



LIST OF CROPS
Suitable to Be Grown in Sesheke District
in Western Province of Zambia



LIST OF CROPS
suitable to be grown in Sesheke District
in Western Province of Zambia

1. Dalmatian Pellitory
 2. Sorghum
 3. Sudangrass
 4. Common millet
 5. Peanut
 6. Okra
 7. Eggplant
 8. Tomato
-

1. Dalmatian Pellitory, Pyrethrum (*Tanacetum cinerariifolium*)

Tanacetum cinerariifolium is a PERENNIAL growing to 0.5 m (1ft 8in).

Some people are highly allergic to this plant. Prolonged contact with the dried flowers can lead to allergic dermatitis, allergic rhinitis and asthma in humans.

USE

The dried flower buds are the source of the insecticide 'Pyrethrum'. The pyrethrins are produced in the yellow disc florets. The highest pyrethrin content is from the flowers when they are in full bloom (1.22%) and lowest in the preceding period (0.71%). This insecticide also kills many beneficial insects, though it is relatively harmless to mammals. Another report says that it is non-



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toxic to mammals. It is best used in the evening so that it will have lost much of its virulence by the morning.

ECOLOGY

Soil requirements: prefers a rich soil with plenty of humus. Prefers a pebbly, calcareous dry soil in a sunny position. When grown in moist climates the plants often die after flowering. Tolerates a pH in the range 5.2 to 7.5.

Suitable for: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil.

Suitable pH: acid, neutral and basic (alkaline) soils and can grow in very alkaline soils.

It cannot grow in the shade. It prefers dry or moist soil. The plant can tolerate maritime exposure.

CULTIVATION

Sowing: sow late winter to late spring or late summer to autumn.

Sow pyrethrum seeds in pots indoors or sow directly where they are to flower in a prepared bed in late spring once all danger of frost has passed. For the best results, choose a planting location that receives full sun and has very well-drained soil of average fertility.

For sowing indoors, sow in pots or trays containing good seed compost. "Just cover" the seeds with a fine sprinkling of compost and make sure the compost is kept moist but not wet.

Germination usually takes 30 to 60 days at 13°C (55°F).

Transplant the indoor seedlings when large enough to handle into pots and grow on. Plant them out into their permanent positions in late spring or early summer, after the last expected frosts.

Space 30cm (12in). Water regularly for the first two weeks of growth for container-grown plants to allow them time to become established.

Increase watering during times of drought or extreme heat. No supplemental fertilizer is typically required.

Harvesting: harvest once the daisies are in full bloom as this is when the concentration of pyrethrins is at its peak. Pick the flowers carefully and hang them in bunches in a warm, airy place to dry. Crush the dried pyrethrum flowers to a fine powder in a mortar and pestle or use a blender. For the best results, use the powder immediately after grinding, as the active ingredients deteriorate very quickly.



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The powder can be applied directly to the leaves of infected plants by dusting with a shaving brush or something similar.

(For stronger results, harvest the flowers with their stems intact and hang upside down in water for 24 to 48 hours before drying to increase the strength of the pyrethrins. This isn't necessary but it will make for a stronger insecticide.)

Insecticide preparation: to make a spray, soak two teaspoons of the powder in 4 cups of very warm water for around three hours. After this time, add 1 tsp of dish washing liquid and the spray is ready to be used.

Use immediately for the best results or within at least 12 hours of preparation. After this time, the active ingredients will no longer offer protection.

Although this spray is safe, be sensible when preparing any natural insecticide and bear in mind that you may be sensitive to its effects. Do not do not inhale or ingest while preparing or spraying.

While spraying it is always good to protect the skin and eyes, do not spray in your face, ensure correct labelling and spray only the amounts needed.

Finally, it is important to keep in mind that there are good insects as well.

2. Sorghum (*Sorghum bicolor* (L.))

OTHER NAMES: durra, jowari, milo

Sorghum originated in northern Africa, and is now cultivated widely in tropical and subtropical regions.

USES

Grain sorghum is used as food for people and for livestock and poultry. Grain sorghum is the fifth most important cereal crop in the world. It is the principle food grain for more than 750 million people in semi-arid areas.

Sweet sorghums are used for producing syrups and molasses (the plants are closely related to sugar cane) and **grass sorghums** are used for pasture and hay.

Broom corns are used to produce fiber for brooms.

ECOLOGY



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Season of growth: Spring and summer through autumn until frosting.

Altitude range: sea-level to 1 000 m.

Rainfall requirements: mostly in an annual rainfall range of 400-750 mm (15- 29 in). It is grown in areas which are too dry for maize.

Optimum temperature for growth: 30°C (86 °F).

