Groundnuts

— Production guideline —

agriculture,
forestry & fisheries

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CONTENT

GENERAL

Classification

Scientific name: *Arachis hypogaea*
Common name: Groundnuts, peanuts, matokomane, dzinduhu

Origin and distribution

The cultivated peanut or groundnut (*Arachis hypogaea* L.), originated in South America (Bolivia and adjoining countries) and is now grown throughout the tropical and warm temperate regions of the world. This crop was grown widely by native people of the New World at the time of European expansion in the sixteenth century and was subsequently taken to Europe, Africa, Asia, and the Pacific Islands. Groundnut was introduced to the present south-eastern United States during colonial times. Groundnuts were grown primarily as a garden crop in the United States until 1870. As a field crop, the crop was frequently used for pig pasture until about 1930. In South Africa, groundnuts are grown in the summer rainfall regions under irrigated or rainfed conditions. Resource-limited farmers, especially in the northern and eastern parts of South Africa, grow groundnuts mainly for their own consumption. Groundnuts are an important source of nutrition in the northern KwaZulu-Natal and Mpumalanga areas

Production levels in South Africa

Groundnut is mainly produced in the western regions of SA, with 40% of production taking place in the western and north-western Free State, 29% in the North West and 24% in the Northern Cape. In Limpopo and Mpumalanga production is low. Groundnut production increased significantly (200 000 tons) during the 2000/01 season because of larger planting areas (± 140 00 ha).

Major production areas in South Africa

Province	District	Towns
North West	Ngaka Modiri Malema	Mafikeng, Delareyville, Lichtenburg, Zeerust, Sannieshof
	Bojanala	Rustenburg
	Dr. Ruth Segomotsi Mompati	Schweizer-Reneke, Vryburg, Christiana

Province	District	Towns
North West	Dr. Kenneth Kaunda	Potchefstroom, Wolmaransstad
Northern Cape	Francis Baard	Kimberley
Free State	Lejweleputswa	Welkom, Reitz
	Northern Free State	Kroonstad
Limpopo	Waterberg	Bela-Bela, Mookgopong, Vaalwater
	Mopani	Giyani, Letsitele, Mooketsi, Bolebedo,Tzaneen, Phalaborwa
	Vhembe	Messina and vicinity, Malamulele, Thohoyandou, Makhado
Mpumalanga	Nkangala	Middelburg, Witbank, Siyabuswa
	Enhlanzeni	Thulamahashe, Makwitswi, Mkhuhlu, Bushbuckridge

Cultivars

There are few registered cultivars for groundnuts in South Africa; however, research on cultivar improvements is under way.

Registered cultivars			
Akwa (254)	Harts (254)	Kwarts (254)	Phb 96B01 R (411)
Anel (254)	JL 24 (959)	Rambo (254)	Phb 95Y41 R (411)
Billy (254)	Kangwane Red (254)	Sellie	Phb 95Y40 R (411)
Robbie	PAN 9212	Tufa (254)	Phb 95Y20 R (411)
Mwenje (1137)	SA Juweel (254)	Inkanyezi (959)	Phb 95B53 R (411)
Nyanda (1173)			

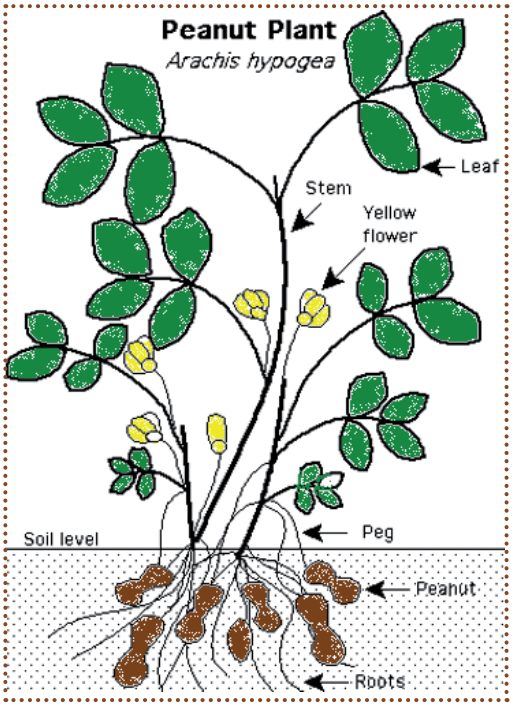
These cultivars are also recommended for warm, dry areas such as the North West, Limpopo, the Northern Cape and the western Free State.

