Plant analysis : An Interpretation manual.

4. Definition of Terms and Abbreviations Used in the Manual

Nutrients

Criteria for the following nutrients and nutrient fractions are described in the accompanying tables: nitrogen (N), nitrate-nitrogen (NO_3-N), phosphorus (P), phosphate-phosphorus (PO_4-P), potassium (K), sulphur (S), sulfate-sulphur (SO_4-S), calcium (Ca), magnesium (Mg), sodium (Na), chloride (Cl), copper (Cu), zinc (Zn), manganese (Mn), iron (Fe), aluminium (Al), boron (B), molybdenum (Mo), cobalt (Co) and nickel (Ni). Reference is also made to published enzyme assay procedures and to rapid field testing techniques.

Unless otherwise stated the concentrations are reported on an oven-dry basis as percentages (%) or in units of mg/kg.

Plant growth stage

The nutrient concentrations listed in the tables are related to specific stages of phenological development (e.g. tillering, flowering) or to plant age (e.g. 40 days from sowing). In perennial crops, calendar dates are often used to specify sampling times. Normally, it would be unwise to use the listed values for interpreting plant analyses at other growth stages or plant ages. The three stages of growth defined for forest species (seedling, juvenile and mature) are illustrated in Figure 4.1.

The following terms and abbreviations have been used to describe plant growth stages. In addition, for some species, references to published keys of phenological development are included beneath the crop name.

3BBE	3rd blade below the ear
DAC	days after cutting
DASAL	days after salination treatment
DOT	days of treatment
DAS/DAE/DAT	days after sowing, emergence, or transplanting respectively
FI	flowering
FS	Feeke's scale of growth stages in cereals (Large 1954, see Figure 4.2).
GS	growth stage
Head	heading
Joint	jointing
Juv	juvenile for forest trees (1–5 years)
MAS/MAE/MAT	months after sowing, emergence or transplanting respectively
Mat	mature plant or one ready for harvest. For forest species, this term means tree age >5 years old
Panicle initiat.	panicle initiation
PF	pod fill or grain fill
PS	pod set
Seedl	seedling stage. For forest species, this term means tree age <1 year old
Shoot	shooting
Stem Elong	stem elongation
Till	tillering
U	unknown
Var	Various
Veg	Vegetative
ZS	Zadok's decimal code for the growth stages of cereals (Zadok *et al.* 1974 see Table 4.1)

Plant part

The following abbreviations have been used for plant parts:

A	apex
Ap LB	apical leaf blade
A+YOL	terminal apices plus youngest open leaf blade (see below)
Basal S	basal stem (cereals)
BOBC	blade opposite and below the cob
BYOL	blade of youngest open leaf
Cot	cotyledons
Lat	lateral
LB	leaf blade (excluding sheath or petiole)
LB+P	leaf blade and petiole
LP	lowest leaf pair
LYMCL	leaflet of youngest mature compound leaf
ML	mature leaf
MRWL	midrib of wrapper leaf
P	petiole
pr	pair
PYMB	petiole of YMB (see below)
PYML	petiole of YML (see below)
PYOL	subtending petiole of YOL (see below)

RML	recently mature leaf
S	stem
Sap	sap
Tfs	trifoliate leaves
TVD	top visible dewlap (sugarcane)
U	unknown
WL	wrapper leaf
WS	whole shoot or 'tops' (i.e. all of the plant parts above ground)
YB	young leaf blade (i.e. younger than YMB); in case of a compound or pinnate leaf, B indicates leaflet or pinna tissues
Y blade	youngest emerged leaf blade (rice)
YEB	youngest (i.e. upper most) emerged leaf blade; in cereals, this leaf blade has completely emerged with its auricles present (see Figure 3.3)
YLB +1	next oldest leaf blade below YEB
YF	young foliage
YFEL	youngest fully expanded leaf
YL	young leaves
YMB	youngest (i.e. upper most) mature leaf blade. Covers terms such as 'recently mature leaf blade', 'uppermost mature leaf blade' or 'youngest fully expanded leaf blade'.
YMB +1	next oldest leaf blade below YMB
YMHL	youngest mature heart leaf
YML	youngest mature leaf
YML +1	next oldest mature leaf below YML
YOB	youngest open leaf blade
YOB +1	next oldest open leaf bladebelow YOB
YOL	youngest open leaf blade in pasture legumes i.e. the three leaflets, excluding subtending petiole, which have opened fully, but which have yet to reach maximum size (see Figure 3.3)
YOL +1	next youngest open leaf blade in pasture legumes (see Figure 3.3)

Other abbreviations for plant parts are defined at the head of the table in which they appear.