Frost tolerance: sorghum is very susceptible to frost, but thick-stemmed, standing, sweet fodder sorghum will retain stem juiciness and sweetness for some time after the leaves are killed.

Latitudinal limits: 40°N and S.

Response to light: sorghum does not grow well in shade.

Drought tolerance: the great advantage of sorghum is that it can become dormant under adverse conditions and can resume growth after relatively severe drought.

Early drought stops growth before floral initiation and the plant remains vegetative; it will resume leaf production and flower when conditions again become favorable for growth. Late drought stops leaf development but not floral initiation.

Soil requirements: it has adapted to a wide range of soils. Varieties to suit each have been selected. Good drainage, however, is necessary. Its deep rooting can extract water from low sources. Its soil pH range lies between pH 5 and 8.5.

Tolerance to flooding: sorghum is intolerant of sustained flooding, but will survive temporary waterlogging.

Tolerance to salinity: the tolerance of sweet sorghum to salt appears to be relatively high after the plants become well established.

Ability to spread naturally: very low, except for loose seed.

Dormancy: sorghum seed shows dormancy for the- first month after harvest.

CULTIVATION

Land preparation for establishment: sorghum requires full seed-bed preparation for good performance.

Sowing methods: in developing countries the seed is often planted by hand hoe and covered, the spacing depending on expected rainfall. Small hand drills are available as a first step in mechanization; sophisticated grain and fertilizer drills for precision placement are used in advanced agriculture.



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Sowing depth and cover: sorghum seed is usually sown at 4-5 cm (1.6- 2 in) depth.

Sowing time and rate: spring to summer after rain (soil temperature should be above 18.5°C (65.3 °F)) at 2-12 kg/ha, depending on soil-moisture expectancy and density of stand required, the heavier seeding being for forage production. Grain production in the 675-750 mm (26- 29 in) rainfall areas calls for 7-8 kg/ha of seed.

Vigor of growth and growth rhythm: most sorghum plants take 90-120 days to mature. The boot stage is reached in 50-60 days, flowering in 60-70 days, with full grain maturity in 120 days.

Fertilizer requirements: these will be determined by soil type and rainfall. A basic dressing of NPK may be required, and the crop usually responds well to additional dressings of nitrogen during growth. Rotation with a leguminous crop can give low-cost fertility build-up.

Compatibility with other grasses and legumes: it is generally grown as a pure crop in commercial grain production. In village crop areas it may be planted in rows alternating with other food or fiber crops in a rotation to spread labor and improve fertility. For forage and silage it is frequently grown with legumes, such as cowpea, to improve the nutritive value for grazing or stored fodder.

ANIMAL FEED

Grazing management: the fodder sorghums are used mainly for silage production and the grain sorghums for grain. The fodder sorghums, however, are also used for autumn grazing by dairy and beef cattle to fill in a feed shortage between summer and winter grazing crops. The grain sorghums are valuable for grazing after the grain has been harvested and the crop residues (stubble, dropped seed-heads and regrowth, plus weeds) provide good autumn and winter roughage.

Response to defoliation: sweet forage sorghum will stand a series of grazing where soil moisture and the temperature remain adequate, new branches and tillers being produced. Stalks may become thick and fibrous in the fodder types and the forage or grass sorghums, such as Sudan grass, make better grazing.

Animal production: the grain is used extensively for animal feeding in concentrate rations, with high-protein constituents. After the grain is harvested, the sorghum stubble gives quite useful grazing in winter when other feed may be scarce. Grazing fodder sorghums in autumn to fill in a feed gap is also a sound practice.



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Suitability for hay and silage: sorghum is made into a coarse hay in some countries and stored for later feeding. Frequently the grain is first harvested and the "stover" used for fodder, for example for work oxen in India, and for building, such as African rondels.

Sorghum is one of the best crops for silage because of its high yields, the sugar content and juiciness of its stalk and its adaptability to areas receiving too little rain to ensure crops of maize. The ensilage of sorghum also usually effectively stops stock losses from prussic acid poisoning.

Palatability: the sorghums are all very palatable, especially in the young and flowering stages.

Toxicity: in common with other Sorghum spp., it can contain lethal amounts of prussic acid.

YIELDS

Dry-matter and green-matter yields: sweet sorghums yield 25 000-75 000 kg/ha green matter, according to soil fertility and rainfall. Grain sorghums yield 300-2 000 kg/ha of grain in India and Africa under rain-fed conditions, and irrigated hybrid sorghums in the United States produce 4 500-6 500 kg/ha of grain.

Seed yield: the grain sorghums yield 300-2 000 kg grain per hectare in India and Africa under rain-fed conditions, and 4 500-6 500 kg/ha under irrigation for hybrid types in the United States and Australia.

