N2Africa is a large-scale, research and development project focused on putting nitrogen fixation to work for smallholder farmers growing legume crops in Africa. N2Africa Phase II is implemented in Zimbabwe, Malawi, Mozambique, Kenya, Rwanda, DR Congo, Nigeria, Ghana, Uganda, Tanzania and Ethiopia.

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Putting Nitrogen Fixation to Work for Smallholder Farmers in Africa

N2Africa

Legume Production Notes

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CONTENT

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SOYA BEAN

Soil and Climatic Requirements

Soya beans require deep well drained loam soils. They do not do very well in sandy soils. Under heavy clays look out for capping which affects germination and causes poor emergence. Soya beans are also sensitive to soil acidity. The crop requires reliable rainfall, especially during the period from flowering to pod maturity. The crop can be rotated very well with maize, cotton, wheat or tobacco.

Fertilisation

Since soya beans are sensitive to soil acidity, always check the pH of the crop. Lime should be applied at the recommended rate to bring the soil to a pH of 5.5, during winter ploughing or before planting.

Soya beans can fix their own nitrogen and therefore do not require much nitrogen fertilizer as basal dressing and do not need top dressing with nitrogen. Generally, it is advisable to apply Gypsum or Single Super Phosphate (SSP) at 200 to 300 kg/ha before planting. Soya beans respond well to manure application.

It is beneficial to inoculate the crop with rhizobia at planting. More about inoculation is discussed in the last section of this booklet.

Land Preparation

The crop requires a fine tilth since it is a weak germinator. Planting depth of 25-30 mm is ideal. Time of planting is from mid-November to late December. It is always advisable to plant with first effective rains. Early planting can result in high yields, but however, losses due to late rains may reverse the gain due to delays in reaping at the end of the season.

Seed Rates and Plant Population

Recommended plant population for soya beans is 300 000 plants per hectare. The plant population can vary from 200 000 to 450 000 plants per hectare. Inter-row spacing is 45 – 60 cm and recommended in-row spacing is 10 – 15 cm. A seed rate of 100 kg/ha is required. A higher seed rate is used on soils that exhibit capping characteristics.

Weed Control

Soya beans are sensitive to weed infestation especially during the first six weeks after emergence. It is important to weed well early in the season.

Pests and diseases

Common pests are semi-loopers. These are often a problem during flowering and pod-filling period. They eat leaves and pods. The caterpillars are controlled in most seasons by a naturally occurring virus disease, which kills the caterpillars. Caterpillars that have died from the disease are black and hang from the leaves. These may be collected, crushed, mixed with water and sprayed around the field to help control other caterpillars. If the virus is not killing the semi-loopers then an insecticide may be required.

Two prevalent diseases in soya beans are frog-eye and rust. At present, most varieties are resistant to frog-eye disease. Rust may be recognised as numerous small grey to russet coloured tufts on the underside of the leaves. They appear similar to red spider mites. Preventative measures include early planting, choice of varieties (early maturing and resistant/tolerant varieties e.g. Squire). When high levels of rust are expected or observed a fungicide can be applied to control the disease. A number of chemicals are available, such as Carbenadazim/Fusilade (Punch Xtra) and Triadimenol (Shavit). All these are applied at 500 ml/ha, and applied as one to two applications

at 10 to 14 day intervals from first flowering.

Maturity and Harvesting

Physiological maturity is attained when leaves turn yellow, then brown and drop off. Pods will then turn brown. Harvesting should start at this stage to avoid losses through shattering. Moisture content at maturity is about 30%. Period between physiological maturity and shattering differs with varieties: it generally ranges from 22-29 days. Hand harvesting is the main method used for harvesting.

SUGAR BEAN

Types of Beans

Dwarf beans – These are grown mainly for dry beans and hence referred as a field crops. Some varieties can be grown for immature pods. These do not need support.

Runner Beans – Are grown for both the immature pods and grain. They need support when growing so they are trellised or poles are needed.

Soil Requirements

The crop does well in most soil types as long as they are well drained. They would however prefer sandy loams that are well manured. They will respond positively to addition of one bucketful of well-rotten manure plus 40g/m^2 of compound D at planting. Heavy soils must be avoided as they crust easily. If these cannot be avoided keep them moist by mulching. A pH range of 5.0 to 7.5 is ideal, but the optimum is about 6.0 to 6.5.

