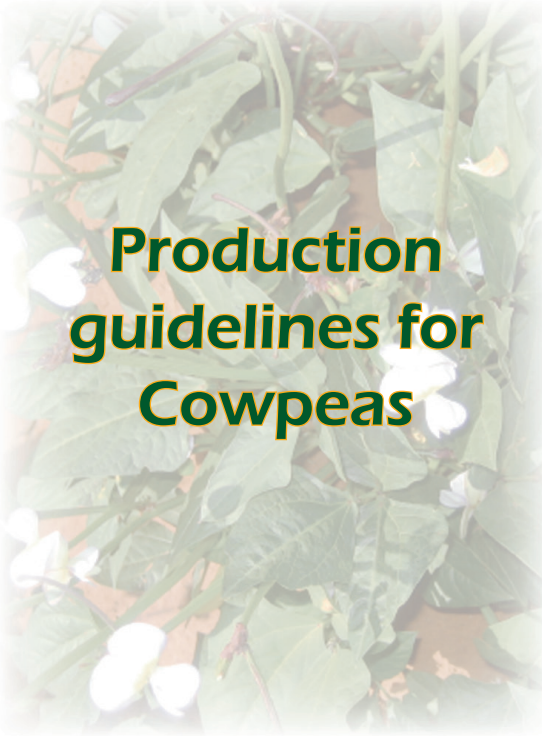
Production guidelines for Cowpeas



agriculture,
forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA



Production guidelines for Cowpeas

DEPARTMENT OF AGRICULTURE, FORESTRY AND FISHERIES

Directorate Plant Productionn

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CONTENTS

PART I: General aspects 1
1. Classification 1
2. Origin and distribution..... 1
3. Production level..... 1
4. Major production areas in South Africa..... 3
5. Varieties and cultivars..... 3
6. Descriptions..... 5
7. Climatic requirements..... 5
8. Soil requirement..... 6

PART II: Cultivation practices 7
1. Propagation..... 7
2. Soil preparation..... 7
3. Field layout and design..... 7
4. Planting..... 7
5. Fertilisation 8
6. Irrigation 8
7. Weed control..... 8
8. Pest control..... 8
9. Disease control..... 9
10. Other cultivation practises..... 10
11. Harvesting..... 11

PART III: Post-harvesting handling 12
1. Sorting..... 12
2. Post-harvesting handling..... 12
3. Grading..... 12
4. Packing..... 13
5. Storage..... 13
6. Transport..... 13
7. Marketing..... 13

PART IV: Production schedule..... 14

PART V: Utilisation..... 14

Acknowledgement..... 15

PART I: General aspects

1. CLASSIFICATION

Scientific name: *Vigna unguiculata*

Common names:

Afrikaans	akkerboon, swartbekboon, boontjie, koertjie, dopboontjie
English	cowpea, bachapin bean, black-eye bean or pea, catjang, china pea, cowgram, southern pea
Sepedi	dinawa (plural), monawa, nawa
Shangaan	dinaba, munaoa, tinyawa
Setswana	dinawa, nawa-ea-setswana
Tshivenda	munawa (plant), nawa (fruit)
isiZulu	imbumba, indumba, isihlumaya

2. ORIGIN AND DISTRIBUTION

Cowpea (Vigna unguiculata (L.) Walp) is one of the most ancient human food sources and has probably been used as a crop plant since Neolithic times. A lack of archaeological evidence has resulted in contradicting views supporting Africa, Asia and South America as origin. Some literature indicates that cowpea was introduced from Africa to the Indian subcontinent approximately 2 000 to 3 500 years ago, at the same time as the introduction of sorghum and millet, while others state that before 300 BC, cowpeas had reached Europe and possibly North Africa from Asia. Speculations are that the Northern part of the Republic of South Africa (former Transvaal region) was the centre of speciation of V. unguiculata, owing to the presence of most primitive wild varieties. They further hypothesised that the species moved northwards from the Transvaal to Mozambique and Tanzania, where the subspecies pubescens evolved. Cowpea is now grown throughout the tropics and subtropics and has become a part of the diet of about 110 million people. Cowpea is believed to have originated from West Africa by some workers, because both wild and cultivated species abound in the region. Others believe that it originated from Southern Africa. Its production has spread to East and Central Africa, India, Asia, South and Central America.

3. PRODUCTION LEVELS

South Africa

A large producer of cowpeas is small-scale farmers under dryland farming conditions. There are no records with regard to the size of area under production and the quantities produced.

