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Dikegulac sodium activity on leafy spurge alone and in combination with 2,4-D and picloram

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Dikegulac sodium is manufactured as Atrinal (Tradename) by Maag Agrochemicals, Vero Beach, Florida. It is applied as a foliar spray and is translocated throughout the plant to meristematic zones. At appropriate concentrations dikegulac sodium causes temporary inhibition of plant growth, reduces or eliminates apical dominance, promotes growth of axillary buds and inhibits flowering and fruit set of certain plant species. The purpose of these experiments was to determine the effects of dikegulac sodium on leafy spurge grown in the greenhouse.

In the first experiment dikegulac sodium was applied to leafy spurge at sodium in solution concentrations ranging from 0.10 to 0.62% a.i. dikegulac sodium in water (v:v) with a hand held mist sprayer to the point of run-off. The leafy spurge plants had approximately equal root mass and were 3 to 4 inches tall with one stem/pot. The numbers of branches on shoots, shoots from roots and root buds were counted 8 weeks after treatments. Then the roots were replanted to observe the number of new shoots from roots for 5 weeks after replanting. The emerged shoots were counted and then removed to stimulate more stem development from root buds.

Four weeks after treatment all treated plants showed profuse branching from the main stem regardless of application rate. Eight weeks after treatment the plants were still 3 to 4 inches tall, with numerous branches and resembled pompons in appearance.

Dikegulac sodium at concentrations of 0.31, 0.46 and 0.62% increased the number of branches on leafy spurge stems by 8 to 11 times (Table 1). All dikegulac sodium concentrations inhibited shoot development from roots, but there were no significant differences between treated and untreated leafy spurge plants for number of root buds. Dikegulac sodium at 0.46 and 0.62% (v:v) decreased the number of leafy spurge shoots arising from the roots when counted two weeks after the topgrowth was removed. All the treatments except the 0.10% treatment caused at least some of the new shoots to be multi-branched, which may indicate that dikegulac sodium was translocated at least partially in the leafy spurge root system. The multi-branching was not seen in new shoots arising from the roots at 3 weeks or later.

In the second and third experiments dikegulac sodium was applied to leafy spurge in the pre-flowering and flowering stages of growth. A range of dikegulac sodium rates from 0.05 to 0.78% a.i. (v:v) were used. The remainder of the experiment was conducted

as in experiment one, except the plants were allowed to grow for six weeks after treatment before the number of branches on shoots was counted. Then the topgrowth was removed to soil level for 8 to 10 more weeks. The number of emerged shoots were counted and then removed to stimulate stem development from root buds.

In general dikegulac sodium was less active on more mature leafy spurge. Dikegulac sodium increased branching on leafy spurge stems in the bud stage, but only at the 0.78% concentration (Table 2). There was no effect on new shoots arising from the roots. Treatment of dikegulac sodium did not affect the number of branches on shoots or shoots from the roots on flowering leafy spurge (Table 3). However, some new shoots from the roots at all concentrations except 0.05% showed increased branching on the stem, thus demonstrating translocation of dikegulac sodium.

In the next experiments dikegulac sodium was applied to leafy spurge as a 24-hour pretreatment to and as a tank mix with the herbicides picloram and 2,4-D; each herbicide was a separate experiment. The leafy spurge had been grown in 6-inch diameter pots for 9 months and then cut back to soil level 4 weeks before treatment. The leafy spurge was 10 to 14 inches tall and in a vegetative growth stage at treatment. The treatments were applied with a moving nozzle pot sprayer delivering 17.5 gpa at 35 psi. The experiments were a randomized complete block with four replications. Plants were evaluated for injury 3, 4 and 28 days after treatment on a scale from 0 to 100 with 0 indicating no injury and 100 indicating complete burn down.

A tank-mix of dikegulac sodium plus picloram caused a rapid burning of the treated leaves and much faster injury than either a pretreatment of dikegulac sodium followed by picloram, or picloram used alone (Table 4). After 28 days the tank-mix and pretreatment applications showed similar leafy spurge injury and both were more injurious to leafy spurge than picloram alone. Tank-mixing dikegulac sodium with 2,4-D resulted in greater injury to leafy spurge than either a pretreatment of dikegulac sodium or 2,4-D alone. Injury was highest at the 2 and 4 oz/A rate of dikegulac sodium tank mixed with 2,4-D but decreased at the 8 oz/A rate.

