The Australasian Native Orchid Society
The Warringah Group Inc.

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CORRESPONDENCE: PO Box 421, Forestville NSW 2087
Monthly Meetings: 3rd Tuesday at 8:00 pm - Senior Citizens Hall, Starkey Street, Forestville

November 2019

Photos: Jane D'Olier

Paphiopedilum glanduliferum John McAuley

Den. normanbyense 'Petite'
x (polysema x eximum) Ela Kielich

Dendrobium prenticei L & B Dobson

Next Meeting
Tuesday 19th November 2019
Guest Speaker
David Hemmings
"Growing Australian Native Orchids in Sydney"

Minutes of the monthly meeting

held at the Senior Citizens' Hall, Starkey Street, Forestville on Tuesday, 15th October 2019.

The meeting was opened by Trish Peterson at 8.10pm who welcomed members and visitor, Graham Cameron.

There will be no guest speaker tonight as the Members' Sarcochilus Show will be held.

Apologies: Warleiti Jap, Lorraine Dobson, Mick Korzenowski, Bill Westwood, Harleen Williams, Erik Lielkajis, Jan & Geoff Duggin.

The minutes of the previous meeting as published in the Bulletin were accepted as a true record on the motion of Bryan Spurrs seconded by Ian Tanner.

Vale: **Murray Corrigan**

Trish advised the meeting of the recent death of Murray Corrigan. She gave a brief history of Murray's involvement in the Society and his role in establishing ANOS and promoting interest in native orchids. Members were invited to submit their memories of Murray's activities. This was followed by a minute's respectful silence.

Correspondence:

- The Orchadian
- Advertising flyers for the Revesby Workers Australian Native Club Show on 19th October 2019.

Moved for acceptance by Bryan Spurrs, seconded by Ela Kielich

General Business:

- Photos taken of orchids in situ may be sent to Trish for inclusion on our web site.
- Volunteers for supper tonight – Bruce and Ted; next month Ela and Cameron.
  Need to develop an annual roster.
- All trophies to be returned as soon as possible for engraving. David to return his to Bill.
- David suggested using a pinch of Slug Out for garlic snails. Combine with fertiliser on top of pot. Available from Australian Orchid Nursery.
- **Plant sales table** to commence next month. Need to provide a list of plants and prices.
  10% will be the Society's commission.

Next Month:

- David Hemmings is next month's speaker. Topic: Growing Australian Native Orchids in Sydney – talk will include a cultural element.

Coming Events:

- ANOS Sydney Group – Sarc. Show at Kellyville 19th & 20th October 2019
- Barrita Orchids Open Day – 20th October 2019
- ANOS Macarthur Group – Late Spring Show 26th October 2019
- SPECIES Show & Auction at West Pennant Hills on 26th October 2019

Ian Chalmers advised of the Three Rivers Orchid Show at Corowa on 16th & 17th November 2019. Jean Dunne was suggested as a speaker.

Members' Sarc. Show

Winning plants of each of the 12 sections were exhibited on a central table.

Each plant was individually displayed and votes for each recorded.

David Hemmings' outstanding *Plectochilus* Richard Jost was declared the winner.

David will be awarded the Iris Pendle Memorial Trophy at the end-of year prize-giving.

Lucky Door Prize: Norm Eakins

Raffle Prizes: Cameron Lanceley, Barry Moore, Ian Chalmers, Bruce Potter, Jim Moore, Peter D'Olier (2)

The meeting closed at 9.35pm

In my Bushhouse

Things are running behind this year including me. I have started repotting later than usual but whatever, it has to be done and so I push ahead pot on and split up when required, and the weather regardless is good for growing and with new growths emerging on most of my plants.

The *Sarcochilus* provide a wealth of colour and beauty in the bushhouse at the moment after most Dendrobiums have finished. The range of colour is astonishing and some of these are my few hybrids in this whole house. While *Sarcochilus falcatus* has finished *Sarcochilus niveus* has started and the fragrance is delightful. *Sarcochilus hillii* has also started flowering along with *Sarcochilus ceciliae* as they all have their season. *Cadetia taylori* has a few flowers as does *Dendrobium prenticei*. *Phaius tankervilleae* has come into flower and should last a few weeks with more buds to open. *Dockrillia* Hot Coals has bunches of flowers and seems to flower a few times throughout the year, one advantage of a hybrid. *Dockrillia linguiformis* flowers only once but what a flowering this year. *Bulbophyllum johnsonii* is in flower, a delightful sight, takes me back to the tablelands of Far North Queensland.

