GROUNDNUT CROPPING GUIDE

4R NUTRIENT MANAGEMENT AND BEST AGRONOMIC PRACTICES

NORTHERN GHANA

AFRICAN PLANT NUTRITION INSTITUTE

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4R NUTRIENT MANAGEMENT AND BEST AGRONOMIC PRACTICES

NORTHERN GHANA

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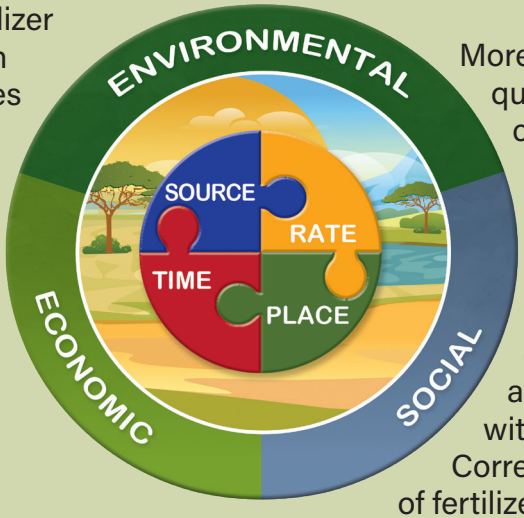
THE 4R NUTRIENT STEWARDSHIP CONCEPT

4R NUTRIENT STEWARDSHIP - is a framework developed to communicate the **Right way** to ensure sustainable and efficient fertilizer use based on four principles namely: applying the **Right Source** of fertilizers, at the **Right Rate**, at the **Right Time**, and in the **Right Place**.



Effective fertilizer use, as guided by 4R Nutrient Stewardship, is important for developing sustainable smallholder cropping systems that support improved food production, increased income for farmers, and enhancement and maintenance of soil fertility.

More and better-quality groundnuts can be produced with fertilizers. The fertility of soils, which has been largely over exploited can also be restored with fertilizers. Correct management of fertilizers based on the 4Rs can therefore result in better social, economic and environmental outcomes for farms, villages, communities, and entire countries in Africa.

RIGHT SOURCE:

refers to applying the correct fertilizer that provides crops with the nutrients required for good growth and high yields.

Different crops have different nutrient requirements. Different fertilizers also provide nutrients in different proportions. Matching a crop's nutrient uptake requirements with the fertilizer that supplies the right mix and proportions of required nutrients ensures that the Right source is achieved.

RIGHT RATE:

refers to supplying growing plants with the right amount of nutrients for healthy growth and development.

Different crops require different quantities of nutrients for healthy growth and development. The quantity of nutrients required by a particular crop also depends on soil fertility status and the crop yield target. Nutrient requirements will increase as soil fertility decreases. Similarly, as crop yield targets increase, the quantity of nutrients required to achieve those targets also increases.

RIGHT TIME:

refers to matching nutrient application with the timing of plant nutrient uptake.

Most crops take up nutrients slowly during the early stages of growth, but the rate of nutrient uptake increases as crops develop. Fertilizer applications timed to match periods of high plant nutrient uptake ensure efficient uptake of applied nutrients.

RIGHT PLACE:

refers to adding nutrients to the soil at a place where plants can easily access them.

Different crops have different rooting characteristics, and this influences their ability to efficiently access and take up applied nutrients. The right placement of fertilizer for a particular crop should be selected to match a crop's rooting characteristics, and other aspects such as the planting density and tillage system. The right placement method will ensure reduced nutrient losses.

FIELD SELECTION & MANAGEMENT

- Groundnut grows best on deep, loose-well drained sandy soils.
- Deep loose-well drained sandy soils are easily penetrated by groundnut roots allowing for good pod formation. Such soils also allow for easier harvesting of groundnut without leaving pods behind in the soil.
- Suitable fields for growing groundnut should also be well-drained and not prone to water logging as groundnut cannot tolerate water logging.
- To ensure good groundnut yields each season, groundnut should not be continuously grown on the same field each year as this increases the chance of pest and disease infestations.
- Farmers should therefore regularly rotate groundnut with cereal crops such as maize or sorghum to manage groundnut pest and disease infestations.