How established

The following abbreviations define how the plant test criteria were derived or established.

D	diagnostic records (derived from data bank of analyses)
f	field experiment
FSC	flowing solution culture experiment
Lit	literature review
Peat	peat culture experiment undertaken in glasshouse
Peat–Ver	peat and vermiculite culture experiment undertaken in glasshouse
Pmix	potting mix
Pot	pot trials
RSC	solution culture experiment in which nutrients were replenished periodically
S	survey data from commercial crops
Sand	sand culture experiment undertaken in glasshouse
SC	solution culture experiment undertaken in glasshouse
Soil	soil culture experiment undertaken in glasshouse
U	unknown

Classification of nutrient concentrations (see Figure 4.3)

Deficient

This is the range of concentrations in the specified plant part which is associated with visible deficiency symptoms on the plant and severely reduced growth and production.

In some cases this range has been defined in experiments. In others it has been developed from analytical data collected during problem diagnosis.

Where values are found in the deficient range, corrective measures are clearly required.

Marginal

This is the range of concentrations in the specified plant part which is associated with a reduction in growth or production but within which plants do not show visible symptoms of deficiency.

This classification is essentially the 'low' range used by many authors who work with woody perennials.

Changes in fertilizer practice are usually required if values in this range are encountered. However, for some nutrient and crop combinations (e.g. nitrogen in apple and stone fruit), there may be merit in operating in this range to obtain best fruit quality.

Critical value (deficiency and toxicity)

The critical concentration for the specified plant part (sometimes stated with defined variance) is that concentration of the single nutrient at which growth or production is found experimentally (where all other conditions are optimum) to be at a predetermined proportion of maximum (e.g. 90% or 95% maximum yield are values often chosen). This value will fall within the marginal range.

A critical value for toxicity above which growth or production falls below, say, 80% or 90% maximum yield, can be similarly defined.

Critical values are always defined objectively.

Plant nutrient status should normally be kept above the critical value (deficiency) or below the critical value (toxicity).

Azalea (*Rhododendron indicum*) Cont'd

Ca(%)	Fl	YMB on Fl shoot	U	<0.20			0.22-1.60			USA	29
	Fl	YMB on Fl shoot	D		<0.40		0.40-1.60	>1.60		Aust	35
Mg(%)	Fl	YMB on Fl shoot	U	<0.16			0.17-0.50			USA	29
Na(%)	Fl	YMB on Fl shoot	D		<0.10		0.10-0.30	>0.30		Aust	35
Cl(%)	Fl	YMB on Fl shoot	D		<0.30		0.30-1.0	>1.0		Aust	35
Cu(mg/kg)	Fl	YMB on Fl shoot	U	<5			6.0-15.0			USA	29
	Fl	YMB on Fl shoot	D		<5		5.0-30.0	>30		Aust	35
Zn(mg/kg)	Fl	YMB on Fl shoot	U	<15			15-60			USA	29
	Fl	YMB on Fl shoot	D		<10		10-100	>100		Aust	35
Mn(mg/kg)	Fl	YMB on Fl shoot	U	<30			30-300		>400	USA	29
	Fl	YMB on Fl shoot	D		<50		50-400	>400		Aust	35
Fe(mg/kg)	Fl	YMB on Fl shoot	U	<50			50-150			USA	29
	Fl	YMB on Fl shoot	D		<100		100-700	>700		Aust	35
Al(mg/kg)	Fl	YMB on Fl shoot	U					Very tolerant		USA	29
B(mg/kg)	Fl	YMB on Fl shoot	U	<16			17-100		>200	USA	29
	Fl	YMB on Fl shoot	D		<20		20-100	>100		Aust	35
Mo(mg/kg)	Fl	YMB on Fl shoot	D		<0.1		0.1-1.0	>1.0		Aust	35

