



## **FACULTY OF AGRICULTURAL SCIENCES & ALLIED INDUSTRIES**

## CULTIVATION OF SORGHUM

BOTANICALNAME	<i>Zea mays</i>
FAMILY	Poaceace
CHROMOSOME NO.	2n=20
COMMON NAME	Makka, Bhutta

### INTRODUCTION:-

Sorghum is a genus with many species and subspecies, and there are several types of sorghum, including grain sorghums, grass sorghums (for pasture and hay), sweet sorghums (for syrups), and Broomcorn. The focus of this species page is on *Sorghum bicolor ssp. bicolor*, or grain sorghum.

Grain sorghum and maize (corn) are comparable in costs of production and in nutrition; therefore the growing environment is the largest determining factor for choosing which to grow.

Grain sorghum requires less water than corn, so is likely to be grown as a replacement to corn and produce better yields than corn in hotter and drier areas, such as the Southern US, Africa, Central America and South Asia.

One study showed that when corn required over 30 inches of water, sorghum required less than 23 inches.

However, in cooler areas corn is probably a better option for production, based on yield.

US sorghum accounts for 70% to 80% of world sorghum exports.

### IMPORTANCE:-

Sorghum is a cereal grain crop mostly grown in Africa, Asia and Central America, primarily to ease food insecurity.

It is the world's fifth largest grain crop and Africa's second most important in terms of tonnage.

Sorghum is mostly grown in semi-arid or sub-tropical regions due to its resistance to harsh weather conditions.

Sorghum, a grain, forage or sugar crop is among the most efficient crops in conversion of solar energy and use of water.

Sorghum is known as a high-energy, drought tolerant crop. Because of its wide uses and adaptation “sorghum is one of the really indispensable crops” required for the survival of humankind.

In the United States, South America, and Australia sorghum grain is used primarily for livestock feed and in a growing number of ethanol plants. In the livestock market, sorghum is used in the poultry, beef and pork industries.

Stems and foliage are used for green chop, hay, silage, and pasture.

### **ORIGIN:-**

There are different views about place of origin of sorghum.

Warth (1937) was of the opinion that it was originated in India and Africa.

De Candolle said that sorghum was originated in Africa.

It is believed to originate from North East of Africa or Abyssinia and brought to USA and European countries by slaves.

### **GEOGRAPHIC DISTRIBUTION:-**

Sorghum is grown all parts of the world except cool North east part of Europe.

Sorghum belts in India receive 400-1000mm rainfall.

In the World, Africa (Nigeria, Sudan) is the major continent cultivates sorghum and North America, South America and Asian continents also grow sorghum.

In India, mainly on central & peninsular India such as, Maharashtra, Karnataka, MP, AP, Rajasthan, Tamil Nadu and Gujarat are important states cultivating sorghum crop.

### **CULTURAL PRACTICES:-**

### **VARIETIES:-**

<b>Varieties (Hybrid)</b>	<b>Days taken to maturity</b>	<b>Yield (q/ha)</b>
CSH-1	95-105	40-50
CSH-2	120-125	40-50
CSH-5	110-115	50-55
CSH-9	110-115	50-60

CSH-10	110-115	40-50
CSH-11	110-115	40-50
<b>Varieties (Composites)</b>	<b>Days taken to maturity</b>	<b>Yield (q/ha)</b>
CSV-1 (Swarna)	100-115	35-40
CSV-2	100-110	40-45
CSV-3	110-135	40-50
CSV-4	100-110	40-50
CSV-5	110-115	50-55
CSV-6	100-110	55-60

### **Selection of seeds:-**

Good quality seeds are collected from disease and pest-free fields.

### **SEED RATE:-**

**Irrigated:-** Transplanted - 7.5 kg/ha; Direct sown - 10 kg/ha

Rainfed (Direct sown) - 15 kg/ha

Sorghum under irrigated condition is raised both as a direct sown and transplanted crop.

### **Advantages of transplanted crop:-**

Main field duration is reduced by 10 days.

Shoot fly, which attacks direct sown crops during the first 3 weeks and which is difficult to control, can be controlled effectively and economically in the nursery itself.

Seedlings which show chlorotic and downy mildew symptoms can be eliminated; thereby incidence of downy mildew in the main field can be minimized.

Optimum population can be maintained as only healthy seedlings are used for transplanting.

Seed rate can also be reduced by 2.5 kg/ha.

