GROUNDNUT PRODUCTION

A CONCISE GUIDE

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Potchefstroom

Introduction

Groundnuts are a popular source of food throughout the world, including South Africa. In many countries groundnuts are consumed as peanut butter or crushed and used for the groundnut oil or simply consumed as a confectionary snack roasted, salted or in sweets. In other parts of the world they are boiled, either in the shell or unshelled.

Groundnuts are produced in the tropical and subtropical regions of the world, on sandy soils. The production practices vary from highly sophisticated commercial ventures in the western world to more traditional cropping practices in third world countries. Yields vary from about 400 kilograms to several tonnes per hectare depending on production system and production area. 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 own consumption. Groundnuts are an important source of nutrition in the northern KwaZulu-Natal and Mpumalanga areas. The crop can also contribute to more viable and sustainable cropping systems in other parts of the country. It is expected to become more important for the following reasons: It is an excellent rotation crop which can replace maize as a monoculture crop since it enriches the soil with nitrogen. Secondly it is a crop with high economic value which can fetch a high price on local markets. Groundnut production requires more management skills than many other crops. Successful farmers are those who apply the prescribed management practices throughout the production process.

Soil requirements

The groundnut plant produces runners (horizontal stems) which in turn produce flowers at each node. These flowers self-pollinate and produce an anchor or peg which penetrates the ground. The groundnut pod is produced underground at the tip of the pegs. The topsoil must thus have a low clay content (less than 20%) with a loose structure so that the peg may penetrate the soil freely. Soils with a high clay percentage in the topsoil may cause the groundnut pegs to break at harvest. Soil compaction can also be a problem if the fine sand fraction of the topsoil is high. This situation can be aggravated in soils where the organic residues are low.

The seedbed should be deep, without compaction layers, to accommodate the groundnut plants root system. Shallow soils must be avoided due to the low water retention capacity, as well as the possibility of water logging.

Soils with a high potential for the production of groundnuts are thus typically deep (900-1200 mm), structureless yellow, yellow-red or red soils with a sandy loam to sandy

texture in the topsoil, without physical limitations, such as compaction. Suitable soil forms are Avalon, Bainsvlei, Clovelly, Hutton, Pinedene and Glencoe.

Moisture requirements

Runner type groundnuts are unsuitable for production in South Africa because of the longer growth season and the higher moisture requirements of these types. The only groundnuts suitable for South African conditions are the Spanish types with an upright growth habit and short growth season.

It is difficult to form an impression of where groundnuts would be best adapted in South Africa by referring only to rainfall distribution. However, in order to illustrate the adaptation of groundnuts in terms of rainfall, Potchefstroom can be used as an example.

The long term average rainfall in Potchefstroom is 659 mm per year. The period July to end of September has a long term average rainfall of only 32 mm. At this time moisture in the soil is limiting, so in order to plant groundnuts in October, 45 mm of additional water is required. The average rainfall for October is 46 mm and planting in October is possible. However, due to the large variation in rainfall patterns from year to year, from 3 mm in 1961 to 151 mm in 1951, this month also has limitations. The probability of receiving 5 mm of rain every fifth day is only 16%.

During November this position improves somewhat with the probability of 10 mm of rain being 45%, which still being rather low is, however, better than 16% in October. Sufficient moisture in the soil at planting time is essential. Too much rain at harvest, however, can reduce the quality of groundnuts if the crop is left to dry in the field.

Temperature requirements

Groundnuts originate from the tropical areas in South America and require a growth period with high temperatures of which at least 160 days are frost free.

The lower limit for germination of groundnuts is around 18°C. Temperatures between 20-30°C result in 95% germination. However at 33°C this declines to 84%. Optimum germination temperatures are thus between 20-30°C with a minimum of 18°C.

