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GROWTH AND NITROGEN NUTRITION
STUDIES OF ONIONS
(*Allium cepa* L.)

A THESIS PRESENTED IN PARTIAL
FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF HORTICULTURAL SCIENCE
IN HORTICULTURAL PRODUCTION AT
MASSEY UNIVERSITY

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1980

11000-18

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THIS THESIS IS DEDICATED TO
MY BELOVED MOTHER

* * * * *

YANDEH JAGNE

* * * * *

WHOM I LOST RECENTLY

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ABSTRACT

The effect of nitrogen (N) fertilizer was studied in the field and in the greenhouse on the growth, development, maturation and storage life of onions (*Allium cepa* L.), cultivar "Pukekohe Long Keeper" (PLK). Samples were taken at specified harvest dates and morphological measurements, growth analysis and plant tissue analysis for nitrate-nitrogen ($\text{NO}_3\text{-N}$) and total nitrogen (total N) in the leaf blades, bulbs and roots of the onion plants were carried out. Also, high temperature storage for onions was investigated and compared with cool storage.

Fresh and dry weight of the entire plant and the bulb dry weight increased with time to a maximum at the end of the growing period. Root dry weight, leaf dry weight, green leaf area and green leaf number increased with time then decreased as maturity approached. In general, whole plant fresh and dry weight and the plant parts, leaf and bulb, increased with increasing N fertilizer. Root dry weight was generally higher with the low N treatments than with the high N treatments. However, when N was too low, root growth was severely restricted.

Low N rates tended to stimulate earlier bulb formation but delayed maturity. Very high N rates induced earlier maturity. Bulb weight and bulb diameter generally increased with increasing N fertilizer at the end of the growing season. Whole plant Relative Growth Rate (RGR) and bulb Relative Growth Rate (bulb RGR) were closely related. RGR and Leaf Area Ratio (LAR) decreased with time, however Net Assimilation Rate (NAR) was constant in the early growth stages but fluctuated in the later stages of growth. All the growth analysis parameters, RGR, NAR, LAR, Leaf Weight Ratio (LWR) and Specific Leaf Area (SLA), generally increased with increasing N fertilizer. The increase in RGR brought about by increases in N rate was mainly due to increases in LAR. The increase in LAR caused by increases in N levels was due mainly to increases in LWR.

In general, $\text{NO}_3\text{-N}$ and total N concentrations in the onion plant parts increased with increasing N fertilizer but declined as the plants advanced in age. Critical $\text{NO}_3\text{-N}$ and total N concentrations for onions were determined from the relationship between relative growth and the $\text{NO}_3\text{-N}$ and total N in the leaf blades, bulbs and roots. The $\text{NO}_3\text{-N}$ concentration in the leaves and bulbs was found to be very low and appeared to be less reliable for determining the N status of the crop. The $\text{NO}_3\text{-N}$ concentration in the roots was much higher, probably because nitrate is reduced in the roots in onions. However, analysing for total N, rather than $\text{NO}_3\text{-N}$, in the plant organs, in particular the leaf blades, is a much better method for monitoring the nitrogen status of an onion crop.

The high N treatments generally removed more N than the low N treatments. A linear relationship was found between the bulb yield and the amount of N removed. For most soil conditions, 200 kg N/ha is considered an optimum level for onion production.

There was little difference in storage life between bulbs stored under high temperature conditions and those under cool storage. Nitrogen fertilizer rates had no significant effect on bulb storability.

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