Plant description

Groundnut is a self-pollinating, indeterminate, annual, herbaceous legume. Natural cross-pollination occurs at rates of less than 1% to greater than 6% owing to typical flowers or the action of bees. The fruit is a pod with one to five seeds that develops underground within a needlelike structure called

a peg, an elongated ovarian structure.

Groundnut emergence is intermediate between the epigeal (hypocotyl elongates and cotyledons emerge above ground as in soya beans) and hypogeal (cotyledons remain below ground as in field pea types). The hypocotyl elongates, but it usually stops before the cotyledons emerge. Leaves are alternate and pinnate with four leaflets (two pairs of leaflets per leaf). The groundnut plant can be erect or prostrate (20–60 cm tall or more) with a well-developed taproot and many lateral roots and nodules. Plants develop three major stems, i.e. two stems from the cotyledonary axillary buds equal in size to the central stem during early growth. Bright yellow flowers with both male and female parts are located on inflorescences resembling spikes in the axils of leaves. One to several flowers may be present at each node and they are usually more abundant at lower nodes. The first flowers appear at four to six weeks after planting and maximum flower production occurs six to ten weeks after planting.



Eight to fourteen days after pollination, aerial pegs will grow 5 cm to 8 cm into the soil and then turn to a horizontal orientation to mature into a peanut pod. Pods reach maximum size after two to three weeks in the soil, maximum oil content in six to seven weeks, and maximum

protein content after five to eight weeks. The crop matures after seven to nine weeks in the soil, which is indicated by maximum levels of protein, oil, and dry matter, and the presence of darkened veining and brown splotching inside the pod. Groundnuts usually require a minimum of 100 to 150 days from planting to maturity, depending on the variety planted.

Flowering continues over a long period and pods are in all stages of development at harvest. Pegs will eventually rot in the soil (25% after 12 weeks in the soil) and the resulting loose pods are lost during the harvest. Because the pod wall is needed to protect the seed, as it is moved through the various markets from producer to processor or consumer, yields and farm prices are based on pods rather than seeds.

Climatic requirements

Temperature

Groudnuts require a high temperature and a frost-free period of about 160 days. They will not reach optimum maturity for a marketable yield to justify commercial production in areas with fewer heat units during the growing season. They are very sensitive to low temperatures and seeds should only be planted when the minimum temperature stabilises above 18 °C. Germination is 95% at soil temperatures ranging from 18 °C to 30 °C. The suitable vegetative growth temperature ranges from 20 °C to 35 °C. However, at 33 °C this declines to 84%. A favourable temperature for flowering and pod formation is about 28 °C. Higher altitudes with cooler climates are not suitable for groundnut production. Avoid planting in dry soil and irrigating during cold spells or planting in cold, wet soil.

Water

Moisture is another critical factor for successful groundnut production. Planting must be done on moist warm soils to speed-up the germination process. Research has shown poor germination in drier soils. Available soil moisture content is also commensurate with row width. Wider rows are advisable in low-rainfall areas while the opposite is true in higher-rainfall areas. Rainfall in the region of 500 to 700 mm per annum will be satisfactory for good yields of groundnuts.

Soil requirements

Groundnuts grow best in well-drained, red-coloured, yellow-red and red, fertile, sandy to sandy loam soils with a pH range of 5, 5 to 7, 0. Saline soils are not suitable because groundnuts have a very low salt tolerance.