LAND PREPARATION

- Groundnut fields require deep ploughing so as make it easier for roots to penetrate the soil and for pods to be pulled from the ground during harvest.
- Start field preparation immediately after the first rains (around mid-April) to ensure that fields are ready for groundnut planting which usually takes place in early May.
- Before ploughing and harrowing, first clear any overgrown weeds, shrubs and stumps.
- After the field is cleared of shrubs and stumps, plough the field uniformly to a depth of about 30 cm.
- Ploughing should be done when the soil moisture level is low to minimize soil compaction.
- After ploughing, harrow the field uniformly by breaking up any large soil clods that may be present, then make ridges 50 to 60 cm apart depending on the groundnut variety to be planted.
- For example, if planning to plant erect groundnut varieties such as YENYAWOSO or SARINUT 2, ridges should be made 50 cm apart. However, if planning to plant spreading groundnut varieties such as SARINUT 1 or NKATIESARI, ridges should be made 60 cm apart.
- Groundnut can be grown on either flat beds or ridges. Ridges are recommended in fields where water logging is a problem.
- Groundnut grown on ridges also tends to have higher yields due to the looser soil which enables better rooting and pod formation.
- Good ploughing and harrowing help to control weeds, kill some insect pests, and makes it easier to incorporate manure, apply fertilizer, and plant.

SEED SELECTION & SEED RATE

- For best groundnut yields, plant improved groundnut varieties recommended for your area.
- To ensure good germination and high yields plant newly purchased certified seeds of the recommended varieties.
- Some of the recommended groundnut varieties for Northern Ghana include SARINUT 1, SARINUT 2, NKATIESARI, and YENYAWOSO.
- If newly purchased certified seeds are not available, farmers can use their seeds from the 1st crop of certified seed as seeds for the 2nd crop, and 2nd crop seeds for the 3rd crop. Do not plant seeds from the 3rd crop.
- If using own seeds, such seeds should be stored unshelled in pods until 1 to 2 weeks before planting when they should be carefully shelled.
- Sort out the good seeds for planting by removing small, shriveled, immature, skinned, split or moldy seeds from the shelled pods.
- The recommended seed rate for good groundnut yields is about 53 to 70 kilograms per hectare depending on the variety selected.
- Based on the size of your farm and the recommended seed rate, acquire enough quantities of seeds in consultation with your agro-dealer or your agricultural extension agent.
- To ensure selected seeds are suitable for planting, conduct germination test at least 10 days before planting by planting 50 seeds. If at least 40 emerge, the seed is good for planting. If 30 to 40 emerge, plant more seeds than recommended. Get new seeds if less than 30 seeds emerge.

Table 1: Groundnut varieties recommended for Northern Ghana.

Variety	Special attributes	Maturity period, days	Attainable yield t/ha	Attainable yield Bags/ha Unshelled	Attainable yield Bags/ha Shelled
SARINUT 1	Semi-spreading type	120	2.6-3	75	33
SARINUT 2	Erect growing	90	2.0-2.4	60	26
NKATIESARI	Semi-spreading type	110	2.0-2.4	60	26
YENYAWOSO	Erect Growing	90	2.4-2.7	68	30

NOTE: A bag refers to a full jute sack weighing 40 kg.

4R Tip

1. Ensure to buy your groundnut seed from trusted dealers only.
2. Seed packs should contain the following information.
   - Groundnut variety
   - Packing date
   - Expiry date
   - Germination rate
3. Check the seeds to ensure they are of good quality and uniform in appearance with no deformed or discolored seeds.

