Postemergence control of anoda weed and hairy wandering jew in peanuts

S. R. Walker
Department of Primary Industries, Kingaroy 4610

Summary

The postemergence herbicides 2,4-D (0.125 kg ha^{-1}), dinoseb (1.1 kg ha^{-1}), bentazone (0.96 kg ha^{-1}), 2,4-DB (0.84 kg ha^{-1}), and MCPB (1.12 kg ha^{-1}) were evaluated on anoda weed *(Anoda cristata)*, and 2,4-D, dinoseb and bentazone on hairy wandering jew *(Commelina benghalensis)* at a range of growth stages. The herbicides were applied alone and in mixtures and the sensitivity of peanut crops in southern Queensland to these treatments was measured.

Bentazone controlled anoda weed at the 2½- and 3½-leaf stages. At the 5-leaf stage anoda weed was controlled by dinoseb + bentazone and dinoseb + bentazone + 2,4-D, but not by these herbicides applied alone. Dinoseb and 2,4-D controlled hairy wandering jew at the 2½-leaf stage, while bentazone was effective at the 2½- and 5-leaf stages. With both weeds herbicide effectiveness declined as weed size increased.

Dinoseb, bentazone and dinoseb + bentazone + 2,4-D had no effect on peanut yield or quality, although 2,4-D and dinoseb + bentazone affected peanut quality.

Introduction

Weeds pose potentially greater problems in peanuts than in most other crops because, apart from the competitive effects, uncontrolled weed growth can severely hinder and, in extreme cases, prevent harvest of peanuts (Rawson *et al*., 1972). Anoda weed *(Anoda cristata)* and hairy wandering jew *(Commelina benghalensis)* are common weeds in peanuts in southern Queensland and they are only partially controlled in commercial crops by the postemergence herbicides currently used by farmers — 2,4-DB, MCPB, dinoseb and 2,4-D, the latter being applied mainly as a tank-mix with dinoseb to increase the range of weeds controlled.

Research overseas has shown that mixtures of one or more of these herbicides have given better control of some weed species than any one of these herbicides applied alone (Gummesson, 1976; Lubigan and Mercado, 1977; McWhorter and Barrentine, 1979; and Oliver, Lambert and Mathis, 1976).

Bentazone became available just prior to the commencement of the trials and had not previously been evaluated for its effect on anoda weed and hairy wandering jew in Australia. Recently Chandler and Oliver (1979) showed that bentazone controlled anoda weed in the United States of America at the 1-leaf stage but was less effective at later growth stages.

The aim of these trials was to evaluate 2,4-D, dinoseb, bentazone, 2,4-DB, and MCPB alone and in mixtures for their effect on anoda weed, and 2,4-D, dinoseb and bentazone alone and in mixtures on hairy wandering jew, at a range of growth stages. The effects of these herbicide treatments on peanuts grown in weed-free conditions were measured in separate trials.

Materials and methods

Eight herbicide efficacy or peanut crop tolerance trials were conducted during the three seasons 1977–78 to 1979–80 within a 20 km radius of Kingaroy (latitude 26°35'S; longitude 151°50'E).

Herbicides were applied through flat fan nozzles with an Oxford Precision Sprayer at 200 kPa pressure in water volumes of 225 L ha^{-1} for Trials 1, 2, and 8 and 450 L ha^{-1} for Trials 3, 4, 5, 6 and 7. All sprayings were conducted at mid-morning under similar climatic conditions with maximum temperatures of spraying days ranging from 31°C to 36°C. Weeds and crops were actively growing at the time of spraying.

A randomized block design with three replications (Trials 1, 2, 3, 6, 7, and 8) or four replications (Trials 4 and 5) was used. Plot size was 2 m × 10 m (Trials 1 and 2) or 3.6 m × 10 m (Trials 3 to 8).

EFFICACY TRIALS

The herbicide treatments listed in Table 1 were applied to natural infestations of anoda weed in crop-free situations. In Trial 1 anoda weed population density was high (average 116 plants m^{-2}), and at spraying a majority of weeds had two true leaves fully expanded and a third leaf opening (2½-leaf stage). In Trial 2, where anoda weed population density was much lower (average 28 plants m^{-2}), treatments 2 to 12 were applied at the 3½-leaf stage and treatments 13 to 15 three days later at the 5-leaf stage.

Herbicide treatments listed in Table 2 were applied to natural infestations of hairy wandering jew growing in peanuts. Hairy wandering jew population density was low in Trial 3 (average 30 plants m^{-2}) and high in Trials 4 and 5 (average 248 plants m^{-2} in Trial 4). In Trial 3 weed size ranged from two to five true leaves, with a majority of weeds at the 2½-leaf stage. In Trial 4 all weeds were at the 2½-leaf stage, and in Trial 5 half the population was at the 2½-leaf stage and the remainder at the 5-leaf stage. In each trial the peanut crop did not restrict spray coverage of the weeds.