New growths are appearing on my *Dendrobium jonesii* var. *magnificum* which is great to see. Also Dendrobium falcorostrum which I used to think was impossible to grow down here and by the sea. Must be doing something right. These plants respond to evening mistings as they grow at high altitudes over 1000m in their natural state.

As the first week this month the plants will receive a dose of Auxinone which will stimulate root activity, great for all the plants but really beneficial to those that have been recently split up. This will be repeated next month and that is it for the year. All the plants will receive a dose of 9 month slow release as well as Blood and bone and some Slug Out pellets to stop slugs and those damn garlic snails. As well as this they will get a Confidor ball or part thereof depending on pot size.

A reminder has just popped up to spray my orchids with Mancozeb, Azamax (Neem) and EcoOil. So this will be done tomorrow morning and I can use my new toy. I purchased a 16 litre Swagman® sprayer with wheels and a 20ft hose. This is battery powered and the spray nozzle allows the spray to cover over and under the whole plant. The best thig is no more humping the 8 litre hand sprayer on my back and no need to hand pump as the battery power takes care of all of that.

By the time this goes out I hope to have my fogging system in place and running automatically each evening 2 sprays a couple hours apart just for a minute, but the humidity and cooling should replicate the mists of the highlands in the evenings.

Outside the bushhouse I have some *Cymbidium canaliculatum* in flower, and try as I may I will have to have someone tie my hands behind me as I put some water, only a bit, on one that is in full flower only to have some of the inflorescences wilt. I'll have to put a sign on this☹

Time to spray outside for Dendrobium beetle. I have tried the Azamax® and this doesn't prevent them from chewing even if they are a little groggy so back to the Carbaryl®.

Remember that you only have to spray the new growths 2ml/litre and 10ml/litre EcoOil® to stick it to the plant. Repeat every 3 weeks until the growths are hardened off.

Well back to work for me good growing.
Bill Dobson

Dendrobium monophyllum

The name monophyllum comes from the Greek word mono meaning single and phylon meaning a leaf. *Dendrobium monophyllum* was named by F. Mueller in 1859 from a plant found at Moreton Bay, Queensland by W. Hill.

The common name for this orchid is 'Lily of the Valley', the name coming from the sweet smell of the flowers which all appear to face in the same direction. It is the largest of the three species in this Monophyllaea section and, although known as monophyllum (meaning one leaf), plants can be observed plants which bear two leaves, which is not uncommon.

Dendrobium monophyllum ranges from approximately Grafton in northern New South Wales (although some reports place it much further south) to the Annon River in South-East Cape York Peninsula, North Queensland.

It is confined to above 600m altitude in tropical areas and in more southern areas it spreads to the coast. It has also been found on offshore islands in south east Queensland growing quite happily into large clumps on Hoop Pines (Araucaria cunninghamii).

On the mainland this orchid reaches its full glory on the high cliff faces of the ranges south west of Rockhampton where it can form huge mats, when in flower it is a sight to behold.

In the southern range of its habitat it can form huge clumps growing on trees and rock faces while in its northern range it tends to be smaller in its growth habit.

In rainforests it grows high up in the trees no doubt to get more light, while in more open habitat it grows lower down on trees and even on rock faces and large boulders. Growing on Hoop Pines (*Araucaria cunninghamii*), Swamp Oaks (*Casuarina glauca*) and Beech Trees (*Nothofagus moorei*) to name some of its hosts.

Flowering can take place several times a year with early Spring, to a lesser degree in mid-Autumn. Flowering seldom occurs in Winter. Flowers range in colour from dull to bright yellow; are bell-shaped and half nodding. *Dendrobium monophyllum* usually flowers once from each pseudobulb while the rhizome stands off from the host with the roots resembling rows of stilts. They do not bury themselves in the moss or litter as do most epiphytes.

While this species is fairly easy to grow, some care must be taken. They can be grown in an open bush house but they do not like the temperature to get down near zero. However, some plants are more tolerant to the cold than others no doubt due to where they originally came from.

Good light, is essential, high humidity and plenty of air movement are musts. While they need a lot of watering in the hot months they must be allowed to dry out between watering.

Slab culture seems to be the best so long as the plant can be tied tightly to its host and hung up high. Slabs can consist of Tree Fern fibre, cork and hardwood etc. It is most important that the host does not retain moisture. Good results can be achieved by growing this orchid on gutter guard filled with coconut fibre. It also does well tied to live trees.

