

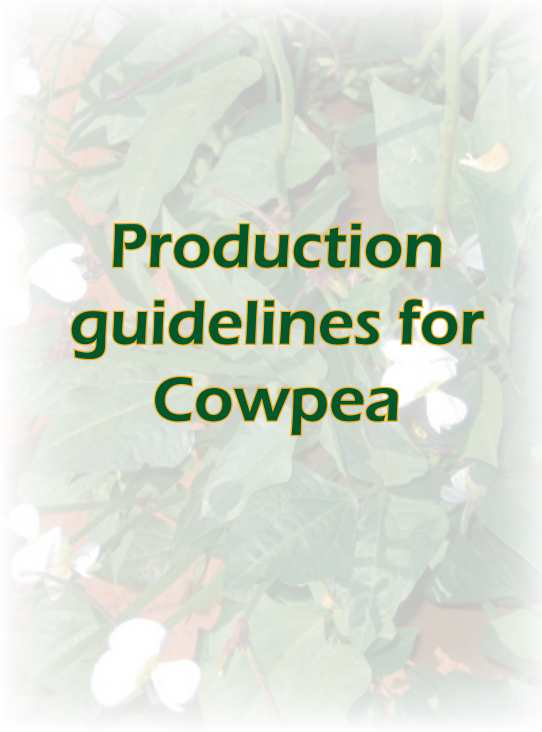
Production guidelines for Cowpea



agriculture,
forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA





Production guidelines for Cowpea

DEPARTMENT OF AGRICULTURE, FORESTRY AND FISHERIES

Directorate Plant Production

2014

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I. GENERAL ASPECTS

1.2 Classification

Scientific name: *Vigna unguiculata*

Family: Fabaceae

Common names: Koertjie, Cowpea, Dinawa, Dinaba, Imbumba, Munawa

1.2 Origin and distribution

The origin of cowpea is not known, but it is believed to have originated from West Africa and South Africa. It is distributed from East and Central Africa to India, Asia, South and Central America.

1.3 Production levels

South Africa

A large producer of cowpea 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, although a small proportion enters international trade. West and central Africa are the leading cowpea-producing regions in the world. These regions produce 64% of the estimated 3 million tons of cowpea seed harvested 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 (US, Brazil, West Indies). Of the developed countries, only the US 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 Agriculture Organization (FAO), the estimate that over 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 over 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 for West and Central Africa. In these regions, the area of cowpea production extends westerly 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 to the West African coast, as in Ghana and Benin.

1.4 Major production areas in South Africa

The main producing areas of cowpea in South Africa are:

Province	District	Town
Limpopo	Bohlabela	Thulamahashe, Hoedspruit, Nkhulu,
	Vhembe	Thohoyandou, Musina, Louis Trichardt, Mutale
	Mopani	Giyani, Duiwelskloof, Tzaneen, Phalaborwa, Musina, Louis Trichardt
	Capricorn	Polokwane, Bochum, Juno, Dendron,
	Sekhukhune	Jane Furse
	Waterberg	Modimolle, Thabazimbi, Ellisras, Mookgopong
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



1.5 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.



1.6 Description

Mature plant

Cowpea is an annual summer leguminous plant herb with varying growth forms. It may be erect, trailing, climbing or bushy, usually indeterminate under favourable conditions.

Roots: Cowpea has a strong taproot and many spreading lateral roots in surface soil.

Leaves: The first pair of leaves is simple and opposite while the rest are arranged in an alternate patterns and are trifoliate (three leaves). The leaves are usually dark green in colour. Cowpea leaves show considerable variation in size (6 to 16 x 4 to 11 cm) and shape (long, pointed to ovate depending on variety). The leaf petiole is 5 to 25 cm long.

Stems: The stems have fine lines, smooth or slightly hairy with some purple shades.

Flowers: Flowers are arranged in racemose or intermediate inflorescences at the distal ends of 5 to 60 cm long peduncles. They are borne in alternate pairs, with usually only two to a few flowers per complete flowers, including stems, stalks and flowers. They are conspicuous, self-pollinating, borne on short stalks like pedicels structure and whorls of petals forming the inner envelopes of flowers 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.

Pods: 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 might be important, i.e. young leaves, seed and pod.