Soils with more than 20% clay and stones will result in poor yield and make harvesting difficult. Shallow and compacted soils are not preferred as the taproot of groundnuts can penetrate to the soil to a depth of about 2 m. The most suitable soil forms are Avalon, Bainsvlei, Clovelly, Hutton, Pinedene and Glencoe

CULTIVATION PRACTICES

Soil preparation

Seedbeds should be prepared either on flat or widely ridged fields. Primary soil cultivation is necessary on virgin soils or any other soil type to remove debris and break the plough layer. A uniform seedbed with sufficient planting depth and spacing, good germination, weed control and sufficient moisture retention is imperative for good yields. All plant residues should be incorporated well into the soil. Producers often grow groundnuts in a minimum till system. This cannot be recommended as the soil layer where the pods develop should be devoid of plant residue. Where plant residue is present, pods rot diseases increase, influencing yield and quality. For successful groundnut production, deep ploughing should be implemented.

Field layout and design

The slope should be favourable and the field should be well-protected from soil erosion through the construction of contours and field waterways.

Avoid using fields with too much clay and fields that were planted to groundnuts the previous year. The field should be protected from soil erosion by means of contour ridges and waterway channels.

Planting

The planting date for groundnuts in South Africa should be as soon as enough rain has fallen and minimum temperatures are met, usually from mid-October to mid-November. Late planting (from December onwards) results in lower yields. Planting should occur during favourable soil and weather conditions. Planting depths of 5 cm to 7, 5 cm are preferred for better germination when soil temperature is 18 oC or above. The correct planting depth of 5 cm to 7, 5 cm ensures that the plant develops and produces optimally.

The preferred population density is 150 000 plants per hectare under dryland and 300 000 plants per hectare under irrigation. The best spacing between rows under rainfed conditions should be 90 cm with a spacing of 4 cm to 7 cm between the plants; and 30 cm to 35 cm under irrigation. The ideal intra row spacing is between 50 to 75 mm for all available cultivars.

Fertilisation

Substantial evidence exists to show that groundnuts respond well to additional fertiliser applications, even though in rural situations this is not

imperative. Groundnuts are adapted to a soil with a pH (H20) of 5, 3 or higher. If the pH is higher than 3, 5 to 8, 0, certain elements become unavailable, e.g. iron and zinc. Being a leguminous crop, groundnuts can fix atmospheric nitrogen (N) with the aid of root bacteria. For this reason this crop is not dependent on nitrogen fertilisation. Root nodules, which fix nitrogen effectively, have a pinkish appearance when dissected. Groundnuts with effective root bacteria do not need additional nitrogen. It has often been accepted that groundnuts prefer residual phosphorus to freshly applied P. In rural fields, however, the level of P is usually low and it should be applied.

Like other crops, groundnuts require adequate levels of potassium for normal growth and development. An oversupply of potassium in the soil can induce a calcium deficiency, which is reflected in a lower yield and quality. In situations where the soil potassium level is low, additional potassium can be applied. In most cases, approximately 10 kg/ha of potassium is probably sufficient, although it is very seldom required. Calcium (Ca) is very important for seed development and is regarded as an essential element in groundnut production. Groundnuts are particularly susceptible to a calcium deficiency in the soil. Where a crop is grown on calcium deficient soils, the producer will have a direct seed loss as well as indirect damage to the seed, which is not always visible.

Seed produced under such conditions is not suitable for planting. Seedlings are often misshapen with a low vigour and the heart or embryonic axis is usually damaged to such an extent that no germination takes place. In situations where less than 100 mg/kg of Ca is present in the soil, gypsum is added at a rate of 200 kg/ha. Boron (B) deficiency symptoms occur in very sandy soils and can affect quality. In cases where boron deficiency symptoms have been observed, boron could be applied with or after planting at a rate of 1 kg/ha. In acid soils in which the pH (KCl) is lower than 4, 8, molybdenum could be unavailable. In these situations it is advisable to treat the seed with molybdenum by applying 50 g sodium molybdate per 50 kg seed. Molybdenum can also be applied to the plant row 10 to 14 days post-emergence.

