Grade 11 Agriculture

CBC NOTES | Terms 1, 2 and 3 - notes for 15 topics

IN EVERY TOPIC

- What you will learn, the key words and key terms explained.
- Clear notes under headings and subheadings, with labelled pictures and step-by-step procedures.
- Comparison tables, and advantages and disadvantages where methods are compared.
- Key points to remember, then structured questions to practise.
- All the answers and a glossary at the back.

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Strand 1.0 Crop Production | Term 1

1.1 Inorganic fertilisers

WHAT YOU WILL LEARN

By the end of this topic you should be able to:

- describe nutrients required by plants for healthy growth
- examine the role of nutrients in healthy crop growth
- categorize inorganic fertilizers used in crop production
- carry out soil sampling for analysis
- apply inorganic fertilizer for crop production
- propose soil amendment practices for crop production
- acknowledge the importance of inorganic fertilizers in crop production

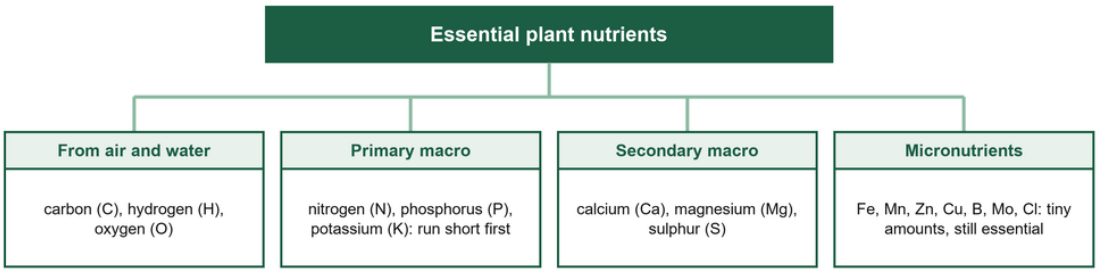
KEY WORDS

essential element, macronutrient, micronutrient, deficiency symptom, chlorosis, straight fertiliser, compound fertiliser, fertiliser grade, top dressing, soil pH, liming, soil sample.

Crops remove nutrients from the soil every season. This topic explains which nutrients plants need and what each does, the kinds of inorganic fertilisers, how to take a soil sample and read the pH, how to calculate and apply fertiliser, and how to improve soil with amendments.

1. Essential plant nutrients

> **Essential element**
> An element the plant cannot complete its life cycle without, whose work no other element can do, and which takes part directly in growth.



Macronutrients are needed in large amounts; micronutrients in tiny amounts

Roles of the main nutrients

Nutrient	Role	Deficiency signs
Nitrogen (N)	part of chlorophyll and proteins: dark green, leafy growth	older leaves yellow first; stunted; low yield. Too much: soft growth, pests, lodging
Phosphorus (P)	roots, energy transfer, flowering, seed and fruit, early maturity	poor roots; purple leaves on young maize; late maturity
Potassium (K)	water movement and stomata; strong stems; resistance to disease and drought; fruit quality	scorched edges of older leaves; lodging; small poor fruits and tubers
Molybdenum (Mo)	helps legumes fix nitrogen	poor nodulation in legumes

2. Recognising deficiencies

Reading deficiency signs (confirm with a soil or leaf test)

Nitrogen	Phosphorus	Potassium	Calcium
older lower leaves yellow first (chlorosis); stunted, thin plants	purple or reddish leaves (young maize); poor roots; late maturity	scorched brown edges of older leaves; weak stalks lodge	growing tips die; blossom-end rot in tomatoes

Magnesium	Iron	Zinc	Boron
yellow between veins of OLDER leaves; veins stay green	yellow between veins of YOUNG leaves	small leaves, short internodes (rosetting)	growing points die; hollow or cracked stems and roots

Look at which leaves are affected and the colour pattern

Sample field observations

Maize, yellow lower leaves starting from the tip along the midrib: nitrogen.
Young maize with purple leaves: phosphorus.
Beans or potatoes with brown, dry leaf edges: potassium.
Tomatoes with black patches at the fruit bottom: calcium (blossom-end rot).

