Kernel number in wheat: effect of light

R.A. Fischer and Y.M. Stockman

CSIRO, Division of Plant Industry, P.O. Box 1600, Canberra City, A.C.T. 2601.

Much of the variation in grain yield in the wheat crop is a result of weather and agronomy is related to variation in kernel number/m. It has been shown overseas, and to a limited degree in Australia (1), that at least under well watered conditions kernel number is strongly influenced by solar radiation levels before anthesis. It is not known to what extent this response is proportional to the known effects of radiation level on crop growth rate, as was the case in controlled environment studies (2), but if this were so, it would be a boost to the idea that kernel number could be modelled via predicting assimilate supply to the growing spike. The present experiment was planned to gather further information on this question, and to do so in field with a current Australian cultivar.

Methods

Wheat (cultivar Egret) was sown on 27 April 1981 at Ginninderra Experiment Station, A.C.T. Owing to the very wet winter, it was necessary to apply 150 kg ha^{-1} N supplemental in late winter. At flag leaf emergence on 30 September, when the crop had an LAI of 5.9, a shading treatment (50% light reduction) was applied to 2 x 2 m portions of crop; at the same time 2 m lengths of single rows were given extra light by bunching together adjacent portions of neighbouring rows. There were 8 replications. Treatments terminated on 13 October and 50% anthesis occurred on 24 October. October plus November rain was sufficient (103 mm, including 19 mm of supplemental irrigation in mid October) to minimize any effects of water limitation.

Results and Discussion

Reduced and increased light affected crop and spike growth rates in the expected manner, but partitioning was changed since spike growth rates were affected relatively less than crop growth rate (Table 1). There was an unexpected after-effect of treatment on growth rates, magnifying their absolute effect on spike dry weight at anthesis. Kernel number/m was reduced significantly by shading and to the same extent as was spike dry weight at anthesis, but was unaffected by extra light despite spike weight increases. Thus the relationship of kernel number to spike dry weight was not entirely unique. Perhaps spikes could not respond to extra assimilate because of early nitrogen stress.

Table 1: Treatment effects (absolute value or % control)[A] on crop[B].

	During treatment		End treatment to anthesis		Anthesis		Maturity		
	CGR	SGR	CGR	SGR	TDW	SDW	Kernel No.	Spike No.	Kernels No.
	$d/m^2/d$		$g/m^2/d$		g/m^2		$1000/m^2$	$/m^2$	per Spike
Control	19.3	8.0	16.4	5.4	1140	195	18.1	587	29.8
Shaded (%)	54	78	74	86	85	83	79	90	88
+ Light (%)	166	133	123	116	120	123	94	-	94

A. Shaded and + light values as % control, area basis or culm basis, respectively.

B. CGR = crop growth rate, SGR = spike growth rate, TDW = total dry weight.

1. Woodruff, D.R. and Mawhood, R.P. 1978. Qld. J. Agric. & Anim. Sci. 35: 95-100.

2. Fischer, R.A. and Stockman, Y.M. 1980. Aust. J. Plant Physiol. 7: 169-80.