Pearl millet — Production guideline —
## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>1</td>
</tr>
<tr>
<td>Cultivation practices</td>
<td>4</td>
</tr>
<tr>
<td>Post-harvest handling</td>
<td>8</td>
</tr>
<tr>
<td>Production schedule</td>
<td>9</td>
</tr>
<tr>
<td>Utilisation</td>
<td>10</td>
</tr>
<tr>
<td>References</td>
<td>10</td>
</tr>
</tbody>
</table>
GENERAL

Classification
Scientific name: *Pennisetum glaucum*
Common name: Pearl millet, Nyalothi, Ntweka, Amabele, Unyaluthi, Unyawoti, Unyawothi, Inyawuthi, Muvhoho, Babala, Manna, Leotja, Mhunga, Bulrush millet

Origin and distribution
Pearl millet originated in central tropical Africa and is widely distributed in the drier tropics and India. It was introduced into the western state in the 1850s and became established as minor forage in the Southeast and Gulf Coast states. The plant was probably domesticated as a food crop some 4 000 to 5 000 years ago along the southern margins of the central highlands of the Sahara. It has since become widely distributed across the semiarid tropics of Africa and Asia.

Production levels
South Africa
Production of millet is still at subsistence level by smallholder farmers and millet is consumed as staple food and drink in most areas. There are no records with regard to the size of land under production and the quantities produced. It is grown commercially in South Africa as forage.

Internationally
Pearl millet is planted on 14 million ha in Africa and 14 million ha in Asia. Global production of its grain probably exceeds 10 million tons a year, to which India contributes nearly half. At least, 500 million people depend on pearl millet for their lives. Approximately one-third of the world’s millet is grown in Africa and Asia, about 70% of it in West Africa. Major producing countries in Africa include Nigeria, Niger, Burkina Faso, Chad, Mali, Mauritius and Senegal in the west, and Sudan and Uganda in the east.

Six countries (China, Ethiopia, India, the Niger, Nigeria and the former Soviet Union) are estimated to account for about 80% of global millet utilisation. Of the 30 million tons of millet produced in the world, about 90% is utilised in developing countries, and only a tiny volume is used in the developed countries. The exact statistical data are unavailable for most countries, but it is estimated that a total of 20 million tons are consumed as food, the rest being equally divided between feed and other uses such as
seed, the preparation of alcoholic beverages and waste. World consumption of millet as food has only grown marginally during the recent past in contrast to the significant increase in consumption of other cereals.

**Major production areas**

In South Africa, pearl millet is produced in Limpopo, KwaZulu-Natal and the Free State.

**Varieties**

No known varieties have been developed in South Africa to date.

**Description of the plant**

*Mature plant*

Pearl millet may grow from 50 cm to 4m tall, and may tiller profusely under favourable weather conditions.

*Stems:* Stems are pithy, tiller freely and produce an inflorescence with a dense spike-like panicle which is 35,56 cm long or 2,54 cm or less in diameter.

*Leaves:* Pearl millet has long leaves that are slender and smooth or have hairy surfaces. The leaves may vary in colour, from light yellowish green to deep purple. The leaves are long-pointed with a finely serrated margin.

*Flowers:* Pearl millet usually flowers from 40 to 55 days. The flowering structure (inflorescence) in pearl millet is called a panicle or head. The mature panicle is brownish in colour.

*Seed:* The seed begins developing after fertilisation and matures 25 to 30 days later. The seeds are nearly white, yellow, brown, grey, slate blue or purple in colour. The size of the seed is about one-third that of sorghum and the weight about 8 mg on average.
Essential parts
The grains are an essential part in pearl millet while the entire crop is used as fodder.

Climatic requirements

Temperature
Pearl millet is usually a short-day plant, but some varieties are day length neutral. It is generally sensitive to low temperatures at the seedling stage and at flowering. High daytime temperatures are needed for the grain to mature. It germinates well at soil temperatures of 23 to 30 °C. Emergence occurs in 2 to 4 days under favourable conditions.

Rainfall
Although the crop is grown where rainfall ranges from 200 to 1500 mm, most occurs in areas receiving 250 to 700 mm. The lowest rainfall areas rely mainly on early-maturing cultivars. Despite its drought resistance, pearl millet requires evenly distributed rainfall during the growing season. Too much rain at flowering can also cause a crop failure.

Soil requirements
Like most plants, pearl millet also does best in light, well-drained loams. The crop tolerates poor, infertile soil better than the other crops. It performs poorly in clay soils and cannot tolerate waterlogging. It is tolerant of subsoils that are acidic (even those as low as pH 4–5) and high in aluminium content.
CULTIVATION PRACTICES

Propagation

Pearl millet is propagated by seed.