Banksia (*Banksia ericifolia*) Coast Banksia (*Banksia integrifolia*)

N(%)	10 weeks	WS	Sand	0.78			1.00-1.14			Aust	33	Growth reductions in deficient plants
P(%)	Seedl	WS	Pmix				0.06-0.16		>0.17	Aust	14	Banksia ericifolia
	10 weeks	WS	Sand				0.17-0.62			Aust	33	
K(%)	10 weeks	WS	Sand	0.21			0.46-0.73			Aust	33	Deficient plants necrotic
Ca(%)	10 weeks	WS	Sand				0.42-0.79			Aust	33	
Mg(%)	10 weeks	WS	Sand				0.11-0.29			Aust	33	

Nutrient	Growth stage	Plant part	How established	Concentration range						Country	Ref	Comments
				Deficient	Marginal	Critical (deficiency)	Adequate	High	Critical (toxicity)			
K(%)	Stem >30 cm long	5th leaf below growing terminal	F		<1.0		1.0-1.5			Aust	28	
S(%)	Stem >30 cm long	5th leaf below growing terminal	F				0.41-0.48			Aust	28	
Ca(%)	Stem >30 cm long	5th leaf below growing terminal	F				1.0-1.2			Aust	28	
Mg(%)	Stem >30 cm long	5th leaf below growing terminal	F				0.24-0.32			Aust	28	
Na(%)	Stem >30 cm long	5th leaf below growing terminal	F				0.65-0.81			Aust	28	
Cu(mg/kg)	Stem >30 cm long	5th leaf below growing terminal	F				9.0-21.0			Aust	28	
Zn(mg/kg)	Stem >30 cm long	5th leaf below growing terminal	F				42-60			Aust	28	
Mn(mg/kg)	Stem >30 cm long	5th leaf below growing terminal	F				150-203			Aust	28	
Fe(mg/kg)	Stem >30 cm long	5th leaf below growing terminal	F				61-81			Aust	28	
Al(mg/kg)	Stem >30 cm long	5th leaf below growing terminal	F				190-233			Aust	28	
B(mg/kg)	Stem >30 cm long	5th leaf below growing terminal	F				49-57			Aust	28	

Leucadendron, Silvan Red/Safari Sunset (*Leucadendron* spp.)

N(%)	Nov-Jan Period of active growth	YFEL	S				0.7-1.0			Aust	8	For high yielding Silvan Red/Safari Sunset
	Nov-Jan Period of active growth	YFEL	S				0.6-0.8			Aust	8	For low yielding Silvan Red/Safari Sunset
	Aug-Oct	YFEL	S				0.5-0.7			Aust	8	For high yielding Silvan Red/Safari Sunset
	Aug-Oct	YFEL	S				0.4-0.5			Aust	8	For low yielding Silvan Red/Safari Sunset
P(%)	Nov-Jan Period of active growth	YFEL	S				0.08-0.1			Aust	8	Silvan Red/Safari Sunset
	Aug-Oct	YFEL	S				0.2 -0.4			Aust	8	For high yielding Silvan Red/Safari Sunset

