A Guide to Peanut Production on the Rupununi Savannas

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A VERY SPECIAL THANKS GOES TO THE PEOPLE OF THE RUPUNUNI SAVANNAS, REGION 9, GUYANA

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NOTES

This publication was developed to provide basic production information to peanut farmers in the tropical regions of the Americas. While the specific information was derived from three years of field studies on the Rupununi savannas, Region 9, Guyana, South America, the principles of peanut production presented in this guide are applicable to anywhere peanuts are grown.

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A Guide to Peanut Production on the Rupununi Savannas

Peanut CRSP Guyana

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The harvest team at Moco Moco 2003

Scene from Shulinab Village, Region 9.

PREFACE

"A Guide to Peanut Production on the Rupununi Savannas" is the result of a project initiated in 2001 to provide assistance to peanut farmers in Region 9, Guyana, South America. The project in Guyana is part of the Peanut Collaborative Research and Support Program (Peanut CRSP) that is funded through the United States Agency for International Development (USAID). This Peanut CRSP project is a joint effort between faculty from the University of Florida, the University of Georgia, and the Beacon Foundation of Guyana. Support has also been provided by the National Agricultural Research Institute (NARI) in Guyana.

The initial objective of the Peanut CRSP program in Guyana was to provide expertise to farmers growing peanuts on the Rupununi Savannas. Recommendations were made to 1) improve productivity as measured by pounds of peanuts harvested per acre of land, 2) develop better storage methods for peanuts, and 3) develop production systems where farmers could grow peanuts in established fields without having to clear new fields every few years.

To insure that recommendations from Peanut CRSP were effective on the Rupununi Savannas, field studies were conducted in 2002, 2003, 2004, and 2005. The objectives of these studies were to assess strategies for planting the crop, management of pests (insects, weeds, and diseases), selecting the best peanut varieties, and providing adequate crop nutrition. The studies were conducted in fields in the Rupununi with coordination and leadership provided by staff of the Beacon Foundation. The success of the trials was in large part the result of labor and efforts of farmers and students from villages such as Aranaputa, St. Ignatius, Moco Moco, and Shulinab. In addition, pest control of stored peanuts was evaluated at a warehouse in Lethem with the cooperation of Mr. Eddie Singh.

Specific recommendations presented in this production guide are the result of the field trials and storage studies conducted during the Peanut CRSP project. The results from these studies have been analyzed and coupled with careful observations of peanut production in Guyana to provide guidance for improved production.

This guide should be of use not only in Guyana, but in other tropical countries as well. Although the examples are specific to the Rupununi Savannas, the principles of peanut production and the technology that is described will be applicable in many developing countries. Farmers in the Rupununi and in other countries may not be able to adopt new technologies, such as use of pesticides or mechanization of planting and harvest, immediately. However, the basic principles of pest management, adequate crop nutrition, field preparation, optimal harvest timing, safety, and proper storage and handling of the peanuts should be useful to all farmers.

The Peanut CRSP project in Guyana has expanded well beyond the initial goals of improved production and storage. The project has been instrumental in the development of cottage industries to produce peanut butter in the region and introduction of peanut butter/cassava bread/fruit juice snack programs in a number of village schools. It is our sincere effort that peanut farmers, their families, and all peoples of the Rupununi will benefit from improved production strategies, new peanut processing technology, and new markets for peanut and peanut products.

1. Why Grow Peanuts?

Most peanut farmers grow the crop to earn money for their family.

1A. THE OBJECTIVES OF PEANUT PRODUCTION

The FIRST OBJECTIVE of a successful farmer is to produce a large amount of quality peanuts while keeping production costs as low as possible.

The most successful peanut farmers manage their crops carefully. Peanut farmers may want to invest money in inputs like equipment, fertilizers, and pesticides, but only in the amounts that will make money for them!

The SECOND OBJECTIVE is to sell the peanuts at the best price!

The most successful peanut growers work to improve productivity by **increasing their YIELD PER ACRE**. Efficient growers increase their profit by producing **more** peanuts on the same amount of ground. This saves in LABOR costs and the amount of seed that is needed.

The most successful peanut farmers carefully plan for the market; they produce enough to sell at a good price but do not over-produce.

Successful peanut production in Region 9 has lead to cottage industries that grind delicious peanut butter from locally grown peanuts. In the photograph on the left, shelled peanuts in Aranaputa are cleaned of debris. In the photograph at right, women in Parishara clean a peanut grinder after use.

1B. MAKE THE MOST FROM GROWING PEANUTS

Students assist a farmer in Aranaputa harvest peanuts in a research trial.

The peanut crop is most valuable if you remember:

You can make the most profit by carefully planning for production, storage **AND** sale of the crop!

Make your best yields by careful planning before you plant.

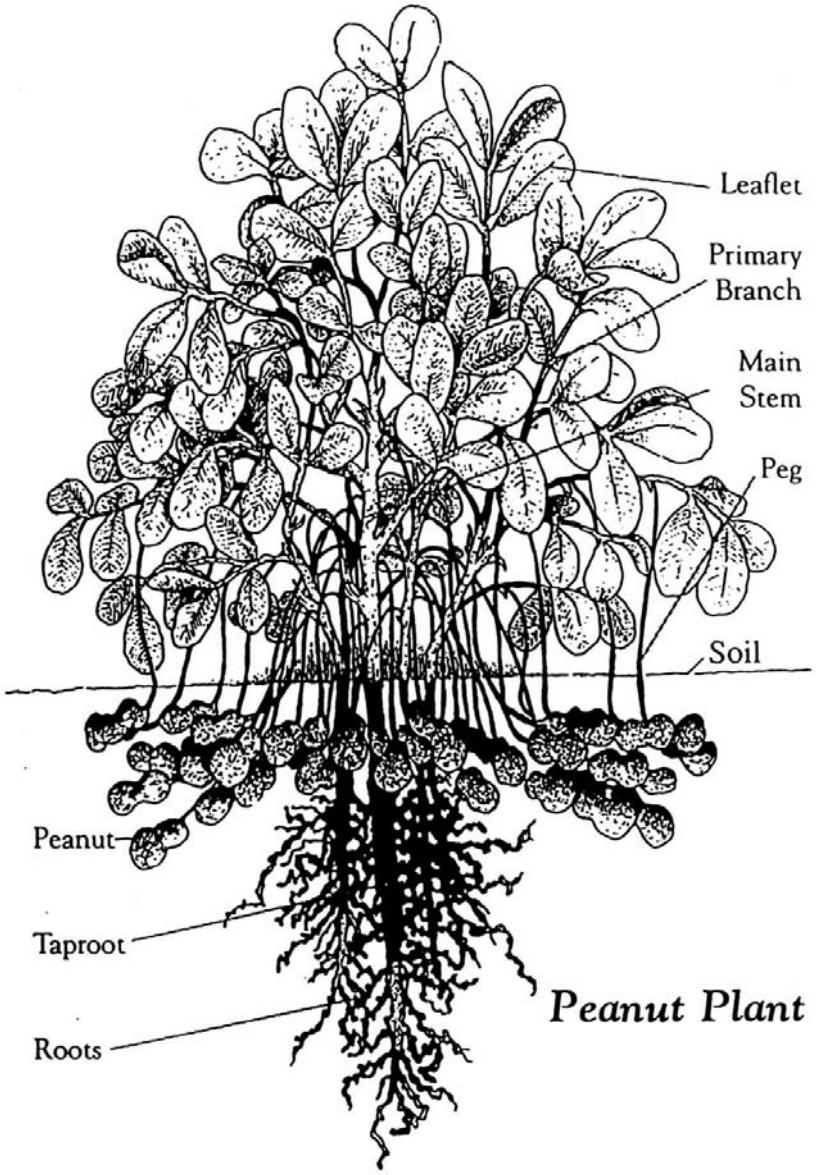
Make your best yields and top quality by carefully managing the crop.

Achieve the best quality by digging the peanuts when they are fully mature, and by adequately drying, sorting, and cleaning the peanuts prior to storage.

Maintain the best quality of the peanuts after harvest by careful storage and good management of the storage area.

After the peanuts have been dried and picked from the vines, they are carefully sorted to remove damaged or rotten pods.

2. THE PEANUT PLANT AND ITS STAGES OF DEVELOPMENT



The peanut plant is an unusual crop because the fruit (pods) grow underground. To produce peanut successfully, farmers must **1)** grow a healthy plant, **2)** give the plants enough fertilizer and nutrients, **3)** protect the plant from pests like weeds, insects, and diseases, **4)** harvest peanuts when they are mature, and **5)** store the peanuts properly.

2A. THE PEANUT SEED

The fragile RADICLE point becomes the young root.

Healthy seed.

Moldy, damaged seed will not likely produce healthy seedlings

Peanut seeds are very fragile.

The seeds will not sprout if the radicle (little point at one end) is damaged.
The seeds will not sprout if broken or split.

Peanut growers MUST plant the highest quality seeds they can if they want to produce maximum yields.

Low-quality seeds or damaged seeds will often not sprout.

Seedlings (young plants) from low-quality or damaged seeds are often weak and may not survive. Weakened seedlings often produce fewer peanuts.

High-quality seeds are produced by making sure the peanut plants have enough nutrients (fertilizer), ESPECIALLY CALCIUM and BORON.

High-quality seeds are ensured by storing the seed in cool and dry conditions with plenty of ventilation and protected from pests like mice and insects!

After harvest, peanut farmers MUST separate GOOD seeds from poor or DAMAGED seeds to ensure good quality.

Peanut farmers can protect their seed and young plants from diseases by treating the seed with special chemicals.

2B. THE SEEDLING

Seedlings grow from seeds. They are very young peanut plants.

It is VERY important to have healthy and strong seedlings.

The **stem** and **roots** of the seedling are very fragile and easily damaged!

Young peanut plants are EASILY hurt by diseases, insects, and carelessness when hoeing weeds.

The BEST ways to grow healthy seedlings and to protect them are:

1. Do not plant peanuts in a field if they were planted there the previous year; use good crop rotation!

2. Only plant seed when there is enough soil moisture for rapid growth.

3. Do not plant the seed if the soil is too wet.

4. Use a chemical seed treatment to fight seedling diseases.

5. Keep the field free from weeds!

2C. THE YOUNG PLANT

It is very important to keep young plants healthy and weed-free.
The photograph above was taken in Moco Moco.

As young plants grow, they produce the many leaves, roots, and limbs (vines or branches) needed to support and feed the peanut crop.

If the young plant does not remain vigorous and strong, it will not be able to produce a high yield.

As the peanut plant grows, the young plant is attacked by more diseases and insects. It may be helpful to apply pesticides SENSIBLY to control them.

It is very important to keep the weeds out of the field! The young peanut plants can be hurt by the weeds. The weeds will compete with the small peanut plants for space, nutrients and sunlight.

2D. THE FLOWER

Yellow flowers on the peanut plant show the beginning of reproductive growth.

The peanut plant begins "reproductive growth" when it begins flowering. This growth stage is also called "first bloom".

Each flower will live for one day and then the flower will wither and die.

The peg, peanut pod, and seed develop from the flower.

Many flowers never produce peanuts. There are many reasons why a flower does not progress to a peanut. For example, if it is very hot and dry, flowers are likely to wither and die.

When the peanut crop begins to bloom and flower, it is CRITICAL that the peanut farmer have enough BORON and CALCIUM in the soil.

The nutrients boron and calcium are **VERY IMPORTANT** to help the peanut seeds and pods grow and remain strong.

As the peanut plant becomes larger and there is less open space, the peanut plant is less affected by weeds. However, it is still very important to protect the plant from diseases and damaging insects at this critical stage of the crop.

2E. FULL PEANUT CANOPY

Above is a photograph from Aranaputa of a peanut crop that has completely closed over the bare ground. Note that some flowers are evident. This field is an excellent example of the potential for peanut production in Region 9.

To achieve the conditions shown in the picture above, the peanut farmer has successfully:

1. Controlled weeds in the field. With the complete closure of the canopy, weed control will no longer be a problem.
2. Managed insect pests. The crop looks very good and insect damage has not yet become a problem.
3. Managed leaf spot diseases. Rain, warm temperatures, and a closed canopy of leaves create perfect conditions for disease. This grower has managed leaf spot diseases well but she will need to continue good management throughout the season.

2F. THE PEG AND POD

Above, peanut pods form at the tip of the peg and continue to enlarge to full size. **At right**, the first and most important peanuts grow near the main root.

Above, the peg attaches the pod to the peanut plant. Both the peg and pod grow underground and must be kept healthy.

The "peg" is the stem that attaches the pod to the vines of the peanut plant.

Peanut farmers must keep the peanut peg healthy. If it is weak or damaged, it will break when the peanut plants are dug at harvest.

If the peg breaks when the plants are dug, it becomes difficult to collect the loose pods left in the soil! Farmers' sales and incomes will be reduced.

Keep pegs healthy using good crop rotation and controlling leaf spot and other diseases.

HEALTHY PODS MEAN INCREASED INCOME! Farmers can keep pods healthy by adding **calcium** to the soil and by applying boron at bloom time!