Climatic Requirements

Sugar beans are a warm season crop. They can be grown in winter depending on the climate of the area in Zimbabwe. The crop is grown in summer in the Highveld and Middleveld and during the dry season in the Lowveld. Long periods of heavy rain or watering cause flower drop hence no pod formation, as well as increased disease problems. Temperatures higher than 38^{o}C will also lead to flower drop and abortion of pods. The optimum temperatures are 25-30^{o}C. Sugar beans are sensitive to frost and are damaged at all stages and so must be protected if temperatures go below 15^{o}C. Night temperatures below 5^{o}C during pod formation will result in pods that are usually hollow and partially filled, but if they are well developed and nearing maturity they may be thickened and sickle-necked. Irrigation is required in dry periods.

Sowing and Production

Beans are directly sown between December and March. Sow weevil free seeds without scars caused by halo blight and discard shriveled seed. Sow singly 5-7 cm apart in rows 20-30 cm. Depth is important for an even stand. In light medium soils a depth of 4-5 cm is ideal and 3-4 cm in heavy soil. On heavy soils, mulch with grass or fill holes with sand to prevent crusting. A seed rate of 100 kg/ha is required. Seeds should germinate within 7-10 days.

Apply 200 kg/ha Compound L. If growth is slow or if leaves are yellowish top-dress with 100 kg/ha AN after flowering. Water carefully during germination to avoid exposing the seed. Water requirements are critical at flowering and pod filling and setting. Sugar beans are shallow rooted and so if heavy with pods to growth becomes too much for the stem. To assist them draw up soil to the stems and add mulch of 5 cm depth to support. Hoeing must be done with care so that roots are not disturbed.

Harvesting

Sugar bean grain is picked when pods are ripe that is when they start to dry on the mother plant but before they shatter. Protect from rain. Separate grain from the pods, grade and store in a dry, well–aired place inside a clean container which does not allow insects to enter. Use of hermetically sealed bags is recommended.

Pests

1. *CMR Beetle* – Hand pick or use Malathion.
2. *Cutworm* – Drench with Dursban.
3. *Aphids and loopers* – Use Malathion or Carbaryl.
4. *Bean Stem Maggot* – Most severe around January and February. Plant crop early to avoid its being attacked when the pest population peaks (after heavy rains). Bank up soil around seedling and/or apply a mulch to encourage formation of adventitious roots. Remove volunteer plants. Use Diazinon. Chemicals like Apron star is also very useful during planting to prevent attack by this pest.
5. *Red Spider Mite* – Avoid passing from infested fields. Use foliar sprays of acaricides such as dicofol, diazinon, amitraz. Avoid Dimethoate.
6. *Heliothis bollworm* – the larvae feed on flowers and pods. Once damage has started control is very difficult. Spray deltamethrin, cypermethrin, endosulphan, monocrophos, lambda –cyhalothrin or fenvalerate.
7. *Root knot Nematode* – use four-year rotations. Use ethylene dibromide (EDB), and carbofuran to control.

Fungal Diseases

1. *Angular Leaf Spot* – Favoured by wet conditions. Spores are spread long distances on seed and short distance by wind, splashing,

water insects and farm implements. Avoid working in wet plots to reduce the spread of the disease

2. *Rust* – Raised yellow or brown spots on underside of leaves. Do not cultivate when plants are wet. Spray Dithane M45 or Maneb, 80 % WP.
3. *Powdery Mildew and Downy Mildew* – are usually in warm wet and overcast weather. Use clean seed and wide spacing of plants to increase aeration. Use Sulphur + Mancozeb, and Sulphur + Copper oxy Chloride + Malathion
4. *Anthracnose* – The fungus is spread by wind or rain, animals, workers or implements. Avoid working in wet plots to reduce the spread of the disease. Cool weather promotes problem. Use fungicides.
5. *Fusarium Dry Root Rot* – use fungicides.
6. *Root rot* – use fungicides.
7. *Grey and White Mould* – use fungicides.

Bacterial Diseases

Bacterial Blight (halo blight): Brown spots surrounded by yellow circles on the leaves and pods. Use clean seed. Do not plant beans on a field which has been infected with bacterial blight for at least three seasons after the infection occurred. Do not wet the *plants* when watering and avoid cultivating when leaves are wet. Spray Dithane M45.