Len Field

WHAT IS PLANT NUTRITION?

Plants use inorganic minerals for nutrition, whether grown in the field or in a container. Complex interactions involving weathering of rock minerals, decaying organic matter, animals, and microbes take place to form inorganic minerals in soil. Roots absorb mineral nutrients as ions in soil water. Many factors influence nutrient uptake for plants. Ions can be readily available to roots or could be "tied up" by other elements or the soil itself. Soil too high in pH (alkaline) or too low (acid) makes minerals unavailable to plants.

FERTILITY OR NUTRITION

The term "fertility" refers to the inherent capacity of a soil to supply nutrients to plants in adequate amounts and in suitable proportions. The term "nutrition" refers to the interrelated steps by which a living organism assimilates food and uses it for growth and replacement of tissue. Previously, plant growth was thought of in terms of soil fertility or how much fertiliser should be added to increase soil levels of mineral elements. Most fertilisers were formulated to account for deficiencies of mineral elements in the soil. The use of soil-less mixes and increased research in nutrient cultures and hydroponics as well as advances in plant tissue analysis have led to a broader understanding of plant nutrition. Plant nutrition is a term that takes into account the interrelationships of mineral elements in the soil or soil-less solution as well as their role in plant growth. This interrelationship involves a complex balance of mineral elements essential and beneficial for optimum plant growth.

ESSENTIAL VERSUS BENEFICIAL

The term essential mineral element (or mineral nutrient) was proposed by Arnon and Stout (1939). They concluded three criteria must be met for an element to be considered essential. These criteria are: 1. A plant must be unable to complete its life cycle in the absence of the mineral element. 2. The function of the element must not be replaceable by another mineral element. 3. The element must be directly involved in plant metabolism. These criteria are important guidelines for plant nutrition but exclude beneficial mineral elements. Beneficial elements are those that can compensate for toxic effects of other elements or may replace mineral nutrients in some other less specific function such as the maintenance of osmotic pressure. The omission of beneficial nutrients in commercial production could mean that plants are not being grown to their optimum genetic potential but are merely produced at a subsistence level. This discussion of plant nutrition includes both the essential and beneficial mineral elements.

WHAT ARE THE MINERAL ELEMENTS?

There are actually 20 mineral elements necessary or beneficial for plant growth. Carbon (C), hydrogen (H), and oxygen (O) are supplied by air and water. The six macronutrients, nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and sulfur (S) are

Continued page 5

ANOS Warringah Monthly Benching Results - October 2019

1. Dockrillia species

1st *Dockrillia striolata* David Hemmings
2nd *Dendrobium prenticei* L & B Dobson
3rd *Dockrillia linguiformis* David Hemmings

2. Dendrobium species

1st *Dendrobium canaliculatum* Cameron Lanceley
2nd *Dendrobium kingianum* 'Black Knight' x 'Darkie' David E Stiles
3rd *Dendrobium kingianum* 'Gotcha' x 'Joyus' David Hemmings

3. Sarcanthinae species

4. Bulbophyllum species

1st *Bulbophyllum shepherdii* I & I Chalmers
2nd Nil
3rd Nil

5. Miscellaneous species

6. Dendrobium Hybrids

7. Sarcanthinae Hybrids

8. Miscellaneous Hybrids

1st *Dockrillia* Duffy David Hemmings
2nd *Dockrillia* Duffy Jim Hemmings
3rd Nil

9. Australasian species

1st *Dendrobium antennatum* John McAuley
2nd *Paphiopedilum glanduliferum* John McAuley
3rd *Dendrobium smiliae* I & I Chalmers

10. Australasian Hybrids

1st *Den.* normanbyense 'Petite' x (polysema x eximum) Ela Kielich
2nd *Den.* Microchip Ela Kielich
3rd *Doc.* Tweetie David Hemmings

11. Novice & Junior

12. Pterostylis species

13. Other terrestrials

14. Terrestrial hybrids

16. Best First Flowering seedling

1st *Dendrobium kingianum* 'Nugget' Trish Peterson
2nd *Den.* Nora Tokunaga x aberrans David Hemmings
3rd Nil

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2019 Members Sarc Show

Species:

1. *Sarcochilus hartmannii*

1st *Sarco. hartmannii* var. Blue Knob 'Dungog' x 'Red Snow' G & H Williams
2nd *Sarco. hartmannii* *David Hemmings*
3rd Nil