				Concentration range								
Nutrient	Growth stage	Plant part	Type of standard	Deficient	Marginal	Critical (deficiency)	Adequate	High	Critical (toxicity)	Country	Ref	Comments
Leucadendron, Silvan Red/Safari Sunset (*Leucadendron* spp.) (ctd)												
P(%) (ctd)	Aug-Oct	YFEL	S				0.08-0.1			Aust	8	For low yielding Silvan Red/Safari Sunset
K(%)	Nov-Jan Period of active growth	YFEL	S				0.21-0.36			Aust	8	Silvan Red/Safari Sunset
S(%)	Nov-Jan Period of active growth	YFEL	S				0.1-0.16			Aust	8	Silvan Red/Safari Sunset
Ca(%)	Nov-Jan Period of active growth	YFEL	S				0.25-0.4			Aust	8	Silvan Red/Safari Sunset
Mg(%)	Nov-Jan Period of active growth	YFEL	S				0.15-0.22			Aust	8	Silvan Red/Safari Sunset
Na(%)	Nov-Jan Period of active growth	YFEL	S				0.55-0.7			Aust	8	For high yielding Silvan Red/Safari Sunset
	Nov-Jan Period of active growth	YFEL	S				0.65-0.8			Aust	8	For low yielding Silvan Red/Safari Sunset
	Aug-Oct	YFEL	S				0.3-0.35			Aust	8	For high yielding Silvan Red/Safari Sunset
	Aug-Oct	YFEL	S				0.4-0.45			Aust	8	For low yielding Silvan Red/Safari Sunset
Cu(mg/kg)	Nov-Jan Period of active growth	YFEL	S				2.0-12.0			Aust	8	Silvan Red/Safari Sunset
Zn(mg/kg)	Nov-Jan Period of active growth	YFEL	S				16.0-30.0			Aust	8	Silvan Red/Safari Sunset
Mn(mg/kg)	Nov-Jan Period of active growth	YFEL	S				70.0-120.0			Aust	8	Silvan Red
	Nov-Jan Period of active growth	YFEL	S				100-300			Aust	8	Safari Sunset
Fe(mg/kg)	Nov-Jan Period of active growth	YFEL	S				15-30			Aust	8	Silvan Red/Safari Sunset

Nutrient	Growth stage	Plant part	How established	Concentration range: Deficient	Marginal	Critical (deficiency)	Adequate	High	Critical (toxicity)	Country	Ref	Comments
B(mg/kg)	Nov-Jan Period of active growth	YFEL	S				12.0-16.0			Aust	8	Silvan Red/Safari Sunset

Maidenhair Fern (*Adiantum raddianum* cv. Elegans)

N(%)	50-120 days after treatment started	Fronds	Peat	<2.0			2.4-2.7			Aust	36	Hysol® fertilizer study; fronds on -Hysol (pale green) diagnosed as N deficient
P(%)	50-120 days after treatment started	Fronds	Peat				0.2-0.4			Aust	36	Hysol® fertilizer study
K(%)	50-120 days after treatment started	Fronds	Peat				2.5-4.0			Aust	36	Hysol® fertilizer study
S(%)	50-120 days after treatment started	Fronds	Peat				0.2-0.3			Aust	36	Hysol® fertilizer study
Ca(%)	50-120 days after treatment started	Fronds	Peat				0.3-0.5			Aust	36	Hysol® fertilizer study
Mg(%)	50-120 days after treatment started	Fronds	Peat				0.25-0.5			Aust	36	Hysol® fertilizer study
Na(%)	50-120 days after treatment started	Fronds	Peat				0.05-0.15			Aust	36	Hysol® fertilizer study
Cl(%)	50-120 days after treatment started	Fronds	Peat				0.3-0.6			Aust	36	Hysol® fertilizer study