Sorghums usually give high yields of seed. The fodder sorghum grains contain higher tannin than the grain sorghum. This may affect egg production by poultry consuming a sorghum meal mixture; hence, grain sorghum is usually used.

3. Sudangrass (*Sorghum x drummondii* (Steud.))

OTHER NAMES: Sudan grass, sudangrass, chicken corn, shattercane, sordan, sorghum sudangrass, sorgho du Soudan, sorgho menu, sudangras, pasto Sudán

Sorghum x drummondii (Sudangrass), is a hybrid-derived species of grass raised for forage and grain, native to tropical and subtropical regions of Eastern Africa. The plant is cultivated in Southern Europe, South America, Central America, North America and Southern Asia, for forage or as a cover crop.

It is distinguished from the grain sorghum (*Sorghum bicolor*) by the grain (caryopsis) not being exposed at maturity.



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USE

Sudangrass is used as forage for ruminants; it can be grazed or utilized in cut-and-carry forages, as hay or silage for ruminants.

ECOLOGY

Sudangrass is suited to warm conditions with low humidity and an average annual rainfall of 600-900 mm (23- 35 in). It is not adapted to the humid tropics and sensitive to frost. It is intolerant of waterlogging but has reasonable tolerance of salinity. Flowering in Sudan grass is to some extent photoperiod-sensitive, but in the tropics it flowers freely.

Soil requirements: sudangrass requires fertile soils of medium to heavy texture, but will respond on light soils to irrigation and fertilizer. Recommended fertilizer rates are 80 to 100 kg N/ha and 125-250 kg/ha superphosphate before planting, followed by 50 kg N/ha after grazing.

CULTIVATION

Propagation and planting: sudangrass should be sown in a well-prepared seed-bed not deeper than 2.5 cm (1 in), at the start of the rainy season, when soil temperatures are around 15° C (59 °F) and rising for quick, even germination. Seed can be drilled at 8-12 kg/ha in rows 25-50 cm (9.8- 19.7 in) apart (wider in drier climates) or broadcast at 12-16 kg/ha.

It responds well to irrigation in dry climates.

Relatively low levels of fertilizer are normally used, but it responds to N, P and K fertilizers where these nutrients are deficient in the soil.

Growth and development: seedlings emerge 5-6 days after sowing. Best time for grazing is when the crop is around 80 to 100 cm (31.5 to 39.4 in) in height.

ANIMAL FEED

Sudan grass may be grazed, chopped and fed directly, or made into hay or silage. As stems are thin, compared with the perennial sorghum species, it dries quickly, which is an advantage when hay-making.

For best regrowth, the crop should not be grazed lower than 15 cm (5.9 in).



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Rotational grazing is preferred for better utilization of the forage. Sudan grass is very palatable to livestock so the level of utilization is high and cattle are reported to consume 80% of the forage at panicle emergence. Rations with a high content of sorghum forage must be supplemented with protein, phosphorus and other minerals.

Toxicity: in common with other sorghum species, young herbage of sudangrass can accumulate high levels of HCN which may lead to prussic acid poisoning in livestock. The HCN potential varies greatly among cultivars. The HCN potential can range from zero to several hundred parts per million on a fresh weight basis. This is rarely a serious problem in sudangrass, except where high levels of N fertilizer have been applied or where it is wilted. However, adequate phosphate status helps to minimize HCN toxicity.

Nitrate poisoning may result from the ingestion of sudangrass containing high concentrations of nitrate N in plants that were fertilized with high rates of N and subsequent slow growth.

Sorghum species and cultivars should not be used with horses, which may develop cystitis, an inflammation of the bladder. This condition results in urinary disorders and lack of coordination of hind legs, and can be severe in some cases. Use of sulphur blocks (10 to 12% S) is highly recommended when grazing forage sorghums. These can substantially improve weight gains, and also help reduce the risk of prussic acid poisoning.

YIELD

Dry matter yields of 12 – 25 t/ha can be obtained.

4. Common millet (*Panicum miliaceum* L.)

OTHER NAMES: proso millet, common millet, broomtail millet, hog millet, red millet and white millet

Grown since prehistoric times as a grain crop - worldwide distribution in suitable climates.

USE

It is cultivated for its grain, mostly in Asia and North America. It is a warm-season grass with a short growing season and low moisture requirement that is capable of producing food or feed where other grain crops would fail.



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While mostly cultivated for its grain, proso millet produces enough plant material to be considered a forage crop. However, proso millet has a lower leaf-to-stem ratio than plants such as foxtail millet which generally causes it to be of lower quality. The forage quality of the straw is poor, and in India it is more often used for bedding than for cattle. The straw is also made into brooms. *Panicum miliaceum* may be a useful catch crop for emergency fodder.