1.7 Climatic requirements

Temperature

Cowpea 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, cowpea are much less tolerant to cold soils.

Rainfall

Cowpea is a more drought-tolerant crop than many other crops. It can grow under rainfall ranging from 400 to 700 mm per annum. Cowpea also has a great tolerance to waterlogging. Well-distributed rainfall is important for normal growth and development of cowpea. 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 into flooding, while in some other areas it is so unreliable that moisture conservation re-

mains vitally important for crop production. Cowpea utilises soil moisture efficiently and is more drought-tolerant than groundnuts, soya beans and sunflowers. Cowpea can be produced satisfactorily with annual rainfall between 400 and 750 mm. In some areas of Mpumalanga where annual rainfall is high, cowpea could be planted at a time as to coincide 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. Cowpea reacts 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.

1.8 Soil requirements

Cowpea grows on a wide range of soils but shows a preference for sandy soils, which tend to be less restrictive to root growth. It is more tolerant to infertile and acids soils than many other crops. This adaptation to lighter soils is coupled with drought tolerance through reduced leaf growth, reduced water loss through stomata, and leaf movement to reduce light and heat load under stress. Cowpea is much less tolerant to cold soils than common beans and shows a poor tolerance of waterlogging. Cowpea thrives in well-drained soil and less on heavy soils. It also requires a soil pH of between 5,6 and 6,0.

2. CULTIVATION PRACTICES

2.1 Propagation

Cowpea is directly grown from seed.

2.2 Soil preparation

The land must not be waterlogged but well drained. During land preparation, the existing fallow weeds, trees and shrubs on the site are cut down manually, or slashed with a tractor-drawn implement 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.

2.3 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 ones. 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.

2.4 Planting

For optimum yield, cowpea should be planted late November to early December in the 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. Planting date manipulation is utilised by farmers for various reasons. The reasons include escape from periods of high pest load or planting cowpea at such a time that harvesting of the crop would coincide with the period of dry weather.

The recommended spacing is 50 to 75 cm between rows and 50 to 75 cm between plants for spreading varieties and 50 cm between rows and 15 to 25 cm for erect and semi-erect varieties.

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.

2.5 Fertilisation

Cowpea makes its own nitrogen but needs phosphorus to grow well. Using a hoe, open up a furrow and apply 40 g of superphosphate in the bottom of the furrow at the rate of 40 g/m or a teacupful per 5 m row. When using chemical fertiliser, purchase a 2:3:2 NPK mixture and apply at the rate of 40 g/m or one teacupful per 5 m. After spreading the fertiliser evenly in the furrow, use a stick to mix the fertiliser with the soil. Water the furrow and make the holes for the transplant.

When using poultry or pig manure, use a 10-ℓ bucket in a band of about 20 cm wide over a length of 15 m, work the manure into the topsoil, water the band thoroughly and wait one to two weeks before transplanting. When using kraal manure, follow the same procedure but use a 10-ℓ bucket over a length of 5 m.

2.6 Irrigation

Water requirements vary with the crop growth's stage, soil type and weather condition (hot or cold). Cowpea tolerates drought, however, water it regularly if it is grown as a leafy vegetable. The frequency of irrigation depends on the soil type. Frequent

irrigation will be required for sandy soils as they tend to drain quickly and do not hold a great deal of water. Clay soils, on the other hand, drain quite slowly and hold more water than sandy soils. There are a few “rules of thumb” to use as a starting point for irrigation frequency and amount. First, sandy soil should be irrigated three times a week. Second, sandy loam should be irrigated twice a week. Third, clay, clay loam and loam soils should be irrigated once a week. Irrigate up to 4 ℓ for a plot size of 1 m x 1 m (4 ℓ/ m²). Sprinkler and drip irrigation can be used to irrigate; however, water savings with drip are substantial and roughly half as much water can do the same or better job than a sprinkler system. Excess water application leaches nutrients away from the roots of the plants, therefore careful irrigation volume and frequency is required to prevent crop stress to help produce large, healthy cowpea plants.

2.7 Weed control

Annual grasses and some broadleaf weeds can be controlled by a presowing application of herbicide.

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

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 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.