Nutrient	Growth stage	Plant part	How established	Concentration range: Deficient	Marginal	Critical (deficiency)	Adequate	High	Critical (toxicity)	Country	Ref	Comments
Poinsettia (*Euphorbia pulcherrima*) (cld)												
Cu(mg/kg)	Just before FI	YMB	U	<5			6.0-15.0			USA	29	
Zn(mg/kg)	Just before FI	YMB	U	<15			25-60			USA	29	
Mn(mg/kg)	Just before FI	YMB	U	<30			100-200		>250	USA	29	
Fe(mg/kg)	Just before FI	YMB	U	<50			100-500			USA	29	
B(mg/kg)	Just before FI	YMB	U	<20			30-100		>200	USA	29	Leaf necrosis at 200 mg/kg
Queen Protea (*Protea* spp.)												
N(%)	2-3 years old at FI bud initiat. (Aug)	YMB on any shoot	S				1.2-1.3			Aust	33	*P. cynaroides* (King protea)
	FI bud initiat. (Aug)	YMB on stem with flower buds	S				1.4-1.6			Aust	33	*P. repens*
	After FI	YL	S				0.8-1.0			Aust	35	*P. magnifica* (Queen protea)
	Shoots >40 cm long with dormant terminal bud during Jan-Feb	Hardened YFEL	S				0.82-0.83			Aust	26	Protea Pink Ice. Adequate can be as high as 1.24 % N when N fertilizer is used.
	Shoots >40 cm long with dormant terminal bud during Jan-Feb	Hardened YFEL	S				0.7-0.9			Aust	26	Protea Pink Ice. Adequate range derived by survey. (G. Barth pers. comm.)
P(%)	2-3 years old at FI bud initiat. (Aug)	YMB on any shoot	S				0.04-0.06			Aust	33	*P. cynaroides*
	FI bud initiat. (Aug)	YMB on stem with flower buds	S				0.09-0.10		0.17	Aust	33	*P. repens*
	After FI	YL	S				0.09-0.10			Aust	35	*P. magnifica* (Queen protea)
	Shoots >40 cm long with dormant terminal bud during Jan-Feb	Hardened YFEL	S				0.06-0.07			Aust	26	Protea Pink Ice

Nutrient	Growth stage	Plant part	How established	Concentration range: Deficient	Marginal	Critical (deficiency)	Adequate	High	Critical (toxicity)	Country	Ref	Comments
K(%)	2-3 years old at Fl bud initiat. (Aug)	YMB on any shoot	S				0.34-0.73			Aust	33	*P. cynaroides* (King protea)
	Fl bud initiat. (Aug)	YMB on stem with flower buds	S				0.31-0.52			Aust	33	*P. repens*
	After Fl	YL	S				0.3-0.4			Aust	35	*P. magnifica* (Queen protea)
	Shoots >40 cm long with dormant terminal bud during Jan-Feb	Hardened YFEL	S				0.37-0.41			Aust	26	Protea Pink Ice
S(%)	2-3 years old at Fl bud initiat. (Aug)	YMB on any shoot	S				0.18-0.24			Aust	33	*P. cynaroides* (King protea)
	Fl-bud initiat. (Aug)	YMB on stem with flower buds	S				0.24-0.29			Aust	33	*P. repens*
	After Fl	YL	S				0.09-0.10			Aust	35	*P. magnifica* (Queen protea)
	Shoots >40 cm long with dormant terminal bud during Jan-Feb	Hardened YFEL	S				0.11-0.13			Aust	26	Protea Pink Ice
Ca(%)	2-3 years old at Fl bud initiat. (Aug)	YMB on any shoot	S				0.52-1.00			Aust	33	*P. cynaroides* (King protea)
	Fl bud initiat. (Aug)	YMB on stem with flower buds	S				0.45-0.73			Aust	33	*P. repens*
	After Fl	YL	S				0.3-0.4			Aust	35	*P. magnifica* (Queen protea)
	Shoots >40 cm long with dormant terminal bud during Jan-Feb	Hardened YFEL	S				0.46-0.51			Aust	26	Protea Pink Ice
Mg(%)	2-3 years old at Fl bud initiat. (Aug)	YMB on any shoot	S				0.10-0.12			Aust	33	*P. cynaroides* (King protea)
	Fl bud initiat (Aug)	YMB on stem with flower buds	S				0.06-0.16			Aust	33	*P. repens*

