PIGGERY BEDDING LITTER AS A SOURCE OF N FOR FIELD CROPS

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Abstract

Afield trial was established in 1996 in the Wimmera district of Victoria to compare the effects of applications of semi-composted piggery bedding litter (10, 15, 20 and 30 t/ha fresh weight) with urea (25, 50, 100 and 200 kg/ha) on the growth and yield of wheat.? The area was re-cropped to barley in the following year (1997) to assess the residual value of the litter. In the year of application, the 15 t/ha application rate of litter showed a 23% yield increase over the control and this was equivalent to the application of approximately 75 kg/ha of urea. The higher rates of litter gave no further yield increase. When re-cropped to barley in 1997, the prior application of litter at the highest rate gave a small residual response, although total N efficiency for both N sources was low. No effects were noted in either year on weed density or species present where the litter was applied.

Key words: Nitrogen, manures, wheat, barley, fertilisers.

With the adoption of new piggery management systems where animals are housed on wheat straw, over 70,000 t of litter will be produced annually in the Wimmera. The litter is a mixture of straw, manure, urine and feed, and is partially composted. This material represents a resource the grains industry could possibly use as a soil conditioner and nutrient source. The object-ive of this work was to establish the agronomic value of this litter when applied to crops, with particular reference to the availability of the nitrogen (N) in the litter. This paper reports on the responses of wheat to pre-sowing applications of litter or urea, as well as the residual effects when the site was re-cropped to barley in the subsequent year.

Materials and methods

Afield experiment was conducted in the Wimmera district of Victoria with four replicates of eight treatments and a control. Four rates of urea (25, 50, 100 and 200 kg/ha) and four rates of litter (10, 15, 20, 30 t/ha) were applied three weeks before sowing to wheat (*cv.* Meering) on 4 July, 1996. The manure was spread using a truck mounted manure spreader and the urea was drilled in using a combine. The litter used had a nutrient composition of 0.74% N, 0.46% P and 0.89% K on a fresh weight basis, a moisture content of 38% and a bulk density of 0.75 t/m^3. In 1997, the site was re-sown to barley (*cv.* Arapiles), with no additional fertiliser or manure additions. No pre-emergence herbicides were used.

At mid tillering in both years, ranges of indicators of plant nitrogen status were taken to assess the early season effect of the treatments. These indicators were plant density, biomass and N content measured in both crops at mid-tillering and at maturity, along with grain yield and protein contents. In both years, the sites were assessed for weed species and densities 60 days after sowing.

Results and discussion

Both 1996 and 1997 were difficult years in the Wimmera for crop growth. Both years had dry springs, and in 1997 a severe hailstorm reduced yields across the site by an estimated 50%. The trial in 1996 was also affected by late sowing, which reduced the yield potential for the site.

Growth and yield

Asummary of the harvest results is given in Table 1.? Total N extracted is the sum of straw and grain N at maturity. The site was clearly responsive to N in 1996, with the highest urea application rate giving a yield 40% higher than the control. In the first year of application, crop yield following pre-sowing litter

application at 15 t/ha was increased by about 23%, which was equivalent to the response of between 50 and 100 kg/ha of urea (23 to 46 kg N/ha). The protein content of the grain taken from the litter treated plots was similar to the 50 kg/ha urea rate. It is thought that the lack of response of the intermediate rates of litter was a result of wheel track compaction during the spreading of the litter.

In the second year of cropping, the higher rates of litter showed biomass responses similar to the highest urea application rates, indicating both sources provided some residual N supply to the crop. The urea applications provided higher protein contents in both years, while higher application rates of litter showed biomass responses in both years. The differential response of growth and protein in the crops indicates that the N from the litter was less available in the first year of application, with subsequent N mineralised in the second year.

Although the piggery litter contains a large amount of N (7.4 kg/t), it is concluded that only 30% of the N present was available to the first sown crop, although more became available in the second year. Nitrogen recovery by the crops over the two years accounted for approximately 37% of the N applied as urea (200 kg/ha) and about 18% of the N applied as litter (15 t/ha).

Nitrogen indicators

Plant N status indicators taken at tillering in the wheat crop indicated no alteration in plant N status where litter was applied. However, the site was clearly N responsive, with increased sap nitrate levels, NIR whole plant N and plant biomass where urea was applied. In the second year, the barley sown in the urea treatments had lower basal stem nitrate levels, generally higher plant N contents and lower biomass compared to the control plots or those that had litter applied in 1996. In general, it appeared that the litter provided a residual effect on plant growth up until mid-tillering. Crops grown on the 15 or 30 t/ha piggery litter rate extracted a similar amount of N to the 100 kg/ha urea treatments.

Weed density and type

There were no significant differences in weed density between the treatments and control, nor were there differences in species present where the litter was applied (data not presented). The weeds present on the trial site were typical of the flora of cereal crops in the region. The weed flora of the paddock from where the straw was sourced for the litter is not known, however, the evidence here is that the use of partially composted litter was not a source of foreign weeds in this situation.

Conclusion

These results indicate that piggery litter is a useful source of N for cereal crops. It was concluded that the N is only slowly available when compared to urea and that only about 30% is available in the year of application.

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