2. Sarcochilus fitzgeraldii

1st *Sarco. fitzgeraldii* David E Stiles
2nd Nil
3rd Nil

3. Other Sarcanthinae species #1

1st *Sarco. olivaceus* David E Stiles
2nd *Sarco. falcatus* Trish Peterson
3rd *Sarco. olivaceus* David Hemmings

3A. Other Sarcanthinae species

1st *Plrhz. Tridentata* Trish Peterson
2nd Nil
3rd Nil

4. Sarcanthinae seedling first flowering

1st *Sarco. olivaceus* David Hemmings
2nd *Sarco. falcatus* David E Stiles
3rd *Sarco. spathulatus* David Hemmings

Hybrids:

5. Primary *Sarcochilus* hybrid with *S. hartmannii* and/or *S. fitzgeraldii* parentage

Nil Entries

6. Sarcanthinae hybrids predominantly WHITE

1st *Sarco.* Starstruck 'Krakatoa' G & H Williams
2nd *Sarco.* Dove 'Good' x hartmannii David E Stiles
3rd *Sarco. hartmannii* x Kulnura Sanctuary David Hemmings

7. Sarcanthinae hybrids predominantly PINK/RED

1st *Sarco.* Fizzy Dove x Velvet David Hemmings
2nd *Sarco.* Kulnura Spice x Sweetheart David Hemmings
3rd *Sarco.* Unknown L & B Dobson

8. Sarcanthinae hybrids predominantly OTHER COLOURS/ YELLOWS/BROWNS

1st *Sarco.* Harlequin 'Court Jester' x Fitzhart 'Rusty Bucket' Trish Peterson
2nd *Sarco.* Freckles Bryan Spurrs
3rd *Sarco.* Fizzy Dove 'Salmon' x Roberta 'Super Yellow' Ted Shaw

9. Sarcanthinae hybrids – first flowering

1st *Sarco.* DUNO Nicky's Twin 'Eloise' x Sunny 'Peachy' Trish Peterson
2nd *Sarco. hartmannii x aequalis* x *Plect.* Tridentata 'Green' George Hardy
3rd *Sarco.* Kulnura Absolute x Kulnura Ballerina Bryan Spurrs

10. SPECIMEN size SPECIES or HYBRID

1st *Sarco. hartmannii* ('Kerri' x 'George') Ian Tanner
2nd *Sarco. hartmannii* I & I Chalmers
3rd Nil

11. Novelty Sarcanthinae

1st *Plchs.* Richard Jost David Hemmings
2nd *Plchs.* Richard Jost Trish Peterson
3rd Nil

12. Novice

1st *Sarcochilus falcatus* Jolan Leforestier
2nd *Sarco.* Nicky's Blush No 2 Bruce Potter
3rd *Sarco.* Nicky's Blush Bruce Potter

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Sarco. Nicky's Blush
Bruce Potter

required by plants in large amounts. The rest of the elements are required in trace amounts (micronutrients). Essential trace elements include boron (B), chlorine (Cl), copper (Cu), iron (Fe), manganese (Mn), sodium (Na), zinc (Zn), molybdenum (Mo), and nickel (Ni). Beneficial mineral elements include silicon (Si) and cobalt (Co). The beneficial elements have not been deemed essential for all plants but may be essential for some. The distinction between beneficial and essential is often difficult in the case of some trace elements. Cobalt for instance is essential for nitrogen fixation in legumes. It may also inhibit ethylene formation (Samimy, 1978) and extend the life of cut roses (Venkatarayappa et al., 1980). Silicon, deposited in cell walls, has been found to improve heat and drought tolerance and increase resistance to insects and fungal infections. Silicon, acting as a beneficial element, can help compensate for toxic levels of manganese, iron, phosphorus and aluminium as well as zinc deficiency. A more holistic approach to plant nutrition would not be limited to nutrients essential to survival but would include mineral elements at levels beneficial for optimum growth. With developments in analytical chemistry and the ability to eliminate contaminants in nutrient cultures, the list of essential elements may well increase in the future.