Nutrient	Growth stage	Plant part	How established	Concentration range: Deficient	Marginal	Critical (deficiency)	Adequate	High	Critical (toxicity)	Country	Ref.	Comments
Queen Protea (*Protea* spp.) (cld)												
Na(%)	2-3 years old at Fl bud initiat. (Aug)	YMB on any shoot	S				0.13-0.21			Aust	33	*P. cynaroides* (King protea)
	Fl bud initiat. (Aug)	YMB on stem with flower buds	S				0.04-0.07			Aust	33	*P. repens*
Cl(%)	2-3 years old at Fl bud initiat. (Aug)	YMB on any shoot	S				0.12-0.14			Aust	33	*P. cynaroides* (King protea)
	Fl bud initiat. (Aug)	YMB on stem with flower buds	S				0.02-0.04			Aust	33	*P. repens*
Cu(mg/kg)	2-3 years old at Fl bud initiat. (Aug)	YMB on any shoot	S				2.0-3.0			Aust	33	*P. cynaroides* (King protea)
	Fl bud initiat. (Aug)	YMB on stem with flower buds	S				4			Aust	33	*P. repens*
	After Fl	YL	S				2.0-4.0			Aust	35	*P. magnifica* (Queen protea)
Zn(mg/kg)	2-3 years old at Fl bud initiat. (Aug)	YMB on any shoot	S				19-27			Aust	33	*P. cynaroides* (King protea)
	Fl bud initiat. (Aug)	YMB on stem with flower buds	S				26-35			Aust	33	*P. repens*
	After Fl	YL	S				10.0-20.0			Aust	35	*P. magnifica* (Queen protea)
	Shoots >40 cm long with dormant terminal bud during Jan-Feb	Hardened YFEL	S				12.0-15.0			Aust	26	Protea Pink Ice
Mn(mg/kg)	2-3 years old at Fl bud initiat. (Aug)	YMB on any shoot	S				145-265			Aust	33	*P. cynaroides* (King protea)
	Fl bud initiat. (Aug)	YMB on stem with flower buds	S				208-220			Aust	33	*P. repens*
	After Fl	YL	S				50-400			Aust	35	*P. magnifica* (Queen protea)

Nutrient	Growth stage	Plant part	How established	Concentration range: Deficient	Marginal	Critical (deficiency)	Adequate	High	Critical (toxicity)	Country	Ref	Comments
	Shoots >40 cm long with dormant terminal bud during Jan-Feb	Hardened YFEL	S				43.0-44.0			Aust	26	Protea Pink Ice
Fe(mg/kg)	2-3 years old at Fl bud initiat. (Aug)	YMB on any shoot	S				38-51			Aust	33	*P. cynaroides* (King protea)
	Fl bud initiat. (Aug)	YMB on stem with flower buds	S				76-115			Aust	33	*P. repens*
Al(mg/kg)	2-3 years old at Fl bud initiat. (Aug)	YMB on any shoot	S				80-150			Aust	33	*P. cynaroides* (King protea)
	Fl bud initiat. (Aug)	YMB on stem with flower buds	S				105-155			Aust	33	*P. repens*
B(mg/kg)	2-3 years old at Fl bud initiat. (Aug)	YMB on any shoot	S				14-24			Aust	33	*P. cynaroides* (King protea)
	Fl bud initiat. (Aug)	YMB on stem with flower buds	S				19-24			Aust	33	P. repens
	After Fl	YL	S				10.0-20.0			Aust	35	*P. magnifica* (Queen protea)

Rose, Floribunda (*Rosa floribunda*)

N(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from Fl shoots	Soil	2.14			3.0-3.3			Swe	21	
P(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from Fl shoots	Soil	0.14			0.28-0.36			Swe	21	
K(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from Fl shoots	Soil	1.01			1.9-2.2			Swe	21	
Ca(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from Fl shoots	Soil	0.39			1.3			Swe	21	
Mg(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from Fl shoots	Soil	0.2			0.3			Swe	21	
Na(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from Fl shoots	Soil				0.4			Swe	21	
Cl(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from Fl shoots	Soil				0.03			Swe	21	

Nutrient	Growth stage	Plant part	How established	Concentration range: Deficient	Marginal	Critical (deficiency)	Adequate	High	Critical (toxicity)	Country	Ref	Comments
	Shoots >40 cm long with dormant terminal bud during Jan-Feb	Hardened YFEL	S				43.0-44.0			Aust	26	Protea Pink Ice
Fe(mg/kg)	2-3 years old at FI bud initiat. (Aug)	YMB on any shoot	S				38-51			Aust	33	*P. cynaroides* (King protea)
	FI bud initiat. (Aug)	YMB on stem with flower buds	S				76-115			Aust	33	*P. repens*
Al(mg/kg)	2-3 years old at FI bud initiat. (Aug)	YMB on any shoot	S				80-150			Aust	33	*P. cynaroides* (King protea)
	FI bud initiat. (Aug)	YMB on stem with flower buds	S				105-155			Aust	33	*P. repens*
B(mg/kg)	2-3 years old at FI bud initiat. (Aug)	YMB on any shoot	S				14-24			Aust	33	*P. cynaroides* (King protea)
	FI bud initiat. (Aug)	YMB on stem with flower buds	S				19-24			Aust	33	P. repens
	After FI	YL	S				10.0-20.0			Aust	35	*P. magnifica* (Queen protea)