Common Blight and Fuscous Blight – Seed borne bacterial diseases promoted by warm wet weather. Use clean seed. Do not plant beans on a field which has been infected with bacterial blight for at least 3 seasons after the infection occurred. Do not wet when watering or cultivate when plants are wet.

Viral Diseases

Mosaic virus-symptoms include stunting plants; mottling of leaves,

and vein drying, dying back of shoot tips and sometimes distortions and stunting of pods. Seeds are often the initial source of viral diseases. The Common Bean Mosaic (BV-1), Bean Yellow Mosaic (BV-2) and Peanut Stunt (PSV) are bean virus disease spread by aphids, in addition to being seed borne. Peanut stunt virus can be transmitted on tools and hands of workers.

COWPEA

Cowpeas are an ideal dry land crop in low rainfall because they are drought resistant and they provide an excellent human nutrition and good rotational benefits.

Climatic Requirements

The crop thrives in hot weather and is sensitive to continuous cold weather. The crop can withstand dry conditions once established but moisture stress from flowering onwards reduces yields.

Soils

Cowpeas may be grown on a wide range of soils, but they are sensitive to acid soils. The soils should be well-drained and eelworm-free. The crop can be intercropped with maize. It is important to grow cowpeas in rotation with other crops in order to help control pests and diseases.

Varieties

Two basic types exist: upright, bunch types, used mainly for grain production and spreading types which may be used for grain, vegetable or fodder. It is ideal to purchase certified varieties so as to achieve high yields.

Planting

Cowpeas are planted any time from the first rains up to the end of December. In high rainfall areas, plant cowpeas late to avoid diseases. They can be sole cropped or intercropped. Cowpeas are sown in two ways; broadcasting or in the rows. When grown on their own, the following plant populations should be achieved:

- Spreading types: 60 000 plants per hectare (12-15 kg seed/ha)
- Upright, bunch types: 120 000 plants per ha (30-50 kg seed/ha).

The row width ranges from 45 to 90 cm. Closer rows may be used for upright, bunch types, while wider rows may be used for spreading types. Intra row spacing is 10 – 30 cm. Planting depth is 20 – 50 mm.

Fertilization

Cowpeas will respond to manure or low rates of fertilizer (100 – 200 kg/ha of a compound fertilizer. It is not necessary to inoculate cowpeas because the crop belongs to a large inoculation group which includes groundnuts and natural inoculation is through naturally occurring rhizobia in the soil.

Seed Treatment

Seed can be treated with Thiram or Apron Star at planting if there are any problems with bean stem maggot. Best way to manage stem maggot is to plant early so as to avoid peaks in insect population, which follow the rainfall pattern. .

Diseases

Cowpeas are susceptible to a wide range of diseases. Virus diseases may be devastating. The best control measure is through the use of virus-free seed.

Pests

Pests include aphids, Heliothis bollworms, CMR beetles and Tip-wilter.

After harvesting the seed is susceptible to bruchids, a grain borer. These pests may be controlled with appropriate chemical. Rootknot nematodes are problematic in cowpeas and these can be controlled by rotation.

Harvesting

Harvesting of pods takes place 70 – 90 days after emergence, usually early April and mid-May. Harvesting is done by cutting the plant when two-thirds of the pods are completely dry and the seeds rattle in the pods. The harvested cowpeas can be thrashed on a on a clean surface or pounding them in a sack. Winnowing then follows and then the crop is stored in sacks or granary.

GROUNDNUT

Climatic Requirements

Groundnut is a warm season crop which is fairly drought tolerant since it rapidly develops a deep root system. It grows better when optimum temperatures are around 30^{o}C. The crop is sensitive to frost. The crop *requires* 450 mm to 1000 mm rainfall annually. Cold weather and insufficient rain at flowering and at early pod setting periods reduces yields.

Soil Requirements

Deep, well-drained soils will achieve the best results. Soil textures ranging from sandy to heavy clays are suitable, but the heavier soils will increase problems of lifting and cleaning. Light sands, however, require more frequent rain. Soil pH is important and should be in the range 5.3 – 5.8. Ideally, the pH should be checked and lime applied and disced into the soil after ploughing.

