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# **Cowpea Production Guidelines**



Zambia Agribusiness Society

# Cowpea Production Guidelines

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**Figure 1.** Cowpea Plants

### **Introduction**

Cowpea (*Vigna unguiculata*) is ranked close to common beans as a food legume in Africa. It performs well in hotter and drier parts of Zambia replacing common bean as a food crop for grain and leaf in those areas. Cowpea is an annual crop that is more tolerant to high temperatures and extended drought periods than most other legumes e.g. Groundnuts, Soya beans or Common Beans. In Zambia cowpea is mainly grown as a substance crop for home use.

### **Origin**

Although the centre of domestication for cowpea is uncertain, all evidence points to its originating in Africa. Ethiopia, Central, Southern and West Africa have all been considered probable centres of domestication. Recent studies have provided further evidence that West Africa was the primary centre of domestication. Its production has spread to East and Central Africa, India, Asia, South and Central America

### **Uses**

- Leaves are used as relish
- The dried seeds are cooked and eaten
- Fresh relish seeds and immature pods may also be consumed
- The plant can also be used as folder plant for hay, silage or pasture or livestock feeding
- The plant can be used as green manure and cover crop

## Varieties and Cultivars

### Varieties

There are a number of local varieties, that take 130 days to mature, and are prostrate/spreading in growth. So far there are two improved varieties and these are:

- Lutembwe – It takes 110 -115 days to mature and semi – erect in growth
- Bubebe – Takes 70 days to mature and is erect in growth.

### Cultivars

Many cowpea cultivars have a vining growth habit, however, modern plant breeding has also led to more upright, bush-type cultivars. The vining type is preferred for forage or cover crop use, while the bush type is better suited for direct combining. The extreme variability of the species has led to a number of commercial cultivars grouped by the variance in bean shape, size and colour.

- **Black-eyed or pink-eyed/purple hull peas** — the seeds are white with a black eye round the hilum. The “eye” can be other colours: pink, purple or shades of red being common. Upon drying, the eye colour darkens to a dark purple. The pods are purple-like on the pink-eyed/purple hull type. The seeds are not tightly packed or crowded in the pod and are kidney-shaped or oblong.
- **Brown-eyed peas** — pods range in colour from green to lavender and in length. The immature seeds, when cooked, are a medium to dark brown, very tender and have a delicate flavour.
- **Crowder peas** — seeds are black, speckled, and brown or brown-eyed. The seeds are “crowded” in the pod and also tend to be globular in shape.
- **Cream** — seeds are cream coloured and not crowded in the pods. This is an intermediate between the black-eyed and Crowder types.
- **White acre type** — seeds are kidney-shaped with a blunt end, semi-crowded and generally tan in colour. Pods are stiff with small seeds.
- **Clay types** — these older varieties are medium to dark brown in colour and kidney-shaped, but are rarely grown.

***It is advisable to check the variety listing of the national Department of Agriculture.***



**Figure 2.** Types of Cultivars

## Botany

### *Mature Plant*

Cowpea is an annual herb with strong tap root system. It may be erect, trailing, climbing or bushy, usually indeterminate under favourable conditions.

- **Root:** Cowpea has a strong taproot and many spreading lateral roots in surface soil.
- **Leaves:** The first pair of leaves is basic and opposite while the rest are arranged in an alternate patterns and are trifoliate. The leaves are usually dark green in colour. Leaves exhibit considerable variation in size (6 to 16 x 4 to 11 cm) and shape (linear-lanceolate to ovate). The leaf petiole is 5 to 25 cm long.
- **Stems:** Striate, smooth or slightly hairy with some purple shades.
- **Inflorescence:** Flowers are arranged in racemose or intermediate inflorescences at the distal ends of 5 to 60 cm long peduncles. Flowers are borne in alternate pairs, with usually only two to a few flowers per inflorescence. Flowers are conspicuous, self-pollinating, borne on short pedicels and the corollas may be white, dirty yellow, pink, pale blue or purple in colour.
- **Seeds:** Seeds vary considerably in size, shape and colour. Usually the number of seeds per pod may vary from 8 to 20. The seeds are relatively large (2 to 12 mm long) and weigh 5 to 30 g/100 seeds. The testa may be



smooth or wrinkled; white, green, buff, red, brown, black, speckled, blotched, eyed (hilum white, surrounded by a dark ring) or mottled in colour.

