

Cultivar release

‘Aquila’—a premium quality facultative bread wheat (*Triticum aestivum*)

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Abstract ‘Aquila’ is a premium quality bread wheat (*Triticum aestivum*) bred by the New Zealand Institute for Crop and Food Research. Given appropriate management it is suitable for sowing in New Zealand in Canterbury from May until October and in the southern North Island in spring, and produces similar yields to the current standard spring wheat ‘Kohika’. It is resistant or moderately resistant to most common wheat leaf diseases and pre-harvest sprouting. It produces a bright white flour with consistently high farinograph water absorption (3–4% higher than other New Zealand premium bread wheat cultivars). It has very consistent baking quality, producing medium–high test bake scores at moderate work inputs. The name ‘Aquila’ was chosen to reflect its high water absorption values.

Keywords ‘Aquila’; bread wheat; premium quality

MORPHOLOGICAL DESCRIPTION

‘Aquila’ is an early-medium maturing, facultative wheat (*Triticum aestivum* L.) with a wide sowing window. It is a fully awned semi-dwarf (it carries a major dwarfing gene, *Rht-1*) with moderate (semi-solid) straw strength. Grain weight is typically 40–45 g/1000 grains, which can be reduced under drought stress.

ORIGIN

The cross (5200), from which ‘Aquila’ was eventually selected, was made at the New Zealand Institute for Crop and Food Research Limited, Lincoln, New Zealand, in 1992 between two advanced DSIR Crop Research Division, Palmerston North, lines, 760.01.1 (‘Rongotea’/‘Oroua’//82PBI728) and 1191.05 (‘Raven’/‘Karamu’//‘Otane’). The cross was grown as F₁ and F₂ bulks at Lincoln in the 1992/93 and 1993/94 seasons. Random F₃ head rows were also grown at Lincoln in 1994/95 and individual plants harvested from selected rows. Seed from these individual plants was used to sow short solid-seeded plots at Palmerston North in spring 1995 and one of these (5200.3) was bulk harvested in 1996 and tested in yield trials at Palmerston North in 1996/97, at Lincoln and Palmerston North in 1997/98, and in multi-site on-farm trials at Canterbury and Manawatu thereafter. The original F₃ plant-derived 5200.3 bulk was reselected from a single plant at F₆ in 1997/98 (5200.3.2) and again in 2000/01 as a single plant at F₉ (5200.3.2.3, the final selection being named ‘Aquila’).

AGRONOMIC PERFORMANCE

‘Aquila’ has been tested in Crop & Food Research spring wheat regional on-farm trials in Canterbury and in the southern North Island since 1999/2000. In 2003/04 it was also tested in autumn at three Canterbury sites. In all sites and seasons trials were of a randomised complete block design and trial data

analysed using standard analysis of variance. Results from these trials are summarised in Table 1. The spring-sown performance of 'Aquila' relative to spring and facultative bread wheats 'Kohika' and 'Torlesse' (respectively the current milling industry spring and facultative standards) indicates that overall 'Aquila' is 2% and 9% lower yielding, respectively. Inspection of individual seasons' data suggests that 'Aquila' may have a yield disadvantage relative to these two cultivars where moisture stress is a factor, but may have more competitive yields where moisture is freely available. Thus it was lower yielding than the two standards (significant for 'Torlesse' only) in the hot, dry seasons of 2000/01 and 2003/04 but similar yielding in the wetter, cooler seasons of 1999/2000 and 2002/03. It is also notable that in 2004, 'Torlesse' significantly out-yielded 'Aquila' when spring planted whereas yields from autumn plantings were not significantly different. This probably arises because in the autumn plantings much grain filling has been completed before the onset of hot, dry weather in the second half of December 2003.

'Aquila' produces consistent physical grain quality characteristics. Its average test weights, screenings, and 1000 seed weights were generally within New Zealand industry specifications. In the hot, dry 2004 season all three cultivars presented were below specification for test weight (industry minimum = 74 kg/hl). 'Aquila' was above minimum specification in the other three seasons, unlike both 'Kohika' and 'Torlesse', which fell below specifications for one or more parameters in one or more seasons. 'Aquila' is a high protein achiever and overall averaged 0.8–1.0% higher grain protein than 'Torlesse' and 'Kohika' respectively. Of particular importance for risk management, 'Aquila' retains a relatively high falling number, even after ripe or near-ripe crops have been exposed to prolonged periods of rainfall. In the wet harvest of 1999/2000, the minimum falling number value recorded at any of the three sites tested was 272 s ('Kohika' recorded 62 s at this site). In 2004 it also had higher falling number values than 'Torlesse', especially when planted in autumn, despite maturing several days earlier. It was tested in specialist sprouting nurseries

Table 1 Yield and grain quality of 'Aquila', 'Kohika', and 'Torlesse' (*Triticum aestivum*) in on-farm trials harvested from 2000 to 2004. In the 2003/04 season both autumn (A) and spring (S) trials were planted.

