Paddock selection is critical for reliable malt barley production

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Abstract

In 1999, TOPCROP farmer discussion groups in Victoria conducted large-scale, paddock demonstrations to develop benchmarks for reliable production of malt barley. Eighteen sites were established, each comparing three standard varieties (Schooner, Sloop and Gairdner), plus others where requested by group members. The results suggest that paddocks with pre-sowing soil nitrate-nitrogen levels above 150kg/ha were unsuitable for malting barley production. Paddocks with pre-sowing nitrate-nitrogen between 100 and 150kg/ha were at increased risk of not achieving barley of malting quality when compared to those with less than 100kg/ha.

Key words

Malt barley, paddock selection, soil nitrogen, on-farm demonstration, TOPCROP.

Introduction

Reliable production of malting quality barley is a recurring grains industry issue in Victoria. Failure to achieve malt, when a suitable variety is sown, results in significant financial penalties. The aim of the statewide on-farm demonstrations was to test current practices and develop benchmarks for increased reliability of malt barley production.

The eighteen demonstrations were located in paddocks selected for malt barley by a grower in each group. All sites were sown, maintained and harvested with farmer equipment. Large plots were used to increase on-farm relevance, but replication was not practically possible. To improve accuracy, a control was sown in every third plot to determine cross-site variability.

To allow broad comparisons, barley cultivars Schooner, Sloop and Gairdner were sown at all sites using treated seed provided from a central source. Seed was treated with triadimenol (150g/kg) and cypermethrin (4g/kg) at 1g/kg of grain. Comprehensive soil and plant analyses were undertaken to identify the major factors influencing barley quality. All samples were sent to the same laboratories for consistency.

This paper reports the major factors influencing paddock suitability for reliable malt barley production.

Results

The results suggest that the most important factors affecting the ability of a paddock to achieve malting quality barley are its nitrogen status, time of sowing in low rainfall environments, and the presence of toxic levels of boron and salt in the subsoil. The presence of toxic levels of root and foliar diseases did not appear to affect the grain quality.

Table 1. Yield, quality and key factors affecting production for each of the eighteen demonstration sites across Victoria during 1999. Figures appearing in bold are not optimal and can impact on yield or grain quality (Evans, 2000).

	Yield	Malt	N	N	Soil P	Hostile	Sowing	Root	Leaf

	t/ha [1]	1 [2]	Total avail. N yield [3]	Soil [4]	Total [5]	mg/kg	soils [6]	date	disease [7]	disease [8]
Mallee	1.9	✓	na	48	na	24	-	na	C, R, T	na
Annuello										
Rainbow	3.9	✗	5.0	**133**	**170**	37	-	na	C, **R**, T	N
East Tempy	2.4	✗	4.7	**122**	**164**	29	**B**	**4 Jun**	Pn, R, T	N
West Tempy	3.7	✗	4.8	**130**	**167**	21	-	**8 Jun**	Pn, R, T	N
Speed	2.2	✓	2.2	36	78	16	-	24 May	C, Pn, R, T	na
Sth Mallee	3.1	✗	6.2	**176**	**216**	43	**B, EC**	12 May	Pn, R, T	N,P,S
Birchip										
Normanville	3.2	✗	6.1	**178**	**213**	32	-	11 Jun	C, R, T	na
Nullawil	2.9	✗	6.7	**203**	**233**	77	**B**	4 Jun	C, Pn, R, T	N
Tarranyurk	4.8	✓	4.3	105	152	33	-	2 Jun	Pn, **R**, T	N
Willenabrina	1.0	✗	3.5	76	121	**13**	**B, EC**	na	R, T	N
Wimmera	4.5	✓	5.9	126	**207**	32	-	na	C, Pn, R, T	N,P,S
Gymbowen										
Lubeck	3.6	✗	5.9	**141**	**207**	40	-	12 Jun	Pn, R, T	P,S
Wallup	2.8	✗	5.5	112	**192**	22	-	10 Jun	C, Pn, R, T	N,P
Winiam	2.1	✓	2.6	49	97	34	-	15 Jun	**C**, P, R	N,S

Other sites	5.9	✗	6.8	**197**	**237**	43	-	21 Jun	C, **P**, T	na
Pyramid										
Katamatite	4.3	✓	3.0	87	145	28	-	11 Jun	R, T, P	N,P,S
Raywood	3.5	✓	4.2	92	146	33	-	9 Jun	C, Pt, **R**, T	N
Casterton	3.9	✗	na	na	na	na	-	16 Jun	-	N,P,S

[1] Yield figures are an average of yields from Schooner, Sloop and Gairdner
[2] A site was deemed to have successfully achieved 'malt 1' if two or more of Schooner, Sloop and Gairdner achieved malt specifications for protein (8.5-11.5%) and screenings (<28%). Weather damage was ignored.
[3] Yield (t/ha) based on total N available (for barley, 35kg N = 1 tonne grain) and assuming unlimited moisture
[4] Nitrate N 0-60cm in kg/ha
[5] Soil Nitrate N 0-60cm + mineralisation + applied N in kg/ha
[6] B – boron (>6ppm), EC – Electrical conductivity (1.0dS/m)
[7] C – Cereal Cyst Nematode; R – Rhizoctonia; T – Take-all; P – *Pratylenchus spp.* (n – neglectus; t – thornei)
[8] N – Spot Form of Net Blotch; S – Leaf Scald; P – Powdery Mildew
na – Information not available for this site

The general trend was that time of sowing did not consistently affect the ability of a crop to achieve malting quality. However, in the hotter and drier Mallee region, June sown crops did not achieve malt quality, whereas the May-sown crop did (Table 1). Excessive boron and salinity levels in the soil profile were identified at four of the sites; none of these attained Malt 1. Root and leaf diseases were present at all sites, with *Rhizoctonia* and *Pratylenchus spp.* being the most significant, however no clear relationship between disease and grain quality was evident.