Soil preparation

Prepare warmer seedbeds on well-drained soils. Seedbeds should be weed free. Deep till or in-row subsoil sandy textured soils are used to disrupt any hard pans. No-till or conservation-tillage plantings can be successful and are desirable on highly erodible land or clayey soils. This will reduce soil erosion and enhance stand establishment owing to better seed depth control in firmer soils and control of emerged weeds prior to planting. If no-tilling in the spring, deep tillage ahead of the winter cover crop in the fall is preferred. However, reconstitution of the hard pan in sandy soils can occur, particularly if good rainfall occurs during the winter.

Planting

Optimum planting time should be early October to November, and this is greatly dependent on the intended use. Soil temperatures should be at least 18 °C. Planting in cooler soils can cause problems with reduced emergence and greater competition from weeds. Plant densities should be similar or slightly higher (100 000 to 175 000 plants/ha) than for sorghum. Seed should be planted into a firm, mellow, moist seedbed. As pearl millet seed is small, shallow planting is recommended to obtain good seed-to-soil contact.

Fertilisation

Millets are generally grown on less fertile soils, but respond well to heavy fertilisation. They are deep-rooted and can use residual nitrogen, phosphorus and potassium and, therefore, may not need the levels of fertilisation required by other summer grains.

Because nitrogen needs are modest, it can be applied as a sidedressing rather than preplant. Nitrogen needs can certainly be met from organic sources, such as animal manure or a leguminous cover crop. These characteristics enhance pearl millet’s desirability in lower-input, dryland production systems. It is advisable to conduct a soil analysis prior to fertilisation.
Irrigation

Little is known about pearl millet’s response to irrigation during growth. Irrigation can improve stand establishment if the soil is dry during and after seeding. It appears that pearl millet responds less to irrigation than other grain crops. Greatest water use occurs during the bloom and soft dough stages.

Weed control

Good weed control is necessary for successful pearl millet production, and it is particularly important to control early emerging weeds. Preventive control options begin with planting clean, weed-free seed. In addition, producers should make sure that all equipment used to plant millet is free of weed seeds. Controlling weeds along ditch banks, roadsides, and field margins will also help prevent weed seed from entering the fields.

Mechanical controls should be used to prepare the seedbed prior to planting millets and where millets are planted in rows for seed, they give producers a headstart on weed control. Because pearl millet is planted relatively late, two preplant tillage operations are recommended, first to stimulate germination of weed seeds, then, several days later, to kill off weed seedlings prior to planting. If planted in wide rows, row cultivation for weed control should be planned, especially if herbicide control is ineffective.

Pest control

Grain pearl millet is not difficult to grow as it hosts few insect pests. The principal insect problems in millet production are chinch bug, stinkbug, nematode and birds. Normally insecticides are not needed on pearl millet.

Chinch bug

The female chinch bugs lay eggs, in summer, that hatch into nymphs within two weeks. The nymphs begin to suck the sap from host plants.

The chinch bug inserts its straw-like mouthparts into the plant tissue and sucks out the plant sap while injecting chemicals into the plant which clog the vascular system. The area around the feeding puncture usually turns yellow. Damaged areas first appear as small, irregular patches which enlarge as the insects spread.

Control: Inspect fields every 5 to 7 days until heading. Apply recommended insecticide after heading.
**Stinkbugs**

Stinkbugs require control on developing grain heads. These insects are most active when pearl millet is planted from July to August. Stinkbug feeding causes small and shrivelled seed. Economic yield loss may occur when 15% or more of the grain heads are infested. Through their needle-like mouthparts, they suck out the plant sap and inject their saliva. As a result, plants become stunted and fruit discoloured. Some plant diseases are also transmitted.

Control: Stinkbugs can be controlled by the use of registered insecticides.

**Nematodes:** Pearl millet hybrids differ in their resistance to nematodes. Primary damage from nematodes is to the roots of the plant. The degree of injury to the roots varies with the age of the plant when attacked. Symptoms are most severe when the feeding occurs during the first few weeks after planting. In general, symptoms consist of greatly reduced root systems with short, stubby roots having dark, shrunken lesions, particularly at the tips. If the root tip is destroyed, new roots may be produced above the damaged area, resulting in a high-rooted appearance. Plants which are not severely damaged by the initial feeding may recover and produce near-normal yields under optimum growing conditions.

Control: It is recommended to rotate pearl millet with nematode resistant crops.

**Bird damage**

Birds readily consume pearl millet seed off the plants in the field. Losses can be severe in small fields or when harvest is delayed for an extended period after maturity.

Control: Crop monitoring, early planting and timely harvesting are essential to minimise bird damage.

**Disease control**

Diseases in pearl millets are not widespread. The most important diseases include mildew, seed rot, rust and grain moulds.

Mildew and seed rots can be controlled with recommended fungicide treatment at planting. Consult the label prior to using the product.

Rust can be a major problem of pearl millet. Planting early will minimise yield and grain quality losses owing to rust because rust is a late-season
disease. Early planting will allow the crop to mature before disease develops. Fungicide applications are not recommended for pearl millet.

