PEANUT

PEANUT PRODUCTION

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INTRODUCTION

Peanut or groundnut (*Arachis hypogea L.*), a member of the legume family, is an important food and oil crop. It is currently grown on approximately 42 million acres worldwide. It is the third major oilseed of the world after soybean and cotton (FAO, 1990). India, China, and the United States have been the leading producers for over the last 25 years and grow about 70% of the world's crop. Peanut originated in South America (Bolivia and adjoining countries). The Portuguese took it from Brazil to West Africa. The Spaniards introduced peanuts to the Philippines from where they spread throughout tropical and sub-tropical Asia, and indeed the world. The peanut, grown mainly for human consumption, has several uses as whole seeds or processed to make peanut butter, oil and other products. The seed contains 25-30% protein (average of 25% digestible protein) and 42-52% oil. One kilogram of peanuts is high in food energy and provides approximately the same energy value as two kilogram of beef, 1.5 kg of cheddar cheese, nine litres of milk or 36 medium size eggs.

In Guyana, peanut production reached 2,279 tons in 1997, but this production steadily declined over the years to 1,313 tons in 2003. Peanut kernels are widely consumed as snack food in Guyana and can be processed in a variety of ways (e.g. peanut butter, roasted, fried and salted). There are many areas where peanuts are currently cultivated in Guyana. The most suitable areas for peanut production are the Rupununi Savannahs, Intermediate Savannahs, North West District (Wauna, Yarakita and Paruima), the Linden Highway, Upper Demerara and Upper Berbice Rivers.

2. BOTANY

The peanut is an annual herbaceous plant that grows to a maximum height of 60 cm. It is characterized by bearing of fruits that develop and mature underground. Fertilization of the ovary results in the development of an elongated stalk (peg) which grows downwards and carries the ovary into the soil to a depth of 2-7 cm. Pegs can attain a length of 15-30 cm. Once penetration of the soil surface has occurred, fruit enlargement proceeds at the peg tip with eventual formation of the peanut pod. Pods can contain 1-6 seeds.

Peanuts are divided into two main species *hypogaea and fastigiata* based on the arrangement of the vegetative and reproductive branches. This division is not only important for taxonomic purposes but has production implications. The *hypogaea* species does not flower on the main stem; it matures later than other sub species and has a high water requirement. This species has alternate branching patterns and produces large seeds. Virginia and runner types are in the *hypogaea* sub species. The *fastigiata* species produce flower on the main stem, has sequential branching, mature earlier, has lower water requirement and produces smaller seeds. Spanish and Valencia are in this sub species.

3.0. ENVIRONMENTAL REQUIREMENTS

3.1. Soil

Peanuts grow best on soils that are well drained, loosely textured and well supplied with calcium, potassium and phosphorous. The soil should be well aerated and contain moderate amounts of organic matter. Heavier clay soils or those that tend to have surface crusting are unsuitable due to their high resistance to peg penetration and pod expansion. Peanut grows best in slightly acidic soils with a pH of 6.0 to 6.5 but a range of 5.5 to 7.0 is acceptable. Saline soils are not suitable since peanut has a very low salt tolerance.

3.2. Moisture Requirement

The peanut seed has a high demand for water during germination. For optimum germination, high soil moisture is required to facilitate the 35-40% water intake by imbibing seeds. Seeds should be planted when moisture levels are favourable for rapid germination and growth. Rapid germination and vigorous growth help the young plant to counteract diseases.

3.3. *Climate*

Peanuts are adapted to a wide range of climatic conditions. They are relatively drought tolerant and require about a minimum of 400 mm rainfall during the growing period. For optimum growth, however, an annual rainfall range of 750-1250 mm is generally considered necessary. Duration of the growing period is cultivar dependent and generally lies within a 90-140 day range (Table 1). Peanuts are day neutral and flowering initiation is unaffected by photoperiod.

Temperature is the major limiting factor for peanut yield. The germination temperature range is 15-45^{o}C. During the growing period, an average temperature of 22-27^{o}C is required. Dry weather is required for ripening and harvesting.

4.0 CULTIVARS

Peanut cultivars adapted to grow under the local conditions can be separated into two types based on their growth habits. These are erect bunch and runner types. The recommended types are those that have a high market value and include the red coated seed (red nut), which are mostly bunch types and lighter pink coated seeds (white nut), which are in most instances runner types. The key growth characteristics of adaptable cultivars in Guyana are shown in Table 1.

Table 1. Key growth characteristics of adapted cultivars in Guyana.

