

Cultivar differences in responses to n fertilizer in malting barley

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South Australia is the major producer of barley in Australia of which only about 30-40% is of malting quality. Farmers are being encouraged to apply N fertilizer to barley to improve yields. However, this sometimes increases grain nitrogen concentration (GNC) which is not desirable for malting quality. It is important therefore to develop varieties which have a high grain yield response but a low GNC response to N fertilizer to improve the chance of producing malting quality when N fertilizer is applied.

Methods

Six malting barley cultivars (Skiff, Weeah, Schooner, Chebec, Clipper, Stirling) were grown with 8 rates of nitrogen fertiliser (0-105 kgN/ha with increments of 15 kgN/ha) at 4 sites in SA in 1990 and 1991. Nitrogen was applied as urea (46%N) 6 weeks after sowing. Measurements of dry matter production were made at anthesis (DMA) and GY and its components were estimated. Following a comparison of different models, quadratic equations were fitted to the yield data of each variety at each site. For each cultivar at each site a response index (RI) at 45 kgN/ha ($RI = GY \text{ increase} / GNC \text{ increase}$) was derived.

Results and discussion

Nitrogen significantly increased grain yield at all sites except Nuriootpa in 1990 and at each site caused a decline in mean kernel weight. There were consistent genotypic differences in RI which were related to the grain yield response (Table I). Clipper, Weeah and Schooner had a lower RI at each site than Stirling, Chebec and Skiff. The RI appeared to depend on the the yield response more than the GNC response. The differences in RI could not be explained in general terms by the changes in the yield components. For example, Clipper and Skiff both showed large increases in ears/in' but had much different RIs. Differences were found with responses in kernels/m². but these again could not be related to RI. Differences in RI may be related to the production and/or partitioning of DM during the growing season because the DMA for Clipper, Weeah and Schooner (572, 592, 614 g/m² averaged over 3 sites respectively) tended to be greater than that of Stirling, Chebec and Skiff (508, 583, 531 g/m² respectively), although the DMA response to N did not show a similar trend. Therefore, RI may be useful to identify responsive malting quality genotypes as it integrates the responses in the different yield components.

Table 1. Grain yield and grain N concentration responses to 45 kgN/ha and the RI of 6 barley cultivars at 3 sites.

Cultivar	ΔGY (kg/kgN) Site ^a				ΔGNC (%) ($\times 10^{-4}$) Site ^a				RI (kg/kgN/%) Site ^a			
	Nf91	Ch91	Nf90	Mean	Nf91	Ch91	Nf90	Mean	Nf91	Ch91	Nf90	Mean
Clipper	3.9	3.8	6.9	4.9	19	38	53	36	2033	990	1293	1439
Stirling	6.5	9.1	12.2	9.3	17	32	51	33	3919	2886	2402	3069
Weeah	-3.0	5.3	6.8	3.0	17	32	40	29	-1732	1643	1667	526
Schooner	0.3	3.5	7.2	3.7	23	75	48	48	121	464	1504	696
Chebec	7.8	5.3	9.8	7.6	20	30	32	27	3834	2107	3064	2881
Skiff	8.2	12.1	12.7	11.0	7	40	56	34	11510	3053	2292	5618
SM ^b	3.3	2.5	2.9		1.77	1.96	1.99					

^a Nf91=Northfield,1991, Ch91=Charlick,1991, Nf90=Northfield,1990; ^b Site mean values for GY (t/ha) and GNC (%).