BIOLOGICAL NITROGEN FIXATION

- Groundnut forms root nodules which contain bacteria called rhizobia.
- The rhizobia bacteria can fix nitrogen from the air into a form that groundnut can use for growth. This is called biological nitrogen fixation.
- Some of the nitrogen is also left in the soil through fallen leaves and roots, helping to improve soil fertility.
- This makes groundnut a good crop to grow as an intercrop or in rotation with cereal crops such as maize as they can benefit from the nitrogen provided by the groundnut crop.
- As a result of this biological nitrogen, groundnut does not require large applications of nitrogen fertilizers.

PLANTING

- Groundnut planting in the Northern region should be done immediately after the first rains which usually occur during the first or second week of May.
- Planting should be conducted when the soil is warm and moist. Avoid planting immediately after heavy rain as the seed can absorb too much water which leads to rotting.
- Plant at a time such that the flowering and early pod development stages will coincide with periods of adequate moisture availability, while the crop matures during the period of relatively dry weather.
- Planting in rows ensures that the right planting density is achieved and makes weeding and harvesting easier.
- Planting rows should be made on previously prepared ridges if planting on ridges, or on flat ground where no ridges have been prepared.
- Planting on ridges is however recommended as groundnut grown on ridges usually has higher yields due to the looser soil which enables better rooting and pod formation.

- The recommended planting spacing for groundnut in Northern Ghana is a row to row spacing of 60 cm if planting spreading varieties such as SARINUT 1 or NKATIESARI, or 50 cm if planting erect groundnut varieties such as YENYAWOSO or SARINUT 2.
- To ensure the right spacing between rows, use wooden pegs and planting lines to demarcate row positions and ensure consistency in row spacing depending on the groundnut variety to be planted.
- In each row, planting holes should be made at a repeated spacing of 15 cm within a row.
- To achieve the right spacing between planting holes, planting twines should be marked at 15 cm intervals (using ink or knots), and planting holes that are about 5 cm deep made adjacent to these markings using a stick.
- The same planting twines can also be used to guide making of holes for fertilizer application adjacent to each planting hole at a spacing of about 5 cm from each planting hole.

- In each planting hole, one groundnut seed shall be sown by hand.
- After sowing groundnut seeds, apply the fertilizer in the holes adjacent to each planting hole following the recommendations provided in the next section on FERTILIZER APPLICATION.
- After planting, the seeds should be covered well with soil to ensure good contact between the seed and soil, as this is essential for good germination.
- After planting, the field should be regularly monitored for germination, and any gaps filled at one to two weeks after sowing where no plants have emerged.

FERTILIZER APPLICATION

For good groundnut yields, fertilizer application should be based on the 4Rs of fertilizer management to ensure that the groundnut crop is supplied with the **Right Source** of fertilizer, applied at the **Right Rate**, at the **Right Time** in the growing season, and at the **Right Place** where growing plants can easily assess nutrients supplied.

To understand the best 4R practices for good groundnut yields, it is important to understand the key nutrients required by the groundnut crop for good growth and how they should be supplied.

- For good growth and yields, groundnut requires to take up large quantities of nitrogen, phosphorus and potassium.
- Nitrogen ensures good growth of groundnut plants.
- Since groundnut can biologically fix (manufacture) nitrogen, it does not require fertilization with large quantities of nitrogen fertilizer.
- Small quantities of starter nitrogen applied as compound or blended fertilizers that additionally supply other nutrients such as phosphorus and potassium are therefore sufficient for good growth and yields.
- Groundnut is not able to fix other nutrients that it requires such as phosphorus, potassium and calcium, these need to be supplied through fertilizers.
- Phosphorus is essential for root and shoot growth in groundnut and stimulates biological nitrogen fixation.
- Potassium increases groundnut resistance to pests, diseases, and water stress, and helps to improve the quality of groundnuts.
- Calcium stimulates the setting of pods, decreases the number of unfilled pods, and hastens crop maturity.
- In low fertility sandy soils that are deficient of calcium, groundnut plants often fail to fill their pods resulting in empty pods and low yields. Application of calcium in such soils ensures good pod filling resulting in high yields.
- Groundnut also requires sulphur for enhanced growth and high quality of groundnut seeds.