2G. PEANUT VARIETIES

Planting the right variety is very important for peanut farmers. **Above**, one can see that the variety **'C99-R' (photograph on right)** is much more affected by leaf spot disease than is **'Guyana Jumbo' (photograph on left)**. The Rupununi variety 'Guyana Jumbo' is much more resistant to leaf spot than 'C99-R' and would not need to be protected with as much fungicide. These photographs were taken near the village of Surama.

Some considerations for choosing a variety include:

1) **Growing season:** How long does it take the variety to grow from planting until harvest? Growers know that the longer it takes for a peanut plant to reach harvest, the greater the risk that something may go wrong, for example, drought, disease, or insect damage.

2) **How long do the vines of the peanut variety grow?** Although varieties with larger vines, for example 'Guyana Jumbo', may grow well in the Rupununi Savanna, large vines make it difficult to use mechanical methods to dig and harvest the peanut fields.

3) **How well does the peanut variety yield under existing conditions (temperature, rainfall, type of soil) where you have your fields?** From trials in the Rupununi, 'Guyana Jumbo' grows very well. Because it has been planted successfully in the Rupununi for many years, it may be better suited for the environmental conditions than other varieties. For example, it seems to be better adapted to very dry conditions and grow with less fertilizer than other varieties, though these are speculations.

4) **Does the variety have large, medium, or small pods? How is the flavor of the nut?** Large pods and nuts are preferred by customers buying parched nuts in Georgetown. However, the size of the nut is less important to peanut butter manufacturers in Georgetown or in the village cottage industries. Peanut manufacturers prefer a nut with good flavor and good oil characteristics. Although Guyana Jumbo is preferred with street vendors, the peanut variety C99-R is preferred by some peanut butter makers.

5) **Does the peanut variety have any resistance to disease?** Results from research conducted in the Rupununi show that peanut farmers would benefit from using fungicides to manage diseases. However, research also showed that Guyana Jumbo is less affected by diseases than are other varieties; C99-R is better than most varieties but is not as disease resistant as Guyana Jumbo.

6) **How much seed is available?** Under normal conditions, peanut farmers in the Rupununi can to find plenty of Guyana Jumbo seed. However seeds from new varieties like C99-R may be more difficult or impossible to find.

7) CAN YOU SELL THE VARIETY AT A GOOD PRICE TO A BUYER?

See section on choosing a variety (Chapter 4) comparing Guyana Jumbo to C99-R.

3. STORING PEANUTS FOR SEED AND CONSUMPTION

Most peanut farmers in the Rupununi have to store peanuts at some point in time.

Peanut farmers usually store peanuts for three reasons.

1. They are waiting to find a buyer for the peanuts (short term storage).
2. They are holding their peanuts to sell at a higher price (medium term storage).
3. They are saving seed for the next season (long term storage).

Growers should recognize that the quality of their peanuts does not improve in storage. IN fact, THE QUALITY OF PEANUTS TYPICALLY GETS WORSE IN STORAGE. And the speed at which peanuts spoil is a result of the quality of the storage management practices.

Problems that can occur in storage include:

1. Damage from insects and rodents.
2. Contamination from poor sanitation, for example droppings from birds and animals that may come in contact with the peanuts.
3. AFLATOXIN may be produced on poor-quality and moldy nuts that have not been dried and sorted properly.
4. Over time, oils in the peanuts become RANCID and peanuts spoil. Rancid nuts are dark in color when roasted and have a "burnt" flavor.

Peanuts can be stored successfully with minimal loss in quality if they are stored carefully. Proper storage practices include:

1. Keeping the peanuts in CLEAN sacks that will not contaminate the nut.
2. Drying the peanuts sufficiently (about 10% moisture) before storage.
3. Sorting the pods before storage so that good pods are not stored with pods that are damaged, moldy, broken, or affected by insects.
4. Storing the sacks of peanuts so that they do not get wet from rain.
5. Storing the sacks of peanuts so that they have movement of air under and between them.
6. Storing the peanuts so they stay cool and dry.
7. Storing peanuts so they are protected from insects and rodents.

8. Treating stored peanuts with appropriate chemicals or natural pesticides like neem to reduce insect damage.
9. Keeping all animals (chickens, pigs, dogs, etc.) away from storage area in order to avoid damage to peanuts and contamination with feces, urine, and parasites.

3A. STORAGE and QUALITY

At left is an image of a peanut storage facility in Lethem, Guyana. The owner of this facility has kept the area very clean and the peanuts are stored on pallets off the ground in clean, well-maintained bags.

Note: In the photograph above, some bags lean against the wall. While this is acceptable in the short term, the bags should be moved away from the wall for longer storage to allow for improved flow of air.

To maintain the highest quality in stored peanuts, it is critical to:

1. Keep the peanuts cool and dry.
2. Allow for air ventilation around the bags of peanuts.
3. Maintain a clean storage facility.
4. Keep the peanuts off of the floor.

In the image above, the bags of peanuts are kept off the ground on simple wooden pallets. The pallets allow air to move under the bags of peanuts and also help to keep the peanuts clean and dry.

As more peanuts are stored at this facility, the owner will carefully stack and arrange the bags to allow continued air-flow.

3B. PREPARING A STORAGE FACILITY

This storage facility pictured above in Lethem is an excellent example of how peanuts can be stored in the Rupununi.

This new building was built to allow air-flow through the building (note ventilation near the ceiling. The owner also uses wooden pallets to keep the bags of peanuts off the floor so as to reduce moisture absorption from the cement. The metal roof keeps the peanuts dry.

Most peanut growers in the Rupununi cannot afford such a facility. However, all growers who store peanuts can use the same principles of sanitation, cleanliness, cool and dry conditions, and proper air-flow when constructing a storage facility for themselves.

3C. PROTECTING SEEDS FROM PESTS

The picture at left shows damage to peanut seed from insects.

Damaged bags in the picture at left should be repaired to help prevent insects (worms, beetles and moths) from attacking peanuts.

Pests pose a serious problem for peanuts in storage.

Pests of stored peanuts include insects, molds, and rodents.

Farmers can reduce the damage from INSECTS on stored peanuts by:

1. Sorting and removing damaged pods before storage. This will also reduce damage from MOLDS and reduce threat of AFLATOXINS.

2. Making sure that the storage bags are clean and carefully sealed.

3. **FUMIGATION OF STORAGE AREA**: Using a chemical fumigant that "gases" the entire storage area is an effective way to kill insect pests and rodents. However, **FUMIGATION IS VERY DANGEROUS IF NOT DONE CORRECTLY AND MAY CAUSE SERIOUS INJURY OR**

DEATH TO HUMANS!!! Fumigation may be difficult in the Rupununi because it is necessary to SEAL the storage building making it "air-tight" and because proper fumigants for use on stored peanuts may not be available.

4. **Treating stored peanuts with appropriate chemicals or other products may help to reduce insect damage.** Studies done by the PEANUT CRSP program on stored peanuts in Guyana have shown that the use of certain insecticides or commercial neem oil products can reduce insect damage. These products should be applied to the peanuts before they are bagged. Spraying the outside of bags may provide some short term protection, but insects will ultimately become established inside. **YOU SHOULD GET CAREFUL INSTRUCTION FROM A QUALIFIED AUTHORITY BEFORE ATTEMPTING THIS TO ENSURE THAT YOU DO NOT PUT YOURSELF OR FAMILY IN DANGER. Insecticides used on peanuts in the field or on other crops may be dangerous to those eating the treated peanuts. Always read, understand, and follow the instructions provided with any pesticide to ensure that the pesticide is used safely.**

5. **Use only recommended insecticides and wear protective clothing and eye protection!!**

At left, appropriate insecticide is applied to peanuts to manage damage from insects while they are stored.
NOTE: Applicator SHOULD NOT apply pesticides without wearing protective clothing and gloves!! This is a DANGEROUS practice!

6. **Placing Neem leaves in the bag with stored peanuts is a traditional method of repelling insects.** The study in Lethem showed this method to be effective, with one precaution. **Moist neem leaves or stems can increase the development of aflatoxin.** If neem leaves

are used, try to remove as many stems as possible and use only dried leaves scattered throughout the bag. Never put handfuls of leaves in one location.

In the photograph at left, neem leaves are mixed with stored peanuts.

7. Marketing your peanuts as soon as economically feasible. Storing peanuts to wait on a better price is sometimes wise, **but there is risk involved!** The longer peanuts are stored, the greater the threat from molds, insects and rodents.

3D. KEEPING SEED VENTILLATED AND DRY

It is critical to keep stored peanuts dry and ventilated to reduce the chance that they will become moldy and develop **aflatoxin**. In storage facility in the picture on page 27, peanuts are kept dry by the good roofing of the building.

Ventilation (air-movement) is provided by 1) the vents around the eaves of the building, 2) the pallets on the floor allow air movement beneath the bags, and 3) orderly stacking of bags allows some air movement around the bags.

The mold on this peanut may produce aflatoxins. Poor storage conditions help cause molds to grow and lead to poor quality nuts.

Bags of peanuts are stacked carefully in the storage facility pictured at left to improve ventilation and air flow.

3E. AVIODING AFLATOXIN

AFLATOXIN is a poison that is made by a mold that grows on stored peanuts, stored corn (maize) and some other products.

Aflatoxin can be a serious problem wherever peanuts are grown. Aflatoxin is more severe when there is DROUGHT during the growing season because the mold grows very well in dry conditions and because the pods may be more easily damaged.

You may eat peanuts that have aflatoxin and not realize it! You will not recognize the aflatoxin because of taste.

The only way to know how much aflatoxin is in stored peanuts is to run CHEMICAL TESTS with special equipment in laboratories.

Roasting, boiling, and drying peanuts **DO NOT** make the aflatoxin go away!

When peanuts and corn that are infected with aflatoxin are fed to animals, **especially** chickens, the aflatoxin may make them very sick or even kill them.

AFLATOXIN has the following effects on people who eat too much of it:

1. Aflatoxin is believed to cause **cancer** in people.

2. Aflatoxin reduces our immune system, especially in children, and makes us more susceptible to illness.

The most effective way to control aflatoxin and keep it out of your peanuts is to carefully manage all aspects of the peanut harvest, drying, and storage process.

1. Peanuts should be dried quickly after they are dug from the ground.
2. The pods should not be damaged in any way. Damaged pods make it easy for the mold to infect the seed. The pods should be protected from mechanical damage at harvest, protected from insect damage, and kept dry.
3. Damaged and moldy pods should be separated from clean, quality pods before storage.
4. Pods should be protected from insect & rodent damage during storage.

3F. PEANUT ALLERGIES

A few people are allergic to peanuts and this can be a very serious problem!

Although many people have allergies, such as to dust, pollen, eggs, etc., peanut allergies are important because they can cause SEVERE REACTIONS and even death if not treated quickly.

Parents should be very cautious when first giving peanuts, or food with peanuts in them, including peanut butter, to young children.

In the United States, some people believe that you should not feed peanuts or peanut products to children until they are 3 years old.

When you first give peanut foods to a young child, WATCH THEM CAREFULLY to make sure they are not allergic.
People with a peanut allergy should NEVER eat peanuts.

4. DECISIONS BEFORE YOU PLANT THE SEED

In the image at left, sticks and debris are removed prior to preparing the field for planting. In the center photograph, a farmer inspects a mechanical planter. At right, farmers mark the rows and open the furrows with simple tools.

The most successful peanut farmers plan carefully for the new season.

There are many challenges to growing peanuts and the best growers have a strategy, or plan, to meet each challenge.

Below are some of the questions that you MUST consider before planting peanuts. If you do not make effective plans, you could very easily LOSE the money you have invested!

1. What variety will I plant and can I get the amount of good quality seed I need?

2. Do I plan to use ORGANIC production practices or do I plan to use agrichemicals to produce my crop?

3. Can my family and I manage the crop throughout the season? Do I have the money needed to buy agrichemicals such as fertilizers and pesticides?

4. How many peanuts should I plant? Will there be a buyer for all of the peanuts that I grow? Can I count on a good price?

5. Where will I plant my peanuts? How does the field need to be prepared to ensure successful peanut production?

6. Should I plant a new slash and burn field or a previously cleared field?

7. Should I invest in mechanization using a tractor and other equipment or should I use traditional technology?

8. If I use mechanization or traditional practices, do I have the time to prepare the field as needed?

9. Are my workers and I using pesticides SAFELY and CORRECTLY?

4A. ORGANIC PRODUCTION VERSUS PEANUT PRODUCTION WITH CHEMICALS

Peanut farmers in the Rupununi must decide if they are going to practice organic production or if they are will use chemicals to produce a peanut crop.

If farmers want to grow "organic" peanuts, then they cannot use:

1. Unapproved pesticides (most insecticides, herbicides, or fungicides). Approval for a few specific pesticides is provided by the organization that buys the organic peanuts
2. Most inorganic-type fertilizers
3. Fields to grow peanuts where pesticides or inorganic fertilizers have been used in recent seasons (the exact requirement varies in different countries and with different marketing groups)

Farmers who want to grow organic peanuts should:

1. Plant only 'Guyana Jumbo' until a variety with greater disease resistance is available.
2. Manage weeds by planting rows closer together (for example spaced 24 inches apart) to allow the peanut plants to cover the bare ground quickly.
3. Manage weeds by planting seeds 6-8 inches apart, again, to allow the peanut plants to cover the bare ground quickly.
4. Fertilize their fields with wood ash, manure, and specific fertilizers that are mined, such as gypsum.
5. Have their fields and peanut crops certified "Organic" by the proper authorities.