ECOLOGY

Season of growth: summer.

Rainfall requirements: it generally grows in areas receiving a rainfall within the range of 500-750 mm (19- 29 in) with summer dominance.

Frost tolerance: it is susceptible to frost.

Latitudinal limits: about 30°N and S.

Response to light: it needs full sunlight for growth.

Drought tolerance: it survives hot weather better than other millets.

Soil requirements: it prefers sandy loams to clay loams, but has a wide soil range. Germination difficulties may be encountered in heavy, self-mulching clays.

Ability to spread naturally: it will grow readily from scattered seed, but is usually sown as a crop.

CULTIVATION

Land preparation for establishment: a good, fine, firm seed-bed is required for good germination.

Sowing methods: as a grain crop it is normally drilled in through a small seeds box.

Sowing depth and cover: sow at about 2.5 cm (1 in), harrow and roll to compress the soil around the seed.

Sowing time and rate: sow mid to late summer at 10-11 kg/ha.

Number of seeds per kg: 176 000.

Vigor of growth and growth rhythm: the plants tiller freely and may thus compensate for a poor initial stand. It flowers in 68 days and matures in 90-100 days.

Water requirement: it seems to have the lowest water requirement of any grain crop (308 liters-81 US gal- of water per kilogram of dry matter produced).



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Fertilizer requirements: soil tests show the need for a basic complete fertilizer.

Compatibility with other grasses and legumes: it is usually sown as a pure crop for grain, but may be combined with cowpea for grazing. Because the stems and leaves are hairy and fibrous, it is not very attractive as a grazing or hay crop.

Ability to compete with weeds: it does not compete successfully with weeds.

ANIMAL FEED

Usually cultivated for bird seed and poultry.

Grazing management: it is not usually used for grazing in Australia. It is grown widely in the USSR as a fodder plant in association with vetches and also as a cover crop in establishing Lucerne.

Response to defoliation: it recovers very poorly from defoliation.

Suitability for hay and silage: because of its hairy nature it is not very suitable for these purposes and other millets are to be preferred. It has been made into silage in Romania. Hay made from flowering plants is poor.

Toxicity: no toxicity has been noted.

Palatability: it is palatable but hairy.

YIELD

Seed yield: yields of up to 1 500 kg/ha can be obtained.

5. Peanut (*Arachis hypoagea* L.) OTHER NAMES: groundnut, monkey nut

The peanut or groundnut (*Arachis hypogaea*) is a species in the family Fabaceae (commonly known as the bean, pea or legume family). The peanut was probably first domesticated and cultivated in the valleys of Paraguay.

The peanut is not technically a nut but rather a legume. Peanuts are often served in a similar manner to true nuts in many western cuisines, and are often referred to as a nut in common English.



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USE

Seeds yield a non-drying, edible oil, used in cooking, margarines, salads, canning, for deep-frying, for shortening in pastry and bread, and for pharmaceuticals, soaps, cold creams, pomades and lubricants, emulsions for insect control, and fuel for diesel engines.

The oil cake, a high-protein livestock feed, may be used for human consumption.

Other products include dyes, ice cream, massage oil, paints, and peanut milk.

Seeds are eaten raw, whole roasted and salted, or chopped in confectioneries, or ground into peanut butter. Young pods may be consumed as a vegetable.

Young leaves and tips are suitable as a cooked green vegetable.

Scorched seeds may serve as a coffee substitute.

Peanut hulls are used for fuel, as filler for fertilizers, and for livestock feed, or sweeping compounds. Foliage provides silage and forage.

ECOLOGY

Suitable for tropics, subtropics and warm temperate regions.

Latitudinal limits: 40°S to 40°N latitude.

Growing period: 3 ½ to 5 months

Soil requirement: grows on light, friable, well-drained sandy loams, but will grow in heavier soils. Peanut can tolerate a pH of 4.3 to 8.7.

Temperature and precipitation: peanut is reported to tolerate annual precipitation of 310 mm to 4100 mm (12 in to 162 in) and an annual mean temperature of 10.5°C to 28.5°C (50.9 °F to 83.3 °F).

CULTIVATION

All commercial peanuts are propagated from seed.

Seedbed should be prepared, either on the flat, or widely ridged. In many countries they are cultivated by hand and sometimes in mixed culture.



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The spacing and seed rate vary with growth rate vary with growth habit and production methods. Stands of 250,000 plants per hectare are sought in machine-drilled planting. For types planted by hand, however, much lower seed rates may be used.