2.8 Pest and disease control

Insect pests attacking cowpea are Mexican bean beetle, bean leaf beetles, cowpea curculio, green stink bug, maize stalk borer and weevils (when in storage). Other important pests also include the cowpea aphid (*Aphis craccivora*), various leaf hoppers, the Egyptian leaf worm (*Spodoptera littoralis*), larvae of the African bollworm (*Heliothis armigera*) and cowpea leaf beetle (*Ootheca mutabilis*).

Diseases reported are fusarium wilt, bacterial canker, southern stem blight, cowpea mosaic virus, *Cercospora* leaf spot, rust and powdery mildew. The root-knot nematode and damping-off can be problems. Other diseases reported are brown blotch (*Colletotrichum capsici*), Septoria leaf spot (*Septoria vignae*), stem cancer (*Macrophomina phaseolina*) and bacterial blight (*Xanthomonas campestris*), scab (*Sphaceloma* sp.), brown rust (*Uromyces appendiculatus*) and web blight (*Rhizoctonia solani*).

Pests can be controlled by cultural practices like crop rotation and the use of specific pheromone lures, which will confuse the males and keep them from mating with the females. It is important to get rid of infected leaves, branches etc. as they might harbour eggs over winter.

Diseases can be controlled by using diseases-free seed by using hot water seed treatment at 50 °C. for 25 to 30 minutes. Strictly follow time and temperature recommendations to minimise damage to seed germination and vigour. The hot water treatment can also eliminate fungal pathogens on the seeds. Chlorine can also be used effectively for seed treatment; use one part household bleach to four parts plus a half teaspoonful of surfactant (liquid soap) per 4,5 ℓ of solution, agitate seed for one minute, then rinse in running water for 5 minutes. Dry the seed thoroughly. Spraying with a copper compound can be effective in controlling bacterial blight.

2.9 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 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 rhizobial 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.

2.10 Harvesting

Harvest maturity

Leaves

Harvest of young leaves for a vegetable can be done as soon as it is 3 weeks from sowing. Cowpea tend to be quite coarse when they are old.

Cowpea varies 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.

Seeds

Pods are harvested from healthy, disease-free plants when they have turned yellow but not yet completely dry. Seeds are harvested when the pods start to dry but before they shatter.

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 directly 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 cowpea being grown for vegetable purposes young leaves are mainly picked by hand; older leaves accumulate dust or get splattered with mud from raindrops if not harvested. Harvesting of cowpea in most cases should coincide with the onset of the 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.

3. POST-HARVEST HANDLING

3.1 Sorting

Seed quality is important, so care in harvest and post-harvest handling is important to avoid cracked or split seeds 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.

3.2 Drying and threshing

Dry the pods and place in a shelter for 1 to 2 weeks of curing. Pods are threshed by hand, however, be careful not to damage or split the seeds. Seeds should further be cleaned and dried after threshing.

3.3 Storage

The leaves are dried to store for the dry season. Usually they are first steamed or boiled, 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 as much 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. Keep properly dried seed in a container to avoid damage by insects.

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 during storage is cowpea weevil *Callosobruchus maculatus*, (Coleoptera: Bruchidae). The rising popularity of organic produce

lines has created interest in non-chemical disinfestation treatments as the use of chemicals in controlling these insect 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 $-18\text{ }^{\circ}\text{C}$ for 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 be stored for up to a year because dried, cooked leaves are not damaged as much by insects as dried seeds.

3.4 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, have less insect damage and often look more appealing. Older leaves accumulate dust or get spattered with mud from raindrops, while younger leaves would not need as much washing.

3.5 Transport

For some markets, the cowpeas must be harvested at a 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.

3.6 Marketing

For the cowpea seed market, quality of seed 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.

4: 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

5: UTILISATION

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 moimoin that is served with rice during ceremonies, and akara served for breakfast. In South Africa, with advanced food technology compared to its West African counterparts, 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 the 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 provides both urban and rural opportunities for earning a regular income. The above-ground 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 obtained as much as 25% of their annual income in this way.

ACKNOWLEDGMENTS

The Department of Agriculture, Forestry and Fisheries acknowledges the Water Research Commission, the Agricultural Research Council – Grain Crops Institute and Agricultural Research Council – Vegetable and Ornamental Plant Institute for providing valuable information.

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NOTES

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