Farmers in the Rupununi may grow organic peanuts because:

1. They are not able to buy or afford pesticides or fertilizers.
2. They are able to find a good market for organic peanuts that offers top value for the crop.
3. They are concerned for the effects that pesticides may have on them, their families, or the environment if not used safely and properly.

Farmers who choose to grow peanuts using pesticides and inorganic fertilizers can expect the following:

1. Use of seed-treatment fungicides to protect the seed and young seedlings from disease.
2. Use of insecticides will allow the farmers better control of thrips and other insect pests.
3. Use of herbicides will allow the farmers easier control of weeds and also save on labor costs associated with hoeing weeds.
4. Use of fungicides will allow the farmers to better protect their crop from diseases.
5. Use of inorganic fertilizers will make it easier to insure the peanut crop has adequate nutrition.
6. Higher costs of production early in the season in order to pay for the pesticides and inorganic fertilizers.
7. Higher yields and better quality peanuts when they are able to protect the crop from pests and provide the needed nutrition.

IMPORTANT NOTE: Farmers who choose to use pesticides to grow their peanut crop must be willing to apply the pesticides safely so that they do not endanger themselves, their co-workers and friends, family members, livestock and other animals, and the environment (the land, streams, rivers, and wells).

4B. CHOICE OF VARIETY

IN REGION 9, growers plant mainly 'Guyana Jumbo' but a few plant 'C99-R'. However, as peanut production continues to expand in Guyana, farmers will likely get other NEWER varieties to plant as well!

GUYANA JUMBO is a **good choice** for growers in the Rupununi because:

1. The variety has long been grown there and seems well adapted to the environment of the Rupununi Savanna.
2. Guyana Jumbo has some resistance to important diseases found in Guyana, including peanut rust and leaf spot diseases.
3. Guyana Jumbo has large nuts preferred by vendors in Georgetown.
4. Consumers like the taste of Guyana Jumbo.

GUYANA JUMBO is **not a perfect variety** for farmers in Guyana because:

1. It has large vines that make it difficult to harvest with machinery.
2. The nuts from Guyana Jumbo do not have the flavor and oil content that a variety like C99-R has for making peanut butter.
3. The seed size in Guyana Jumbo is irregular, making it more difficult to sort mechanically.
4. Guyana Jumbo takes 5-6 months to mature. Many problems can develop when a crop is in the ground that long. Guyana Jumbo is often only ready to harvest after the rainy season has ended and the ground is hard and dry. This makes digging very difficult and losses increase!!!

The photograph at left was taken in a peanut field in Aranaputa in 2006. Drought occurred late in the season making harvest very difficult. These peanuts were left in the ground when the Guyana Jumbo was dug.

C99-R has been grown successfully in Guyana in recent years.

C99-R is a good variety for the Rupununi because:

1. It matures more quickly than Guyana Jumbo and is harvested approximately 4 ½ months after planting.
2. C99-R has a smaller vine and was developed to be grown using tractors, mechanical planters, and harvesters.
3. Seed size in C99-R is uniform. All seed are about the same size.
4. C99-R has the flavor and oil content that make a great peanut butter.

C99-R may not be chosen by some farmers in the Rupununi because:

1. The smaller size of pods and nuts is not be desired by some buyers.
2. The C99-R variety is not as disease-resistant as Guyana Jumbo and will definitely need the use of fungicides!
3. Seed may not be available in large enough quantities to meet demand.

4C. SOURCE AND QUALITY OF SEED

Many peanut growers in the Rupununi save their own seed from the previous season to plant in the following season.

Planting quality seed is the single most important aspect of growing peanuts.

Peanut farmers should be willing to invest in good seed. It is not worth the risk of planting lower quality seed, even if the cost is low!

High-quality seed should be grown with adequate levels of the nutrients calcium and boron. Seed that is grown where the levels of calcium and boron are too low likely will have poor germination; that is, they will not sprout well.

Growers in the Rupununi typically get their seed from three sources.

1. Farmers use seed they save from the previous season. This is usually the least expensive way to get seed. However, farmers need to make sure that they save their BEST seeds for planting and that they store them in a cool and dry location during the off season.

2. Farmers may purchase seed back from the buyer who bought their peanuts originally. In buying seed, the grower should insure that the seeds they are buying are of top quality. That means that the seed should be free from breakage, spoilage, molds, and insect damage.

3. Farmers may purchase seeds from some commercial seed source, for example in Brazil. Hopefully, the peanut has been produced specifically for planting and is of high quality.

At left is an example of a pod with very poorly developed seeds. The seeds did not develop properly because there was not enough calcium in the soil. Growers who save their seeds to plant the following season must make sure the seed was produced with enough calcium and boron for healthy, vigorous sprouting and growth!

4D. FIELD LOCATION

In the image on the left, a farmer in the north Rupununi plants his crop in a long-established field located against the mountains. The new slash and burn field in the central Rupununi, pictured at right, is located in the forest far from free-roaming livestock.

Choosing the right place to grow peanuts is nearly as important as using the highest quality seed. In the Rupununi Savanna, there are traditionally four sites for peanut fields.

1. The first are fields, as found in the north Rupununi, where crops are grown on a fairly regular basis. The fields are typically located at the base of mountains and are left fallow (with weeds) between crops. These fields typically require less labor to clear and prepare than do slash-and-burn fields. They tend to be well-suited for planting and harvesting with machinery. However, the fertility in these fields is often low, requiring addition of fertilizers.

2. The second type of fields are found in the central and north-central Rupununi and tend to be located in forested areas well away from villages to protect crops against foraging livestock and fires. Slash-and-burn agriculture is used in these fields and they usually have not been planted to a crop for many years. Some may never have been planted with a crop before. These fields have better fertility than the older fields described above but could still benefit from some fertilizer use.

3. Thirdly, in the south Rupununi, peanuts are typically planted in "bush-islands". "Bush-islands" are patches of forested growth in a sea of savanna. The soils, drainage, and fertility are better in these patches than in the surrounding areas.

4. Finally, peanuts may be planted in the savannas, away from mountains and bush-islands. Although the savannas are rarely used for growing peanuts, they are very flat and well suited for mechanical field preparation, planting and harvest. **However, growers who plant on the open savannas must select sites that do not flood** and they must plan to use fertilizers to manage fertility.

5. PREPARING FOR PLANTING

Meetings for peanut farmers in February and March provide the opportunity to plan for the new growing season.

5A. PLANNING

Plans to plant a peanut crop should begin long before putting the first seed in the ground.

Careful planning allows the peanut farmer to have a better chance of making a profit on his or her labor. Poor planning can lead to low yields, low quality, low levels of income, and financial disaster.

Below is a series of questions that a peanut farmer should ask himself or herself during the planning process:

1. Will there be a good or bad market for peanuts this year?

2. Can I expect to get a good price for my peanuts?

3. Was there an over-supply or an under-supply of peanuts last year? If so, how will that affect this year's price?

4. Where should I plant peanuts this year?

5. Should I use the same production system as in the past or should I adopt some level of mechanization?

6. Do I have timely access to tractors, tillage equipment, etc., and can I afford the cost of rent and/or fuel?

7. Do I have the labor available to prepare the land and have I budgeted for the cost of labor?

Preparing a field for planting requires a great deal of time, effort, and labor.

8. Do I plan to use fertilizers this year? If so, what will they cost and where and when can I get the fertilizers?

9. Have I done a soil test on my field(s) to determine the type of fertilizer I need?

10. Are fertilizers available and can I afford them?

11. Do I plan to use any herbicides, insecticides, or fungicides?

12. Do I know where to find these pesticides and can I afford them?

13. Do I have access to a sprayer and is it calibrated properly?

14. DO I KNOW HOW TO USE PESTICIDES SAFELY? If not, where can I receive training?

15. Have I chosen the right peanut variety to plant and do I have access to seeds?

16. Am I ready to prepare the field for planting?

17. Since it is best to kill the weeds, clear the land, and turn the soil about 6 weeks before planting, ask yourself, "Am I on time?"

18. Have I done the necessary maintenance on my field equipment so that it is ready for planting, spraying, and/or harvesting?

5B. LAND PREPARATION

Mechanical planting with a tractor in the north Rupununi near Aranaputa.

The goal of land preparation is to get the field ready for planting.

Land preparation typically includes 1) removal of logs, stumps, plants and debris already in the field, 2) initial preparation of the soil for a successful planting, and 3) application of some types of fertilizer such as calcium (lime or gypsum) that need time to become active in the soil.

To prepare the land for planting the peanut seeds, farmers need to make sure that the clods of soil and dirt are broken up to create a good seed bed that will hold moisture and support rapid growth of the young plants.

In the Rupununi, three basic types of land preparation are practiced.

1. Most common, in general, is "slash-and-burn" preparation where the farmers identify a suitable area of forest nearby then burn the existing site, cut the trees down, and remove the debris from the field. Although the burning does add nutrients to the soil, for example potassium, clearing the land requires much labor. The stumps that are left in the field make it impossible to use tractor-pulled equipment. In slash-and-burn agriculture, there is little preparation to the soil besides opening the furrow. PEANUTS TEND TO GROW BEST WHEN PLANTED IN A "LOOSE", EASILY WORKED SEED BED. Also, the presence of large amounts of leaf and plant matter in the soil may increase the risk of diseases.

2. The more common practice used in the north Rupununi savannas is the clearing of established fields of brush and weeds that have grown since the last crop was planted. These fields tend to be lower in fertility than are the slash-and-burn fields. Because they are often cleared just before planting, plenty of plant matter and weed seed remains in the field and quickly becomes a problem. The soil in these fields is not tilled much more than in slash-and-burn preparation, which can restrict root development. However, because these fields are generally free of logs and stumps, the farmer has the option to use mechanization, thereby saving on labor costs.

3. The third alternative, practiced by a few farmers in the north Rupununi and Moco Moco, is the use of tractors and tillage equipment such as plows and harrows to prepare the fields. Typically this type of land preparation takes place in established fields and requires the initial removal of weeds and other brush. The use of the tractor, harrow, and plow allows the farmer to "break" the soil providing and excellent foundation for a seedbed. This practice allows incorporation of fertilizer and allows burial of crop debris to reduce the risk of disease.

Below are some suggestions that can help peanut farmers improve their land preparation practices:

1. **Begin land preparation earlier.** This allows the farmer to reduce the amount of old plant material in the field by planting time. It also

allows for time to incorporate some fertilizers into the soil and to begin pre-planting use of herbicides.

2. **Try to do more tillage to the soil**, especially in those areas where the seeds will be planted. A "looser" more "friable" field will allow the roots of the peanut plant to develop more rapidly, facilitate air and water penetration of the soil, and allows the pegs of the peanut plant to enter the soil more easily.

6. PLANTING DAY

In a field prepared using slash-and-burn practices, much of the work, such as opening a furrow, must be done by hand.

On the day the seed is to be planted, farmers should insure that the soil is moist enough to encourage germination and rapid growth of the seedlings. If it is too dry or too wet, the grower should wait for a better day to plant.

Below are some important questions that the farmer and his or her laborers should ask themselves:

1. Do I have the fertilizers that I intend to apply at planting time?

2. Do I have seed-treatment fungicides and insecticides that I want to use?

3. Do I have proper safety items, such as rubber gloves and dust masks to prevent injury?

4. Do I have the herbicides I need to apply immediately after planting?

5. Is my sprayer properly calibrated and ready to use?

6. Do I have a plan for mixing the herbicides for a final spray volume?

7. Do I have a plan for safely cleaning up all equipment used for the application of fungicides, insecticides, and herbicides?

6A. PREPARING THE SEED BED

Some farmers in the Rupununi plant their peanuts on raised beds. This requires extra labor but could be beneficial if the field does not drain well.

Preparing a slash-and-burn field requires a lot of labor. The seed bed is usually prepared by simply opening the furrow. The rest of the field is not tilled.

In the North Rupununi, peanuts are often planted in old fields. Farmers usually do more tillage to the soil, either with tractors or hoes, than is done in slash-and-burn fields.

Regardless of which type of land preparation used, it is very important to prepare a good seedbed.

The seedbed is the area in which the seeds are planted. The seedbed should be well-worked, loose, friable soil without crop debris or remains of leaves and roots from the plants present before the land was cleared. THE

SEEDBED SHOULD BE WELL-DRAINED, which means it should not be allowed to flood!

6B. MOISTURE NEEDS AT PLANTING

If the soil is too wet at planting time, the seeds may rot. If it is too dry, the seeds will not sprout quickly and may be eaten by rodents.

100% of the peanut fields in Region 9 are rain fed. Since there are no irrigated farms, growers rely on rainfall to provide the water needed to sprout the seeds and grow the plants for a successful crop.

Getting the growing season off to a good start is CRITICAL for successful and profitable peanut production.

An important strategy for a good start is getting rapid, vigorous sprouting of the seeds and healthy, vigorous seedlings.

Having enough moisture when the seeds are planted is key to success!

If it is too dry, the seeds will not sprout and will remain in the ground until the rains come. This allows rodents and birds time to find and eat the seed.

If it is too wet, the seed will very likely **ROT** and not sprout, or the young seedlings that do grow will be weak and affected by disease.