Internationally

It is estimated that the annual world cowpea crop is grown on 12,5 million ha, and the total grain production is 3 million tons altough only a small proportion enters the international trade. West and Central Africa is the leading cowpea producing region in the world; this region produces 64 % of the estimated 3 million tons of cowpea seed produced annually. Nigeria is the world's leading cowpea producing country, followed by Brazil. Other countries in Africa, e.g. West Africa, are Nigeria, Senegal, Ghana, Mali and Burkina Faso. Ghana, Niger, and Cameroon are significant producers. The major production areas elsewhere in the world are Asia (India, Myanmar) and the Americas (USA, Brazil, West Indies). Of the developed countries, only the USA is a substantial producer and exporter. The cowpea is one of the mandated crops addressed by the International Institute of Tropical Agriculture, Ibadan, Nigeria. Worldwide cowpea production in 1981 was estimated at 2,7 million tons from 7,7 million ha. That notwithstanding, based on information available from Food and Agricultural Organization (FAO), it was estimated that more than 3,3 tons of cowpeas were produced worldwide in 2000 from at least 12,5 million ha. Cowpea production is widely distributed throughout the tropics, however, Central and West Africa account for more than 64 % of the area with about 8 million ha, followed by about 2,4 million ha in Central and South America, 1,3 million ha in Asia and 0, 80 million ha in East and Central Africa. Cowpea can be regarded as the fulcrum of sustainable farming in semiarid lands. This applies to West and Central Africa. In these regions, the area of cowpea production extends in a westerly direction from Cameroon through Senegal, lying mainly between 10 °N and 15 °N, covering the dry savannah (northern Guinea and Sudan savannahs) as well as Sahel zones. There are also a few additional pockets of production at more southerly latitudes, where the dry savannah agro-ecology penetrates closer into the West African coast, as in Ghana and Benin.



4. MAJOR PRODUCTION AREAS IN SOUTH AFRICA

The main producing areas of cowpeas in South Africa are:

Province	District	Town
Limpopo	Bohlabela	Thulamahashe, Hoedspruit, Nkhulu,
	Vhembe	Thohoyandou, Musina, Louis Trichardt, Mutale
	Mopani	Giyani, Duiwelskloof, Tzaneen, Phalaborwa,
		Thohoyandou, Musina, Louis Trichardt, Mutale
	Capricorn	Polokwane, Bochum, Juno, Dendron,
	Sekhukhune	Jane Furse
	Waterberg	Modimolle, Thabazimbi, Ellisras, Naboomspruit
Mpumalanga	Gert Sibande	Ermelo, Secunda, Carolina
	Nkangala	Middelburg, Delmas, Witbank
	Ehlanzeni	Nelspruit, Lydenburg
North-West	Central	Lichtenburg, Mmabatho
	Bophirima	Vryburg
	Southern	Wolmaransstad
KwaZulu-Natal	Umgungundlovu	Pietermaritzburg

5. VARIETIES AND 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, semicrowded 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.



6. DESCRIPTION

Mature plant

Cowpea is an annual herb with varying growth forms. 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.

Fruit and 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.

Esential 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.

7. 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.

Water

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 are 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 South Africa. 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 some areas of Mpumalanga, where annual rainfall is high , cowpeas could be planted ata 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.

8. 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.

PART II: 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 of South Africa. 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 presowing application of herbicide.

Row crop cultivation may be necessary with cowpeas, depending on the weed pressure, soil conditions, and rainfall. Preplant 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, particularly in the semiarid regions. 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 parasitised 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.*), **aphis** (*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 be should 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 socking bugs)

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

Scientific name: *Aphis craccivora*

9. DISEASE CONTROL



The most important disease of cowpea is stem rot caused by *Phytophthora vignae.* This disease frequently occurs in the wetter coastal and subcoastal 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.

10. 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.

11. 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.

PART III: 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 spat-

tered 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 oC 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 South Africa, Ghana, Mali, Benin, Cameroon, Ethiopia, Uganda, Kenya, Tanzania and Malawi.

PART IV: Production schedules

ACTIVITIES	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
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

PART V: Utilisation



The cowpea is used both as a vegetable and grain. The semispreading 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. In South Africa, with advanced food technology compared to West African countries, cowpea utilisation is poor because production is still in the hands of smallholder farmers. It is envisaged that cowpea meals can be served with various popular maize meals, custard, bread, pap and rice in South Africa when production is increased and utilisation awareness improves. In many localities in Limpopo and Mpumalanga provinces cowpea leaves are harvested fresh as a vegetable for soup preparation or cured for future use during winter when there is no rain to sustain the crop production. The trading of seeds and processed foods provide both urban and rural 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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