SEED·CO

The African Seed Company

FARMERS GUIDE

-GRAIN CROPS-

THE HOME OF BUMPER HARVESTS

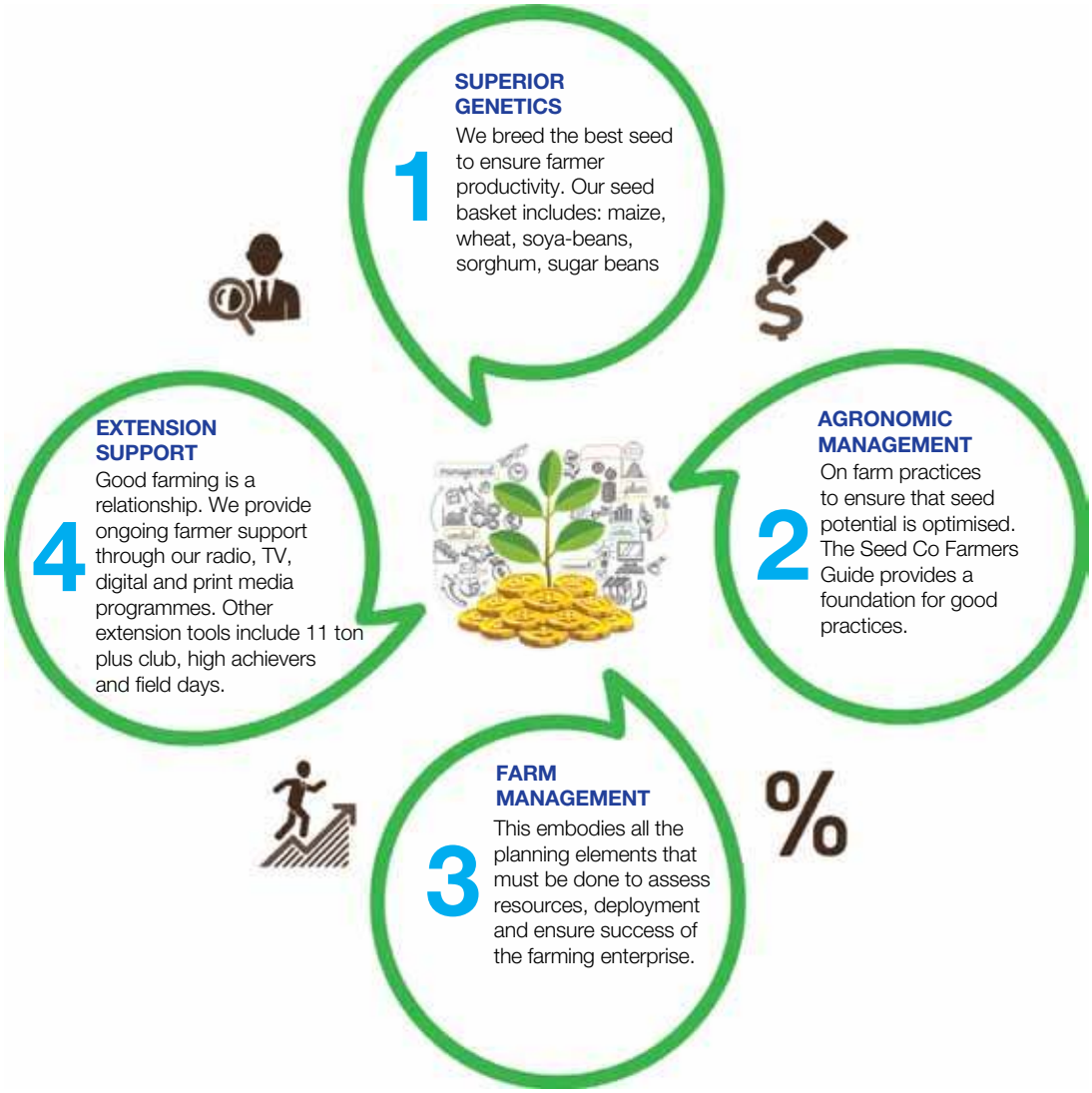
IT STARTS WITH THE RIGHT SEED

Foreword

Agriculture Revolution, A Must Win Battle: It Can Be Done!

Agriculture is at the centre of Zimbabwe's economy and holds the key to poverty reduction, economic and industrial development. Successful and productive farming is the golden key to food security and national wellbeing. As Seed Co we see farmers as economic partners that we support through our world-class fit for purpose Breeding Programmes, Seed distribution and Extension support. The key elements of farmer's profit equation are well-bred seed, good agronomic and management practices to optimise the seed potential. We are always striving to broaden our seed basket and provide superior genetics of both field crops and vegetables.

This Farmers Guide is a step in our efforts to support farmers and ensure good agronomic and grain crop management practices. We are obsessed with enhancing farmer productivity. The farmer profit story is our key motivation and that is what this Farmers Guide is all about. The figure below shows our perspective of this story:



As you use this Farmers Guide we wish you success and our Agronomy and Extension Services Desk is always ready to support you. Together we can write a new story of successfull farming in Zimbabwe.

Denias Zaranyika
Seed Co Limited Regional Managing Director (Southern Africa)

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The African Seed Company

A crop doctor is a farmer who takes time to investigate his fields in order to prevent problems and improve productivity. He walks his fields regularly, observing, thinking, inspecting and evaluating. He diagnoses problems and seeks solutions.

Crop protection is concerned with ensuring that pests, diseases and weeds are maintained at levels, which do not cause economic damage to crops. It begins with giving the crop every opportunity to grow well.

Farmers should plan for harvesting, prepare equipment early and set/calibrate machinery, packaging/bagging materials and dryers should be in place and ready.

Introduction by Agronomy and Extention Services Manager

Seed Co is committed to enhancing the productivity of farmers. This is primarily achieved through the provision of quality seed of the best food crop varieties suited to each agro-ecological environment of Zimbabwe. However, the right crop variety and certified seed are only two parts of the farmer's strategy to be productive and profitable. Good Agronomic Practices (GAPs) play a crucial role in achieving high and economically sustainable yields. A productive farmer has to combine variety choice and the environment with GAPs to be successful. This manual provides some basic information that will help farmers produce maize, soyabean, groundnuts, sorghum, cowpea and wheat efficiently, profitably and sustainably.

There are a thousand reasons for low yields, but only two reasons for higher yields: Seed Co Seed and adoption of Good Agronomic Practices

The Basics of Productive Crop Farming

Soil

Soil is one of the most basic resources required for crop production. It is the medium where crops grow. It is made up of very small rock particles, organic matter, micro-organisms, air and water, and the proportions of these and many other related factors have an impact on the potential for crop production. The two basic universal limiting factors of soil for crop production are:
-the ability to supply nutrients; and
-the supply of water.

Other soil factors that affect crop productivity include:

- Adverse chemical conditions, such as soil acidity, alkalinity, salinity and toxic chemicals.
- Lack of aeration, particularly in wet years and in waterlogged soils.
- Erosion, which removes the topsoil and washes away nutrients.
- Physical limitations, such as shallow soil, rocks, gravel, hard sub-soil layers and surface crusts.

NB: Soil acidity must be corrected promptly by liming. We will give an addendum on issues to do with soil conditioning in later sections.

Soil conditions that favour crop growth include:

- Fertility, including the soil reaction (i.e., the acidity or alkalinity). Fertile soils that are slightly acid to neutral are best for most crops, while saline soils are adverse for most crops. Soil management follows this rule, “Productive soils are always fertile, but fertile soils are not always productive.”
- Depth and drainage: Deeper and well drained soils are better than shallow soils, simply because they store more water and allow water movement.
- Texture and structure: These refer to the amount of clay in a soil and the way the soil particles bind together. Soils with some clay tend to be better than pure sands, while soils with a good structure are stable, resist erosion and are good for crop production.

Water

All crops need water, which must be supplied to the soil either by rain, irrigation or both. The key for good crop growth is to have a balance between too little water and too much water, as either case may adversely affect crop productivity. Over-supply and under-supply of water all have negative implications on crop growth. The best situation is where there is sufficient water to meet the needs of the crop during the various stages of its, growth; therefore it is not just the total amount of rainfall or irrigation but the distribution that is important for good growth. In regions where rainfall or water supply is insufficient, conservation of rainfall and reduction of run-off are important.

Nutrients

- Crops need 16 chemical elements for growth and reproduction, but not all in the same quantities. Carbon, oxygen and hydrogen (COH) are obtained from the air and water, and are used in very large quantities.
- The remaining thirteen are obtained from the soil, of which two, nitrogen and phosphorous, are generally deficient in most African soils and have to be supplied in large quantities.
- Many nutrients are only required in very small amounts, but a lack of them may severely limit crop growth and reduce yields. These are the micro- or trace elements.The 13 elements that come from the soils and fertilizer are categorized as follows:

-Major nutrients (NPK): Nitrogen (N), Phosphorus (P), and Potassium (K)

-Secondary nutrients (CMS): Calcium (Ca), Magnesium (Mg), and Sulphur (S) Micronutrients (BCCIMMZ): Boron (B), Chlorine (Cl), Copper (Cu), Iron (Fe), Manganese (Mn), Molybdenum (Mo), and Zinc (Zn)

See later sections for simple symptoms of micro-nutrient deficiency.

Sunlight, air and temperature

- The sun provides the energy needed for plant growth.
- The air supplies essential gases used by plants, while the temperature of the air and soil affects the rate of plant growth processes.
- Sunlight, air and warm air temperatures are factors which farmers rarely need to worry about in Africa.
- However, at times in summer, cloudy, overcast, cool conditions may slow down plant growth, while strong winds may cause plants to fall over (called lodging).
- Some areas are also very hot and dry, which may adversely affect crop growth.
- Thus, it is important to time the production of a crop in a period of the year that is best suited to maximise yield potential.

Good Agronomic Practices (GAPs)

- Many times farmers blame other factors for failed crop production, when in fact their own management might be lacking.
- Good Agronomic Practices (GAPs) is often forgotten or neglected ingredient for good crop production.
- Farmers must recognise that there are some factors within their control which directly reduce crop yields, such as weeds, pests and diseases, and others which may add to yield potential, such as fertilisation, plant spacing, and timing of planting, land preparations, variety selection and water conservation measures.
- Management requires that the farmer does everything to promote those factors that enhance crop production and as much as necessary to minimise those factors that reduce crop production, while at the same time ensuring profitability.

The main factors that reduce yields are:

Biotic stress

>Weeds

- Weeds reduce crop yields through competition for water, sunlight, nutrients, space below and above the soil. Weeds compete with crops for sunlight, water and nutrients.
- Crop yields are most adversely affected by weed competition during the first four weeks after crop emergence.
- Weeds may also interfere with other activities like spraying and harvesting.
- The timely use of herbicides is encouraged to keep weeds under control to prevent economic damage and to minimise production costs which are associated with hand weeding.

>Insect pests and diseases

- Low levels of pests and diseases may be of little concern, but when they increase above certain limits (called Economic Threshold Levels-ETLs), then they must be controlled otherwise yield reduction and economic losses may occur.
- In many cases, especially with diseases, the pre-disposing factors of the problem must also be determined and dealt with if the problem is to be overcome sustainably.
- Climate change has major effect on the occurrence and intensity of both disease and insect pest pressure.
- Some minor pests and disease can become major pests due to climate change effects, such as increasing temperature regimes in areas that used to be generally cool.
- Therefore farmers are encouraged to follow recommendations of routine crop scouts so that they will be able to act in time before economic damage is caused.
- When chemical sprays are used, safety

precautions and correct application techniques must be followed.
- Chemicals of different mode of action or active ingredients must be rotated to avoid emergence of pests that are resistant to commonly used pesticides.
- More detailed discussion of particular pests and diseases are given in the crop production sections.

Abiotic stress

>Climate and water

- Abiotic stress factors that affect yield include drought intensity and frequency.
- These ranges from dry spells, moderate to severe drought and can occur early, mid or late in the season.
- Seasonal variability is very high in eastern and southern Africa with occurrence of El Niño and La Nina weather conditions in some years, which are associated with drought and heat, and high rainfall, respectively.
- While probability of drought has generally been anticipated once in three years, the occurrence, intensity and severity are increasing modified by climate change.
- Therefore farmers are encouraged to monitor regional and national weather forecasting at the beginning of every season and throughout the season.
- The use of irrigation for early establishment of crops and to augment rainfall during the season is recommended to obtain the best yields for all crops.

>Soil condition and nutrition

The other abiotic factors include soil nutrient conditions, soil pH, and soil salinity that all affect crop growth. Farmers are encouraged to test soils and condition their fields accordingly, well in time before planting crops. Soil acidity, which is the major abiotic factor that compromises yield even in the presence of good rainfall or irrigation, is discussed further in later sections in this manual. See item on soil conditioning and liming on page 7.

Application Of Fertiliser And Manure

- Fertiliser and manure must be applied taking into consideration the soil's ability to supply nutrients, the requirements of the intended crop (i.e., the yield targets) and the economics of fertiliser application. Wherever possible, organic manure can be a good source of nutrients for crops, because they are essentially free and contribute much to soil sustainability.
- Bought inorganic fertilisers are very essential supplement of nutrients for the soil. The amount and type of inorganic fertiliser to apply depends on:

- The nutrient supplying ability of the soil. Soils that are infertile or where no manure is applied will require more fertiliser than fertile soil or when manure is applied. Fertilisers should supply those nutrients that are most limiting.

- The expected yield from the crop. Higher expected yields demand more nutrients, and therefore more fertiliser. But, more fertiliser will not always give higher yields.
- Crop fertilisation should be in accordance to the soil and the yield potential, which in turn is related to the environment and management ability of the farmer.

- Economics. Fertilisers cost money, and therefore the farmer must be sure of obtaining a profitable return on the cost of fertiliser if he is to stay in business.
- Nevertheless, in well-managed fields the consequence of over-fertilising is generally less costly than under-fertilising, because it builds up the fertility status of the soil.

NUTRIENT REMOVAL (kg per tonne of grain and stover)

Nutrient	Maize		Soyabeans		Groundnuts		Wheat	
	Grain	Stover	Grain	Stover	Grain	Stover	Grain	Stover
N	13	10	65	16	40	24	22	7
P_2O_5	5.8	4.5	15.0	3.0	8	8	10.3	9.2
K_2O	4.2	16.0	22.0	13.0	7	19	6	12
Ca	1.1	2.4	28	25	4	16	0.4	2.0
Mg	0.88	1.85	7.8	8.4	6	6	2.0	1.5
S	1.5	1.0	3	4	?	?	1.2	1.5
Zn	22g	20g	24g	18g	?	?	55g	15g

Checklist before applying fertilizers:

- ✓ Are other agronomic factors (variety, plant protection, water, etc.) satisfatory?
- ✓ Are basic requirements of soil fertility fulfilled? (pH, organic matter, stable porous soil structure, absence of compacted layer, good drainage, no salinity).
- ✓ Which nutrients need not be considered in this particular soil? (Many soils have adequate Ca, Fe, Mo, etc.)
- ✓ Which nutrients need not be considered every year? (e.g. Mg may be supplied in liming material, Zn, B and Cu in long-lasting, slow-acting fertilisers.)
- ✓ What amounts of fertiliser Phosphorus and K (Potassium) are needed at sowing time? (To be determined by soil testing or, in well supplied soils, estimated from nutrients removal by crop).
- ✓ What kind and amount of N fertiliser is needed, and when? (Either based on expected yield or soil testing).
- ✓ Which nutrients may have special problems in this soil (e.g. fixation of Mn) or are needed in large amounts by particular plant species (e.g. S for oilseed rape, B for beet and legumes)?
- ✓ What is the best way of applying fertiliser? (Banding in crops such as maize is usually more efficient than broadcasting, depth and placement of fertiliser should relate to root structure. Broadcasting is more efficient on other crops such as soyabean, sugar bean, and sorghum.

Brief key to deficiency symptoms on maize

Symptoms appearing first on younger leaves:	
Mottled yellow-green leaves with yellowish veins	S
Mottled yellow-green leaves with green veins	Fe
Brownish black spots (e.g. on legumes, potatoes)	Mn
Youngest leaf has white tip	Cu
Youngest leaf is brownish or dead (e.g. on beet)	B
Broad bands of bleached, pale tissue	Zn
Symptoms appearing first on older leaves:	
Chlorosis (i.e. yellowing of leaf) starting from leaf tips	N
Necrosis (i.e. death) on leaf margins	K
Chlorosis mainly between veins (which remain green)	Mg
Brownish, greyish, whitish spots (e.g. on cereals)	Mn
Reddish colour on green leaves or stem	P

Item on: Soil Conditioning and Liming-The secrete to improving crop productivity

Soil pH is an excellent chemical indicator of soil conditions (quality and its ability to avail both macro and micro nutrients) to the crop on top of other soil structural quality properties. The soil pH also affects microbial activities in the soil which can impact crop growth.

Why is soil sampling and analysis important?

- Firstly farmers MUST sample their soils for pH and fertility analysis.
- If there are any imbalances in the soil pH and fertility, they must be corrected promptly e.g. low pH is corrected by liming. Use of appropriate liming agents (dolomitic or calcitic lime) is recommended as this enhances Fertilizer Use Efficiency (FUE). Agricultural lime is a relatively cheap soil conditioner whose many benefits to the farmer far outweigh the cost of procuring and applying it.
- Hence the continuous and consistent use of lime will enhance the profitability of any cropping concern.
- This is the top secret to enhancing yield. It is our strong feeling that it must be promoted and encouraged. Some would even argue for the legitimation of this critical aspect.

- Secondly application of fertilizers is heavily recommended if we are to get good crop productivity levels and returns on investment.
- The principle is to apply the right quantities of the right type of fertilizer at the right time and place.
- Fertilizer regime management should follow prescriptions from the soil analysis recommendations.

- It is important to sample your soils for analysis after every 3-4 years depending on soil type.
- We recommend 3 years for lighter soils and 4 for heavier soils. In a season the best time to sample soils is the first week after harvesting a summer crop. This will give the farmer a good lead time to correct any deficiencies in the soil, 3-6 months before establishing the next crop in summer.
- Farmers should note that lime can be applied even on the day of planting and still act as a "buffer" before correcting the soil acidity condition but the ideal/optimum time to apply is at least three months before planting the next crop.

How important is pH on NPK uptake efficiency?

For more appreciation on the importance of pH on crop development, farmers should refer to the following table showing NPK uptake efficiency vs pH levels:
This is critical information.

pH level	4.5	5.0	5.5	6.0	6.5	6.8
Nitrogen	30%	43%	77%	89%	100%	100%
Phosphorus	23%	31%	48%	52%	100%	100%
Potassium	33%	52%	77%	100%	100%	100%

Key:

	Low pH, low NPK uptake efficiency, lime is recommended
	Optimum pH (6.0-6.8), high NPK uptake efficiency

How to sample soils?

- The most commonly used procedure for soil sampling would be based on soil type.
- Fields are split into sampling blocks that contain similar soils e.g. block A, B, C and so on.
- Hillsides are kept separate from bottoms since the soil types will vary greatly.
- Soil survey maps, if applicable, can help organize the soil types throughout the sampling area. Samples will not necessarily need to be collected for every soil type; however, similar soils should be kept together.
- The zig zag, random, the cross diagonal methods are commonly used and recommended where samples are taken in a zig zag or at cross diagonal format from a block. This will result in a sample which scientifically represents the whole block.
- The sampling block will be dependent on the soils and topography. Generally, a block of 10-20 ha is considered the maximum size.
- Smaller sampling blocks may be needed if the soils are quite variable or a production problem is apparent and evident.
- Once the sampling block is determined, a sufficient number of sites/cores should be taken to acquire a representative sample. This is generally 10 to 20 sites. The depth of sample for surface soils would be about 20cm or as deep as the primary tillage or specifically as deep as the root zone of intended crop(s). This is also called the tillage layer.
- The most commonly used tools for taking samples are augers, probes, hoes or sometimes shovels.
- Samples from different sites in a block are then mixed thoroughly and bagged into a khaki pocket and labelled. Information on the labels should include farmer name, farm name, contact details, block name, date taken and intended crop before they are submitted for analysis to approved laboratories.

When to sample soils?

- Winter is the ideal time for soil sampling except for testing for nitrate-nitrogen in sandy soils.
- Winter sampling allows more time to get the results from the testing laboratory and avoids the busy laboratory schedule in the spring.
- Getting results on time will also allow time for actioning of the recommendations e.g. if lime is to be applied then the best time is 3 – 6 months before crop establishment.
- Mid or late summer is the appropriate time to collect soil samples for winter wheat.
- Phosphorus level in the soil should be determined prior to seeding winter wheat.
- Nitrate-nitrogen tests made prior to planting winter wheat help predict nitrogen fertilizer needs for the crop.

Where are the Laboratories?

- Most fertilizer houses do sampling free of charge or for a nominal fee.
- Other approved laboratories include the Department of Specialist Services-Soil Chemistry laboratories. Other recognized laboratories include Soil Testing Laboratory at the University of Zimbabwe's Soil Science Department; Tobacco Research Board, AgLabs, Africa University, fertiliser companies (Omnia, Windmill, ZFC) etc. •Always prescribe the intended tests before submission.
- We strongly recommend farmers to do a full analysis (pH and soil nutrient profiling).
- Soil analysis results normally come with recommendations. We recommend farmers to understand the recommendations from the laboratory tests and also to seek technical guidance in the interpretation of results from Agritex extension personnel in their respective holding areas.
- Seed Co Agronomy Services also assists in interpreting results from laboratories. Contact a Seed Co Agronomist in your province.

What are Acid Soils?

- These are soils with a pH measure of less than 7 on a Calcium Chloride Scale in Zimbabwe. These soils contain high levels of active hydrogen and or aluminum in relation to calcium and magnesium levels.
- Farmers can improve the soil quality of acid soils by liming to adjust pH to the levels needed by the crop to be grown.

- Soil pH is the measure of the acidity or alkalinity of the soil. The degree of acidity or alkalinity is determined by measuring the concentration of the hydrogen ions in the soil solution. This is expressed in terms of a scale with a range of 0 to 14.
- A soil with a pH of 7 is considered neutral while less than 6 is considered acid and a soil with pH greater than 7 is considered alkaline.
- A good liming program is based on soil test that determines the degree of soil acidity and the correct amount of a liming material needed to neutralize that acidity. Once this amount is determined, a liming material must be selected that will economically satisfy the soil test recommendation and result in maximum and efficient crop productivity levels.

What causes soils to be acidic?
There are basically three causes of soil acidity:

- Soils may become more acid as a result of harvested crops removing bases such calcium and magnesium from the soil. This is a normal and natural process. Different crops remove different amounts of Calcium and Magnesium from the soil.

- Rainfall also affects soil pH, whereby water passing through the soil leaches basic nutrients such as Calcium and Magnesium beyond the root zone into drainage water replacing them with acidic elements such as Hydrogen, Manganese and Aluminum and thereby acidifying the soil.

- Application of nitrogen fertilizers e.g. Ammonium Nitrate or Urea and, to a lesser extent, basal fertilisers, contribute to soil acidity by nitrification of ammonium to nitrate through a process which releases hydrogen ions. Organic matter breaks down naturally in the soil and hydrogen ions are released, which causes an increase in soil acidity. Plants release hydrogen ions to the soil which contributes to the soil acidity.

Why does soil acidity matter to crop productivity?

- Toxicity to crop: as the pH decreases below 5.5, the availability of aluminum and manganese increase and may reach a point of toxicity to the plant. Excess aluminium ions in the soil solution interfere with root growth and function, as well as restricting plant uptake of certain nutrients.
- **Effect on phosphorus availability:** Acid soils cause phosphorus to form insoluble compounds with aluminium and iron.
  Liming of soils with low pH dissolves these insoluble compounds and allows phosphorus to be more available for plant uptake.

Micronutrient availability: Acidic soils affect the availability of micronutrients in the soil and ultimately general crop development and productivity

- **Soil organisms:** Some micro-organisms e.g. important bacteria and fungi in the soil associated with nitrification require a certain soil pH level to function efficiently in acidic soils (low pH).
- **Soil physical condition:** Liming improve soil physical structure by reducing soil crusting/capping and this promotes better emergence of small-seeded crops and ultimately result in better crop stands. Remember population stand is key in attaining higher yields generally in all crops.

When is the right time to lime?

- Lime should be applied at least 3 to 6 months before crop establishment since it takes a significant amount of time for lime to dissolve and react with the soil to cause the desired adjustments in pH. In other words, a week after harvesting is the best time to apply lime.
- However, farmers should note that, application of lime can still be done even during crop establishment and the lime can act as a 'buffer' which works as a conduit for nutrient uptake from soil to crop through the roots and adjust the pH during the later stages of the crop cycle.
- Frequency of subsequent liming should be determined by soil tests.

Lime placement and incorporation

- The most important factor determining the effectiveness of lime is placement and incorporation.
- Placement for maximum contact with the soil into the root zone of the intended crop/tillage layer is essential and must be achieved.
- We generally recommend lime to be applied in the 15-25cm zone as this is a root zone range of most food crops grown in Zimbabwe e.g. the staple crop - maize.
- For maximum effectiveness, lime should be uniformly spread and incorporated into and with the soil. Incorporation can be achieved through discing or harrowing followed concurrently by a roller.
- In Zimbabwe liming agents are in powdery formulations to increase surface area for quicker reaction with the soils.
- Lime can be spread by hand or by lime spreaders - which normally gives the best results.
- Hand application is normally not recommended when the weather is windy. However, some smallholder farmers mix lime with a basal fertilizer before application and giving commendable results. However, the only concern with this method is on the timing of lime applications (basal fertilizers are normally applied during planting and yet we recommend lime to be applied 3-6 months before crop establishment). But still act as a buffer.

What amounts of lime can one apply?

- We recommend farmers to follow recommendations on the soil analysis results with regards to amounts and type of lime to be applied.
- The amount is depended on the acidity levels of the soil and differs from one soil type to another.
- However, the following general recommendation can be useful and is dependent on the soil type.
  Amount of lime required to raise soil pH by 0.1 units for different soil types - a gentle guide:

Soil type	Lime rates to raise by 0.1 pH units
Sandy soils	100kg/0.1 pH units
Sandy Loamy soils	120kg/0.1 pH units
Clay soils	200kg/0.1 pH units

- General interpretation: it means a farmer with a sandy soil requires 1000kg (1 tonne) of lime to raise his pH from 4.5 (acidic) to 5.5.

What is maintenance liming?

- The use of Nitrogen containing fertilizers increases soil acidity levels. We generally recommend that whenever any form of Nitrogen, be it from basal (compound D, L, S or J, blends and high analysis blends etc.) OR top dressing (e.g. AN/Urea) is applied, a farmer needs a maintenance lime application of about 1.8kg for every 1kg of Nitrogen applied. This is applicable if one does not carry out a soil analysis before the next crop. However, the top recommendation is to sample your soils for analysis to determine lime rates and type after at least every 3 or 4 years of soil use.

What are the liming agents available in Zimbabwe?

- It is important to sample your soils for analysis to determine pH and also the liming agent to be used.
- We strongly discourage farmers to blindly apply lime without qualification of the liming agent from soil analysis results. This can result in some detrimental effects to the soil and crop productivity. It can result in what we call preferential uptake.
- In Zimbabwe we basically have two types of liming agents i.e. Dolomitic Lime (Magnesium Carbonate) which is ideal for adjusting pH in magnesium deficient soils.
- The other agent available in Zimbabwe is Calcitic Lime (Calcium Carbonate) which is suited for adjusting pH in calcium deficient soils.
- There is no blanket recommendation for a liming agent and hence this should be noted. Preferential uptake is when a certain nutrient is taken up at the expense of the other or a balanced uptake due to concentration differences.
- A good example is when Calcitic lime is applied (blindly) instead of Dolomitic lime- this will cause an increased uptake of Calcium at the expense of a balanced uptake with other elements e.g. Magnesium, and therefore a crop will show magnesium deficiencies-yield will be affected.