Cultivar	Type	Days to 50% flowering	Maturity range(Days)
Ak 62	Red Nut	35-40	90-95
Florunner	White Nut	40-45	100-120
Basanti	Red Nut	40-45	100-120
GN-94-A2	Red Nut	40-45	100-120
Guyana Jumbo	White Nut	40-45	120-150
C99R	White Nut	40-45	120-130

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4.1. Runner Market Types

4.1.1. Florunner

Florunner is a late maturing (120 days) large seeded variety. It yields relatively well (1500-2000 kg/ha) under local conditions. Florunner has a spreading runner growth habit with a typical branching pattern. It has a prolific fruiting habit with pods concentrated near the taproot.

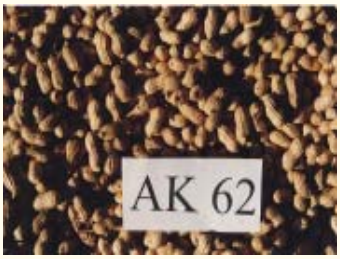
4.1.2. Guyana Jumbo

Guyana Jumbo is a large seeded roasting variety planted by farmers in the Rupununi. It was obtained from Brazil and sometimes referred to as 'Brazil nut". It produces yields up to 1200 kg/ha. It is tolerant to leaf spot and rust.

4.1.3. C99R

C99R is a runner type recently introduced to farmers in the Rupununi Savannahs. It is moderately resistant to fungal leaf spot and rust disease affecting peanuts. The average yield is 1200 kg/ha. This type is mostly recommended for peanut production in the Rupununi

4.2. Spanish bunchy market types



4.2.1. AK 62

AK 62 is an early maturing (90 days), red medium seeded variety. Its yield potential in the savannahs ranges between 800 – 1,200 kg/ha. AK 62 is more susceptible to *Cercospera* leaf spot than Florunner.

4.2.2. GN 94-A2

GN 94-A2 is a large seeded variety which originated from Brazil. This variety exhibits good adaptability and yields up to 1200 kg/ha.

4.2.3. Basanti

Basanti has a bunchy growth habit with good yield potential of up to 1200 kg/ha.

5.0. LAND PREPARATION

Good land preparation is critical for maximum moisture retention, precision planting, fast uniform seed germination and emergence and effective weed and disease control. The first tillage should take place six weeks before planting using a disc plough. This tillage involves deep turning of the soil 20-30 cm in depth (8-12") to completely bury weed seed and incorporate crop residues.

The second tillage operation is conducted using a spike harrow in order to create a suitable seedbed that is loose, smooth and level. On virgin soils, clearing and leveling is necessary. However, heavy equipment is not recommended for leveling since these contribute to soil compaction. The second tillage operation is conducted using a spike harrow in order to create a suitable seedbed that is loose, smooth and level. On virgin soils, clearing and leveling is necessary. However, heavy equipment is not recommended for leveling since these contribute to soil compaction.

6.0. LIMESTONE APPLICATION

Peanuts grow best when the soil pH range is 5.8 to 6.2. Availability of soil nutrients and the nitrogen fixation process are optimized in this range. Liming is usually needed in most of the peanut productive areas since soils tend to be low in calcium. Low levels of calcium result in peanut partial filling out or not at all, resulting in 'wind nut' formation. In the case of virgin land, limestone should be applied at least four weeks before planting, at a rate of 500 kg/ha (1500 lb/A). A soil test is advisable before recommendations are made.

7.0. PLANTING

Crop rotation practices are recommended with non-leguminous crops e.g. corn and sorghum. This would reduce the pest and disease build up problems associated with prolonged monocropping.

7.1. Seed Quality

A major constraint is non-availability of quality seed of suitable and adaptable improved varieties to the farmers. The seed is a basic input and it alone would enhance production and productivity if quality was assured. The seed quality is a combination of multiple attributes. It refers mainly to genetic and physical purity, physiological and health quality. These parameters independently and in interaction with each other constitute the overall quality of seed. The peanut propagation material should possess all the major quality attributes above the prescribed standards.

Poor stand is perhaps the most common cause of low yields. To obtain a full stand, use undamaged seed with intact seed coats and treat shelled seed with a seed dressing prior to planting.

7.2. Timing

Commercial production should be limited to the May-June season. Planting is dependent on the on-set of the rains, and it extends to the end of May or in some instances up to mid-June.

It is better to plant during the middle of the rainy season (i.e. May/June or November/December), so that the crop matures in the dry season. This makes it easier for harvesting.