Rose, Floribunda (*Rosa floribunda*)

N(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from FI shoots	Soil	2.14			3.0-3.3			Swe	21	
P(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from FI shoots	Soil	0.14			0.28-0.36			Swe	21	
K(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from FI shoots	Soil	1.01			1.9-2.2			Swe	21	
Ca(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from FI shoots	Soil	0.39			1.3			Swe	21	
Mg(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from FI shoots	Soil	0.2			0.3			Swe	21	
Na(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from FI shoots	Soil				0.4			Swe	21	
Cl(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from FI shoots	Soil				0.03			Swe	21	

Nutrient	Growth stage	Plant part	How established	Concentration range: Deficient	Marginal	Critical (deficiency)	Adequate	High	Critical (toxicity)	Country	Ref	Comments
	Shoots >40 cm long with dormant terminal bud during Jan-Feb	Hardened YFEL	S				43.0-44.0			Aust	26	Protea Pink Ice
Fe(mg/kg)	2-3 years old at FI bud initiat. (Aug)	YMB on any shoot	S				38-51			Aust	33	*P. cynaroides* (King protea)
	FI bud initiat. (Aug)	YMB on stem with flower buds	S				76-115			Aust	33	*P. repens*
Al(mg/kg)	2-3 years old at FI bud initiat. (Aug)	YMB on any shoot	S				80-150			Aust	33	*P. cynaroides* (King protea)
	FI bud initiat (Aug)	YMB on stem with flower buds	S				105-155			Aust	33	*P. repens*
B(mg/kg)	2-3 years old at FI bud initiat. (Aug)	YMB on any shoot	S				14-24			Aust	33	*P. cynaroides* (King protea)
	FI bud initiat. (Aug)	YMB on stem with flower buds	S				19-24			Aust	33	*P. repens*
	After FI	YL	S				10.0-20.0			Aust	35	*P. magnifica* (Queen protea)

Rose, Floribunda (*Rosa floribunda*)

N(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from FI shoots	Soil	2.14			3.0-3.3			Swe	21	
P(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from FI shoots	Soil	0.14			0.28-0.36			Swe	21	
K(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from FI shoots	Soil	1.01			1.9-2.2			Swe	21	
Ca(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from FI shoots	Soil	0.39			1.3			Swe	21	
Mg(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from FI shoots	Soil	0.2			0.3			Swe	21	
Na(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from FI shoots	Soil				0.4			Swe	21	
Cl(%)	1 day before harvest	2nd and 3rd 5-leaflet leaves from FI shoots	Soil				0.03			Swe	21	

Nutrient	Growth stage	Plant part	How established	Concentration range: Deficient	Marginal	Critical (deficiency)	Adequate	High	Critical (toxicity)	Country	Ref	Comments
Umbrella Plant (*Schefflera actinophylla*) (ctd)												
K(%) (ctd)	U	Central leaflet	Soil, Sand	<1.50						USA	30	
Ca(%)	U	Central leaflet	Soil				1.0-1.5			USA	38	
Mg(%)	U	Central leaflet	Soil, Sand				0.3-0.6			USA	30	
Cu(mg/kg)	U	Central leaflet	Soil, Sand				5.0-20.0			USA	30	
Zn(mg/kg)	U	Central leaflet	Soil, Sand				30-70			USA	30	
Mn(mg/kg)	U	Central leaflet	Soil, Sand				100-450		>1000	USA	30	
Fe(mg/kg)	U	Central leaflet	Soil, Sand				50-250		>1900	USA	30	
B(mg/kg)	U	Central leaflet	Soil, Sand	<20			25-60			USA	30	
Waratah, New South Wales (*Telopea speciosissima*)												
N(%)	2nd year during dormancy (Aug)	YMB below flower bud	S				1.3-1.6			Aust	33	
P(%)	2nd year during dormancy (Aug)	YMB below flower bud	S				0.07-0.10			Aust	33	Possible toxicity at 0.83%
K(%)	2nd year during dormancy (Aug)	YMB below flower bud	S				0.45-0.53			Aust	33	Possible deficiency at 0.17%

