

Nutritional Summary

Macronutrients

Nitrogen is the nutrient needed in greatest quantities to maximize growth and yield. Peak need is during late leaf production and main uptake is earlier than for other macronutrients (Figure 3).

Figure 3
Major Nutrient Uptake - Whole Plant (kg/ha/week) Onions - South Africa

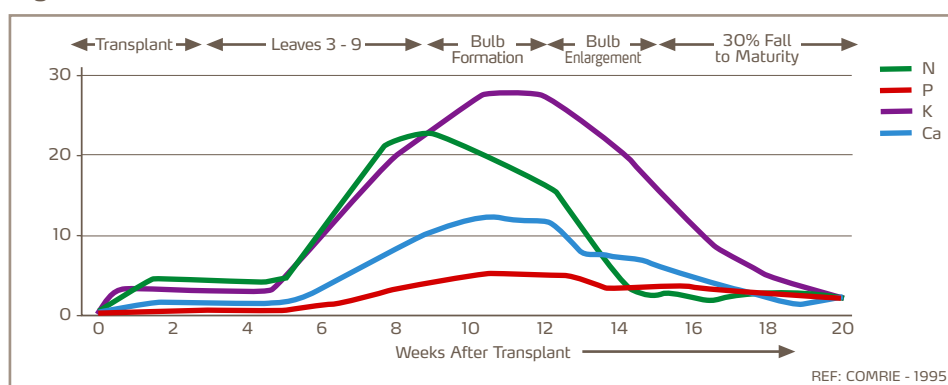


Figure 4
Major Nutrient Removal Onion Bulbs - USA

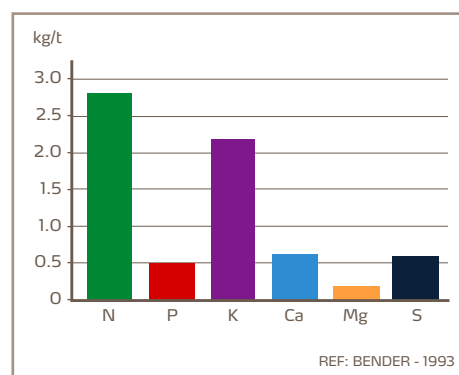


Table 3
Nutrient Removal (kg/t)
Onions - USA
Garlic - Spain

Type	N	P	K	Ca	Mg	S
Onions	2.71	0.5	1.9	0.77	0.15	0.07
Salad Onion	3.7	0.5	4.4	1.55	0.4	0.45
Garlic	2.3	0.61	2.1			

REF: BENDER - 1993
REF: CONSEJERIA AGRICULTURA CASTILA LA MANCHA - 2003

However it is important not to over-apply nitrogen, particularly in bulb onions, as this can delay maturity, soften bulbs and lead to storage rots.

In similar fashion to nitrogen, most **Phosphorus** is required early on in the plant's development to ensure good root growth and to boost establishment (Figure 3).

Similarly, in onions, over 70% of the phosphorus taken up is found in the bulb (Figures 5 and 6).

Common practice is to apply phosphate pre-planting or as a starter fertilizer.

Potassium is also needed in large quantities. Crop removal is around 2.0kg/t in bulb onions (Figure 4).

Peak demand is later than that for nitrogen, during bulking (Figure 3).

Onions require around 3kg/t of bulb yield (Figure 4). In comparison, salad onions, which are harvested when green, have a larger N-requirement (Table 3).

Because onions crops are shallow rooting, high rates of nitrogen are needed to satisfy crop demand, and little and often applications during early growth are needed to maximize uptake and minimize potential soil losses.

Most of the nitrogen taken up by onions is found in the bulb (Figure 5).

Figure 5
Major Nutrient Distribution
Onion, Alfa Tropical - Brazil

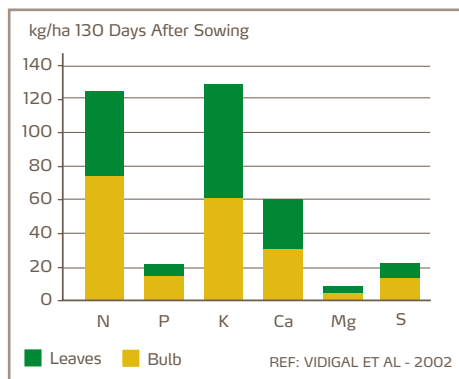
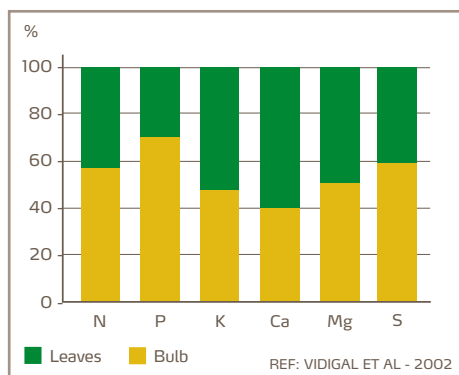


Figure 6
Major Nutrient Distribution % Total
Onion, Alfa Tropical - Brazil



Base applications of potassium are usually followed by regular applications throughout the season.

