Effect of timing and intensity of drought on perennial ryegrass seed yield

R.J. Martin, R.N. Gillespie and S. Maley
New Zealand Institute for Crop & Food Research Limited, Private Bag 4704, Christchurch, New Zealand, Email: martind@crop.cri.nz

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Introduction Perennial ryegrass seed worth about $50 million is produced annually in Canterbury, New Zealand (Rowarth 1998). Ryegrass seed production in New Zealand is often affected by drought, reducing both seed number and seed size (Rolston *et al*., 1994). Irrigation management recommendations are not currently available for farmers growing ryegrass seed crops. To quantify the effect of water stress on perennial ryegrass seed yield, we carried out an experiment in a rainshelter where rainfall was excluded from experimental plots otherwise exposed to normal weather (Martin *et al*., 1990).

Materials and methods 'Bronsyn' perennial ryegrass was sown on 11 April 2002 in 15 cm rows at a seeding rate of 8 kg/ha. Treatments applied were: (1) full irrigation weekly from late winter to harvest, adding the weekly actual soil moisture deficit each time; (2) no irrigation from early winter to harvest, (3) irrigation to field capacity in late winter then no irrigation until harvest; (4-8) same amount of water as (1) except (4) drought at head emergence; (5) drought from head emergence to harvest; (6) drought at peak flower; (7) drought from peak flower to harvest; (8) drought from early seed fill to harvest. The experiment was a randomised complete block design with three replicates. Each 5 m x 3 m plot had its own trickle irrigation supply and was harvested on 6 January 2003 by cutting two 0.5 m^2 quadrats to ground level.

Results Total seed yields and % first grade seed were markedly affected by intensity of water deficit as measured by maximum potential soil moisture deficit (MPSMD) (Table 1). Seed yield was closely related to head numbers, but % 1st grade seed was reduced in season-long drought and later drought treatments. First grade seed yields were closely related to maximum potential soil water deficit with a small additional reduction in yield in late drought treatments (Figure 1).

Table 1 MPSMD (mm), total seed yield (kg/ha), % 1st grade seed and head numbers/m^2

Tmt	MPSMD (mm)	Total seed yield	% 1st grade seed	Head no/m^2
1	184	2380	79	1980
2	548	990	48	1010
3	478	1530	49	1370
4	368	2090	72	1850
5	500	1730	56	1640
6	372	2090	69	1710
7	410	1530	55	1470
8	332	1870	60	1760
LSD (5%)		525	8.2	302

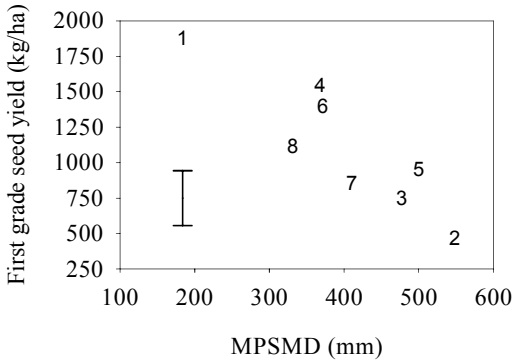

Figure 1 First grade seed yield (at 11% m.c.) v. MPSMD. Bar is LSD (5%). Numbers are treatments

Conclusions Water stress at any time reduced ryegrass seed yields, mainly through lower head numbers, but the effect was accentuated in crops with high biomass, where late drought reduced seed size. Perennial ryegrass seed crops should therefore be irrigated on the basis of actual or potential soil moisture deficits rather than at certain stages of development, with special attention late in the season when deficits occur quickly and seed size, as well as head number, can be reduced.

References

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