The temperature of the water absorbed by the seed is also critical as far as germination is concerned. If the water temperature is initially low and gradually increases we find reduced germination. **Planting in cold wet soil is therefore unsuitable. Planting in warm soils results in fast germination and healthy seedlings.** Do not plant in dry soil and irrigate with cold water.

The warmer the environment, the faster the plant reaches the reproductive phase. Flower formation is closely related to mean temperature on condition that the variation between day/night temperature does not exceed 20°C. The most flowers are formed at a day temperature of 27°C, while a warm day (29°C) and a cool night (23°C) gives the highest pod formation.

Growth requirements and nutrition

Substantial evidence exists to show that groundnuts respond to additional fertiliser applications, even though in rural situations this is not imperative. Groundnuts are adapted to a soil with a pH (H_20) of 5,3 or higher, if the pH is higher than 3,5 to 8.0, certain elements become unavailable eg. 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 pink coloured appearance when dissected. Groundnuts with effective root bacteria do not need additional nitrogen.
It has often had 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 sufficient levels of potassium for normal growth and development. An over supply 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^{-1} of potassium is probably sufficient although it is very seldom required. **Calcium (Ca) is very important for seed development. 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 mostly the heart or embryonic axis is damaged to such an extent that no germination takes place. In situations where less than 100 mg kg^{1} Ca is present in the soil, gypsum is added at a rate of 200 kg ha^{-1}.

Boron (B) deficiency symptoms occur in very sandy soils and can affect quality. In cases where boron deficiency symptoms have been observed 1 kg ha^{-1} of boron may be applied with or after planting. In acid soils in which the pH (KCl) is lower than 4.8, molybdenum may not be available. 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 10-14 days post emergence.

Seed quality and the handling of seed

Groundnut seed is extremely susceptible to physical damage and should be handled with care at all times. Damaged or split kernels will not germinate and grow. It is also important to plant high quality seed. Better seed will produce more healthy. Poor quality kernels should not be kept for seed for the following season.

Artificial conditioning (drying of the seed)

Wherever possible, only naturally dried groundnuts should be utilised for seed purposes. Unless heat application in artificial drying is controlled very carefully, germination of groundnut seed can be greatly impaired. Sun-dried groundnuts usually result in poor germination. It is always recommended to test the germination capacity of seed prior to planting.

Seed coating agents

Groundnut seed is susceptible to fungal rot in the soil. A fungicidal seed treatment will limit this decay and increase the stand in the field. **It is therefore recommended that all seed be treated before planting**. Two seed coating agents are currently registered for use on groundnuts, namely Mancozeb and Thiram. Comprehensive directions for the use of these agents are indicated on the label. Complete coating of the seed is essential and the use of a mechanical mixing apparatus is strongly recommended.

Cultivar choice and production potential

All cultivars can be grown under irrigation. For later plantings (late November to mid December) Kwarts can be considered, while Harts is the cultivar with the shortest growing season. Anel does well without irrigation and is suitable for the developing farmer. KanGwane Red is also a cultivar that is suitable for developing farmers.

The seed yield that can be expected depends largely on the cultivar used and the conditions of production. Under irrigation and with optimal managerial practices Akwa can yield between 3,75 and 4 t ha^{-1}. Under low yield conditions (for example under drought) Robbie, Sellie, Kwarts, Anel, PAN 9212 and Akwa will still produce an acceptable yield. These cultivars are also recommended for warm, dry areas such as the North West Province, Northern Province, North Cape and the Western Free State.

Under high potential conditions the choice would be between Akwa, Anel, Jasper, Kwarts, Robbie, PAN 9212 and Sellie (Table 1). The final choice is determined by the presence or absence of black pod rot, pod nematode or scab nematode (Table 2).

Crop rotation

A well planned, crop rotation system can ensure good yields of high quality. In order to reduce risk in the farming system, groundnuts should be grown in rotation with other crops, especially grass type crops. Groundnuts have been shown to improve the yield of subsequent maize and other grain crops up to 20%.