Peanut seed should be planted when there is enough moisture in the soil so that the soil sticks together when you press it in your hand. If water runs from the soil when you press it, it is too wet!

Growers should not plant seed if they think there will be too much rain soon after planting. It is better to delay planting until after severe storms or extended periods of wet weather pass.

6C. PLANTING DEPTH AND SEED TREATMENTS

This farmer is wearing latex gloves to plant the seeds because the seed has been treated with a fungicide. The gloves protect the farmer's health.

Planting the peanut seed at the proper depth is very important for uniform establishment of the seedlings..

In most situations, seed is best planted between 1 and 1 ½ inches deep.

If the seeds are planted too deeply, it takes longer for the young plants to emerge and the young, tender stems are at greater risk to damage from molds and diseases (see section on seedlings).

If seeds are planted too shallow, they are more easily discovered by birds and rodents or they may not have enough moisture to sprout quickly.

Seed treatments are chemicals, usually dusts or liquids, that are put on the seeds before they are planted. **SEED TREATMENTS CAN BE INEXPENSIVE AND VERY HELPFUL TO THE GROWER.**

Seed treatments help to protect the seed from rotting and the seedling from disease and damage from insects like thrips.

Seed treatments are applied by mixing a specific amount of chemical with a specific amount of seeds. Treatments are mixed with seed in a bucket or in a plastic bag. Farmers should wear protective gloves and dust masks to avoid breathing the dusts and getting chemicals on their skin.

Some seed treatments, such as the insecticide Orthene, can hurt the seed if the seed is not planted on the same day that it is treated!!!

READ THE PESTICIDE LABEL CAREFULLY AND FOLLOW THE INSTRUCTIONS PROVIDED. PLEASE SEEK ADVICE IF NECESSARY!

6D. SEEDING RATE

Many farmers in the Rupununi now plant their seeds 8-to-12 inches apart. Seeds in the middle picture above were planted 12-to-18 inches apart which is farther apart than recommended based on research conducted on the Rupununi savannas. Seeds in the photograph at right were planted 4-to-8 inches apart.

"Seeding rate" is the amount of seed that a peanut farmer plants in a row.

For example, the seeding rate is often described as "the number of seeds planted in 1 foot of row" or "the distance between each seed".

When the Peanut CRSP-Guyana program began in 2002, many growers in Region 9 were planting their seeds 18 inches and even 24 inches apart! (NOTE: seeds in the middle picture above were planted 12-to-18 inches apart.)

Growers had chosen this seeding rate for two reasons:

1. Economics: By using fewer seeds in their field, they could save money.
2. Productivity: Peanut farmers knew that peanut plants can grow larger when planted further apart and they assumed that larger plants would increase their yields.

Today, more growers are planting seed 6-to-8 inches apart.

Why are Rupununi peanut farmers now planting their seed closer together?

1. Research has clearly shown that total-field yield is better when seeds are planted closer together.
2. Seedlings that are closer together will cover the bare ground more quickly making it more difficult for weeds to become established.
3. When seeds are planted further apart, labor costs for weeding increase.
4. **The greatest number of high-quality peanuts grows close to the taproot. Fewer peanuts come from far out on the limbs. Growing more plants in a field INCREASES THE "TAP-ROOT" CROP!**

6E. ROW SPACING

The picture at left was taken in the United States. It shows that even in a state like Georgia, researchers still study the benefits of different rows spacing.

Farmers must make decisions about the distances between the rows in their peanut field.

In the Rupununi, farmers usually plant their peanuts with 24 inches between rows, though some growers plant with 18 inches between rows. However,

with the use of tractors, mechanical planters, and pickers, some growers are beginning to plant with 36 inches between rows.

When farmers plant their seeds on narrower rows, they achieve some important things.

1. It is easier to control weeds when peanuts are planted on narrower rows. With smaller distances between the rows, it takes less time for the peanut vines to cover the bare ground. Once the bare ground is covered with peanut vines, weeds are less likely to become a problem where the ground is shaded.

2. With narrower rows, the number of plants in the field is increased meaning more "taproot" peanuts. As mentioned earlier, the taproot crop is very important for peanut productivity and higher yields.

The peanut plant at left was grown on a wide row spacing (4 feet between rows) and wide seed spacing (2 feet between seeds). Note that most of the mature peanuts are close to the taproot. Fewer peanuts are found away from the taproot. The extra vine growth took up needed space but did not produce much additional yield.

However, there are important considerations to be made in regards to narrow row spacings.

1. Planting narrower rows requires more seed per acre which adds cost, though this may not be a critical problem.

2. When a grower plants narrower rows, he may not be able to use tractors and mechanical harvesters to reduce the labor costs needed to plant and harvest.

As peanut farmers in the Rupununi experiment with tractors, mechanical planters, and harvesters, they will need to widen their row spacing. This is because mechanical equipment needs more space to operate efficiently.

With wider rows, farmers will need to protect their crop from weeds for a longer period of time. This is because it will take longer for the rows to cover the bare ground.

Although there will be fewer plants in a field planted on 36-inch rows than on narrower rows, this will be partially offset by planting seeds closer together.

For the above and other reasons, peanut farmers must become business men and women with decision making skills so as to maximize their profits.

For example, when they have no tractor they may choose to plant narrow rows so as to save money on weeding. However, as they have access to tractors and mechanical diggers, they can choose to plant rows at greater distances and save money by reducing their labor costs.

This farmer has planted peanuts on rows that are up to 4 feet apart and planted seeds 2-3 feet apart. Although this is a traditional way to plant peanuts, many growers are now planting peanuts on narrower rows and with a reduced seed spacing to better manage weeds and to reap larger harvests.

7. NUTRIENTS AND FERTILIZER FOR THE PEANUT PLANT

Soils from the Rupununi Savannas are highly weathered and sandy. These soils typically have low fertility, low organic matter content, low water holding capacity, and are prone to erosion. This is especially true of older, established fields as in the north Rupununi. Growers who practice slash-and-burn agriculture can expect improved fertility for a limited period of time (two years) until the available nutrients are depleted by the crops. It is reported that soils in the savannas can be good for crop production if managed well.

Fertilizer can be used to improve productivity in peanut fields in the Rupununi.

Fertilizers can be thought of as "food" for the plant.

Fertilizers, like the different kinds of boron pictured above, help a crop to grow more peanuts and better quality peanuts.

Fortunately, the peanut plant is a good scavenger of nutrients in the soil and can also fix its own nitrogen with the help of specific bacteria in the soil.

In order to produce higher-yielding and better quality peanuts in Guyana, growers should consider 1) adding lime before planting to raise pH and provide calcium to the pegging zone, and 2) spraying boron fertilizer. If lime is not needed, according to results of a soil test, an application of gypsum at early bloom should be considered, especially in the North Rupununi.

The plant in the picture at left shows symptoms that may be caused by poor soil fertility.

Poor soil fertility means that the peanut plant will not have enough food to grow a healthy, high yielding, peanut crop.

The only way to know how much fertilizer is needed is to take a SOIL TEST on the field and add fertilizer (food for plants) as needed!

Fertilizers are difficult to access in the Rupununi and they can be expensive; however fertilizers are an important way to increase yields, especially in older, established, peanut fields!

All plants require 16 essential nutrients. Since the peanut plant has a deep trap root and extensive root system it is a very good scavenger of what little nutrients may already be in the soil.

Even though this is true, research on peanuts in the Rupununi indicate that yields and quality can be increased significantly with the addition of phosphorous fertilizers such as diammonium phosphate ("DAP"). An application of approximately 90 pounds per acre of P2O5 (for example from 200 pounds per acre of 18-46-0 or "DAP") has increased peanut yields by 500 to 1000 pounds per acre.

Lime will increase the pH which will make nutrients in the soil more available to the plants. Lime also provides calcium which can reduce "pops" or "windnuts" (that is pods without nuts inside) which have no value. Boron is important to pollination and fruiting and will reduce the problem known as "hollow heart".

7A. WHAT IS FERTILIZER?

Fertilizer is food for the plant.

Fertilizer is defined as a material that provides a plant with one or more of its essential nutrients. There are numerous types of fertilizers containing multiple combinations of these essential nutrients.

Fertilizers can be divided into two general categories: organic and inorganic:

Organic fertilizers contain carbon and include such things as animal manures, plant residues and compost. NOTE: If you plan to grow peanuts for the "organic" market, you must use organic fertilizers and NOT inorganic fertilizers!

Inorganic fertilizers are manufactured and include nutrients such as nitrogen fixed into ammonium, phosphorous from phosphate rock treated with phosphorous acid and "muriate of potash", a mined potassium salt. Inorganic fertilizers are not to be used for "organic" peanuts.

Soil testing: finding out how much fertilizer you need

Soil testing is the best way to determine if lime and/or fertilizer is needed to increase yield and quality of peanuts. Inexpensive soil testing kits are available; however some are not very accurate (for example for pH and phosphorous).

In the absence of a soil test, applying moderate rates of lime, phosphorous and boron are recommended if high-yield, high-quality peanuts are the goal of production.

7B. Soil "pH" MEASURES ACIDITY of SOIL

In these images, lime has been applied in a band over newly planted peanuts in Aranaputa and Moco Moco to raise the soil pH and to add calcium to the soil. Soil tests showed that the pH was too low in these fields.

Soil pH is a measure of the acidity of a soil. Acidity is mainly caused by excess hydrogen ions. The pH scale runs from 0 to 14 with 7 being neutral.

Peanuts require a pH of around 6.0. At this pH the nitrogen fixation process occurs adequately and many essential plant nutrients already in the soil or applied in fertilizers become available for uptake.

Soils in the Rupununi tend to be on the acidic side and show pHs below 6.0. Agricultural limestone (calcium/magnesium carbonate) is the material

needed to raise pH. Based on field tests in the Rupununi, approximately 500 lb/acre of lime should be applied to assure the proper pH. Banding the lime in a 6-inch wide band over the row, either by hand or with a drop spreader, as shown in the pictures on page 52, is a good way to increase the efficiency of lime applications.

The pH is a test of the acidity of the soil. If the soil pH is too low the peanut plants will not grow well.

If soil pH is too low, nutrients in the soil may be "locked up" and the peanut plant can't get them. If the soil pH is raised with lime, then the nutrients are "unlocked" and become available to the peanut plant. This will increase yields!

The peanuts at left were collected near Aranaputa and show a common problem in the Rupununi. If there is not enough calcium in the soil, the seeds do not form properly.

7C. Calcium and Boron for the Peanut

"Wind-nuts" result when there is not enough calcium in the soil to develop healthy, high-quality peanut seeds. Wind-nuts have no value!

Peanuts have a unique and high requirement for calcium. Unlike many plants, peanuts can not take calcium up from the soil through the roots and move it to the developing nuts. Calcium actually has to be absorbed directly from the soil through the peanut hull into the developing nut.

Therefore it is important to have good levels of calcium in the top 3 inches of soil where peanuts pegs grow (the "pegging zone") and peanuts develop.

If lime is not needed according to results of a soil test, then an application of gypsum at bloomtime should be considered, especially in the North Rupununi. The application of gypsum at bloom-time is NOT to increase the soil pH, but is rather to ensure that there is adequate calcium in the soil surrounding the developing pods.

Above left: This drawing shows that calcium moving from the soil to the roots and throughout the plant does not supply enough calcium to the developing pod. **Above right:** Healthy pods and seeds require direct uptake of calcium from the soil through the pod wall.

If adequate calcium is not provided to the developing peanuts, the result will be pods containing one or more shriveled, undeveloped kernels. These pods are called "pops" or "windnuts".

CAUTION: Farmers should never save peanut seed that did not get adequate calcium. Peanuts saved for seed that did not get adequate calcium will not germinate properly.

Boron is required by peanuts in small amounts, but is important to add to the crop to reduce the hollow heart that is pictured below. Boron is usually applied when the crop begins to flower.

The seeds in the picture on the left are malformed from lack of the nutrient boron. Note the large pit in the center of each peanut. This is called "hollow heart".

There are a number of boron fertilizers available commercially. These are either derived from sodium borate or boric acid and come in granular or liquid forms.

Boron applications of 0.5 lb Boron/acre are required to assure good pollination and fruiting of the peanut. Adequate boron will also help yield and quality. Usually there is no visible symptom of boron deficiency on the growing plant. Instead, inadequate boron results in "hollow heart". This is also referred to as "hidden damage" since it is usually not noticed until the peanut shells are opened.

NOTE: Growers who save their seed to plant in the following season should insure that they have sufficient boron and calcium in the soil.

In order to produce high-yielding and good quality peanuts in Guyana, growers should consider:

1) Adding phosphorous fertilizer at planting,
2) Adding lime at planting if pH is low according to a soil test (more likely needed in the North Rupununi),
3) Applying boron at planting or at first bloom as a foliar spray,
4) Applying gypsum (calcium sulfate) at bloomtime if lime is not used and there is a history of "windnuts" (again, more likely in the North Rupununi).

7D. NITROGEN AND RHIZOBIUM INOCULANT IN PEANUT PRODUCTION

Peanut plants, like other legumes, can fix their own nitrogen from the air with the help of bacteria (*Rhizobium*) that infect the roots.

Commercial Rhizobium inoculants are available from NARI at Mon Repos, East Coast, Guyana. These should be used as insurance to achieve top yields.