At sites that failed to achieve Malt 1, potential yield based on total available N, was, on average, 2.27t/ha higher than measured yield. At sites that did achieve Malt 1 specifications, this difference was only 0.13 t/ha.

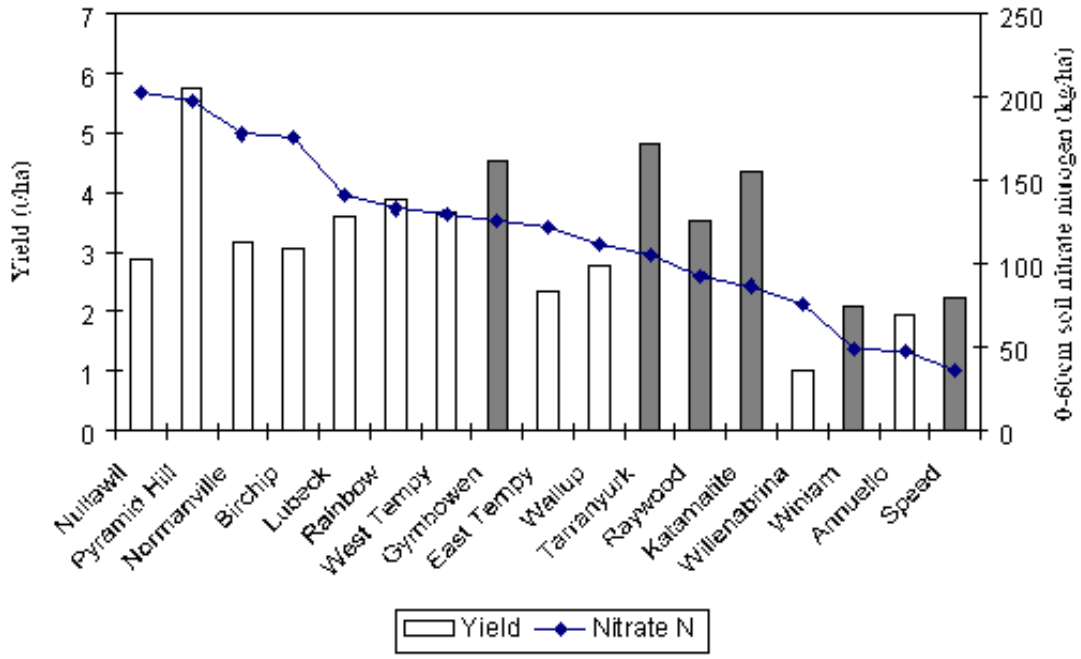

Figure 1. Deep soil nitrate nitrogen effects on barley yield and malt specifications for each demonstration site during 1999. Shaded columns represent malting barley and unshaded represent feed barley (Evans, 2000).

As pre-sowing 0-60cm soil nitrate-nitrogen levels increased, Malt 1 specifications were achieved less frequently (Figure 1). Six sites contained < 100kg/ha of pre-sowing nitrate-nitrogen; four of these sites achieved Malt 1specifications. Seven sites contained between 100kg/ha and 150kg/ha of nitrate-nitrogen; only two of these sites achieved Malt 1. No site with > 150kg/ha nitrate-nitrogen pre-sowing achieved Malt 1 classification.

Discussion

"If I'd realised what the soil N levels were I would never have put on so much urea." (Bolwell, pers.comm., 1999).

Soil N is a key factor in producing malt barley. Paddocks with soil N levels exceeding the levels required to achieve realistic target yields are unlikely to produce barley to Malt 1 specifications. In these situations, some of the N not used for yield will be directed into grain protein.

About half the paddocks in the 1999 State Focus had sufficiently high soil N levels to make achieving Malt 1 unlikely even with average rainfall. As farmers had selected all these paddocks for growing malting barley, the likelihood is that many paddocks chosen for malt barley in Victoria are unsuitable. Knowledge of paddock history and rotation, as well as use of management tools such as deep soil nitrate testing prior to sowing, will enable better identification of paddocks suitable for malt barley.

"As a result of seeing the deep soil nitrogen levels, I decided not to pre-drill nitrogen." (Smith, pers. comm., 1999).

Total available nitrogen consists primarily of N stored in the soil, N mineralised during the growing season and N applied as fertiliser at sowing. Growers have most influence over the fertiliser N fraction of total N available to the crop. With a realistic yield target and knowledge of available N at sowing, ‘best bet’ N fertiliser strategies can be made. Nitrogen application, for paddocks with pre-sowing soil nitrate levels above 100 kg/ha, should be carefully considered. Where this measure exceeds 150 kg/ha, the risk of not achieving malt quality is significant and paddocks more suitable should be selected for malt barley production.

In addition to N management, growers can further increase the reliability of malt barley production through knowledge of paddock rotations, potential subsoil limitations and root disease levels.

Conclusion

Pre-sowing soil nitrate N was the most significant factor determining paddock suitability for malt barley. The data suggests that nitrogen application should be carefully considered for paddocks with pre-sowing soil nitrate N levels above 100 kg/ha. More suitable paddocks should be chosen where this measure exceeds 150 kg/ha.

These benchmarks will be further refined in 2000, with monitoring of soil nitrogen, yield and grain quality on farms across Victoria.

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References

Evans, M. February 2000. TOPCROP State Focus Malting Barley.