Right Source

- The right source of fertilizer for groundnut are compound fertilizers or fertilizer blends that contain small quantities of nitrogen, but supply large quantities of phosphorus and potassium, plus secondary macronutrients such as sulphur and calcium.
- An example of a fertilizer recommended for groundnut fertilization in Northern Ghana is NPK 11:22:21 + 5 S + 0.72 Zn + 0.5 B.
- In soils where calcium application is required, application of gypsum or Omya Calcipril® is recommended.
- If phosphorus and potassium blends are not available, farmers can use phosphorus-rich fertilizers such as Triple Super Phosphate (TSP), which additionally supplies calcium.
- To supply potassium, Muriate of Potash (MOP) which supplies large quantities of potassium can be used in combination with TSP.
- Different fertilizer companies have also developed legume-specific fertilizers. Consult your agro-dealer or local agricultural extension agent for available legume-specific fertilizers that are suitable for groundnut.

Right Rate

- Groundnut needs to be supplied with about 20 kg/ha N, 40 kg/ha P_2O_5, and 40 kg/ha K_2O.
- To achieve the right rate using NPK 11:22:21 + 5 S + 0.72 Zn +0.5 B, an application rate of 4 bags of fertilizer is required per hectare.
- To achieve the right rate for different field sizes, follow the guidelines in **Table 2** below.
- In low fertility sandy soils that are low in calcium, gypsum or Calcipril should additionally be applied at a rate of about 400 kg/ha to supply groundnut crops with calcium.

Table 2: Recommended groundnut fertilizer application rates for groundnut.

Field size	Number of 50 kg bags (NPK 11:22:21)	Number of 25 kg bags (Gypsum of Omya Calcipril®)
One acre	1.5 bag	6 bags
Two acres	3 bags	12 bags
Five acres	7.5 bags	30 bags

NOTES: The NPK fertilizer rates rates above can be adjusted for any size of the field by multiplying the size of the field in acres by 1.5 bag. For Gypsum of Omya Calcipril®, multiply size of field in acres by 6 bags. Application of above rates of Gypsum of Omya Calcipril® are only recommended in low fertility sandy soils where previous harvests have been characterized by many empty pods.

4R TIP - *If you do not have any fertilizer, you can grow groundnut in a field where maize had previously been grown and applied with fertilizer containing phosphorus.*

Right Time

- For best growth and high yields, fertilization of groundnut with phosphorus and potassium-rich fertilizers such as NPK 11:22:21 + 5 S + 0.72 Zn +0.5 B or other groundnut-specific fertilizers should be applied at planting. However, if this is not feasible, fertilizer application should be done within two weeks after planting when there is adequate moisture in the soil.
- Where calcium application is required, Gypsum of Omya Calcipril® should be applied just before flowering.

Right Place

- Fertilizer application at planting should be done by applying small amounts of the fertilizer in small holes close to each groundnut planting hole.
- To ensure the Right placement of the NPK supplying fertilizers, use a stick to make small holes about 5 cm from each groundnut planting hole.
- Use a bottle top or teaspoon to apply equal amounts of the selected fertilizer in each hole by applying a quarter full bottle top or a quarter full teaspoon in each hole. Alternatively, one full bottle top or teaspoon can be applied to four holes.
- Cover the applied fertilizer with soil to avoid nutrient losses.
- If fertilizer is applied after planting, make small holes about 5 cm from each groundnut plant stand, and use a bottle top or teaspoon to apply and cover fertilizer as described above.
- Applying fertilizer 5 cm away from groundnut seeds or young plants prevents the fertilizer from contacting and damaging seeds or young plants as the fertilizer dissolves.
- Where calcium application is required, the recommended quantities of Gypsum or Omya Calcipril® should be applied by broadcasting on the surface of the soil close to each plant stand just before flowering starts. Do not incorporate the gypsum into the soil to avoid damaging developing pods.