Research results in the Rupununi indicate that peanuts will yield at decent levels even without the addition of commercial inoculant. This is most likely due to the existence of a native population of Rhizobium bacteria that help the peanut plants fix nitrogen.

In the picture above, one can clearly see the nodules on the peanut roots. These nodules contain Rhizobium bacteria that make nitrogen for the peanut plant. Without these nodules, the peanut plant would not be healthy and would not produce many peanuts.

8. USING AGRICULTURAL CHEMICALS SAFELY

WARNING
This farmer is not wearing any protective clothing and is demonstrating the **WRONG** way to apply pesticides!!! This could be DANGEROUS!

NOTE: This farmer is applying pesticides with the **CORRECT** uniform: eye protection, mask, hat, and chemical spray suit!

The group of agricultural chemicals referred to as "pesticides" includes herbicides (or weedicides) for controlling weeds, insecticides for controlling bugs and insects, and fungicides for controlling diseases.

Pesticides are a very powerful tool for growers, but ONLY if they are used safely and as directed!

For example, used correctly, pesticides can save much labor in the battle to control weeds and they are very effective at controlling insects and diseases.

IF PESTICIDES ARE NOT USED CORRECTLY, THEY CAN:
Poison, injure or even kill the farmer, his family, and others who work with him or come in contact with misused pesticides.

Even pesticides that are not disposed of properly can poison humans and animals or cause serious harm to the environment; especially WELLS, STREAMS, and RIVERS!

If too much, **OR THE WRONG** pesticide is used on the crop, it may cause damage to the peanut crop!

If too little **OR THE WRONG** pesticide is used, it may not control the pest and money will be wasted.

8A. TYPES OF AGRICULTURAL CHEMICALS

Pesticides can be described and identified based on three different categories.

The first category of pesticide is determined by the type of pest that is targeted. Here we include:

Herbicides (weedicides) are pesticides that kill weeds. Remember: herbicides are not all effective against the same weeds and many herbicides should not be used in peanut production as they will harm or kill the plants!

Insecticides are pesticides that kill insects. Remember: insecticides are often VERY dangerous to the farmer if not used safely. Also, not all insecticides are effective on the same insects, so farmers need to be very careful of which insecticides they use.

Fungicides are pesticides used to control diseases. Remember: like herbicides and insecticides, these pesticides can also be dangerous. Also, not all fungicides are effective on the same diseases!

The second category of pesticides is determined by the formulation type.

Many pesticides are formulated as a **dust or a powder** that is mixed with water to form a mixture that can be sprayed on the field.

Other pesticides are formulated as liquid **flowables**. A specific amount of the flowable is mixed with a specific amount of water and is then applied to the field.

Another formulation is referred to as "EC" or "**emulsifiable concentrate**". Emulsifiable concentrates are liquids with an oily base. **Emulsifiable concentrates should not be transferred to regular plastic containers because they will DISSOLVE the plastic and then spill or leak out.**

The third and final category of pesticides is determined by the "mode of action" of the pesticide. This category describes how the pesticide kills the pest. This information is very important, but not necessarily needed by the farmer to use the pesticide correctly.

8B. CALIBRATING YOUR SPRAYER

Farmers who choose to use pesticides to control pests in their peanut fields MUST calibrate their sprayer properly! Each farmer must determine his or her OWN calibration!!!

"Calibrate" means that the farmer knows how much pesticide is being sprayed on the field.

Calibration involves determining the amount (volume) of water being applied to a measured area of land. Once this is determined, the correct amount of pesticide can be added to the water.

If a farmer does not calibrate his sprayer correctly, he will either spray too much, or not enough of the pesticide to the crop.

If too much pesticide is sprayed, you will waste money because you could have gotten the same results with a smaller amount of pesticide.

If you spray too much pesticide, especially an herbicide, you may cause injury and damage to the crop.

If you do not spray enough pesticide, you will not control the pest adequately and you will have wasted your money and time.

STEPS TO CALIBRATING YOUR PESTICIDE APPLICATION

Step 1. Pour water in your spray container and spray out as much of the water as you can. A little water will be left in the bottom that you cannot spray out. Leave it in the spray container.

Step 2. Measure out 2 gallons of water and pour it into the spray container.

Step 3. Mark a line on the ground.

Step 4. Start at the line on the ground. At a normal pace that you will keep while spraying, walk in a straight line and spray the water on the ground as you walk. Hold the spray boom as you would as you spray in the field and pump the sprayer to maintain normal spray pressure.

Step 5. When the sprayer runs out of water, stop and mark the spot on the ground with a line.

Step 6. Measure how far you walked. That would be the distance between the two lines.

Step 7. Figure out how wide a swath (width) that your boom is spraying. Normally farmers in the Rupununi are spraying a band about 2-feet wide (the width of the typical row).

Step 8. Calculate your spray calibration with the following equation:

(2 gallons) ÷ [(number of feet between the two lines) X (spray width-feet) ÷ (43,560 square feet per acre)] = RATE of SPRAY (GALLONS PER ACRE).

Example 1.

Let's say that you spray 2 gallons of water over a 2 foot spray width in 2350 feet of walking. To use our formula above, we say:

(2 gallons) ÷ [(2350 feet) X (2 feet) ÷ (43,560 square feet per acre)] = 18.53 Gallons/Acre

This means that the farmer in Example 1 will need to use 18 ½ gallons of spray mixture to completely cover 1 acre of land. NOTE: every farmer needs to calibrate his or her sprayer for their own walking speed.

Step 9. In this step, you will calculate how much pesticide you will need to mix with every gallon of water.

For example, if you are using a pesticide that calls for 1.5 pints/acre and you are spraying 18.5 gallons/acre, then the amount of pesticide you mix with each gallon is calculated as:
(Rate/acre) ÷ (gallons/acre) =
1.5 pints/acre ÷ 18.5 gallons/acre = 0.08 pints/gallon
So, for every gallon you use in this example, you will mix 0.08 pints of the pesticide with it. **HINT: it is sometimes easier if you use metric units rather than English units here!**

1 fluid ounce = 26.6 mL
1 pint = 0.473 L
1 gallon = 3.785 L
1 dry ounce = 28.35 grams
1 pound = 453.6 grams

Step 10. The next step for the farmer is to calculate the area of his or her field. If the field is roughly rectangle or square, then the area of the field (acres) is calculated as (length of field X width of field) divided by

43,560 square feet per acre. This will give the farmer an idea of the size of the field.

Example 2.

If the field is 200 feet wide and 327 feet long, then the area of the field is calculated as (200 ft) X (327 ft) ÷ 43560 = 1.50 Acres

Step 11. Calculate how much spray volume and pesticide is needed to cover the field. First add a little extra to the area so that you have enough spray volume in case you slow down a bit. For example, if your field is 1.5 acres, calculate for 1.7 acres.

To calculate how much volume you need, multiply your rate, for example 18.53 gallons/Acre, and multiply it by the field area, for example 1.7 acres.

18.53 gallons/acres X 1.7 acres = **31 gallons** needed to spray the entire field. (**Note:** your container probably won't hold this volume, so you will need to spray the field with several containers of spray mix. For example, if your container holds 5 gallons then you will use 31÷5=6 containers for the field) Remember that you have already calculated how much pesticide you will mix with every gallon of mixed spray.

8C. SAFE MIXING OF PESTICIDES

Nearly all pesticides will need to be mixed with water before they are sprayed on the crop.

There are two important cautions when mixing the pesticide with the water.

First, the farmer who is mixing the pesticide must wear proper protective clothing. Protective clothing includes:

Rubber or latex gloves
Eye-glass protection or goggles
A long-sleeved shirt and long pants.

The second important caution regards rinsing equipment. The containers used to measure and hold the pesticide after mixing MUST NOT be rinsed or washed in a stream or river and they MUST NOT be rinsed near a well. The rinse water will be a serious pollutant to the water.

Finally, all containers used for work with pesticides should be clearly marked and NEVER used for food or drink, even after washing!

8D. SAFE STORAGE OF PESTICIDES

WARNING
Pesticides, like the white jugs seen at left should be stored out-of-reach of children! NOTE: empty fungicide bottles on ground in background are a real danger for children.

Pesticides must always be handled and stored safely. The greatest risks from stored pesticides are:

1. The container holding the pesticide will break or leak, polluting the area in which it was stored.

2. People, especially children, who do not recognize the **DANGER** of pesticides may incorrectly come in contact with them and be injured. Injury may occur by mistakenly drinking or eating the pesticide or just by getting some on skin or clothing without recognizing the danger.

The pesticides pictured at right are labeled and stored properly in a locked, secure facility near Lethem.

BASIC RULES FOR SAFE STORAGE of PESTICIDES

Always store pesticides in **WELL-MARKED** containers.

NEVER store pesticides in food containers or in drink bottles, even if they are well marked!

Pesticides should be stored where children cannot reach or find them.

The picture above demonstrates a very dangerous situation. Diesel fuel is stored in unmarked soda bottles in a peanut field in Aranaputa. People, especially young children, would be very tempted to drink from the bottles, thus poisoning themselves. Chemicals, pesticides, and fuel should NEVER be stored in old beverage containers!

8E. SAFE HANDLING AND SAFE APPLICATION

WARNING

The applicator above is not wearing the correct protective clothing. He should wear a spray suit, rubber gloves and boots, and eye protection.

The most important safety measure whenever handling and applying pesticides is to wear the proper protective clothing!

Farmers and workers should wear necessary protective items. These include:
Eye protection such as glasses or goggles.
A protective ventilator mask for some pesticides.
Rubber or latex gloves.
A full chemical spray suit.
Rubber boots.

A chemical spray suit like the one pictured here can be very hot when spraying pesticides in a warm climate. However, it is IMPORTANT for the safety of the farmer or worker!

HOW DO YOU RESPOND TO AN ACCIDENT?

Unfortunately accidents will happen. Accidents with pesticides can be very dangerous or even deadly. If an accident occurs, DO NOT PANIC! Have a plan of action and work quickly to solve the problem.

IF you get pesticide in your eyes, QUICKLY flush your eyes with large quantities of water. Continue to flush your eyes for at least 15 minutes and only then seek medical attention.

IF you or someone else accidentally ingests (eats or drinks) a pesticide, quickly read the label on the bottle for instructions. The label should direct you to an effective treatment, such as drinking large quantities of water or other treatment. Follow the instructions and seek medical attention.

IF you or someone else gets pesticide on their skin or clothing, quickly wash the skin with soap and water and remove the clothing. If the spill is large enough, it may be best to throw the clothing away. YOU MUST WARN whoever will wash the clothing that it is soaked with pesticide so that they can be very careful! DO NOT wash clothes containing pesticides in lakes, ponds, streams, or rivers.

8F. SAFE DISPOSAL OF PESTICIDES

After you mix a tank of pesticide for application on a crop, you should spray it all out on the field. This means that you should not mix any more of the pesticide than you will need.

When you reach the last of the pesticide in a container, you should wash the container at least THREE TIMES vigorously with water and add this rinse water to the spray mix. The empty containers should then be disposed of in a way that they will never be used by children or for food or drink.

8G. STEPS TO PROTECT YOUR FAMILY FROM PESTICIDES ON YOUR CLOTHES

(From University of Georgia Bulletin # CHFD-E-80 12/06)

Pesticides can be absorbed into a farmer's clothing (particularly in cotton). This clothing is then mixed with the family's laundry further exposing the entire family to harmful poisons.

Pesticides can enter your home on the bottom of a farmer's shoes and then tracked throughout the home.

Pesticides can also be found on a farmer's skin and transferred through touch. Be sure to wash your hands before handling food or touching your family or others!

1. Remove contaminated clothing before entering your home.

2. Shake clothing outside and empty your pockets.

3. Wear rubber gloves when handling contaminated clothing.

4. Keep contaminated clothing separate from other family clothes.

5. Do not wash contaminated clothing directly in a stream, creek, or in other natural water source. Wash contaminated clothes in a bucket and discard water away from well or other freshwater source.

6. Dry clothes on the line in the bright sunshine after washing.

9. WEED CONTROL

A weed is a plant out of place or a plant growing where it is not wanted or desired.

Most weeds are easily distinguished, with some practice. They are commonly found where man cultivates the land to grow a crop. Many weeds are also found along roads, footpaths and cattle paths where the ground has been disturbed. However, some weeds may not be easily recognized as such. Sorrell growing in a peanut field can be considered a weed if the sorrel interferes with the peanut production. Peanuts growing in cassava can also be a weed if the peanut interfere with cassava production. **Remember, if a plant is harming the main crop or is not desirable in that crop – it is a weed!** The main factor determining whether you think a plant is a weed, is whether or not you want to control that plant.

At left are weeds in a peanut field near Aranaputa after being sprayed with an herbicide. It is critical to apply herbicides when weeds are small, otherwise the farmer will not be able to kill them.

These photographs show a clean, non-weedy field at harvest (top) and a field with a severe weed problem at harvest (bottom).

9A. HOW DO WEEDS HURT PEANUT PRODUCTION?

1. The most important way weeds damage or stunt peanuts is through competition for light.

Peanuts are low growing, with most of their leaves near the ground. Many weeds grow taller than peanuts and steal sunlight before it can reach the peanut leaves.