Fertilizer Requirements

Groundnuts grow best on soils that have been well fertilized in the preceding years. Groundnut has a deep root system that allows it to access nutrients below the zone that can be exploited by cereals. Generally lime is applied at 200-300 kg/ha during winter ploughing or before planting. While groundnuts fix nitrogen, nitrogen supplies from its own fixing only become adequate 14 days after emergence. Therefore starter nitrogen is needed, but restrict the nitrogen to 20kg/ha. Groundnut is an outstanding phosphorus user and can access phosphorus that can no longer be accessed by crops such as cereals. Apply Single Super Phosphate or Compound L on soils that have low P levels at a rate of 400kg/ha as basal dressing.

Groundnuts have a high requirement for calcium. Calcium is important for symbiosis with N-fixing bacteria and seed quality. Calcium deficiency leads to poorly developed seed and empty pods. The crop cannot translocate calcium from the roots to pods, hence enough quantities have to be made available in the zone where the pods are developing. Calcium can be supplied in lime or calcium sulphate (gypsum). Gypsum is applied at early flowering and pegging (approximately 8-12 weeks after germination). Apply 100-150 kg/ha gypsum over plant rows at flowering and a further 100-150 kg/ha 4 weeks later. Magnesium is also an essential element and in most cases it is supplied in lime.

Land Preparation

The land is ploughed just after harvesting in autumn to at least 25 cm deep to bury plant residues and allow their decomposition before the next crop. Land is disced or lightly ploughed after the first effective rains to have a fine tilth, kill weeds and volunteer plants and to incorporate lime into the soil. The land can be ridged if planting is on ridges or raised beds. Avoid narrow ridges for upright groundnut types

as this presents pegging problems. Under dry land conditions if soils are likely to be hard and dry, use plant for the flat land. Treat seed with a seed dresser (Apron Star) to prevent it from pest and disease attack.

Planting and Plant Spacing

Groundnuts are dry planted but mostly just after the first effective rains, usually from mid-October to November. For optimum yields it is essential to obtain good plant population. If a farmer uses retained seed, it should be tested for germination. The inter-row spacing is usually 30 – 45 cm and in-row spacing differs depending on the target plant population to be achieved. Generally an in-row spacing of 7.5 – 15 cm is ideal. Planting depth should be 5 – 8 cm. The seed rate is 100 – 120 kg/ha.

Weeding

Weeds are controlled by cultivating or hoeing before flowering. At pegging and pod formation stages, hand pulling is recommended. Herbicides like round up, Trifuralin and Nitralin can be used before planting. Lasso, Gesagard, Dual, and Igram can be used before emergence.

Harvesting Groundnuts

The crop should be lifted when 40-50% of the pods contain mature kernels, or when the crop has lost 90% of its leaves – whichever is sooner. A delay in lifting beyond 70% maturity will result in spoilage, pod loss and lower quality due to excessive discolouration. Therefore, lifting should be timed to complete the whole operation by 70% maturity.

The crop is pulled by hand, and allowed to dry in wind-rows for 2-4 days. If left for too long in the windrow, kernels tend to shrivel.

The crop is cured in cocks. The method keeps plants off the soil surface, protects pods from direct sunlight and encourages ventilation. The plants can be cured on tripods or tetrapods, but cocks can be built on the ground bearing in mind the principles involved. Cover the top of the cock to prevent moisture penetration. Do not use plastic materials to avoid condensation. The period spent on the cock is approximately 2 – 6 weeks depending on weather conditions.

Picking

After cocking the crop is ready for picking when the kernels rattle in the pods. The moisture content is then 10 – 15 %. Picking can be done by various machines or by hand at the rate of approximately 2 bags per labourer per day.

Pest and Disease Control

Groundnuts are grown as a fourth crop after maize, cotton, and sorghum in rotation to prevent pests and diseases building up. They rotate and intercrop very well with maize.

Common groundnuts pests are:

a. Termites which damage stems, roots and pods. They can be controlled by fumigating with Ethylene dibromide. They are a problem if there are mid –season dry spells. Mulching with leaves of *Tephrosia vogelii* helps to deter termites.

b. Cutworms damage pegs, young pods and young plants. They attack plants that are still succulent and can be controlled by band spraying with pyrethroids.

c. Aphids suck sap and spread rosette virus. The pests attack during the early growth stages and are controlled using dimethoate.

d. *Hilda patruelis* causes yellowing and wilting of plants and can be

controlled with monocrotphos.

e. Semi-loppers damage leaves, flowers and reduce photosynthesis. They are controlled with monocrotophos, endosulphan and carbaryl.

f. Leaf hoppers cause lopper burns that reduce photosynthesis and can be controlled using carbaryl.