TEST BEFORE YOU BUY

Many deficiency signs look alike, so confirm with a soil or leaf test before spending money on fertiliser.

3. Categories of inorganic fertilisers

Straight and compound fertilisers

A straight fertiliser supplies one primary nutrient; a compound supplies two or three. The grade is the percentage by weight, always in the order N : P2O5 : K2O.

Inorganic fertilisers (grade = % N : P2O5 : K2O)

Nitrogenous	Phosphatic
CAN 26% N; urea 46% N; SA 21% N (+ sulphur); ASN 26% N. Fast acting, leached, hygroscopic: top dressing	SSP about 20% P2O5; TSP 46%; rock phosphate (slow, acid soils). Placed at planting; hardly moves

Potassic	Compound
muriate of potash 60% K2O; sulphate of potash 50% K2O (potatoes, tobacco)	DAP 18:46:0; NPK 17:17:17, 23:23:0, 20:10:10. One application; ratio fixed

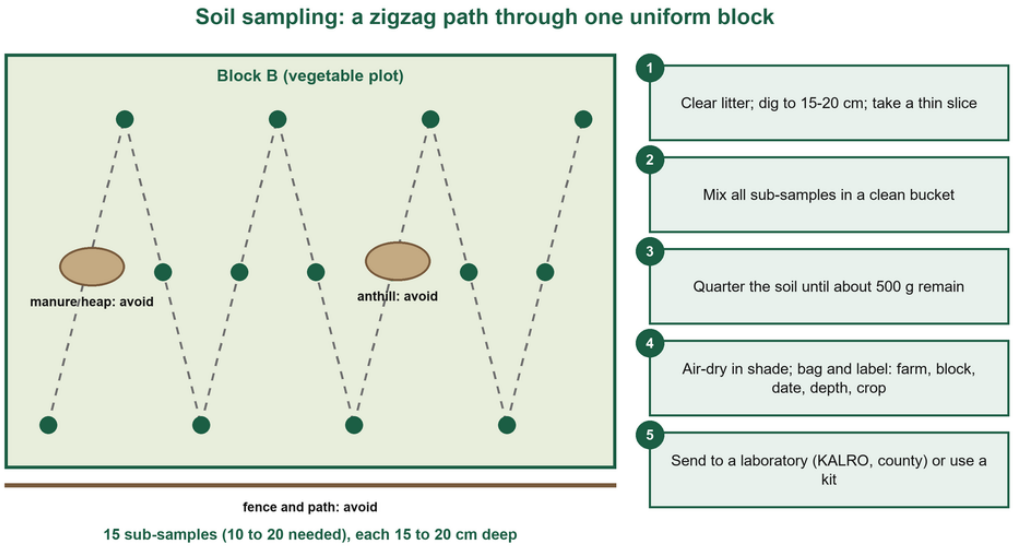
The four groups and common examples

Identifying fertiliser samples (wear gloves; do not taste or smell)

Sample	Typical appearance
CAN	grey or brown-white granules
Urea	small, white, round, shiny granules
SA	white or brownish crystals
DAP	dark grey to black granules
TSP	grey granules
Muriate of potash	red or pink crystals

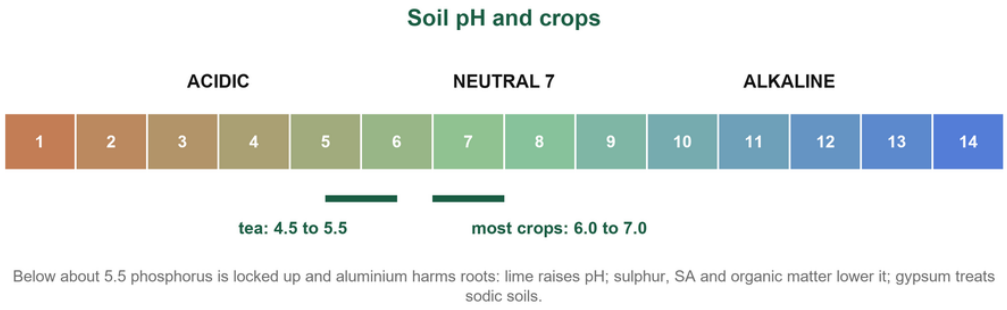
> **Reading a grade**
> DAP is 18:46:0, so a 50 kg bag holds 50 x 18 / 100 = 9 kg N and 50 x 46 / 100 = 23 kg P2O5.
> A mixed compound is made by mixing straight fertilisers; a complex compound by a chemical reaction, so every granule holds all the nutrients.