Lime vs Gypsum

- This is a frequently asked comparison. Lime (Calcium Carbonate/ Magnesium Carbonate) adjust soil pH and at the same time supply the soil with either Calcium or Magnesium and Carbon, depending on the liming agent used. Lime 'sweetens' acidic soils.
- On the other hand Gypsum (Calcium Sulphate) is a supplementary source of Calcium and Sulphur which farmers apply whenever there is deficiency of these 2 elements in the soil.
- It should be noted that Gypsum does not adjust soil pH but rather supplement the soil with Calcium and Sulphur.
- Gypsum also improves the soil's physical structure i.e. removes hard setting clodiness, removes surface crusting/capping and improves soil workability.

What are the benefits of liming?

- Liming generally improves soil structure and nutrient availability in the soil and ultimately crop productivity and to a

greater extent improves livelihoods and the economy at large. Liming also provides some plant nutrients such as Calcium or Magnesium and Carbon. The favourite term for these is 'complimentary benefits'.

- Liming improves Fertilizer Use Efficiency (FUE) of crops. Use of fertilizer alone without lime results in poor fertilizer uptake and reduces the economic benefit of using fertilizer. In economic terms, lime is an enabler to get the best ROI on fertilizers. See table on NPK uptake efficiency

  Lime reduces availability of toxic elements in the soil such as aluminum and manganese. This results in improved root development and ultimately nutrient uptake.

- Liming improves the soil physical structure, resulting in good crop emergence and stand, greater root proliferation and an improved nutrient uptake.

- Liming acid soils improves the environment for beneficial soil microorganisms. In simpler terms, liming acidic soils to optimal levels creates a conducive environment for microorganisms to carry out necessary processes in the soil eg nitrification. A good example we always mention to farmers is of a soyabean crop. For the rhizobium (inoculant) to function properly (trap atmospheric nitrogen and fix into usable nitrate-process widely known as nitrogen fixation), there must be a conducive pH range of 5.2 to 6. That is why soyabean and most other legumes and food crops are sensitive to low soil pH. So generally liming will increase crop productivity in all crops (food, plantations and cash crops).
- Liming promotes a more rapid break-down of organic materials in the soil, releasing nutrients to growing plants.
- Liming improves the palatability of forages.
- Some herbicides and soil based chemicals will not work properly in low pH soils, hence liming soils will enhance the efficacy of some herbicides especially pre-emergent herbicides.

Planting and planting time

The planting operation is one of the most important in crop farming because it is the time when the seed or seedlings are placed in the ground to establish the crop. If there is poor establishment, yield potential is immediately limited. Factors to consider are the time of planting, the plant spacing, and the depth of seeding and placement of the seeds relative to fertilizer.

- The time of planting has a major effect on the yield of a crop. For most crops there is an optimum time of planting, which depends on the climatic conditions and the time taken to reach maturity.
- For summer crops, such as maize, cotton and groundnuts, early planting at the beginning of the rainy season is desirable, as yields decrease with late planting.

- The plant spacing refers to the distance between rows and between plants in the row. The closer the spacing, the greater the number of plants per hectare. The ideal plant spacing depends on the type of crop, variety and the climatic conditions such as rainfall/water availability.
- Short statured crops like soyabean may be grown at closer spacing than tall, large crops such as maize. In drier areas, wider spacing is preferable in order to provide more soil water to the individual plants.
- In high rainfall areas, or where there is irrigation, closer spacing is possible.

- The sowing depth of a crop depends on the size of the seed, the type of soil and the weather.
- Generally, smaller seeds are sown at a shallower depth than larger seeds, while the deeper the seed is planted, the longer will the seedling takes to emerge and the weaker the plant be at emergence, which may reduce plant vigour and yield.
- Seed may be planted deeper into sandy soil or when dry planting (i.e., planting before the rain).
- An important point to remember when planting is to ensure good seed-to-soil contact, as this enables the necessary imbibition of water which initiates germination.

- Allow for soil temperatures with dry planting. Seed is a living organism that can desiccate and die.
- Plant seed at least 2 centimetres away from applied fertilizers as the fertilizers can burn the seed.

An important point to remember when planting is to ensure good seed-to-soil contact, as this enables the necessary imbibition of water which initiates germination, emergence and good crop establishment.

Variety selection

For most crops there are a number of varieties available. These are often appropriate for certain conditions, such as dryland or irrigated and short season or long season production. The Seed Co Seed Product Manual and the Crop Sections in this Booklet provide more information. It is advisable not to rely on only one variety, but instead to grow a selection of the best varieties suitable to the farm's conditions. The use of certified seed also ensures that the seed is of the highest quality in terms of genetic purity, germination and viability/vigour.

Factors which affect varietal choice:

- amount and distribution of rainfall in ones' area
- length of the growing season
- altitude and air temperature
- soil fertility and fertiliser application
- planting date
- desired plant density/population
- occurrence of pests and diseases
- general management

Soil And Water Conservation Practices

- Soil is the medium for crop production, while rainfall is one of the most important limiting factors.
- Therefore, farmers ought to make every effort at conserving these two resources. This may be done using such techniques as zero-tillage, ridge-tillage, tied-ridges, pot holing, contour planting, strip-cropping, agroforestry or minimum tillage.

Yield targets

- Yield targets for each crop should be set to give a goal to work towards.
- At the end of the season, it is useful to determine whether the target was achieved, and if not, establish the reasons in order for improvements to be made.
- The aim should be to increase yields each year. Some yield targets for field crops are as follows:

Crop	Enviromental potential		
	Low	Medium	High
Maize	3 t/ha	6 t/ha	10 t/ha
Soyabeans	1.5 t/ha	2.8 t/ha	4.0 t/ha
Groundnuts (short season, unshelled)	1.0 t/ha	2.0 t/ha	3.0 t/ha
Groundnuts (long season, unshelled)	2.0 t/ha	3.5 t/ha	5.0 t/ha
Sorghum (White)	0.7 t/ha	2.0 t/ha	4.0 t/ha
Sorghum (Red)	2.0 t/ha	4.0 t/ha	6 t/ha

NB: It is critical to benchmark one's yields against the leading farmer's yields in one's area.

Matter of fact: Higher yields are closely related to higher profits. Higher yields lower unit production costs and increase profits per ha. Always aim for higher yields each cropping season.

Land preparation

Land preparation is the process of preparing fields so that they may be planted to a crop. The objective is to create a seedbed with a fine tilth to enable crop establishment.

1. Minimum use of energy;
2. Minimum damage to the soil; and
3. Maximum conservation of soil and water.

- The land preparation methods will vary with crop, soil type, field conditions, tools available and the farmer's overall objective, but will generally involve some measure of soil disturbance, called tillage.
- The optimum amount of tillage may be defined as that which maximises the return from the crop planted.
- The more tillage that is applied, the more it will cost, the more energy it will take, the more it will damage the

soil and the more water will be lost from the soil through evaporation.
- Consequently, farmers need to consider ways of effectively reducing the amount of tillage. Not only does this save on cost and energy, but it is usually better for the soil and helps to conserve soil and water, especially if there are residues remaining on the soil surface.

- A traditional form of land preparation in Africa is ploughing. This is a system that inverts the soil, buries residues and pulverises the soil structure, leaving the soil exposed to erosion.
- The amount of soil, nutrients and water lost from ploughed fields by erosion is great, and therefore it is an unsustainable method of land preparation and leads to the degradation of many farms.
- Furthermore, continuous shallow ploughing on sandy soils leads to an increase in acidity, a decrease in magnesium and results in poor yields.

- Nevertheless, there are certain conditions under which ploughing may be warranted.
- For example, ploughing may be necessary to incorporate lime, or there may be a case for ploughing where the crop seed requires a fine seedbed. Where ploughing is necessary, it should be deep and preferably done in the winter season.
- However, for most field crops, ploughing should be considered the exception and not the rule. If a field is to be ploughed it must be for a very good reason, and only if no other better options are available.

- Much better alternatives to ploughing exist, and these are generally termed conservation tillage systems.
- The aim with these is to carry out tillage only to the extent that is needed to produce a crop and with the primary aim of conserving soil and water.
- This is essential in parts of Africa because water is generally the most limiting factor, while the soil is the fundamental resource for all farming activities and must be conserved.
- One of the keys to conservation tillage is the maintenance of surface residues on the field to at least 30% soil cover.

The major benefits of conservation tillage include:
- Reduced soil erosion. The residues on the soil surface serve to “cushion” the rainfall impact and slow the runoff of water (and soil) from the field.
- Improves infiltration of water into the soil and reduces evaporation of water from the soil surface.
- Moderates the extremes of soil temperature. This is especially important in October and November when soil temperatures may be very high in the southern hemisphere countries.
- Improves soil structure. By minimising soil disturbance, the soil is given an opportunity to consolidate, roots are able to bind the soil together and the organic matter in the soil increases and soil organisms are able to flourish.
- Improves timeliness of operations. Tillage takes time and energy. Reducing tillage saves time and energy and therefore gives more opportunities to carry out other essential operations.
- Reduces costs. Conventional tillage generally contributes 15 to 20% of the variable cost structure and adopting conservational tillage methods will reduce this cost driver significantly
- Weed suppression. Residues on the soil surface smothers weeds and reduce weed pressure.

Conservation tillage include:
Tied Ridging
- This involves either planting the crop in small furrows, on the flat and making ridges during crop development, or planting the crop on prepared ridges, and then blocking the furrows at regular intervals.
- These “ties” act as mini-dams, which collect the rainwater and minimise the flow of water off the field.
- They are effective in both a wet and dry season. In a wet season, the crop is elevated on the ridge and suffers less from water-logging. In a dry season, the trapping of rainfall and conserving it in the field enhances yield.

- Tied ridging requires much draught power and labour, but it is possible to have a permanent ridge system, which is simply maintained from year to year.
- Permanent ridge tillage controls the traffic in the field and leaves a compaction-free zone under each ridge.
- There is also available appropriate machinery, both for animal draught and tractor draught to manage ridge tillage and tied ridging systems.

Some of the problems related to tied ridging include:
- Poor germination of seed on ridges. This may be overcome by timely planting when ridges are wet, or by making an “M” shaped ridge or cup-shaped seed-planting hole to capture rain water.
- Weeding by hand may be difficult, but the key is early weeding, before weeds get too big. Alternatively, the ridges may be re-made when the crop is young, primarily as a weeding operation. Thereafter the furrows may be closed mechanically or by hand hoes.
- Lack of implements. The normal ox-drawn plough may be used for ridging, or a simple disc tie ridger adapted to the plough beam may be made.
- Ridges get destroyed in winter by cattle. This is true to some extent, especially on very weak sands, but generally, the ridges are still visible by the end of winter and provide a guide for re-ridging.

Rip-on-row (also known as Mulch ripping).
- This involves ripping lines with a tined implement along the intended planting row, following the contour line.
- Planting stations are marked out along the row with a hoe ready for hand planting, or the seed is sown directly into the furrow by hand or with a machine planter and then covered.
- The advantage of rip-on-row is that it is quick, requires less draught power than ploughing or tied-ridging and helps to maintain surface residues.
- It is useful where soils have a hard top-soil or surface crust, and/or where crops like soyabean, dry beans or groundnuts are to be grown.
- Ripper tines are available which fit onto the ox-plough beam after removal of the mouldboard. This system is effective for soil water conservation in semi-arid areas, and reduces rainfall run-off in high rainfall areas.

Wet ripping

- This is when ripper tines are passed through the inter-row space during crop development (especially before 4 Weeks After Crop Emergence-WACE in maize). This helps conserve moisture.

Zero-tillage

Involves sowing the crop directly into an untilled soil.

- Planting stations are made with hoes, or the seed is sown with a specially made machine planter.
- The great benefits of zero-tillage are that it does not require draught power, while soil and water are conserved, and yields may be stabilised or enhanced.
- The labour requirements of zero-till are no more than any other system, if well managed.
- Two key factors for successful zero-tillage are the maintenance of at least 30 % residue cover and good weed control. In order to achieve this a farmer must:

- be prepared to control the extent of residue removal from fields. It is better to leave crop residues on the land
- learn the system - begin small, learn how to deal with problems and expand progressively as experience is gained, and
- control weeds throughout the year. Late weed control and winter weed control is essential and beneficial. The use of herbicides may well help in zero-tillage.
- When using zero tillage it is important to use rotations, monitor pests and diseases and beware of surface compaction.

At commercial level technology has brought in minimum tillage compatible planters such as zero till planters, strip till planters or minimum till planters which can plant in untilled soils or even soils with previous crop residues.

Conventional Tillage

This normally follows this procedure:

- **Ripping >Discing >Rolling >Planting**
- **Ploughing>Discing >Rolling>Planting**
- **Chisel Ploughing> Discing>Rolling>Planting**
- Deep/ Primary tillage such as Ripping, Ploughing or Chisel Ploughing are normally recommended after 2 or 3 seasons of soil use.
- Disking and Rolling are called Secondary tillage procedures.

Zero-tillage Involves sowing the crop directly into an untilled soil

Crop protection

Crop protection is concerned with ensuring that pests, diseases and weeds are maintained at levels, which do not cause economic damage to crops. It begins with giving the crop every opportunity to grow well, which includes:

- maintaining diversity and rotations,
- good soil fertility management and timely planting, and
- conservation of soil and water.

- When pests, diseases and weeds become a problem, crop protection relies on correctly identifying the nature and extent of the problem and knowing how best to prevent or control the problem.
- Thus, the starting point is knowing the various weeds, pests and diseases which may affect your crops.
- Make it a goal to learn about these problems by inquiring from extension personnel and by studying specific farming books. In addition, “scout” fields regularly in order to detect and predict the numbers of weeds, pests and diseases.
- Crop scouting is a form of insurance.

The benefits of scouting are:

Control measures are only applied when needed, fields are saved from unexpected losses through early detection and control.

Successful scouting of fields relies on the following:

- knowledge of the crop and the expected weeds, pests and diseases
- frequent scouting, at least weekly visits to each field are required,
- representative areas of each field should be visited,
- plants must be thoroughly examined, including the roots, stems, leaves, flowers and fruit, and
- maintain written records of observations. In the case of cotton, there are specialised scouting forms and pest threshold levels available that help to determine when to apply chemical control measures.

Crop protection chemicals may be used to prevent or cure problems. In either case, the chemical must be used according to the instructions given.

Therefore, it is important that the farmer:
- knows what the problem is and how to control it;
- selects the appropriate chemical which is the least toxic to humans and the environment (i.e., green label);
- reads, understands and follows the label instructions;
- applies the chemical at the correct time, in the correct manner and at the right dosage rates;
- ensures that the spraying equipment is functioning properly; and
- follows the appropriate safety precautions.

Check list for choosing the right chemical:
- Is it safe for the crops following in the rotation?
- Is it effective?
- Is it appropriate for the problem?
- Is it safe for the user and environment?
- Is it economically viable?
- Can it be safely and correctly applied using available machinery?

Tips on safe use of crop chemicals
- Do not contaminate the environment. Pesticides must not be spilt into water, onto the soil or in houses.
- Always read and understand the label on the pesticide container before use. Store pesticides in a cool, dry and ventilated place that may be securely locked and is out of reach of children.
- Wear protective clothing when handling and using pesticides. The more toxic a pesticide the more the necessity for protective clothing. This should include a hat, visor, overalls, apron, gloves and boots.
- Never eat, drink or smoke while using pesticides.
- Dispose of empty pesticide containers in such a way that they will not cause a hazard to humans or animals. Never use empty pesticide containers for food or water storage.
- Only use appropriately designed equipment to apply chemicals.
- Rotating the selection of herbicide in closely spaced rotations needs careful consideration
- Apply chemicals only to labelled crops
- Do not exceed maximum recommended rate for chemicals
- Apply at times recommended or specified on the label for spray equipment and for sprayer calibration refer to appendices

Harvesting And Harvesting Preparations

Plan ahead and prepare for the harvest
Farmers should plan for harvesting, prepare equipment early and set/calibrate machinery, packaging/bagging materials and dryers should be in place and ready. In addition, at least two full days will be needed to check machinery for proper maintenance, adjustments and safety before harvest usually around April/May. We advise farmers to review owner's manuals of their harvesting implements before making adjustments.

- We suggest farmers to book combines and transport on time
- Health checks on combines should be done around April/May
- Check moisture levels to allow for planning
- Harvesting and drying can commence when the crop reaches a maximum moisture level of 20% and below. It makes economic sense to harvest and dry a crop at this moisture level.
- The optimum acceptable storage moisture levels for maize grain is 12.5% and below.

Hand harvesting-maize

Bang Board Trailer
- This is an option to farmers who cannot access combine harvesters.
- Cobs are loaded (by throwing) directly into a tractor drawn trailer which is fitted by a bang board.
- It is recommended that 6 rows be harvested on each side of the trailer at a time.
- This is because workers become less accurate as the number of rows increase and forward speed is also reduced.
- The cobs in the 2 rows straddled by the tractor wheels are harvested first and heaped on the sides or on the rows and loaded later or as the tractor passes.

Drums/Sacks and trailer:
- When large harvest gangs are available, the drums and trailer method is recommended.
- Cobs are harvested into a 25 litre container or a 25kg empty bag then emptied into a tractor/animal drawn trailer.
- Larger containers can also be used but 2 workers may reap into one container. For efficiency, 2 tractors and 3 trailers will be ideal if the gang is large.
- The crop (with husks) is then shelled using a tractor driven sheller.

Using empty bags/sacks

- Some farmers prefer reaping directly into sacks. This system is particularly useful when shelling is done in the field.
- The cobs are reaped into the sacks by reapers and they are emptied into tractor towed sheller.
- The ratio of reapers to waiter is 2:1. Reaping can be done directly into a towable sheller.
- However, this has proved to be inefficient in most cases as reapers may fail to match sheller rate.

Mechanical harvesting

- Combine harvesters are mostly used in commercial setups especially when area under crop exceeds 50ha and are a modern harvesting technology which comes in two types (Conventional and Rotary types).
- A combine harvester performs a bout of functions concurrently (cutting the stalks, picking, de-husking, shelling, winnowing, blowing out chaff, cleaning the grain and loading bins/trailers for delivery, measuring grain moisture, test density and moisture among many traits.

With a combine:

- The farmer is independent of labour hires
- There is faster rate of harvesting than with hand harvesting, so the method suits large hecterages.
- The machine can chop up the stover for ploughing down and/or planting.
- This method works well with bulk handling operations.

However:

- When there are problems with cob rots, there is no possibility/provision of sorting out the affected cobs.
- The combine cannot pick up cobs lying on the ground and as a result it will not work efficiently on lodged crops.
- Steep slopes, small fields and moisture content (high) of the crop affect the efficiency of the machine.
- The combine cannot work well in densely weeded fields.

What needs to be checked on a combine harvester?

- Harvesting losses must not exceed 3% when using a combine harvester and therefore it is important for farmers to do a 'health check' from 'front to back' using a check list provided by experts/suppliers.
- Always target ZERO breakdowns during the harvesting period.

- A health check is critical - April/ May is the right time to do it. Part of the checklist/inspection points:
  Fan belts, bearings (for wheels and shafts), chains, (check all inspection points), intake auger (check all chains), winnowing fan (which blows the chaff), grain pans/sieves, augers to grain tanks, straw shredders among other points must be checked and if need be rectified, adjusted or even replaced.

(Factors that affect combine efficiency and reaping output. Lookout!)

- Grain moisture levels:-Dry crop and cobs are easier to pick, de-husk and shell. A crop can be harvested below 20% moisture content. Moisture levels above 20% can compromise harvester efficiency.
- Cob placement and standability: A variety with good standability and average cob placement is easily and efficiently harvestable. A lodging crop is difficult to harvest with a combine and can cause harvesting and yield losses. That is the reason why varieties with good standability are recommended and to always plant at recommended population densities.
- Land terrain: a well prepared and levelled (even) land is easy and less costly to harvest. Otherwise speed must be adjusted/rather reduced if terrain is not even.
- Combine - trailer/truck/bin ratio: it is always recommended for farmers to strike a good balance of combine harvesters and trucks in the field for efficiency so that the combine must not stop or wait for bins/trucks.

Gleaning

- Field inspection during harvesting is always recommended.
- All knocked down crops and fallen cobs must be picked up by gleaning gangs after the combine has passed.
- A relatively sizable gang is sent into the field to pick up the left overs following a combine harvester.
- The collected left overs can be shelled by a sheller or fed into a running combine/sheller.

Grain drying

- Harvesting when moisture content is high may necessitate drying the crop/grain to the optimum moisture level for shelling/storage.
- To maximise on land/irrigation utilisation, farmers are advised to harvest a maize crop before reaching storable moisture level (12.5%) and plant a winter crop.

- This will require drying the crop/grain which can be done naturally or artificially.

- With natural drying, the cobs are left on the plant to dry or reaped and heaped in strips on open dry land/slabs.
- The cobs can also be reaped and put in cribs and left to dry to the required moisture content.
- Alternatively, grain is dried in bags; but this tends to be a very slow process.
- Normally natural drying is common when the weather is sunny.
- You must always make sure that the rate of heat extraction when drying must not deform the grain otherwise it will lead to downgrading of produce.

- In artificial drying, the underlying concept is 'forcing heat through the grain'.

- The heated air then causes moisture to evaporate from the grain.
- The rate of drying depends upon the temperature of drying air, velocity of the air through the grain and the uniformity of its distribution in the drying silo/chamber.

- Maximum temperature of drying air will depend on such factors as the type of crop to be dried, the use of the crop and the system of drying being employed.

Postharvest handling of grain

- Grain can be stored as 'bulk' or bagged.
- The storage facility must be suited to the method of delivery.
- Bulk stored grain is loaded into bulk trailers/bins using augers.
- Bagged grain usually requires conveyors or labour for loading.

Bulk storage

There are many methods that can be used for bulk storage. Examples include: above ground silos, bulk containers and bags stored in the open or in buildings.
There are a number of pros for the bulk storage method. These include:

- It is more economical than bag storage
- Less supervision is required
- Labour requirements and handling are reduced
- It is more hygienic than bag storage However, bulk storage has some cons in that it is costly in terms of capital outlay requirements than bagging

Conditions for bulk storage

- The maize grain must be dry; with less than 13.5% moisture content.
- The storage facility must be structurally sound and designed for loading and offloading.
- The storage facility must be weather tight and dry, thermally insulated from the sun's radiation and also rodent free.
- The facility must be convenient for inspection, fumigation and cleaning
- The facility must be provisioned to allow loading (of grain by augers) and offloading of grain (from the field)

Chemical treatment for long term storage

- Maize in storage can be affected by many pests including: maize weevil (Sitophilus spp), Indian meal month (Sitotroga cereale), Flour beetle (Tribolium castaneum), Sawtoothed grain beetle (Oryzaephilus surinamensis), Lesser grain borer (Rhyzopertha dominica), Larger Grain Borer (Prostephanus truncatus), Rusty grain beetle and other storage pests.
- These post-harvest pests can cause significant yield losses (eat into your pocket) if left uncontrolled hence the use of stored grain chemical protectants is recommended. Several options are available on the market.

NB: Always read chemical labels carefully, use safe practices and adequate protective gear during application. Always observe recommended pre-consumption intervals on the grain protectant labels.

Grain storage

This is a process which involves three basic steps i.e.

- **Sanitation** (Clean storage places, spray and fill up cracks)
- **Chemical treatment** (Apply grain protectants to the grain at recommended moisture levels)
- **Inspection** (Inspect stored grain regularly and check roofs and pests)

Stored grain may deteriorate if:

- the temperature of the grain is too high
- the moisture of the grain is too high
- the grain is diseased
- insects multiply in the stored grain
- rodents are allowed access to the grain
- the untreated grain is stored for a long time

Guidelines for successful storage of grain:

- Only store dry grain and keep it dry. (Damp grain or damp air will lead to rotten grain.) The ideal moisture content of grain for good storage is less than 13%.
- Grain may be dried naturally in the field while on the plant, but losses from termites, deterioration, theft and weevils may accrue if crops are left too long in the field. Thus, it is better to harvest crops as soon as possible after maturity and dry the grain in the sun where there is good airflow over the grain.
- Alternatively, artificial drying may be used for large quantities of grain. However, this requires some mechanical method to blow ambient or heated air through the grain, and it is consequently an expensive and technical process.
- Never store grain that has already been attacked by insects, unless the insects have been destroyed. Damaged grain is susceptible to diseases or the insects may have laid eggs in the grain, in which case the stored grain may be re-infected.
- Never let rodents make the grain store their home. Prevention is better than cure - keep rats out (Cats are an excellent way of controlling rats).
- Proper grain storage depends greatly on the storehouse. Build a good storehouse that keeps out thieves, rodents and moisture.

Before filling a grain store:

- Thoroughly clean out and fill in any cracks with mud or mortar.
- Burn the debris that is swept out of the grain store.
- Spray surfaces with Malathion or Kontakill, or paint the surfaces with goat or cattle manure and ash (burnt sunflower stalks or aloe leaves may be used).
- Mix a grain protectant chemical (e.g., pirimiphos/permethrin) with the grain during filling.
- Eucalyptus leaves can be mixed with maize grain to reduce weevil infestation.
- Alternatively, mix ash with the grain (3 to 10 kg ash per 100 kg grain). Burn a mixture of dry maize cobs, sunflower stalks and cow dung in order to produce the ash. Powdered (crushed) Syringa seeds also help to keep away insects.
- Small quantities of beans may be stored in a container with some sand. At frequent intervals (at least every two weeks) shake the container to mix the sand and the beans.
- Always use the oldest grain first. Remember the maxim: first in, first out.

Crop Planning And Budgeting: The Profit Story

Matter of fact: Success favours better planners
6 PHASES IN PLANNING

Step 1:
Identifying and setting farm and household goals

Step 2:
Conducting a resource inventory (availability, quantities and quality)

Step 3:
Organising resources into whole farm plan

Step 4:
Estimating costs and returns (enterprise budgeting)

Step 5:
Organising enterprise budgets into whole farm budget

Step 6:
Implementation

Maize Gross Margin Guide/ Ha

High Management Farmer						
Crop: Maize: Commercial						
Season	2017/18		Plant: Oct '17	Tonnes per ha		10.00
Area: Ha's			Sell: May < Jun '18	Price per Tonne USD$		390.00
Inputs	**Rate per ha**	**Unit**	**Input Detail**	**Unit Cost USD$**	**% Total Cost**	**USD$ /ha**
Seed	25	kg	SC Variety	3.000	6.58%	75.00
					6.58%	**75.00**
Fertilizer and Lime	400	kg	Basal	0.780	27.37%	312.00
	450	kg	AN	0.600	23.68%	270.00
	500	kg	Lime	0.091	3.99%	45.50
					55.04%	**627.50**
Herbicides	3.000	l	Atrazine	6.200	1.63%	18.60
	1.500	l	Metalachlor	14.000	1.84%	21.00
	50.000	g	Halosulfuron	0.800	3.51%	40.00
	45.000	g	Nicosulfuron	0.556	2.19%	25.00
					9.17%	**79.60**
Insecticides	0.2	l	Lambda	10.000	0.18%	2.00
					0.18%	**2.00**
Labour	15	day	Permanent	4.000	5.26%	60.00
					5.26%	**60.00**
Tractor Hires	Wet Rate	l	Chisel Ploughing, Discing, Planting, Spraying		14.91%	170.00
					14.91%	**170.00**
Harvesting (Combine)	30	l	Hire Charge	3.000	7.89%	90.00
	30	l	Diesel Usage	1.200	3.16%	36.00
					11.05%	**126.00**
Transport/30ton		l	Delivered 50Km Radius	210.000	0.00%	-
					0.00%	**-**
Irrigation (Electricity +Z	0	mm	Pumped from water body	-	0.00%	-
					0.00%	**-**
	Total Variable Costs				**100.00%**	**1,140.10**
	Gross Income at 10.00 t/ha				**342.08%**	**3,900.00**
	Gross Margin				**242.08%**	**2,759.90**
	Return per $TVC					**3.4**
	Gross Income @ 7 t/ha				**239%**	**2,730.00**
	Gross Margin				**139%**	**1,589.90**
	Return per $TVC					**2.3**

Break even yield at $390/ton price is 3t/ha
This is only a guide and prices are based on industrial average. Increasing productivity (yield/ unit area) will reduce the cost of producing a tonne of grain and optimise margins.