Common Groundnut Diseases:

1. Grey mould which causes grey growth and drying of the affected parts. The fungus attacks from January that is when plants have completely covered the ground. It is controlled by rotation and fungicides.

2. Leaf Blotch is a fungal disease which causes dark leaf margins and defoliation. It appears mostly during January/February and is controlled by rotation and the use of fungicides.

3. Leaf spot causes brown spots and defoliation. The disease appears late in the growing season and can be controlled by rotations and fungicides.

4. Rosette virus causes chlorotic growth, deformed leaves and suppresses growth and flowering. It can be controlled by controlling aphids. This usually becomes a problem when the crop has severe aphids attack and there is dry spell.

MOISTURE CONSERVATION IN ARABLE LANDS

Most of communal areas in Zimbabwe receive low rainfall and farmers in these areas do not have access to irrigation facilities. It is therefore necessary to make maximum use of available moisture. The main aim is to retain as much moisture as possible in the soil. To do this, farmers have to:

a) Improve water infiltration

b) Reduce runoff

c) Increase water retention

The moisture conservation measures described below will help farmers in their fields to gain from the little rains that come during the season.

1. Early Deep Ploughing

- Conserves previous season's moisture.
- Increase area of water storage.
- Clods encourage water infiltration because of reduced flow of water on rough ground. Overworking the soil leads to a finely powdered, highly erodible soil.
- Plough on contour.

2. Manure and compost

- Improve soil texture for water holding capacity because of the spongy nature of humus.

3. Ridging

- Cutting lengths of slope reduces runoff on steep slopes, channels water down a slower gradient increasing contact time between water and soil and thereby enhancing infiltration.

4. **Tied – Ridging**

- Damming up of water to increase contact time for infiltration. This is done on crops that are planted on ridges.

5. **Pot Holing**

- Creating pot holes for water to settle, increasing contact time. This is done on crops that are grown on flat surface.

6. **Ripping**

- Shattering of the land improves infiltration. Channels left behind encourage moisture collection in the furrow.

7. **Conservation Tillage**

- Stover and mulch encourage water infiltration and reduce evaporation.

8. **Fertility Trenches**

- These encourage high moisture retention and reduce soil erodibility.

9. **Cropping**

- Bare soils constitute water erosion hazard.
- Plant population – the better the yield, the lower the soil loss through water erosion. It is always advisable to follow recommended plant spacings and fertilizer rates.
- Late planting reduces yields and increases soil loss.
- Very early planted crops will be harvested early enough, leaving the soil unprotected towards the end of the rainy season.

INOCULATION OF LEGUMES

Inoculation is the process of adding rhizobia inoculant to the seed. It is important for farmers to ensure that that they inoculate their crops properly so that they can enjoy the benefits of inoculation.

Please take note of the Following:

- You must use the correct inoculant for the correct crops. Do not use soybean inoculant on sugar beans because they may not be host specific or compatible.
- Note the expiry date of the inoculant and do use the inoculant after 6 months of manufacture. Read the label to know the date of manufacture and date of expiry of the inoculant.
- Always note the batch number and lot number for quality control and feedback in case of any challenges e.g. inoculant does not work.
- Always observe all instructions during the inoculation.
- Observe necessary storage conditions. The inoculant is not supposed to be left in a hot vehicle or in the sun. Do not expose the inoculant to temperatures that are above 40^{o}C Always remember: The inoculant has LIVING RHIZOBIUM BACTERIA.
- Observe the net weight of the inoculant and the amount of seed that is supposed to be inoculated. Do not exceed the recommended weight of the seed per inoculant sachet.
- Inoculation is supposed to be done in a cool place away from sunlight.
- You must plant soon after inoculation. Do not exceed 24 hours before you plant the inoculated seed.

- You must always plant the inoculated seed in a moist soil.
- Do not mix the inoculated seed with fertilizer because the fertilizer may denature the bacteria. At planting the inoculated seed should also not get in contact with fertilizers. Do not treat the seed with a fungicide or insecticide after inoculation.

