Implement a plant nutrition program

AHCPCM301

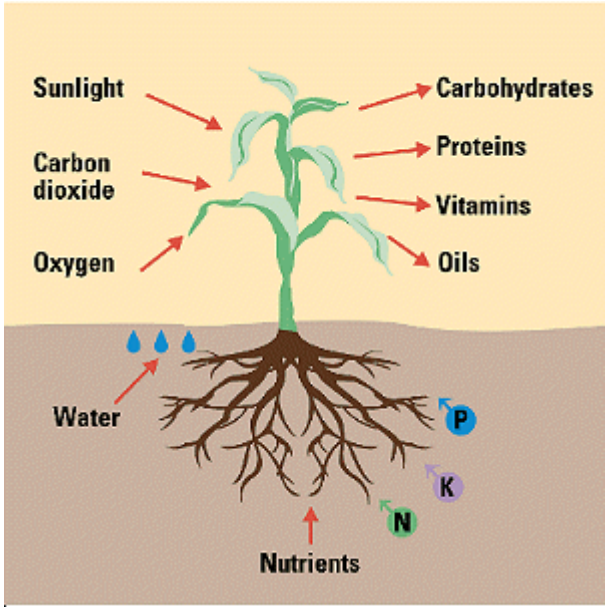
Overview

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

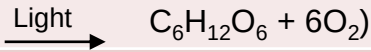
- Prepare for implementation of the plant nutrition program
- Monitor soil pH
- Determine nutritional problems in plants
- Prepare to use fertilisers
- Prepare application equipment
- Apply specific products at appropriate rates

- Nutrients are absorbed through a plant's root system
  - The nutrients then travel from the roots to the leaves

- Most soil conditions can provide plants with adequate nutrition
  - However, soil can be artificially modified with fertiliser to promote plant growth



- Processes relevant to plant nutrition:

Term	Definition
Osmosis	Movement of water (including nutrients) through a selectively permeable membrane (root tips)
Photosynthesis	Process for a plant to make its own food – using carbon dioxide and water, combining it with light energy, to make sugars and oxygen in all green parts of the plant (chlorophyll) 
Respiration	Conversion of sugars back into energy for growth
Transpiration	Loss of water vapour through the stomata (pores) of the leaves
Xylem	Tissue that transports water and nutrients from the roots to the aerial parts of the plant
Phloem	Tissue that transports sugars and nutrients throughout the plant

Preparing to implement a plant nutrition program

- To prepare for the implementation of a plant nutrition program, you should familiarise yourself with the following:
  - Task requirements
    - Identify target site, soils/media, plants
      - Be sure to identify a plant's growing cycle to determine the best timing to implement the program
    - Confirm requirements with others
      - Speak to your supervisor to confirm goals and clarify unclear instruction
      - Speak to a horticulturalist to determine causes of nutritional or toxicity problems
      - Coordinate your activities with the requirements and schedules of your work group and contractors
      - Apply active listening when receiving instructions

Preparing to implement a plant nutrition program

- To prepare for the implementation of a plant nutrition program, you should familiarise yourself with the following:
  - Workplace information
    - Site-specific information, such as:
      - Enterprise work procedures
      - Enterprise fertiliser calendar
    - Details for suppliers of fertiliser and other products

Preparing to implement a plant nutrition program

- To prepare for the implementation of a plant nutrition program, you should familiarise yourself with the following:
  - Work area
    - Establish where materials are stored
    - Be aware of the location of underground services
      - Speak to your supervisor
      - Contact Dial Before You Dig
    - Identify any WHS hazards (e.g. injuries to your person, heat stroke, sunburn, injuries from equipment)
      - Rectify and/or report hazards to your supervisor within a timely fashion – especially emergency situations

- Risk is measured in terms of the seriousness of the possible **consequences** of the hazard and the **likelihood** that those consequences will occur, as in the matrix shown below:

Extreme	High	Medium	Low

Consequences
A: Death or Permanent Disability
B: Serious Injury
C: Lost Time Injury
D: Casualty Treatment
E: First Aid

