Effects of Nitrogen on potato yields and on the total-N and nitrate-N content of the tops

T. F. GATELY

An Foras Taluntais, Soils Division, Johnstown Castle, Wexford, Ireland

Accepted for publication: 11 September 1970

Summary

The effects of 4 nitrogen levels on tuber yield, and on the total-N and nitrate-N content of plant samples taken during the early growing season were examined using the variety Kerr's Pink grown on nineteen sites.

The mean yield of the zero N treatment was 38.7 tons/ha. Application of 45, 90 and 135 kg/ha increased yields by 4.5, 6.5 and 8.8 tons/ha respectively.

The total-N and nitrate-N content of the plant samples increased as the amount of N fertiliser was increased. They were highest at sites where the response to N fertiliser was least.

There were no significant relationships between yields and plant analyses, but correlations between percent responses and plant analyses were significant.

Introduction

Farmers in Ireland grow some 60,000 hectares of potatoes annually. These potatoes are grown on a wide variety of soils. A considerable amount of work on the nitrogen requirements of the crop in this country showed that with yields of around 25-30 tons/ha a dressing of about 80-105 kg/ha was adequate (Ryan, 1961; Herlihy and Carroll, 1969). Recently, however, yields have increased due mainly to improved cultural practices such as better weed and disease control and this indicated the need for further information on the nitrogen requirements of these high yielding potato crops. In these earlier trials plant analyses were not used to ascertain the adequacy of the nitrogen rates used. Reports from other countries (Tyler et al, 1961; Van Burg, 1966) indicate that the nitrate-N content of the plant early in the growing season is a useful indicator of the nitrogen status of a potato crop.

The effects of four different levels of nitrogen on the yield of potato tubers and on the total-N and nitrate-N content of the tops at the early growth stage are reported on in this study. In addition, the relationships between these nitrogen contents and tuber yields are discussed.

Experimental

Soil: The sites selected for the trial were located on soils representative of the major tillage soil types in the country (Gardiner and Ryan, 1969).
EFFECTS OF NITROGEN

Layout: The design was a randomised block with 4 rates of N and 3 replications giving a total of 12 plots at each site. The trial was laid down at a total of 19 sites in 1968. Plot size was 5.5 x 14.6 m.

Treatments: The potato trial followed a previous swede trial at each of the sites. The rates of N used on each crop were:

N kg/ha
(As calcium ammonium nitrate)

<table>
<thead>
<tr>
<th></th>
<th>swedes</th>
<th>potatoes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1967</td>
<td></td>
<td>1968</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>34</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>102</td>
<td>135</td>
<td></td>
</tr>
</tbody>
</table>

Zero N plots for swedes in 1967 were also zero N plots for potatoes in 1968 and the plots which received the high N treatments for swedes also received the high N treatments for potatoes. The N treatments for potatoes together with a basal dressing of 68 kg P as superphosphate and 179 kg K as muriate of potash were all applied broadcast before drilling.

Sowing and harvesting: Whole seed of potato tubers, variety Kerr’s Pink, were sown about 28 cm apart in 66 cm drills at each site. Sowing took place between the 7th March and 7th April apart from one site which was sown on 24th April. A pre-emergent weedkiller was used, the crop was sprayed 4 times for blight control, and the haulms were burnt off 3 weeks before harvesting in October. The spraying treatment proved effective against blight at all the sites and consequently the growing season was not shortened due to this fungus. An area of 21 sq m was harvested from the centre of each plot for yield determinations.

Plant sampling: All the samples were taken around mid-June or about 75 days after planting. Samples consisted of 40–50 of the youngest fully expanded leaves from the centre drills of each plot. Each leaf had a small amount of attaching petiole which formed part of the sample. After collection in polythene bags, the samples were dried on trays in a forced draught oven at 70°C. Because of the widespread location of the sites drying did not take place until 1 to 4 days after sampling.

Chemical analyses: Total-N was determined by the micro-kjeldahl method of the A.O.A.C. (1955) and nitrate-N by an adaptation of the phenoldisulfonic acid method (Johnson and Ulrich, 1959).

Climate: Monthly rainfall figures for the previous winter and the growing season and average rainfall figures over a period of years are shown in Table 1 (Monthly weather reports, 1967–68).

Results

Tuber yields: The mean yield of the zero N plots at the 19 sites was 38.7 tons/ha with a range from 29.4 to 52.0 tons. Application of 45, 90 and 135 kg N increased