### **NURSERY PRACTICES FOR TRANSPLANTED SORGHUM:-**

## **Nursery preparation:-**

For raising seedlings to plant one hectare, select 7.5 cents (300 m<sup>2</sup>) near a water source where water will not stagnate.

## **Application of FYM to the nursery:-**

Apply 750 kg of FYM or compost and apply another 500 kg of compost or FYM for covering the seeds after sowing. •

Spread the manure evenly on the un-ploughed soil and incorporate by ploughing or apply just before last ploughing.

## **Laying the nursery:-**

Provide three separate units of size 2 m x 1.5 m with 30 cm space in between the plots and all around the unit for irrigation.

Excavate the soil from the inter-space and all around to a depth of 15 cm to form channels and spread the soil removed on the bed and level.

## **Pre-treatment of seeds:-**

Treat the seeds 24 hours prior to sowing with Carbendazim or Captan or Thiram at 2g/kg of seed.

Treat the seeds with three packets (600 g)/ha of Azospirillum and 3 packets (600g) of phosphobacteria or 6 packets of Azophos (1200g) using rice gruel as binder.

## **Sowing and covering the seeds:-**

Make shallow rills, not deeper than 1cm on the bed by passing the fingers vertically over it.

Broadcast 7.5 kg of treated seeds evenly on the beds.

Cover by leveling the rills by passing the hand lightly over the soil.

## **Water management:-**

Provide one inlet to each nursery unit.

Allow water to enter through the inlet and cover all the channels till the raised beds are wet and then cut off water.

Adjust the frequency of irrigation according to the soil types.

If it is red soils, at 4-5 days interval and black soils, 5-6 days interval is to be maintained.

NOTE: Do not keep the seedlings in the nursery for more than 18 days. If older seedlings are used, establishment and yield are adversely affected. Do not allow cracks to develop in the nursery by properly adjusting the quantity of irrigation water.

## **FIELD PREPARATION:-**

### **Ploughing: -**

Plough the field with an iron plough once (or) twice. Sorghum does not require fine tilth since fine tilth adversely affects germination and yield in the case of direct sown crop.

To overcome the subsoil hard pan in Alfisols (deep red soils) chiseling the field at 0.5m intervals to a depth of 40 cm on both the directions of the field followed by disc ploughing once and cultivator ploughing twice help to increase the yield of sorghum and the succeeding blackgram also. This was true with Sorghum followed by Groundnut also.

Application of FYM and 100% of recommended N can also be followed. In soils with subsoil hard pan, chiselling should be done every year at the start of the cropping sequence to create a favourable physical environment.

### **Application of FYM:-**

Spread 12.5 t/ha FYM or composted coir pith along with 10 packets of Azospirillum (2000g/ha) and 10 packets (2000 g/ha) of phosphobacteria or 20 packets of Azophos (4000g/ha) on the unploughed field and incorporate the manure in the soil.

Apply well decomposed poultry manure @ 5 t/ha to improve the grain yield as well as physical properties of soils.

### **Formation of ridges and furrows:-**

Form ridges and furrows using a ridger at 6 m long and 45 cm apart.

Form irrigation channels across the furrows.

Alternatively, form beds of size 10 m<sup>2</sup> and 20 m<sup>2</sup> depending on the availability of water.

## **APPLICATION OF FERTILIZER:-**

### **Transplanted crop:-**

Apply NPK fertilizers as per soil test recommendations. If soil test recommendations are not available, adopt a blanket recommendation of 90 N, 45 P<sub>2</sub>O<sub>5</sub>, 45 K<sub>2</sub>O kg/ha.

Apply N @ 50:25:25% at basal, 15 and 30 DAS and full dose of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O basally before planting.

In the case of ridge planted crop, open a furrow 5cm deep on the side of the ridge at two thirds the distance from the top of the ridge and place the fertilizer mixture along the furrow and cover with soil up to 2 cm.

Soil application of Azospirillum at 10 packets (2 kg/ha) and 10 packets (2000g/ha) of phosphobacteria or 20 packets of Azophos (4000g/ha) after mixing with 25 kg of FYM + 25 kg of soil may be carried out before sowing/planting.

### **Direct sown crop:-**

As above.

In the case of sorghum raised as a mixed crop with a pulse crop (Blackgram, Greengram or Cowpea) open furrows 30 cm apart to a depth of 5 cm.

Apply fertilizer mixture in two lines in which sorghum is to be raised and cover upto 2 cm.

Skip the third row in which the pulse crop is to be raised and place fertilizer mixture in the next two rows and cover upto 2 cm with soil.