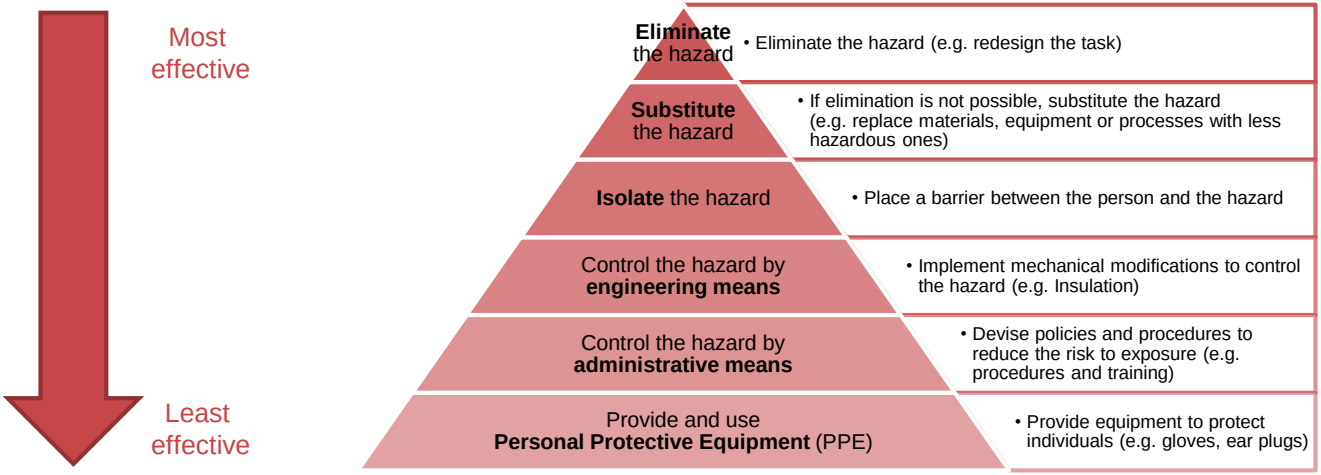
Likelihood

1: Very Likely
2: Likely
3: Possible
4: Unlikely
5: Very Unlikely

Matrix	A	B	C	D	E
1	E	E	H	H	M
2	E	H	H	M	M
3	H	H	M	M	L
4	H	M	M	L	L
5	M	M	L	L	L

Workplace risk control

- The hierarchy of control gives priority to the order in which hazard and risk controls should be implemented.



Preparing to implement a plant nutrition program

- To prepare for the implementation of a plant nutrition program, you should familiarise yourself with the following:
  - Available PPE, tools and equipment
    - PPE may include: Gloves, protective clothing, wide brimmed hat, work boots
    - Tools and equipment may include: Hose, shovel, spade, trowel, watering can, wheelbarrow
    - Ensure they are appropriately selected, prepared and used for the task, following supervisor's instructions and manufacturer's specifications
      - Undertake pre-operational and safety checks
      - Undertake calibration tasks and adjust accordingly

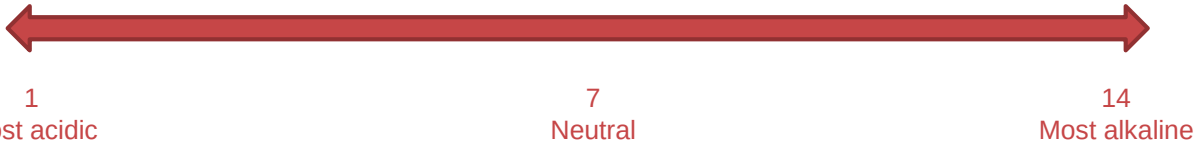
Types of nutrients

- The major and trace plant nutrients

Major	Trace
Nitrogen (N) Phosphorus (P) Potassium (K) Sulfur (S) Calcium (Ca) Magnesium (Mg)	Copper (Cu) Zinc (Zn) Boron (B) Manganese (Mn) Iron (Fe) Chlorine (Cl) Molybdenum (Mo) Sodium (Na) Cobalt (Co) Vanadium (V) Silicon (Si)

