

MAIZE GROWERS GUIDE

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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 tasseling) can cause serious yield losses, and therefore some form of water conservation is important (e.g., pot-holing, mulching, tied-ridges), especially in the drier areas. Temperatures above 38 degrees celcius affect yield by affaceting pollen viability while temperatures below 10 retards maize growth.

Fertilisation

The fertiliser requirements of 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, for it is an excellent source of nutrients and has many other benefits for soils. Bought inorganic fertilisers should be considered as a supplement to manure. The following table gives a general recommendation for fertilising maize with inorganic fertilisers:

		Yield potential of maize		
Fertiliser	Less than	3 to 5 t/ha	5 to 8 t/ha	8 to > 12 t/ha
Type	3 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.

- The 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.
- The top dressing should be applied when the maize at 3.5 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 contains 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	Between					
		5	8	12	16	22
Rows	Plants	Fertilizer rate (kg/ha)				
(Cm)	(Cm)					

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

Top Dressing Fertilizers (TOP) e.g. 34.5% N

Plant Spacing		Cup size				
Between	Between	5	8	12	16	22
Rows (Cm)	Plants (Cm)	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

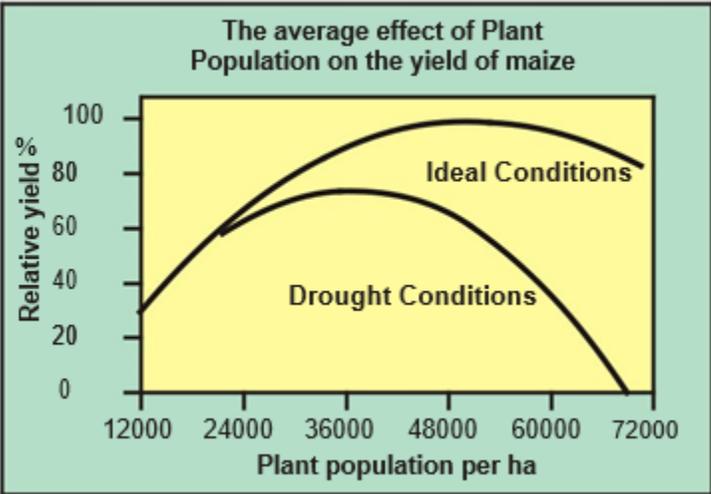
NOTE:

- *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.*

Plant spacing

The width of rows and the spacing of plants in the row determines 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 yield 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 should be 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 is presented in the Table below:

HYBRIDS

	ULTRA & VERY EARLY		EARLY	MEDIUM		LATE	
							SC719
							SC727
Expected	SC403	SC513	SC533		SC608(Y)		
Yield	SC417	SC529 SC533	SC537	SC637	SC633		
T/ha	SC419			SC627			
	SC402			SC649			
				SC 643			
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	44000	47000	40000	
9	56000	55000	48000	48000	48000	48000	
10	60000		52000	49000	48000	49000	
11			56000	50000	50000	50000	
12	SC419@60k		60000	55000	60000	52000	
13				55000	60000	52000	
14				55000	60000	55000	
>15						55000	

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 spacings 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

Key:

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

NB: To derive your population per hectare divide 10,000 by your 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.

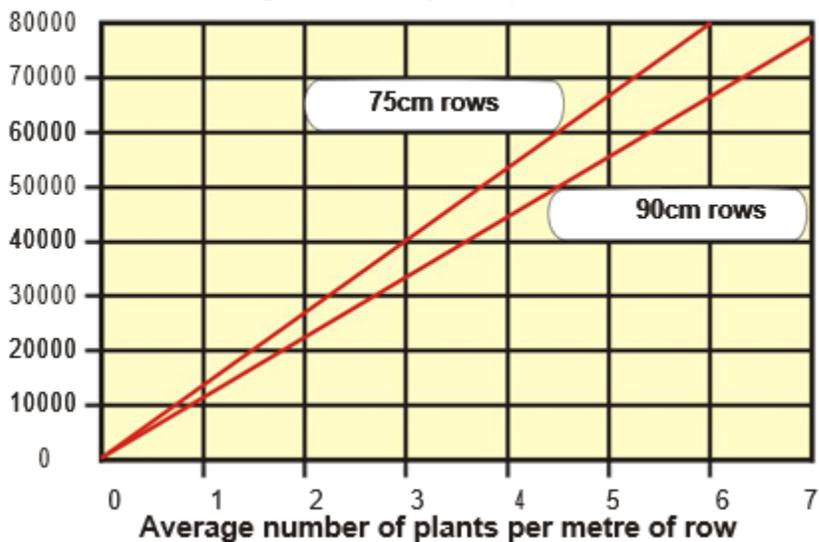
The following table gives the plant spacing and seed rate requirements when machine planting:

Target Harvest	Required Planting	Average kernel of		Average number		Hectares planted per 25kg bag		
		Spacing (cm)	in-row kernels per row	Row width (m)	Row width (m)	Large	Medium	Small
Per ha	Per ha	0.75	0.90	0.75	0.90	1600 seeds/kg	2100 seeds/kg	2400 seeds/kg
25 000	28 070	48	40	2.1	2.5	1.4	1.9	2.1
32 000	35 100	38	32	2.6	3.2	1.1	1.5	1.7

38 000	42 100	32	26	3.2	3.8	1.0	1.2	1.4
44 000	49 100	27	23	3.7	4.4	0.8	1.1	1.2
51 000	56 100	24	20	4.2	5.0	0.7	0.9	1.1
57 000	63 200	21	18	4.7	5.7	0.6	0.8	0.9
63 000	70 200	19	16	5.3	6.3	0.6	0.7	0.9
69 000	77 200	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.



