Sulphur and grain quality in autumn sown milling wheat cv. Monad

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Abstract

Two experiments on winter wheat involving sulphur treatments showed variable herbage and grain protein responses to sulphur (S). In one experiment herbage S levels were increased through sulphate S application at tillering or mid stem extension but grain S did not differ. In a second experiment, the use of spring nitrogen fertilisers containing ammonium sulphate significantly increased grain protein values over those not containing S.

Experimental and Discussion

Sulphur (S) is an important component of several proteins and S deficiency can have an influence on grain protein and the baking quality of wheat, in particular reduced extensibility and increased resistance to stretching of dough (Moss *et al.*, 1981; Moss *et al.*, 1983; Wooding *et al.*, 1993). Randall *et al.* (1981) established that wheat was likely to be sufficiently S deficient to affect baking quality if grain S was < 0.12% and grain N:S ratio was wider than 17:1, although Byers and Bolton (1979) suggested a N:S ratio of 15:1.

Two trials at the Ravensdown Seadown Farm in 1995/96 on a low S site looked at the effects of timing, rates and form of S fertilisers, and the use of early spring nitrogen-sulphur fertilisers on autumn sown wheat cv. Monad. These trials were fully replicated randomised block designs and will be more fully reported at a later date. In the first trial treatments included planter S (range 16-47 kg S/ha), 30 or 60 kg S/ha applied at Feekes GS2, 5 or 9, split applications of S (3 x 10 kg S/ha) and a single high rate (103 kg S/ha). The second trial consisted of fertiliser products containing nitrate and/or ammonium nitrogen with and without S, (urea, ammonium sulphate – Amsul; calcium ammonium nitrate – CAN; and ammonium sulphate nitrate – ASN). Treatments were applied at 92kgN/ha split into two early spring applications.

In the first trial sulphate S applications in the spring either at tillering (GS2) or mid stem extension (GS5) increased herbage S levels within 14-18 days of application, whereas booting applications (GS9) did not. Planter S responses were variable and for farmers their use is likely to depend on the risk of S deficiency caused by winter leaching. Higher rates (30-103kg S/ha) were more likely to initially increase herbage levels compared to low S rates (10-20kg S/ha). Irrespective of treatment, S levels in the grain were good (0.14-0.15%S) and N:S ratios were 14-16:1, reinforcing previous work by Randall *et al.* (1981) and Haneklaus and Schnug (1992) in that large differences in herbage S are only reflected in minor differences in grain S, and that if S is applied it should be applied early in the spring.

In the second trial (Table 1), while those treatments containing nitrate nitrogen increased early spring dry matter and N uptake as had been previously reported on pasture (Craighead *et al.*, 1997), it was the S fertilisers, ASN in particular that increased grain protein. As the N:S ratios in the grain were similar, it appeared S enhanced nitrogen uptake and translocation to the grain. This has been previously demonstrated by Archer (1974), although Byers and Bolton (1979) found the opposite effect.

It is doubtful low S levels impact greatly on wheat quality in New Zealand, even though organic S reserves are not high on many of our cropping soils. This is

Table 1. Effect of early spring fertiliser on yield and quality of wheat cv. Monad.

Treatment[1]	Dry matter[2] (kg/ha)	Grain yield (kg/ha)	N:S ratio	Grain protein %
Control	490	7690	14.23	11.74
Urea	520	7960	14.92	12.31
CAN	610	8010	14.60	12.45
Amsul	555	8030	14.65	12.73
ASN	625	8250	15.05	12.86
LSD $_{p<0.05}$	118	540	1.16	0.39

[1] Control received 176kgN/ha, treatments 268kgN/ha
[2] measured 30th September

because superphosphate, elemental S fortified S supers, ammonium sulphate and products such as Cropmaster 20 (20-10-0-12) are widely used on wheat. In addition, cropping rotations including pasture allow for S mineralisation from built up organic reserves, while winter leaching is not often high in Canterbury, the major milling wheat growing area of New Zealand.

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