7.3. Inoculation

Before sowing, a Rhizobium inoculum should be applied to peanut seeds, especially when the soil is being used for the first time. Inoculation with Rhizobium bacteria stimulates nodulation on the roots, thus, causing the plant to provide its own nitrogen and consequently reducing the need to apply large quantities of nitrogenous fertilizer.

When inoculating seeds, they should first be dampened and then mixed thoroughly with Rhizobium inoculant at 168 grams / 36 kg seed.

7.4. Spacing and Seed rate

Seed spacing and row width will depend upon grower practices; whether mechanization is used or the crop is managed with labour. Generally in peanuts, the higher the planting density, the higher the yield. Close spacing promotes compact fruiting, even maturity, weed suppression and also reduces soil erosion. For mechanized systems, the currently available technology in the savannahs, allows, primarily for a row spacing of 75 cm and wider. Seeds are usually sown at a rate of 80 kg/ha for runner varieties and 75 Kg/ha for bunchy varieties. The following are recommended spacings for the various cultivars and soil types:

Bunchy type (AK 62, GN 94-A2, Basanti)

10 cm within rows and 60 cm between rows

Spreading type (Florunner, Guyana Jumbo, C99R)

15 cm within rows and 60 cm between rows

Light textured soil

2 seeds per hole, 5-7.5 cm (2-3") deep

Heavy soil

2-3 seeds per hole, 3-4.5 cm (1.5-2") deep

8.0. WEED CONTROL

Weeds are a major problem for peanuts especially during the first 4-8 weeks. They reduce yields by competition, interference with harvest and by harbouring pests. Peanut is inherently a poor weed competitor and emphasis on cultural practices such as good land preparation and crop rotation are best recommended practices to farmers. Some common weeds associated with peanut in Guyana are shown in Table 2.

Table 2. Common weeds of peanuts in Guyana

Common name	Scientific name
1.Burr grass	*Cenchrus echinatus*
2.Nut grass	*Cyperus esculentus*
3.Mongoose tail grass	*Pennisetum solanum*
4.Crow foot grass	*Dididteria sanguinalis*
5.Hair grass	*Rhynchelytrum repens*
6.Fowl foot grass	*Eleusine indica*
7.Savannah bisi bisi	*Cyperus kyllingia*
8.Consumption vine	*Emilia fasbargii*
9. Crab grass	*Digitaria ciliaris*
10.Shame bush	*Mimosa pudica*
11.Sicklepod	*Crotataria incana*
12. Chowrai Bhajee	*Amaranthus dubius*

9.0. FERTILIZER USE

It is always advisable to have the soil tested before applying fertilizers. When nutrients are needed (low or very low soil test levels) split broadcast applications are recommended, first application at planting and second application at 50% flowering.

At planting

100 kg/ha DAP

50 kg/ha T.S.P

100 kg/ha Sul-po-mag

40 kg/ha F.T.E

At 50% flowering

250 kg/ha 12:12:17:2

250 kg/ha Sul-po-mag

Gypsum

Along with the second fertilizer application, Gypsum should be applied at the rate of 500 kg/ha. This helps to reduce the number of “wind nuts”.

Boron

Boron applications may be necessary to produce high quality and high yields of peanut, especially on sandy soils. This element can be applied by adding soluble boron at a rate of 0.5 -0.25 Kg/ha in the first fungicide application or alone at pegging time.

10.0. INSECT PEST MANAGEMENT

Peanut is attacked by a wide variety of insect and mite pests. The main insects that attack peanuts are the leaf feeding caterpillar, thrips, stalk borer, leaf eating ants, bean and flea beetle, aphids and leaf miner.

(I) Leaf Feeding Caterpillar

Casual agent: *Spodoptera frugiperda (Figure 1).*

When in abundance, they can strip plants of foliage and migrate or "march" to other host plants. Once flowering and pegging begin, loss of leaves can reduce the ability of the plant to produce pods.

When used correctly, chemical insecticides can prevent insect damage and increase yield.

Fig.1 Leaf Feeding Caterpillar

(II) Thrips

Thrips often cause stunted plants with leaves that are scarred (Figure 2)and "possum eared" (leaves edges are turned down). Thrips also transmit the virus that causes spotted wilt in peanuts. Thrips can be controlled with use of systemic insecticides applied at planting or with foliar sprays.

Fig.2 Thrips

(III) Stalk Borer

Outbreak of stalk borer in sandy soils usually occurs during hot, dry weather. The stalk borer feeds on underground pegs and pods; larvae tunnel into any aboveground part of the plant that is in contact with the surface of the soil (Figure 3). During the early stages of plant development, tunneling into the hypocotyls will stunt, and some times kill, young plants. Fields should be scouted at weekly intervals for the stalk borer.

