Effects of 2,4-dr (amine salt) on the growth, nodulation and nitrogen fixation of annual medics

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Annual medics (*Medicago* spp.) provide high-quality feed and raise soil nitrogen (N) levels in the lower rainfall regions of southern Australia especially on neutral to alkaline soils. In South Australia 2,4-DB is used to control broad-leaved weeds in medic pastures particularly in medic seed crops. However, farmers report that when the herbicide is used, nodulation of young medic plants is reduced. There have also been other reports of herbicides adversely affecting nodulation and N_2 fixation of legumes (1, 2). This paper reports the effects of the herbicide 2,4-DB on the growth, nodulation and N_2 fixation of 10 medic cultivars.

Methods

Seeds of 10 medic cultivars were inoculated with commercial inoculant and sown in washed river sand in 2L pots. At the first trifoliate leaf stage, plants were sprayed with either deionised water (control) or 2,4-DB at 1.4 L/ha and 2.8 L/ha (half and recommended rates respectively) and 24 days later assayed *in situ* for acetylene reduction (AR) activity (3). Medic plants were washed out, nodulation assessed and total dry weights recorded.

Results and discussion

Overall 2,4-DB significantly reduced total dry weight, nodule numbers and N_2 fixation (Table I) but there were marked differences between cultivars and species. On well-nodulated, herbicide-treated plants, there was a large number of small nodules and an absence of leghaemoglobin in the larger nodules indicating a loss of activity. Nodule distribution on the roots showed that with increasing rate of application, the herbicide reduced nodule numbers on the top half of the root while those of the lower half increased. This suggests that the plants may have the ability to recover from the herbicide with time. Generally AR decreased with herbicide concentration.

Table 1. Changes in total plant weight, the distribution of nodules on roots and AR of ten medic cultivars sprayed with the herbicide 2,4-DB at the first trifoliate leaf stage.

	Total plant weight (g)			Nodule number Upper root			Nodule number Lower root			AR µmol C_2H_4/pot		
	Herbicide rate (L/ha)											
Species/Cultivar	0	1.4	2.8	0	1.4	2.8	0	1.4	2.8	0	1.4	2.8
M. littoralis												
Harbinger	0.9	0.3	0.9	50	80	53	20	60	59	7.7	3.6	2.4
Harbinger(AR)	2.6	2.1	1.8	120	40	30	80	120	123	10.2	10.8	8.7
M. rugosa												
Paraponto	4.9	3.4	3.8	185	70	80	40	90	80	7.0	5.9	5.3
M. scutellata												
Kelson	8.0	2.9	4.6	120	40	3	35	50	0	8.3	3.9	1.1
Sava	4.4	5.3	3.1	330	123	55	161	63	128	4.8	4.8	3.9
M. truncatula												
Caliph	5.4	2.9	3.2	170	58	30	25	2	15	8.3	4.7	0.9
Jemalong	4.9	4.2	3.5	85	60	0	33	20	50	12.7	10.8	9.5
Mogul	4.0	2.9	2.0	73	0	5	13	9	10	10.8	6.1	4.0
Parabinga	5.0	5.3	4.0	140	30	20	30	90	43	9.6	12.9	9.3
Paraggio	4.5	2.1	2.9	171	43	41	57	29	45	10.3	7.1	7.8
se ±(Cult x Herbicide)	1.2	69.7	28.9	2.4								

References

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