Nutrient	Growth stage	Plant part	How established	Concentration range						Country	Ref	Comments
				Deficient	Marginal	Critical (deficiency)	Adequate	High	Critical (toxicity)			
S(%)	2nd year during dormancy (Aug)	YMB below flower bud	S			0.20-0.26				Aust	33	
Ca(%)	2nd year during dormancy (Aug)	YMB below flower bud	S			0.39-0.53				Aust	33	
Mg(%)	2nd year during dormancy (Aug)	YMB below flower bud	S			0.12-0.15				Aust	33	
Na(%)	2nd year during dormancy (Aug)	YMB below flower bud	S			0.013-0.058				Aust	33	
Cl(%)	2nd year during dormancy (Aug)	YMB below flower bud	S			0.07-0.15				Aust	33	
Cu(mg/kg)	2nd year during dormancy (Aug)	YMB below flower bud	S			2.0-3.0				Aust	33	
Zn(mg/kg)	2nd year during dormancy (Aug)	YMB below flower bud	S			8.0-9.0				Aust	33	
Mn(mg/kg)	2nd year during dormancy (Aug)	YMB below flower bud	S			220-318				Aust	33	
Fe(mg/kg)	2nd year during dormancy (Aug)	YMB below flower bud	S			50-90				Aust	33	
Al(mg/kg)	2nd year during dormancy (Aug)	YMB below flower bud	S			175-380				Aust	33	

Nutrient	Growth stage	Plant part	How established	Concentration range: Deficient	Marginal	Critical (deficiency)	Adequate	High	Critical (toxicity)	Country	Ref	Comments
Waratah, New South Wales (*Telopea speciosissima*) (ctd)												
B(mg/kg)	2nd year during dormancy (Aug)	YMB below flower bud	S				15-21			Aust	33	
Wattle (*Acacia* spp.)												
P(%)	1 month after potting up to 250 mm pot	Leaves	S				0.16		>0.20	Aust	35	*A. baileyana*; in toxic range, stunting, discoloration of leaves and retarded root development.
	1 month after potting up to 250 mm pot	Leaves	S				0.2		>0.25	Aust	35	*A. retinoides*; in toxic range, stunting, discoloration of leaves and retarded root development
	1 month after potting up to 250 mm pot	Leaves	S				0.18		>0.20	Aust	35	*A. decurrens*; in toxic range, stunting, discoloration of leaves and retarded root development.
	1 month after potting up to 250 mm pot	Leaves	S				0.2		>0.25	Aust	35	*A. iteaphylla*; in toxic range, stunting, discoloration of leaves and retarded root development
Zinnia (*Zinnia elegans*)												
N(%)	F	YMB	U				2.0-5.0			Ger	5	
P(%)	F	YMB	U				0.2-0.45			Ger	5	
K(%)	F	YMB	U				2.2-5.5			Ger	5	
Ca(%)	F	YMB	U				0.8-2.0			Ger	5	
Mg(%)	F	YMB	U				0.2-0.6			Ger	5	
Cu(mg/kg)	F	YMB	U				4.0-10.0			Ger	5	
Zn(mg/kg)	F	YMB	U				25-70			Ger	5	
Mn(mg/kg)	F	YMB	U				40-120			Ger	5	
B(mg/kg)	F	YMB	U				25-70			Ger	5	
	F	Buds	SC	9			73-114	206		USA	40	
Mo(mg/kg)	F	YMB	U				0.3-1.0			Ger	5	