Phosphorous (P) is added on tropical red earths but less on temperate sandy soils on which other crops in the rotation receive P fertilizer.

Roots and fruits absorb nutrients.

Calcium (Ca) supply in the pegging zone is essential for high yield of good quality peanuts in large-podded, alternate types. Seeds produced on Ca-deficient soil often have poor germination and poor seedling growth. In tropical red soils of Africa, addition of S may be beneficial.

Harvesting: although flowering may commence in 30 days, 80–150 days or more are required for fruit maturation.

In hand-harvest plants are pulled up and turned over on the ground or stacked or placed on racks to cure. Pods are picked and allowed to complete drying in depths of 5 cm (2 in) or less on trays, or spread in the sun in the dry season tropics. In case of fully mechanized harvesting a single operation pulls up, inverts and windrows the plants where they remain a few days for preliminary drying. The pods are removed by combine machines and elevated into baskets attached to the combine or blown directly into trailing "drying wagons" which when full may be towed to a drying station where warm or ambient air is forced through the load of peanuts. In Argentina the combines pick and shell the pods in one operation so that the crop is marketed as dried seeds instead of dried pods.

YIELDS

Yields have increased remarkably since 1951 and now range from 2000 to 6000 kg/ha. Yields with poorer conditions range from 400–1500 kg/ha. Shelling percentage: 75–80% (sequential types) and 60–80% (alternate types).



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6. Okra (*Hibiscus esculentus* L.)

OTHER NAMES: ladies' fingers, bhindi, bamia, ochro, gumbo

Okra is a flowering plant in the mallow family. It is valued for its edible green seed pods. The geographical origin of okra is disputed, with supporters of West African, Ethiopian, and South Asian origins. The plant is cultivated in tropical, subtropical and warm temperate regions around the world.

USE

It is valued for its edible green seed pods. Okra is rarely used “straight,” except when fried with a meal, just a little of it usually being cooked with other vegetables or added to soups and stews. Okra is easily dried for later use. A little dried okra in prepared dishes produces much the same results as does the fresh product. In some lands, the seeds rather than the whole young pods are of most interest. When ripe, the seeds yield edible oil that is the equal of many other cooking oils. The ripe seeds of okra are sometimes roasted and ground as a substitute for coffee. In Turkey, the leaves are used in preparing a medicament to soothe reduce inflammation.

ECOLOGY

Optimum temperature range: 22 °C to 35 °C (71.6 °F to 95 °F)

Elevation: about 1300 m

Relative humidity: 60 to 70%

Precipitation about 1200 mm (47 in)

pH: 6.2 to 6.5

Soil requirement: lime to clay soil. It can be grown on a wide range of soils. Well drained soil is suitable.

CULTIVATION

Land preparation:

Wet zone

- a. Clean the field of weeds;



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- b. Making planting holes 30 x 30 cm (12 x 12 in) and add organic manure at the rate of one basket for four holes;
- c. If irrigation facilities are available use the ridge and furrow system.

Dry zone

- a. Plough to a depth of 15 -30 cm (6- 12 in) followed by one harrowing;
- b. Make planting holes 30 x 30 cm (12 x 12 in) and add organic manure at the rate of one basket for four holes;
- c. Same as wet zone.

Seed rate- 4.5 kg seed / ha

Time of planting: Avoid planting during heavy rains.

- Planting and spacing**
- a. Space planting holes at 90 x 60 cm (35.4 x 23.6 in) as a monocrop;
 - b. Dibbled 3-4 seeds per holes at depth of 1-2 cm (0.4- 0.8 in). Deeper sowing delays germination;
 - c. Two weeks after sowing, thin to 2 plants /hill . Fill vacancies 1 week after sowing

Harvesting: harvest can begin in 50-55 days and extended to about 100 days. Harvest pods every other day to maintain good table quality. Pods for export must be 10 - 12 cm (3.9- 4.7 in) long and harvested no oftener than every other day.

Irrigation: water daily until germination is complete and 3-4 days intervals thereafter.

YIELD

Under good management 10 - 15 t /ha.



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7. Eggplant (*Solanum melongena* L.)

OTHER NAMES: aubergine, brinjal

Eggplant is an annual in temperate zones and perennial in the tropics.

USE

Eggplant fruit is usually baked, sautéed, stuffed, cut into strips or cubes and fried. It can be baked, stewed, fried, or added to soups, curries etc. It is a good source of vitamin C and potassium.

It has been used as an antidote to poisonous mushrooms. It is bruised with vinegar and has been used as a poultice for cracked nipples, abscesses and hemorrhoids.

The leaves are narcotic and toxic. A decoction is applied to discharging sores and internal hemorrhages. A soothing and emollient poultice for the treatment of burns, abscesses, cold sores and similar conditions can be made from the leaves.