One of the best crop rotation systems is one in which a grass fallow is followed by groundnuts. Fewer diseases are also present in groundnuts following a grass crop. Usually groundnuts also produce a better crop on fields that have been fallowed. Groundnuts should be grown after a main crop such as maize, small grains, sorghum or millet. Groundnuts should not follow cotton or soybeans due to the risk of diseases. Groundnuts following tobacco also have a risk of diseases.

Circumstances may force a farmer to plant groundnuts in succession in which case disease problems can be expected, especially leaf and pod diseases. This can be improved by deep ploughing which may reduce the disease problem. However, monoculture cannot be recommended.

Soil and seedbed preparation

A uniform seedbed with sufficient planting depth and spacing, good germination, weed control and good moisture retention is imperative for good yields. All plant residues should be well incorporated 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 residues. Where plant residues are present, pod rot diseases increase, which influence yield and quality. For successful groundnut production deep ploughing should be implemented.

Planting date

The normal planting time for groundnuts in South Africa is mid October to mid November. However several factors, the most important being rainfall, will determine the precise date. Planting after the first rains in September is not recommended. Groundnuts planted at this time of the year usually encounter cool soil conditions (lower than 18°C) which reduce germination. Farmers must be aware that irrigation directly after planting also has a cooling effect on the soil.

Groundnuts must thus be planted as early in the season as possible when the danger of cold spells has already been reduced. Groundnuts planted later, usually

produce lower yields and also have higher demands in terms of foliar disease control.

Planting depth

The correct planting depth of 50-75 mm ensures that the plant develops and produces optimally. Seed which germinates slowly as a result of deep planting, takes longer to emerge and a substandard plant will be produced.

Seed germination is rapid if the soil moisture and temperature are optimal (above 18°C). Shallow planting of seed (less than 50 mm) can only be considered when enough moisture is available and the climate is moist. In situations where moisture is not limiting 50 mm is the ideal planting depth.

Spacing

Generally 150 000 plants per hectare are recommended for dryland production, while 300 000 plants per hectare are ideal for irrigation. Various plant patterns can be followed, namely single row, double row, tram lines, etc. The particular pattern selected is not important, as long as the growing space of plants is adequate (see Table 3).

Intra row spacing

Groundnuts should not be planted closer than 50 cm in the row. Plantings that are too dense or to sparse both present problems. Plants growing in isolation are subject to tomato spotted wilt and rosette virus infection resulting in yellow, stunted or dead plants and poor yield. On the other hand, plants in low populations produce large quantities of pods per plant but total yield per hectare will be poor. The ideal spacing is between 50-75 mm for all available cultivars.

Inter row spacing (row width)

The ideal row width for Spanish type groundnuts is 90 cm under rainfed conditions and between 30 and 45 cm under irrigation. This, however, depends on the variety that is being used. The runner types (Norden and Selmani) require a row width of between 60 and 72 cm and are only produced under irrigation. Such types are generally not well suited to production in South Africa (see **Moisture requirements** on Page 1).

Planting practices

Success or failure is determined at planting. Warm soil at the time of planting is recommended. It is also generally recommended not to plant too early in the morning, but rather to let the soil warm up. When planting in irrigated soil, the soil must first be

moistened prior to planting. Groundnuts which are planted in dry soil and then irrigated normally germinate slower than groundnuts which have been planted in moist soils. If the soils should dry out too soon, an irrigation after one or two days can be considered.

Planters and planting

The best planter for use in groundnuts has to comply with the following requirements: accurate and regular spacing of the seed (75 mm apart); good depth control; does not damage seeds; the formation of a press wheel track ridge adjacent to the plant row is undesirable as it can lead to earthing up. A better seed spacing can be achieved if the planting process is done at a low speed.