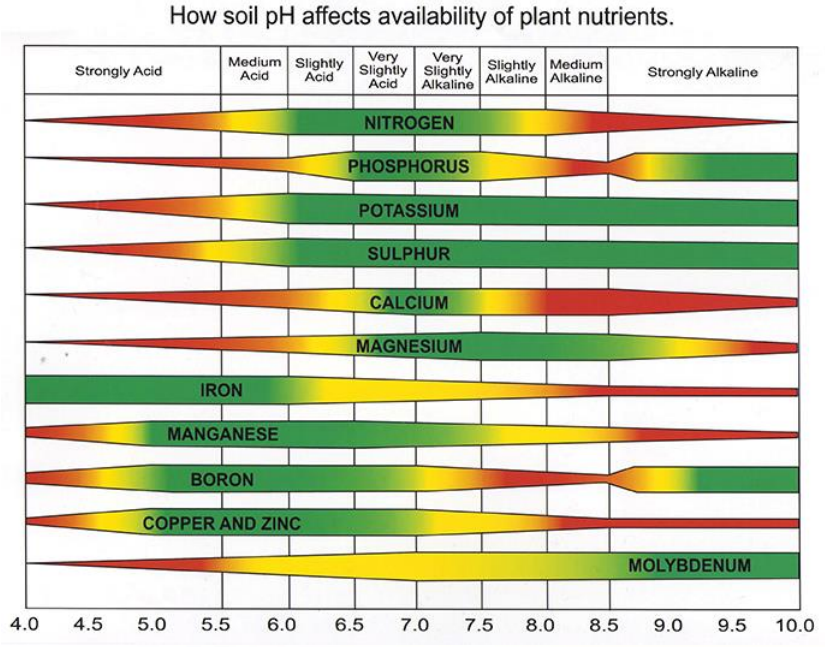
Soil pH

- Soil pH is a measure of the acidity or alkalinity in soils
  - You can test soil/media pH yourself using an over-the-counter kit or meter



- Soil pH affects plant nutrition
  - Having the correct soil pH is important for healthy plant growth
  - Soil pH affects the amount of a particular nutrient that can be taken up by plant roots

Soil pH


How soil pH affects availability of plant nutrients.
Strongly Acid
Medium Acid
Slightly Acid
Very Slightly Acid
Very Slightly Alkaline
Slightly Alkaline
Medium Alkaline
Strongly Alkaline
NITROGEN
PHOSPHORUS
POTASSIUM
SULPHUR
CALCIUM
MAGNESIUM
IRON
MANGANESE
BORON
COPPER AND ZINC
MOLYBDENUM
4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0

Soil pH

- Factors affecting pH include:

Acidic soils (less than 5.5 pH)	Alkaline soils (greater than 7.5 pH)
• Aluminium toxicity • Manganese toxicity • Calcium deficiency • Magnesium deficiency • Low levels of essential plant nutrients (e.g. phosphorus and molybdenum)	• Sodium toxicity (pH greater than 9) • Zinc deficiency • Copper deficiency • Boron deficiency • Manganese deficiency

Soil pH

- You can lower or raise soil pH using a range of products

Lower soil pH	Raise soil pH

• **Acidic fertiliser** (e.g. containing ammonium sufate, or sulphur-coated urea)
• **Elemental sulphur** (Flowers of sulphur), needs to be broken down by soil bacteria to be available for plant uptake
  • Apply at 35g/m^2 on soils with sandy structure
  • Apply at 100g/m^2 on clay soils
• **Manure** (i.e. from poultry, cows, horses and sheep)
	• **Agricultural lime** (Calcium carbonate), a finely ground limestone which is untreated
	• **Hydrated/slaked lime** (Calcium hydroxide), which is more soluble and faster acting than agricultural lime
	• **Dolomite** (Calcium magnesium carbonate), which contains more magnesium than agricultural lime
	• **Quick lime** (Calcium oxide), but not for garden use