Soyabean Gross Margin Guide/ Ha

Soyabean Gross Margin Budget

High Management

Gross Margin Guide/Ha	**2017/18**			**Tonnes per Ha**		**3.50**
Hecterage	**1**		**Plant: Mid Nov-Mid-Dec'17**			
			Sell: May/Jun '18	**Price per Tonne**		**550.00**
Inputs	**Rate per Ha**	**Unit**	**Input Detail**	**Unit USD$ Costs**	**% Total Cost**	**USD$/ha**
Seed	100.000	kg	SC Serenade, Safari, Status, Se	1.650	21.05%	165.00
Seed Dressing	1.000	scht	Innoculant	6.000	0.77%	6.00
	0.250	kgs	Thiram 80 WP	7.000	0.22%	1.75
					22.04%	**172.75**
Fertilizer and soil conditioners	250	kgs	Soya Blend 5:12:24/ 6:27:20	0.700	22.33%	175.00
	150	kgs	Gypsum	0.140	0.00%	-
	700	kgs	Lime	0.100	0.00%	-
					22.33%	**175.00**
Herbicides	5.000	l	Glyphosate	6.500	4.15%	32.50
	1.000	l	Metribuszine/Sencor	15.000	1.91%	15.00
	1.500	l	Metalachlor	15.000	2.87%	22.50
	0.035	kg	Classic	16.000	0.07%	0.56
	2.000	l	Fusilade	28.000	7.14%	56.00
					16.15%	**126.56**
Insecticides	0.200	l	Lambda	9.000	**0.46%**	**3.60**
Fungicides	0.500	l	Triademnol	15.000	**1.91%**	**15.00**
Labour	20.000	day	Permanent/Hired	3.000	7.65%	60.00
					7.65%	**60.00**
Tractor Operations	50.000	l	Conventional 1 Tillage+1 planter+3 spraying+1 fertilser app	1.200	**7.65%**	**60.00**
Combine	14.000	l	Hire Charge	7.500	13.40%	105.00
	14.000	l	Diesel Usage	1.200	2.14%	16.80
	2.000	l	Combine Trailer	4.547	1.16%	9.09
					16.70%	**130.89**
Transport		l	Delivered 30Km Radius		**5.10%**	**40.00**
Irrigation	-	mm	Irrigation	0.780	**0.00%**	**-**
			Total Variable Costs		**100.00%**	**783.80**
			Gross Income at 3.5 t/ha		**245.60%**	**1,925.00**
			Gross Margin before overheads		35.80%	**1,141.20**
			Return per $TVC			2.46
			Total Variable Costs			783.80
			Gross Income at 2.50 t/ha			1,375.00
			Gross Margin before overheads			**591.20**
			Return per $TVC			1.75
			Total Variable Costs			783.80
			Gross Income at 4.00 t/ha			2,200.00
			Gross Margin before overheads			**1,416.20**
			Return per $TVC			2.81

Break even yield at $550/ton price is 1.5t/ha
This is only a guide and prices are based on industrial average. Increasing productivity (yield/ unit area) will reduce the cost of producing a tonne of grain and optimise margins.

Sugar bean Gross Margin Guide/ Ha

Sugar Bean Gross Margin Budget

High management farmer

Season	**2017**			**Tonnes per Ha**		**2.50**
Land(s):		**Plant:**		**Price per Tonne**		**1,150**
Area: Ha's	**?**	**Sell:**				

Inputs	Rate per Ha	Unit	Input Detail	% Area	Unit Cost USD$	% Total Cost	USD$/ha
Seed	100	kg	SC Sharp	100%	2.400	**25.66%**	**240.00**
Fertilizer and Lime	100	kg	Compound "DD" 13:26:13	100%	0.840	8.98%	84.00
	200	kg	AN	100%	0.680	14.54%	136.00
	-	kg	Lime	0%	0.100	0.00%	-
						23.52%	**220.00**
Herbicides	4.00	l	Alachlor/Lasso (Pre)	100%	5.450	2.33%	21.80
	3.00	l	Basagram(LB)	0%	15.000	4.81%	45.00
	0.60	l	Fusilade (PoE)	15%	20.000	1.28%	12.00
						8.43%	**78.80**
Insecticides	0.10	l	Belt (Sytemic Pests)	200%	234.000	2.50%	23.40
	1.00	l	Diazinon (Bean stem maggot)	300%	12.000	1.28%	12.00
	0.15	l	Lambda (Cut Worm/Boll worm/LE	100%	4.000	0.06%	0.60
	1.50	l	Thionex 35 EC (Boll Worm)	200%	9.000	1.44%	13.50
						5.29%	**49.50**
Fungicides	1.00	l	Copper Oxy	200%	8.000	0.86%	8.00
	1.00	kg	Dithane M45	200%	2.000	0.21%	2.00
	0.50	l	Folicur (Rust)	200%	14.500	0.78%	7.25
						1.84%	**17.25**
Labour	20	day	Permanent	100%	3.000	6.42%	60.00
						6.42%	**60.00**
Tractor Operations	25.00	ltr	Minimum Tillage	100%	4.547	12.15%	113.67
Transport	-	ltr	Delivered 30Km Radius	100%	6.905	-	-
Irrigation	200	mm		100%	0.780	16.68%	156.00
ZINWA Charges	1.5			0.0%	87.000	0.00%	

Total Variable Costs		**100.00%**	**935.22**
Gross Income at 2.50 t/ha		**307.41%**	**2,875.00**
Gross Margin before overheads		**207.41%**	**1,939.78**
Return per $TVC			3.07
Total Variable Costs			935.22
Gross Income at 2.00 t/ha			2,300.00
Gross Margin before overheads			**1,364.78**
Return per $TVC & Inc Yield / Margin			2.46
Total Variable Costs			935.22
Gross Income at 3.00 t/ha			3,450.00
Gross Margin before overheads			**2,514.78**
Return per $TVC & Inc Yield / Margin			3.69

Must be planted before the end of Feb or Jul to avoid Frost!!!

Break even yield at $1150/ton price is 0.8 t/ha
This is only a guide and prices are based on industrial average. Increasing productivity (yield/ unit area) will reduce the cost of producing a tonne and optimise margins.

Wheat Gross Margin Guide/ Ha

Wheat Gross Margin Budget High Management Farmer					WHEAT		
Season	2018		Plant: May '18		Tonnes per Ha		7.00
Land(s):			Sell: Sept/Oct '18		Wheat	price/t	500
Area: Ha's	?				Area: Ha's		?
Inputs	**Rate per Ha**	**Unit**	**Input Detail**	**Est Unit cost USD**	**% Area**	**% cost**	**USD$/ha**
Tractor Operations	70	ltr	Conventional tillage	3.660	100%	**13.0%**	**256.20**
Fertilizer and Lime	250	kg	Blend 13:26:13 (P)	0.831	100%	10.5%	207.75
	400	kg	Blend 13:26:13 (P)	0.831	0%	0.0%	-
#	350	kg	Urea (W)	0.670	100%	11.9%	234.50
#	400	kg	Urea (W)	0.670	0%	0.0%	-
#	1000	kg	Lime (LaF)/Gypsum	0.100	0%	5.1%	100.00
						27.4%	**542.25**
Seed	125	kg	Wheat (SC)smart/nduna	1.344	100%	8.5%	168.00
#	100	kg	Barley (Delta) Hope	1.000	0%	0.0%	-
						8.5%	**168.00**
Irrigation(gross 600m	600	mm	incl Electricity and ZINWA	0.781	100%	23.7%	468.60
						23.7%	**468.60**
Herbicides	0.25	ltr	Banvel (PrCh)	20.000	100%	0.3%	5.00
	0.75	ltr	MCPA (Po)	7.000	100%	0.3%	5.25
						0.5%	**10.25**
Bird Shield	6.00	kg	9, 10 - Anthraquinone 50% WP	8.25	100%		49.50
Insecticides	0.50	ltr	Pesticide	10.000	100%	0.0%	5.00
	0.50	ltr	Pesticide	14.000	100%	0.0%	7.00
Fungicide sprays x 2	1.50	ltr	Fungicide	15.000	100%	1.1%	22.50
						4.2%	**84.00**
Combine	1	ltr	Contract(AT)	130.000	100%	6.6%	130.00
Combine Fuel	14	ltr		1.130	100%	0.8%	15.82
Harvest Trailer	4	ltr		3.660	100%	0.7%	14.64
						8.1%	**160.46**
Labour	15	day	Permanent (inc welfare)	6.381	100%	4.8%	95.72
	10	day	Seasonal	5.815	100%	2.9%	58.15
	5	hrs	O/Time x 3/2	0.598	100%	0.2%	2.99
	27	hrs	O/Time x 2/1	0.798	100%	1.1%	21.55
						9.0%	**178.40**
Drying	2.00	Tonne	2% removal.10%crop	30.000	10.0%	**0.0%**	**-**
Transport	7	Tonne	Delivered 50Km($0.156/kmt	0.156	100%	2.8%	54.75
	#REF!	Tonne	Delivered 120Km($0.1596kr	0.156	0%		
		Tonne	Fert/Seed/Chem 50Km($0.1	0.156	100%	0.2%	4.69
						3.0%	**59.44**
Financing	0.00%			0.00	100%	0.0%	-
Insurance	0.50%	%		0.50%	100%	**0.0%**	**-**
Levy (Marketing)	1.00%	%		0.00%	100%	0.0%	-
			Total Variable Costs			**100.0%**	**1,977.10**
			Gross Income 7.0t/Ha			177.0%	3,500.00
			Gross Margin before overheads			**77.0%**	**1,522.90**
			Return per $TVC				1.77
			Total Variable Costs			100.0%	1,977.10
			Gross Income 8.0t/Ha			202.3%	4,000.00
			Gross Margin before overheads			**102.3%**	**2,022.90**
			Return per $TVC				2.02

Break even yield at $500/ton price is 4 t/ha
This is only a guide and prices are based on industrial average. Increasing productivity (yield/ unit area) will reduce the cost of producing a tonne and optimise margins.

Maize production

Soils and climate

- Maize grows best on deep, well-drained, fertile soils, and where total seasonal rainfall exceeds 500 mm.
- Maize is reasonably tolerant to soil acidity, but if the soil is very acid, liming will improve the soil and enhance maize yields.
- Maize is susceptible to both drought and water-logging. Thus, poorly drained soils should be avoided, unless practices like ridge tillage, drainage and early planting are employed.
- Drought, during the four week period spanning flowering (silking and tasselling), can cause serious yield losses. Therefore some form of water conservation is important (e.g., pot-holing, mulching, tied-ridges), especially in the drier areas.
- Pollen viability can be affected by temperatures above 38 degrees Celsius, while temperatures below 10 degrees Celsius retard maize growth.

Fertilisation

- The fertiliser requirement for maize depends on the soil fertility and yield target. Infertile soils require more fertiliser, as does a higher yield target.
- The two most important nutrients for maize are nitrogen and phosphorous, but maize also requires potassium and, on some soils, Zinc in small quantities.
- The first consideration for fertilising maize is manure, as it is an excellent source of nutrients and has many other benefits for soils.
- Inorganic fertilisers should be considered as a supplement to manure. The following table gives a general recommendation for fertilising maize with inorganic fertilisers:

Fertiliser Type	Yield potential of maize			
	Less than 3 t/ha	3 to 5 t/ha	5 to 8 t/ha	8 to 12 t/ha
	Number of 50kg bags of fertiliser per ha			
Basal fertilizer (e.g. 7:14:7)	0 to 3 bags/ha (0 to 150kg/ha)	2 to 5 bags/ha (100 to 250kg/ha)	5 to 7 bags/ha (250 to 350kg/ha)	6 to 12 bags/ha (300 to 600kg/ha)
Top dressing fertilizer (high N) e.g ammonium nitrate (34.5% N)	1 to 3 bags/ha (50 to 150kg/ha)	2 to 5 bags/ha (100 to 250kg/ha)	5 to 7 bags/ha (250 to 350kg/ha)	6 to 10 bags/ha (250 to 500kg/ha)

Facts:

- The yield potential largely depends on the variety, expected rainfall and on the management applied to the crop.
- The addition of manure and ash will greatly improve the response of maize to the applied fertiliser. Under commercial set ups addition of lime to acidic soils improve response to fertilisers
- Fertiliser rates may be reduced after a drought, where manure and ash is applied or when the maize is following a legume or well-fertilised crop, like potatoes.
- Basal fertiliser must be applied before or at the time of planting, preferably cupped into the planting hole, or applied in a band below and to the side of the seed with the mechanical planter.
- Top dressing should be applied when the maize is at three and half to 6 Weeks After Crop Emergence (WACE).
- Top dressing splits may be recommended in sandy to sandy loam soils. A maximum of 3 usually is ideal
- Basal fertilisers which contain zinc are recommended for application every two to three years on sandy soils.
- If boronated fertilisers are not normally applied as part of the rotation, then a boronated fertiliser should be applied every three years.

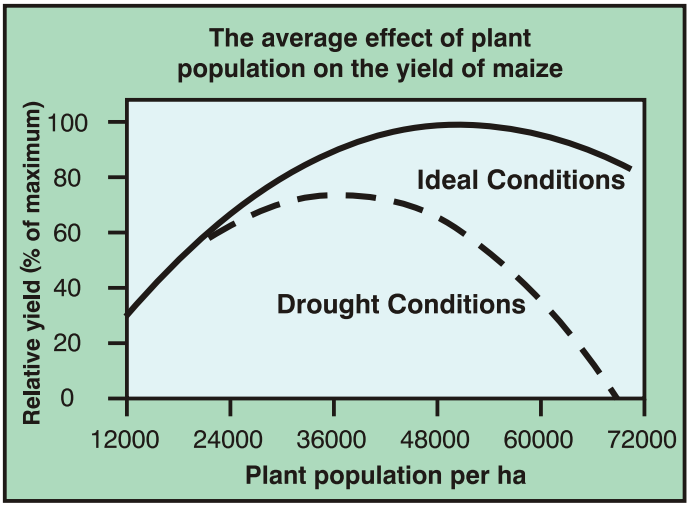
The approximate application rates (to the nearest half-bag) of inorganic fertilisers to crops can be determined from the following tables:

Basal fertilizers e.g. 7,14,7						
Plant Spacing		Cup size				
Between Rows (Cm)	Between Plants (Cm)	5	8	12	16	22
		Fertilizer rate (kg/ha)				
100	50	125	200	275	375	525
90	60	100	175	250	350	475
90	50	125	250	300	425	575
90	30	200	350	525	700	950
75	60	125	200	300	425	575
50	50	250	375	550	750	1050

Note

- 1 ha =2.5 acres
- 1 bag of fertiliser = 50kg
- To convert kg/ha to bags per hectare, divide by 100 and multiply by 2.
- To convert kg/ha to kg per acre, divide by 2.5 (or multiply by 0.4).
- Specific amounts of fertilizer will vary according to the specific density of the fertilizer used.

Top Dressing Fertilizers (TOP) e.g. 34.5% N						
Plant Spacing		Cup size				
Between Rows (Cm)	Between Plants (Cm)	5	8	12	16	22
		Fertilizer rate (kg/ha)				
100	50	100	150	250	325	450
90	60	100	150	225	300	400
90	50	100	175	250	350	500
90	30	200	300	450	600	800
75	60	100	175	250	350	500
50	50	200	325	500	650	875



Plant spacing

- The width of rows and the spacing of plants in the row determine the plant population. The closer the spacing, the more plants there will be per unit area.
- The recommended number of maize plants per hectare varies from 36,000 to 60,000, depending on the environmental potential and hybrid.
- High plant populations are appropriate for early-planted crops under high rainfall or irrigated conditions where management is of a good standard.
- Lower plant populations should be used under dryland conditions, especially in drought prone areas, where a population of about 37,000 to 40, 000 plants per hectare is recommended.
- Some varieties may be susceptible to lodging under high plant populations.
- Generally, the taller the variety, the lower the plant population.
- Short maize varieties may be grown at higher plant populations.
- Whatever the case, the minimum plant population for maize is 36,000 plants per ha.

The plant populations for the various Seed Co hybrids related to the expected yield are presented in the Table below:

Expected Yield T/ha	HYBRIDS					
	ULTRA EARLY/ VERY EARLY	EARLY		MEDIUM		LATE
	SC 301 SC 403 SC 417 SC 419 SC 402y	SC 513 SC 533	SC 529 SC 537	SC 637 SC 627 SC 649 SC 643	SC 608(Y) SC 633	SC 719 SC 727
1	36000	32000				
2	36000	36000	32000			
3	40000	36000	36000	32000	36000	
4	40000	40000	36000	32000	36000	
5	44000	40000	40000	36000	40000	
6	44000	44000	40000	36000	40000	
7	48000	44000	40000	40000	44000	**37000**
8	52000	48000	44000	40000	44000	**40000**
9	56000	48000	48000	44000	48000	**48000**
10	60000 **-72000**	**55000**	52000	44000	48000	**49000**
11		**60000**	56000	**50000**	50000	**50000**
12			60000	**55000**	**55000**	**52000**
13				**55000**	**60000**	**52000**
14				**60000**	**60000**	**55000**
>15						**60000**

•A seed rate of about 25 kg/ha is required, but this depends on the seed size. 10 kg is enough to plant 1 acre and 5 kg for half an Acre.
•Small seed will go further, and give equal germination and yield performance as large seed.
•However, small seed should not be planted too deep (i.e., not deeper than 5 cm). For SC 727, a 50, 000 kernel (1 hectare pack) is enough to plant 1 Ha, 20, 000 kernel for 1 Acre.

The following table gives the number of plants per hectare at various spacing for hand planting:

Spacing between rows (cm)	Spacing between plant station (cm)	Number of plants per station	Plant population (plants per ha)
100	60	2	33 300
100	50	2	40 000
90	60	2	37 000
90	30	1	37 000
90	50	2	44 400
90	40	2	55 500
75	60	2	44 400
90	**22**	**1**	**50 500**
75	**24**	**1**	**55 555**
75	**25**	**1**	**53 333**
90	**19**	**1**	**58 000**
75	**23**	**1**	**58 000**

Key: Recommended in low rainfall areas e.g. regions 4 & 5 Recommended in high rainfall areas e.g. regions 1 to 3 or irrigated areas

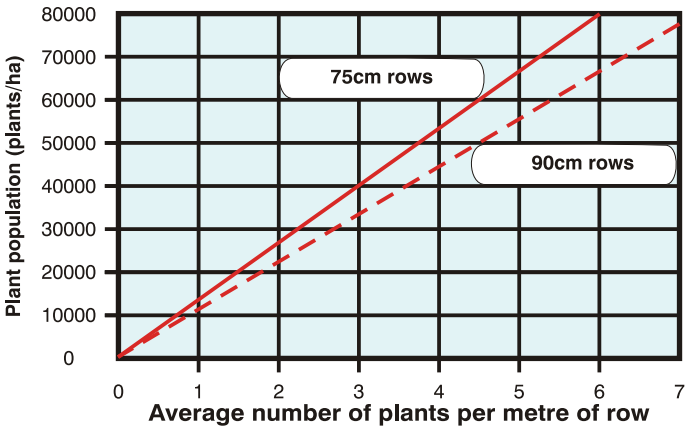
NB: To obtain the population per hectare, divide 10,000 by the row spacing (m) and then divide the answer by the spacing between the plant stations in metres. Multiply the answer by the number of plants per station.

The following table gives the plant spacing and seed rate requirements when machine planting:

Target Harvest Population Per ha	Required Planting Population Per ha	Average kernel Spacing in-row (cm)		Average number of kernels per row		Hectares planted per 25kg bag		
		Row width (m)		Row width (m)		Seed size		
		0.75	0.90	0.75	0.90	Large 1600 seeds/kg	Medium 2000 seeds/kg	Small 2400 seeds/kg
25000	28070	48	40	2.1	2.5	1.4	1.8	2.1
32000	35100	38	32	2.6	3.2	1.1	1.4	1.7
38000	42100	32	26	3.2	3.8	1.0	1.2	1.4
44000	49100	27	23	3.7	4.4	0.8	1.0	1.2
51000	56100	24	20	4.2	5.0	0.7	0.9	1.1
57000	63200	21	18	4.7	5.7	0.6	0.8	0.9
63000	70200	19	16	5.3	6.3	0.6	0.7	0.9
69000	77200	17	14	5.8	6.9	0.5	0.6	0.8

Note: The required planting population was calculated assuming 95% germination and 5% field loss.

Simple method to determine the plant population of maize from the average number of plants per metre of row.



Population densities of 50 000 to 60 000 plants per Ha on all Seed Co varieties in Zimbabwe are recommended

New trends in population density management - commercial

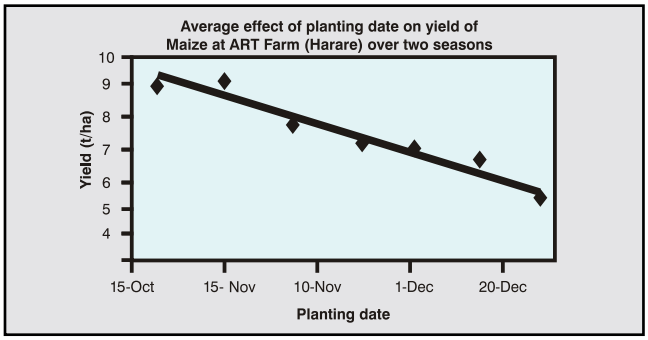
- Some farmers are pushing population densities higher than the recommended in search for 'compensatory yield gains'.
- The farmers are targeting population densities such as 65 000, 70 000, 80 000 up to 100 000 plants per hectar.
- The trend or condition is that the farmers are following up with a growth regulator spray such as CeCeCe or ethrel before day 35 after emergence. However, this comes at a cost in terms extra seed cost, extra compensatory fertilization, spraying cost, and risk of response failure especially when spraying times coincides with extended wet periods or dry spells.

- There is need for further research especially to ascertain whether the yield gains are significant (or if they do exist in the first place); the profitability of this concept; and the breeding for short statured but high yielding varieties to accommodate high densities.

- However, the optimum population densities of 50 000 to 60 000 plants per Ha on all Seed Co varieties are recommended in Zimbabwe in high potential and irrigated areas.

Planting time

- The later maize is planted, the lower the yield, as shown in the graph below.
- Highest yields are obtained with October plantings, but these can usually only be sustained with irrigation (i.e. irrigation to establish crop).
- However, planting in October may be feasible on vleis or when there is good early rain (over 50mm).
- November planting with the onset of the first rains is the safest under dryland conditions.
- In order to exploit these early rains, fields need to be ready before the rains (i.e. in October) and seed and fertiliser must be on hand, so that as soon as the first rains fall, fields may be planted.
- Planting in December will produce low yields, and is very risky, because the crop may suffer from drought stress at the end of the season; while pests (e.g. stalk borer) and diseases (maize streak virus and HT) are more prevalent on late planted crops.
- Under rainfed situations, after second week of November a farmer is encouraged to dry plant anyway at a depth of about 5 cm to ensure the seed is not reached by light showers.



- On average, for every day that planting is delayed (after first effective rains), the yield loss is one bag (50 kg) per ha. This is a significant loss and something to be remembered by those who wish to be productive farmers.
- Yield decline in later plantings is due to reduced cob size; reduced number of kernels per cob; and lower seed mass.
- Early planting with the right Seed Co maize hybrid, together with fertiliser and manure and the control of early weeds, will make a large difference to the productivity of a farmer's fields.
- Heat unit accumulation is closely correlated with grain yield. It should be noted that 40-50% of the heat units are experienced in October, November and December.

Advantages of early plantings

- The length of growing season is extended
- Pollination period may occur early before mid season dry spells
- Early planting will allow greater dry matter accumulation and yield
- The plants will have a more vigorous rooting system if planted before the main rains

Achieving a good stand (important tips)

The following are factors that influence the devlopment of a good and even stand:

- the existing soil structure eg crusting/capping soils may affect emergence
- efficiency and evenness of soil preparation
- quality of seed used
- the need for a good seed-soil contact
- efficiency of planting operation i.e. correct adjustment of planting machinery is encouraged
- efficiency of early weed and pest control
- soil temperatures (optimum being 25 to 30 degrees celcius)
- planting depth and spacing are also important considerations

Varietal choice

- The choice of variety depends on the yield potential; season length; anticipated disease problems; and use.
- The Seed Co Product Manual gives descriptions and recommendations of all the Seed Co hybrids on the market. Study the manual and determine which hybrid will be best for each situation.

Considerations when choosing maize hybrid varieties

- ✓ amount and distribution of rainfall
- ✓ length of the growing season
- ✓ altitude and air temperature
- ✓ soil fertility and fertiliser application
- ✓ planting date
- ✓ plant density and standability
- ✓ use (commercial grain, green mealie and silage)
- ✓ occurrence of diseases
- ✓ management

Pointer!
Always plant new certified Seed Co seed each year for maximum yields.

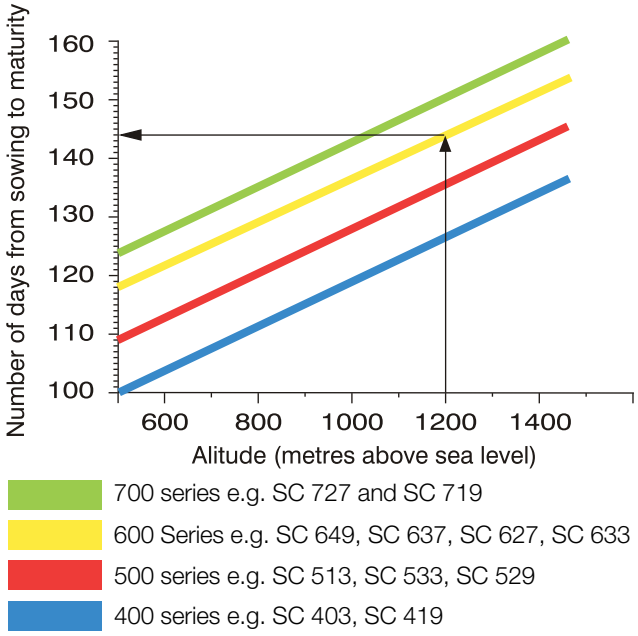
- Early maturing hybrids take between 120 and 140 days from planting to maturity, whereas medium to late maturing varieties take between 141 and 155 days to mature.
- However, the time to maturity for any variety depends on air temperature: The cooler the temperatures the longer the plants will take to mature.
- Seed Co has a very simple way of differentiating its hybrids using animal symbols as shown in the accompanying table.

- The range of hybrids available from Seed Co is continuously changing as we develop new hybrids with improved performance and disease tolerance.
- Therefore, it is important to keep oneself informed by attending field days and following communications disseminated through various media platforms such as radio, television and press.
- It is advisable to grow more than one maize hybrid on a farm.

- Approximately half the fields should be planted to a familiar variety that is most suited to one's environment; a quarter to an earlier maturing hybrid and another quarter to a later maturing hybrid.
- Start planting with the later maturing hybrid and end with the earlier maturing hybrid.
- Also consideration should be given to trying out a small area of one or two new hybrids to compare their performance with familiar hybrids.

- Altitude has an effect on the number of days from planting to flowering and maturity because the rate of development of maize is affected by air temperature.
- The warmer the weather, the faster the crop development.
- Higher temperatures at lower altitudes therefore have the effect of accelerating the development rate.
- Conversely, the lower air temperatures at higher altitudes retard development and extend the time taken to reach flowering and maturity.
- The graph below gives a rough guide as to the time from planting to maturity for the four groups of Seed Co maize hybrids:

The approximate time from planting to maturity for maize hybrids



Planting

A maize yield decline as planting is delayed after the first week of November. Therefore plant as early as possible. For hand planting, this may be achieved if the farmer is well prepared.

The following guidelines help plan for an early planting:

- Obtain fertiliser and seed in September or earlier.
- Prepare planting holes early (i.e., in August or September) and cup-in the compound fertiliser so that all fields are ready for planting by the end of October.
- It is unwise to plant in October, unless substantial rain has been received (i.e., more than 50 mm within 3 days and the soil is wet down to 45 cm on clays and 60 cm on sands) or unless you have irrigation.
- In November, after each rainfall event, check the soil moisture status by digging in the field. Sow seed if the soil is wet down to 30 cm on clay soils or 50 cm on sandy soils. If more than 25 mm of rain has fallen, plant as much as you can in two days and then stop until further rain is received.
- If no planting rains have fallen by the second week of November, then dry plant. Ensure the seed is placed into dry soil at a depth of 5-6cm.
- In all planting operations ensure the seed is well covered with loose soil and pressed, so as to achieve good seed-soil contact. Avoid covering the seed with clods or rocks.
- Soaking seeds in water for 12 hours (overnight) hastens germination, but such seed must be planted into wet soil the day after soaking. However, with this practice farmers should note that they will be washing away the fungicides and pesticides which are normally used to treat certified seed. These prevent early disease and pest infestations.