GROUNDNUT CROP MANAGEMENT

Management of Weeds

- Weeds reduce the growth and yield of groundnut by competing for nutrients, water and light.
- Weed control is especially important when the plants are small, during the first six weeks, and as the pods are setting.
- Good land preparation (ploughing and harrowing twice) is needed for initial weed control.
- For best yields, groundnut fields should be kept weed-free by conducting timely weeding at regular intervals. Usually, 2 to 3 weedings are normally needed. Weed control can be manual, chemical, or both.

Manual weed control:

- Weed 2 or 3 times.
- The first two weedings should be done before flowering at about 3 weeks after planting and again at around 6 weeks after planting.
- Once flowering and pegging begins, it is advisable to weed by hand pulling instead of using a hoe. Hoe weeding might damage developing pods.

Chemical weed control:

- Herbicides can be used for both pre-emergence and post-emergence weed control.
- To control the early and post-emergence of weeds, apply post-emergence weed control herbicides recommended for groundnut immediately following planting.
- If there are actively growing weeds in the field at planting, spray non-selective herbicides such as glyphosate or paraquat after applying the pre-emergence herbicide.
- If only pre-emergence herbicide is applied at planting, one weeding may be required at 5 to 6 weeks after planting.
- Before applying any herbicide, carefully read and follow instructions provided by the manufacturer or consult your local AEA.
- Crop rotation and good field preparation during ploughing and harrowing also help to control weeds.

4R TIPS FOR WEED MANAGEMENT

- *During weeding, avoid covering young plants with soil as this increases the risk of disease infestations and reduces yields.*
- *Take care when walking through the groundnut field when the crop is flowering to prevent disturbing the flowers as this will reduce yields.*
- *At pegging, avoid disturbing the soil near the plants: at this stage pull weeds by hand and avoid use of hoes.*

Management of Pests

- Pests can cause considerable damage to groundnuts when infestations are high.
- Regular (weekly) monitoring of groundnut should be conducted to monitor the presence of insect pests.
- Common insect pests affecting groundnut include aphids, caterpillars, termites, and thrips.
- Other pests include rodents such as rats and rabbits.
- If insect pests are damaging pods, control the pest with recommended insecticides. Take care to follow instructions provided by the manufacturer or consult your local agricultural extension agent.
- Rodent pests such as rats and rabbits can be controlled through appropriate local methods.

4R TIPS FOR PEST MANAGEMENT

- *Birds and rodents such as rats and squirrels feed on improperly buried seeds and can easily dig up seeds.*
- *Immediately after planting, scare birds and rodents away using local control methods.*
- *If unsure how to manage certain pests, seek advice from your local AEA or agro-dealer.*

Table 3: Recommended control and prevention of insect pests.

Pest and Impact	Signs	Management
Aphids are mainly a threat because they spread viral diseases such as groundnut rosette but can also affect groundnut plants directly by sucking sap.	Small brownish-grey insects that are mainly found on growing tips and young foliage.	**Control** • Spray with suitable insecticide, e.g., dimethoate (make sure to follow manufacturer's instructions) **Prevention** • Plant early using the recommended planting distance • Rotate groundnut with cereal crops such as maize • Conduct regular weeding • Plant tolerant/resistant varieties if available
Groundnut leaf miner is the caterpillar of the moth, which tunnels into the leaf to feed, emerging when it is larger. Infestation can destroy a crop.	Distorted leaves due to caterpillars inside. Leaves folded over or stuck together with silk. Leaves turn brown, roll up and dry.	**Control** • Spray with suitable insecticide, e.g., dimethoate (make sure to follow manufacturer's instructions) **Prevention** • Plant early • Rotate groundnut with cereal crops such as maize • Conduct regular weeding • Plant tolerant/resistant varieties if available

