Grain set failure and boron deficiency in wheat in Thailand

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In the 1986/87 growing season, sterility of wheat ears was frequently observed at experimental sites in northern Thailand. Since hollow heart in peanut, a symptom specific to boron (B) deficiency, is widespread in this region, a study was undertaken to determine whether the observed disorders in wheat could have been due to B deficiency.

Methods

Three experiments were carried out at Chiangmai during the 1987/88 growing season using wheat selections (SW23, SW41) of Kasetsart University. Experiment 1: SW41 was sewn on Dec. 15 in 2 treatments, nil (B0) and plus borax at 1.1 kg B ha (B+). The crop was flood irrigated. Experiment 2: SW23 was sown on Nov. 6 as a rainfed crop following previous crops of seybean, peanut and blackgram supplied with B0 or B+ (2.3 kg B ha). Experiment 3: SW41 sown on Nov. 7 ws grown under rainfed conditions with either B0 or B+ (1.1 kg B ha) Samples of flag leaves were taken at booting and anthesis, and ears at anthesis. The central 4 x 2 m rows in each plot were harvested for grain yield parameters.

Results and discussion

In the three experiments grain yield was depressed by 39-49% in BO plants (Table 1). In BO the numbers of grains se/spikelet were about half of those in B+. Ear number and size, ears/m2 and spikelets/ear were unaffected by boron levels.

Table 1. Effects of boron application on wheat yield, yield components and other related parameters.

	Experiment 1		Experiment 2		Experiment 3	
Boron treatment*	B0	B+	B0	B+	B0	B+
(a) Yield and yield components						
seed yield (kg/ha)	766	1488	1223	2005	1312	2294
Grains/spikelet	1.30	2.70	1.20	2.10	1.60	2.20
1000 grains wt.(g)	35	29	36	30	35	33
(b)Tissue boron (mgB/kg dry matter)						
Booting: flag leaf	6	12	5	13	6	13
Anthesis: flag leaf	6	13	5	16	7	11
Grain	1.2	1.2	1.4	1.8	1.2	1.2
(c)Soil boron, hot water soluble						
0-25 cm (mgB/kg)	0.09	0.46	0.08	0.53	0.12	0.42

*Comparison between B0 and B+ in each experiment; pairs of B0 and B+ joined by an underline are not significantly different at $p<.05$; pairs not under-lined are significantly different at $p<0.05$.

During anthesis 62% of B0 florets remained open for several days (1% in B+). These ears contained mostly undeveloped anthers with a few distorted pollen grains. Boron concentrations of the flag leaf at booting and anthesis were significantly lower in BO plants. These results show that grain yield in wheat is depressed by boron deficiency due to poor grain set which is associated with male sterility.