Dikegulac sodium applied to young leafy spurge caused the plant to stop growing in height and to develop a large number of branches from the main stem. Dikegulac sodium had a slight effect on leafy spurge in the bud stage of growth but did not affect the morphology of flowering leafy spurge. The plant growth regulator was translocated in the leafy spurge root system. Herbicide injury to leafy spurge was increased when dikegulac sodium was tank-mixed with 2,4-D and picloram.

Table 1. Effect of dikegulac sodium on young leafy spurge plants. (Lym and Messersmith).

Dikegulac sodium Concentration (%)	Branches on shoots (No./plant)	Shoots from roots (No./plant)	Root buds (No.)	New shoots from roots (weeks)			
				2	3	4	5
0.10	2	2	10	7	1	4	3
0.33	8	2	2	6	1	2	2
0.31	20	2	7	6	2	1	2
0.46	16	2	1	1	0	0	0
0.62	23	1	6	2	2	2	1
0	2	5	8	8	1	2	2
LSD (0.05)	8	2	8	4	2	4	3

[a]Dikegulac sodium (Atrinal) in water (v:v)

Table 2. Effect of dikegulac sodium on leafy spurge in the bud stage. (Lym and Messersmith).

Dikegulac sodium concentration (%)	Branches on shoots (No./plant)	Shoots from roots (No./plant)	New shoots from roots (weeks)					
			2	3	4	6	8	10
0.05	3	4	7	10	19	11	13	2
0.23	8	3	2	7	8	11	7	2
0.46	10	3	3	7	12	14	5	0
0.62	13	4	3	6	9	12	4	2
0.78	29	3	2	8	13	9	8	5
0	5	3	1	7	4	9	5	5
LSD (0.05)	16	3	6	5	9	7	9	4

[a]Dikegulac sodium (Atrinal) in water (v:v).

Table 3. Effect of dikegulac sodium on flowering leafy spurge. (Lym and Messersmith).

Dikegulac sodium concentration (%)	Branches on shoots (No./plant)	Shoots from roots (No./plant)	New shoots from roots (weeks)				
			2	3	4	6	8
0.05	4	7	2	9	9	4	11
0.23	5	6	3	7	7	6	16
0.46	6	3	2	7	10	4	15
0.62	7	4	3	8	8	6	19
0.78	6	2	2	4	6	4	18
0	5	5	2	4	6	4	13
LSD(0.05)	4	6	3	5	7	5	7

[a]Dikegulac sodium (Atrinal) in water (v:v).

Table 4. Effect of dikegulac sodium in combination with picloram and 2,4-D as split or tank mix treatments on leafy spurge. (Lym and Messersmith).

Treatment	Rate	Injury		
		3 days	14 days	28 days
	(oz/A)			
Dikegulac sodium+picloram (split)	2+2	3	20	45
Dikegulac sodium+picloram (split)	4+2	8	20	35
Dikegulac sodium+picloram (split)	8+2	22	28	43
Dikegulac sodium+picloram (tank mix)	2+2	18	25	40
Dikegulac sodium+picloram (tank mix)	4+2	30	30	43
Dikegulac sodium+picloram (tank mix)	8+2	48	50	60
Picloram	2	13	18	30
LSD (0.05)	---	12	10	11
Dikegulac sodium+2,4-D (split)	2+8	38	25	38
Dikegulac sodium+2,4-D (split)	4+8	30	25	33
Dikegulac sodium+2,4-D (split)	8+8	48	33	30
Dikegulac sodium+2,4-D (tank mix)	2+8	75	73	78
Dikegulac sodium+2,4-D (tank mix)	4+8	78	75	88
Dikegulac sodium+2,4-D (tank mix)	8+8	48	40	50
2,4-D	8	15	20	20
LSD (0.05)	---	16	22	21

[a] Dikegulac sodium was applied 24 hours before herbicides with split treatments.