Mid-season management

Weed control, especially in the first 10 weeks after crop emergence is essential.

- Hoeing is effective, and is easiest when weeds are small and on small portions.
- However, if the fields are big enough and farmer's management is good, herbicides are recommended.
- There is a wide selection of pre-emergence herbicides for maize, but a common combination is Alachlor/Metalachlor and Atrazine.
- When applying herbicides, read and follow the label instructions and take the necessary safety precautions.
- Pre-emergence should always be sprayed in most soils to activate and incorporate the herbicides to create a herbicide layer which suppreses weed seed germination.

- Rain-harvesting techniques should be employed as early as possible, e.g., mulching, pot-holing, tied-ridging or wet ripping. This is particularly beneficial in the dry areas where rainfall is unreliable.
  N.B. Wet ripping should always be carried out before the crop reaches 3 weeks after emergence to avert root damage

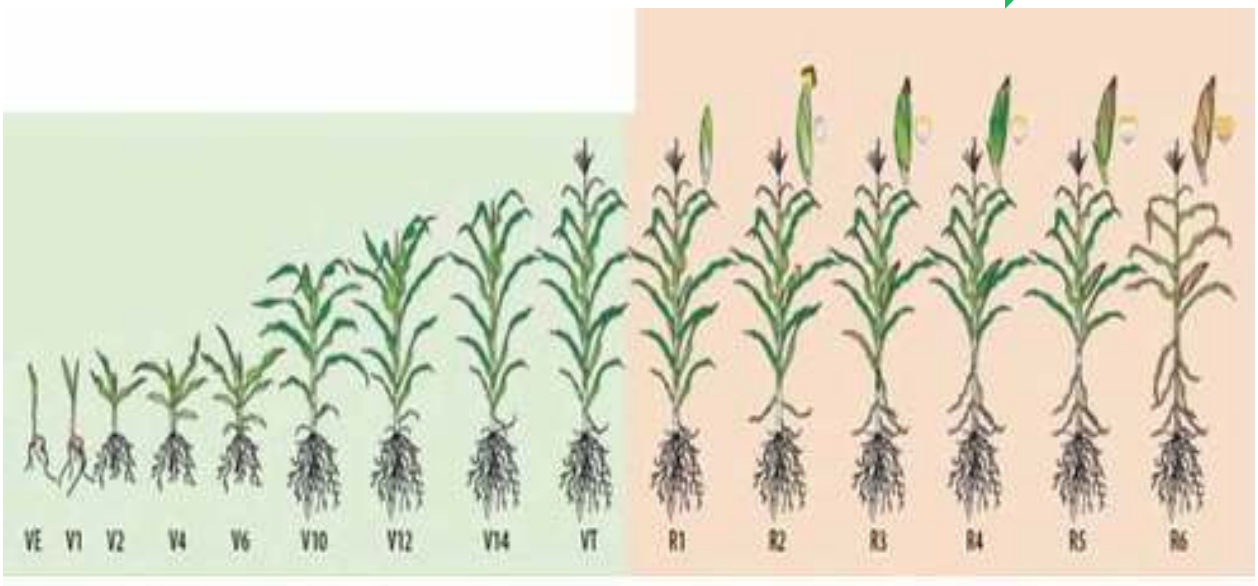
- Top dress with Ammonium Nitrate/Urea when the maize is 4 to 6 weeks old.
- Maize on sandy soils may require a split top-dressing, with the first half applied at 4 weeks and the second at 7 weeks after emergence.
- Use appropriate sized fertiliser cups to place the fertiliser near each plant, or dribble-band the fertiliser along the row with a suitably calibrated pipe attached to a bag (chola).
- Fertiliser applicators are recommended to band top dressing fertilizer on the inter-rows. These can be calibrated and adjusted depending on the intended rates.
- In many cases on large scale maize production a vicon is used to broadcast top dressing fertilisers.

- Check for stalk borer damage at 4 to 6 weeks after planting.
- The characteristic evidence of early infection of stalk borer is the appearance of numerous small holes in the new leaves in the funnel.
- If necessary apply insecticide granules or sprays into the funnels of the maize plants to control stalkborers.
- It is important to control the first generation of stalkborers, otherwise a second generation may develop in large numbers which may be difficult to control.

- Start to scout for Fall Army Worm damage at 2 to 3 weeks after planting and make spraying decisions early before damage reaches economic levels.
- Leaves show typical bullet-shot holes and leaves dry horse manure-like droppings called frass on the leaves particularly the central whorl. Leaves show a typical "window pane" damage.
- The damage includes holes on the stem causing significant stalk lodge, the cob and the tassel. See appendices for more details on Fall Army Worm pest identification and control.

Insect pests and pesticide remedies

Cutworms, Fall Armyworm, Aphids, Stink bugs, Leaf beetles, Stem borers, Leaf hopers, Grasshoppers

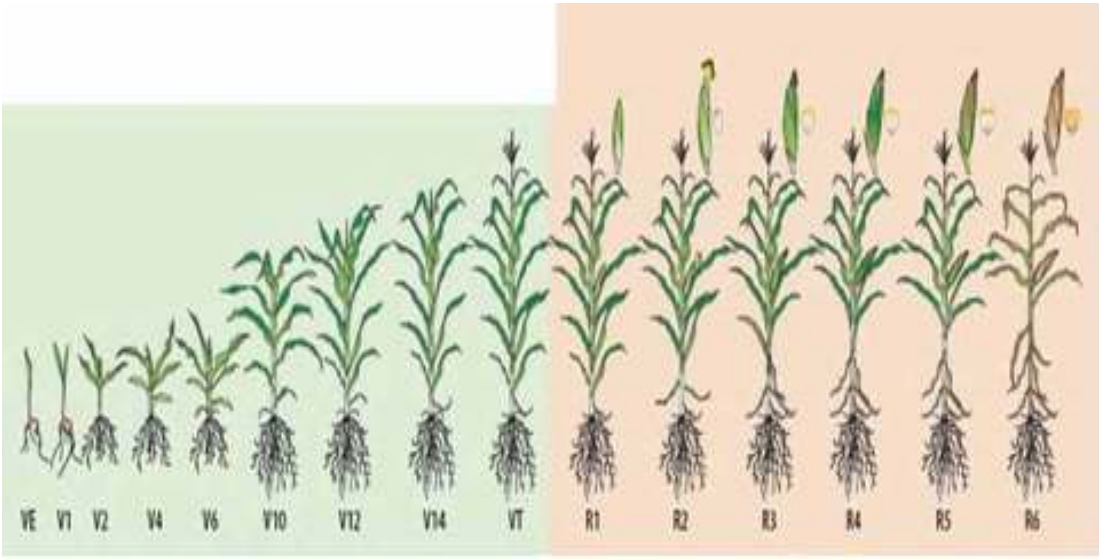


Super Dash, Blanket, Macten, Lufenuron, Ema, Tide Plus, Thionex, Karate Zeon 5CS, Blast Super, Dipterex, Bulldock etc

Herbicides

Pre-emergence

Atrazine
Dual Magnum
Lasso
Metalachlor
Prowl
Alachlor
Intergrity
Glyphosate
etc



Post- emergence

Servian, Frontier Optima, Maximus, Accent, Stellar Star, Prowl, Bateleur Gold, Basagran, Revolt etc

- Control late weeds with a hoe or post emergence herbicides from flowering onwards, as this reduces weed pressure, weed seed reservoirs, and also makes the harvesting operation easier.

- Harvest the crop as early as possible to reduce in-field losses and weevil infections. If whole cobs are harvested and placed in an outside grain crib for storage until shelling, protect this from rain.
- Shell the cobs as soon as possible to minimise infection by weevils.
- Store the grain when it is dry and protect it from insects and rodents.
- The best place for grain storage is a cool dry room that prohibits the entry of moisture and rodents. The application of a grain protectant chemical will prevent infection by weevils and other storage pests.

Hard facts about weeds in maize

- The annual yield loss in maize as a result of weed problems can reach 50% or more
- The crop must have a good head start ahead of weeds
- The crop must be weed free for the first 10 weeks of the crop cycle after crop emergence
- This is the most critical time when the crop requires at least 50% of the nutrients and hence must be weed free
- If a farmer fails to control weeds in maize in the first 5 weeks of the crop cycle, then 50% of the yields could be lost.
- A good and important example, Shamva grass can reduce maize yields by 57-85% if not controlled throughout the season.
- Never allow weeds to seed, it will enhance the weed seed bank and result in future weed control costs increases and difficulties.
- One year of seeding makes seven years of weeding
- There are more than 20 herbicides registered in Zimbabwe which can be sprayed on maize crop. The choice is very wide!

Yield forecasting in maize

Steps:

- Walk the land to ensure that the stand is even, standing (not lodging) and there are not many gaps.
- Reap the cobs from a measured 20 sq. metres. If the rows are at 90cm, then reap 22m row length; and if the rows are 75cm, then measure 26.6m row length.
- Shell the cobs, weigh the grain and determine the moisture content using a moisture meter
- Do this for three or four separate samples at widely separate points and determine the average
- Use the formula below to calculate yield average estimate corrected to 1 ha and to 12.5% Moisture Content
- Mass Grain (Kg) x (100-moisture content)/ (100-12.5) x10 000/20

NB: The formula automatically correct the final yield to 12.5% moisture content

The crop must be weed free for the first 10 weeks of the crop cycle after crop emergence.

11 Ton PLUS Club

NATIONAL WINNER
Tinashe Ziki

"We planted 1100ha and we are happy with the performance of SC 719 this year"
Yield 21.92 T/Ha

FIRST RUNNER UP
Kudakwashe Kudenga

"We achieved 21.86 Ton/Ha with Seed Co SC 727 and I'm very happy. Good land preparation and use of good quality seed goes a long way"

SECOND RUNNER UP
Eskbank Farm-E. Nascmento

SC 608 is our yellow variety here and has extremely performed well for us every year"
Yield 15.7 T/Ha

Register to enter the Seed Co Annual 11 Ton Plus contest
-Have at least 10ha of maize
-The adjudication team comprising of Agritex and farmer unions in Zimbabwe randomly select the best 3 x 1 hectare blocks, combine harvest and determine the yield at 12.5% moisture content.

SEED·CO
The African Seed Company

2016/17 SEASON SEED CO 11 Ton PLUS Club RESULTS

SEED·CO
The African Seed Company

RANKING	FARMER NAME	PROVINCE	YIELD @ 12.5% MOISTURE-T/HA	VARIETY
1	Tinashe Ziki	Mash West	21.92	SC 719
2	Kuda Kudenga	Mash East	21.86	SC 727
3	Eskbank Farm-E. Nascmento	Mash Central	15.66	SC 608
4	ARDA/Trek-Mbuya Nehanda Estate	Mash West	15.54	SC 637
5	Mike Mutasa	Mash West	15.45	SC 719
6	Oswell Chakwanda	Mash West	15.32	SC 727
7	Peter Dilmetris	Mash West	15.26	SC 727
8	Hashmon Matemera	Mash West	15.00	SC 719
9	Irmaos-Angus Guthrie	Mash Central	14.90	SC 727
10	Mwenewazvo Estates	Mash Central	14.70	SC 727
11	Leticia Chako Tapfumaneyi	Mash East	14.53	SC 727
12	Richard Chinyani and Lynfield	Mash West	14.45	SC 727
13	Godfrey and Helen Pfachi	Mash Central	14.38	SC 727
14	Len Smit	Mash Central	14.00	SC 727
15	Eng. R. J Chitsiko	Mash West	13.90	SC 727
16	Christopher Nyangoni	Mash Central	12.51	SC 727
17	Merry Ellen-Halsteads Brothers	Mat North	12.42	SC 727
18	Berry Stewart	Mash West	12.40	SC 727
19	Bulelani Usher Cakana	Mash West	12.35	SC 727
20	Moddy Mahoho	Mash Central	12.08	SC 727
21	Conorpia Farm	Mash Central	12.01	SC 727
22	Glenara Esatates	Mash Central	11.99	SC 727
23	Kunatsa Estates	Mash Central	11.86	SC 727
24	Joseph Nyakudya	Mash East	11.85	SC 727
25	Justin and Idah Mupamhanga	Mash Central	11.70	SC 727
26	Moffat Sefu	Mash West	11.50	SC 727
27	ART Farm Commercial Farm	Harare	11.32	SC 727
28	Petronella Midzi	Mash East	11.25	SC 727
29	ARDA/Trek-Antelope	Mat South	11.20	SC 529
30	Billabong Farm	Mash Central	11.12	SC 727
31	Inamo Agri-Gary Parharm	Mash Central	11.03	SC 727
32	Grace Hama	Mash Central	11.00	SC 727
33	Noah Mangondo	Mash East	11.00	SC 727

Competition Judge By:

AGRITEX
Department of Agriculture
Technical and Extension Services

ZNFU

cfu Commercial Farmers Unioun

ZCFU

zfu

Sorghum Production

This falls under small grain cereals which are drought tolerant and should be included in rotations on small-scale farms. Not only may the grain be used for human food, but they are also useful for livestock feeding and silage. A break of two or three years between sorghum crops is recommended because sorghum is susceptible to nematodes. Rotate with broadleaf crops, like soyabean or groundnuts.

Soils and climate

These crops grow best in warm areas. They are grown on a wide range of soils. Sorghum is sensitive to nematodes, especially on sandy soils, and therefore sorghum must not be grown continuously on its own or in close rotation with maize.

Fertilisation

- Sorghum does not do well on sandy soils.
- Generally, little fertiliser is required or applied to small grain crops.
- However, they respond to manure applications, and where rainfall is favourable, sorghum, in particular, responds well to a low application of basal fertilizer (100 to 300 kg of 7.14.7 per ha) followed with a top dressing of 100 to 200 kg per ha of 28 - 34% N fertilizer.
- Sorghum also favours a soil pH of 5.5 to 6.8 on a Calcium Chloride Scale.

Varietal choice

Soils and climate

The two preferred varieties in Zimbabwe are:

SC SILA

- Used for human consumption and livestock feed.
- Medium maturing variety with a good yield potential of up to 6 T/Ha.
- Short stature and does not lodge easily.
- Tolerant to most sorghum diseases.

* Can be used for clear and opaque beer brewing

SC SMILE

- Brown seeded OPV with good brewing qualities.
- Early maturing variety.
- Stiff straw that averts lodging.
- High yield potential of up to 6 T/Ha under good management.

* Very good for heat and drought stress

Characteristics of Seed Co Sorghum varieties

	MACIA	SC SILA	SC SMILE
Plant height (cm)	150	150	80-100
Days to maturity:			
Lowveld (below 800 m)	110	110	105
Middleveld (800 – 1,200 m)	120	120	113
Highveld (over 1,200m)	130	130	120
Leaf Blight Score	2.4	2.2	4.1
Sooty Stripe Score	4.6	4.5	1.4
Mass/1,000 seed (g)	20	20	20
Grain Colour	White	White	Brown
Principle use	Meal	Meal	Brew

Production practices
Nutrients required per tonne of grain

Nutrient	Total uptake (Kg)	Nutrients removed In grain (Kg)
Nitrogen (N)	**30**	**18.0**
Phosphate (P2 O5)	**10**	**7.2**
Potash (K2O)	**30**	**5.4**

Planting

- It is not advisable to continuously plant a sorghum crop due to pest build-up.
- Spacing: 75 x 5 cm, 5 – 7 kg seed/ha for small seed and up to 10 kg for large seed. Final stand for SC Smile, SC Sila and Macia should be 200 000 and 250 000 plants/ha, respectively.
- Planting Time: From end of November through to end of December in Zimbabwe.
- Keep fields weed free by making use of herbicides or hoe weeding
- Scout for aphids and bollworm during head emergence and grain filling periods.
- Harvest early to avoid bird damage and should engage bird scares when growing susceptible varieties.
- It is not advisable to continuously plant a sorghum crop due to pest build-up.
- Spacing: 75 X 5 cm, 5 – 7 kg seed/ha for small seed and up to 10 kg for large seed. Final stand for SC Smile SC Sila and Macia should be 200 000 and 250 000 plants/ha, respectively.
- Planting Time: From end of November through to end of December in Zimbabwe.
- Keep fields weed free by making use of herbicides or hoe weeding
- Scout for aphids and bollworm during head emergence and grain filling periods.
- Harvest early to avoid bird damage and should engage bird scares when growing susceptible varieties.
- Small grain crops may be planted after maize in early December. They can be sown in 50 to 100 cm rows. A seedingrate of 5 to 15 kg is recommended depending on variety and use.

- Basal fertilizer is broadcast and incorporated by disking before planting can commence.
- The common practice of planting is broadcasting seed on a well ploughed land (with fine tilth) and covering lightly using a light harrow, roller, bush drag by cattle over the lands and covered to a depth of 2-3 cm.
- Mechanical planting using seed drill can also be done but this will require high seed rates and more labour for thinning.

Thinning

- Thinning should be done to establish an in-row spacing of 15-20 cm before tilling begins and normally 4 weeks after emergence.
- At this stage it is also recommended to fill in for the seeds that did not germinate or seedlings that were affected by diseases.

Recommended seed spacings, seed rate and populations for sorghum

	Average Annual Rainfall			
	Below 500	500 - 650	650 - 800	Irrigated
		Recommended plant population		
	60000	90000	110000	250000
Row Width		Within row seed spacing (mm)		
90cm	155	85	60	30
75cm	140	100	75	40
Seed Rate	5kg/ha	8kg/ha	12kg/ha	15kg/ha

Pests

- Aphids: These usually appear during head emergence and flowering. If necessary, spray with Dimethoate (Rogor) or Mercaptothion (Malathion).
- Heliothis bollworm: These caterpillars may attack the heads after flowering. Control with Thiodan before 1st February or with synthetic pyrethroids from February onwards.
- Stalk borer: This is the same pest as in maize. If necessary, use trichlorfon (Dipterex) or Endosulfan (Thiodan) granules applied in the funnels at 3 to 6 weeks after planting. Alternatively, spray into the funnels with Carbaryl. Extensive damage by stalk borers may result in the introduction of Fusarium stalk rot, stem lodging and considerable loss of grain yield.
- Shoot fly: Feeding larvae causes drying up of central leaf and dead heart symptoms on 1-4 week old seedlings. Timely planting, Thionex and Carbaryl are the chemical control remedies.
- Spider mites: Suck sap from the leaves to cause stunting especially rife during hot dry spells. Acaricides will be a good chemical control measure.
- Birds: These become a problem as the crop approaches maturity. Bird scaring is the only effective way of minimising bird damage, but community co-operation in planting dates may also help to spread the risk. Red/Brown sorghum is bird resistant.

Diseases

- Leaf Blight: This is common in southern Africa, and is favoured by moderate air temperatures and wet conditions or heavy dews. Dry weather retards the disease. Rotation with non-susceptible crops (non-grasses) aids in destruction of infected residue thereby reducing the level of primary infection.
- Downey mildew: Infested seedling leaves are chlorotic, stunted and pre-mature death may result. Use of Seed Co resistant varieties is the smartest control method
- Smut: Ear head becomes swollen and turn grey. Use of Seed Co resistant varieties is the smartest control method
- Ergot is an important fungal disease. It infects the flowers. Symptoms: sticky fluid or honey dew from the flowers. Control: resistant varieties, chemical fungicides.

Other management tips:

- Sorghum is very sensitive to weed competition especially during the early stages of growth and establishment. Normally 2-3 hoe-weeding regimes are done even though the use of pre-emergence herbicides like Atrazine can be recommended in soils with greater than 25% clay content. Control weeds throughout, but especially in the early stages of crop growth.
- Employ rain harvesting techniques (pot-holing or tied-ridging).
- Harvest early to minimise bird damage.
- If red sorghum destined for brewing is to be artificially dried, low air temperatures (35 to 38 degrees Celsius) must be used in order to preserve grain quality and germination ability.

Harvesting/drying /storage

Harvesting is normally done when plants reach physiological maturity. Leaves will be turning yellowish and beginning to dry up naturally. Combine harvesting can be done with suitable heads.

Marketing

Grain sorghum is marketed through the Grain Marketing Board that pre-sets the prices and also other private buyers such as milling companies, beer malting companies, etc. Private companies like Delta may buy brewing sorghum mostly from those farmers under their growers' contracts.

Soyabean production

Soils and climate

- Soyabean is a legume plant suited to soils with relatively high clay content, as it does not do very well on weak sands. The crop is also sensitive to soil acidity hence does well on pH ranges of 5.5 to 6.5.

- Soyabean requires reliable rainfall, particularly from flowering to pod maturity. The crop requires about 550-650 mm of water to physiological maturity.

- It is a good crop to grow in rotation with maize, cotton and wheat. The yields of these other crops are usually enhanced when following soyabean, as shown in the Table below.

- The ideal temperature range for growth ranges from 18 to 30 degrees Celcius. The crop is sensitive to day length (photo-periodism) and as such requires early planting around mid November in the highvelds. Shorter day length as experienced in February and March affect the frame size and reduces the number of nodes and pods per plant especially if shorter days coincide with vegetable growth, so planting should be done as early as mid - November.

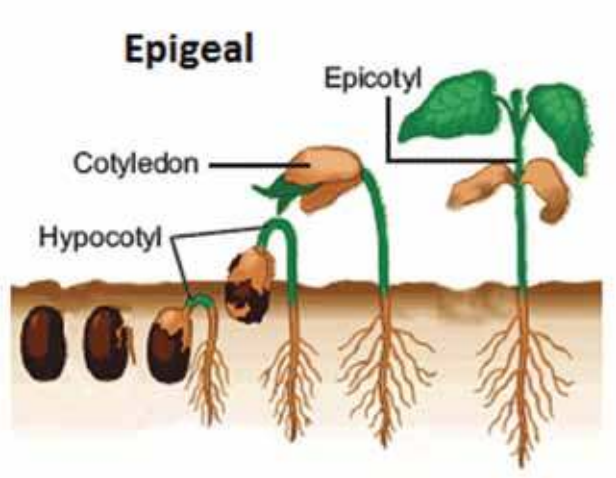
- Soyabean is a nutritious addition to human and animal feed. It is also used in making cooking oil, margarine, soya chunks etc. It is the richest crop in terms of crude protein (ranges between 35-45 %) and contains 20 % oil.

The yields of wheat (t/ha) following either maize or soyabeans at different levels of nitrogen.

Applied Nitrogen (kg/ha) →	0	40	80	120	160	200
Previous Crop ↓						
Maize	5.5	7.0	7.3	8.5	9.1	9.5
Soyabeans	6.4	7.2	8.0	9.4	10.0	9.5

Land preparation

- Land should be ploughed after harvesting the previous crop to conserve moisture.
- A seedbed with fine tilth should always be achieved as soyabean endows epigeal germination characteristic. (see diagram).
- •A fine tilth will ensure a good seed-soil contact and aid good and even crop establishment. An evenly prepared soil will enhance harvestability when using combine harvesters



Fertilisation

- Since soyabean is sensitive to soil acidity, check the soil pH (acidity or basicity) in winter.
- If necessary, apply lime at the recommended rate to bring the soil to a pH of 5.5 to 6.5 (CaCl2 scale).

- Soyabean grows well on residual fertiliser.
- However, a general recommendation is to apply a pre-plant application of 200 to 300 kg per ha of either a basal fertiliser (e.g. compound L; 5.17.10 with 8.5S and 0.25B), or Single Super Phosphate before planting, particularly where fertility is low. Soyabean responds well to manure application.
- Soyabean does not need much nitrogen in the basal fertiliser, but only requires a starter up Nitrogen for the first 6 weeks after planting.
- The crop does not require nitrogen fertiliser hence no need for top dressing, since it is able to obtain its nitrogen require-ments from the nitrogen fixation process i.e. if the seed is properly dressed with Rhizobia pre-planting.
- For Nitrogen fixation to take place sufficient amounts of Rhizobia is required and this is normally supplemented through seed dressing.
- Direct contact between seed and basal fertiliser must be avoided and it is therefore recommended to cover the basal fertiliser with a film of soil (2cm) before planting the soyabean crop.

Basal fertiliser application

- Make out furrows 5-7cm deep.
- Band the fertilser into the furrow and cover with a film of soil (2cm) to avoid direct contact of fertiliser with seed as the fertiliser can 'burn' the seed.

Table 4:Average nutrient requirements of soyabean kg/ha

	Nutrient status of soil		
Nutrient	**Good**	**Medium**	**Poor**
N	Nil	20 - 30	30 - 40
P2 05	Nil	20 - 30	40 - 60
K2 0	Nil	20 - 30	40 - 60

- On soils of poor to medium soil fertility, a small amount of fertiliser is recommended to sustain the crop for the first six weeks before effective nodulation occurs.
- The recommended fertiliser application is 150-200 kg of Compound L (Cottonfert) or Soya Blend applied as basal fertiliser.
- It is therefore essential to apply Rhizobium inoculant to the seed at planting. This inoculant is obtainable from Seed Co.

Inoculation process

For soyabean to be able to form nodules and fix nitrogen the seeds must be inoculated with Rhizobia as most soils in Zimbabwe are deficient of this bacteria.

Rhizobium is a living culture and must be handled properly for it to work effectively. In particular, do not leave the inoculant in a sunny, hot place, but rather store it in a cool, dark place. eg a fridge

- spread 100kg of seed on a clean plastic sheet or a large container
- mix 100g of inoculant and 1 litre of water in a clean bucket
- add 50g of sugar into the soultion. The sugar act as an adhesive between the seed and the inoculant
- stir the solution for 30 seconds
- sprinkle the inoculant mix onto the seed
- as you sprinkle the inoculant onto the seed, turn the seed gently to ensure that all seeds are coated with the inoculant. The inoculated seed should look shiny wet.
- plant immediately after inoculation and protect the inoculated seed from direct sunlight by covering with a paper or mixing in a shed.
- sow seeds in cool moist soils and cover immediately afterwards to cover rhizobia from direct sunlight.

Seed dressing

- Fungicide seed dressing may help to ensure good crop emergence and establishment.
- Treated seed protects the seed against diseases such as damping off and sore shin. Captan, Thirum and Vitavax are the seed dressing options.

Checking for nodulation

- Active nodules are bright pink inside when cut through with a clean knife whereas inactive young nodules are white.
- It is always important to do this nodulation test 6 weeks after emergence as this can inform whether to come in with a light top dress if nodulation did not take place as expected.
- Extended wet conditions in the soil create an anaerobic environment which reduces nodulation.
- In the case where nodulation is weak a light top dressing of about 75kg/Ha may be recommended and should be applied before flowering.

Varietal choice

There are two basic types of soyabean cultivars: determinate and indeterminate. This refers to the way the plant grows. Determinate cultivars grow vegetative for about six weeks and then begin flowering, having put on 10 to 12 leaves. Once flowering begins, no further new leaves are produced on the main stem.

- Indeterminate cultivars, on the other hand, grow vegetative for about six weeks, then begin flowering when the main stem has about 10 leaves, but at the same time as flowering, the stem continues to grow for another three weeks or so, producing another five to seven leaves.
- Thus, the vegetative and reproductive growth periods overlap in indeterminate cultivars but not in determinate cultivars.
- Indeterminate cultivars also tend to grow taller than determinate cultivars.

- For these reasons, determinate cultivars are better suited to warm, fast growing environments like the Lowveld, where irrigation is available, whilst on the Middleveld and Highveld, both types are suitable.
- Under drought conditions, indeterminates may have some advantage over determinates. In the Highveld, both types are suitable. Apart from the growth habit of the cultivars, farmers must choose cultivars which have high yield potential; do not lodge; have high clearance of pods from the ground; good resistance to disease; and take a long time from maturity to pod shattering.