- **Fruit:** Pods that vary in size, shape, colour and texture. They may be erect, crescent-shaped or coiled. Usually yellow when ripe, but may also be brown or purple in colour.

### *Essential Part*

What is considered essential part of the plant in cowpea would be determined by the intended end use of the plant. A number of the plant parts could be important, i.e. seed, young leaves or seed and pod.

## **Climatic Requirements**

### *Temperature*

Cowpeas grow best during summer. The base temperature for germination is 8.5 °C and for leaf growth 20 °C. Cowpea is a heat-loving and drought-tolerant crop. The optimum temperature for growth and development is around 30 °C. Varieties differ in their response to day length, some being insensitive and flowering within 30 days after sowing when grown at a temperature around 30 °C. The time of flowering of photosensitive varieties is dependent on time and location of sowing and may be more than 100 days. Even in early flowering varieties, the flowering period can be extended by warm and moist conditions, leading to asynchronous maturity. The optimum sowing times are December to January. Early-sown crops tend to have elongated internodes, are less erect, more vegetative and have a lower yield than those sown at the optimum time.

The presence of nodular bacteria specific to cowpea ([Bradyrhizobium spp.](#)), make it suitable for cultivation in the hot, marginal cropping areas of Southern Africa, as well as in the cooler, higher rainfall areas. However, cowpeas are much less tolerant to cold soils. Cowpeas grow best during summer.

### *Rainfall*

Cowpea is a higher drought-tolerant crop than many other crops. It can grow under rainfall ranging from 400 to 700 mm per annum. Cowpeas also have a great tolerance to waterlogging. Well-distributed rainfall is important for normal growth and development of cowpeas. The frequency and unreliability of rainfall pose problems to cowpea growth in Zambia. In some areas, the frequency of rain is too high, resulting in flooding, while in some other areas it is so unreliable that moisture conservation remains vitally important for crop production. Cowpeas utilise soil moisture efficiently and are more drought-tolerant than Groundnuts, Soya-Beans and Sunflowers. Cowpeas can be produced satisfactorily with an annual rainfall between 400 and 750 mm. In areas where annual rainfall is high, cowpeas could be planted at a time to coincide with the peak period of rainfall during the vegetative phase or flowering stage so that pod-drying could take place during dry weather. Adequate rainfall is important during the flowering/podding stage. Cowpeas react to serious moisture stress by limiting growth (especially leaf growth) and reducing leaf area by changing

leaf orientation and closing the stomata. Flower and pod abscission during severe moisture stress also serves as a growth-restricting mechanism.

### **Soil Requirements**

Cowpeas are grown on a wide range of soils but the crop shows a preference for sandy soils, which tend to be less restrictive on root growth. It is more tolerant to infertile and acid soils than many other crops. Cowpeas are grown on a wide range of soils but prefer sandy soils which are less restrictive to root growth. This adaptation to lighter soils is coupled with drought tolerance through reduced leaf growth, less water loss through stomata, and leaf movement to reduce light and heat load under stress. Cowpeas are much less tolerant to cold soils than common beans and show a poor tolerance to waterlogging. Cowpeas thrive in well-drained soil and less on heavy soils. It requires a soil pH of between 5.6 and 6.0.

### **Cultivation Practices**

#### *1. Propagation*

Cowpea is directly grown from seed.

#### *2. Soil Preparation*

The land must not be waterlogged but well drained. During land preparation, the existing fallow weeds, trees and shrubs in the site are cut down manually, or slashed with a tractor and fallen trees should be removed. This should be followed by plowing and harrowing, using a disc plough and harrow. Some 4 to 6 days between each operation should be allowed to enhance good soil tilth for good seed germination. The land may be ridged or left as flat seedbeds after harrowing.

#### *3. Field Layout and Design*

Both inter-row and intra-row spacing will be determined by the type of variety and growing pattern. More space between plant and rows will be required with trailing types relative to the upright growing pattern. Generally for grain production, a plant population of 200 000 to 300 000/ha at 30 to 50 cm inter-row spacing is preferred to wider rows (70 to 100 cm), which could be suitable to the trailing types.

#### *4. Planting*

For optimum yield, cowpeas should be planted late November to early December in lower rainfall areas. The seed should be planted at 3 to 4 cm deep. The early-sown crops tend to have elongated internodes, are less erect, more vegetative and lower yielding than those sown at the optimum time. Date of planting manipulation is utilised by farmers for various reasons. The reasons include escape from periods of high pest load or to plant cowpea at such a time that harvesting of the crop would coincide with the period of dry weather.