Most of the potassium taken up by the plant is utilized by the leaf (Figures 5 and 6). This is why removal is higher in salad onions (Table 3).

Calcium is also needed in relatively large

quantities at around 0.8kg/t (Figure 4 and Table 3). Peak requirements mirror those of potassium and peak at bulb formation and early enlargement (Figure 3).

While it is particularly important for leaf growth (Figures 5 and 6), the relatively small amounts that are found in the bulb maintain bulb density and crop storage quality.

As with nitrogen, because calcium is important for good leaf growth, relatively more calcium will be removed in crops harvested green, e.g. salad crops (Table 3) and leeks.

A steady supply of calcium is usually applied during the season.

Sulfur is particularly important in developing the taste and pungency of onions. However, removal in dry bulb onions is low at around 10% of that of the calcium (Figure 4).

Peak uptake is during the later stages of bulb maturity. Thus, earlier harvesting or restricting sulfur supply on low-S supply soils will lead to production of sweeter onions.

For the same reason, crops harvested earlier, e.g. salad onions have a reduced sulfur uptake and are less pungent.

Only small levels of **magnesium** are utilized by the crop (Figure 4 and Table 3). Peak uptake is relatively late.

All nutrient uptake figures above are given in elemental form. For conversion to the oxide form see the conversion table on page 36.

Micronutrients

While much lower levels of micronutrients are needed to satisfy yield and quality onion crop production, the correct balance of these trace elements is essential.

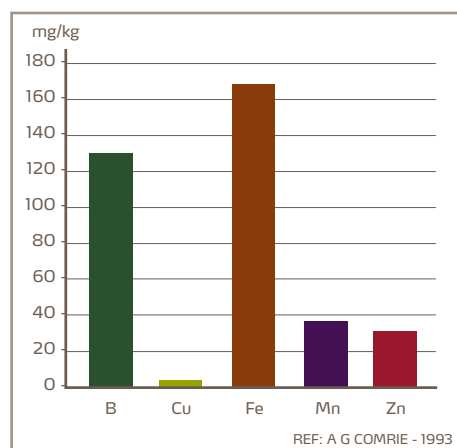
All micronutrients play a role in seedling and leaf growth. Without good leaf productivity, growth slows and yield suffers.

Leaf tissue analysis to assess micronutrient need, will enable deficiencies to be correctly diagnosed and treated, and ensure that onion production is maximized.

The key micronutrients needed in greatest quantities are **boron**, and **iron** (Figure 7). These have an influence on yield and quality. **Zinc** also plays a role in seed germination.

Copper whilst only needed in very small quantities is important for skin finish and color.

Figure 7
Mean Micronutrient Removal in Bulbs
Onion - South Africa



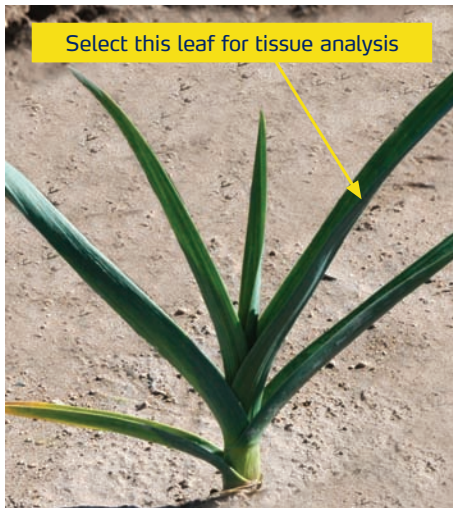
Harvesting onions in the USA

Nutrient Analysis

Soil analysis is used to provide baseline initial information for a fertilizer programme – particularly an indication of potassium and phosphorus. It is also used to assess soil pH, and organic matter levels.

Plant leaf analysis is important to continually monitor the balance between elements and fine-tune a fertilizer programme that ensures quality crop production.

Tissue analysis will also confirm visible deficiency symptoms and reveal hidden deficiencies where visual plant symptoms are not yet present.