Fig.3 Stalk Borer

(IV) Peanut Root-Knot Nematode

Root-knot nematodes exist in the soil in the form of eggs or larvae (Figure 4). Larvae begin feeding on the root tissue, which causes plant cells to increase in size and number. After 20-30 days, the larvae swell into large females. The female produces about 200 to 1500 eggs in a gelatinous matrix.

Fig 4. Peanut Root-Knot Nematode

The time from egg to female depends on the moisture and the temperature, but under favourable conditions two to four cycles can occur per season. Infected plants are usually stunted and chlorotic (75 to 90 days after planting). Typically, injury is not uniform in fields, and infected areas are often circular. Roots, pegs, and pods of infested plants are galled (swollen infected tissue). Galls on pods are wart-like in appearance and dark in colour. Knots in the roots appear much like nitrogen fixing bacterial nodules.

(V) Weevil

Casual agent: *Sitophilus zeamis*

Weevil attacks the peanuts during storage and can cause significant damage once the pest populations are high. Jute bags or sacks used for storage can be treated with neem oil or neem extracts to prevent pests particularly weevils (*Sitophilus* species) and flour beetles (*Tribolium* species) from penetrating for several months.

11.0 DISEASES MANAGEMENT

(I) Early & Late Leaf Spot

Casual agent: *Cerosporium orachidicola, Cerosporidium personatum*

Both early and late leaf spot cause drastic and direct damages, resulting in reduced photosynthesis (Figure 5). Both types of leaf spots can appear as early as 40 days after planting, but can be earlier depending on the suitability of environmental conditions for spore germination. In both cases, the fungus can girdle pegs, and necrotic leaflets falling on soil surface promote soil borne diseases. Early leaf spot lesion is usually tan to brown or reddish-brown and is often surrounded by a yellow halo. Late leaf spot lesions are darker, often nearly black, with little or no halo.

Fig. 5 Early leaf spot

Control

The recommended methods of control include the use of resistant cultivars, deep ploughing to move plant debris away from the soil surface, crop rotation and appropriate fungicides.

(II) Southern Blight

Casual agent: *Sclerotium rolfsii*

The first readily apparent symptoms of southern blight are rapid yellowing and wilting of limbs or entire plants. Affected limbs and plants then turn brown and die as a result of the decay of the lower stem (Figure 6). Southern blight infection is characterized by white or cream coloured moldy growth (mycelium) covering lower stems and importing a whitewashed appearance to the base of the affected plants.

Fig 6. Mycelium of the southern blight fungus at the base of an infected plant.

Control

Crop rotation (at least two years of a non host), deep turning (ploughing) residue prior to planting, resistant varieties, moisture, (irrigation) when necessary, and fungicides are recommended methods of control. Moisture (rain or irrigation) is necessary to wash the white mold fungicides (Folicur, Moncut) into the crown area of the plant and this can be done as soon as four hours after application. Irrigate after, not before application.

(III) Seedling Diseases

Seedling organisms include *Rhizoctonia, Fusarium, Aspergillus niger* and *Pythium*. Infection usually occurs within 24 to 48 hours after planting under adverse planting conditions (excessive moisture, excessive heat and drought). Seedling diseases are best characterized as poor stands. These soil-borne organisms can attack seeds and cause a decrease in germination. Seeds can be covered in masses of black spores, appear reddish brown, water-soaked depending on the fungus responsible. These fungi also cause pre-emergent soft rot of the hypocotyls but the most common cause of loss from these pathogens is early post-emergence seedling blight. Young plants collapse and die soon after emergence due to rot of succulent elongating hypocotyls (Figure 7) .

Fig 7. Seedling diseases

Control

Use good quality undamaged seed for planting, crop rotation, crop sanitation and resistant varieties. Seed dressing can be very effective and plant when conditions are favourable for germination.

(IV) Peanut Rust

Casual agent: Puccinia *arachidis*

The orange-coloured pustules develop on all aboveground plant parts except flowers and pegs. The spores appear first on the lower leaf surfaces. Rust-damaged leaves often remain attached to the plant (Figure 8).

Fig 8. Peanut rust

Damage

Peanut rust mostly occurs late in the season, so it mainly affects pod filling and maturity distribution. Severe infections are relatively rare. However, it can cause significant yield losses if no fungicides are applied. Weather conditions favour heavy disease development, and infection begins more than six weeks before harvest.

Control

Indirect: Growers can reduce their crops' exposure to rust by planting early, controlling volunteer peanuts, and avoiding contamination from external sources.