Choosing the right soyabean variety

When choosing a variety to grow in your particular farming area the following points are very important:

- The variety must fit in a growing season of 4 to 5 months.
- The variety should give the highest yield as well as good stability across seasons and for that particular area.
- The variety must be resistant to lodging especially where combine harvesters are used
- The variety should have a longer period between physiological maturity (time when no more dry matter is added to seed) and pod shattering.
- High pod clearance to reduce losses when harvesting with a combine harvester.
- Rapid stem dehydration -stems must dry concurrently with the pods.
- Resistance to diseases, especially Red Leaf Blotch (Pyrenochaeta glycines); Frogeye (Cercospora sojina); Soyabean
  Rust (Phakospora pachyrhizi).

Some of the farmers' choice varieties available from Seed Co include:

Indeterminate

SC Serenade
SC Safari
SC Squire
SC Saga
SC Spike

Determinate

SC Status
SC Sequel
SC Sentinel (New)
SC Santa

- Newer varieties are continuously being produced, and therefore it is important to keep up to date with these, as the new ones always have an advantage over the old varieties in yield and agronomic traits such as disease resistance.

Characteristics of Seed Co soyabean varieties

Varieties	Serenade	Safari	Sequel	SC Spike	Status	Squire
Growth habit	Indeterminate	Indeterminate	Determinate	indeterminate	Determinate	Indeterminate
Recommended areas of producti	Highveld & Middleveld in Zimbabwe	Highveld & Middleveld in Zimbabwe	All areas of Zimbabwe		All areas of Zimbabwe	Highveld & Middleveld in Zimbabwe
Plant heights in centimetres	102	100	83	105	88	105.0
Pod clearance in centimetres	17	16	16	20	16	18
Lowveld	N/A	N\A	120	126	119	N\A
Middleveld	122	120	125	130	124	122
Highveld	128	125	128	140	127	128
Number of days to pod shattering	26	28	25	27	26	25
Seed Hilum colour	Black	Yellow	Black	Brown	Brown	Yellow
Mass of 1000 seeds (g)	230	210	210	190	190	230
Bacterial blight	2.6	2.0	2.5	1.2	2.1	2.5
Wildfire	1.0	1.0	1.6	1.5	1.5	2.1
Downy mildew	1.2	2.0	2.0	1.3	1.8	1.0
Red leaf blotch	2.1	1.6	2.5	1.8	2.5	2.1
Frogeye leafspot	1.2	1.2	1.3	1.4	1.5	1.2
Soyabean rust (see Note 1 below)	3.0 4.0	3.0 4.0	1 1.7	3.0 4.0	1.0 1.5	1 1.5

Notes: 1st Digit 1= Bottom third of leaf canopy on the plants 2nd Digit 1= No lesions
2= Middle third of leaf canopy on the plants 2= Light lesion density
3= Top third of leaf canopy on the plants 3= Moderate lesion density
4= Heavy lesion density

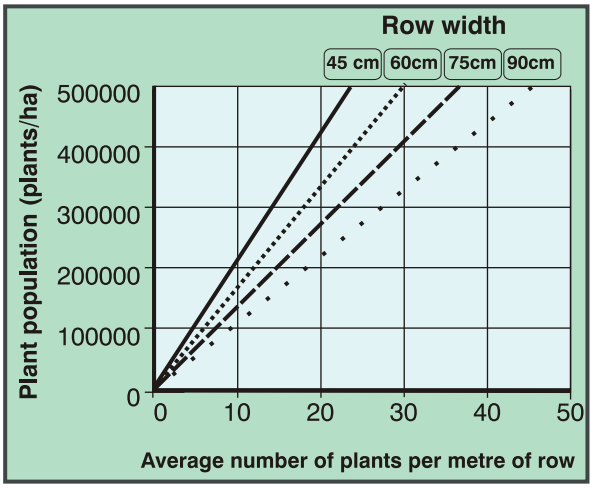
Planting and crop management

- The seed rate is about 90-100 kg per ha.
- The desirable plant population is around 350 000 plants per ha, but soyabean is capable of adapting to a wide range of plant populations. The minimum plant population is 200 000 plants per ha, while 550 000 plants per ha is the maximum.
- The higher the plant population, the greater is the danger of lodging, but the higher is the pod clearance.
- Shorter stature varieties like Status and Sequel should be planted at a higher population than taller varieties

- Row spacing may be from 25 to 90 cm.
- The closer the row spacing, the higher the yield, but the yield advantage is not great (about 5 to10 %).
- The wider the row, the closer the seeds placed in the row, and this sometimes helps, especially for emergence on soils that have a tendency to cap (seal on the surface).
- Do not plant seed deeper than 5 cm. Be careful not to plant soyabean in such a way that when covered with soil it is in a furrow; rather the soil should form a slight mound over the row, as this makes it easier for the seedling to emerge. It is essential not to plant too deep. Seed should be planted 25-50 mm deep, depending on soil texture. If soil crusting occurs before emergence, wetting the soil with irrigation or breaking the crust with a 'millipede implement' will improve emergence.
- The time to plant soyabean is after planting maize, but this should preferably be before mid-December.
- Soyabean is sensitive to day length (photoperiodism), such that when planted late there is a significant reduction in the number of nodes and number of pods hence yields will be affected.
- A fungicide seed dressing of, for example, Thiram 80 WP (85 g/50 kg seed) or Flusilazole (Captan 50 WP at 125 g/50 kg seed) will help ensure good emergence.
- Soyabean is particularly sensitive to weed competition during the first six weeks of the season. Control weeds adequately during this period.

Soyabean planting guide

Target Harvest Population per ha	Required Planting Population per ha	Required average number of seeds per metre of row				Seeding rate (kg/ha)		
		Row width (m)				Thousand seed weight (g)		
		0.45	0.60	0.75	0.90	250	220	190
200000	248000	11	15	19	22	62	54	47
240000	297000	13	18	22	27	74	65	57
280000	347000	16	21	26	31	87	76	66
320000	396000	18	24	30	36	100	87	75
360000	446000	20	27	33	40	111	98	85
400000	495000	22	30	37	45	124	109	94
440000	545000	25	33	41	49	136	120	104



Mid-season crop management

- Soyabean is very susceptible to drought during the flowering and pod-filling stage.
  The pod filling stage occurs in the last third of the crop's life, and the beginning of this stage is identified when the pods on the upper nodes of the main stem are 2 cm long and the small seeds are visible in the pods.
- If supplementary irrigation is available, this is the time to apply water, as it can produce large yield increases.

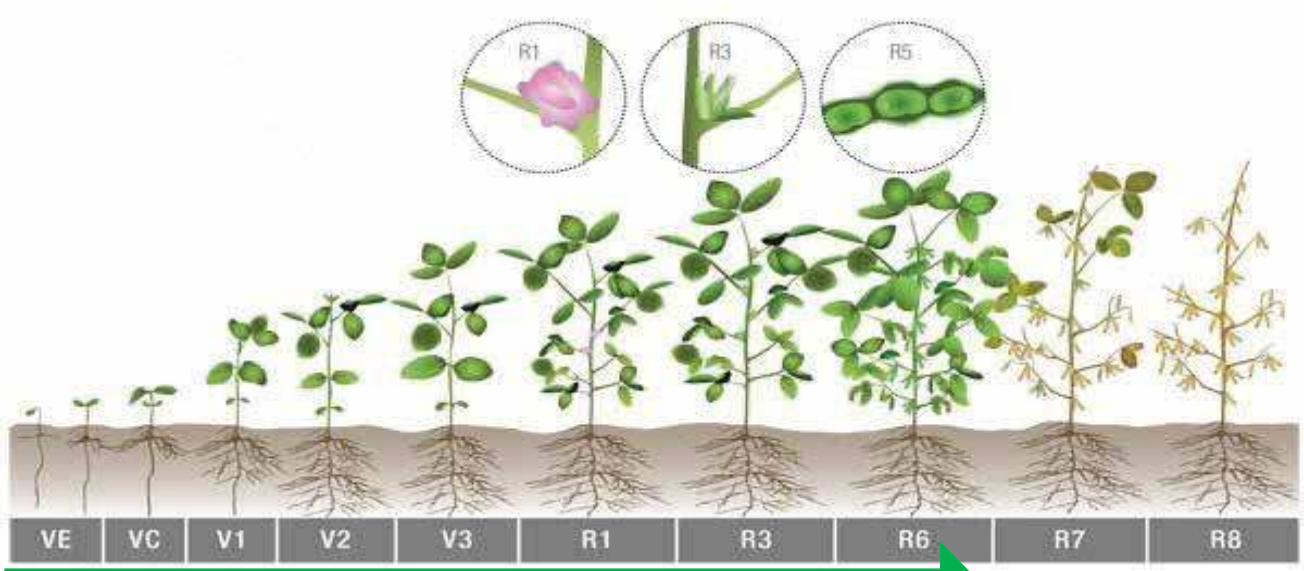
Supplementary irrigation (if available) should target these critical stages (i.e. if they coincide with excessive dry spells):

For a crop taking about 125 days from planting to physiological maturity these critical periods will be as follows:-
-Germination - day 1 to day 6
-Flowering - day 55 to day 75
-Pod fill - day 95 to day 125

NB. Depending on variety, if the flowering period coincides with excessive moisture stress, only 25% of the flowers will set into pods while the rest will abort.

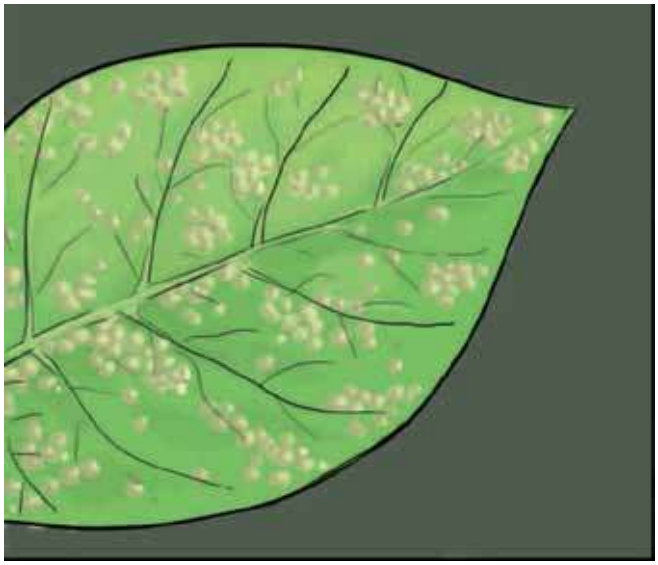
Insect Pests and control options

Cutworms, Armyworms, Aphids, Stink bugs, Leaf beetles, Stem borers, Loopers etc



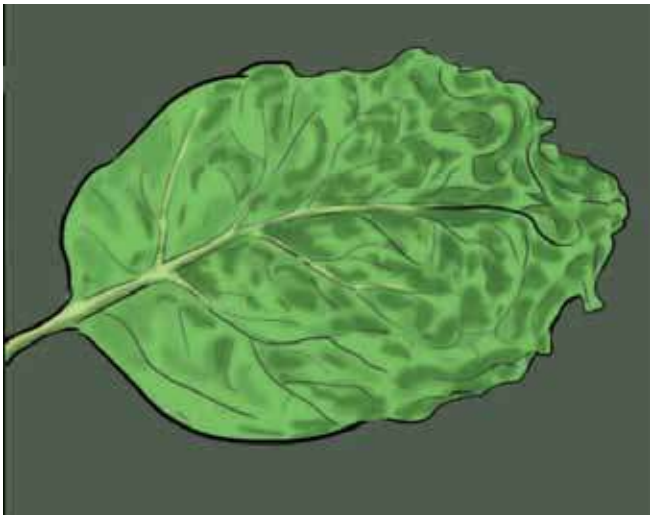
Rogor, Karate, Cabaryl, Decis, Dichlorvos, Lambda, Fenvelerate, Ampligo etc

Diseases and control



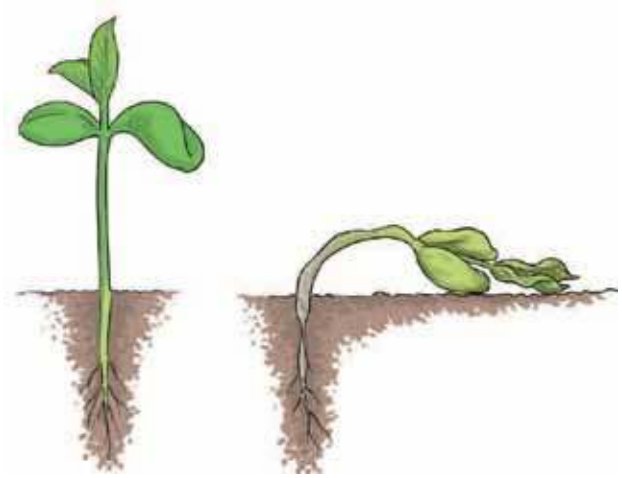
Soybean rust:

- Infected leaves have small dark brown to reddish brown lesions.
- Small raised bumps may occur on the lower leaf surface.
- Premature defoliation may result and can cause high yield losses. See appendices for chemical control options.



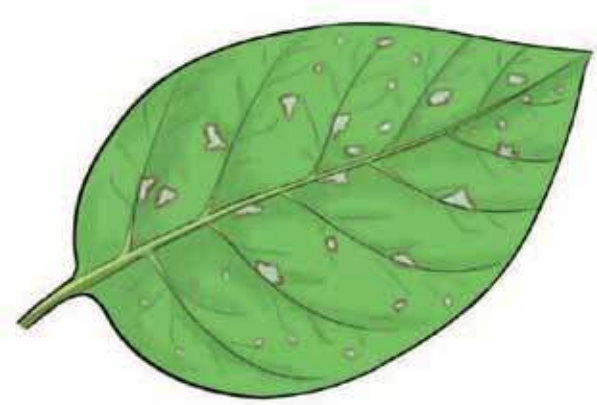
Downy mildew:

- Symptoms include yellowish-green areas with indefinite borders on the upper leaf surface.
- The infected areas can enlarge and become brown and papery.
- In severe cases, infected leaves die and fall off.
- The disease also attacks the pods and infects the seeds. See appendices for chemical control options.



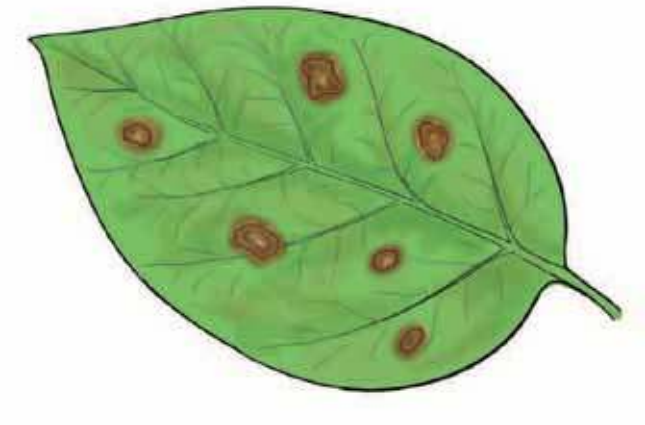
Damping off:

- This is a seed-borne disease.
- The disease causes rotting of seeds before emergence from the soil or death of seedlings after emergence.
- When seedlings emerge from the soil, they often have brown, sunken cankers on the leaves, which can become covered with pink spores in moist weather. See appendices for chemical control options.



Frogeye leaf spot:

- Symptoms consist of brown, circular to irregular spots with narrow reddish brown margins on the leaf surfaces.
- When mature seeds are infected, lesions can develop on stems and pods.
- Infected seeds may show dark grey or brown discoloration in small specks to large blotches.
- The fungus survives in infected crop residues and in infected seeds. It is important to invest in certified fresh seed every year. See appendices for chemical control options.



Red leaf blotch:

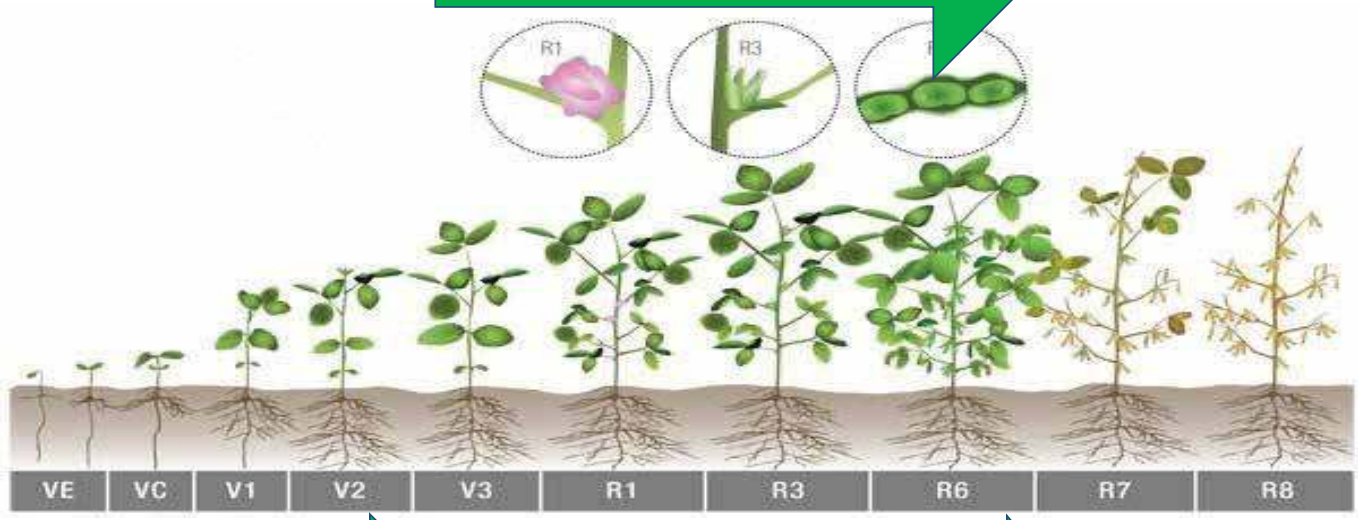
- In the first stage of the disease lesions appear on unifoliolate leaves associated with primary leaf vein.
- At this point the disease is easily confused with other diseases or cultural conditions affecting soybeans.
- Later, dark red spots on the upper leaf surfaces and similar spots with reddish brown and dark borders on the lower leaf surfaces develop on trifoliate leaves.

Bacterial blight:

- When plants are infected early in the season they may be stunted and die.
- Symptoms in later growth stages consist of angular lesions, which begin as small water- soaked yellow to light brown spots on the leaves.
- The centres of the spots will turn a dark reddish-brown to black and dry out.
- Water- soaked tissue then surrounds the lesions and is bordered by a yellowish-green halo.
- Eventually the lesions will fall out of the leaf.
- The disease spreads during windy rainstorms and during cultivation while the foliage is wet.
- The bacteria are carried over in crop debris and in infected seeds.
- Always use fresh certified seed every year.
- Use of copper based fungicides helps prevent bacterial diseases.

Fusarium, Rhizoctonia, Phytopthora & Pythium root rot

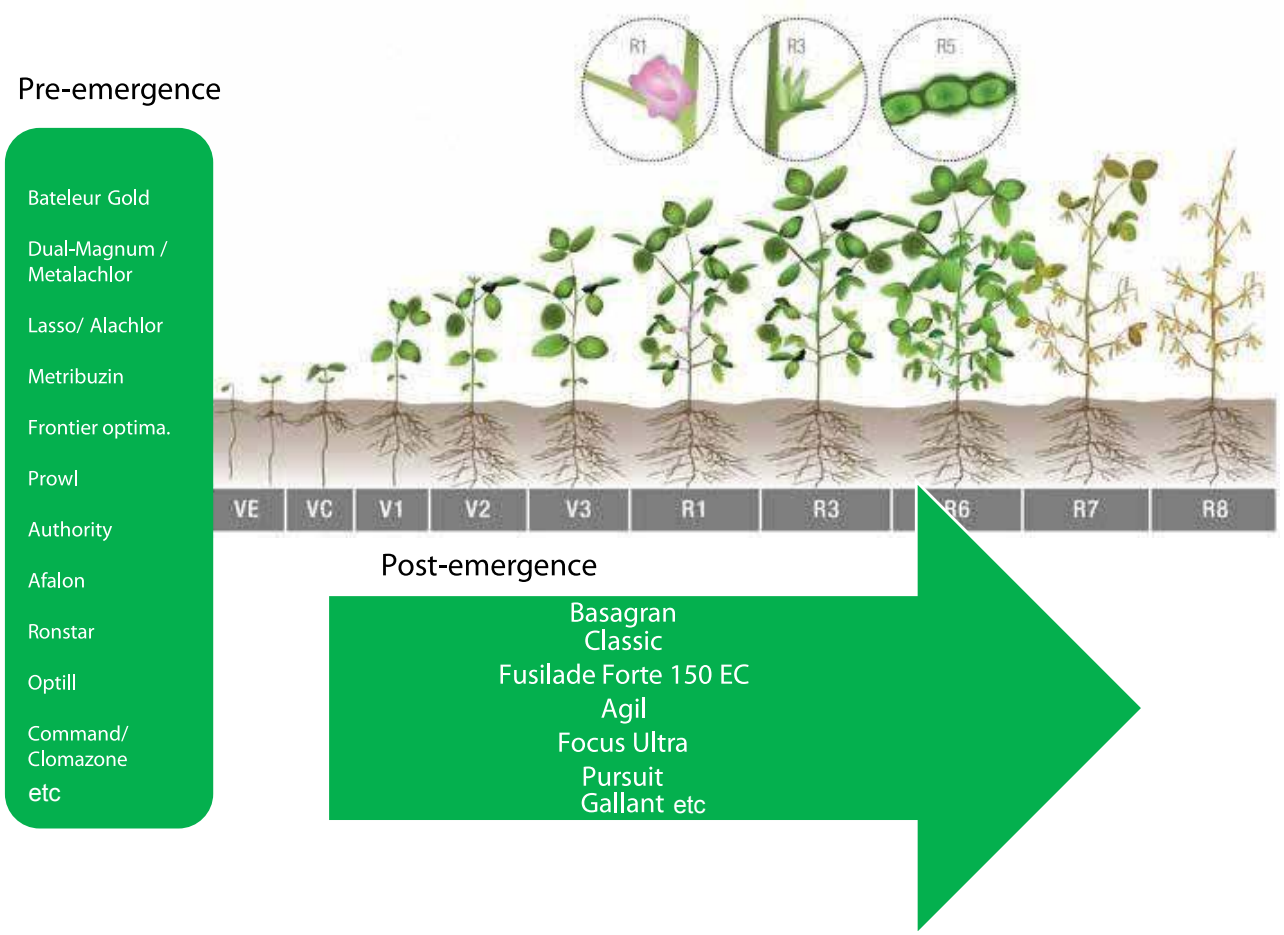
Downy mildew, Powdery mildew, Soybean Rust, Red leaf Blotch, Frog Eye **etc**



Apron Star, Vitavax, Captan Ridomil gold, Nativo, **etc**

Shavit, Opera, Amistar Top, Punch Xtra Score, Folicur, Ampligo **etc**

Weed control



- Soyabean is sensitive to weed competition during the first 6 weeks after emergence. Failure to control weeds during this period will result in marked yield reduction due to competition. Once the soyabean crop reaches full canopy, especially when planted in narrow rows, it smoothers the weeds.

Harvesting

Soyabean should be harvested as soon as the plants have dried. If harvesting is delayed, the pods may shatter with a consequential loss of yield.

a) Hand harvesting. This method is suitable for small areas, or where a large labour force is readily available.

- The advantages of hand harvesting are that losses can be reduced to a minimum; soyabean of a high quality is produced; and the beans normally have a high viability.
- Therefore, hand harvesting is suitable for seed production.
- The usual system of hand harvesting is to allow labourers to cut or pull as much plant material as they are able to thresh in a day.
- For hand cutting, labourers require sickles or sharp hoes.
- A labourer should be able to cut and thresh at least 50 to 90 kg of clean beans per day.

b) Mowing or cutting by hand and shelling. A variation is to use a mower to cut the plant material, and a mechanical winnower for the final cleaning.

- This method should enable an output of ± 150 kg (3 bags)/labour/day. This method enables harvesting to commence before the pods split, but allows sufficient moisture to be lost, thereby preventing mould developing in the established cocks or stacks.

c) Swather plus combine. This method involves the use of a swather to cut and wind-row the crop before it is combined. A pick-up attachment (picker) is required to be fitted to the combine table.

d) Combine harvesting. Large areas are usually reaped by combine harvester and losses are inevitable.

- The degree of loss depends on the efficiency of the machine and operator; the evenness of the land; the height of the pods off the ground; lodging; the moisture content of the beans; and weed control.
- Machines must cut very close to the ground, and losses must be minimised by cutting at the correct moisture content and paying attention to machine adjustments.
- The golden rule for combining is to “take it low and take it slow”.
- Soyabean seed is delicate and can be easily damaged by the threshing mechanism which must be carefully adjusted and run slowly.

Groundnut Production

Groundnuts may be divided into three types, according to the time taken to maturity: early, medium and late. Early maturing groundnuts have a bushy bunch growth habit; while medium and late maturing groundnuts have a spreading growth habit. This section deals only with early maturing groundnuts, commonly grown under dryland conditions.

Soils and climate

- Best results are obtained from deep, well-drained soils in good condition.
- Suitable soils include sands and sandy loams. Groundnuts will not grow well on acid soils and thus liming may be necessary for good production (the ideal pH is 5.3 to 6.8). •Groundnuts
- must not be grown on the same land more than once in every four years.
- Groundnuts are a good crop to grow before maize.

- Early maturing groundnuts (e.g. SC Mwenje and SC Nyanda) take about 115 days or less to maturity on the Middleveld.
- Late maturing groundnuts take about 160 days to maturity on the Middleveld and hence not very suitable in a rainfed system.

- Groundnuts are sensitive to cool overcast conditions both in the early part of the season and during pod filling. The ideal season is one which has much sunshine, coupled with sufficient rainfall, especially during pegging and pod-filling.

Varietal choice

Two sought after short season varieties are Nyanda and Mwenje.

Nyanda

- A very short duration, taller-statured variety with a more open growth habit.
- Better seed appearance and uniformity.
- Two-seeded pods.
- Good kernel yields of 1t/ha.
- Drought stress tolerance.
- Resistant to aphids, Hilda and grain moth.

Mwenje

- A very short duration, taller-statured variety with a more open growth habit.
- Better seed appearance and uniformity.
- Two-seeded pods and good taste.
- Good kernel yields of 1.3t/ha.
- Drought stress tolerance.
- Resistant to aphids, Hilda and grain moth.
- Good rosette virus tolerance.

Characteristics of Seed Co Groundnut Varieties

Varieties	SC Nyanda	SC Mwenje
Type	Short season & Valencia type	Short season & Valencia type
Seed Colour	Tan	Tan
Use	Edible Nuts & Peanut Butter	Edible Nuts & Peanut Butter
Days to maturity		
Lowveld (below 900masl)	85-95	85-95
Middleveld (900-1250masl)	95-105	95-105
Highveld (above 1250masl)	105-105	105-115
Defoliation at lifting (%)	95	95
Mass of 100 seeds (g)	290	290
Sound Mature Seeds (%)	70	70

Fertilisation

- Basal fertiliser - Groundnuts should be grown in rotation with cereals (e.g., maize and sorghum), which have been well fertilised, because groundnuts respond well when fertiliser is applied to the previous crop rather than to the groundnuts themselves. Thus, in most cases, no basal compound fertiliser is applied. Nevertheless, where the soil is known to be infertile or deficient in some nutrients, manure or a low rate (150 to 300 kg/ha) of a basal fertiliser (e.g. 7,14,7 or 5,18,10) or Single Super Phosphate may be applied. Groundnuts respond well to manure, because the manure not only supplies nutrients, but also helps to ameliorate soil acidity.
- Top dressing. Groundnuts have a high requirement for calcium, especially during the pegging stage. Low availability of calcium at this stage will result in a large proportion of empty shells. Calcium may be supplied with Gypsum (calcium sulphate) at a rate of 250 kg per ha broadcast over the plants at flowering (7 to 8 weeks after planting).
- Split apply the Gypsum - half at first application and the other half 2 weeks later.

Crop establishment

- Groundnuts should be planted as early as possible, at least before the end of November, but care must be taken not to plant too early otherwise they will be ready for lifting while the rains are still around, which will cause problems.
- Suitable short-season varieties include Nyanda and Mwenje. Nyanda has proven to be the best short season cultivar in trials throughout the drier regions.
- Plant groundnuts at a spacing of 35 to 45 cm between rows and 5 to 10 cm between seeds in the row. Seed requirements are about 100 kg per ha. Depth of planting is 5 cm.

