

INTERPRETATION OF SOIL, PETIOLE AND LEAF ANALYSES

Several laboratories throughout the Australian cotton-growing regions perform routine analyses of soil, petiole and cotton leaves. Because they do not all use the same extraction procedures and operate different analytical equipment, results are not necessarily comparable between laboratories.

SOIL ANALYSIS

The following table relating to soil analyses aims to compare the nutrient concentrations determined by commonly used methods. The critical concentration of each nutrient is indicated, below which a response to fertilizer addition could be expected.

Also, refer to the 'Soil sampling and analysis' chapter of this manual.

PETIOLE AND LEAF ANALYSES

Petiole and leaf tissue analyses are conducted using more uniform methodology and are therefore more comparable between laboratories than soil analyses. However, variation between laboratories may result from the type of analytical equipment used.

Petiole nitrate analysis: Collect petioles from the same mainstem node between squaring and late-flowering (500–1000 day degrees). The NutriLOGIC program allows for petiole nitrate analysis data to be entered and a calculation of the growing day degrees made and the N fertilizer requirement is estimated. Table 9-2 refers to nutrient concentrations found in petiole sampled at 750 day degrees. Refer to chapters 'Leaf and petiole analysis' and 'NutriLOGIC – predicting N fertilizer requirements of cotton'.

Table 9-1.
Soil analysis and
interpretation

Nutrient	Extractant	Critical value	Comments
Nitrogen (N)	Nitrate in aqueous extract	Depends on soil sampling time, but generally >20-30 ppm	Refer to NutriLOGIC. Some labs report values as nitrate rather than N (ie 4.4 times higher)
Phosphorus (P)	Bicarbonate Lactate	6 ppm 10 ppm	Take care with sampling soil in fields where P has been previously applied in bands
Potassium (K)	ammonium acetate	0.2 - 0.4 meq/100g 100 - 150 ppm	
Sulfur (S)	Acetate buffer	5 - 10 ppm	
Calcium (Ca)	ammonium acetate	2 - 3.5 meq/100g 400 - 700 ppm	
Magnesium (Mg)	ammonium acetate	1 - 1.2 meq/100g 120 - 140 ppm	
Zinc (Zn)	DTPA EDTA	0.5 ppm 4 ppm	
Iron (Fe)	DTPA EDTA	2 ppm 80 ppm	
Copper (Cu)	DTPA EDTA	0.3 ppm 2 ppm	
Manganese (Mn)	DTPA Quinol acetate	2 ppm 65 ppm	
Boron (B)	MgCl ₂ CaCl ₂ /mannitol Hot water	1.5 ppm 0.4 ppm 0.15 ppm	
Molybdenum (Mo)		Not reliable	Mo availability increases with soil pH. Usually not a problem in alkaline soils

Table 9-2.

Optimum nutrient concentrations in leaves and petiole samples at flowering.

Leaf analysis: The youngest mature leaf is normally sampled; this usually corresponds to the fifth node from the top of the plant. Leaves can be sampled from squaring to boll fill. The optimum concentration range for the essential plant nutrients is given in Table 9-2.

However, the concentrations of some nutrients change with leaf age and the stage of crop growth. Leaf N, for example, declines with time, whereas leaf Ca increases. An indication of the changes in leaf nutrient concentrations is given in Table 9-3.

Nutrient	Petiole	Leaf	Comments
		Normal range	
Nitrogen (N)	20,000 ppm	3.5 – 4.5 %	Refer to NutriLOGIC for petiole nitrate interpretation
Phosphorus (P)	12,000 ppm	0.28 - 0.5 %	
Potassium (K)	10,000 ppm	1.5 - 3.0 %	
Sulfur (S)		0.6 – 1.2 %	
Calcium (Ca)	5,000 ppm	0.4 - 6.0 %	
Magnesium (Mg)	2,000 ppm	0.4 - 0.9 %	
Zinc (Zn)		20 – 60 ppm	
Iron (Fe)		50 – 350 ppm	
Copper (Cu)		5 – 25 ppm	
Manganese (Mn)		50 – 200 ppm	
Boron (B)		50 – 80 ppm	
Molybdenum (Mo)		0.4 – 0.9 ppm	Very low concentrations, hence Mo is hard to detect/analyse

Table 9-3.

Leaf nutrient concentrations assessed throughout the cotton season - the cotton crop yielded more than 9 bales/ha.

Nutrient	Day degrees from sowing			
	800	1000	1300	1800
Nitrogen (N)	4.0 %	4.13 %	3.73 %	2.72 %
Phosphorus (P)	0.33 %	0.34 %	0.33 %	0.33 %
Potassium (K)	1.77 %	1.90 %	1.73 %	1.27 %
Sulfur (S)	0.66 %	0.80 %	1.01 %	1.25 %
Calcium (Ca)	4.03 %	4.12 %	5.06 %	6.67 %
Magnesium (Mg)	0.92 %	0.94 %	1.04 %	1.11 %
Zinc (Zn)	20 ppm	20 ppm	20 ppm	20 ppm
Iron (Fe)	204 ppm	137 ppm	130 ppm	175 ppm
Copper (Cu)	6.8 ppm	6.7 ppm	6.0 ppm	5.1 ppm
Manganese (Mn)	84 ppm	84 ppm	94 ppm	111 ppm
Boron (B)	70 ppm	81 ppm	80 ppm	80 ppm
Molybdenum (Mo)	1.5 ppm	1 ppm	<1 ppm	<1 ppm