| Trait | Cultivar | Year: | 2000 | 2001 | 2002 | 2003 | 2004A | 2004S |
|-----------------------|----------|---------------|------|------|------|------|-------|-------|
| | | No. of sites: | 6 | 5 | 5 | 4 | 3 | 4 |
| Yield (t/ha) | Aquila | | 8.8 | 6.4 | 6.6 | 6.5 | 8.3 | 5.8 |
| | Kohika | | 8.4 | 6.7 | 6.8 | 7.0 | – | 6.0 |
| | Torlesse | | – | 7.6 | 6.4 | 7.1 | 8.9 | 6.7 |
| | LSD (5%) | | 0.9 | 1.0 | 0.7 | 0.8 | 1.1 | 0.5 |
| Test weight (kg/hl) | Aquila | | 75.7 | 77.7 | 75.0 | 75.0 | 69.4 | 68.7 |
| | Kohika | | 71.0 | 80.8 | 75.0 | 77.0 | – | 71.2 |
| | Torlesse | | – | 75.2 | 72.0 | 72.5 | 62.9 | 69.9 |
| | LSD (5%) | | 3.5 | 3.4 | 2.8 | 2.8 | 4.1 | 6.0 |
| 1000 grain weight (g) | Aquila | | 40.9 | 46.0 | 42.0 | 43.0 | 41.0 | 40.0 |
| | Kohika | | 40.2 | 49.4 | 44.0 | 49.0 | – | 44.3 |
| | Torlesse | | – | 41.0 | 37.0 | 41.0 | 40.3 | 37.7 |
| | LSD (5%) | | 4.1 | 1.6 | 2.8 | 5.3 | 3.0 | 3.4 |
| Screenings (2 mm, %) | Aquila | | 2.4 | 2.9 | 2.7 | 0.5 | 1.6 | 4.4 |
| | Kohika | | 4.4 | 5.6 | 1.8 | 1.0 | – | 4.0 |
| | Torlesse | | – | 4.2 | 3.2 | 1.0 | 2.2 | 3.9 |
| | LSD (5%) | | 2.3 | 1.8 | 0.9 | 0.9 | 3.4 | 7.8 |
| Protein (%) | Aquila | | 12.2 | 13.9 | 13.1 | 11.7 | 13.6 | 14.1 |
| | Kohika | | 11.5 | 13.0 | 12.1 | 10.8 | – | 12.7 |
| | Torlesse | | – | 12.8 | 12.8 | 10.8 | 13.2 | 13.0 |
| | LSD (5%) | | 2.4 | 0.5 | 1.9 | 2.0 | 0.6 | 0.5 |
| Falling number (s) | Aquila | | 274 | 347 | 316 | 408 | 289 | 328 |
| | Kohika | | 89 | 287 | 232 | 365 | – | 162 |
| | Torlesse | | – | 341 | 370 | 345 | 213 | 306 |
| | LSD (5%) | | 48 | 90 | 88 | 65 | 110 | 129 |

for the first time in 2003/04. Data from these nurseries indicate that it has intermediate seed dormancy levels relative to the least (e.g., ‘Kohika’) and most dormant (e.g., ‘Monad’) check cultivars, which would explain the major determinants of its sprouting resistance.

PROCESSING QUALITY

Milling and other quality parameters are presented in Table 2. ‘Aquila’ does not readily yield its flour and consequently produces relatively low flour extraction rates when milled on the Buhler test mill, averaging 2% and 5% lower flour yields than ‘Torlesse’ and ‘Kohika’ respectively. However, its commercial milling performance (77.5% extraction) was satisfactory. Its mixing properties are typical of a medium-strong wheat with development time and stability at the lower end of the bread wheat specification range, making it ideal for mechanically developed bread production (data not shown). ‘Aquila’ has exceptional farinograph water absorption values, which should translate to higher bakery yields and anti-staling properties. It is apparent that its dough properties are also at the lower end of the spectrum for bread wheat, being both less extensible and having slightly lower maximum resistance on the extensogram (Table 2). However, its baking quality (2000/03 mean bake score = 38) is at least as good as that of ‘Torlesse’ (35) and ‘Kohika’ (37) and at a

4-year average of 13 Wh/kg this is achieved at lower work input than most other current bread wheat cultivars.

COMMERCIAL PRODUCTION/MARKET SHARE

New Zealand milling wheat production is currently c. 100 000 million t. Approximately 10 000 million t contracted production of ‘Aquila’ is expected for 2004/05 season.

