Variation in responses of barleys to applied nitrogen

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Many farmers growing malting barley in South Australia avoid applying nitrogenous fertilizers because of the risk of increased grain protein levels. These farmers suffer a yield disadvantage that in many cases is not compensated for by the premium paid for the malting grade. The long term goal of this research is to breed a variety that will give maximum returns at higher levels of productivity, but that does not force the farmer to compromise between yield and quality. The major objectives of the project are to identify genetic variability for specific responses in barley to applied nitrogen. Several characters are being sought namely: i) A high yield response concomitant with a low response of grain nitrogen to applied N. ii) A low content of nitrogen in the grain for a given level of applied N. iii) A higher yield at lower levels of applied or soil N.

Methods:

A preliminary experiment was conducted at Arthurton on the Yorke Peninsula in 1985. The site chosen was in its third year of Galleon barley. The split plot experiment with three replicates included 70 barleys at three levels of nitrogen (10, 40 and 70 kg N/ha applied just prior to jointing). Extensive agronomic data were collected during the season. Data obtained at harvest included yield (grain and straw), 1000 kernel weight, test weight, and grain assortment. Grain protein was determined by near infrared reflectance (NIR). Straw protein and grain protein for NIR calibrations were determined by Kjeldahl methods. Harvest index and nitrogen harvest index were determined for all entries.

Results and discussion

The response to applied nitrogen (see table) was an approximately linear increase in both % protein and yield (2.01%, 961 kg).

Table: Selected Protein and Yield data, Arthurton, 1985

Barley	% Protein				Yield (kg/ha)			
	10 kg N/ha	40 kg N/ha	70 kg N/ha	Mean	10 kg N/ha	40 kg N/ha	70 kg N/ha	Mean
Schooner	9.15	9.93	11.96	10.35	2,356	3,100	3,513	2,990
Stirling	8.99	10.07	11.14	10.07	2,649	3,243	3,581	3,157
O'Connor	8.98	9.42	13.27	10.20	3,090	3,420	3,716	3,409
Dampier	9.77	9.78	9.73	9.76	2,189	2,943	3,337	2,823
Parwan	8.13	9.10	10.62	9.28	2,695	3,571	3,529	3,265
Grimmett	8.55	9.23	10.43	9.41	2,323	2,855	3,527	2,902
G.Promise	7.79	8.65	9.39	8.61	2,183	2,931	3,240	2,785
Triumph	8.67	9.15	10.19	9.42	2,252	2,859	3,425	2,845
Izmir 9	9.14	9.93	10.27	9.76	2,362	3,242	3,543	3,049
WI-2477	7.89	8.97	10.20	9.02	2,669	3,430	3,805	3,301
WI-2585	8.88	9.38	10.64	9.63	3,242	3,574	4,100	3,639
WI-2647	9.69	9.97	10.52	10.06	2,535	3,289	3,612	3,145
Mean (70 entries)	8.97	9.87	10.98	9.94	2,438	2,997	3,399	2,945

Dampier did not increase protein content and combined this with a high yield response to increasing N. Golden Promise, Parwan and WI-2477 were notable for their low protein contents. Many barleys gave high protein responses (Schooner, O'Connor, Parwan). On the other hand Triumph, Izmir 9 and WI-2647 gave low protein responses. O'Connor and WI-2585 yielded well under low nitrogen treatments but did

not increase yield greatly in response to increasing N. Further experiments and more detailed studies are required to establish whether high yield responses, low grain protein content and low protein responses to applied N are heritable and whether these characters can be combined through hybridization and recombination.