Irrigation

Most of the cultivated groundnuts in South Africa are under dry land. Irrigation can be done in areas with limited soil moisture/low rainfall areas so that production and quality can be maximised. The irrigation method will depend on the available water resources and the available irrigation equipment. Avoid application of excess moisture by ensuring that scheduled

irrigation is practiced. A great deal of moisture is needed before flowering and during pod filling (moderate during flowering and no application is required during ripening).

Weed control

Groundnut is susceptible to a wide range of weeds that are in severe competition with it for available soil moisture, soil nutrients, light, space, etc., and others which serve as hosts for diseases. Weeds can result in low yield and poor quality of the groundnut seeds, as well as making harvesting difficult. Therefore, an integrated system, ranging from the chemical and mechanical to the biological, should be used in order to prevent weed suppression. Effective weed control implies good control of weeds throughout the growing season.

Mechanical: Three mechanical weeding operations are important (assuming no herbicides are applied). The first is done prior to emergence of seedlings, which is usually about seven days after planting. The second one will be performed at 21 to 28 days after planting, while the last cultivation is dependent on weed growth, but should not be delayed later than 60 days after planting.

Chemical: Chemical weed control is also recommended on groundnuts. Several herbicides are registered for utilisation; however, the choice of herbicide and the concentration applied will largely depend on the species of weeds involved and the level of infestation. Labels on the herbicide should be studied carefully and emphasis should be placed on the following:

- Waiting period for both ensuing and previous crops
- Application rate based on clay percentage of the soil
- Application time, conditions, etc.

Disease and pest control

Diseases in groundnuts can be classified as leaf, stem and pod diseases, and particular viral diseases are also encountered. Insect pests such as termites could also plague the groundnut farmer. All of these diseases can be identified using the Publication *Groundnut Diseases and Pests* of the ARC-Grain Crops Institute.

The most prevalent diseases remain early leafspot and Sclerotium stem rot. These diseases are both difficult to control. Early leafspot is recognisable by the brown spots on the leaves which are surrounded by a yellow halo. Stem rot may be identified by the white mycelium (fungal growth)

in the stems, pegs and pods. Both diseases are particularly devastating when the weather is warm and the soil is moist. For information on chemical control, *A guide to the use of pesticides and fungicides in the Republic of South Africa*, published by the Department of Agriculture, Forestry and Fisheries should be consulted.

Other cultivation practices

Rotational benefits

Groundnuts, like other annual legumes in a rotation, offer several cropping advantages for the producer. Groundnut yields often increase when the crop is planted after non-legumes because of the following factors:

- Disease and insect cycles become disrupted.
- Alternative herbicides can be used to kill grassy weeds.
- Soil nutrients are used efficiently.

Inoculation

Groundnut is a leguminous crop, and it has the ability to fix 60% to 70% of its nitrogen requirement from the atmosphere under ideal conditions. Groundnut has a very specific relationship with *Rhizobium* bacteria and it is essential that an inoculant should be used. Under good growing conditions, groundnut is considered a relatively good nitrogen fixer, provided that it is inoculated with an appropriate strain of *Rhizobium*.

Other practices include intercropping, use of good cover crops to improve the soil, organic matter management, construction of diversion ditches, tilling and planting along contours, construction of terraces, conservation tillage and improving soil drainage.

Harvesting

Harvest maturity

In order to determine the best harvest date, a farmer must scout his/her crops on a regular basis, as the groundnut plant usually gives an indication of when to harvest. The number of days to maturity varies with cultivars. There are some characteristics that require close attention and observation to determine harvest maturity, namely:

- Pod colour—inner walls display a dark-brown colour as a result of darkening of the inner tissue of the hull. When 75% of the pods of the selected number of plants have reached maturity by showing the dark discoloration, harvesting can start. The outer wall of the pods should display various shades on the inner cell layer when scraped with a knife. The colours are white on the immature and yellow pods, and orange, light brown or black on mature pods. Harvesting can be done if 70% of the pods show the other colours except white.
- Seed colour—the colour of seeds in the pods can also be used as an indication. Young, immature seed is usually white in colour and changes to pink and dull pink as the seed matures.
- Leaves—the leaves develop a yellow colour and are dry at the tips.
- Prevailing weather conditions—these can influence the determination of the harvest date because they influence quality. Drought determines the harvest date when the soil is desiccated to such an extent that the plant withers and the seeds in the pods begin to shrivel and take on a ripe appearance. Such groundnuts must be harvested immediately.