Pest and Impact	Signs	Management
Termites destroy roots and make holes in pods and seeds.	Wilting and death of plants. Presence of termite mounds.	**Control** • Apply recommended insecticides to seed or soil (make sure to follow manufacturer's instructions) **Prevention** • Avoid growing groundnut in areas with obvious signs of termites • Plant early • Remove residues of previous cereal crops like maize • Dig out and destroy termite nests • Apply furadan® insecticide to termite nests • Conduct timely harvesting to avoid pod damage
Thrips small yellow, green or black flying insects that feed on flowers and leaves.	Dwarfing and distortion of leaves with yellow/green patches.	**Control** • Spray with suitable insecticide, e.g., dimethoate (make sure to follow manufacturer's instructions) • Spray with Neem seed extract **Prevention** • Plant resistant varieties if available

Management of Diseases

LEAF SPOT

The most important and widespread groundnut disease in northern Ghana is early and late leaf spot infections caused by two different fungi species. Farmers often mistake leaf spot symptoms as a sign of maturity, but it is a deadly disease that has been reported to cause up to 70% yield loss in groundnut.

- Early leaf spot can occur two weeks after crop emergence.
- Symptoms include circular lesions with yellow (chlorotic) halos surrounding the darker lesions and a lighter shade of brown on the lower surface of the leaves.
- Late leaf spot occurs late in the season and shows almost round lesions which are darker in colour than those of early leaf spot.
- Other symptoms of leaf spot infestation include dark lesions on stems of plants, and partial or complete defoliation of infected plants.
- Early leaf spot often reduces yield more than late leaf spot.

Prevention measures

- Remove and bury infected plants.

Control measures

- Leaf spot pathogens survive mainly in crop debris. Crop rotation, burying crop debris during land preparation and early planting help to reduce the incidence of this disease.
- Early and late leaf spot diseases can also be controlled by spraying fungicides and/or local detergent (alata samina) preparations.

GROUNDNUT ROSETTE DISEASE is fast becoming one of the most important groundnut diseases in Northern Ghana. It is caused by a virus transmitted by aphids.

- Groundnut rosette occurs in three forms: chlorotic rosette, mosaic rosette and green mosaic rosette.

- Groundnut plants with chlorotic rosette have bright yellow leaves, except for small parts that remain green. The yellowing may affect the whole plant or only some shoots. Early infections result in severely stunted plants with small, deformed leaves.
- Groundnut plants with mosaic rosette have yellow and dark green areas on the leaves. Plants are stunted, although not as seriously as with chlorotic rosette.
- Groundnut plants with green mosaic have very dark green small leaves or have a light and dark green mosaic, with leaf margins rolled downward. They too are stunted if infected early.
- In all forms of the groundnut rosette disease, early infection causes severe pod loss and reduced yields.

Prevention measures

- Use of resistant varieties.
- Remove any self-sown groundnut that has germinated as a result of the last crop.
- Plant at recommended (high) density, to cover the soil as quickly as possible. The landing behaviour of aphids that spread the disease is disturbed when the soil is covered.
- Early planting to produce a crop before the arrival of winged aphids.
- Intercropping with maize or sorghum.
- Crop rotation with maize or sorghum.

Control measures

- If rosette disease occurs, diseased groundnut plants should be removed as soon as they are seen and destroyed. Weeds should also be removed from within and around the groundnut fields.
- After harvest, all plant debris should be collected and destroyed by burning or used as fodder for livestock.
- The most reliable control method is however the planting of disease-resistant varieties such as SARINUT 2.

