INCREASING THE EFFICIENCY OF FALL-APPLIED UREA FERTILIZER BY PLACING IN BIG PELLETS OR IN NESTS

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Key words
Barley  Fertilizer nests  Fertilizer pellets  Nitrogen fertilizers  Placement  Urea

Summary

In three field experiments with fall-applied urea fertilizers, placement of urea in big pellets, or in nests, produced about twice as much increase in yield of subsequent spring-sown barley than did application of urea by conventional incorporation or by banding.

Introduction

In western Canada N fertilizers are often applied in the fall, rather than in spring for cereal grain crops that are sown in the spring. However, ammonium-based or urea N fertilizers have been found less effective in increasing yields when applied in the fall rather than in the spring. The reduced effectiveness of the fall-applied N in Alberta is associated with its nitrification and subsequent denitrification. Addition of nitrification inhibitors with fall-applied N may increase N-uptake and yield of crops, but placement of the N fertilizer in bands may also slow nitrification and increase N-uptake and crop yields. In Alberta, fall banded application of urea increased yield of barley by about 200 kg per ha more than did incorporation of urea into the topsoil. Further concentration of fertilizer N in the soil by placement in large pellets or ‘nests’ might further increase yields in Alberta, considering the results obtained elsewhere with this technique.

The purpose of this note is to report preliminary field experiments with urea placed in big pellets or nests.

Methods

Experiment No. 1 was conducted in 1975–76 at Egremont, Alberta, on a soil described in Table 1. The crop grown was barley (Hordeum vulgare cv. Galt). Treatments were: (1) nil; (2) small pellets (0.01 g) of commercial urea banded in the soil; (3) pellets (0.1 g) of urea + thiourea (2:1), banded; (4) big pellets (2.1 g) of urea + thiourea (2:1), banded; and (5) small pellets (0.01 g) of urea, incorporated into the soil to a depth of 10 cm. Treatment (5) was applied in May just before seeding the experiment.
Table 1. Description of soil at location of three field experiments

<table>
<thead>
<tr>
<th>Experiment no.</th>
<th>Location</th>
<th>Soil great group</th>
<th>Texture</th>
<th>Organic matter (%)</th>
<th>pH</th>
<th>Mineral N* (kg/ha in the 0–15 cm depth)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Egremont, Alberta</td>
<td>Dark Gray Chernozemic</td>
<td>Loam</td>
<td>5.0</td>
<td>7.3</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>Canwood, Saskatchewan</td>
<td>Dark Gray Chernozemic</td>
<td>Loam</td>
<td>4.1</td>
<td>7.0</td>
<td>23</td>
</tr>
<tr>
<td>3</td>
<td>Breton, Alberta</td>
<td>Gray luvisol</td>
<td>Loam</td>
<td>3.6</td>
<td>6.7</td>
<td>16</td>
</tr>
</tbody>
</table>

* Mineral N was determined on soil samples taken in fall at the time of fertilizer application.

while treatments (2), (3), and (4) were applied the previous October 28. In treatments (2) and (3) the bands were placed 5 cm deep and were spaced 23 cm apart; and in treatment (4) the big pellets were set 5 cm into the soil and spaced 23 cm apart in one direction and 69 cm in the other direction. In treatments (2) and (3) commercial urea fertilizer was used. In preparation for use in treatments (3) and (4), commercial urea and technical grade thiourea (in a ratio of 2:1 by weight) were first dissolved in a minimum amount of water at 50°C. For treatment (3) the cake of the mixture which formed on cooling was broken, dried, and sieved to pellets of about 0.1 g in weight; while for treatment (4) the dissolved mixture was poured into spherical moulds and large pellets 2.1 g in weight were formed.

Individual plots were 6.8 m by 1.8 m and contained 8 rows of barley 23 cm apart. Plots were arranged in a randomized complete block design in four replicates. The urea, or urea plus thiourea, were applied at a rate of 56 kg of N per ha. All treatments received P, K, and S. Immediately before sowing all plots were cultivated to a depth of approximately 10 cm.

Two experiments were conducted in 1976–77, at Canwood, Saskatchewan, and Breton, Alberta. The soils are described in Table 1. Treatments were: (1) nil; (2) small pellets of urea incorporated into the soil in October; (3) small pellets placed in nests centered on areas 60 cm by 60 cm in October; and (4) small pellets of urea, incorporated into the soil in May. Treatments (2), (3) and (4) all received 84 kg N per ha. The ‘small’ pellets of urea (0.01 g each) were commercial urea fertilizer, and in the case of treatment (3), 6.8 g of the small pellets were constricted in the soil by applying through a small funnel at a depth of 5 cm. In the spring all treatments received P, K, and S fertilizers. Thereafter all plots were cultivated to a depth of 8 to 10 cm and Galt barley was sown using rows 15 cm apart.

Results and discussion

In Experiment 1, commercial urea applied in a band in the fall gave an increase in barley grain of 1520 kg per ha, while spring application gave an increase of 2140 kg per ha (Table 2). The larger yield increase from the spring application of urea, is in agreement with results obtained by Malhi 3 with 10 field experiments conducted over a period of two years. As shown in Table 2, fall application of urea plus thiourea banded as pellets (0.1 g