Harvesting methods

MECHANICAL

The digger-shaker-windrower is used to lift groundnuts and detach them from the soil. Dig deep enough to prevent cutting pegs. Windrow-inverting attachments orient plants as they leave the shaker so pods are primarily on the top of windrows to permit greater air circulation and exposure to sunlight for a shorter drying time.

Windrowed groundnuts could be combine-harvested wet (35% to 50% moisture), semidry (18% to 25%), or dry (8% to 10%). These pods could reach a semidry condition (seeds rattle in pods) one to three days after digging. Drying in the windrow to a moisture level of 8% to 10% requires five to ten days of good drying weather. However, groundnuts remaining in windrows for several days are more susceptible to weather damage than those that are freshly extracted. Combining wet (green) or preferably semi-dry groundnuts, followed by artificial drying, could result in better-quality nuts. Adjust combines regularly to give better picking action when vines are tough, and reduce picking action when vines are dry, to obtain good picking efficiency and minimise mechanical damage to the hulls.

Manual

This method involves very careful operations that, if improperly done, could result in some groundnuts being lost in the soil.

- Lifting or loosening the groundnuts: This involves severing of the taproot below the soil surface with a “blade” implement normally at a depth of 10 cm to 15 cm.
- The stacking process: After several hours, groundnuts can be packed into bundles and stacked. It is important to shake off loose soil before stacking. The stacks are formed with a core of 15 to 40 plants placed on their leaves with the pods facing upward. A properly formed stack will not lodge or become damp when it rains. The stacks are then left on the land for four to eight weeks for final ripening and moisture loss before being picked.

- Picking and shelling: This should be done with the correct picker. The method of picking involves removing the pods from the entire plant. Plants are fed into the picker and the shells are separated from the plants. Close monitoring of the process is necessary in order to detect any defaults that could affect the quality of the kernels.
- Shelling: Hand-operated machines are available for shelling groundnuts pods. Pods should be cleaned before being fed into the sheller. Close monitoring to avoid quality loss is also important during shelling.

POST-HARVEST HANDLING

Sorting

Sorting is done to ensure that foreign materials, weed seeds, undesired split seeds, stones and leaves are removed from the desired seeds. Grades of groundnuts should be sorted according to their colours and sizes so that market demands can be met, and they must be free from insects and musty, sour and undesirable odours; they must also not contain any substance which renders them unfit for consumption and processing. Sorted groundnuts must comply with the requirements for permitted tolerances for total Aflatoxin as well as Aflatoxin B1 as prescribed by the Foodstuffs, Cosmetics and Disinfectants Act, 1972 (Act No. 54 of 1972).

Grading

There are five classes of groundnuts, namely Class A, Class B, Class C, Class D and Class E.

Specifications for classes

A consignment of groundnuts is classified as:

Class A, if it contains at least 97% of the Red Spanish type of groundnuts (for example Harts)

Class B, if it contains at least 97% of the Spanish type of groundnuts (for example Natal Common, Selection 5, Sellie, Agaat, Jasper, Robbie, Akwa, Kwarts and Anel)

Class C, if it contains groundnuts that cannot be classified in accordance with the same standards and requirements as for Class A, Class B, Class D or Class E groundnuts

Class D, if it contains at least 97% of the runner-type of groundnuts (for example Norden)

Class E, if it contains at least 97% of the Virginia runner-type of groundnuts (for example Selmani)