Direct: Direct control currently relies on fungicides used to control leaf spot, but rust requires shorter treatment schedules or higher inputs. In the long term, fungicide-resistant populations of the rust fungus may develop.

(V) Pod Rot

Casual agent: *Rhizoctonia solani*

As peanuts approach maturity and plants are pulled up to make maturity assessments, rotten pods may be noticed. This is a disease commonly called pod rot, but it is a complex problem involving soil fungi, nutrition (calcium deficiency and/or out of balance calcium/ potassium ratio) and probably other factors. Pod rot is the only visible symptom when this disease occurs.

Fig. 9. Pod Rot

Pods of any size may rot, but most commonly only full size pods rot. Rot usually starts at the distal end (the end away from the stem attachment). Pods may be partially or completely rot (Figure 9).

Control

Maintain proper calcium levels and 3 to 1 calcium: potassium ratio.
Use high quality, treated seed.

(VI) Aflatoxin

Casual agent: *Aspergillus flavus*

A yellow coloured fungus sometimes found on the seed coat of the peanut, is toxic in nature and affects human health. The fungus is both soil and air borne. It provides a major problem in storage and is also known to affect living peanut plants. Conditions necessary for its growth are, temperatures between 25^0C and 35^0C, relative humidity of 85% and higher or a peanut kernel moisture content in excess of 10%. Wilting during the growing period makes the nut more susceptible to fungal attack. It is therefore important to control insect pests and diseases, which may cause defoliation and wilting.

12. HARVESTING

Peanuts are harvested mainly by hand (manually) (Figure 10). It is important to harvest peanuts at the right time since this is important for determining nut quality.

Too early a harvest results in pod loss, and late harvest may result in fungal infestation.

Peak maturity can be assessed by inspection of:

(a) The haulms – lower leaves die and fall off.

(b) Pods – (i) the shell hardens and the rib on the outer surface can be easily seen. (ii) the shell is thin and can be split easily.

(c) The seed coat darkens in colour – immature ones are white or pale pink. Peanuts should be picked at an average kernel moisture content of 18-25 %.

Fig 10. Peanut leaves and freshly dug pods

Care should be taken to avoid damaging the pods during harvest

Broken and rotted pods should be removed at once. Where harvesting is done under wet conditions, the pods should be picked from the plants within 3 days and sun dried in shallow layers.

Peanuts generally mature within 90-120 days depending on the variety.

13. THRESHING/ SHELLING

Threshing / shelling is done mostly by hand, a process where fully dried nuts are cracked open by hand to get the seeds out.

Mechanical threshing is being used by some farmers in the Rupununi

14. DRYING

The two most important operations in handling peanut after harvest are cleaning and drying. Peanuts must be properly cured if desirable flavour, texture, germination and overall quality are to be maintained. Moisture reduction is the major consideration in peanut curing and may be accomplished by natural window drying or by artificially drying in a mechanically control environment. Once the prevailing humidity is low in the productive areas open window drying for 5-7 days under good conditions is usually sufficient. In managing the drying system quality control is important, as constant checks must be done on peanut kernels especially as moisture content approaches the 12% moisture level. Do not allow average moisture content to get below 8.5% for any lot with no portion of the lot containing less than 7 % moisture nor more than 10 % moisture. Drying should be rapid to prevent mould growth and the possible formation of Aflatoxin. However, the drying rate must be controlled to prevent excessive slippage and splitting when the nuts are shelled. Nuts should be dried to a moisture content of approximately 8-10% using a temperature of about 34^0 C for 2-3 days.

15. STORAGE

Safe storage of peanut requires an atmosphere with low relative humidity of 60 to 70 %. Storage facilities for peanuts should be weatherproof and free from insect and disease bearing litter. Buildings should have provisions for good ventilation to prevent condensation of water. Adequate air space should be provided between the surface of stored peanuts and the floor using pallets or similar materials. Avoid storing peanuts in buildings where the temperature may become too high. Proper storage is important to maintain peanut quality and prevent aflatoxin contamination. Aflatoxions are very potent cancer causing chemicals that are produced by various fungi. Thus, under no conditions should moldy peanuts be eaten or sold. Peanuts saved for seed must be protected from insects, rodents, as well as from high temperatures and high relative humidity. Peanut is usually stored in the form of unshelled nuts. Seed retain viability longer when stored in the pod than shelled. Peanut seeds to be use for planting should be treated with fungicides to prevent damage from seed rotting and damping off fungi in the soil.

The use of dried neem leaves could also be used to control storage pests in peanuts. This was demonstrated successfully in the Rupununi.