#### *Plot Layout*

The field is marked into blocks of known areas with alleyways between blocks to enhance movement of materials and agronomic operations.

### Seed-Sorting and Treatment

Seeds to be used for planting must be sorted to make sure that these are free from insect damage (without damage holes or wrinkles) or any inert materials.

### Plant Spacing and Density

Three seeds are planted at 20 cm along the ridge spaced 75 cm apart (20 cm x 75 cm) representing 133 000 plants/ha for erect/semi-erect varieties and (50 cm x 75 cm; 60,000 plants/ha) for the spreading types, but later thinned to two seedlings per hill, 1 week after germination. Seeding rate ranges from 25 to 30 kg of good and viable seeds per hectare in experimental stations. Commercial seeding rates would depend on plant spacing.

### 5. Fertilisation

Fertiliser application in cowpea production depends on anticipated yield and soil fertility. As a legume, cowpea fixes its own nitrogen, and does not need nitrogen fertiliser. Seed should be inoculated with the appropriate *Rhizobium* species for optimum nitrogen fixation, however nodules will generally form on cowpeas. Application of a phosphate fertiliser is usually beneficial. Cowpea can grow in a pH range of 5.6 to 6.5.

### 6. Irrigation

Cowpeas are usually grown under dryland rather than irrigated conditions.

### 7. Weed Control

Annual grasses and some broadleaf weeds can be controlled by a pre-sowing application of herbicide.

Row crop cultivation may be necessary with cowpeas, depending on the weed pressure, soil conditions, and rainfall. Pre-plant tillage can assist greatly in reducing early weed pressure, and the use of cover crops.

*Striga gesnerioides* and *Alectra* spp. are the principal parasitic weeds attacking cowpeas. The following three are the most common *Striga* species that are a pest to cowpea: *S. hermonthica*, *S. asiatica* and *S. gesnerioides*.

The pest status is complex because the forms of parasitic weeds that are found on one species cannot germinate on another host plant. Careful observations and records are therefore necessary to clarify which crops are parasitized by which species.

### Control

Control of *Striga* is difficult and time consuming. At present, chemical control is not recommended, as the chemicals are expensive, handling them is very difficult and no research results are available to support chemical treatment.

Farmers are advised to improve soil fertility where this weed is a problem. Soil fertility has an effect on *Striga* infestation; more fertile soils are less infested with



*Striga*. Use of manure and/or small quantities of fertiliser may reduce the infestation, when combined with weeding of plants before seed setting.

Hand weeding of the infested areas before *Striga* sets seeds is the most important control method at present. *Striga* should be weeded out as soon as any flowering is observed, as the development of seeds takes only a few weeks. It may be necessary to weed the area twice in a season.

## 8. *Pest Control*

Cowpea is very attractive to insects. Insect pests have remained the most important setback to cowpea production, because each phase attracts a number of insect pests. The main pests during the growing season are pod sucking bugs (*Riptortus* spp., *Nezara viridula* and *Acantomia* sp.), aphid (*Aphis fabae*, *Aphis craccivora*), blister beetle (*Mylabris* spp.) and pod borer (*Maruca vitrata*).

Control by one or two applications of insecticide is invariably necessary. For commercial production this will lead to downgrading of grain.

**Aphid control.** In most cases, it is not recommended to control aphids. Control should only be considered where large infestations are threatening the crop or when viral infections have been observed. The decision to treat for aphids is based mainly on visual counts and the stage of crop development. Measurable thresholds are not available. Several commercial pesticides are available to control aphids, of which the most effective are systemic pesticides.

In some cases heavy rain may reduce the number of aphids, for example the black cowpea aphid, which is very exposed on the pods. Frequently, parasites and predators prevent the infestation from becoming established throughout a field. Hot temperatures (higher than 30 °C) frequently inhibit build-up of large densities of aphids. If a few plants are seriously affected these can be pulled up and burnt or fed to livestock. Old plants that have been harvested are best removed from the field, as these often host the aphids.

**Bruchid control.** Farmers often mix cowpea grains with ash. This method is still recommended as a cheap and safe control method. To be efficient, it should be used with at least 5 % of ash. It is recommended to avoid using chemicals in stored food. If chemical control is still considered necessary, technical assistance is needed for precise advice on chemical control.