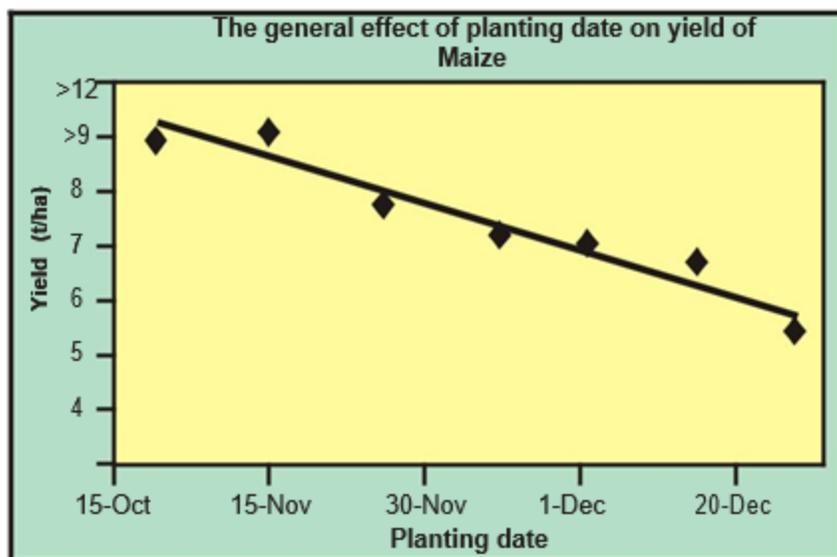
New trends in population density management-commercial

Some farmers are pushing their population density higher than the recommended in search for 'compensatory yield increases'. The farmers are targeting populations densities such as 65 000, 70 000, 80 000 up to 100 000 are being achieved. The trend or condition is that the farmers are coming in with a growth regulator such as CeCeCe (@ 2.1l/Ha) and 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.

There is need for further research especially the whether the yield gains are significant (or if they do exist in the first place), profitability of this concept, breeding for short statured but high yielding varieties to accommodate high densities. However we recommend optimum population densities of 50 000 to 60 000 plants per Ha on all Seed Co varieties in Zimbabwe.

Planting date

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 (ie 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, 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. 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 farmers' fields.

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. It is best to study that 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

- use (commercial grain, green mealie and silage)
- occurrence of pests and 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 Limited has a very simple way of differentiating their hybrids using animal symbols as given in the accompanying table.

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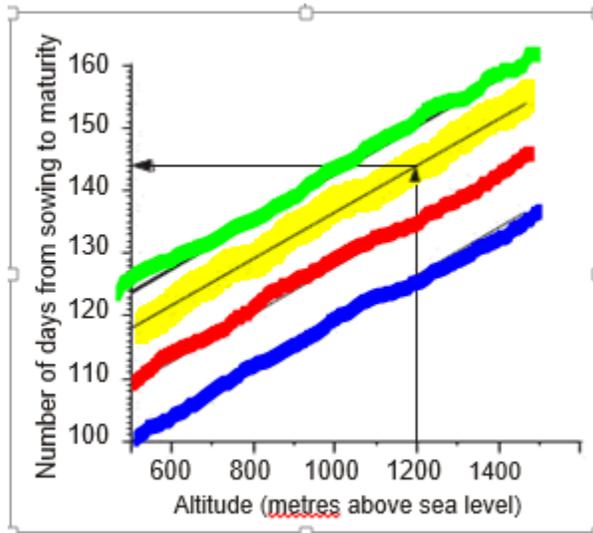
The range of hybrids available from Seed Co is continuously changing as we develop new hybrids with improved performance and disease tolerance. Therefore, it is important to keep oneself informed by attending field days and reading adverts.

It is a good idea 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 your environment, one quarter to an earlier maturing hybrid and one quarter to a later maturing hybrid. Start planting with the later maturing hybrid and end with the earlier maturing hybrid. Also consider trying out a small area of one or two new hybrids to compare their performance with hybrids you know.

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 crop development is. 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 Seed Co maize hybrids at different altitudes



Key:

-  700 series e.g. SC 727 and SC 719
-  600 Series e.g. SC 649, SC 637, SC 627, SC 633, SC 643
-  500 series e.g. SC 513, SC 533, SC 529
-  400 series e.g. SC 403, SC 419

Planting

Maize yield declines 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 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 rain (within 3 days) and the soil is wet down to 45 cm on clays and 60 cm on sands).
- 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 prevents early disease and pest infestations.

Mid-season management

1. 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 bigger enough and your 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 applied pre-emergence. When applying herbicides, read and follow the label instructions and take the necessary safety precautions.
2. 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.
3. 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 interrows. These can be calibrated and adjusted depending on the intended rates.
4. 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 which will be more numerous and difficult to control.
5. Start to check 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.

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

7. Harvest the crop as early as possible to reduce in-field losses. 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 you fail to control weeds in maize in the first 5 weeks of the crop cycle, then 50% of the yields will be lost.
- Never allow weeds to seed, it will enhance the weed seed bank and result in future weed control costs increases and difficulties.
- 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 has no many gaps
- Reap the cobs from a measured 20 sq. metres. If the rows are at 90cm, then you should reap 22m row length, 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

- $\text{Mass Grain (Kg)} \times (100 - \text{moisture content}) / (100 - 12.5) \times 10\,000 / 20$

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