The ashes of the peduncle are used in the treatment of intestinal hemorrhages, piles and toothache. A decoction of the root is an astringent.

The fruit helps to lower blood cholesterol levels and is suitable as part of a diet to help regulate high blood pressure.

ECOLOGY

The eggplant is a warm season crop and is very tender to frost. It can even be injured by periods of cold temperature above freezing, and is more sensitive to low temperatures than either tomatoes or peppers.

Optimum temperature for growth: 25-30 °C (77- 86 °F). Some grades may tolerate lowered temperatures.

Soil requirement: the site should have fertile, well-drained soil. Prefers light loamy soil.

Plant eggplants in full sun. Those growing in partial shade will produce less than optimum yields and will take longer for the fruit to ripen. These young seedlings will perform better with protection from the wind.

CULTIVATION



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Site preparation: till soil to a depth of 15- 25 cm (6-10 in) to allow for root development. In areas that have compacted soil till or subsoil to a depth of 46 to 61 cm (18 to 24 in) to destroy the hard pan. Soil preparation should be performed in the fall after the harvest season or in the spring before planting. Soil should not be worked while it is wet.

If possible, avoid planting where eggplant, tomatoes, potatoes, or peppers were planted the previous year. All of these can be susceptible to and harbor similar disease problems.

Fertilizing: eggplant is a heavy feeder and therefore may need extra fertilizer for a good crop. A soil test may be necessary to determine the fertility of your soil.

One half of the fertilizer should be incorporated at the time of planting and the remaining fertilizer after the first fruit appears. Do not over-fertilize.

Watering: Eggplant need generous moisture at all times. One inch (2.5 cm) of water each week is a minimum. This may vary, however, due to air temperature, wind, soil type, rainfall, and whether or not mulch is used. Sandy soils require more frequent watering. Heavy soakings at weekly intervals are better than many light soakings as light, frequent watering promote shallow root systems. Mulching will reduce water loss from the soil.

Weed Control: weeds compete with eggplant for sunlight, nutrients and water. In small plantings, weeds are best controlled with cultivation or mulches.

Harvesting: eggplant fruits are harvested from the time they are one-third grown to full size. Over-mature fruits that have passed the prime stage for eating become spongy, the seeds harden and darken, and the fruit surface becomes dull. Fruits can be snapped from the plant, but less damage usually occurs if they are clipped with a sharp knife or scissors. The short stem that attaches the fruit to the stalk is often covered with sharp spines so gloves may be necessary when harvesting. The harvested fruits are delicate; be careful when handling them.

Wind and irrigation can cause the branches to break or droop. Fruit touching the ground may spoil.



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8. Tomato (*Lycopersicon esculentum* (Mill.))

Annual herb, strong-scented. The species originated in the South American Andes. **All green parts of the plant are poisonous.**

USES

It can be used as a savory vegetable or flavoring in cooked foods, or can be eaten out of hand as a dessert fruit. It is much used in salads and as a flavoring in soups and other cooked foods. The fruit can also be dried and ground into a powder that can be used as a flavoring.

Edible oil is obtained from the seed.

Sliced fruits are a quick and easy first aid treatment for burns, scalds and sunburn.

A decoction of the root is ingested in the treatment of toothache.

The strong aroma of this plant is said to repel insects from nearby plants.

A spray made from tomato leaves is an effective but very poisonous insecticide. It is especially effective against ants but should be used with great caution because it will also kill beneficial insects and, if ingested, is toxic to humans.

ECOLOGY

Soil requirements: light (sandy), medium (loamy) and heavy (clay) soils and prefers well-drained soil.

Suitable pH: acid, neutral and basic (alkaline) soils. It cannot grow in the shade. It prefers moist soil.

CULTIVATION

Adding a layer of topsoil at least 15 cm (6 in) deep to soils that are heavy in sand or clay provides a fertile bed for growing tomatoes.

Watering needs: tomatoes require regular watering in a well-drained soil to maintain healthy growth. Water your tomato plants often enough to keep the soil moist without saturating it.

Saturated soil has visible water after pushing your finger into the soil. If the leaves of your tomato



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plant begin to curl in on themselves at the edges and turn yellow, increase the frequency of your watering regimen. Tomatoes typically require at least an inch of water per week over their roots.

Growing tomatoes: applying a layer of mulch 5 to 10 cm (2 to 4 in) thick around the base of your plants reduces water loss and helps prevent competing weeds from taking hold around your tomatoes. Supporting your tomato plants with a wire cage ensures full fruit production and prevents root damage when your plants reach their mature height. Wire cages with a height and diameter of roughly 1.2 m (4 feet) installed at planting time provide support for the plant when it reaches its full size.