Mid-season management

- Weed control is most important, especially in the early stages of crop growth. Weeding with hoes is possible up to the flowering stage. Thereafter, weeds must be pulled out by hand to avoid disturbance of the pegs.

- Diseases - Groundnuts are susceptible to a number of leaf diseases such as Cercospora and Phoma, but control in short season groundnuts is not always necessary. Nevertheless, a single spray with a fungicide like Mancozeb (Dithane M45) or Chlorothalonil (Bravo) at flowering or early pegging may be beneficial, especially in wet years where diseases may be problematic. With late maturing groundnuts, disease control is important.
- Pests - Aphids may be a problem and may be controlled with a pesticide, for example, Dimethoate (Rogor). Leaf eating pests and Heliothis bollworm may be controlled with chemicals like Carbaryl.

Harvesting

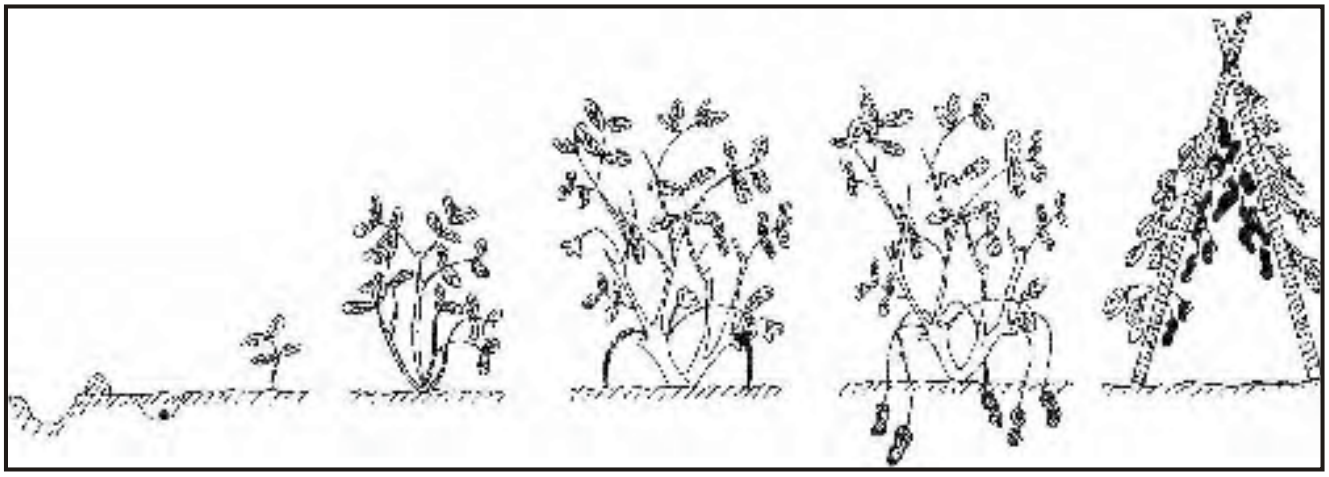
1. This is a critical aspect of groundnut production, because of the potential losses and disease infection that may occur at this time. Here are some points to consider:
   Begin lifting groundnuts when 40 to 50 % of the pods are mature. Pod maturity may be determined by counting out 100 pods from a number of plants and shelling these to separate the mature and immature kernels (seeds). Mature seeds have a seed skin (testa) that does not easily rub off, and which has a thin papery texture and has developed the colour of the variety. An immature seed has a thick, fleshy skin with a pale colour and which rubs off easily. Lifting should be complete by the time 70 to 80 % of the seeds are mature or before plants are 90 % defoliated.
2. The harvesting process includes loosening, lifting, wilting, cocking (curing), picking and finally shelling. It is important that once the plants are lifted they be allowed to wilt for a few days with the pods exposed to the air before cocking. When cocking the groundnuts, keep the plants off the ground; ensure the cock is constructed to allow free flow of air through the cock (to facilitate rapid drying); and construct the cock so that water cannot penetrate during rainy spells. Curing and drying may take from 2 to 4 weeks. Begin picking when the kernels rattle in the pods. It is possible to pick one to two bags per person per day.
3. Groundnuts must be dry before placing in a storehouse. The storehouse must be dry, cool and well ventilated. It is best to store groundnuts in their shells. Discard diseased, sprouted or insect-damaged pods and only store healthy, dry pods. Shelling of groundnut pods may begin any time after the pods are dry. From 10 kg of unshelled nuts, there will be about 5 to 7 kg of shelled nuts.
4. One large bag of shelled groundnuts weighs about 80 kg. One large bag of unshelled groundnuts weighs about 35 kg.
5. Groundnuts may be sold to any dealer, but there are now small hand mills that make fine peanut butter, suitable for local markets, and which add value to the product.

Production Guide in summary steps

Land preparation and planting
- Prepare lands early.
- Apply lime, if required.
- Seed dress with Thiram.
- Sow seed as soon as effective rains fall.
- Rows 45cm apart. Seed 7,5cm apart in row.
- Seeding rate 100kg/ha.

Flowering and vegetative stages
- Apply 100 - 300kg/ha Gypsum 7 - 8 weeks after germination.
- On sandy soils, apply two applications, one at 7 weeks and the other at 10 weeks.
- Avoid hoeing fields after onset of flowering - rather pull weeds out.
- Scout for pests and diseases and control as necessary.

Harvesting
- Lift crop when 50 - 80% of pods contain mature kernels (ie. When the kernel skin is thin and difficult to rub off).
- After wilting, dry on "A"-frames or in cocks for 3 - 4 weeks, with pods inside to protect them from sunlight.
- Pick pods when dry, discard diseased, sprouted or insect-damaged pods. Store in cool, dry place.



Vegetative Growth Stages:
- Ensure good weed control.
- Scout for aphids and other pests, apply control measures as necessary.

Pegging and podding:
- Ensure good weed control, but only hand-pull weeds. Do not use a hoe.
- Scout for pests and diseases and control as necessary.

Sugar bean production

Soils and climate

- Beans may be grown on a wide range of soils, but they generally prefer soils with some clay content (> 15 %), and they are sensitive to soil acidity.
- Beans are best grown during the cooler months of summer (January to April) on the Highveld or in winter in the Lowveld with irrigation. In the Highveld, sugar bean can be grown after frost occurrence.

Varietal choice

- A number of varieties are available, from speckled sugar beans, for example SC Bounty and SC Sharp types to white broad beans.
- It is important to select the right variety for the intended market, as there are definite market preferences.
- The most preferred is the speckled type.
- Also, choose varieties that are resistant to Rust, Anthracnose, Angular Leaf Spot and Common Mosaic Virus diseases. Beans are prone to diseases transmitted through the seed, so good quality, disease-free certified seed from Seed Co should be obtained.
- Do not plant retained seed, but rather buy good seed each year.

Land preparation

- Select fertile to moderately fertile land with no waterlogging. Sugar beans do not tolerate acidic soils. The optimum pH range for sugar beans is 5.5-6.5
- Think about the rotation scheme for the field you want to plant. To prevent diseases, do not plant beans in the same field you used for beans last season.
- Clear all vegetation and prepare the field manually with a hoe, or use animal power or a tractor. You can plant sugar beans on ridges or on a flat seedbed. Planting on ridges helps prevent waterlogging, which damages the sugar bean plants.
- Well-prepared land ensures good germination and reduces weed infestation.

Inoculation process

- Inoculation with Rhizobia is important to help sugar beans form nodules and fix nitrogen. Each legume crop needs a different type of rhizobium bacteria, so always check you have the right inoculant for sugar beans.

How to inoculate sugar beans with Rhizobia

1. Spread 100 kg of sugar bean seed (enough to plant 1 Ha) on a clean plastic sheet or in a large container.
2. Mix 100 g of inoculant and 1 litre of water in a clean bucket.
3. Add 50 grams of sugar into the solution. The sugar acts as an adhesive between the seed and the inoculant.
4. Stir the solution for 30 seconds.
5. Sprinkle the inoculant mix onto the seed.
6. As you sprinkle the inoculant onto the seed, turn the seed gently to ensure that all seeds are coated with the inoculant. The coated seeds should look shiny wet.
7. Plant immediately after inoculation and protect the inoculated seed from direct sunlight by covering the container with paper, cloth or gunny bag.
8. Sow the seeds in cool moist soil and cover immediately afterwards to protect the Rhizobia from sunlight.

Each inoculant packet is sufficient for 100 kg of seed. For smaller amounts of seeds, use 10 g inoculant (2 heaped teaspoons), 5 g sugar (1 teaspoon) and 100 ml water per 10 kg seed.

Planting and crop establishment.

This depends somewhat on the variety. Short determinate varieties ought to be planted in 45 cm rows with 5 to 10 cm between plants, giving a population of about 350,000 plants per ha. Tall indeterminate varieties may be planted on wider spacing. Seed is placed about 2 cm deep.

Fertilisation

- Beans are sensitive to acid soils, so lime is required if the pH is less than 5,3 optimum level is 5,5 - 6,5. Beans are efficient users of residual fertiliser but nevertheless they do respond to applied fertiliser, especially if the soil is inherently fertile. Beans may be fertilised with manure or low rates (200 to 350 kg per ha) of a compound fertiliser (e.g. 7.14.7).
- A light top dressing with 100-150 kg/ha (depending on soil type) with a 28-34% N fertiliser (e.g. Ammonium Nitrate) just before flowering may also be required if the leaves are pale in colour.

Plant spacing for beans sown on 45cm rows:

Type	In-row Spacing (cm)	Plant Population (Plants/ha)
Speckled (SC Sharp/Bounty)	10	222 000
Speckled (SC Sharp/Bounty)	8	278 000
Speckled (SC Sharp/Bounty)	6	370 000
Speckled (SC Sharp/Bounty)	4	556 000

Plant spacing for beans sown on 50cm rows:

Type	In-row Spacing (cm)	Plant Population (Plants/ha)
Speckled (SC Sharp/Bounty)	10	200 000
Speckled (SC Sharp/Bounty)	8	250 000
Speckled (SC Sharp/Bounty)	6	333 000
Speckled (SC Sharp/Bounty)	4	500 000

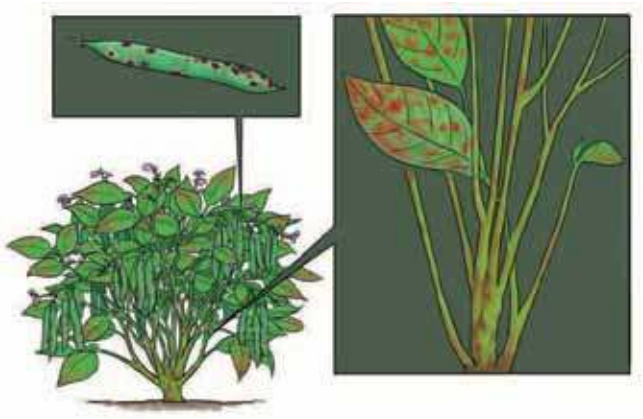
Target a population of 220k -330k/ha final stand

Diseases

- A number diseases such as Angular Leaf Spot (a fungus disease common on speckled beans), Anthracnose (fungus), Common Blight (bacteria), Halo Blight (bacteria), and Bean Common Mosaic Virus affect sugar bean.
- Some of the fungal diseases may be controlled with appropriate chemicals, but for the other diseases, clean seed, crop hygiene and crop rotation is important as a disease control measure. Avoid walking through wet crops.

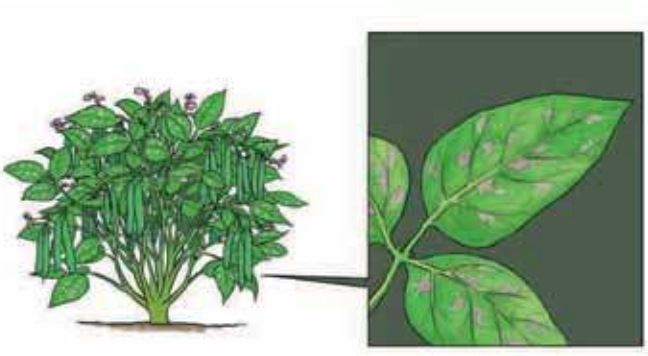
Rust

- Rust is a common disease, which initially shows itself as small yellow-white lesions (spots) on the older leaves. These enlarge and become reddish-brown.
- Most of the older varieties are susceptible to rust, but usually the newer varieties have some resistance.
- Several fungicides are registered for control of rust (e.g., Mancozeb and Triademnol e.g. Shavit).
- These may be applied either as a preventative spray or when the disease is first seen.
- Generally, several sprays are required at intervals of 7 to 14 days.



Anthracnose

- Anthracnose is a fungal disease where dark red to black lesions develop on the whole plant, including the pods.
- On stems and pods, lesions are sunken.
- In moist weather the centres of lesions can become covered with pink spores.
- Do not work in the field when plants are wet.

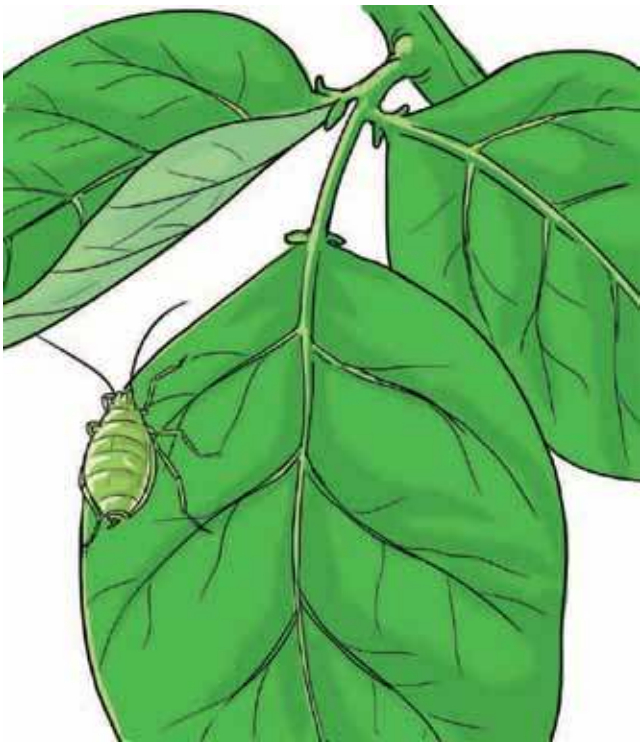


Angular leaf spot

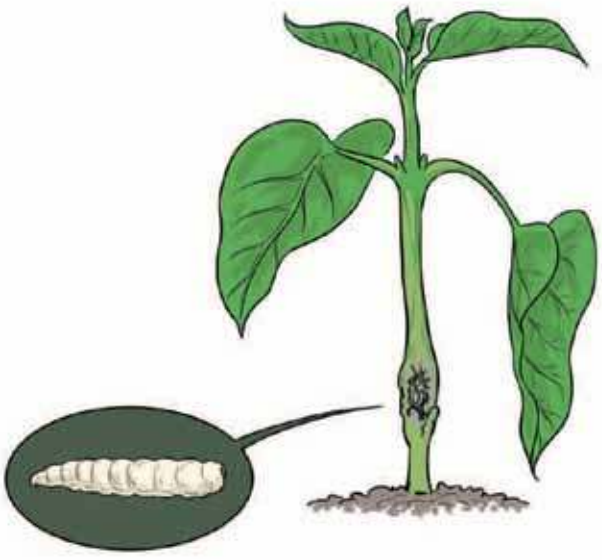
- This is a fungal disease and is usually observed at flowering.
- Primary leaves have round lesions and are usually larger than the lesions on trifoliolate leaves. Lesions first appear grey, and then become dark brown in colour. The spots may increase in size and join together and reduce the yield.

Pests

- Common insects affecting bean plants in Zimbabwe are the CMR beetle (blister beetle), cutworm, aphids, semi-loopers, bean stem maggot, red spider mite, heliothis bollworm and rootknot nematode.
- Insects can damage an entire crop.
- Therefore, check the field regularly for insects that damage your plants. Not all insects, however, cause damage to the bean plant.
- For example, bees will not harm your crop and some insects such as spiders, lady birds and ants are natural enemies of harmful insects.
- Also the larvae of the CMR beetle are beneficial because they feed on grasshopper eggs.
- A number of other pests may attack beans, such as aphids, blister (CMR) beetles, chafer beetles, stink bugs, and boll worms. Chemicals are available for the control of these.



Aphids



Bean stem maggot

Harvesting

- When the pods are almost dry, but before they shatter, cut plants and wind-row.
- Thresh when fully dry.
- If the grain is being kept for home consumption, treat appropriately to avoid infestation with bruchids and weevils.

Cowpeas production

Cowpeas are an ideal dryland crop (pulse) in low rainfall areas because they are drought resistant and provide excellent human nutrition and good rotational benefits. They are also an intercropping crop under maize.

Soils

- Cowpeas may be grown on a wide range of soils, but they are somewhat sensitive to acid soils.
- Cowpeas are legumes and may be grown on their own (sole cropping) or inter-cropped with maize.
- It is important to grow cowpeas in rotation with other crops in order to help control diseases.

Varieties

There are two basic types of cowpeas: upright, bunch types, used mainly for grain production; and spreading types, which may be used for grain, vegetable or fodder. Improved cultivars, e.g., IT18, are ideal for grain production, and mature quickly. Do not plant retained seed r to avoid build-up of seed borne diseases.

Planting and crop establishment

- Plant cowpeas anytime from the first rains until the end of December.
- In high rainfall areas, plant cowpeas late to avoid diseases when the crop reaches maturity.
- When grown on their own, the following plant populations should be achieved:
  - -Spreading types: 60 000 plants per ha (12 to 15 kg seed per ha). Upright, bunch types: 120 000 plants per ha (30 to 50 kg seed per ha).
  - -The row width may be 45 to 90 cm.
  - -Closer rows may be used for upright, bunch types, while wider rows may be used for spreading types.

Cropping system	Plant type	Spacing (cm)	Seed rate (kg/Ha)	Populations
Sole crop	Bushy	45 x 15	40-50	150 000
	Spreading	75 x 20	20-25	67 000
Intercropping	Bushy	180 x 15	10-15	37 000
	Spreading	180 x 30	5-10	18 500
Planting depth= 5-7cm				

Fertilisation

Cowpeas will respond to manure or low rates (100 to 200 kg per ha) of a compound fertiliser. (E.g. 7.14.7).

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 produced under strict rogueing production systems (i.e., removing and destroying any plants showing virus disease symptoms).
- Anthracnose – fungal disease that affects the stem, branches, leaves and pods.
- Control – grow resistant varieties; chemical control (mancozeb) or any other suitable fungicide.

Pests

Pests include Aphids, Heliothis bollworm, CMR beetle and Tip-wilter.

- After harvest, the seed is susceptible to bruchids, a grain borer.
- These pests may be controlled with appropriate chemicals.

Wheat production

Soils and climate

- Wheat is a temperate crop and is best grown in winter under irrigation with optimum day temperatures of between 15 – 20 degress celcius and cooler nights giving the best yields.
- There are some varieties that may be grown in summer (such as Sahai), but generally there is high disease and weed pressure in summer accompanied by warmer temperatures that result in depressed yields (≤ 3t/ha), therefore, winter is the best time for growing wheat in Zimbabwe.

- The crop is adapted to a wide range of soils. The soils must be well drained with an optimum pH range of 5.5-6.5 on a Calcium Chloride scale.
- Wheat yields are greater in the Highveld (>1200 masl (metres above sea level)) and Middleveld (900 – 1200 masl) with yield potential of 8 to 12 t/ha compared to the Lowveld (<900 masl) where yields average of 4.5-7 t/ha under good management.

Varietal choice

- Newer varieties are continuously being developed for wheat production because of the threat of diseases, especially Leaf Rust and Powdery Mildew.
- The varieties from Seed Co, ideal for bread making, are short stature, disease resistant and well adapted to winter production.
- Current varieties include SC Nduna (White seeded), SC Sekuru (red seeded), SC Smart (Red seeded), SC Stallion (red seeded), Sky (red seeded), Select (white seeded) and SC Serena (white seeded). SC Sahai is a rain-fed variety which can be planted in mid-summer, around January.

Land preparation and soil conditioning

The most suitable soil for wheat is one with:

- A good effective depth with a fine tilth to ensure seed-soil contact. Good seed-soil contact ensures good crop emergence and stand which are the basis for good yields
- Favourable physical properties: good internal drainage and good water holding capacity.
- Chemical properties: sufficient and balanced quantities of nutrients (NPK and other micro-nutrients/trace nutrients)
- Biological properties: good level of organic matter, and with beneficial micro-organisms. The objective of soil tillage is to maintain the existing structure of soil or to improve the structure of poorly

structured soils as well as addressing the three properties as mentioned above (physical, chemical and biological).

Soil conditioning

- Lime can be applied if required to 'sweeten' acidic soils to the pH optimum range. Lime application should be based on soil analysis prescriptions.
- Gypsum improves soil physical structure i.e. removes hard setting clodiness, removes surface crusting and poor workability as well as supplying the soil with complimentary Calcium and Sulphur for good crop stand and growth.

Tillage procedures

There are several options of tillage which fall under two broad categories: conservational and conventional tillage which can be adopted in wheat production.

- The conventional tillage procedure follows the following steps: Deep ploughing (ripping or chisel plough)> liming and basal fertilizer application> disking and then followed by rolling. A roller can be pulled concurrently behind a disc harrow.
- Conservational tillage also known as zero/minimum tillage is another cheaper and more sustainable option which farmers can adopt. Conservational tillage minimizes soil disturbances by reducing the number of machine operations and promotes organic matter retention. Good tillage ensures good soil-seed contact and good crop emergence and establishment.

Time of Planting

The optimum time for planting winter wheat is between mid-April and the last week of May and even earlier in the Lowveld. Sometimes planting time can be extended to mid-June but not normally recommended. Delayed planting results in a loss of about 50kg/ha/day after May. The first two weeks of May tend to give the best yields in the Highveld areas.

Adhering to the optimum planting time has some agronomic benefits:

- Early summer rain escape: Rains which come after the wheat has reached physiological maturity causes pre-harvest sprouting (grain germination in the ear) and results in down grading of the wheat due to a decline in baking qualities
- Disease escape: Disease pressure especially for rust diseases, normally rises when temperatures start to warm up around August and an early planted crop would have gotten a good head start without disease pressure.
- Pest escape: Likewise pest pressure, such as aphids, begin to increase when temperatures start to rise. An early planted crop will have a good head start ahead of pest pressure.
- Early planting will result in early harvesting around September. One of the key considerations for the adoption of double cropping is early planting and early harvesting for both summer and winter crops. The farmer will come in with his summer crop on time when wheat is planted and harvested early. Generally, wheat takes about 125-140 days to reach physiological maturity depending on variety, altitude and weather conditions. The higher the altitude, the longer the time from planting to maturity.
- Wheat critical stages such as crop establishment, tillering, flowering and grain filling will coincide with the optimum growth conditions when the crop is early planted. For instance, for robust tillering i.e. for the plant to produce secondary stems (4 – 5 weeks after crop emergence) requires very cool conditions that normally occurs in May and June while Flowering (60 - 90 days) and Grain filling (> 90 days) must not coincide with frosty conditions to avoid crop sterility.

Seeding Rates

- The optimum plant population for wheat is 220-250 plants per m2. Seed rate depends on the seed size, germination percentage, planting conditions and planting method. To achieve optimum population density, a seeding rate of about 110-125 kg/ha when drilling and 125-135 kg/ha when broadcasting with a vicon spreader is recommended. To ensure good crop standability and yield, farmers should adhere to these optimum population densities. Diseases such as Powdery Mildew are also minimized with good agronomic practices.

Irrigation requirements and scheduling

Since there is very little or no rainfall during winter in Zimbabwe, irrigation is required to achieve a high yielding wheat crop. The total gross amount of water required is between 450 and 600 mm per ha (i.e. 4.5 - 6 mega litres per ha) depending on method of irrigation (Overhead irrigation with sprinkler or use of Centre Pivots) and must be applied as the crop requires it. The key points are:

- the soil must be brought to field capacity to the full potential rooting depth (about 1,2 m) at planting to emerge the crop;
- a light irrigation must be applied at the 4th or 5th day after sowing, to break the crust to ensure good crop emergence
- a light irrigation must be applied at 14 to 17 days after emergence to stimulate crown root development and tillering.
- irrigation thereafter must be applied to match crop water use. On sandy soils with low water holding capacities, irrigate frequently (7 to 9 day cycles with 30-35mm net). On clays and sandy clays, with good water holding capacities, irrigation may be less frequent with larger amounts (10 to 14 day cycles with 40-45 mm net). This is a general irrigation scheduling guide. For an informed irrigation scheduling, the use of a soil auger to evaluate the soil water content ahead and behind the irrigation line is a good aid to irrigation management. Irrigation is terminated when the neck of the ears/spikes/head (peduncle) turn yellow i.e. physiological maturity.

Crop hardening

After the crop has emerged, the hardening stage begins. This induces crown root development as well as tillering. The recommended hardening period (irrigation is temporarily terminated during this stage) is 10 and 14 days in light and heavy soils respectively.

- Top dressing fertilizer and herbicide application is done after a light irrigation which follows the hardening period, normally about 21 days after emergence.

Fertilisation

- The fertiliser regime management in wheat, like any other crop, must be tailored to the soil fertility status; the yield potential; and the grain quality requirements. As a general guide, wheat requires a basal application of 300 to 500 kg/ha of a compound fertiliser (such as 7-14-7) and a top dressing of 350 to 500 kg of Urea or Ammonium Nitrate per ha. Both fertilizer dressings are broadcast by a vicon.
- Generally, 160 -190kg/ha of Nitrogen Units (N), 50 - 70 units of Phosphorous (P) and 30 – 50 units of Potassium (K) are adequate for optimum plant growth.

- Basal fertilizer need incorporation into the soil by disking and should be applied after primary tillage.

- The top dressing is usually applied in one application between 14 – 21 days after emergence on heavy soils, and in two applications of equal amounts at 14 and 35 days after emergence on sandy soils by broadcasting. Top dressing should be applied after the hardening stage. Top dressing is essential for good leaf and general plant growth and ultimately the yield but also importantly for attaining good protein levels.

- The minimum protein level requirement for "Premium" (Good quality) wheat is 11%. It is one of the considerations for grading and pricing of wheat.
- Attainment of good protein levels is also determined by varietal choice and general management.
- Application of Nitrogen after flowering can also boost the Grain Protein Content of wheat.

All fertility management practices must be based on proper full soil analysis recommendations by approved laboratories.

Weed control

- Farmers are advised to use some wheat specific post-emergence herbicide which should be applied after a light irrigation which follows the hardening period (2 Weeks After Crop Emergence).
- It is also recommended that farmers apply specific herbicides against volunteer crops.
- Puma super is normally sprayed when wheat is planted after a maize crop to protect against maize volunteer plants.
- For soya volunteers, a herbicide called Ally is recommended. Banvel and MCPA combination covers a wide spectrum of broad leaf weeds and is recommended.

It is important for farmers to read labels whenever they are applying herbicides. Consult with chemical companies for information on new effective herbicides. See appendices for wheat herbicide options.

Pests and diseases

- Aphids and stalk borers can attack wheat with aphids coming in early, soon after tillering, while borers can attack the plant from flowering onwards.
- Farmers must also be on the look-out for "Fall armyworm" given that wheat is one of the host crops to the pest. These pests can be controlled with appropriate pesticide sprays after scouting.
- During the late grain-filling period, Quelea birds may consume much grain and reduce yields significantly if not attended to.
- A pesticide molecule called 9,10-Anthraquinone 50% WP (Bird Shield) has been developed, which can be used as a seed dressing or as a foliar spray at soft dough stage.
- Efficacy of this pesticide molecule can be enhanced by applying with a sticker and also a rainfree period of 4 hours or more. This pesticide molecule will act as a bird repellent. This is the best and the most efficient option. The other option is bird-scaring using bells, tins, whistles, discs/reflectors etc. by bird scaring gangs.
- Diseases such as Leaf Rust, Stem Rust, Powdery Mildew, Fusarium Head Blight and Take-All may cause yield reduction. Farmers must seek professional advice on how to control these diseases.

