

# Sorghum and Millet

Sorghum is in general the most productive millet variety and is mostly cultivated in those areas with a sufficient water supply to achieve good yields. On drier locations sorghum is frequently replaced by *Pennisetum americanum*.

## Sorghum (*Sorghum bicolor* (L) Moench)

French: Sorgho; Spanish: Sorgo; Italian: Sorgo; German: Mohrenhirse, Sorghum; Indian: Jowar; Arabic: Durra

### Crop data

Annual.

Can be used for many purposes: as grain, animal feed, silage, for broom-making, as a sweetener (sugar sorghum), for fuel or as a building material.

Temperature for germination >15 °C, for optimal growth 25-30 °C.

Can be grown where rainfall over 250 mm, best with 800-1 200 mm during the vegetation period. Seldom irrigated.

Often found on light, sandy soils but yields are greater on good, rich soils.

Plant density:	under very dry conditions,	0.5 to 1-3 plants/m <sup>2</sup>
	under dry conditions,	5 to 10 plants/m <sup>2</sup>
	irrigated or for forage,	10 plants/m <sup>2</sup>

Early maturing varieties can be harvested 3-4 months after sowing; late varieties mature at 8-10 months. The crop can be cut for forage at 2 months or for silage at 3-4 months. Ratooning for forage or grain production is possible.

### Nutrient demand/uptake/removal

Depends on soil conditions, stand, yield expectation and growth rate:

Nutrient uptake - Macronutrients			
Conditions	kg/ha		
	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Dryland, low yield	40	20	40
Wet, medium yield	60	35	75
Irrigated, high yield	100	50	125
Green forage	80	30	70
Silage	150	40	150
Top yield, grain or forage	250	60	250

### Fertilizer requirements

Where farmers consider sorghum to be an important crop, organic manuring with f.y.m., compost or crop and food wastes is widely practised. This may be enough for low-yielding sorghum, but where such manures are scarce, inadequate or unavailable, mineral fertilizers must be used instead or as a supplement. The rates required depend on the ecological conditions and yield potential;

<b>Fertilizer recommendations - Macronutrients</b>			
<b>Conditions</b>	kg/ha		
	<b>N</b>	<b>P2O5</b>	<b>K2O</b>
Dryland, low yield	0- 20	0- 20	0- 20
Wet, medium yield	20- 60	20- 40	20- 50
Irrigated, high yield	60-100	40- 60	50-100
Green forage	40- 60	20- 40	40- 60
Silage	40- 80	20- 60	40- 80
Top yield, grain or forage	100-250	60-100	100-300

Under very dry conditions and with a yield potential below 1 t/ha, low rates of N and P2O5 may increase yield but fertilizer application is often inefficient and uneconomic. With better rainfall and potential yields of 1-2 t/ha, fertilizer N and P2O5 rates need to be doubled and in most cases should be accompanied by up to 60 kg/ha K2O. With irrigation and potential yields of 6 t/ha or more, the rates should be substantially increased.

With the higher rates of application, split dressings are generally recommended (60 % at sowing and 20-40 % at shooting or at the beginning of flowering) except for P2O5 which should all be included in the basal dressing at sowing. On P-fixing soils, band or lay-by application is more effective than broadcasting. Fertilizer use is most effective when the stand is not too thick and the soil pH is below 5.

For forage or silage, the crop must grow quickly and produce a dense vegetative mass. Therefore, the N-application has to be relatively high (40-80 kg/ha, or even above 100 kg/ha N). Especially under irrigated conditions and on light soils, the doses at sowing time may be as low as 20-40 kg/ha, with further split applications (50-80 kg/ha N) when the crop has reached a height of 50-80 cm.

After harvesting the first crop, for a ratoon crop a dressing of 20-60 kg/ha N should be given. A further 20-40 kg/ha K2O may also be advisable. The extra P needed (15-30 kg/ha P2O5) ought to be included in the basal dressing when sowing the first crop but, if omitted at that time, around 20 kg/ha P2O5 may be given as a lay-by application.

## **Preferred nutrient forms**

**N:** ammonium sulphate or urea before sowing; urea or a nitrate fertilizer for topdressing.

**P:** in easily plant-available form before sowing; in granular form, placed (band or lay-by), for P-fixing soils.

**K:** before sowing, as sulphate or chloride.

## **Pearl or Bulrush Millet** (*Pennisetum americanum* (L) Leeke, Syn: *P. glaucum*, *P. spicatum*, *P. typhoides*)

French: Millet à chandelle, millet perle ; Spanish: Mijo perla, lagartera; Italian: Miglio perlato, miglio africano; German: Perlhirse, Rohrkolbenhirse; Indian: Bajra

### **Crop data**

Annual. Preferably grown under dryland conditions, as replacement for sorghum.