Harvesting: harvest your tomato plants regularly encourages them to produce more tomatoes. Tomatoes are best harvested just before the fruit fully ripens on the vine to avoid sun scald and other problems.

Fertilization: according to the Purdue University, complete fertilizers with a nitrogen, phosphorous and potassium ratio of 10-10-10 or 5-10-5 are best for tomatoes. Fertilizer is best applied at planting time, three weeks later and in small doses once every week afterwards.

Cleaning up tomatoes or leaves that drop to the ground prevents the spread of disease and pests among your tomatoes.

ANNEX 1 - DESCRIPTION
of cropping systems,
climate and soils in Zambia
by dr. R. Chikowo

Description of cropping systems, climate, and soils in Zambia

(by dr. R. Chikowo)

Agriculture in general

The agricultural sector in Zambia supports livelihoods of 85% of the population. Maize is the principal cash crop (>65% of cropped land) as well as the main staple crop. Per capita consumption of maize is estimated at 105 kilograms annually, most of which is ground into meal and consumed as stiff porridge, or fermented for beer, with by-products used as livestock feed. Other important crops include soybean, cotton, sugarcane, sunflower, wheat, sorghum, pearl millet, cassava, tobacco and various vegetable and fruit crops. Unlike elsewhere in sub-Saharan Africa, agriculture is relatively unimportant in Zambia's economy compared to mining (primarily copper). It contributes less than 20% of Gross Domestic Product. But Zambia has potential for significant increases in agricultural output; currently, less than 30% of potentially arable land is cultivated. In the past, the agriculture sector suffered from low product prices, difficulties in availability and distribution of credit and inputs, and shortage of foreign exchange.

There are three major categories of farmers in Zambia, defined in terms of the land area cultivated by each farmer. *Small-scale farmers*, who are the vast majority, cultivate less than five ha, use few external inputs, and consume most of their produce, occasionally entering the market to sell any surplus. The hand hoe is the predominant means of cultivation. *Medium-scale farmers* cultivate between 5 to 20 ha. They use improved seeds and fertilizers and sell most of their production. These farmers commonly use a combination of manual, animal draft power and tractors. *Large-scale commercial farmers* plant over twenty ha annually. These farmers apply high levels of purchased inputs and use oxen or machinery for farm operations. They produce almost exclusively for direct market sale or feed their grain to livestock kept on the farm. Large-scale farmers make up only 4% of farm households, but cultivate 22 per cent of all cropped land.

Production and yield

Crop yields depend on the production circumstances, with higher yields on commercial farms and low yields on small-scale farms. Annual maize production in Zambia was on average 1.1 Mt in the period 2000 to 2010, and average yields of about 1.5 t/ha that have not significantly changed over the past 20 years. Cultivated maize area has been on average 700,000 ha between 1987 and 2007, with largest area of 900,000 ha in 2008. The yield gap between actual yields and potential yields remains wide. Zambia produced an annual average of about 24,000 metric tons of sorghum and 42,000 metric tons of millet between 1987 and 2008. Sorghum and millet national average yields are very low, about 0.55 and 0.65 t/ha, respectively.

Agro-ecological zones and soils

Zambia is divided into three major agro-ecological regions (Regions I, II and III), which are primarily based on rainfall amount but also incorporate soils and other climatic characteristics.

Semi-arid Region I includes areas of southern, eastern and western Zambia: Zambia's valleys at 300-800 m altitude mostly lie in Region 1. Mean annual rainfall in Region I ranges from 600 to 800 mm. The growing season is relatively short (80-120 days) and risky for crop production, as poorly distributed rains result in crops enduring frequent dry spells. Region I contains a variety of soil types,

LIST OF CROPS
 Suitable to Be Grown in Sesheke District
 in Western Province of Zambia



ranging from slightly acidic loamy and clayey soils with loam topsoil, to acidic sandy soils. Characteristics of these soils which have significant constraints for crop production, include: erosion, limited soil depth in hilly and escarpment areas, poor physical properties that make it difficult to till especially on cracking clay soils, crusting, and low water holding capacities in sandy soils.

Region II includes much of central Zambia, with most of Central, Southern, Eastern and Lusaka provinces. It contains the most fertile soils and most of the country's commercial farms. Annual rainfall in Region II averages 800-1000 mm, and the growing season is 100-140 days long. Distribution of rainfall is not as erratic as in Region I, but dry spells are common and reduce crop yields, especially on the sandier soils. Average mean daily temperatures range from 23- 26°C in the hottest month October to 16-20°C in the coldest months of June and July. The most common soils in Region II are red to brown clayey to loamy soil types that are moderately to strongly leached. Physical characteristics of the soils that affect crop production, include low water holding capacity, shallow rooting depth, and top soils prone to rapid deterioration and erosion. These soils also have low nutrient reserves and retention capacity, are acid, have low organic matter and nitrogen content, and are phosphorus-deficient.