Common nutrients

- Common nutrients found in soil and plants include:
  - Nitrogen (N)
    - Essential for green growth – affects plant colour and lusciousness
    - Affects growth of roots and shoots
    - Provides strength against disease and weather (heat, cold and drought)
    - May be lost from soil:
      - By leaching through the soil profile
      - By removing grass clippings
      - Into the air as ammonia gas (volatilisation) or nitrate gas (denitrification)

- Common nutrients found in soil and plants include:
  - Phosphorus (P)
    - Essential for root development
    - Affects the maturation of plants (i.e. avoids stunted growth)
    - Affects the branching of turf
    - Deficiency is more prevalent in sandy soils, which have little ability to hold onto the nutrient

- Common nutrients found in soil and plants include:
  - Potassium (K)
    - Essential for flower development
    - Essential for fruit development
    - Affects the ability of plants to withstand wear, drought, disease and stress

Nutrient problems

- Many plant nutrient issues can be visually identified. For example:

Nutrient	Toxicity	Deficiency	Treating deficiency
Nitrogen	• Increased disease susceptibility • Reduced root system • Leaves dry and fall off • Fruit and flowers are inhibited or deformed	• General chlorosis of older leaves (i.e. entire leaf changing from green to yellow) • Plant is stunted and wilts in normal weather • Slow and thin turf growth	• Ammonium fertiliser (e.g. ammonium nitrate, urea, ammonium sulphate, ammonium phosphate) • Bone meal • Poultry manure • Fish emulsion

Nutrient problems

- Many plant nutrient issues can be visually identified. For example:

Nutrient	Toxicity	Deficiency	Treating deficiency
Phosphorus	• Weeds increase in high-phosphorus soils	• Plants have small, thin stems • Reduced flowers • Failure to produce fruits • Older leaves shed easily • Older leaves turn dark green, purple and then a reddish purple	• Rock phosphate • Fish emulsion • Poultry manure

- Many plant nutrient issues can be visually identified. For example:

Nutrient	Toxicity	Deficiency	Treating deficiency
Potassium	• May result in burning of turf	• Deformed, stunted leaves • Weak stems • Fruits drop prematurely • Poorly developed roots • Older leaves become a lighter green colour with scorched edges • Young leaves show interveinal chlorosis (i.e. yellowing between veins)	• Potassium fertiliser (e.g. potassium chloride, potassium nitrate, potassium sulfate, monopotassium phosphate) • Potash • Banana peel

Nutrient problems

- Many plant nutrient issues can be visually identified. For example:

Nutrient	Toxicity	Deficiency	Treating deficiency
Iron	• Leaf surfaces may become bronze or display tiny brown spots • Turf may turn black	• Leaves may turn pale yellow or white	• Iron chelates • Agricultural sulphur
Magnesium	• Not generally exhibited visibly	• Interveinal chlorosis, veins remain green • Dropping of old leaves • Smaller, woodier fruits of poor colour	• Dolomite • Magnesium nitrate • Calcium nitrate

Fertilisers

- Fertilisers are generally classified as
  - Organic (plant or animal waste), such as manure, leaves or compost; or
  - Inorganic (man-made chemical-based)
- There are a range of inorganic fertilisers on the market:

Type	Description
Simple	Supplies only one nutrient
Blended	A number of simple fertilisers mixed together, but the different components can be easily seen
Compound	Two or more nutrients are contained within the same granule
Complete	Contains the three main nutrients (N, P, K)

- Comparing organic and inorganic fertilisers

Organic	Inorganic
• Natural breakdown of nutrients by organisms • Slow-release (reapplied at six month intervals) • Resistant to leaching • Adjusts pH • Improves soil structure • Cost effective • Non-toxic • No withholding period	• Quick fix for nutrient issues, may be costly over time • Generally reapply at six week intervals • Readily leached through soil profile • Feeds the plant, rather than improving soil • Application rate must be adhered to, otherwise plant may be negatively affected (e.g. burning of root tips) • Withholding periods may apply