DISEASE RESISTANCE

The resistance or susceptibility of existing and potential new cultivars to the major wheat diseases in New Zealand is monitored in a series of specialist disease nurseries designed to specifically encourage each of these target diseases. The ratings for ‘Aquila’ in comparison with ‘Kohika’ and ‘Torlesse’ are presented in Table 3. Stripe rust (*Puccinia striiformis*) is the most economically important disease in New Zealand. Seedlings of all three cultivars are susceptible to some extent to stripe rust, but have moderate–good adult plant resistance. ‘Aquila’ appears to have similar adult plant resistance to ‘Torlesse’ to stripe rust. However, it is more susceptible to this disease in the seedling stage, though not as seedling susceptible as ‘Kohika’. In

Table 2 Mean milling and processing quality from trials (2000/03) and commercial milling and processing (2004) for ‘Aquila’ plus overall 2000/03 means for ‘Aquila’, ‘Torlesse’, and ‘Kohika’ (*Triticum aestivum*). (FE, Buhler flour extraction rate (%); L*-B*, Minolta colour grade value; WA, farinograph water absorption (%); WI, work input (Wh/kg); BS, bake score (arbitrary scale). Figures in parentheses are the coefficient of variation (%) for each cultivar over the eight samples tested.)

| Cultivar/year (no. sites) | Milling | | Colour L*-B* | WA% | Extensograph | | Test bake | |
|-------------------------------|-----------|------|-----------------|---------|--------------|----------|-----------|----|
| | FE | | | | Ht (BU) | L (cm) | WI | BS |
| Aquila trial means | | | | | | | | |
| 2000 (3) | 75.4 | – | 68.2 | 270 | 22.4 | 13 | 39 | |
| 2001 (3) | 73.4 | – | 68.8 | 269 | 22.2 | 12 | 38 | |
| 2002 (3) | 72.7 | – | 65.6 | 290 | 23.0 | 15 | 38 | |
| 2003 (2) | 70.8 | 82.1 | 65.6 | 421 | 19.4 | 13 | 37 | |
| Aquila commercial 2004 | | | | | | | | |
| Mill 1 | 77.5 | 82.2 | 67.5 | 335 | 22.4 | 12 | 38 | |
| Mill 2 | N/A | 82.8 | 70.5 | 260 | 18.9 | – | – | |
| 2001–03 means | | | | | | | | |
| Aquila | 72.3(2.3) | 82.1 | 66.7(3.2) | 327(25) | 21.5(13.1) | 13(15.6) | 38(5.0) | |
| Kohika | 77.2(2.0) | 85.1 | 62.5(4.3) | 325(32) | 24.2(8.1) | 13(16.4) | 37(7.5) | |
| Torlesse | 74.2(1.4) | 78.8 | 61.7(4.5) | 380(33) | 24.8(7.5) | 14(13.5) | 35(7.1) | |
| LSD (5%) | 1.6 | | 2.5 | 112 | 2.4 | 2.2 | 2.7 | |

Table 3 Seedling and adult plant disease nursery ratings for ‘Aquila’, ‘Kohika’, and ‘Torlesse’ (*Triticum aestivum*) for 1999/03. (Scores are composed of a numerical value (% leaf area affected) and a reaction type (S, susceptible; MSS, almost susceptible; MS, moderately susceptible; MR, moderately resistant; MRR, almost resistant; R, resistant. LSD values are for % leaf area affected.)

| Cultivar | Year | Stripe rust | | Leaf rust | | Powdery mildew | Speckled leaf blotch |
|----------|-----------|-------------|---------|-----------|-------|----------------|----------------------|
| | | Seedling | Adult | Seedling | Adult | | |
| Aquila | 1999/2000 | S | 0R | R | 3S | 1 | 23 |
| | 2000/01 | S | 10MRR | S | 20S | 0 | 3 |
| | 2001/02 | S | 1R | S | 0R | 1 | 7 |
| | 2002/03 | MS | 0R | S | 30MR | 0 | – |
| Kohika | 1999/2000 | S | 1MS | S | 4S | 3 | 18 |
| | 2000/01 | S | 20MR/MS | MS | 40S | 60 | 8 |
| | 2001/02 | S | 7MR | S | 0R | 40 | 0 |
| | 2002/03 | S | 3MR | R | 50MS | 3 | – |
| Torlesse | 1999/2000 | S | 3 MR | S | 18S | 1 | 18 |
| | 2000/01 | R | 10MR | R | 40MSS | 0 | 5 |
| | 2001/02 | R | 7MR | R | 4S | 5 | 10 |
| | 2002/03 | R | 0R | R | 60MS | 0 | – |

LSD (5%)

high pressure seasons when there is a prolonged infection period, an early fungicide application (GS 30) may be warranted. It has good resistance to current races of powdery mildew (*Erysiphe graminis*) and although it shows seedling susceptibility to leaf rust (*Puccinia recondita*) it has good adult plant resistance to this late season disease. Spray programmes specific to either of these diseases should not be necessary. ‘Aquila’ is, however, susceptible to speckled leaf blotch (*Septoria tritici*) and autumn-sown crops should be monitored carefully for this disease if pressure is high.

MANAGEMENT

In general, but depending on season, time of sowing and disease pressure, either one or two fungicide applications between leaf 3 and ear emergence will usually be sufficient. An early pre-leaf 3 fungicide should not be necessary unless seedling stripe rust is particularly severe or there is significant speckled

leaf blotch pressure. ‘Aquila’ is a high protein achiever, however, adequate nitrogen nutrition needs to be maintained to ensure target specifications are met. Straw length of ‘Aquila’ is at the tall end of the spectrum for semi-dwarf wheats so to reduce the risk of lodging, growth regulators may be required if yields in excess of 7 t/ha are anticipated.

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