4. Soil sampling and pH



A sample must represent the whole block

Avoid manure heaps, anthills, fences, paths, spots under trees, waterlogged places and recently fertilised areas. Sample a few weeks before the season.

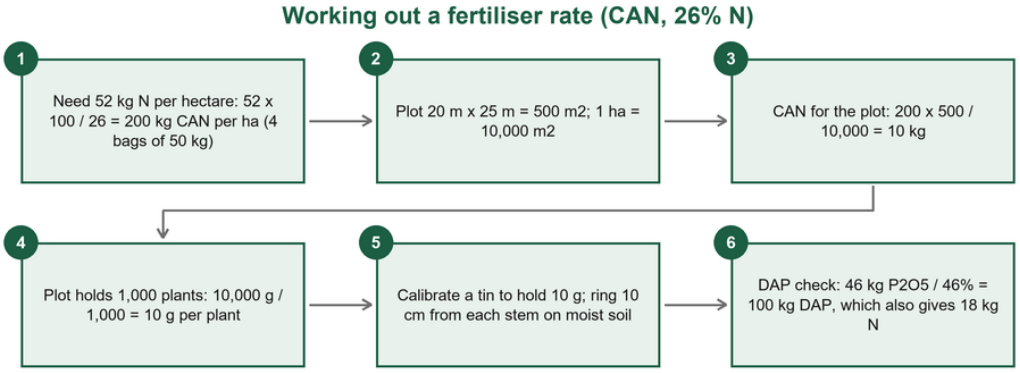


Most crops grow best between pH 6.0 and 7.0

Testing pH with a kit

1. Put about one spoon of air-dried soil in a test tube.
2. Add distilled water (and the kit reagent) to the mark; shake and let it settle.
3. Dip pH paper in the clear liquid or compare the colour with the chart.
4. A laboratory report also gives organic carbon, N, P, K with ratings and a recommendation, e.g. "apply 2 tonnes of lime and 125 kg DAP per hectare".

5. Calculating and applying fertiliser



Fertiliser = nutrient needed x 100 / % nutrient in the fertiliser

Methods of application

Method	How and when
Broadcasting	spread evenly over the surface: pastures, closely spaced crops
Placement	in the planting hole or a band beside the row, mixed with soil: DAP at planting
Top dressing	sprinkled around growing plants: nitrogen when maize is knee-high
Side dressing	a band along the row a few cm from the plants
Foliar application	dilute spray on leaves: mainly micronutrients
Fertigation	dissolved in irrigation water: drip lines

SAFETY AND TIMING

Apply on moist soil, not before a heavy storm and never on wet leaves; keep fertiliser off leaves and stems; wear gloves and a mask; wash hands afterwards.

6. Soil amendments and responsible use

Soil amendment
Any material added to improve the physical or chemical condition of the soil so crops use nutrients better. A fertiliser's main job is to supply nutrients.

Soil amendment practices

Problem	Amendment
Acidic soil	agricultural lime or dolomite (adds Mg), worked in weeks before planting; top-dress with CAN instead of SA
Alkaline soil	elemental sulphur, acidifying fertilisers such as SA, organic matter
Sodic (salty) soil	gypsum, then leach salts with good water and drainage
Poor structure	farmyard manure, compost, green manure, mulch, legume rotation, drainage

Inorganic fertilisers

+ Advantages

- Replace nutrients removed by harvests; act fast.
- Raise yields, food security and income.
- Concentrated: less weight to carry; exact amounts possible.

- Disadvantages

- Acidity (especially SA); scorching of crops.
- Nitrates leach into wells; runoff causes eutrophication in lakes.
- Costly; add no organic matter.

RESPONSIBLE USE
Test the soil; right fertiliser, rate, time and place; combine with manure or compost; store bags dry, off the floor and away from food and children; never wash equipment into a river.