THE MINERAL ELEMENTS IN PLANT PRODUCTION

The use of soil for greenhouse production before the 1960s was common. Today a few growers still use soil in their mixes. The bulk of production is in soil-less mixes. Soil-less mixes must provide support, aeration, nutrient and moisture retention just as soils do, but the addition of fertilisers or nutrients are different. Many soil-less mixes have calcium, magnesium, phosphorus, sulfur, nitrogen, potassium and some micronutrients incorporated as a pre-plant fertiliser. Nitrogen and potassium still must be applied to the crop during production. Difficulty in blending a homogenous mix using pre-plant fertilisers may often result in uneven crops and possible toxic or deficient levels of nutrients. Soil-less mixes that require addition of micro and macronutrients applied as liquid throughout the growth of the crop, may actually give the grower more control of his crop. To achieve optimum production, the grower can adjust nutrient levels to compensate for other environmental factors during the growing season. The absorption of mineral ions is dependent on a number of factors in addition to weather conditions. These include the cation exchange capacity or CEC and the pH or relative amount of hydrogen (H+) or hydroxyl ions (OH-) of the growing medium, and the total alkalinity of the irrigation water.

CEC OR CATION EXCHANGE CAPACITY

The Cation Exchange Capacity refers to the ability of the growing medium to hold exchangeable mineral elements within its structure. These cations include ammonium nitrogen, potassium, calcium, magnesium, iron, manganese, zinc and copper. Peat moss and mixes containing bark, sawdust and other organic materials all have some level of cation exchange capacity.

pH: WHAT DOES IT MEAN?

The term pH refers to the alkalinity or acidity of a growing media water solution. This solution consists of mineral elements dissolved in ionic form in water. The reaction of this solution whether it is acid, neutral or alkaline will have a marked effect on the availability of mineral elements to plant roots. When there is a greater amount of hydrogen H+ ions the solution will be acid (<7.0). If there is more hydroxyl OH- ions the solution will be alkaline (>7.0). A balance of hydrogen to hydroxyl ions yields a pH neutral soil (=7.0). The range for most crops is 5.5 to 6.2 or slightly acidic. This creates the greatest average level for availability for all essential plant nutrients. Extreme fluctuations of higher or lower pH can cause deficiency or toxicity of nutrients.

THE ELEMENTS OF COMPLETE PLANT NUTRITION

The following is a brief guideline of the role of essential and beneficial mineral nutrients that are crucial for growth. Eliminate any one of these elements, and plants will display abnormalities of growth, deficiency symptoms, or may not reproduce normally.

MACRONUTRIENTS

Nitrogen is a major component of proteins, hormones, chlorophyll, vitamins and enzymes essential for plant life. Nitrogen metabolism is a major factor in stem and leaf growth (vegetative growth). Too much can delay flowering and fruiting. Deficiencies can reduce yields, cause yellowing of the leaves and stunt growth.

Phosphorus is necessary for seed germination, photosynthesis, protein formation and almost all aspects of growth and metabolism in plants. It is essential for flower and fruit formation. Low pH (<4) results in phosphate being chemically locked up in organic soils. Deficiency symptoms are purple stems and leaves; maturity and growth are retarded. Yields of fruit and flowers are poor. Premature drop of fruits and flowers may often occur. Phosphorus must be applied close to the plant's roots in order for the plant to utilise it. Large applications of phosphorus without adequate levels of zinc can cause a zinc deficiency.

Potassium is necessary for formation of sugars, starches, carbohydrates, protein synthesis and cell division in roots and other parts of the plant. It helps to adjust water balance, improves stem rigidity and cold hardiness, enhances flavour and colour on fruit and vegetable crops, increases the oil content of fruits and is important for leafy crops. Deficiencies result in low yields, mottled, spotted or curled leaves, scorched or burned look to leaves..

Sulfur is a structural component of amino acids, proteins, vitamins and enzymes and is essential to produce chlorophyll. It imparts flavour to many vegetables. Deficiencies show as light green leaves. Sulfur is readily lost by leaching from soils and should be applied with a nutrient formula. Some water supplies may contain Sulfur.

Magnesium is a critical structural component of the chlorophyll molecule and is necessary for functioning of plant enzymes to produce carbohydrates, sugars and fats. It is used for fruit and nut formation and essential for germination of seeds. Deficient plants appear chlorotic, show yellowing between veins of older leaves; leaves may droop. Magnesium is leached by watering and must be supplied when feeding. It can be applied as a foliar spray to correct deficiencies.

Calcium activates enzymes, is a structural component of cell walls, influences water movement in cells and is necessary for cell growth and division. Some plants must have calcium to take up nitrogen and other minerals. Calcium is easily leached. Calcium, once deposited in plant tissue, is immobile (non-translocatable) so there must be a constant supply for growth. Deficiency causes stunting of new growth in stems, flowers and roots. Symptoms range from distorted new growth to black spots on leaves and fruit. Yellow leaf margins may also appear.