The best and smarter option is for farmers to grow resistant varieties and Seed Co wheat varieties such as SC Select that are resistant to these diseases. Generally two preventative fungicide sprays are recommended if farmers are located in disease prone areas and give some form of insurance against climate change that can result in new disease pathotypes.
NB: Farmers are encouraged to scout their wheat crop for diseases, pests and deficiencies and make spraying decisions early when pest/disease reaches economic threshold levels.

Crop rotation with legumes such as soybean is a good way of reducing disease pressure.
Consult Agrochemical companies for more information on chemicals. Always read chemical labels carefully, use safe practices and adequate protective gear during application.

Wheat is a temperate crop and is best grown in winter under irrigation

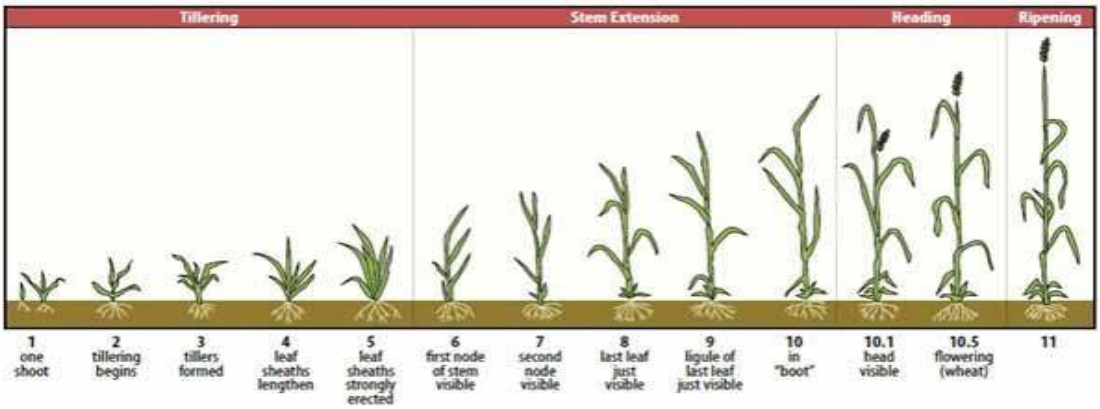
Generally centre pivot irrigation is the simplest method of irrigating any crop

Seed Co wheat varieties are ideal for bread making

Fungal disease & fungicide remedies

Take All, Fuarium & Damping off Pythium root rot

Leaf and Stem rust, Septoria Leaf Blotch, Powdery mildew & Loose Smut



Seed dressing

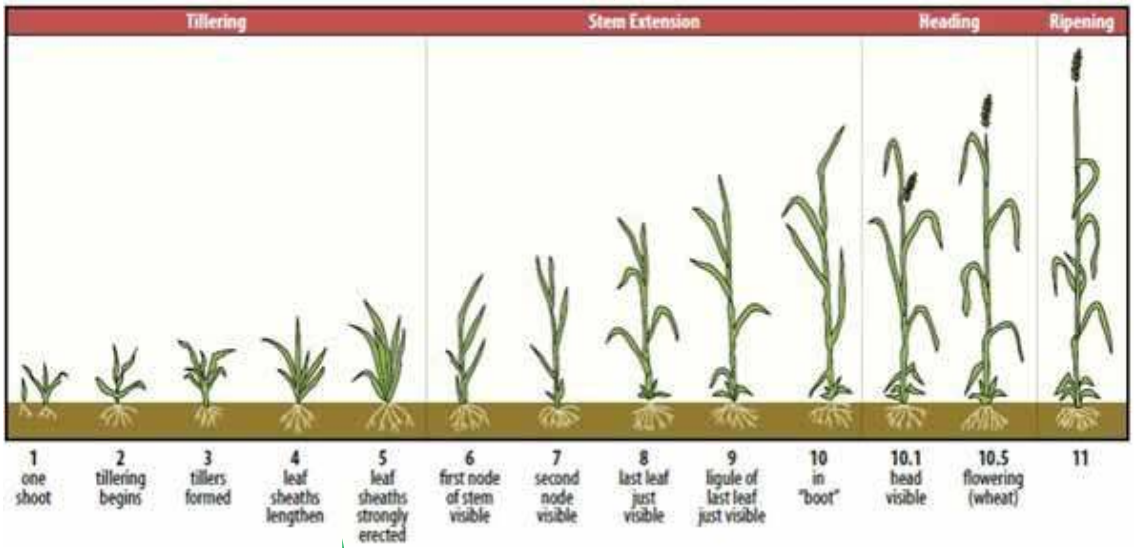
Thiram , Apron XL, Vitavax,Chaya- always buy certified seed

Foliar spray

Tilt, Shavit, Ridomil Gold, Opera, Chlorathalonil, Propiconazole+ Trifloxystrobin, Folicur, Bravo, Poladime, Benomyl April Combi, etc

Weed and pest control

Cutworms, Fall Armyworm, Aphids, Leaf beetles, Stem borers, Leaf hopers, Bollworms



Post- emergence

MCPA, Ally, Super Puma, Weed killer M, Basagran, Bromoxynil, Dicamba, Granistar

Lambda, Blast, Marshal, Chlopyrifos, D/Methoate, Carbaryl, Malathion, Thunder, Gardona, Mevinphos etc

Wheat production: General tips:

1. **Plan ahead:** Evaluate available water resources in order to calculate wheat area based on proposed gross application. Irrigation equipment and infrastructure must be ready, with checks made on pumping unit, conveyance system, pivot, sprinkler condition and nozzle wear.
2. **Soil condition and fertilisation:** Soil sampling is always the starting point in determining the rates and types of soil conditioners and fertilisers to be used.
3. **Start at field capacity:** Crop emergence requires a soil profile that is at field capacity down to the full potential of the rooting depth. This should be achieved by the 3 – 4 leaf stage, at the latest. This is important because wheat roots grow downwards at a rate of 20 – 30 mm/day and any dry layers within the profile will impede root growth and proliferation.
4. **Establishment irrigation:** Seed germinates better in the presence of good soil moisture. Establishment irrigations need to be geared to achieve a uniform and adequate stand, and this depends on planting method and uniformity of irrigation. Drilled seed normally requires one good irrigation to cause germination because of good soil-seed contact. Broadcasted seed or zero tillage fields, require frequent (2 – 3 day intervals) light irrigations (25mm) for effect establishment. A light irrigation is essential (4 – 7 days after the first irrigation) in soils that are prone to crusting to assist with emergence.
5. **Ensure crown root development and tillering:** At 3 - 4 leaf stage (14 – 17 days after the first germination irrigation), crown roots and the ear begin to develop and tillers start growing. Water deficit adversely affects these processes yet they play an important role in yield formation. At this stage, usually the top 100 – 150mm of the soil is dry and crown roots will not grow into the dry soil. It is necessary to apply a light irrigation to stimulate crown roots and tillering. It is also an appropriate time to top dress the wheat with Nitrogen fertilizer.
6. **Initiate an irrigation schedule early and monitor the soil and crop through to maturity:** Scheduling assists the manager to monitor crop progress and thereby ensures the best treatment possible is given to the crop. Assess soil and crop conditions before and after each irrigation cycle to evaluate whether or not the irrigation is recharging the soil profile to the satisfaction of the plant needs. A soil auger is extremely useful in this regard. An auger test ahead of the line will show how deep the plant is drawing water while an auger test two positions behind the line will show how effective the irrigation application is in replenishing the soil. Well irrigated wheat has a dark green colour, soft large leaves and many tillers, whilst “stressed wheat” has a bluish colour, hard, spikey leaves which may also roll up in some varieties, and a few tillers with small ears.
7. **Crop maintenance:** Weed, disease and pest control are important in achieving a good crop.
8. **Timing of the last irrigation:** There is no point in irrigating a yellowing crop and grains are fully formed and after hard dough stage. Full maturity is reached when the peduncle (neck, area below the ear/spike) turns yellow. Irrigation applied during later grain-fill at hard dough stage is of no value to the crop and may even reduce the quality of the grain. Water after ripening may cause pre-harvesting sprouting (germination in the ear) leading to down grading of wheat due to reduced grain quality.
9. **Keeping irrigation records:** It helps to plan future irrigation practices. Useful records include;
   - Water usage with a flow meter
   - Energy use, either electricity units or diesel litres
   - Dates and amounts of irrigation applied
   - Evaporation and air temperature
   - Labour

Centre pivot-irrigation scheduling-a general guide

Generally centre pivot irrigation is the simplest method of irrigating any crop. For efficiency, there are factors to consider when using centre pivots.

- It is proven that a farmer gets more effective water application on a fixed centre pivot as compared to a towable pivot. This is largely due to the fact that there is run down time loss due to towing from one centre to the other.

- It is advisable that when using a fixed centre pivot anything between a 10mm and 12 mm spray package is recommended.

- However, if it is a towable centre pivot and a farmer intends to do two circles with one pivot a bigger spray package is more ideal for the pivot and this can be from 14 mm to 20 mm spray package depending on specific requirements.

- A bigger spray package is recommended for towable centre pivots to reduce the turnaround time of the centre pivot to avoid moisture stress in the other circle.

- For easy water application, a farmer is advised to run their pivot in WET mode. The wet mode allows the operator to program the pivot to apply the exact amount of mm required at the particular stage of growth of the crop. In instances where the pivot is run in dry mode the operator will be required to calculate the percentage on the timer which corresponds with the amount of water (mm) that need to be applied and in most cases errors on calculation are sometimes common and a farmer will not achieve the intended spray volumes.

- It is advisable then that farmers should ask their centre pivot service provider to program the machine to work in the wet mode.

Chemigation/fertigation calibrations guide

Calibration factors that need to be considered when using a centre pivot for chemigation and fertigation include the sizing of the dosing pump and its pumping rate.

- Always ensure you discuss with your pumps specialist before purchasing a dosing pump for correct dosing pump sizing for your applications as applications vary from case to case.

- It is also important that your fertigation or chemigation unit is as close as possible to the centre pivot inlet as possible generally not more than six metres. Below are critical factors to be considered when using a pivot for both chemigation and fertigation.

1. Length of the pivot to the edge of the effective wetted area
2. Length of the pivot to the last tower
3. Last tower travel distance in a given amount of time running at present application. This point has to be verified physically by the farmer with the pivot running in wet mode at the present application rate. Do not rely on literature or pivot control panel as other factors such as terrain (e.g. slope/gradient) can affect last tower run speed - so this must be verified.
4. Targeted product application rate in kg/litre per hectare
5. Product concentration in kg/litres per cubic metre of active ingredient
6. Percentage of a full circle centre pivot that will be used during the application

Harvesting

On a large scale, wheat is usually harvested by combine, but it is possible to hand harvest and thresh small areas of wheat. Combine harvesters must be set carefully and operated according to Service Manuals in order to keep harvest losses to a minimum.

Wheat harvesting done by combine

A crop doctor

A crop doctor is a farmer who takes time to investigate his fields in order to prevent problems and improve productivity. He walks his fields regularly, observing, thinking, inspecting and evaluating. He diagnoses problems and seeks solutions.

Here are some tips on how to be a crop doctor:

- ✓ Take with you a small hoe or spade, a knife, a notebook and pen. Walk through your fields in a random manner, stopping every now and then to examine the soil, plants and surrounds. Be observant, be an investigator, think, take notes.
- ✓ Examine at least ten places in the field when taking a general inspection, but if scouting for pests it may be necessary to examine between 24 and 100 plants, depending on the pest and the size of field.
- ✓ Consider the recent weather patterns. How has the weather been for crop production? Has it been hot and dry, cold and wet, or overcast? How may this have affected the crop?
- ✓ Look at the soil and roots. Dig into the soil, and ask yourself questions: Are the roots shallow, deformed, or normal? Is the soil dry or wet? Is there a crust, compaction or impediment? Are there any pests in the soil?
- ✓ Study the crop plants. What was the planting date? Is the plant spacing correct? Are the plants evenly spaced? How many leaves are on the plant? Do the plants look healthy? When and how was the fertiliser applied? What pests and diseases can you find? Are the leaves being eaten? Is there any lodging? How long before harvest? Pull up a plant, cut open the stem,
- ✓ and look to see if there is anything unusual. Pull up a plant, cut open the stem, and look to see if there is anything unusual. Pull open the flowers, pods or cobs; what do you find? Are they normal, or are there problems?
- ✓ Weed control. Can you identify the weeds? Are they too numerous? How and when are you going to control the weeds? Did the herbicide work? If no, why not? If you are hand weeding, how long before the field will be finished?
- ✓ Pest and disease control. Do the pests or diseases need to be controlled? How will you do this? Was the last pest or disease control measure effective? If not, why not?
- ✓ Make plans. What is the most important thing to be done in each field? How and when are these going to be done?

Matter of fact: The best fertilizer is the footmarks of the farmer in the field!

Appendices

MAIZE PESTICIDE REFERENCE GUIDE: Maize *Insecticides*

PROBLEM	*ACTIVE INGREDIENT*	*TRADE NAME*
Aphids	Dimethoate 40EC	Rogor
Armyworm	Carbaryl 85 WP	
	Malathion 50 EC	
Black Maize Beetle	Carbosulfan 25EC	Marshall
	Chlorpyrifos	Pyrinex Dusban
Chafer Beetle	Carbaryl 85 WP	
Cutworm	Chlopyriphos/ Pyrinex 48EC	
	Fenvalerate	
	Lamda - cyhalothrin	
	Thiamethoxam/metalaxyl-M/Difenoconazole	Apron star
Dusty Surface beetle	Imidacloprid	
False Wireworm	Chlopyrifos	
Larger Grain Borer	Actellic Gold Dust	ACTELLIC GOLD DUST
Leaf Hoppers	Imidacloprid 70 WS	Gaucho 70 WS/
	Dimethoate 40 EC	
Snout Beetles	Carbaryl 85 WP	
	Carbofuran	Curaterr
SEED DRESSING	Imidacloprid (Gauncho 70 WS)	125g/50 kg seed
Stalk borer	Carbaryl 85 WP	
	Chlopyriphos	
	Carbosulfan	Marshal 25 EC
	Cypermethrin	Ripcord
Termites	Imidacloprid 200SL(confidor)	200ml/100lt of water
	Fipronil	Regent

STORAGE INSECT PESTS:

Larger grain borer, lesser grain borer, MOTHS	Pirimiphos methyl/ Thiamethoxam Pirimiphos-methyl/Permethrin	Actellic gold dust Chirindamatura Super Guard	Sprinkle 25g/50kg grain 25g/50 kg grain 10ml/1-2 l water & spray over 1000kg grain	

MAIZE HERBICIDES

PRODUCT	***TRADE NAME***	***TIME OF APPLICATION***	***APPLICATION DETAILS/ REMARKS***
Acetochlor 900 EC	HANNESS	Pre - Emergence	Annual grasses & some broad leaf weeds. Use with B/L herbicide for improved B/L weed control. Use Higher rates for yellow nutsedge control
Alachlor 480 EC	LASSO	Pre - Emergence	Annual grasses & broad leaf weeds. Apply immediately after planting to well-prepared seedbeds. Use with recommended broad leaf herbicide.
Ametryn 50 SC		Post Directed	Annual grasses, B/L weeds & Nutsedge. Apply as a directed spray. AVOID DIRECT CONTACT WITH CROP. (MCPA must be 40% formulation)
Atrazine 50 FW		Pre & early Post E	B/L weeds & some grasses. should be mixed with a grass herbicide. Refer to label for combination rates.[
Bentazone	BASAGRAN	Post Emergence	B/L weeds & yellow nutsedge. May be applied at any stage of crop. Use Higher rates for nutsedge control.
Bromoxynil	BUCTRIL	Post Emergence	Apply over the top of the crop from 3 leaf stage until tassel emergence. Use higher rate for aerial application. May be mixed with Atrazine 500 FW to give residual weed control.
Dicamba	BANVEL	Post E directed	B/L weeds & soya beans. Over the crop spray until maize is knee high. Directed spray from knee height to 15 days before tassle emergence. COMMERCIAL MAIZE ONLY
Frontier Optima		Pre & Early Post E	Annual grasses, some B/L weeds & suppression of yellow nutsedge & wandering Jew. May be mixed with a B/L herbicide.
Halosulfuron 75 WG	SERVIAN	Post Emergence	Yellow & Purple Nutsedge control. Add Compliment oil. Apply to young 2- 6 leaf stage weeds.
MCPA		Pre -Emergence Post -Emergence	B/L weeds Post - emergent directed inter-row spray after 12 leaf stage of maize
Sencor 480 SC + MCPA (tank mix) Metribuzin 48 SC + MCPA (tank mix		Post – Emergence Post Emergence	Early post emergence. B/L weeds (4 leaf stage). Apply as a full cover or as a directed spray. Essential that crop is treated with pre- emergent grass killer (Post E directed (layby). Apply when crop is 300 - 400mm tall. Avoid spraying crop
Nicosulfuron (Accent) Nicosulfuron (Sanson)	SHAMVA KILL, ACCENT, SANSON	Post Emergence Post Emergence	Shamva grass & wild sorghum control. For use on commercial maize only. Shamva grass & some B/l weeds. Add Sanawett at 0.1 % spray mix & apply before 4 leaf stage & not after the 7 leaf stage of maize. COMMERCIAL MAIZE ONLY.
COMBINATION HERBICIDES:			Annual grasses & broad leaf weeds. Avoid spraying over

Topamezone/Dicamba	STELLAR STAR	Early Post Emergence	top of maize after the maize is 80cm high.
Saflufenacil/ Dimethenamid-P	INTEGRITY	Pre Emergence	Annual grasses, B/L weeds & yellow nutsedge.
Metolachlor/Terbuthylazine/Mesotrione	MAXIMUS	Pre Emergence	B/L weeds.
	AUXO	Pre Emergence	Annual grasses & broad leaf weeds.

SOYA BEAN PESTICIDE REFERENCE GUIDE: *Diseases*

PROBLEM	***ACTIVE INGREDIENT***	***TRADE NAME***	***APPLICATION DETAILS***
Soya bean rust	Flusilazole/ Carbendazim	Punch Xtra	Apply 3 or more sprays from flowering at 21 day intervals
	Difenoconacole	Score	Full cover spray from 50 days after planting
	Terbuconazole	Folicure	Full cover spray at 1st signs of disease
	Pyraclostrobin/Epoxiconazole	Opera	Apply 1st spray at 28 days after emergence
	Triadimenol	Shavit	Applyv 2 or 3sprays from day 50after planting
Frog eye leaf spot	Azoxystrobin/ Difenoconazole	Amistar Top	First spray at onset of disease
	Difenoconazole	Score	Full cover spray at 1st signs of disease
	Epoxiconazole	Opus	Full cover spray at 1st signs of disease
	Pyraclostrobin/Epoxiconazole	Opera	Full cover spray at 1st signs of disease
Red leaf blotch	Difenoconazole	Score	First spray at onset of disease
	Chloranhtraniliprole/ Lamda cyhalothrin	Ampligo	Full cover spray at 1st signs of disease
	Pyraclostrobin/Epoxiconazole	Opera	Full cover spray at 1st signs of disease

SOYA BEAN PESTICIDE REFERENCE GUIDE: *Insecticides*

PROBLEM	***ACTIVE INGREDIENT***	***TRADE NAME***	***APPLICATION DETAILS***
Aphids	Dimethoate 40EC	Rogor	Mix with 100lt water. Repeat as necessary as low volume, full cover spray.
Cutworm	Chlopyriphos/ Pyrinex 48EC		Apply in 300mm band in 400 lt of water at planting.
	Fenvalerate		Mix with 100lt of water. Apply as a band spray at planting or at germination in 250lt water/ha.
	Lamda - cyhalothrin		Apply over crop row at time of germination
	Thiamethoxam/metalaxyl-M/Difenoconazole	Apron star	Apply as seed dressing.
Semi loppers & Bollworms	Carbaryl 85 WP		Apply at 1st signs of infestation.
	Dichlorvos	DDVP	Apply as a full cover spray after flowering.
	Chlorontraniliprole/Lamda Cyhalothrin	Ampligo	Apply as a full cover spray as necessary.

SOYA BEAN HERBICIDES

PRODUCT	***TRADE NAME***	***TIME OF APPLICATION***	***APPLICATION DETAILS/ REMARKS***
Acetochlor 900 EC	HANNESS/ VOLCANO	Pre - Emergence	Annual grasses & some broad leaf weeds. Use with B/L herbicide for improved B/L weed control. Use Higher rates for yellow nutsedge control
Alachlor 480 EC	LASSO	Pre - Emergence	Annual grasses & broad leaf weeds. Apply immediately after planting to well-prepared seedbeds. Use with recommended broad leaf herbicide.
Linuron	Afalon	Pre Emergence	Annual grasses & B/L weeds.
Clomazone	COMMAND/ KALIF	Pre Emergence	Annual grasses & volunteer cereal
Metribuzin	Sencor	Pre Emergence	B/L weeds & some grasses
Metalachlor	Metalachlor	Pre Emergence	Annual grasses some broad leaf weeds & yellow nutsedge
Frontier Optima		Pre & Early Post E	Annual grasses, some B/L weeds & suppression of yellow nutsedge & wandering Jew. May be mixed with a B/L herbicide.
Fluazifop-P - butyl	Fusilade	Post Emergence	Annual & Perennial grasses
Imazethapyr	Puruit	Post Emergence	Annual grasses & B/L weeds.
Fomesafen	Flex W	Post Emergence	B/L weeds
Bentazone	BASAGRAN	Post Emergence	B/L weeds & yellow nutsedge. May be applied at any stage of crop. Use Higher rates for nutsedge control.
Chlorimuron-ethyl	CLASSIC	Post	B/L weeds & yellow nutsedge.

GROUNDNUTS PESTICIDE REFERENCE GUIDE: ***Insecticides***

PROBLEM	***ACTIVE INGREDIENT***	***TRADE NAME***	***APPLICATION DETAILS***	***H.I (Days)***
Aphids	Dimethoate 40EC	Rogor	Mix with 100lt water. Repeat as necessary as low volume, full cover spray.	21
Cutworm	Chlopyriphos/ Pyrinex 48EC		Apply in 300mm band in 400 lt of water at planting.	32
	Fenvalerate		Mix with 100lt of water. Apply as a band spray at planting or at germination in 250lt water/ha.	
	Lamda - cyhalothrin		Apply over crop row at time of germination	
Snout beetles	Cabaryl		Apply at 14 -21 day intervals	14

Semi loppers & Bollworms	Dichlorvos	DDVP	Apply as a full cover spray after flowering.	2
	Chlorontraniliprole/Lamda Cyhalothrin	Ampligo	Apply as a full cover spray as necessary.	15

GROUNDNUTS: ***Diseases***

PROBLEM	***ACTIVE INGREDIENT***	***TRADE NAME***	***APPLICATION DETAILS / REMARKS***	***H.I (Days)***
Cercospora	Benomyl Difenoconazole Chlorothalonil Sulphur	Benlate Score Bravo Wettable sulphur	Apply a full cover spray at 1st sign of leaf spotting. First spray at onset of disease. First spray at onset of disease	14 14 7
Rust	Terbuconacole	Folicur	Full cover spray	
	Lamda - cyhalothrin		Apply over crop row at time of germination	
Botrytis	Benomyl Terbuconazole	Benlate Folicur	Apply at 14 -21 day intervals Apply 4/5 sprays per season	14 21
	Dichlorvos	DDVP	Apply as a full cover spray after flowering.	2
	Chlorontraniliprole/Lamda Cyhalothrin	Ampligo	Apply as a full cover spray as necessary.	15

GROUNDNUT HERBICIDES:

PRODUCT	***TRADE NAME***	***TIME OF APPLICATION***	***APPLICATION DETAILS/ REMARKS***
Acetochlor 900 EC	HANNESS/ VOLCANO	Pre - Emergence	Annual grasses & some broad leaf weeds. Use with B/L herbicide for improved B/L weed control. Use Higher rates for yellow nutsedge control
Alachlor 480 EC	LASSO	Pre - Emergence	Annual grasses & broad leaf weeds. Apply immediately after planting to well-prepared seedbeds. Use with recommended broad leaf herbicide.
Metalachlor	DUAL MAGNUM	Pre Emergence	Annual grasses some broad leaf weeds & yellow nutsedge
linuron	Afalon	Pre Emergence	Annual broadleaf weeds & some grasses

Dimethenamid	Frontier Optima	Pre Emergence	Annual grasses, some B/L weeds & suppression of yellow nutsedge & wandering Jew. May be mixed with a B/L herbicide.
Prometryn		Pre Emergence	B/L weeds
Fluazifop-P - butyl	Fusilade	Post Emergence	Annual & Perennial grasses
Imazethapyr	Pur	Post Emergence	Annual grasses & B/L weeds.
Fomesafen	Flex W	Post Emergence	B/L weeds
Bentazone	BASAGRAN	Post Emergence	B/L weeds & yellow nutsedge. May be applied at any stage of crop. Use Higher rates for nutsedge control.
Propaquizafop	Agil	Post Emergence	Annual & Perrenial grasses including wheat & Shamva grass

SORGHUM PESTICIDE REFERENCE GUIDE: ***Insecticides***

PROBLEM	*ACTIVE INGREDIENT*	*TRADE NAME*	*APPLICATION DETAILS*
Aphids	Dimethoate 40EC	Rogor	Mix with 100lt water. Repeat as necessary as low volume, full cover spray.
Black maize beetle	Carbosulfan	Marshal	Apply as a 250 mm wide band into planting furrow or as full cover spray disced in before planting.
	Chlopyriphos		Spray into plant furrow just behind the planter shoe before closing the furrow.
Heliothis bollworm	Fenvarelate		Apply when pest is noticed from flowering.
Stalk borer	Carbosulfan	Marshal	Apply as a 250mm wide band into plantiung furrows.

STORAGE INSECT PESTS:

Larger grain borer, lesser grain borer, MOTHS	Pirimiphos methyl/ Thiamethoxam Pirimiphos- methyl/Permethrin	Actellic gold dust Chirindamatura Super Guard	Sprinkle 25g/50kg grain 25g/50 kg grain 10ml/1-2 l water & spray over 1000kg grain

SORGHUM: ***Diseases***

PROBLEM	*ACTIVE INGREDIENT*	*TRADE NAME*	*APPLICATION DETAILS*
Smut & Damping off.	Thiram	Score	Apply as seed dressing.

