Seed treatments improve germination and growth of soybean cv. chaffey sown into cool soils

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The summer in southern WA is short, so soybean has to be sown as early as possible in order to reduce the risk of harvest losses due to early winter rains at the end of March. The minimum air temperature in September is 10?C or lower and the soil temperature at 5 cm depth maybe 10-15?C. This study was to test the hypothesis that KNO3 treatment and the sowing of seeds with a high initial moisture content would reduce damage by low temperatures, and would promote germination, emergence, and seedling and plant growth.

Methods

In the glasshouse experiment low and high moisture seeds were imbibed with water or 20 mol m-3 KNO3 at 5 or 25?C for 200 degree-hours, then transferred to different germination temperatures. The times of the first (t0) and median seed (t50) to germinate, and the maximum percent germination (Pmax) were recorded. Germinated seeds were transferred to pots for growth for 30 days at different temperatures (25/20,20/15,18/13?C for 12 h/12 h; daylength = c.14.5 h).

Results and discussion

Germination (Pmax) was 100% at 25% moisture content and high temperatures, but was reduced to 48% at 10% moisture content and low temperatures (Table). In the latter, Pmax was increased to 76% with KNO3 . While KNO3 was advantageous to Pmax at low imbibition and germination temperatures (it is K+ and not the anion that is effective), it had no advantage at high temperatures. For the seeds which did germinate, those with a high moisture content had a 48% greater shoot dry weight (albeit non significant) but no increase in leaf area after 30 d relative to values from the low moisture content seed (Table). Radicles of high moisture content seeds were longer (19 mm) at 72 h after germination had occurred, relative to the low moisture seeds (9 mm).

Table Germination and plant growth after imbibition at 5 or 25?C, germination at 10 or 15?C for 5 days, and growth at 20/15?C for 30 days.

Moisture content (% DW)	+/- KNO_3	Temperature of Imb.	Temperature of Germ.	t0 (h)	t50 (h)	Pmax (%)	Shoot DW (g)	Leaf area (cm^2)
10	-	5	10	101b	151b	48a	0.46a	136
10	+	5	10	108b	154b	76b	0.46a	128
25	-	5	10	101b	142b	88bc	0.68ab	111
25	+	5	10	108b	149b	88bc	0.68ab	91
10	-	25	15	69a	110a	92bc	0.59ab	136
25	-	25	15	69a	104a	100c	0.86b	111
								nsd

These results were supported by a field experiment sown at 8.8 plants m-2 in Perth on 17 September, and 22 October (mean minimum soil temperatures = 6?C). Plants from high moisture (18%) seeds were 2 days earlier at the opening of first flower, and for the September sowing matured 8 days earlier (at 139 days after sowing and 1868 degree days (tb = 7?C)) without a loss in seed yield, compared with those from low moisture (10%) seeds.

A high moisture content at sowing protects against chilling damage to the germinating seed (confirming Obendorf and Hobbs, 1970). The new information is that high moisture seeds produce plants that flower

and mature earlier than those from low moisture seeds. K treatment may be advantageous when soil temperatures are particularly low.

1. Obendorf, R.L. and Hobbs, P.R. 1970. Crop Sci. 10: 563-66.