with insecticides. There are several insecticides for this treatment, and we do not see a big difference among them: they all do a good job of providing protection for below-ground insect pests and a few above-ground pests like chinch bugs. Most common insects on sorghum are:
 - Chinch bugs (Blissus leucopterus)
 - Wireworms (Elateridae)
 - Aphids (Aphis maidis)
 - Midge (Contarina sorghicola)
 - Stink bug (Pentatomidae)
 - Cut worms (Agrotis ipsilon, Celama solighella and others)
 - Borers (Chilo, Sesamia, Pyrausta spp)
 - Earworms (Helicoverpa zea, Noctuidae)

• Crop rotation helps in avoiding heavy attacks of insects, however insects' control is based on application of seeds insecticides, for protection of seedlings and foliar insecticides applications in later stages of growth.

DESEASES CONTROL

• Sorghum anthracnose is the most important, dangerous and spread disease which has economic consideration in grain sorghum production. The control of fungi and bacterial diseases is based on planting hybrid with a certain degree of resistance to these diseases. Chemical treatment are expensive and not that common. The occurrence of anthracnose and other diseases indicates that inoculum for future epidemics is present in soils or plant residue and suggests that producers should practice crop rotation and plant resistant hybrids whenever possible. The more recent information on these diseases, especially anthracnose, suggests that a high degree of variability exists within these fungi in the world.

• Commercial hybrids are available to producers that carry a significant level of resistance to the anthracnose. Sorghum producers are strongly encouraged to consider the anthracnose resistance or susceptibility of any hybrid that may be offered for sale.

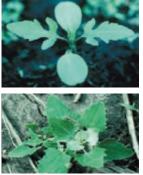
SPRAYING

FACTS

- Weed control in grain sorghum is best achieved with an integrated approach based on **crop** rotations and herbicides or tillage, which enhances the ability of sorghum to compete with weeds.
- **Repeated tillage** before sorghum planting can effectively control weeds, but it is not likely to provide always adequate protection from soil erosion by wind and water. **Herbicides may substitute** for some or all preplant tillage.
- Weed control is carried out both during the pre-planting, pre-emergence, and post emergence stages.
- Weed competition in grain sorghum can reduce yields, cause harvesting losses and increase the seed content of the soil seed bank. Even light weed infestations in the early growing season will reduce yields significantly. Grain sorghum seedlings grow slowly and are weak competitors to most weeds.
- Research data have shown that one pigweed plant per 3 foot of row left uncontrolled until sorghum reaches the three-leaf stage will reduce yields by 10 percent. Heavy infestations of grassy weeds may cause up to a 20 percent yield reduction in the first two weeks after sorghum germination. Late season weed infestations have less effect on produced yields, but reduce harvesting efficiency and may reduce harvested yields.

- Consistency is an important factor affecting the result of spraying operations.
- Uniformity and droplet size determine whether an application will have the desired effect.
- Adjustments to pressure and volume are required depending on what the target is (weeds, fungi, insects) and the thickness of the canopy.
- Numerous university and company researches show that if weeds are allowed to emerge with corn and are left uncontrolled while corn is growing from the first leaf to 3td leaf, the yield loss is usually more than one bushel per acre per day. (60 kg per hectare)
- Drift control is another important factor that must be managed to avoid damages to surrounding environment.





Pigweed

Lambsquarters

TOOLS

New Holland Guardian Sprayers have clearance and balance which are crucial facts from agronomic point of view. Delivering consistent droplet size is a critical part of sprayer operation. This function can be more important depending on which chemical is used and on what canopy type.



Hoeing

GOOD HOEING CAN HELP IMPROVING WATER AVAILABILITY

- Interrow cultivation remains an option for control of weeds between bands of herbicides and for later emerging weeds. Heavy, high-residue cultivators can be effective even in no-till planted sorghum.
- They also can be used as backup where herbicides have performed poorly and where perennial weeds have not been controlled. Electronic guidance systems can increase cultivating speed and efficiency by reducing operator fatigue and cultivator blight.

Fertilization

- As for all crops, only results of soil tests can suggest the more rational fertilization plan. However, on average 100 kg of grain removes:
 - Nitrogen (N) 2.1 kg per hectare
 - Phosphorus (P₂O₅) 0.9 kg per hectare
 - Potash (K₂0) 1.6 kg per hectare.
- If residues are chopped and incorporate into soil, about 50 kg N, 20 kg P_2O_5 and 100 kg K_2O return back into soil. Guidelines for high yields are, in kg per hectare:
 - non irrigated soils: N 80-150; P₂O₅ 80;
 - irrigated soils: N 150-200; P₂O₅ 100.

- K₂O is required only in poor soils at a rate of 60 kg per hectare.
- Phosphorus and Potash are applied in pre planting. N is applied 50% in pre planting and 50% in top dressing after tillering and before jointing. A hoeing helps in incorporating N into soil. Nitrogen management should be similar to corn. Apply a certain amount before or at planting (up to 30% of total N), and then sidedress the remainder nitrogen once plants gets to the 5- to 6-leaf stage. At about the 6-leaf stage, the plant will be entering a rapid growth stage and the plant will need to have the nitrogen available at that time for optimal yields.