The grades for the different classes of groundnuts are:

- Choice grade
- Standard grade
- Machine-cleaned choice grade
- Machine-cleaned standard grade
- Machine-cleaned crushing 100/130
- Machine-cleaned splits
- Hand-cleaned splits
- Crushing grade
- Sundry machine-cleaned 80/100
- Sundry hand-cleaned 80/100
- Crushing hand-cleaned 100/130
- Pods hand-cleaned
- Grade other

Packaging

Groundnuts of different classes (with the exception of Class C) and grades cannot be packed in the same container. For the purposes of the application of the regulations a consignment of groundnuts should be packed in containers that are suitable, intact, clean, dry, odourless and strong enough.

Storage

The seeds should be dried to a moisture content not exceeding 7%. A silo can be used to store the dry seeds. The storage structure should be free of moisture to prevent moulding/micro-organism build-up. Groundnuts are usually stored in the form of unshelled nuts. Seven to eight months' storage is usually required for groundnuts used as seed, and those intended for food uses can be stored until the start of the next harvesting season.

The stored seeds should be regularly inspected to maintain proper health and for sanitary measures.

Transport

The most frequent mode of transport for groundnuts is by road trucks or railway wagons and ships, and in very rare instances air cargo can be used. The tremendous increase in the fuel price in South Africa could affect the producers' profit if the seeds are to be sold in remote areas.

Marketing

The average annual gross value of groundnuts for the past five years up to 2005/06 is approximately R332 million. Groundnuts are sold mainly as edible groundnuts and crushed groundnuts, as seed and for the animal feed industry. Marketing of groundnuts, like any other crop, is free of government intervention. Producers are able to take advantage of the free-market system through techniques such as hedging and market research. However, the producer price for groundnuts is fluctuating owing to the strengthening of the rand against the dollar and large carry-overs/large domestic stocks.

Updated information on the markets can be obtained from Grain South Africa, the South African Grain Information Service, the National Oilseed Producers' Organisation and the Oil and Protein Development Trust. Global trade requires phytosanitary standards and quality, and several certificates, including one from the PPECB, should be acquired. Locally and internationally, an increase is expected in the demand for groundnuts as a result of the biofuel initiative in South Africa and worldwide.

PRODUCTION SCHEDULE

Activities	January	February	March	April	May	June	July	August	September	October	November	December
Soil sampling												
Soil preparation												
Planting												

Activities	January	February	March	April	May	June	July	August	September	October	November	December
Fertilisation												
Irrigation												
Pest control												
Disease control												
Weed control												
Mulching												
Leaf sampling												
Harvesting												
Marketing												

UTILISATION

Human consumption

Seeds yield non-drying, edible oil, used in cooking, margarines, salads, canning, and deep-frying; the oil content of the groundnut kernels is between 45% and 55%. Groundnut oil contains high levels of energy, fat-soluble vitamins (A, D, E and K) and essential fatty acids. Seeds can be eaten raw or boiled and roasted for immediate consumption. They can be chopped into confectioneries, or ground into peanut butter. Groundnuts are also used for sweets (brittle). Young pods may be consumed as a vegetable. Young leaves and tips are suitable as a cooked green vegetable.

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

Industrial uses

Groundnut oil can be used in various ways at different levels within the industry. It can be utilised as

a raw material for manufacturing pharmaceuticals, soaps, hair creams, cosmetics, dyes, paints, lubricants; emulsions for insect control and fuel for diesel engines. It can also be used to produce a fluid diet used to strengthen patients physically and sharpen their appetites before and after operations. The hulls are used for furfural and as filler for fertilisers.

Animal feed

The oilcake that is a by-product of the groundnut oil extraction process serves as a high-protein livestock feed; it can also be used to make glue for wood. Foliage provides silage and forage. Groundnuts hulls are also used as livestock feed. The vines with leaves provide excellent high-protein hay for horses and ruminant livestock. The pods or shells serve as high-fibre roughage in livestock feed.

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