Tissue analysis - garlic

Table 4

Critical Nutrient Content - Onion

Leaf Analysis - youngest fully expanded blades - 30-70 days after transplant

Nutrient	Adequate Range
N (%)	1.9 - 4
P (%)	0.25 - 0.4
K (%)	2 - 5
Ca (%)	0.9 - 3.5
Mg (%)	0.18 - 0.5
S (%)	0.5 - 1
Cu (mg/kg)	6.2 - 10.3
Fe (mg/kg)	60 - 300
Mn (mg/kg)	50 - 300
Zn (mg/kg)	10 - 55

REF: VIDIGAL ET AL - 2002

The type and position of the leaf selected for tissue analysis varies according to local practice.

For young onion plants, whole shoots or leaf tops of the same physiological age are sampled.

For plants in mid-growth to harvest, the youngest mature leaf or fully developed leaf blade is usually sampled.

It is necessary to take into account the sampling method used and the time of sampling when interpreting the data.

Table 5

Macronutrient and Micronutrient Leaf Analysis Guide

Newest fully elongated leaf blade sampled just prior to bulb initiation
Guidelines for all Alliums USA

Nutrient (dry weight basis)	Nutrient Level		
	Deficient	Adequate	High
N (%)	<2.0	2.0 - 3.0	>3.0
P (%)	<0.2	0.2 - 0.5	>0.5
K (%)	<1.5	1.5 - 3.0	>3.0
Ca (%)	<0.6	0.6 - 0.8	>0.8
Mg (%)	<0.15	0.15 - 0.30	>0.30
S (%)	<0.2	0.2 - 0.6	>0.6
B (mg/kg)	<10	10 - 25	>25 (toxic >100)
Cu (mg/kg)	<5	5 - 10	>10
Fe (mg/kg)	<50	50 - 100	>100
Mn (mg/kg)	<10	10 - 20	>20
Zn (mg/kg)	<15	15 - 20	>20

REF: MAYNARD ET AL - 1999

Table 6

Macronutrient Leaf Analysis Guide

Newest fully elongated leaf blade at various sample times
Garlic - USA

Sampling Time and Nutrient	Nutrient Level		
	Deficient	Intermediate	Sufficient
Early (pre-bulbing)			
Total N (%)	< 4	4 - 5	> 5
P (mg/kg)	< 2000	2000 - 3000	> 3000
K (%)	< 3	3 - 4	> 4
Mid-season (bulbing)			
Total N (%)	< 3	3 - 4	> 4
P (mg/kg)	< 2000	2000 - 3000	> 3000
K (%)	< 2	2 - 3	> 3
Late (post-bulbing)			
Total N (%)	< 2	2 - 3	> 3
P (mg/kg)	< 2000	2000 - 3000	> 3000
K (%)	< 1	1 - 2	> 2

REF: DAVIS UNIVERSITY EXTENSION SERVICE

Table 7**Macronutrient Leaf and Bulb Analysis Guide**Plant material sampled from transplant to end of dry mass production
Onion - South Africa

Plant						
Type	Norm	% N	% P	% K	% Ca	% Mg
Leaves	Max	4.3	0.73	6.7	2.60	0.81
	Min	1.2	0.13	1.9	0.50	0.24
	Average	2.4	0.35	3.6	1.20	0.43
Bulbs	Max	4.3	0.83	6.1	1.10	0.49
	Min	0.9	0.22	1.1	0.26	0.13
	Average	1.6	0.38	2.3	0.52	0.23

REF: COMRIE - 1993

Table 8**Micronutrient Leaf and Bulb Analysis Guide**Plant material sampled from transplant to end of dry mass production
Onion - South Africa

Plant								
Type	Norm	B	Cu	Fe	Mn	Zn	Na	Al
Leaves	Max	808	11.6	707	191	48	1750	271
	Min	13	3.5	57	52	10	338	6
	Average	166	10.5	190	97	24	966	51
Bulbs	Max	453	16.7	601	84	67	1665	87
	Min	12	2.8	40	14	12	290	10
	Average	129	5.6	167	37	30	771	18

REF: COMRIE - 1993

Table 9**Macronutrient - Foliar Analysis Guide**

Garlic and Leek - New Zealand

Crop	Cultivar	Time of Sampling	Plant Part	% N	% P	% K	% Ca	% Mg
Garlic	Unknown	6 months	Youngest Mature Leaf	3.2 - 4.0	0.20 - 0.30	3.2 - 4.0	0.7 - 1.1	0.11 - 0.20
Leek	Muskelburgh	6 months	Leaf	3.7 - 4.3	0.26 - 0.34	3.1 - 4.1	1.0 - 1.4	0.14 - 0.18

REF: HORTICULTURE & FOOD RESEARCH INSTITUTE - 1995

Interpretative nutrient ranges for onions and garlic are given in Tables 4 to 9.

- These figures are general guidelines and could vary according to cultivation practice, cultivar type as well as local research.
- Consult your local agronomist for ways of overcoming deficiencies.



Harvesting onions in New Zealand