**Blister beetle (*Mylabris tincta*) control.** Local farmers do not consider most beetles important pests and they may not even be mentioned. Farmers get worried, however, in the rare cases when large numbers of beetles are found on flowering crops. Handpicking of beetles is not frequent because most species are known to give blisters. To speed up handpicking, a basic homemade net could be used for catching the flying beetles.

*Green vegetable bug (pod sucking bugs)*

(*Nezara viridula*, *Riptortus* spp. and *Acantomia* sp.)

Scientific name: *Aphis craccivora*

## Disease Control



**Figure 3.** Diseased Plant

The most important disease of cowpea is *stem rot* caused by *Phytophthora vignae*. This disease frequently occurs in the wetter areas, and on heavier soils which may become waterlogged.

*Bacterial blight* (*Xanthomonas vignicola*) causes severe damage to cowpeas, while the most frequent virus disease encountered is *aphid-borne mosaic virus* (CabMV). *Fusarium wilt*, *bacterial canker*, *Cercospora leaf spot*, *rust* and *powdery mildew*.

***Cowpea is susceptible to nematodes and should therefore not be planted consecutively on the same land.***

### *Birds*

Birds, especially of the parrot family, could be a problem, as they can pull-up emerging seedlings and feed on developing green pods.

### **Other Cultivation Practices**

For average yields to be attained, cowpea should be accompanied by either heavy doses of insecticides or specific management measures such as intercropping or mixed cropping. Cowpea can be grown as a cover crop or green manure. Inoculant should be applied on cowpea seeds. Inoculant is marketed in liquid and powder forms for seed inoculation or in granular form for soil inoculation. Powder and granular formulations can consist of clay or peat carriers. Rhizobium inoculant is sensitive to some fungicide seed treatments and fertilisers. Seed-applied inoculant must be applied to the seed just before planting. Large populations of this introduced

Rhizobia bacteria must survive in the harsh soil environment for 2 to 3 weeks to effectively form nodules on the roots of pulse crop seedlings. In dryland cropping regions, granular inoculant is preferred because it is more reliable in dry seedbed conditions.

## **Harvesting**

### *Harvest Maturity*

Cowpeas vary in growth habit from erect or semi-erect types with short (<100 days) growth duration, grown mostly for grain, to longer (>120 days) duration in semi-erect to trailing plants which are normally grown primarily for forage. At maturity, leaves will dry down but may not drop off completely. They need to be harvested when seed moisture content is 14 to 18 %, depending on the consumer's requirement. In cowpeas grown for vegetable purposes, the leaves are picked 4 weeks after planting, and this continues until the plants start to flower.

### *Harvesting Methods*

Cowpea can be harvested using a harvester or by hand. The upright cultivars are easy to harvest by machine. Cowpea grown as a dried seed product can be direct combined, using a platform head or a row crop head. Adjustments to combine settings and possibly sieve sizes should be made for the cowpea seed. Because the pods are relatively long, some will touch the ground or be close to it, making it important to run the grain table close to the ground. In the case of cowpeas grown for vegetable purposes, young leaves are mainly picked by hand, older leaves accumulate dust or get spattered with mud from raindrops if not harvested. Harvesting of cowpea in most cases should coincide with the onset of dry season when the dry pods can remain about a week awaiting harvesting without spoilage. However, to avoid field weathering or shattering, dry pods should not be left in the field longer than 2 weeks after full pod maturity. Harvesting can be carried out manually (hand harvesting) or by using a combine harvester in the case of large-scale production.

## **Post-Harvest Handling**

### *1. Sorting*

Seed quality is important, so care in harvest and post-harvest handling is important to avoid cracked or split seed as such seeds which were allowed to dry on plant are harvested to ensure full maturity. Sorting is done to separate the broken seeds from the full seeds. Some buyers will want the seed cleaned and bagged, while others will take the grain in bulk form and clean it themselves.

### *2. Post-Harvest Handling*

The leaves are dried to store for the dry season. Usually they are first steamed or boded, but not in all places. Sun-drying requires 1 to 3 days; storage for up to a year is possible because dried cooked leaves are not damaged to the same extent as by insects as dried seeds. Excessive losses of P-carotene, vitamin C, and the amino

acid lysine often occur in sun-dried leaves, however, these can be reduced by minimal cooking followed by drying in the shade.

