The use of wild wheats to increase potential grain number per head in hexaploid wheat

S.E. Knights and G.M. Halloran

School of Agriculture and Forestry. The University of Melbourne.
Parkville, Victoria, 3052.

The aim of this study was to see whether the developmental processes in ancestral *Triticum* species differed from those in commercial wheat. The possibility was explored that potentially higher spikelet number might be incorporated in commercial. hexaploid. wheat from such species to increase grain yield.

Methods

The durations and rates of development of five accessions of *T. monococcum* and two accessions of *T. timopheevi* were compared with those of three commercial cultivars, *T. nestivum.* All plants were vernalized for six weeks and then transplanted into pots containing soil on the 12 July 1992 and grown in a glasshouse. There were 4 replications of 40 plants per accession and the pots were arranged in a randomized block design. One plant per accession in each replicate was sampled and examined under a dissecting microscope at 2-3d intervals from transplanting to determine the stage of development of the apex of the primary tiller. The leaf initiation phase was defined as the period from sowing to double ridge, the spikelet initiation phase from double ridge to terminal spikelet initiation and the culm elongation phase from the commencement of elongation *(i.e* when the culm was >0.4 cm) to when it ceased. Hourly temperatures were recorded in the glasshouse on a datalogger and a base temperature of 0?C was used for calculating thermal time. Durations of the phases were measured in thermal time. Rates of development through the phases were determined by simple linear regression of the number of primordia or the length of culm produced in the phase against thermal time. Development was also monitored by regular photographs of shoot apices under a scanning electron microscope.

Results and discussion

The hexaploid wheats developed much faster than accessions of both of the wild wheat species (Table 1).

Table 1. Rates and Durations of development phases of ten wheat accessions

Wheat accession	Leaf initiation phase (degree days)	Spikelet initiation phase (degree days)	Culm elong. phase (degree days)	Leaf nitiation rate (Prim./dd)[a]	Spikelet initiation rate (prim./dd)[a]	Culm elong. rate (cm/dd)[a]
Yecora 70	228	211	833	0.016ab	0.031a	0.038a
Olympic	391	227	895	0.018a	0.041a	0.051b
Rosella	309	359	865	0.017a	0.031a	0.046ab
T.timopheevi 17646	570	808	1869	0.011b	0.019b	0.055b
T.timopheevi 11432	718	661	1739	0.013b	0.011c	0.066c
T.monococcum 90424	570	931	1869	0.012b	0.023ab	0.053b
T.monococcum 16296	669	832	1915	0.012b	0.027a	0.051b
T.monococcum 16282	853	770	2145	0.011b	0.029a	0.053b
T.monococcum 19843	853	770	2220	0.011b	0.036a	0.055b
T.monococcum 18760	570	1052	1996	0.011b	0.027a	0.049b

[a]Values in columns followed by the same letter are not significantly different (P..0.05)

Table 2. Final measurements on the main tiller

of ten wheat accessions

Wheat accession	Leaf number	Spikelet number
Yecora 70	8.7	18.3
Olympic	7.6	15.6
Rosella	8.7	19.0
T. timopheevi 17646	14.4	18.9
T. timopheevi 11432	14.8	18.6
T. monococcum 90424	13.4	26.2
T. monococcum 16296	14.0	30.6
T. monococcum 16282	14.9	30.6
T. monococcum 19843	15.8	40.8
T. monococcum 19760	14.4	30.5
LSD (P=0.05)	0.3	1.5

The *T. monococcum* accessions achieved significantly higher spikelet number per head than the other accessions (Table 2). The spikelet initiation rates for the accessions of *T. monocoecum* were not significantly different from the hexaploid wheats (Table 1). *T. monococcum* achieved the high spikelet number through a longer duration of spikelet initiation than the hexaploid wheats. This development characteristic may be useful in late maturing wheats.

Acknowledgements

This work was funded by Grains Research and Development Corporation grant number UM32C