Region III, the high-rainfall area, lies in a band across northern Zambia, including the Northern Luapula Copper belt, Northwestern provinces and some parts of the Central province. This region receives over 1000 mm of precipitation each year, and the growing season ranges from 120-150 days. Soils in Region III are highly weathered and leached, and characterized by extreme acidity. Consequently, the soils have few nutrients available for plant growth, and are high in exchangeable aluminum and manganese, both of which are toxic to most crops unless soils are limed to increase pH

Major cropping systems

Region I has predominantly small-scale farmers in the major valley systems. In the Luangwa Valley, sorghum, finger millet and maize are the major starchy food crops, while groundnuts, cowpeas and pumpkins are also grown. Farmers use hand hoes for cultivation. Goats and chickens are commonly kept by farm households, and some farmers have a few cattle. Other areas of the region mainly produce bulrush millet, sorghum, and cassava.

Zambia's large commercial farmers are concentrated in Region II. Their farming systems are mechanized and highly diverse, cultivating maize, soybeans, wheat, cotton, tobacco, coffee, vegetables, and flowers, and breeding livestock. Besides these large-scale systems, there are also small- and medium-scale farmers in the region. Maize is the main staple crop in these systems in Central and Eastern provinces. Beans, groundnuts, pumpkins, and cassava leaves are grown to diversify diets. Other crops include cotton, sorghum, soybeans and sunflower. Cattle, chickens, goats, pigs and sheep are common. Farmers also grow tobacco. Cattle are important for traction, meat, milk and manure. The major constraints to increase crop production in Region II are the lack of low-cost biocides to control pests and diseases, soil degradation, and the depletion of soil fertility.

Small-scale farming predominates in Region III. Rural areas of this region have the lowest population density in Zambia. Farmers use very low-input, shifting and semi-permanent cultivation techniques. Chitemene and fundakila are two widely used, traditional methods of cultivation. In Chitemene, trees are cut at 1 meter height, branches are heaped in piles and burned, and then crops are planted in the ash. Fundakila is used in cleared fields. Grass is cut and buried at the end of the rainy season and allowed to decompose. The composted material is spread before the next planting season onto frequently mounded fields.

Principal crops in the hand hoe system of Northern, Luapula and Northwestern provinces are cassava, landrace maize varieties, sweet potatoe, pumpkin, finger millet and beans. Most farmers have chickens and a few goats, but other livestock is uncommon. The existence of tsetse fly in some areas limits opportunities for cattle production.

With typical altitudes of 1,000–1,600 metres, the resulting cooler temperatures make for a comfortable climate.

But in the valleys of the Zambezi, Kafue, Luangwa and Luapula rivers (below 500 metres), hotter weather can be more oppressive. Here, temperatures in October can reach more than 45°C in the shade.

A land of three seasons

Zambia's seasons fall broadly into three periods:

Rainy season (December–April): During these months it is warm and wet, with temperatures in Lusaka generally in the low 20s°C. Most yearly rainfall occurs at this time. But sunshine is still frequent – Lusaka sees around five hours per day in January.

Cool dry season (May–August): In the middle months of the year, temperatures drop, averaging around 16°C in Lusaka. July is usually the coldest month, with clear skies at night giving the occasional ground frost, even in the valleys.

Hot dry season (Sept–November): Just two months separate the coldest month (July), from the hottest (October) as temperatures rise rapidly and reach into the 30s°C. High humidity can make this one of the least comfortable times of the year. The first rains clear the air and wash away the dust.

Reliant on the rain

Zambia's soils are generally poor, though the favourable climate allows for a range of crops.

Increasingly, farmers are choosing crops which have higher levels of essential nutrients. An orange maize/corn variety is being grown in Zambia which has high levels of beta-carotene (also be found in carrots). This is converted by the body into Vitamin A, which is essential for children to develop a healthy immune system.

Crops grown for domestic consumption include maize, tobacco and groundnuts/peanuts. Vegetables such as cassava and sweet potatoes and fruits are often cultivated, as is sugar cane for both local and export markets. Other agricultural exports include tobacco, cotton and maize.

Much of Zambia's farming remains subsistence-style, relying on seasonal rains. Efforts are being made to increase yields by introducing techniques such as crop rotation and inter-cropping (where two different crops share the same land). Soil-improving crops such as velvet beans and hemp are also being promoted.