When Azospirillum is used, apply only 75% of recommended N for irrigated sorghum.

### **SOWING / TRANSPLANTING SORGHUM:-**

#### **Transplanted crop: -**

Pull out the seedlings when the seedlings are 15 to 18 days old.

Prepare slurry with 5 packets of Azospirillum (1000g/ha) and 5 packets (1000g/ha) of Phosphobacteria or 10 packets of Azophos (2000 g/ha) in 40 lit. Of water and dip the root portion of the seedlings in the solution for 15-30 minutes and transplant.

Plant one seedling per hill

Plant the seedlings at a depth of 3 to 5 cm.

Plant the seedlings on the side of the ridge, half the distance from the top of the ridge and the bottom.

Maintain a spacing of 15 cm between plants in the row which are 45 cm apart (15 plants/m<sup>2</sup>).

#### **Direct sown crop:-**

In the case of pure crop of sorghum, maintain the seed rate at 10kg/ha.

In the case of inter crop of sorghum with pulse crop, maintain the seed rate of sorghum at 10 kg/ha and pulse crop at 10 kg/ha.

In the case of pure crop of sorghum, sow the seeds with a spacing of 15 cm between seeds in the rows which are 45 cm apart. •

Maintain one plant per hill.

If shootfly attack is there, remove the side shoots and retain one healthy shoot.

Sow the seeds over the lines where fertilizers are placed.

Sow the seeds at a depth of 2 cm and cover with soil.

In the case of sorghum intercropped with pulses, sow one paired row of sorghum alternated with a single row of pulses. The spacing between the row of sorghum and pulse crop is 30 cm.

Forage cowpea CO 1 can be inter-cropped in sorghum at two rows of fodder cowpea in between paired rows of sorghum.

### **WEED MANAGEMENT: -**

Apply the pre-emergence herbicide Atrazine 50 WP @500 g/ha on 3 days after sowing as spray on the soil surface, using Backpack / Knapsack / Rocker sprayer fitted with a flat fan nozzle using 900 litres of water/ha.

Sorghum is slow growing in early stages and is adversely affected by weed competition. Therefore keep the field free of weeds up to 45 days. For this, after pre-emergence herbicide application, one hand weeding on 30-35 days after sowing may be given.

If pulse crop is to be raised as an inter-crop in sorghum do not use Atrazine.

Hoe and hand weed on the 10th day of transplanting if herbicides are not used. Hoe and weed between 30-35 days after transplanting and between 35-40 days for a direct sown crop, if necessary.

### **Thinning of the seedlings and gap filling:-**

Thin the seedlings and gap fill with the seedlings thinned out.

Maintain a spacing of 15 cm between plants after the first hand weeding on the 23rd day of sowing.

Thin the pulse crop to a spacing of 10 cm between plants for all pulse crop except cowpea, for which spacing is maintained at 20 cm between plants.

### **WATER MANAGEMENT:-**

Usually sorghum is raised as rain fed crop.

The irrigation should, however, be provided whenever, rains are not received.

At the time of flowering and grain filling stages, the crop requires more water.

If enough moisture is not there in the soil at the time of flowering and grain filling stages, it should be irrigated at once. At no stage, the plants should be allowed to wilt.

Suitable drainage conditions should be provided for the removal of excess rain water from the field. About 400mm of water is required to raise grain sorghum crop.

NOTE: Adjust irrigation schedule according to the weather conditions and depending upon the receipt of rains.

Contingent plan: This should be done before 75% of soil moisture is lost from available water. Spraying 3% Kaolin (30 g in one liter of water) during periods of stress will mitigate the ill effects.

## **HARVESTING & PROCESSING:-**

Consider the average duration of the crop and observe the crop. When the crop matures the leaves turn yellow and present a dried up appearance.

The grains are hard and firm. At this stage, harvest the crop by cutting the ear heads separately.

Cut the straw after a week, allow it to dry and then stack. In the case of tall varieties, cut the stem at 10 to 15 cm above ground level and afterwards separate the ear heads and stack the straw.

Dry the ear heads. Thresh using a mechanical thresher or by drawing a stone roller over the ear heads or by using cattle and dry the produce and store.

## **YIELD:-**

With improved cultivation practices it is possible to harvest nearly 50 quintals of grain and about 100-125 quintals of dry stover from a hectare of crop.

Under irrigated conditions and about 25-30 quintals of grain and about 80-100 quintals of dry stover from a rain fed crop.