Inoculation Method

1. Spread the seed out on a clean plastic sheet or in a large container.
2. Mix 1 litre of water with 50 grams sugar to make a sugar solution in a clean bucket. The use of sugar is to enable the inoculant to stick to seed.
3. Pour the inoculant into the bucket with sugar solution. Make sure that all the inoculant is poured into the bucket. (Do not leave some inoculant in the sachet after opening. Use all of it at once.
4. Stir vigorously with a wooden spoon for 30 seconds.
5. Sprinkle the inoculant mix onto the seed.
6. Do not use a lot of water on the seed because this can result in the outer coat of the seeds peeling off.
7. Turn the seed gently. When the seed is gently coated it will look shiny.

The inoculated seed is ready for planting and it may be allowed to dry in a cool shaded place.

Sow seed in a moist soil and cover immediately afterwards to protect the rhizobium from sunlight.

GROSS MARGIN ANALYSES FOR LEGUMES

Gross Margin Analysis for Soya bean			
Area (ha)			1
Yield Level (kg/ha)			1500
Price per 1000 kg			$600
Gross Output (A)			**$900**
Variable Costs			
Item	**Rate**	**Quantity**	**Cost**
Seed @ $185/100 kg	100 kg/ha	100 kg	$185
Apron Star @$20/ 1litre	0.25 litres	0.25 litres	$5
Fertilizers			
SSP @ 360/tonne	250 kg/ha	250 kg	$90
Insecticides			
Karate @$20/litre	0.5 litres/ha	0.5 l	$10
Thionex @ $15/litre	0.5 litres/ha	0.5 l	$8
Shavit @$16/litre	1.5 litres/ha	1.5 litres	$24
Apron star @$2/0.01kg	10g/4kg seed	250	$50
Land Preparation	$15/ha	$15/ha	$15
Transport to market @ $0.5/bag	30 bags	30 bags	$15
Packing materials @$50/t	$50	$50	$50
Labour days @$4/lday	22/ ha	22	$88
Subtotal			**$525**
Miscellaneous 10%			$52.45
Total Variable Costs (B)			**$576.95**
Gross Margin (A-B)			**$323.05**

Gross Margin Analysis for Sugar bean			
Area (ha)			1
Yield Level (kg/ha)			1000
Price per 1000 kg			$1200
Gross Output (A)			**$1,200**
Variable Costs			
Item	Rate	Quantity	Cost
Seed @ $200/100 kg	100 kg/ha	100 kg	$200
Fertilizers			
Compound L @ $630/t	200kg/ha	200kg	$126
AN topdressing @ $680/t	100kg/ha	100 kg	$68
Insecticides			
Karate @$15/litre	0.5 litres/ha	0.5 litres	$8
Thionex @ $15/litre	0.5 litres/ha	0.5 litres	$8
Shavit @$16/litre	1.5 litres/ha	1.5 litres	$24
Apron star @$2/0.01kg	10g/4kg seed	250	$50
Land Preparation	$15/ha	$15/ha	$15
Transport to market @ $0.5/bag	30 bags	30 bags	$15
Packing materials @$50/t	50	50	$50
Labour days @$4/lday	20/ ha	20	$80
Subtotal			$628
Miscellaneous 10%			$63
Total Variable Costs (B)			$691
Gross Margin (A-B)			$509

Gross Margin Analysis for cowpeas			
Area (ha)			1
Yield Level (kg/ha)			1500
Price per 1000 kg			$500
Gross Output (A)			**$750**
Variable Costs			
Item	**Rate**	**Quantity**	**Cost**
Seed @ $160/100 kg	50 kg/ha	50 kg	$80
Fertilizers			
SSP @ $360/tonne	200 kg/ha	200 kg	$72
Insecticides			
Karate @$20/litre	0.5 litres/ha	0.5 l	$10
Thionex @ $15/litre	0.5 litres/ha	0.5 l	$8
Apron star @$2/0.01kg	10g/4kg seed	250	$50
Land Preparation	$15/ha	$15/ha	$15
Transport to market @ $0.5/bag	30 bags	30 bags	$15
Packing materials @$50/t	50	50	$50
Labour days @$4/lday	15/ ha	15	$60
Subtotal			$345
Miscellaneous 10%			$34
Total Variable Costs (B)			**$379**
Gross Margin (A-B)			**$371**