MICRONUTRIENTS

Iron is necessary for many enzyme functions and as a catalyst for the synthesis of chlorophyll. It is essential for the young growing parts of plants. Deficiencies are pale leaf colour of young leaves followed by yellowing of leaves and large veins. Iron is lost by leaching and is held in the lower portions of the soil structure. Under conditions of high pH (alkaline) iron is rendered unavailable to plants. When soils are alkaline, iron may be abundant but unavailable. Applications of an acid nutrient formula containing iron chelates, held in soluble form, should correct the problem.

Manganese is involved in enzyme activity for photosynthesis, respiration, and nitrogen metabolism. Deficiency in young leaves may show a network of green veins on a light green background similar to an iron deficiency. In the advanced stages the light green parts become white, and leaves are shed. Brownish, black, or greyish spots may appear next to the veins. In neutral or alkaline soils plants often show deficiency symptoms. In highly acid soils, manganese may be available to the extent that it results in toxicity.

Boron is necessary for cell wall formation, membrane integrity, calcium uptake and may aid in the translocation of sugars. Boron affects at least 16 functions in plants. These functions include flowering, pollen germination, fruiting, cell division, water relationships and the movement of hormones. Boron must be available throughout the life of the plant. It is not translocated and is easily leached from soils. Deficiencies kill terminal buds leaving a rosette effect on the plant. Leaves are thick, curled and brittle. Fruits, tubers and roots are discoloured, cracked and flecked with brown spots.

Zinc is a component of enzymes or a functional cofactor of a large number of enzymes including auxins (plant growth hormones). It is essential to carbohydrate metabolism, protein synthesis and internodal elongation (stem growth). Deficient plants have mottled leaves with irregular chlorotic areas. Zinc deficiency leads to iron deficiency causing similar symptoms. Deficiency occurs on eroded soils and is least available at a pH range of 5.5 - 7.0. Lowering the pH can render zinc more available to the point of toxicity.

Copper is concentrated in roots of plants and plays a part in nitrogen metabolism. It is a component of several enzymes and may be part of the enzyme systems that use carbohydrates and proteins. Deficiencies cause die back of the shoot tips, and terminal leaves develop brown spots. Copper is bound tightly in organic matter and may be deficient in highly organic soils. It is not readily lost from soil but may often be unavailable. Too much copper can cause toxicity.

Molybdenum is a structural component of the enzyme that reduces nitrates to ammonia. Without it, the synthesis of proteins is blocked and plant growth ceases. Root nodule (nitrogen fixing) bacteria also require it. Seeds may not form completely, and nitrogen deficiency may occur if plants are lacking molybdenum. Deficiency signs are pale green leaves with rolled or cupped margins.

Chlorine is involved in osmosis (movement of water or solutes in cells), the ionic balance necessary for plants to take up mineral elements and in photosynthesis. Deficiency symptoms include wilting, stubby roots, chlorosis (yellowing) and bronzing. Odours in some plants may be decreased. Chloride, the ionic form of chlorine used by plants, is usually found in soluble forms and is lost by leaching. Some plants may show signs of toxicity if levels are too high.

Nickel has just recently won the status as an essential trace element for plants according to the Agricultural Research Service Plant, Soil and Nutrition Laboratory in Ithaca, NY. It is required for the enzyme urease to break down urea to liberate the nitrogen into a useable form for plants. Nickel is required for iron absorption. Seeds need nickel in order to germinate. Plants grown without additional nickel will gradually reach a deficient level at about the time they mature and begin reproductive growth. If nickel is deficient plants may fail to produce viable seeds.

Sodium is involved in osmotic (water movement) and ionic balance in plants.

Cobalt is required for nitrogen fixation in legumes and in root nodules of nonlegumes. The demand for cobalt is much higher for nitrogen fixation than for ammonium nutrition. Deficient levels could result in nitrogen deficiency symptoms.

Silicon is found as a component of cell walls. Plants with supplies of soluble silicon produce stronger, tougher cell walls making them a mechanical barrier to piercingand sucking insects. This significantly enhances plant heat and drought tolerance. Foliar sprays of silicon have also shown benefits reducing populations of aphids on field crops. Tests have also found that silicon can be deposited by the plants at the site of infection by fungus to combat the penetration of the cell walls by the attacking fungus. Improved leaf erectness, stem strength and prevention or depression of iron and manganese toxicity have all been noted as effects from silicon. Silicon has not been determined essential for all plants but may be beneficial for many.

Written by Dorothy Morgan.

Staff Horticulturist employed by Dyna-Gro Corporation.