Effect of seeding rate on organic wheat production and ryegrass density in northeast Victoria.

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Abstract

An experiment to investigate the effect of seeding rate on wheat emergence, crop and weed biomass, grain yield and protein was established at Rutherglen Research Institute under a certified organic regime. Wheat, cv. Diamondbird, was sown in June 2001 on an acid (pH_{Ca} 5.2) soil (chromosol/dermosol mix) at six seeding rates; 60, 80, 100, 120, 150, 170 kg/ha with phosphorus (P) applied with the seed as Guano™ at 10 kg/ha. Increasing seeding rate was associated with a reduction in weed biomass, and increases in grain yield though results were not significant. Our data showed that a seeding rate of 100 kg/ha was required to achieve a plant density of 200-250 plants/m^2 for maximum potential yield. There was no effect of seeding rate on ryegrass numbers at emergence or tillering, on crop dry matter during spring or on grain protein. The wheat was established four weeks later than the optimum time for maximum yield but there was sufficient rainfall during spring to allow for grain filling. Increasing seeding rate in wheat may provide organic producers with one option to reduce weed biomass and the potential for weed carryover to the next season.

Keywords

Organic farming, ryegrass, grain yield

Introduction

Certified organic farming systems rely on an integrated approach to weed management for crop production. This includes cultural practices such as intensive grazing, cutting hay or silage, green manuring during the pasture phase, capturing weed seeds at harvest, or the use of increased seeding rates of crops. Increasing the wheat-seeding rate has been shown to be an effective way of providing some suppression of annual ryegrass (*Lolium rigidum*, Gaudin) during crop establishment in conventional wheat production (1,2). Previous research under conventional cropping in northeast Victoria has shown that an increased seeding rate resulted in improved grain yield of wheat, especially with later sowing times (3). This study was conducted to measure the effect of seeding rate on wheat growth and yield, annual ryegrass density and biomass, under a certified organic regime.

Methods

The experiment was established at Rutherglen Research Institute in 2001. The site was a mix of Chromosol and Dermosol soils; soil chemical properties (0-10 cm depth) were pH_{Ca} 5.2, Olsen P of 7 mg/kg (0-20 cm) and available nitrogen of 121.2 kg/ha (0-100 cm). Growing season rainfall (April - November) was 318 mm compared with a long-term average of 439 mm. Previous weed management on the site involved cutting a legume hay crop in 2000. The wheat, cv. Diamondbird, was sown into a prepared seedbed on June 5, at six sowing rates; 60, 80, 100, 120, 150, 170 kg/ha with phosphorus applied with the seed as Guano™ at 10 kg/ha, and harvested in December. The experiment was a factorial design with four replicates. Wheat emergence was assessed in mid winter by counting ten 0.5m lengths of drill row from each plot (28m^2); ryegrass density was assessed at the same time by counting ten quadrats of 225 cm^2 from each plot. Crop and weed biomass was assessed in spring by cutting five quadrats of 1225 cm^2, drying for 24 hours at 70?C, and calculating dry matter.

Results

Higher wheat-seeding rates resulted in more plants per square metre (P=0.05)(Table 1). To achieve the recommended plant density for wheat in northeast Victoria (200-250 plants/m^2) (4), a seeding rate of 100 kg/ha was required. There was no effect of seeding rate on ryegrass density at emergence or at wheat tillering (Table 1). A trend towards higher wheat biomass and correspondingly lower weed biomass was observed during spring (Table 2). This trend was reflected in the grain yield (Table 2). The trend of improved grain yield with increased seeding rate concurred with results obtained by Coventry *et. al.* (2), where yield increases with seeding rate were observed with later (May and June) sowing times. There were relatively low numbers of ryegrass plants when the wheat emerged, and these did not increase significantly between emergence and tillering (Table 1). Previous weed management on the site consisted of cutting a hay crop (faba beans and lupins) in 2000 and this practice may have reduced the population of ryegrass in the following wheat crop. A lower growing season rainfall combined with the competitive ability of the wheat, could have reduced ryegrass germination during the season, and thus accounted for low ryegrass plant numbers at tillering and low weed biomass.

Table 1. Wheat emergence, and ryegrass density at emergence and at wheat tillering.

Seeding rate (kg/ha)	Wheat emergence (plants/m^2)	Ryegrass density at wheat emergence (plants/m^2)	Ryegrass density at wheat tillering (plants/m^2)
60	137	27	70
80	185	37	59
100	219	28	61
120	272	31	70
150	298	42	71
170	363	32	75
s.e.d.	**20**	**13**	**17**

Table 2. Wheat and weed biomass (kg/ha), grain yield (t/ha) and grain protein (%).

Seeding rate (kg/ha)	Wheat biomass (kg/ha)	Weed biomass (kg/ha)	Grain yield (t/ha)	Grain protein (%)
60	5528	1073	3.8	10.6
80	5191	853	3.9	10.7

100	5299	868	4.1	10.2
120	6037	661	4.2	10.4
150	5860	497	4.2	10.9
170	6099	543	4.3	10.7
s.e.d.	**467**	**232**	**0.2**	**0.4**

Conclusion

Increasing wheat seeding rate may provide organic producers with an additional method to reduce the effects of ryegrass in wheat crops. Further field experimentation of increased wheat-seeding rates under certified organic regimes is required to validate these preliminary results.

Acknowledgments

The authors gratefully acknowledge the funding provided for this work by the Department of Natural Resources and Environment in Victoria under the Naturally Victorian Initiative.

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