Grain moulds develop when grainfill and maturation occur in wet or humid conditions. Grain moulds may reduce the quality of the grain. It is important to harvest grain as early as possible after maturity, because some grain moulds will increase if harvest is delayed.

**Cultural practices**

Diseases in pearl millet can also be controlled by certain sound cultural practices. The following cultural control practices have been found to be economically feasible in reducing disease losses. Growers should properly identify the diseases that limit production and then use a variety of controls in combination.

Rotation with unrelated crops is probably the most utilised cultural practice for disease control. This helps keep populations of pathogens from building up to damaging numbers. One should not expect rotation to eliminate disease development, but it certainly aids in reducing damage from most diseases.

Fertiliser usage may have some bearing on development of certain diseases. It differs with each crop and each disease but, in general, nitrogen out of balance with other nutrients enhances foliar disease development and predisposes some plants to other diseases. Potash, on the other hand, helps reduce disease development when it is in balance with other elements.

Deep burial of crop residue helps to control certain diseases by placing the organism contained in the residue at a depth where there is an oxygen deficiency. This reduces the population of the disease-causing organism and permits the crop to escape much of the damage.

Planting on a raised bed is helpful in preventing certain diseases such as Southern blight and certain of the wilt diseases.

Burning of crop residue has been discouraged because of destruction of valuable organic matter and creation of an air-pollution problem. However, the fact remains, that it is a highly effective means of eradicating some disease-causing organisms associated with crop residue.

Undesirable plants that might serve as a host reservoir for virus diseases, should be removed. Infected rhizomes of Johnson grass are the primary overwintering host for the maize dwarf mosaic virus that attacks grain sorghum, forage sorghum and maize.
Removal of diseased plants as these appear is often an effective method in helping reduce the spread of a destructive disease. Virus diseases of stone fruit and bacterial wilt of cucurbits are examples where roguing is worthy of consideration.

**Harvesting**

*Harvest maturity*

Grain can be harvested as early as 40 days after flowering. When the crop is ripe and dry, grains will pop out cleanly when the head is pinched. You can also begin to harvest when the seed moisture content drops below 15%, but artificial drying to 10 to 12% moisture after harvest is needed to prevent storage moulds. Matured seeds range in colour from white to brown, blue to almost purple. Most are slate grey.

*Harvesting methods*

Pearl millet can be harvested by hand, using a knife or sickle. The heads are then dried in heaps on the ground or threshing floor. It can also be harvested by using a combine harvester. Combine harvesting must be adjusted to properly thresh the small seed of pearl millet.

Harvesting for silage is well-suited to mechanical harvest and it should be done when heads appear.

---

**POST-HARVEST HANDLING**

Poor post-harvest handling can result in the reduction of seed quality and yield. The grain is tougher and denser than sorghum and can be easily combined, when well dry, using higher cylinder speeds, more air and adjusting the screens for the smaller seed size.

**Sorting**

The grain must be dislodged and be separated from spikelet and other debris. One traditional technique that is frequently used is winnowing, that is wind blowing threshed seed, thereby separating the grains from foreign materials or debris.

**Packing**

Packing is normally done in bags, which must be tightly closed.
Storage
Mould and germination of grain (sprouts) may occur if grains are not properly dried. It is recommended that the grain be stored at maximum moisture of 12 to 13% and kept in a cool place. Several factors lead to the loss of both viability and nutrients, owing to insect, bird, rodent and mould damage. Sometimes millets are stored as unthreshed heads in a solid-walled container.

Transport
When trucking millet over long distances, it is probably best to cover the grain to prevent seed loss. Pearl millet grains are normally transported in bulk bags.

Marketing
There is, currently, a lack of commercial markets for pearl millet in South Africa. It is, so far, grown mainly for subsistence and traded locally by small-scale farmers.

PRODUCTION SCHEDULES

<table>
<thead>
<tr>
<th>Activities</th>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil preparation</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planting</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fertilisation</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irrigation</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pest control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disease control</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weed control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harvesting</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marketing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>
UTILISATION

It is used mainly as whole, cracked or ground flour, dough, or a grain-like rice. These are made into fermented breads, foods and thick porridges, steam cooked dishes, non-alcoholic beverages and snacks. Pearl millet is also grown for silage and hay production. Crop residue and green plants provide building materials for fencing, thatching and making basketry.

Nutritional composition

The seed contains 5 to 7% oil, and has higher protein and energy levels than maize and sorghum.

REFERENCES


http://www.ext.nodak.edu/extpubs/plantsci/hay/r1016w.htm

http://www.icrisat.org/PearlMillet/PearlMillet.htm

info@jeffersoninstitute.org
Further information can be obtained from:
Directorate Plant Production
Private Bag X250
PRETORIA 0001
Tel: +27 12 319 6072
Fax: +27 12 319 6353
E-mail: DPP@daff.gov.za or PA.DPP@daff.gov.za