Leaves use light, water and nutrients to make food for the plant. This food is moved from the leaves to the developing nuts under the ground. The more light that the weeds take from the peanut plants, the fewer the nuts produced by the peanut plant.

If weeding does not occur within the first 3-4 weeks, farmers' will see a loss in yield – no matter how clean the farmers keep the field later in the season.

Below is a picture that shows young peanut plants during early growth when they must be kept weed-free. Farmers must make sure the peanuts are weed-free in the beginning part of the growing season, or else they will lose much yield at harvest.

2. Weeds hurt peanuts through competition for water.

Water is needed by the peanut to make nuts and maintain healthy growth. Many weeds, especially grassy weeds, use a lot of water – much more than peanuts. As the peanuts get older and bigger, they use more water. The same happens with weeds – the bigger and taller, the more water they use.

The real problem with weeds and competition for water occurs when the peanuts begin to make nuts. This happens when the peanuts are 75 days old and continues until harvest. When the peanut plant makes the nuts, the demand for water goes up dramatically. Now, the peanuts need a lot more water. If weeds are in the field during this time, they can steal water from the peanut and cause fewer nuts to be formed, or cause smaller nuts to grow.

3. Weeds hurt peanuts by stealing nutrients.

In the Rupununi, the major nutrients peanuts need are phosphorus and calcium. Many weeds also need these same nutrients and will take these away from the peanut. This causes the peanut to make fewer nuts.

4. Weeds create a problem by stealing space from peanut plants.

Every plant needs a certain amount of space to grow and expand. As the peanut plant grows, it expands and puts on more leaves and more stems. More leaves and more flowers produce more nuts. If weeds get in the way, the peanut plant cannot expand and will produce fewer nuts.

5. Weeds make it more difficult to harvest peanuts.

Besides competing for light, water, nutrients and space, weeds also complicate harvest. When there are a lot of weeds in the field, it generally takes longer to harvest. Not only must the weeds be removed but their roots are often tangled with the roots of the peanuts. This makes it harder to pull the peanuts by hand. Drying also takes longer, because the weed roots hold more soil and more moisture.

When a farmer is lucky enough to have a mechanical harvester, weeds can clog the machine and damage the mechanical pickers. Remember that harvest is the final step in making a good crop of peanuts.

To ensure a good crop, the peanuts must be harvested, picked, dried and bagged as quickly as possible. A lot of weeds will slow down this process and cost the farmer more money, especially for labor.

Notice the two fields shown in the pictures on page 70. They are about the same size – which one would be easier to harvest? Which field will take less time to harvest? The more time it takes to harvest, the more labor the farmer has to pay.

In general, the taller the weeds at harvest, the greater the problems with digging and mechanical harvesting. This will likely reduce yields through increased drought stress and inefficient harvest.

Weeds hurt the farmer in two ways – less yield because of competition with the peanut plant, and less money because of higher harvesting costs.

In summary:

Any plant growing in a peanut field that the farmer does not want there, or that is hurting the peanuts, is a WEED.

Weeds reduce peanut yields by competition for:

- Light – especially early in the season
- Water – especially late in the season
- Nutrients
- Space

Weeds also affect yields and add costs by causing problems at harvest time.

9B. TYPES OF WEEDS AFFECTING PEANUTS

There are three main types of weeds found in peanut production.

These are broadleaf weeds, grassy weeds and sedges. Each type differs in how they grow, when they grow and how they affect the peanut crop.

Note: pictures of common weeds found in peanuts in the Rupununi region of Guyana are included at the end of this production guide.

Grassy weeds (grasses)

Grassy weeds are a common problem for peanut farmers in the north Rupununi.

There are many different types of grasses found in peanuts. They are hard to tell apart when they are small. Fortunately for peanut growers, grasses are all managed the same way. Therefore, knowing which grass is which is not as critical as knowing the difference between types of broadleaf weeds.

Grasses grow in two different ways – upright or creeping. Most upright grasses form a tight clump with a cluster of leaves and stems coming out of the center. Creeping grasses spread along the ground and send shoots and leaves up through the peanut leaves. Grasses compete with peanut for light, but even more so for water.

Sedges

Sedges look a lot like grasses, but the leaves of sedges grow in rows of three, rather than one at a time in grasses. Sedges also have a triangular stem that can be felt when rolled between your fingers. Sedges prefer wetter fields and are less common than grasses and broadleaves. However, the control for sedges is completely different than for broadleaves and grasses. As broadleaf weeds and grasses are controlled, sedges may become more of a problem.

Broad-leaf weeds

Broadleaf weeds, such as those at left, cause significant yield losses in peanut fields if not effectively controlled.

The broadleaf category has the greatest variety of weeds found in peanut fields. Most broadleaf weeds grow upright, and range from 2 to 5 feet tall. The leaves are round to arrow shaped. Some broadleaf weeds are vining and climb up other weeds. When vines grow in peanuts, they generally lie on top of the peanut leaves. The broadleaf weeds that cause the most problems in peanuts are those that grow tall and bushy, since they grow above the peanuts and absorb much of the available light.

Savanna and Bush Island Weeds

At first glance, these two types of planting areas (savanna and bush-island) appear to have completely different types of weeds. However, the major difference is the level of weed pressure.

In bush islands, there are fewer weeds. Most of the weeds are the trees and other plants that have regrown after clearing the land (see the picture below).

In this picture from a bush island, the young palm tree is a weed in this peanut field!

The second and third year after clearing, the weed pressure increases. This increase is due to seeds accidentally brought in by people working the fields and those weeds that went to seed the year before. Most of the time, the weeds that come into the field the second and third years are more like the weeds found in the savanna lands.

In the savanna lands, the same piece of ground is farmed each year. This type of yearly, or annual, tilling the ground favors those weeds that germinate, grow and produce seed in one year. The reason these annual weeds are not observed in the bush islands is because the ground is not tilled for several years and annual weeds die out as trees grow into the area.

9C. How Are Weeds Controlled?

There are five methods used to control weeds.

These are preventative, cultural, mechanical, biological and chemical methods. It is important to remember that each method alone will not work for every situation and every time, therefore growers must use several methods in an integrated approach. In the following paragraphs, each method is discussed as it relates to peanut production.

Preventative

One of the most effective means of weed control is prevention. In simple terms - don't let weeds get into your field. The paths leading to many fields have weeds growing on both sides. Seeds of these weeds are easily carried into the field as people walk by. Vehicles such as trucks, tractors, motorcycles and carts also drag seeds into the field. Harvesting equipment, especially peanut combines, are often the biggest source of weed seeds.

Weeds are mostly found along the edges of the field and nearest the paths leading into the area. Once these weeds go to seed, they are easily moved into the rest of the field. This is how weeds get started. The main reason weeds take over a field is because weeds were allowed to make seeds the year before. If a field is full of weeds at the end of harvest, they should be burned or removed before they can set seeds. Keeping the field well weeded throughout the season is also very helpful.

Note the weed seeds stuck to the pants of this farmer.

Cultural

Cultural weed management uses the peanut crop to help suppress weeds. Peanuts are extremely aggressive and will suppress many weeds once the plants have covered the ground. Close planting densities that help the peanuts get quick coverage will hold back many weeds. In addition, good fertility, good seed quality, proper insect control and proper disease control will allow peanuts to grow more rapidly. The more rapidly peanuts grow, the better they will be able to suppress weeds. Another important cultural technique is crop rotation. Crop rotation is basically switching crops from one year to the next and NOT growing peanuts in the same area year after year. Once weeds get adapted to a certain area and crop, they stay and become major problems.

Mechanical

There are many types of mechanical control, including hand pulling, hoeing or cutting. Mechanical weed control is the most common method used in the Rupununi. This type of control is very effective and only removes the unwanted weeds. Tillage to prepare the ground before planting is primarily to remove weeds. Sometimes a disk harrow is used if a tractor is available. Some weeds can be buried in this step but this generally requires tillage to 8 inches deep or greater.

Once the crop is planted and emerges, hoeing to remove weeds is performed. **Hoeing should be done early when the weeds are small and easy to kill.** It is important to remember to only lightly scratch the weeds out. Workers should be trained not hoe too deep – no more than 1/2 inch. The deeper you hoe, the more weed seeds you will bring to the surface. Once these seeds reach the surface, they will germinate and force more hoeing throughout the season. Remember that the ground is full of weed seeds, but only those near the surface will grow.

Biological

This method of weed control uses an insect or an animal such as a duck to eat the weeds but not the crop. This type of control is not used in the Rupununi.

Chemical

Chemical control of weeds uses compounds called herbicides (weedicides) that kill weeds without harming the peanuts. Herbicides are very unique, each having different properties. Some herbicides only kill grasses, some only broadleaves, while some will control both grasses and broadleaves. Some herbicides only kill weeds after they are up and growing, while others kill the weed as its seed is trying to grow out of the ground. To help clarify the uses and properties of the various herbicides used in peanuts, the definitions of some herbicide terms are given below.

Pre-emergence – this means the herbicide is applied to the soil after the peanuts have been planted BUT before the peanuts emerge and before the weeds emerge. If weeds are already out of the ground and growing, most pre-emergence herbicides will **NOT** work on them. Therefore, it is critical to apply pre-emergence herbicides as soon as possible after planting. Another important issue with most pre-emergence herbicides is rainfall. Rainfall helps to activate the herbicide. Lasso (alachlor) and Dual (metolachlor) are examples of pre-emergence herbicides that have been used successfully in the Rupununi.

Post-emergence – this means the herbicide is applied over the top of the weeds. The herbicide is taken up through the leaves and kills the weeds through a variety of ways depending on the herbicide. Cadre (imazapic) and Pursuit (imazethapyr) are examples of post-emergence herbicides that have been tested with positive results in the Rupununi.

Post-emergent weed control is very labor intensive if farmers have to use hoes!

Surfactant – this is a material that is added to post-emergence herbicides to help the herbicide stick to and get inside the leaves. It may also be called an adjuvant or spreader/sticker. It generally looks like oil. If commercial surfactant is unavailable, farmers can use laundry soap mixed with water as a substitute. With liquid soap, use approximately 5 drops per gallon of water. With a bar of soap, use approximately the amount of shavings that will fill the cap from a beer bottle.

9D. HERBICIDES EVALUATED IN THE RUPUNUNI

The following section summarizes the advantages and disadvantages of each herbicide evaluated in the Rupununi. Some precautions and directions for use are also given.

Cadre

Cadre is the most popular and well-known herbicide for peanuts in the Rupununi and for good reason.

Cadre is excellent on a wide range of grasses, nutsedge and broadleaf weeds and is one of the most complete herbicides for any crop. It should be applied at the rate of 1.44 oz per acre. This is one half of an individual packet - each packet treats 2 acres. Cadre can be used as pre-emergence (right after planting but before weed and crop emergence) or post-emergence (after weeds and crop have emerged). Post-emergence applications should have a surfactant added to ensure good uptake of the herbicide and therefore good control.

Farmers should also make sure the weeds are small when treated because weeds that are too big will often grow out of Cadre damage. The picture on page 74 shows the recommended size when Cadre is applied.

Application at the right size is CRITICAL to ensure maximum control with herbicides. The weeds at left are the proper size to control with Cadre.

From control observations over 4 years, Cadre was effective on most of the weeds in the north Rupununi with the exception of mimosa (sensitive plant) and possibly others. However, if applied pre-emergence, some weeds may break through in mid-season. This can happen when there is excessive rainfall and/or heavy weed pressure. Grasses and certain broadleaf weeds have been known to "break-thru" a treatment of Cadre - this is normal. DO NOT try to compensate for this by using a higher rate, as injury to the peanuts will occur.

Pursuit

Pursuit herbicide is similar in activity and weed spectrum to Cadre, but does not kill as many weeds. It is not as strong on grasses and misses some broadleaf weeds and yellow nutsedge. Pursuit can also be used pre-emergence and post-emergence (with surfactant). It is used extensively on soybeans and many beans (vegetable-type) have fair to good tolerance. It may be easier to obtain than Cadre, and will certainly be cheaper. Peanuts have good tolerance with Pursuit, so injury should not be an issue. The application rate is the same as for Cadre - 1.44 oz. per acre; one packet will treat 2 acres.

Valor

Valor is a soil-applied herbicide and is good on many morninglories and other broadleaf weeds. It will control some grasses, but is not great. Nutsedge will also escape this herbicide. Valor may have activity on mimosa and some of the weeds that escape Cadre.

Caution: Valor must only be applied PRE-EMERGENCE and within 2 days after planting. Do not apply Valor to peanuts that have been planted for longer than 3 days. NEVER, NEVER, NEVER apply Valor to peanuts that have emerged. If there is green tissue present, Valor will burn and kill it.

Valor is a good herbicide, but it can slightly injure peanuts, even when applied correctly. However, in such cases, peanuts will generally out-grow the damage. Valor will take a little time and effort to make it fit into the Rupununi peanut production scheme, but it will be worth the effort as it works well in an integrated system.

Valor may be available in Brazil since it is also labeled on soybeans. Valor should be applied at rates of 2 to 3 oz. per acre.

Lasso or Dual

Use Lasso at a rate of 2 quarts per acre, Dual at 1 quart per acre. These herbicides can only be applied pre-emergence and will only control weeds before they have emerged. These are good herbicides to mix with Cadre or Pursuit. They provide a boost for grass control and have activity on grasses and small-seeded broadleaf weeds such as pusley and pigweeds. They do not control broadleaf weeds such as mimosa, sicklepod or senna.