Gross Margin Analysis for groundnuts			
Area (ha)			1
Yield Level (kg/ha)			1500
Price per 1000 kg			$800
Gross Output (A)			**$1,200**
Variable Costs			
Item	**Rate**	**Quantity**	**Cost**
Seed @ $2.40/ kg	100 kg/ha	100 kg	$240
Fertilizers			
SSP @ $360/tonne	250 kg/ha	250 kg	$90
Gypsum @ $120/t	300kg/ha	300kg	$36
Insecticides			
Karate @$20/litre	0.5 litres/ha	0.5 l	$10
Thionex @ $15/litre	0.5 litres/ha	0.5 l	$8
Shavit @$16/litre	1.5 litres/ha	1.5 litres	$24
Land Preparation	$15/ha	$15/ha	$15
Transport to market @ $0.5/bag	30 bags	30 bags	$15
Packing materials @$50/t	50	50	$50
Labour days @$4/lday	25/ ha	25	$100
Subtotal			$573
Miscellaneous 10%			$57
Total Variable Costs (B)			**$630**
Gross Margin (A-B)			**$570**

Gross Margin Analysis for Maize			
Area (ha)			1
Yield Level (kg/ha)			2
Price per 1000 kg			$300
Gross Output (A)			$600
Variable Costs			
Item	**Rate**	**Quantity**	**Cost ($)**
Seed	25kg/ha	25kg	$55
Fertilizers			
AN topdressing	250kg/ha	250kg	$170
Compound D	250kg/ha	250kg	$150
Insecticides			
Carbaryl	2kg/ha	2kg	$5
Land Preparation	$15/ha	$15/ha	$15
Transport to market @ $0.5/bag	30 bags	30 bags	$15
Packing materials @$50/t	$50	$50	$50
Labour days @$4/lday	20/ ha	20	$80
Subtotal			$540
Miscellaneous 10%			$54
Total Variable Costs (B)			$594
Gross Margin (A-B)			$6

SUMMARY GROSS MARGINS	**Maize**	**Soya beans**	**Sugar bean**	**Cow peas**	**Ground nuts**
Area (ha)	1	1	1	1	1
Yield Level (kg/ha)	2	1500	1000	1500	1500
Price per 1000 kg	$300	$600	$1200	$500	$800
Gross Output (A)	**$600**	**$900**	**$1,200**	**$750**	**$1,200**
Variable Costs					
Item					
Seed	$55	$185	$200	$80	$240
Fertilizers					
Compound L			$126		
AN topdressing	$170		$68		
SSP		$90		$72	$90
Gypsum					$36
Compound D	$150				
Insecticides					
Karate		$10	$8	$10	$10
Thionex		$8	$8	$8	$8
Shavit		$24	$24		$24
Apron star		$50	$50	$50	
Carbaryl	$5				
Land Preparation	$15	$15	$15	$15	$15
Transport to market	$15	$15	$15	$15	$15
Packing materials	$50	$50	$50	$50	$50
Labour days	$80	$88	$80	$60	$100
Subtotal	$540	$520	$628	$345	$573
Miscellaneous 10%	$54	51.95	$63	$34	$57
Total Variable Costs (B)	$594	$571.45	$691	$379	$630
Gross Margin (A-B)	$6	$328.55	$509	$371	$570

COWPEAS SAUSAGES OR MEAT BALLS

By Caroline Chipomho

Ingredients:

- 3 cups clean dried cowpeas
- I clove onion or garlic
- 2 eggs
- Ground spices e.g. rosemary, thyme etc.
- Cooking oil enough to deep fry
- 2 tablespoons flour
- Salt to taste

Preparation

1. Boil the cowpeas until they are cooked and become soft and put them off the stove to cool down.
2. After cooling mash them into pulp using a wooden spoon
3. When they are finely mashed; add some seasoning including all the ground spices. Quantity depends on your taste preference.
4. In the meantime put your cooking oil to heat
5. Knead the mashed stuff and add in the 2 tablespoons of flour and the eggs (beaten)
6. Shape them either into sausages or meat balls.
7. When the cooking oil is smelling ready to fry; put the sausages/meat balls to fry
8. Remove them when they are crispy brown but not very hard
9. Serve hot with a starch of your choice, but rice or samp will be best
10. Serves 4.