### 3. *Grading*

Usually the youngest leaves or tender shoots in the distinctive colour phase of new growth are gathered. Young leaves are tender, usually higher in protein, and, lacking insect damage, often look more appealing. Older leaves accumulate dust or get spattered with mud from raindrops, while younger leaves would not need so much washing.

### 4. *Packing*

Some buyers will want the seed cleaned and bagged, while others will take the grain in bulk form and clean it themselves. Packaged in sacks and put into electrical dryers or spread on a concrete slab in the case of sun drying in order to reduce the moisture content to about 12 %.

### 5. *Storage*

Insect pests in particular can be devastating to cowpea during storage. There are storage insects that cause damage to the seed; it is therefore important to store seed in a protected place. A serious insect pest during storage is the cowpea weevil *Callosobruchus maculatus*, (Coleoptera: Bruchidae). The rising popularity of organic produce lines has created interest in nonchemical disinfestation treatments as the use of chemicals in controlling these insects is becoming a problem.

The storage life of cowpea depends on its moisture content before storage. The lower the moisture content, the better the quality of seeds in storage. In developed countries; one alternative is the use of cold storage. An exposure to -18 °C during 6 to 24 hours can reduce pest numbers by more than 99 %. The grain can be stored short term at around 12 % moisture or less, with 8 to 9% recommended for long-term storage. Cowpea leaves are dried to store them for the dry season. Sun-dried leaves may store for up to a year because dried, cooked leaves are not damaged as much by insects as dried seeds.

### 6. *Transport*

For some markets, the cowpeas must be harvested at higher moisture, such as 18 %, and trucked directly from the field to the processor and do not require specialised transportation for seed, however, it could be necessary for the leaf market to avoid wilting.

### 7. *Marketing*

For the cowpea seed market, seed quality is vital, so care in harvest and post-harvest handling may be important to avoid cracked or split seed. Cowpea leaves are sold in Zambia, South Africa, Ghana, Mali, Benin, Cameroon, Ethiopia, Uganda, Kenya, Tanzania and Malawi.



## Production Schedule

Activities	Ja n	Fe b	Ma r	Ap r	Ma y	Ju n	Ju l	Au g	Se p	Oc t	No v	De c
Soil sampling								X				
Soil preparation									X			
Planting										X	X	
Fertilisation											X	
Irrigation										X	X	X
Pest control										X	X	X
Disease control											X	X
Weed control	X									X	X	X
Pruning												
Leaf sampling												
Harvesting					X	X						
Marketing									X	X	X	X

**Table 1.** Production Schedule

## Utilisation



**Figure 4.** Fried Cowpea Fruits



The cowpea is used both as a vegetable and grain. The semi-spreading types are suitable for use as a vegetable. The use of cowpea seeds as a seed vegetable provides an inexpensive source of protein in the diet.

The dried pulse may be cooked together with other vegetables to make a thick soup, or ground into a meal or paste, before preparation in a variety of ways. Similarly, fresh, immature pods may be boiled as a vegetable. Fresh leaves and growth points are often picked and eaten in the same way as spinach. Dried leaves are preserved and eaten as a meat substitute. Cowpea is also grown as a dual-purpose crop — the green pods are used as a vegetable and the remaining parts as livestock fodder. It is very palatable, highly nutritious and relatively free of metabolites or other toxins.

In West Africa where cowpea is very popular and a staple food, utilisation in family menus has advanced. For instance, in Ghana it is used to fortify cassava, plantain, cereal-based meals and yoghurt. In Nigeria, cowpea paste can be boiled or fried to produce a popular meal known as “moinmoin” that is served with rice during ceremonies, and “akara” served for breakfast.

It is envisaged that cowpea meals can be served with various popular maize meals, custard, bread, pap and rice in Zambia when production is increased and utilisation awareness improves. In many localities, cowpea leaves are harvested fresh as a vegetable for soup preparation or cured for future use during the cold season when there is no rain to sustain the crop production. The trading of seeds and processed foods provide both urban and rural areas, opportunities for earning regular income. The aboveground plant parts of cowpea, except the pods, are utilised as animal fodder. Local farmers who cut and store cowpea fodder for subsequent sales at the peak of the dry season have been found to obtain as much as 25 % of their annual income in this way.

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