Sprayer Calibration

This area is extremely critical! A more detailed discussion of this information is presented on pages 60-63. Most of the growers use a backpack sprayer (Solo) to apply herbicides. The first thing is to calibrate for each person since everyone walks at different speeds. Fill the sprayer with one gallon of water, go to a open area and start spraying at the rate the person feels comfortable with - making sure the coverage is uniform and thorough. Remember that soaking an area is not needed. Spray until empty and then measure the area sprayed. Repeat and measure again until the person is consistent with the area sprayed. This procedure will allow you to calculate the spray volume per acre for each person using the sprayer. For example, if one gallon was applied to 1500 square feet, then that amount would be roughly 30 gallons per acre (one acre - 43,560 ft^2 / 1500 ft^2). If your backpack held 4 gallons, you would need 7.5 tanks to cover an acre (30

gallons per acre / 4 gallons per backpack). In addition, an easy way to stay on track is to figure number of rows that should be covered by a tank-full.

The backpack will only allow you to cover a percentage of an acre at one time, but the rate of chemical application is based on an amount per acre. One of the ways to divide out the amount per tank (backpack) is to make a solution containing an acres worth of material. For example, if you needed 7.5 tanks to do an acre, you could mix up one acres worth of herbicide (let's say ½ pack of Cadre) into a 2 quart (64 oz) bottle, mix thoroughly and pour 8.5 oz. per tank for the correct amount per acre (64 oz / 7.5 trips = 8.5 oz/trip). If you plan on making a solution, be sure to use it up within a day or two - herbicides will begin to break down in water over time.

Proper sprayer calibration is critical to successful and profitable farming!

10. INSECT CONTROL

10A. DAMAGE CAUSED BY INSECTS

There are thousands of species of insects in the Rupununi but only a few are of concern to peanut growers.

Many insects are actually beneficial because they eat the insects that can are pests of the peanut crop.

Insect populations are always changing, building to a peak, and then declining. **Low populations of pests and low levels of damage usually have little or no impact on final peanut yields and quality.** However, there are times when insect populations rise rapidly and their feeding results in significant damage to the crop.

Unlike diseases and weeds, which are fairly predictable problems, insect problems tend to be sporadic and very unpredictable.

10B. TYPES OF INSECT PESTS

Insects of the Rupununi are different from those found in other peanut-producing regions of the world.

Each insect has its own unique habitat, life-cycle and method of feeding. Although we are not totally familiar with all of the specific insects affecting the peanut crop in the Rupununi, we can generalize about the types of damage the farmer may see.

1. **Foliage feeding insects** – These are insects that feed on peanut leaves. Caterpillars and grasshoppers are the most common foliage feeders, but some beetles will also eat leaves.

NOTE: Small amounts of leaf damage will have no effect on peanut yield or quality, but excessive damage will limit the plants ability to make and to mature peanuts.

Farmers are fortunate in the Rupununi in that the major peanut varieties grown have lots of foliage and can tolerate a good deal of leaf loss with no negative impact. Peanuts can tolerate almost total defoliation (loss of leaves) when they are very young without a lasting effect. Peanuts that are within 2-3 weeks of maturity can also stand a lot of leaf loss without a major impact on yield.

The most critical time to maintain foliage is during the period when peanuts are pegging and making pods.

This grasshopper is one of many foliage feeders in the Rupununi.

This "southern" army worm (above left) caused the damage to the peanut foliage (above right) in Moco Moco.

2. Pod feeders - These are insects that spend most of their life in the soil and damage peanuts by feeding directly on the pods and/or pegs.

This type of damage is more important than foliage damage, but a small of amount of damage is not as bad as it may seem.

The peanut plant has an **amazing ability** to compensate for pod loss. In other words, if a pod is lost to insect feeding, another one is usually made to take its place. Of course, there is no time to replace pods lost late in the growing season.

These peanut pods were damaged by insects feeding in the soil.

3. Sucking Insects – Some insects feed on plant juices much like a mosquito feeds on blood!

Insects that feed on plant juices include mites, scale insects, aphids and thrips (although thrips feeding is a little unique).

Thrips are very common in the Rupununi but their impact on peanut yield is not known. Excessive feeding can result in leaf damage. Unlike in the United States, thrips damage can occur throughout the entire season in the Rupununi.

This peanut seedling shows damage to the leaves from thrips.

This is a close-up image of thrips damage to the leaves.

10C. CULTURAL CONTROL OF INSECT PESTS

Insect populations often respond differently to different production practices.

1. Sometimes varieties can be selected that are not well-liked by the pest.

2. Or a **short season variety** can be used to shorten the time that the crop is vulnerable to pests.

3. Planting in a higher, well-drained location can help avoid soil pests that prefer soggy conditions.

The use of these types of cultural practices to help control insects requires knowledge of what the key pests are and what conditions they like.

Variety selection and row spacing are cultural practices that can help reduce disease and weed problems, but unfortunately, enough is not yet known about the effects of cultural practices on insect populations in the Rupununi to make specific recommendations at this time.

One thing that could be done is to promote natural insect control, known as biological control. Biological control is an ongoing process where good (beneficial) insects and animals feed on bad (damaging) insects. Farmers can encourage biological control by avoiding unnecessary insecticide applications. **Notice the presence of insect eating birds and even domestic birds such as chickens in peanut fields. They are examples of biological control and often indicate the presence of insect pests.**

Chickens feeding on insects in a field.

10D. CONTROLLING INSECTS WITH INSECTICIDES

Insecticides are chemicals that kill insects.

While very effective in some situations, no insecticide is effective for all pests at all times.

Insecticides will almost always have an effect that the farmer didn't plan on. For example, they can be very damaging to beneficial insect populations. Without the beneficial insects, the pest populations can

increase rapidly. For this reason, insecticides should be used only when absolutely necessary.

Farmers should walk their fields once a week and look for insects and the damage they cause. **Insecticides are much more effective when used at the beginning of an outbreak than when used after insects are established and have already done a lot of damage!!**

Using Insecticides to Improve Peanut Yield and Quality

There are hundreds of different kinds of insecticides, each with its own positive and negative points. Only a few insecticides are readily available in the Rupununi.

Products containing **lamda cyhalothrin (Karatox, Karate and others)** have been shown to have value in the control of thrips in the Rupununi. These products will work on many other pests as well, but not all. Use Karatox at the beginning of a thrips outbreak, when leaf damage suddenly becomes apparent, but has not reached its peak. Overuse of Karatox can lead to outbreaks of other insect pests. **It's a good idea to have an alternate product to occasionally substitute for Karatox. This will help prevent thrips from developing resistance. The overuse of Karatox in the north Rupununi has resulted in outbreaks of the insect pest cottony cushion scale. The cottony cushion scale can result in severe losses in yield. The solution to this problem is to rotate the use of different insecticides for management of insect pests.**

Cottony cushion scale is pictured at left. Cottony cushion scale is now a problem in peanut fields in the north Rupununi because Karatox was the only insecticide used to control thrips. Growers should use more than one insecticide in order to prevent this from happening.

Karatox should be used at 2-4 fl. ozs. per acre depending on the level of pest pressure, but be aware that products containing the same ingredient sometimes have different strengths and should be used at different rates.

Products containing **spinosad (Tracer, SpinTor and others)** should be a good substitute and will also provide control of some pests that Karatox is weak on. Again, spray only as needed and before major insect damage has occurred.

Always obtain a product label and follow label directions for exact rates to be used for any pesticide.

11. DISEASE CONTROL

The disease pictured on left is "late" leaf spot. The disease on the right is peanut rust. Both diseases are common in the Rupununi.

The disease at left is known as "early" leaf spot. Early leaf spot, late leaf spot, and peanut rust can severely damage the leaves of the peanut plant.

Diseases of peanut "steal" a large part of a farmer's yield each year on the Rupununi savannas.

1. Diseases attack the leaves of the peanut plant, often causing them to defoliate (fall off). The leaves produce the food for the peanut plant. If

too many leaves defoliate because of disease, the farmer's yields and profit are reduced.

2. Diseases attack the stems and roots of the peanut plant and may kill the plant or severely weaken it.

3. Diseases attack the pods and the pegs of the plant, reducing yields and the quality of the harvested peanuts.

Peanut diseases in Guyana are often caused by molds and fungi that attack every part of the peanut plant.

The molds and fungi produce spores (like tiny seeds) that are blown in the air and splashed in the rain onto the peanut plants.

When spores land on peanut leaves, they infect and grow inside the plant.

Other molds grow in or along the ground and attack the peanut plant with long, cottony fibers.

The farmer can be sure that diseases will affect every peanut field in the Rupununi Savanna every time he plants.

Most peanut farmers in the Rupununi do not recognize just how much damage the diseases and molds are causing to their peanut crop.

In field studies conducted by the Peanut CRSP-Guyana team, it was learned that controlling diseases is a very important method for improving productivity, that is, increasing the number of peanuts that can be produced in one field!

Peanut diseases can be controlled in three ways:
1. Planting a more resistant variety.
2. Cultural methods like crop rotation and field sanitation.
3. Using chemicals called fungicides that protect the plant from infection.

11A. DISEASES OF THE PEANUT LEAVES

The leaves at right are infected with "target spot" disease. Although common in the Rupununi, this disease does not seem to cause much damage.

The leaves in the upper two photographs are infected with late leaf spot and peanut rust diseases.

The peanut diseases on these leaves are caused by molds (fungi).

The plant in the **top left picture (page 92)** is infected with a disease called "late" leaf spot which is a very common disease of peanuts in the Rupununi Savanna. The black spots (found on leaves in the upper two images) show where mold is making more spores. The spores (tiny seeds) can infect more leaves.

Leaf spot diseases cause leaves of the peanut plant to drop off. The peanut plants need the leaves to make food for the plant to grow, and make the pods and the nuts grow and mature before harvest. In very bad cases, the black spots will even damage the peanut vines. This may cause the pods to fall off the vines at harvest, thus reducing yields and profits!

The peanut leaves in the **top right picture (page 92)** are infected with the two most common diseases in the Rupununi peanut fields. The large black

spots are the "late" leaf spot mentioned above. The small orange specks are caused by "peanut rust" disease.

Peanut rust produces many spores that easily blow in the wind and then infect other leaves. Leaves infected with rust quickly wither and die. However, the leaves do not fall from the plant as they do for leaf spot, but remain attached to the plant.

Like late leaf spot, early leaf spot is a very common disease of the peanuts in the Rupununi. Early leaf spot produces leaf spots, like those in the photograph below. The spots associated with early leaf spot are not as dark as the spots caused by late leaf spot. Also, the spores from early leaf spot occur on the TOP of the leaf. The spores from late leaf spot are found on the BOTTOM of the leaf. If not controlled, early leaf spot can cause complete defoliation of the peanut plants.

The above picture is of early leaf spot. Note the spores of the fungus that appear as dusty particles in the center of the large brown spot.

11B. DISEASES OF THE ROOTS, STEMS, AND PODS

The white moldy growth in the top pictures causes a disease called "stem rot". The seedling in the lower pictures is damaged by a disease called "crown rot".

Although leaf spot disease and peanut rust are the most common diseases in the Rupununi peanut fields, there are other diseases caused by molds as well.

In Guyana we have observed three diseases caused by molds from the soil.

The Peanut CRSP team believes that these diseases are less severe in the Rupununi because most farmers use good crop rotation. Most farmers do not plant peanuts in the same field year after year. The diseases will become more severe if the farmers do not use crop rotation.

"Stem rot" is a disease that attacks the stems, pegs, pods, and crown of the plant. This disease is best managed in Guyana by crop rotation and by keeping dirt away from vines when weeds are hoed.

"Aspergillus crown rot" is a disease that usually affects seedlings and young plants. The best control is to use a fungicide seed treatment.

In the photograph above, note that dirt and soil cover part of the peanut limb after the rows were hoed to control weeds. This soil on the vine has caused stem rot disease to develop and the plant is beginning to wilt! See additional information on page 98.

11C. DISEASES ARE AFFECTED BY WEATHER

Weather conditions in the Rupununi Savanna
are PERFECT for diseases during the rainy season.

Most peanut diseases are caused by molds that thrive when there is plenty of rain and temperatures are very warm!

Rain is very important for the diseases because 1) molds need water to grow, 2) the spores need water to infect the peanut, and 3) the spores are spread in splashing rain.

FARMERS SHOULD RECOGNIZE THAT IN VERY WET WEATHER DISEASES OF PEANUT WILL BE MORE SEVERE.

IF A FARMER SPARYS A FUNGICIDE, THE FUNGICIDE MUST DRY ON THE LEAVES TO BE EFFECTIVE. IF NOT, RAIN WILL WASH IT OFF!

11D. CULTURAL PRACTICES TO MANAGE DISEASE

In the picture at left, peanuts have been planted in the remains of last year's peanut crop. The peanut debris and pods will spread disease in the new crop.

The first step to manage diseases of peanut is to use production practices that reduce the threat of disease.

"Cultural practices to manage disease" means that the farmer grows his or her peanut crop in such away to reduce the chance of disease.

Listed below are important production practices that the growers should use to reduce the risk of disease.