KEY POINTS TO REMEMBER

- Primary nutrients N, P, K run short first; Ca, Mg, S are secondary; micronutrients are needed in tiny amounts.
- Straight fertilisers supply one nutrient; compounds supply two or three; the grade is % N : P_2O_5 : K_2O.
- Sample in a zigzag, 10-20 sub-samples at 15-20 cm, mix, quarter to 500 g, air-dry and label.
- Fertiliser = nutrient needed x 100 / % in the fertiliser.
- Lime raises pH; sulphur lowers it; gypsum treats sodic soils; organic matter improves structure.

ANSWER THESE

1. Why are N, P and K called primary nutrients? (2 marks)
2. State the deficiency symptom of each: nitrogen, phosphorus, magnesium. (3 marks)
3. Calculate the CAN (26% N) needed to supply 52 kg N per hectare, and the amount for a plot of 20 m by 25 m. (4 marks)
4. How many kg of nitrogen and of P_2O_5 are in a 50 kg bag of DAP (18:46:0)? (2 marks)
5. Describe how a representative soil sample is collected. (6 marks)
6. Give three dangers of misusing inorganic fertilisers. (3 marks)

Strand 1.0 Crop Production | Term 1

1.2 Water conservation

WHAT YOU WILL LEARN

By the end of this topic you should be able to:

- describe various methods of irrigation in crop production
- apply efficient approaches to irrigation in crop production

KEY WORDS

irrigation, surface irrigation, basin, furrow, flood irrigation, sprinkler, drip irrigation, emitter, water use efficiency, irrigation scheduling, waterlogging, salinity.

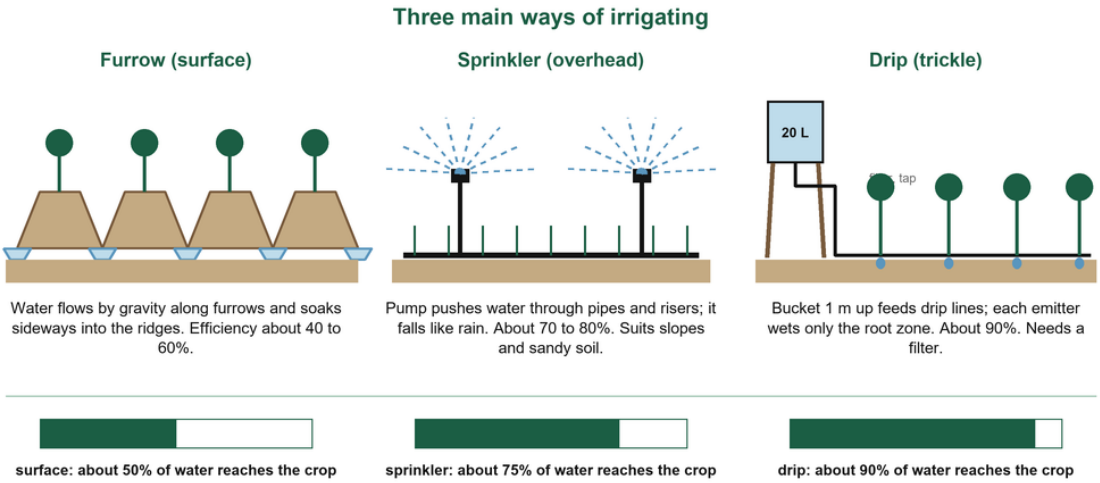
Rain in much of Kenya is too little or unreliable. Irrigation lets farmers grow crops in dry areas and seasons. This topic covers water sources, surface, sprinkler and drip methods, how to choose and use them efficiently, measuring water, and the problems irrigation can cause.

1. Irrigation and sources of water

> **Irrigation**
> The artificial application of water to the soil to supply the moisture crops need for growth.

- Why: little or unreliable rain; dry-season crops; crops that need much water (rice); high-value crops all year.
- Sources: rivers, dams and water pans, boreholes and wells, springs, lakes, roof and road runoff in tanks, treated waste water for some crops.
- A good source gives enough, clean (low-salt) water, is close and reliable.
- Large users need a permit from the Water Resources Authority, and water must be shared fairly downstream.

2. Methods of irrigation



Surface, sprinkler and drip irrigation