Fertilisers

- Things to consider when selecting a fertiliser:
  - The plant species
    - Fruiting plants require compound fertiliser with phosphorus and potassium
    - Grass plants require fertiliser with high nitrogen content
    - Rooting plants require phosphatic fertiliser with some added sulphur
  - The type of growing media
  - The form of the fertiliser
    - Granular fertilisers do not act as quickly as fertilisers in soluble form
  - Percentage of nutrients within the fertiliser:
    - Low-analysis: Lower percentage of nutrients
    - High-analysis: Higher percentage of nutrients
  - Salt index
    - The measure of salt concentration the fertiliser induces in the soil

- There are a range of methods of applying fertiliser:

Type	Description
Banding	If subsurface, it is applied below the soil surface close to the seed row
Broadcasting	Uniform application of fertiliser by hand or mechanically
Fertigation	The injection of fertiliser, soil amendments and other water-soluble products into an irrigation system
Ripping	Loosening the soil by tillage

- Consider the fertiliser and soil type when selecting a method

Fertilisers

- Refer to the fertiliser label to determine:
  - Product requirements
  - Application rates to optimise plant benefit
  - Timing of application
  - Method of application

- As a general rule:
  - Fertilise during early spring
  - Avoid fertilising just before and during the wet season as nutrients could be leached through the soil profile
  - Apply less fertiliser in sandy areas

- Refer to the fertiliser Safety Data Sheet to determine:
  - Handling requirements (e.g. PPE)
  - Storage requirements
  - Hazard types and how they should be dealt with (e.g. first aid, spills)
  - Disposal considerations

- Be aware of signage, such as:

Acute toxicity

Corrosive

Flammable

Danger to human health

Warning

Calibration of equipment

- Follow the steps outlined below to calibrate a boom spray:
  - Clean the filter/nozzles/tank
  - Check the pump and pressure gauge
  - Fill the tank with clean water and prime the spray unit
  - Measure and perform calculations
    - Swath width
    - Liquid put out by single nozzle
    - Liquid put out by all nozzles combined
    - Time take to travel 100m
    - Spray application rate
  - Calculate the amount of fertiliser you need to add to the tank

- Follow the steps outlined below to calibrate a rotary spreader:
  - Set the spreader to an estimated setting for the required application rate
  - Weigh and add fertiliser to the hopper
  - Measure out and fertilise 100m^2 area
  - Weigh left-over fertiliser in hopper
  - Calculate the amount required to fertilise 100m^2 area
    - Calculate the amount required to fertilise 1m^2 area
    - Calculate the amount required to fertilise one hectare
  - Repeat steps until the setting gives the required application rate

Environmental impacts

- To optimise plant benefit and minimise environmental impact when applying products:
  - Check the product
    - Ensure that you are using the most effective product
      - Consider how long soil treatment will last, soil texture, soil salinity (and salt index of treatment)
    - Ensure that you are using the least harmful product

Environmental impacts

- To optimise plant benefit and minimise environmental impact when applying products:
  - Consider the application process
    - Check the amount being used
      - A high-analysis fertiliser might be better value if more nutrients are being required
      - Excess nutrient may be leached into the water table
    - Do not apply products if raining, as it will not absorb. Run-off will affect the environment.
    - Do not spray products if windy, as non-target damage will be increased.
      - Monitor, document and report non-target effects

Clean up

- As part of clean up tasks, you are required to complete the following practices:
  - Clean up the work area
  - Record treatment details on appropriate paperwork
    - Record your findings as clearly as possible, being mindful of people's varying backgrounds and abilities
  - Maintain, clean and store tools and equipment according to manufacturer's specifications
    - Report faults that are discovered
  - Dispose of materials that cannot be reused or recycled
    - Be mindful of disposal procedures to reduce environmental impact