Practice crop rotation. Growers who plant peanuts in the same field for consecutive years will have more disease. Molds and fungi will survive on remains of the last crop, such as pods, old leaves and stems.

To reduce the severity of disease, farmers should not plant peanuts in the same field from one year to the next. Farmers should plant crops like rice, corn, or cassava after the peanut crop. Ideally, peanuts should be planted in a field no more than once every three years.

Rice and maize (corn) are excellent crops to rotate with peanuts and will help reduce disease in the peanut fields.

Remove peanut crop debris from the field. Farmers and their families often stack peanut vines in the field at harvest. After they pick the pods from the vines, they leave the vines stacked in the field. The molds and fungi live in this debris and will be ready to invade the next peanut crop.

To reduce the severity of disease, farmers should burn, bury, or remove old peanut crop debris from the field. This will help reduce the molds and fungi in the fields.

When growers are hoeing the weeds in their crop, they should avoid pushing soil onto the vines of the peanut plants. The "seeds" of the mold that causes stem rot can be in the soil and dirt and can infect the plants. The stem rot causes damage to the vines, to the pegs, and to the pods.

To reduce the amount of disease in the field, the farmer should keep the dirt they hoe while weeding away from the peanut vines.

Growers should avoid planting peanuts in a field that floods easily or stays wet and muddy long after rains. Molds and disease do better in wet fields and can cause damage to the peanut crop.

To reduce the amount of disease in a field, the farmer should only plant peanuts fields that are well-drained after heavy rains.

Growers should destroy "volunteer" peanut plants by hoeing them or pulling them up. "Volunteer" peanuts are plants that sprout from seed left in the field from the last season. Volunteers often carry over diseases from the last season OR become infected with leaf spot and rust and then spread them to the new crop. Even if peanuts are not planted in the field this season, the volunteers should be destroyed to insure good crop rotation.

To reduce the amount of disease in a field, farmers should destroy all volunteer peanut plants, even if a peanut crop is not planted in the field.

11E. FUNGICIDES IN PEANUT PRODUCTION

Fungicides are chemicals that are used to control peanut diseases.

GROWERS MUST ALWAYS READ THE LABEL ON THE FUNGICIDE FOR SPECIFIC INFORMATION ON HOW TO USE THE PRODUCT PROPERLY. THE LABEL WILL TELL YOU HOW MUCH FUNGICIDE TO USE AND OTHER SAFETY CONSIDERATIONS!

THIS IS VERY IMPORTANT. **READ THE LABEL!!**

Although farmers can grow peanuts without using fungicides, farmers who use fungicides effectively can expect 1) healthier plants, 2) more peanuts, and 3) peanuts that have stronger pegs so that pods will not fall of the vines at harvest.

FUNGICIDES NEED TO BE APPLIED **BEFORE** DISEASE SPREADS IN A FIELD. FUNGICIDES DO A GOOD JOB OF PROTECTING AGAINST DISEASE BUT DO NOT DO A GOOD JOB OF CURING DISEASE!!

NOTE this comment well!!

There are two major categories of fungicides in peanut production, those that are used for controlling diseases of the leaves (foliar fungicides) and those that affect the diseases of the stems, pods, and roots.

There are two common fungicides used in the Rupununi to control leaf diseases. These are chlorothalonil and propiconazole. They are sold under several different names. These fungicides can also be mixed together for maximum control.

Chlorothalonil can be used to control leaf spot diseases and rust disease. It must be applied **BEFORE** disease is in the field. Chlorothalonil cannot cure diseases of the peanut plant.

Propiconazole can be used for control of leaf spot disease. Propiconazole by itself does not control rust disease! **The Peanut CRSP team does NOT**

recommend applying propiconazole alone. To use propiconazole, we recommend mixing it with chlorothalonil.

The most effective fungicide combination that the grower can use is to MIX chlorothalonil with propiconazole. This mixture is especially helpful when leaf spot is becoming difficult to control. Consult the labels on these fungicides for more information.

11F. TIMING OF FUNGICIDE OPTIONS

If a farmer sprays a fungicide on his or her peanuts, IT IS CRITICAL to spray at the RIGHT TIME!

Spraying fungicides costs the farmer money, time, and labor. Farmers need to make sure they get the most benefit they can!!

If fungicides are sprayed too early (before they are needed), the farmer may not get any benefit.

If fungicides are sprayed too late and disease is already in the field, farmers will not get maximum benefit. Fungicides are good at protecting the peanuts, but not CURING disease already in the field!

If it rains on a peanut field before the fungicide dries on the leaves, the fungicide will wash off and be wasted. FARMERS SHOULD NOT SPRAY FUNGICIDES FOR LEAF DISEASES UNLESS THEY EXPECT 2-4 HOURS OF DRY WEATHER. FARMERS SHOULD NOT SPRAY FUNGICIDES UNTIL DEW OR RAIN DRIES ON THE LEAVES.

If the weather has been very dry, farmers can wait to spray fungicides because molds need water to grow.

BELOW ARE RECOMMENDATIONS FOR SPRAYING PEANUTS WITH FUNGICIDES IN THE RUPUNUNI

For Guyana Jumbo

Begin spraying chlorothalonil or propiconazole + chlorothalonil mixture about 45 days after the peanut plants sprout.

Repeat the sprays every 21 days. If the weather is very wet, shorten the time between sprays. If weather is dry, you can delay your spray.

If leaf spot or rust disease is in the field, spray a mixture of propiconazole + chlorothalonil mixture.

Stop spraying peanuts 3-to-4 weeks before you plan to harvest.

For C99-R peanut variety

C99-R gets leaf spot diseases and peanut rust more easily than Guyana Jumbo does. Therefore, C99-R needs protection.

Begin spraying chlorothalonil or propiconazole + chlorothalonil mixture for C99-R about 35-to-40 days after the peanut plants sprout.

Repeat the sprays every 14 days. If the weather is very wet, shorten the time between sprays. If weather is dry, you can delay your spray.

If leaf spot or rust disease is in the field, spray propiconazole + chlorothalonil mixture.

Stop spraying peanuts 3-to-4 weeks before you plan to harvest.

FINAL NOTES ON FUNGICIDES

Research in the Rupununi proves that farmers can significacntly benefit from spraying fungicides on their peanut crop.

Many growers may not be able to afford the cost of all of the fungicide applications recommended above.

In such cases, here are some recommendations for minimum requirements:

Spray fungicides on Guyana Jumbo at least 2 or 3 times. Begin spraying 60 days after planting and then spray every 28 days.

In the case of C99-R, spray fungicides at least 4 times. Begin spraying about 45 days after planting and repeat the spray every 21 days.

12. HARVEST AND MATURITY

Farmers must harvest their peanut crop at the proper time to ensure highest quality, greatest yields, and the most value (profit) for the crop.

In the picture above, the pods increase in maturity from left to right. The two pods on the far right are mature.

12A. HARVESTING FOR HIGHEST YIELD AND QUALITY

Harvesting at the best time insures growers they have achieved the maximum yield and value, as well as the best possible quality for their crop. Fully mature peanuts are essential to provide the most flavorful and nutritious products possible. Immature peanuts have poor flavor. They are more likely to deteriorate in storage, be damaged by insects, and are more susceptible to contamination by toxic molds in storage.

Peanut are indeterminate in their fruiting or pod set, meaning they set pods over an extended period of time and have many levels of maturity or ripeness present on the vines at harvest.

1. If peanuts are harvested too early, yield, flavor, quality and earnings are sacrificed.
2. If peanuts are harvested too late, over-ripe pods will shed from the vines and will either be lost or must be gathered by hand, resulting in economic losses.
3. Growers must balance the risk of losing mature pods because of weakened or diseased stems versus the potential gain from pods still maturing.

Harvest should coincide with the end of the rainy season, but before the soil dries out too much to make digging difficult. Timeliness of harvest becomes even more critical as agricultural practices move from hand lifting and shaking to increased mechanization.

The best time to harvest is when the crop has the highest yield and the highest percentage of mature, marketable kernels. Some important guidelines to keep in mind are:

1. Peanuts should have 75% to 80% dark inner hulls or deep pink seed coats for ideal maturity.
2. A variety like C99-R may require 140 days to reach this maturity.
3. Guyana Jumbo may take 160 or more days to reach the same level of maturity.

Other factors, such as the time of emergence, rainfall, and temperature also affect the total number of days until harvest maturity. Therefore, it is

best to take a sample of pods from each field and determine the maturity on a field by field basis using the following technique.

12B. MATURITY SAMPLING

Maturity sampling has similarities with soil sampling. The sample must be representative of the field or the results will be meaningless. Some important steps include:

1. Carefully lift plants from several areas that represent the field.
2. Pick off all the pods that are harvestable on each plant until getting a sample of 100 pods.
3. Observe the condition of the pods' stems, particularly for those pods nearest the tap root of the plant.
4. If stems are starting to break down, this must be considered as well as maturity, since weak stems will result in lost pods and lost dollars.

12C. HULL-SCRAPE METHOD TO CHECK MATURITY

Scrape the pods by holding the pod so that the "beak" on the front end is pointed down and away from the body.

1. Scrape away a portion of the outer hull layer, beginning at the saddle area (indentation between the two seeds in the pod) and extending back toward the pod stem near the line where the hull splits apart when shelled.
2. Colors change from white to light yellow to dark yellow to orange to brown to black with increasing maturity.
3. Brown and black pods are considered to be fully mature, orange pods are intermediate in maturity, and yellow or white pods are immature. The darker pod colors correlate with the darkening of the inner hull, as well as with the development of the deep pink seed coats.

Mature peanuts should have dark hulls and deep pink seed coats. From left to right, photo shows immature, intermediate maturity, and mature pods of the variety C99-R. Harvest should be delayed until at least 75% or 80% are in the intermediate to mature categories.

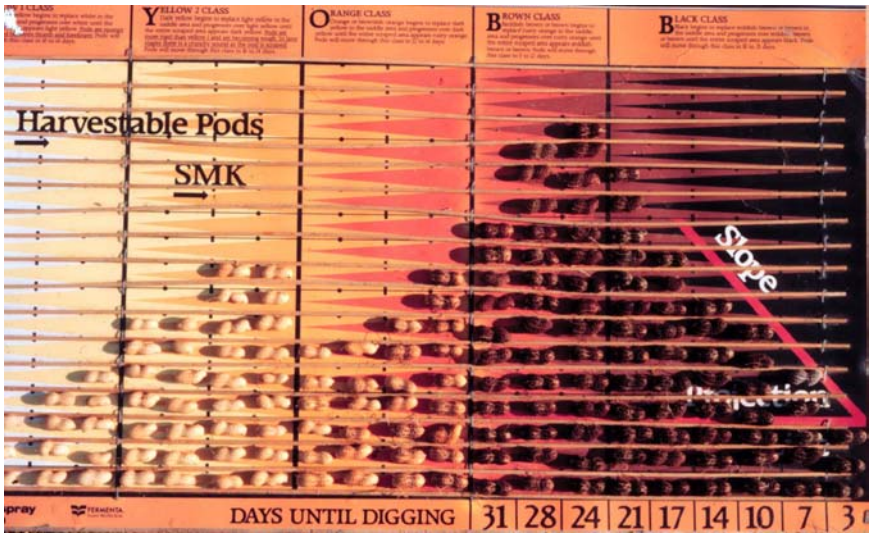
As pictured above, scrape the pod in the saddle area to determine its maturity. Colors progress from white to yellow to orange to brown to black with increasing maturity. Pods that are brown or black are considered to be fully mature.

Colors of the outer layer of the hull correspond with the darkening of the inner hull and maturity of the seed.

Once the pods have been scraped, the farmer should compare the colors and place the pods in groups of mature (orange, brown, or black) and immature (yellow).

Ideally, the crop should be harvested when 75% to 80% of these pods are dark or mature. However, a farmer must also consider the conditions of the soil and the conditions of the vines. If the fields are drying out and there is little probability of more rainfall, the farmer may be forced to harvest early. If the plants are heavily diseased, the time before shedding the most mature pods may be shortened.

A pod maturity profile chart may be used to project the best time to harvest the peanuts. A profile can be prepared by placing 150 harvestable peanuts on a profile chart (see image below) according to their color and structure as shown by the guidelines on the chart. This will become more important as more peanuts are harvested mechanically.



By scraping each pod in the saddle area,

a pod maturity profile may be constructed to project the best time to harvest.

Peanuts set pods over an extended period.

Many stages of pod maturity are present

at harvest. In the image above, pods of different maturity are on the same limb.

Stem (peg) breakdown occurs on the oldest pods as a result of full-maturity or a combination of maturity and disease.

Over-ripe pods will shed from the plants and will be lost or must be retrieved by hand, thus increasing labor costs.

If the soil dries out and there is no chance of rain, digging peanuts by hand or harvesting by machine may become impossible.

Maturity sampling is similar to soil sampling. The sample must represent the entire field or the results will be meaningless. Digging at the best time will become more and more important with increased mechanization.

13. The Peanut CRSP Team

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Scenes from the Rupununi Savannas

Scenes from the Rupununi Savannas

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A Note of Sincere Appreciation

We on the Peanut CRSP-Guyana Team are indebted to you, the people of Region 9, for your extreme efforts, unfailing support, and interest in this project. Your kindness will not be forgotten.