Earthing up of groundnuts

Earthing up of groundnuts is not recommended as it limits yields. Earthing up of groundnuts (where soil is piled up around the main stem of the peanut plant) is an important yield limiting factor as it influences pod formation of the lower highly productive nodes, and promotes disease development. Earthing up, especially in the early stage, has an influence on plant development leading to deformed plants with poor or no production at the lower nodes. Flowers cannot develop at the nodes, and thus no pegs or pods are formed. Earthing up later in the season normally does not lead to deformed plants (as in the previous instance) but does lead to lower yields.

Weed control

Weeds compete with the crop for moisture, nutrition, light and space. Effective weed control implies good control of weed throughout the growing season. Weeds can be controlled chemically, mechanically or with a combination of the two. However, the ultimate choice depends on the species of weeds involved and the level of infestation.

Diseases

Diseases in groundnuts can be classified as leaf, stem and pod diseases and in addition to these particular viral diseases are also encountered. Insect pests such as termites could also plague the groundnut farmer. All of these diseases can be identified with the publication "**Groundnut Diseases and Pests**" of the ARC-Grain Crops Institute. The most important 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 myceliam (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 National Department of Agriculture should be consulted.

When to harvest

In order to determine the best harvest date a farmer must scout his crop on a regular basis. The groundnut plant usually gives an indication when to harvest. In order to determine the correct harvest date, the development of the plant must be considered. The groundnuts should be harvested when approximately 75% of the pods have reached maturity. The inner wall of the pods usually has a dark discolouration at maturity. When 75% of the pods of a selected number of plants already show the dark discolouration (indicating maturity), the harvest process can start. When groundnut pods are scraped with a knife, the inner cell layer displays various colour shades. Depending on the degree of maturity, this colour will vary from white, (in immature pods) to yellow, orange, light brown, brown to black in mature pods. The colour of the seed in the pod can also be used as an indication. The colour of the young immature seed is usually white, gradually becoming pink as the seed reaches maturity. When the seeds are matured, the colour turn light pink.
Diseases can also have an influence on the determination of harvest date. Plants in which the leaves have been lost due to leaf spot diseases, do not lead themselves to the making of a professional stack, as water easily penetrates the stack. In such a case the farmer will be forced to harvest at an earlier stage.

Prevailing weather conditions can also influence the determination of the harvest date, as it influences 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 process

Groundnuts can be harvested either by means of the stacking method or mechanically. In the mechanical harvesting method, groundnuts are placed in wind rows after being lifted, harvested with a combine and conditioned in a drying unit. In the stacking method, the taproots are cut and the plants are collected and stacked by hand. In this process the plant are loosened to be removed from the soil by hand.

After the plants have been lifted they are collected in bundles of 10-20 plants and placed in stacks. A stack which has been properly made will not collapse or allow moisture to penetrate with rain. Groundnuts are left in the stack until picking commences.

Groundnuts are ready for picking once the pods can be removed from the stems without causing long shreds to form. At this stage the groundnut seeds clearly rumble when the pods are shaken and the seed already has a nutty taste. Picking should commence

when the moisture content of the seeds is approximately 10% when shelling is to be done on the farm, otherwise it should be 7%.

Feeding of the picker machine must be as regular as possible, to ensure an efficient picking action. If the picking action is too fast, more stems and foreign matter will end up in the bag.
Mechanical harvesting of groundnuts can be divided in the following processes, lifting, drying in wind rows, picking and conditioning (artificial drying). The harvested groundnuts have a moisture content of approximately 25%. As groundnuts with such a high moisture content tend to rot easily, it is necessary that they be subjected to a conditioning or drying process as soon as possible. Approximately three days are required to dry the groundnuts to 8% moisture level before delivered to the buyer at 7% moisture content.

Available low cost harvesting apparatus

At the ARC in Potchefstroom a basic groundnut picker and sheller have been developed. These are available from the address given below at R80 for the picker and R700 for the sheller. Both are mechanical and require no electricity and very little upkeep. The prices quoted are subject to change.

For any enquiries regarding groundnuts contact:
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