SORGHUM: HERBICIDES:

PRODUCT	*TRADE NAME*	*TIME OF APPLICATION*	*APPLICATION DETAILS/ REMARKS*
Atrazine		Pre & Early Post	Annual broadleaf weeds & some grasses

Bentazone	Basagran	Post Emergence	Broad leaf weeds & sedges.
Bromoxynil	Buctril	Post Emergence	Annual grasses some broad leaf weeds & yellow nutsedge
MCPA-K-Salt	MCPA	Post Emergence	B/L weeds. Post emergent application only when crop plants are 150 -250 mm. Any spray after should be directed.
Metolachlor/Terbuthylazine/Mesotrione	Maximus	Pre E & Post E	B/L weeds.
Terbutryn		Pre Emergence	B/L weeds

SUGAR BEAN PESTICIDE REFERENCE GUIDE: Sugar bean *Insecticides*

PROBLEM	***ACTIVE INGREDIENT***	***TRADE NAME***
Aphids	Dimethoate Malathion Diazinon	Rogor, Dimethoate 40 EC Malathion 25 WP/50EC , Aphid kill Diazinon 30 EC/40 EC
BEAN STEM MAGGOT	Diazinon	Diazinon 30 EC/ 40 EC ***(SPRAY AT DAY 3,6,13,20)***
Crickets	Cabaryl	Cabaryl 85 WP
Flour Beetle, Moths	Pirimiphos-methyl/Permethrin Primiphos - methyl + Thiamethoxam	Chirindamatura Dust Actellic gold dust
Grass hoppers	Cabaryl	Cabaryl 85 WP
Heliothis bollworm & caterpillars	Cabaryl	Cabaryl 85 WP
Leaf miner	Cartap nydrochloride	Suntap 500 SP
Red spider mite	Amitraz Diazinon Dimethoate Malathion Sulphur	Amitraz 20 EC Diazinon 30 EC Dimethoate 40 % Malathion 25 WP/50EC Dusting sulphur, Agridust
Semi loopers	Dichlorvos	DDVP100EC

SUGAR BEAN: HERBICIDES

PRODUCT	***TRADE NAME***	***TIME OF APPLICATION***	***APPLICATION DETAILS/ REMARKS***
S – Metalachlor	DUAL MAGNUM	Pre Emergence	Annual grasses, yellow nutsedge & some broad leaves.
Lasso	ALACHLOR	Post Emergence	Annual grasses & some broadleaf weeds.
Metalachlor + Flumetsulam	BATELEUR GOLD	Pre Emergence	Grasses & Broad leaf weeds including yellow nutsedge.
Clomazone	COMMAND	Pre Emergence	Annual grasses & some broadleaf weeds
Dimethanimide - P	FRONTIER OPTIMA	Pre Emergence	Annual grasses, broad leaf weeds & yellow nutsedge
Bentazone	BASAGRAN	Post Emergence	Wide range of broad leaf weeds
Propaquizafop	AGIL	Post Emergence	Annual & Perennial grasses
Fluazifop – P- butyl	FUSILADE Super/ Forte	Post Emergence	Annual & Perennial grasses

SUGAR BEAN : Diseases

PROBLEM	***ACTIVE INGREDIENT***	***TRADE NAME***	***APPLICATION DETAILS***
Rust & Scab	Terbuconazole Mancozeb	Folicure Dithane M 45	Apply when 1st signs of the disease appear . Spray as preventative & repeat as necessary.
Anthracnose & Black spot	Mancozeb	Dithane M 45	Spray as preventative & repeat as necessary.
Bacterial Blight	Copper Oxychloride	Copper Oxychloride 85 WP	Spray as preventative & repeat as necessary.
Damping off & Rhizoctonia	Thiram Fludioxonil	Thiram 80 WP Maxim XL 035 FS Apron star	Apply as seed dressing.

WHEAT PESTICIDE REFERENCE GUIDE: Wheat *Insecticides*

PROBLEM	***ACTIVE INGREDIENT***	***TRADE NAME***
Aphids	Dimethoate 40EC Imidacloprid Carbosulfan	Rogor Pilaking Marshal
	Acetamiprid	Blast 60 EC
	Carbosulfan	Marshal 25 EC
	Thiometon	Ekatin 25 EC
	Pirimicarb	Pirimor 50 DG
Armyworm	Carbaryl	Carbaryl 85 WP
	Malathion	Malathion 50 EC
	Cypermethrin	ZFC Cypermethrine
Termites	Imidacloprid 200SL(confidor)	
	Fipronil	Regent
Bollworm	Tetrachlovinphos	Gardona 50 WP

WHEAT: Herbicides

PRODUCT	*TRADE NAME*	*TIME OF APPLICATION*	*APPLICATION DETAILS/ REMARKS*
Bentazone	BASAGRAN	Post Emergence	B/L weeds & yellow nutsedge. May be applied at any stage of crop. Use Higher rates for nutsedge control.
Bromoxynil	BUCTRIL	Post Emergence	Apply over the top of the crop from 3 leaf stage until tassel emergence. Use higher rate for aerial application. May be mixed with Atrazine 500 FW to give residual weed control.
Dicamba	BANVEL	Post Emergence directed	B/L weeds & soya beans. Over the crop spray until maize is knee high. Directed spray from knee height to 15 days before tassle emergence. COMMERCIAL MAIZE ONLY
MCPA – K- Salt	MCPA	Post Emergence	B/L weed apply from 3 leaf stage.
Metsulfuron-methyl	ALLY	Post Emergence	B/L weeds & soya beans
Tribenuron methyl	TRIBENURON, GRANSTAR	Post Emergence	B/Lweeds & volunteer soyabean
Fenoxaprope-p-ethyl	Puma Super	Post Emergence	Annual and perennial grasses, volunteer maize and sorghum.

WHEAT: Diseases

PROBLEM	*ACTIVE INGREDIENT*	*TRADE NAME*	*APPLICATION DETAILS*
Rust	Triadimenol	Triadimenol/Shavit	Apply when 1st signs of the disease appear .
Powdery mildew	Terbuconazole	Folicure	Full cover spray at 1st signs of disease
Brown stem rust	Propiconazole	Tilt	Full cover spray at 1st signs of disease
Damping off	Thiram		Apply as seed dressing.
	Triadimenol	Shavit	Applyv 2 or 3sprays from day 50after planting
Loose smut & Smut	Benomyl Tridimenol	Benlate	First spray at onset of disease

Sugar bean weed control

Pre-emergence

Frontier
Optima
Metalachlor
Basagran
Alachlor
Bateleur
Gold

Post-emergence

Imazamax, Pursuit, Afalon, Basagran, Fusilade, Agil e.t.c.

Sugar bean pests and control

Bean stem maggot, cutworm, aphids, white flies, blister (CMR) beetles, chafer beetles, stink bugs and bollworms, semi loopers e.t.c.

Foliar spray

Thionex, Karate Zeon 5CS, Lambda, Dimethioate, Blast Super & Cabaryl e.t.c.

Sprayer calibration
Proper calibration can save the farmer a lot of money which can be losses through phytotoxicity, over or under-applying, reduced chemical efficacy. Accurate sprayer calibration is essential for proper chemical application and control. Thoroughly inspect and service spray rigs regularly and calibrate at least twice in a season.

Calibration is the setting of the sprayer to apply the correct or given volume of spray mixture on a per unit area (or per hectare) basis. Consider the following pointers when calibrating:
• Type and size of nozzle
• Spray volume/ha- around 200l/Ha
• Pressure-usually 1.0 bar for flood jet nozzles
• Walking speed-recommended speed is 0.9m/second to 1.25m/second (average 1m/second)
• Lance height-75-80cm above ground
• Chemical application rate-always refer to the chemical label
• Spray tank capacity e.g. 10l, 15, 16l knapsack or 500l, 2500l boom sprayer tank

Calibration steps
Step 1-Determine the speed (metres/seconds)
• Train one or more people to walk at a speed of 0.9 to 1.25m/second. This training must be done in the field which you intend to spray, under the anticipated conditions of the actual operation, and the trainee should have the knapsack half full of water on his back.
• A convenient distance is marked say 50m and the sprayers should be timed spraying water up and down the marked distance.
• Each distance must take approximately 50 seconds.

Step 2- Determine the nozzle output rate (millilitres/second)
• Half fill a knapsack with water and spray at the correct pressure (say 1-1.5 bars) but catch in a measuring jar and measure the amount of discharged water, say in 50 seconds.
•This step is to be repeated 3 times and average out.
•For example, the output from a single nozzle could be 1000 ml in 50 seconds. Therefore, the sprayer nozzle is discharging 20 ml/second.

Step 3- Determine the swath width (metres)
• Decide on what the spray band (swath width) will be and measure it.
• This is done by spraying on a flat surface say a concrete slab and measuring the band wetted by the spray with a tap measure.
• Always aim to cover a swath width of 0.9 to 1m. Maintain a lance height of 0.75 to 0.8m from the ground.

Step 4- Calculating the application rate (litres/ha)
The application rate is calculated as follows:

Assumption in this example:

Speed	= 1 metre/second.
Nozzle output rate	= 20 ml/second (Step 2)
Swath width	= 1.0 metres (Step 3)
Herbicide rate	= 4 litres/ha, say Atrazine
Knapsack volume	= 15 litres
Number of nozzles	= 1
Square meters	= sqm

• If one sprays over a distance of 50 metres at 1 metre/second, the time taken is 50 seconds, the area covered is 50 square meters (50m x 1m). The spray volume discharged/50 sqm is 1000ml (50m x 20ml/second).
• Now we calculate the spray volume on 1 Ha (10 000sqm). There are 200 plots of 50 sqm size in 1 Ha ie (10 000sqm/50sqm).
• If 1000ml is applied to 50sqm, then 200l of water is applied to 1 Ha from the following formula:

$$\frac{10\,000 \times 1000}{50} = 200\,000\ ml = 200l\ spray\ volume$$

Step 5-calculating the amount of chemical required per spray volume capacity
• The next step is to determine the amount of chemical to be mixed in a 15 l knapsack sprayer.
• If a spray volume of 200l is required per Ha, then it means 13 knapsacks are enough to cover 1 Ha, from the following calculation;

$$\frac{200}{15} = 13.3\ knapsacks\ to\ pray\ 1Ha$$

• With a herbicide rate of 4.0l/Ha or 4.0l per 200l of water, it means

$$\frac{4\,000ml}{13} = \mathbf{ml}\ of\ herbicide\ is\ required\ in\ a\ knapsack\ with\ 15l\ water$$

• Some farmers prefer to do the mixing say in a non-corrosive (preferably plastic) 200l drum, then transfer the mixture in knapsack ready for spraying. But always remember to agitate or stir the mixture with a clean stick before loading the knapsack.
• The same principle for knapsack calibration applies to tractor mounted boom sprayers but the following points should be noted and considered:
• Tank capacity, say 500l or 2500l for bigger tractor mounted booms must be known
• Select tractor speed, gear and revolutions, equal to 540 r.p.m which is required to maintain the speed
• Boom sprayer swath, nozzle type, number and size
• Pressure must be kept between 2-3 bars depending on nozzle type

Maize nutrient deficiency

Nitrogen Deficiency


Symptoms:

1. Stunted, spindly growth and pale, yellowish-green foliage in young plants
2. Older plants develop a V-shaped yellowing along the midrib to the tips of the bottom leaves
3. Stalks remain thin and spindly
4. Ears tend to be pinched at the tips, kernels are glossy, hard and flinty.

Notes:

1. Favored by cold, wet, or flooded soils, drought (especially after midseason), sandy soils low in organic, heavy leaching rains and ponded areas in warm weather
2. Apply ammonium nitrate fertilizer at the recommended rate (400kg/ha)

Magnesium Deficiency


Symptoms:

1. Manifests in seedlings as general yellowing of upper leaves.
2. Eventually, yellow-to-white interveinal stripping develops, and older leaves appear reddish purple along their edges and tips

Notes:

1. Favored by strongly acid, sandy soils in regions of moderate to high rainfall, high K, and soil treated with limestone low in magnesium.
2. Apply foliar spray of Magnesium sulphate

Phosphorous Deficiency


Symptoms:

1. Purpling or reddening of the leaves beginning early in the growing season.
2. Leaf tips die and turn dark brown
3. Ears on affected plants are small and often appear twisted with irregular kernel rows and with imperfectly developed ear tips

Notes:

1. Favoured by: cold, too wet or too dry soils, restricted root growth in compacted soils and root damage by insects, cultivator or herbicides.
2. Apply basal fertilizer (N,P,K) at the recommended rate (400kg/ha)

Potassium Deficiency


Symptoms:

1. Yellowing and dying of the leaf margins beginning at the tips of the lower leaves.
2. Plants often lodge due to increased susceptibility to stalk rot
3. Ears maybe small, chaffy, and dull with pointed, poorly developed tips

Notes:

1. Favoured by sandy, organic, wet or compacted, strongly weathered soil and heavy K removal by the preceding crop(s)
2. Apply basal fertilizer (N,P,K) at the recommended rate (400kg/ha)

Herbicide toxicity


Approximate NPK Values of Various Animal Manures*

ANIMAL	% NITROGEN	% PHOSPHORIC ACID	% POTASH
Dairy cow	0.57	0.23	0.62
Beef steer	0.73	0.48	0.55
Horse	0.70	0.25	0.77
Swine	0.49	0.34	0.47
Sheep/Goat	1.44	0.50	1.21
Rabbit	2.40	1.40	0.60
Chicken	1.00	0.80	0.39

** Adapted from: Anon. 1998. Fertilizer values of some manures. Countryside & Small Stock Journal. September-October. p. 75*

This is a useful guide for those who use animal manure. Many a times we apply blindly. It means for every 20 tons of eg beef steer manure, one is applying about 146kg of Nitrogen, 96kg of phosphorus and 110kg of potash.

Fall armyworm Identification and control

gg mass laid on top leaves

Hatched larvae

First instar larva

Fourth instar larva

Adult female moth

Damage symptoms

Window panning by young larvae

Foliar damage by adult larvae

Damage on tassel reducing pollen production

Silk damage reducing kernel set

Early cob and kernel damage

Reduced yield and quality on harvested cobs

Early scouting is key

- At this stage larvae is tiny and exposed
- Damage not significant
- Ideal time for chemical control

Late control challenges

- At this stage larvae is big and burrowed deep into the plant
- Damage very significant
- Chemical control less effective

- Scout early for 'window panning' damage on leaves and spray if the damage is more than 5% of the field
- Alternate insecticides at two weeks intervals depending on level of damage

RECOMMENDED INSECTICIDES FOR THE CONTROL OF FALL ARMYWORM IN ZIMBABWE

ACTIVE INGREDIENT	*TRADE NAME*
Indoxacarb	Steward 150EC Missile 150SC Devacarb 150SC Blanket 150SC Indoxacarb 150SC
Indoxacarb and Acetamiprid	Attitude 80SC
Indoxacarb and Acetamiprid	Aryna 46EC
Emmamectin Benzoate and Acetamiprid	Blast Super
Chlorantraniliprole	Coragen 20SC
Chlorantraniliprole and Lambda Cyhalothrin	Ampligo 150ZC
Flubendiamide and Thiacloprid	Belt Expert
Emmamectin Benzoate and Acetamiprid	Super Dash Nemesis
Flubendiamide	Belt 480SC
Deltamethrin and Pirimiphos Methyl	Ecoterex 0.5GR

SEED CO MAIZE SEED PRODUCTS

Ultra Early Maturing Maize Hybrid

Product	Product Description
SC 301 **Heat and drought stress tolerant hybrid. Ultra-earliness confers early maturity superiority.** 	• An ultra-early, 3 months to maturity, maize hybrid with high yield potential that is comparable to the SC 403. It confers significant early maturity superiority (<110 days to reach physiological maturity at 1300 metres above sea level). • Excellent heat and drought stress tolerance characteristics making it suitable for areas with short rainfall seasons such as regions 4 and 5. Excellent wide regional adaptation. An excellent alternative for small grain cereals such as sorghum and millet. An elastic hybrid, in a poor season a decent yield is achievable and in a good season the variety has high yield potential of up to 10 t/ha at 53000 plants per ha. Average plant height of about 2.2m and an average cob placement of 1.02m aiding excellent standability. Good standability at high population densities of up to 72 000 plants per Ha. • Moderate tolerance to Maize Streak Virus, Phaeosphaeria Leaf Spot and Grey Leaf Spot diseases • Hard dent grain texture • White grain colour • Excellent cob rot tolerance • A variety highly recommended for very low to low potential conditions - marginal rainfall areas of Zimbabwe in particular agro-ecological region IV and V • Suitable for very early or late planting in high potential areas

Very Early Maturing Maize Hybrid

Product	Product Description
SC 403 **Heat and drought stress tolerant hybrid. Excellent tolerance to Maize Streak and Mottle Viruses. Wide adaptation.** 	• SC 403 is a very early maturing white grained hybrid. Takes 119-127 days to reach physiological maturity at 1300 metres above sea level. Stable across regions and seasons. • Heat and drought stress tolerant hybrid with very good synchronization of silks with pollen. Farmers' choice for low rainfall and marginal areas. • Has a yield potential of up to 9 t/Ha. A good sizeable cob and a high shelling out percentage of up to 80%; are the yield components. • Outstanding tolerance to Maize Streak and Mottle Viruses. Tolerant to other major maize diseases such as Blights. Moderate tolerance to Grey Leaf Spot. Average stalk height is 2.6m with a cob placement of 1.4m. The average cob placement confers excellent standability. • Can stand plant population densities of up to 60 000 plants per Ha. Semi-flint grain type with a medium dry down rate of 1.5% moisture loss per week after physiological maturity. • It is an excellent short season option for green mealie. • It is also recommended for irrigated winter production. An early, Maize Streak Virus tolerant hybrid is ideal for green mealies.

Early Maturing Maize Hybrid

Product	Product Description
SC 513 **Ultra-early maturity (<100 days) and leaf disease tolerant hybrid** 	• An early maturing white grained maize hybrid. Reaches physiological maturity in 137 days at 1300 metres above sea level. • Pan-African early maturing hybrid that performs across diverse environments. Excellent drought tolernance. • Elastic maize hybrid, good for both high and low potential environments with yield potential of up to 10 t/ha. Popular variety with farmers - Farmers' choice. Excellent Grey Leaf Spot tolerance. Moderately tolerant to Maize Streak Virus. • High shelling percentage • Excellent thick ear with dent grain and a good taste for green mealies. • Good stand ability up to >50 000 plants/ha aided by average cob placement of 1.5 m against an average plant height of 2.4m. • Good green mealie properties • Recommended for regions 2, 3 and 4.

Early Maturing Maize Hybrid

Product	Product Description
SC 529 **Early, stable, widely adapted high yielding hybrid. Top yielder beyond its maturity group.** 	• Early, adapted high yielding maize hybrid • Reaches physiological maturity in 135 days at 1300 metres above sea level. Top yielder in the 500 series category in Zimbabwe and perfoms beyond its maturity group under favourable conditions • Out-competes most 600 series hybrids on the market. • Top yielder in this maturity group with high yield potential of up to 13 t/ha. Long attractive cob (28-30 cm) with semi-flint grain texture and good tip cover • High Shelling percentage of about 80% • Moderate cob rot tolerance • Good Grey Leaf Spot tolerance with moderate Maize Streak Virus tolerance. • Plant height 2.50 m and cob height 1.26 m • Good standability, can with stand population densities of up to 60 000 plants/ha. • Early maturing coupled with medium dry down rate of about 1.8% per week making it suitable for short crop rotations/double cropping set-ups e.g. maize-wheat rotations • Recommended for Natural regions II, III and IV.

Medium Maturing White Maize Hybrid

Product	Product Description
SC 633 **Medium maturing, high yielding maize hybrid (135-148 days to physiological maturity)** 	•Medium maturing white maize hybrid (135-140 days to reach physiological maturity) •Excellent variety for both dryland and irrigated farming systems •High yield potential up to 14 t/ha •Excellent shelling out percentage •Very good tolerance to heat and drought stress. Recommended for region II, III & IV •Good Maize Streak Virus disease tolerance •Moderate tolerance to Grey Leaf Spot Tolerance •Dent Grain Texture with the fastest dry down rate of 2.5% per week and hence farmers' choice for short crop rotations eg maize-wheat. •Plant height 2.30 m and cob height 1.20m •Good Standability up to 60 000 plants/ha

Medium Maturing White Maize Hybrid

Product	Product Description
SC 637 **Medium maturing, high yielding maize hybrid (135-148 days to physiological maturity)** 	•Medium maturing white maize hybrid (135-148 days to reach physiological maturity) •Excellent farmers' choice variety for high potential and irrigated farming with yield potential of up to 16 t/ha •Mild tolerance to heat and drought stress tolerance •Good tolerance to Maize Streak and Mottle Virus •Moderate tolerance to Grey Leaf Spot, Northern Corn Leaf Spot and Common Rust •Very good cob rot disease tolerance •Semi flint grain texture. Medium dry down rate of less than 1.6% per week. An option for short rotations but need to be established aerly with irrigation •Three yield components: high shelling out %, high row number (16-18 under good environments) and long cobs (up to 31.5cm and up to 900 kernels per cob) •Very good stand ability at up to 55 000 plants/ha •Excellent tip cover. Farmers' choice for green mealie production. •Plant height 2.7m and cob height 1.5m. •Recommended for natural regions 1, 2 and 3. Can be grown in natural regions 4 and 5 but under irrigation.

Medium Maturing White Maize Hybrid

Product	Product Description
SC 627 **Medium maturing, drought and disease tolerant maize hybrid (135-144 days to maturity)** 	•Medium maturity white maize hybrid (135-144 days to reach physiological maturity) •Widely adapted and stable variety across diverse environments with yield potential of above 10 t/ha under good management. • Recommended for regions II, III & IV •Excellent tolerance to Grey Leaf Spot •Good tolerance to Maize Streak Virus and Northern Corn Leaf Spot •Plant height 2.5m and cob height 1.4m aiding Good stand ability at densities of up to 55 000 plants/ha •Semi-flint grain texture. A good green mealie option. •High shelling percentage above 80%"

Medium Maturing White Maize Hybrid

Product	Product Description
SC 649 (New) **Medium maturing, high yielding and drought tolerant maize hybrid (135-145 days to maturity)** 	•Medium maturing white maize hybrid (135-145 days to reach physiological maturity) •Highest yielder in Zimbabwe in the 600 series maturity group up to 16 t/ha. •Semi-dent grain texture •Excellent heat and drought tolerance •Wide adaptability and yield stability across environments. •Recommended for natural regions 1, 2, 3 and 4 in Zimbabwe •Excellent tolerance to Grey Leaf Spot disease •Moderate tolerance to Maize Streak Virus •A second choice silage contender (after SC719), because it has excellent standability, bulkish, leafy and a stay green character to aid/give a silage cutting window •Three yield components: high shelling out %, high row number (16-20 under good environments) and long cobs (up to 31.5cm) •Plant height 2.61 m and cob height 1.50 m. Good standability, can with stand population density of up to 60 000 plants/ha.

Medium Maturing Yellow Maize Hybrid

Product	Product Description
SC 608 (Yellow) **Medium maturing, high yielding and drought tolerant yellow maize hybrid (135-148 days to maturity)** 	•Medium maturity yellow maize hybrid •High yield potential of up to 14t/ha •Reaches physiological maturity in 135- 148 days. Farmer's choice for livestock feeds and green mealie production as well as yellow grain. •Good heat and drought tolerance aiding wide adaptation. •Moderate MSV tolerance •Good GLS tolerance and cob disease. •Thick cob with dent grain texture •Very good standability • Can stand population density of up to 60 000 plants per hectare • Good for green mealies and silage

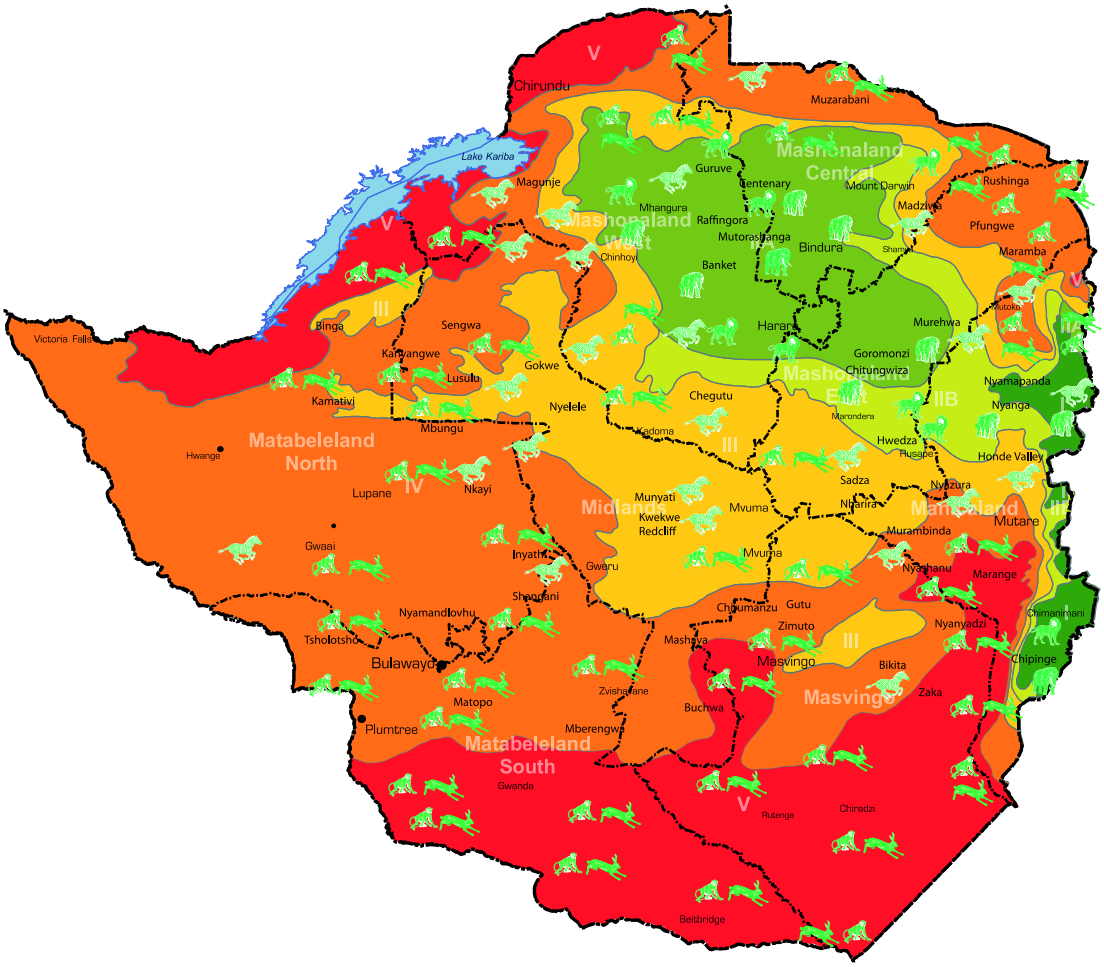
Late Maturing White Maize Hybrid

Product	Product Description
SC 719 **Top late maturing, pan African, well adapted and high yielding white maize hybrid (148 -155 days to maturity)** 	•Farmers' first choice in the irrigated and high potential environments - yields up to 21 t/Ha under good management •Late maturing white maize hybrid (148-155 days to reach physiological maturity) •Top performer and a global hybrid, hardy and well adapted across environments and seasons •Hard dent grain texture •Good Maize Streak Virus and Grey leaf Spot tolerance •Good cob rot tolerance. • Average plant height of 2.8m with average cob placement at 1.64m •Good standability up to 55 000 plants/ha •Excellent tip cover. Medium dry down rate of 1.8% per week. •High shelling out % up to 80 •Farmers' first choice for silage because it has excellent standability, bulkish, leafy with a stay green character to give a silage cutting window •Has a good chaff: grain ratio-a measure of silage quality due to high grain yielding ability •Good for green mealies; properties – characteristic very long cobs (up to 31.5cm) with up to 900 kernels per cob •Three yield components: high shelling out %, high row number (16-18 under good environments) and long cobs (up to 31.5cm) •Recommended for natural regions I, II & III

Late Maturing White Maize Hybrid

Product	Product Description
SC 727 **Top late maturing, best yielder in Zimbabwe, well adapted and high yielding white maize hybrid (155-160 days to maturity))** 	•Highest yielding conventional hybrid in Africa with some farmers hitting the 21t/Ha in the high potential/irrigated areas •Late maturing white maize hybrid (155-160 days). •Excellent heat and drought escape mechanisms. An elastic and widely adapted hybrid for both dryland and irrigated farming. Recommended for natural regions 1, 2 and 3 in Zimbabwe. •Up to 85% shelling out percentage •Good resistance to Maize Streak Virus, Grey Leaf Spot, Phaesopheria Leaf Spot, Northern Corn Leaf Spot and Common Rust •Cylindrico-curved ear with dent grain texture. Medium dry down rate of 1.8% per week. •Plant height 2.8 and average cob placement 1.6m •Good stand ability up to 55 000 plants/ha •Very long cob ≥ 32cm with up to 900 kernels per cob and very white grain •Three yield components: high shelling out % up to 85, high row number (18-20 under good environments) and long cobs (up to 33cm) •Excellent option for green mealies •An excellent product for silage because it has excellent standability, bulkish, leafy. •Has a good chaff: grain ratio-a measure of silage quality

CHOOSE THE RIGHT SEED·CO MAIZE HYBRIDS FOR YOUR AREA



Natural Farming Regions

- I - Specialised & Diversified Farming Region (>1000 mm)
- IIA - Intensive Farming Region (750 - 1000 mm)
- IIB - Intensive Farming Region (750 - 1000 mm)
- III - Semi-Intensive Farming Region (650 800 mm)
- IV - Semi-Extensive Farming Region (450 - 650 mm)
- V - Extensive Farming Region (<650 mm)

700 Series | 600 Series | 500 Series | 400 Series | 300 Series

SEED·CO

Farmers Guide