4R TIPS FOR PEST MANAGEMENT

- *Use only herbicides, pesticides and fungicides that are recommended for groundnut to avoid damage to plants*
- *Chemicals can be toxic to humans, so always follow instructions on the product package or from the agro-dealer for safe use. Also follow instructions about the time needed between spraying and safe consumption of fresh pods*
- *Do not store chemicals in the same place as food*
- *Do not eat from the same spoon used to measure chemicals*

HARVESTING

Harvesting Tips

- Harvest at the right time. Harvesting too early causes yield losses and harvesting too late encourages aflatoxin contamination.
- When the groundnut crop looks mature, test for maturity by randomly digging out a few plants.
- Crack the pods and observe the inside wall. If most of the pods crack open easily and the inside walls are dark brown, the crop is ready for harvesting.
- If pods from majority of the plants checked are not yet mature, postpone harvesting and wait till the pods show signs of maturity.
- Avoid using yellowing leaves as the only indication of maturity (yellowing of leaves could be a symptom of diseases).

Recommended harvesting process

1. Preferably, harvest during a dry period. If the soil is too moist, part of the pods might remain in the soil.
2. To harvest, dig up the plants and remove soil from the pods immediately to prevent aflatoxin contamination.
3. Dry harvested plants in the sun for up to 2 weeks and ensure to protect plants from rain or animals. Preferably dry plants on a mat, plastic sheet or tarpaulin, or a raised platform. Avoid drying on bare ground to prevent aflatoxin contamination.
4. Strip the pods immediately after drying.
5. Sort the pods by removing damaged, shriveled, or rotten pods before storage.
6. Dry the sorted pods in the sun on a clean surface.
7. Do not shell groundnuts if you plan to store them.
8. Avoid mixing clean harvested pods with gleaned pods.
9. For storage, place the groundnuts in clean bags; if re-using bags in which grain was previously stored, the bags should first be washed and then disinfected by boiling them in water for 5 minutes. If the bags are polythene, make sure they don't touch the outside of the pot to avoid melting. Completely dry the bags before using them for storage.
10. Clean the storage room making sure to remove old grains and insects. Do not store grain which is to be eaten in the same place as pesticides or other dangerous chemicals.
11. Stack the bags with pods on a raised platform or wooden pallets away from the wall, making sure to avoid direct contact of storage bags with the ground.

12. Avoid pod damage by insects by applying recommended insecticides during storage (ensure to follow the manufacturer's instructions).

13. To prevent aflatoxin contamination, inspect and remove infested or rotting grains on a regular basis.

4R TIPS FOR AFLATOXIN CONTAMINATION

- *Aflatoxin is a toxic substance produced by fungi that causes sickness, hepatitis and or liver cancer in human beings who consume aflatoxin infested crop products.*
- *Aflatoxin contamination can take place before and after harvest.*
- *To control afalatoxin, it is very important to ensure good management of groundnut crops before and after harvesting.*
- *When crops are in the field, avoid damage to pods as this increases the chance that aflatoxin producing fungi can infect and spread across damaged pods.*

COMMON SYMPTOMS OF NUTRIENT DEFICIENCY

Potassium deficiency with yellowing of older leaves and scorching of the leaf margins.

Sulfur deficiency shown as yellowing of the younger leaves.

Iron deficiency symptoms of chlorosis first occur on younger leaves and then develop into brown necrotic spots.

Boron deficiency (top row) compared to normal groundnuts (bottom row).

References

Part of the contents of this guidebook have been adapted from the following handbooks.

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Desmae, H. and K. Sones. 2017. Groundnut cropping guide. Africa Soil Health Consortium, Nairobi.

Notes

Notes

ABOUT **The 4R Solutions Project**

www.4RSolution.org

The 4R Solutions Project is funded by Global Affairs Canada to improve the livelihoods of 80,000 smallholder farmers in Ethiopia, Ghana and Senegal by improving agricultural productivity and farm income through incorporation of 4R Nutrient Stewardship into local farming practices. 4R Nutrient Stewardship supports best management of plant nutrients based on four key practices: Right Source, Right Rate, Right Time, and Right Place.

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