ARE NITROGEN RESPONSES OF SPACED WHEAT PLANTS REPRESENTATIVE OF A FIELD CROP?

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Once the vagaries of weather patterns and soil type begin to limit the conclusions which can be drawn from field studies the natural recourse of the researcher is to move to controlled environment conditions. In a glasshouse or growth cabinet, climatic conditions and uniform soil mixes permit treatment effects to be studied in isolation of the confounding effects in the field. The question which agronomists have continued to ask of breeders, physiologists and molecular biologists is *how representative of the real world are glasshouse grown spaced wheat plants?*

MATERIALS AND METHODS

A glasshouse experiment was set up to investigate haying-off in wheat, taking precautions to simulate the field environment as closely as possible. Plants were grown in 1.2 m long tubes 0.1 m in diameter filled with a reconstituted duplex soil profile. A refrigeration system was used to maintain soil temperatures between 11-14^{0}C. Sowing density was 29 plants/m^2 of floor space or 119 plants/m^2 of soil surface. Side curtains were installed around the micro-canopy and plants repositioned regularly. Data were compared to three field experiments with a mean sowing density of 149 plants/m^2. Spaced plants and field crops received 0 or 240 kg N/ha (urea 46% N).

RESULTS AND DISCUSSION

At anthesis spaced plants had produced approximately three times the biomass per unit soil area but 60-70% of the biomass per unit ground area of field crops, leaves were thicker, stems heavier and stem water soluble carbohydrates (WSC) were higher (Table 1). In response to N, specific leaf area of spaced plants decreased while individual stem weight and stem linear density increased. In contrast opposite responses were observed in the field. The level of stem WSC remained constant with the application of N for spaced plants but fell by almost half for field crops after starting at 35% lower concentrations in control plants.

Table 1. The effect of N fertiliser on attributes of spaced plants or field crops at anthesis.

Physiological attribute	Spaced plants		Field crops	
	Low N	High N	Low N	High N
Specific leaf area (cm^2/g)	174	148	210	235
Stem weight (g/stem)	1.7	2.1	1.3	1.1
Stem linear density (g/m)	3.0	3.5	1.7	1.3
Stem WSC (% of stem wt.)	46	45	30	17

Plant dry weight (g/plant)	18.9	25.0	5.9	7.0
Biomass (g/m^2 soil area)	2249	2975	874	1043
Biomass (g/m^2 ground area)	548	725	874	1043

Despite the efforts to simulate field conditions, there was unexpectedly greater WSC levels in spaced plants at anthesis attributed to better light relations. Utilisation of pre-anthesis stem WSC reserves was estimated to contribute 41% and 35 % of grain yield for control and high N treatments in spaced plants while in field crops the contribution decreased to 32% and 17 % respectively. This difference throws light on the importance of closed canopies and pre-anthesis WSC reserves in the development of haying-off.