Main use is for grain production. Green stuff, stalks and stubble used as by-product for animal feed, building material and fuel.

Temperature for germination >15 °C, for optimal growth 25-30 °C.

Will grow where rainfall at least 200 mm, but better growth and higher yields with 500-750 mm/season (where rainfall exceeds this, sorghum would be the crop of choice). Seldom irrigated.

Often grown on light and sandy soils (more important crops are given preference on more fertile soils).

Plant density:	under very dry conditions,	0.5 to 1 plants/m <sup>2</sup>
	under dry conditions,	3 to 5 plants/m <sup>2</sup>
	under slightly moist	5 to 7 plants/m <sup>2</sup>
	conditions,	

Early maturing varieties can be harvested after 2-3 months. Late maturing varieties of *Pennisetum* grown under cooler conditions need up to 10 months until harvest.

### **Nutrient demand/uptake/removal**

Depends on soil fertility, yield potential, rainfall and plant density:

Nutrient uptake-Macronutrients			
Conditions	kg/ha		
	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Very dry, very low yield	30	15-20	30
Dry, low yield	40	20	40
Rainfed, average yield	60	40	70
Irrigated, intensive crop with high yield	100	60	100

### **Fertilizer requirements**

If available, organic manure should be applied as much as possible. This may suffice if the yield potential is below 1 t/ha. Where higher yields are possible, the additional use of mineral fertilizer is recommended.

The N requirement ranges between 20 and 60 kg/ha N under rainfed conditions and may increase to 100 kg/ha if yields of 3-5 t/ha are aimed at. P<sub>2</sub>O<sub>5</sub> is badly needed on soils low in P or with a high P-fixing capacity (pH very low or >7); depending on nutrient uptake and yield potential, rates of 15-40 kg/ha P<sub>2</sub>O<sub>5</sub> for rainfed or around 60 kg/ha for irrigated conditions should be worked into the soil before sowing. K<sub>2</sub>O should be applied where the soil is deficient in this nutrient or yields are high as a result of applying N and P<sub>2</sub>O<sub>5</sub>, in which case 20-70 kg/ha K<sub>2</sub>O may become necessary under rainfed conditions; with irrigation as much as 100 kg/ha may be needed for the best results.

Fertilizer recommendations			
Conditions	kg/ha		
	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Very dry, low yield	0- 20	0- 20	0- 20
Wet, medium yield	20- 60	20- 40	20- 50
Irrigated, high yield	50-100	40- 60	40-100

Split dressings of N are advised under moister conditions, whether from higher rainfall or from irrigation. P<sub>2</sub>O<sub>5</sub> should be worked into the soil before sowing, as indicated above; on soils with a high P-fixing capacity placement is very important and the fertilizer should be applied in granular form. K<sub>2</sub>O too should be applied before sowing.

## Preferred nutrient forms

**N:** at sowing, as ammonium sulphate or urea; for topdressing, as ammonium nitrate or as nitrate.

**P:** at sowing, mainly as triple superphosphate but also as basic slag or rock phosphate. Late spray applications have often been promoted but have rarely been put into practice.

**K:** in sulphate or chloride form before sowing.

## Further reading

Special Issue: Pearl Millet. *Field Crop Research* 11, 113-290 (1985)

CLARK, R.B.: Mineral nutrition factors reducing sorghum yields: micro-nutrients and acidity. In: ICRISAT: Sorghum in the eighties. Proc. International Symposium, ICRISAT, Patancheru, India (1982)

DE GEUS, J.G.: Fertilizer Guide for Tropical and Subtropical Farming, p. 94-111. Centre d'Etude de l'Azote, Zurich, Switzerland (1973)

GAUTAM, R.C.; KAUSHIK, S.K.: Maximization of yield of rainfed pearl millet (*Pennisetum typhoides*). *Indian J. Agric. Sci.* 53, 223-224 (1988)

SANKAR, G.R.M.; SONAR, K.R.; REDDY, K.C.K.: Pooling of experimental data for predicting fertilizer requirements of rabi sorghum for varying soil test values. *J. Maharashtra Agric. Univ.* 13, 59-62, India (1988)

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