Irrigation

- The most critical phase for water supply in sorghum is before flowering (bloom). Sorghum, when compared with corn, is a drought resistant crop, due to the particular conformation of leaves, roots system and physiology. Evapotranspiration coefficient is about 200-250 kg of water per 1 kg of dry matter produced by the plant: this is 25% less than corn. Sorghum can extract water from soil even when its content is low (20-30% of field capacity), which is not possible for corn: the crop is capable of "waiting for water": it means that, in dry conditions, the plant stops its growth and restart when moisture allows further growth. Of course there are limits at such a positive behaviour, meaning that sorghum, too, needs some water to develop and needs enough water to give high yields. As for corn, the maximum need for water is before blooming, when the crop needs a daily volume of 7-9 millimetres per day or 70 - 90 cubic metres per hectare and per day.
- The total amount of water that a grain sorghum crop needs during the growing season may vary from 350 to 600 millimetres depending on factors such as latitude, weather conditions, plant density, fertility, soil type and days to maturity. A reliable average is 500 millimetres per season: about one half should be delivered from soil, and the other half is rain or irrigation. So, the irrigation system needs to be capable of providing at least 250 millimetres of irrigation water to assure a good yield potential. Therefor for high yields, irrigation should be applied from 1 to 6 times, each applying about 35- 40 millimetres of water eight.



Harvesting

- Sorghum is ripe when grains moisture content is 14-15% which is ideal. Harvesting can be carried out at moisture of 20%.
- Grain sorghum can be harvested with a grain header (rigid cutterbar), preferably with guard extensions). Typically, guard extensions are attached to every other guard in standing grain sorghum. Guard extensions provide support to guide more heads into the header in order to reduce gathering loss.
- Excellent cutterbar maintenance and adjustments are vital. Cut just below the heads to minimize the stem and leaf entering

the combine, even if an occasional head isn't gathered. Total field loss is typically lower if the thresher can separate the grain well without excess foliage entering the combine.

• Constantly adjust the cutterbar height to avoid overloading the combine separator with flag leaves, thus, restricting its capacity to harvest grain sorghum. Grain sorghum heads that extend well above the foliage are the biggest factor in maintaining a high proportion of grain in the separator. But an excellent operator must constantly adjust the header height in grain sorghum with variable head heights.

COMBINE CONFIGURATION

- At the proper reel speed/forward speed ratio, heads move smoothly across the cutterbar into the platform. Adjust reel speed so the pickup finger speed is 15 to 25 percent faster than the forward speed in order to minimize gathering loss.
- A slow reel speed, relative to travel, allows heads to fall forward over the cutterbar. Excessive reel speed, low reel position and cutting too low contribute to heads flipping over the reel bats.
- If the grain heads vary throughout a wide height range, fastening a "baffle" or extension above the reel bats may help to control the taller heads and reduce the loss of dropped heads. The reel hub should be positioned slightly ahead of the cutterbar. Draper headers work very well for grain sorghum.

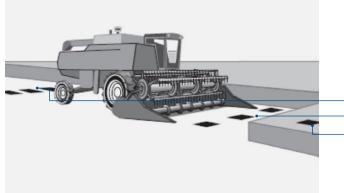


HEAVY DUTY VARYFEED



RIGID HEADER HIGH AND EXTRA CAPACITY





- Grain moisture is about 14-20%, stalks and leaves green
- Wheat headers, only rigid for grain sorghum or draper can be used. Varifeed and draper better choice

–Check separator loss here – Check header loss here –Check preharvest loss here

Machinery

IMPLEMENTING YOUR GROWTH PROJECTS





NEW HOLLAND ST830 Chisel Plow

New Holland ST 830 Chisel Plow can perform a proper primary tillage for sorghum in a conventional farming system.

NEW HOLLAND TRACTORS SERIES

New Holland has a huge legacy in manufacturing agricultural tractors, which are used in all conditions and on all crops. New Holland tractor Series, starting with T5 Series up to T9 Series, offer to our Customers a wide choice of units with the necessary configurations combined with the right powers for all operations.

GRAIN DRILL

Sorghum can be planted or drilled. Planters are first choice, because they allow for seeds sparing and mechanical weed control, if needed. Grain drill, (on the left New Holland Air Hoe Drill P8020 and New Holland T9 Tractors) are an alternative to planters in dryland agronomical conditions







NEW HOLLAND GUARDIAN SPRAYERS

Sprayers

It's all about doing more with less time. Guardian[™] front-boom sprayers cover ground faster, reduce downtime and maximize acres sprayed per hour. These sprayers offer the highest horsepower, largest tank size, and the smoothest suspension combined with the highest ground clearance and the tightest turning radius in the industry to maximize your spraying productivity and quality.

NEW HOLLAND COMBINES

New Holland Combines series TC, CX and CR offers a wide choice of equipment to perform an efficient sorghum harvesting. From simple conventional combines TC up to extra productive CR twin rotor combines, tradition and technology at New Holland are the fundaments of a successful story.

NEW HOLLAND FR

Forage Harvester

New Holland forage harvesters Series FR are manufactured for delivering an outstanding cutting and chopping of sorghum, which delivers a healthy silage. Processors are essential for cracking the kernel/shell at harvesting. Breaking the shell provides cows access to the valuable starch inside. The underside of many row-independent sorghum headers are equipped with knives to break the stalk and promote stalk rot down.





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AT YOUR OWN DEALER



The data indicated in this folder are approximate. The models described here can be subjected to modifications without any notice by the manufacturer. The drawings and photos may refer to equipment that is either optional or intended for other countries. Please apply to our Sales Network for any further information. Published by CNHI INTERNATIONAL SA. Brand Marketing and Communication. Bts Adv. - 09/16 - (Turin) - **AP5712N/INB**