CROP TOLERANCE TRIALS

Herbicide treatments used in the efficacy trials were applied to weed-free Virginia Bunch peanut crops six weeks after planting in each of three years, when the peanuts were at the early flowering stage. Trials 6, 7, and 8 received 461, 326 and 475 mm of rainfall respectively from planting to harvest. The long-term average rainfall for Kingaroy for this period is 479 mm.

MEASUREMENTS

In the efficacy trials, plant density of anoda weed was measured from two 0.5 m^2 quadrats in each plot, plant density of hairy wandering jew from four 0.5 m^2 quadrats (Trial 3), and above ground fresh weight of hairy wandering jew from three 0.5 m^2 quadrats (Trials 4 and 5). These measurements were expressed as percentage control. In the analyses of variance of data from Trials 3 to 5, controls were not included as all other treatments were obviously superior.

In the tolerance trials, plots were rated for crop injury on a scale of 0 (no damage) to 100 (complete crop destruction) seven days after herbicide application. At crop maturity, the centre 1.8 m (two rows) by 8 m of each plot was harvested and the following traits were measured:

nut-in-shell yield (kg ha^{-1}) air dried to a uniform moisture,

percentage edible kernel,
percentage oil kernel, and
crop value ($ ha $^{-1}$)

Percentage edible and oil kernel were determined from a 1 kilogram sample which was shelled and the kernels sieved using a 7.9 mm diameter round-hole screen. The edible kernel remained on the screen and the oil kernel passed through the screen.

Crop value was computed from the formula which is used by the Peanut Marketing Board:

$$C = \frac{Y(Q + F.A.Q.)}{100}$$

where C is crop value, Y is nut-in-shell yield, Q is quality bonus (cents kg^{-1}), and assuming a base payment (F.A.Q.) of 44 cents kg^{-1} in 1977–78, 40 cents kg^{-1} in 1978–79, and 38 cents kg^{-1} in 1979–80.

Quality bonus was calculated from:

$$Q = 0.8\,(X - 56) + 0.25\,(Z - 13)$$

where X is percentage edible kernel and Z is percentage oil kernel.

Table 1 Effect of herbicides on the density of anoda weed expressed as percentage control

Treatment			Trial 1		Trial 2	
No.	Herbicide	Rate (kg ha^{-1} a.i.)	Leaf stage	Control (%)	Leaf stage	Control (%)
1.	Untreated	—	—	0	—	0
2.	2,4-D	0.125	2½	5	3½	0
3.	Dinoseb	1.1	2½	70	3½	19
4.	Bentazone	0.96	2½	98	3½	95
5.	2,4-DB	0.84	2½	40	3½	17
6.	MCPB	1.12	2½	47	3½	0
7.	2,4-D + dinoseb	0.125 + 1.1	2½	65	3½	12
8.	2,4-D + bentazone	0.125 + 0.96	2½	100	3½	100
9.	Dinoseb + bentazone	1.1 + 0.96	2½	100	3½	88
10.	2,4-D + dinoseb + bentazone	0.125 + 1.1 + 0.96	2½	100	3½	86
11.	2,4-DB + dinoseb	0.84 + 1.1	2½	76	3½	48
12.	MCPB + dinoseb	1.12 + 1.1	2½	86	3½	43
13.	Bentazone	0.96	—	—	5	5
14.	Bentazone + dinoseb	0.96 + 1.1	—	—	5	95
15.	2,4-D + dinoseb + bentazone	0.125 + 1.1 + 0.96	—	—	5	95
LSD P = 0.05						
for comparisons with untreated				25		25
for all other comparisons				29		30

Note: Densities in untreated plots were 116 and 28 plants m^{-2} in Trial 1 and Trial 2 respectively.

Results

EFFICACY TRIALS

Trial 1 All treatments except 2,4-D reduced anoda weed density (Table 1). Of the herbicides applied alone, bentazone was the most effective with 98% control of anoda weed at the 2½-leaf stage. Dinoseb gave 70% control and the addition of 2,4-D, MCPB or 2,4-DB to dinoseb did not improve the control of anoda weed.

Trial 2 When applied to anoda weed at the 3½-leaf stage, bentazone, all mixtures with bentazone, 2,4-DB + dinoseb, and MCPB + dinoseb reduced the weed density. There was a trend towards better control with 2,4-DB + dinoseb and MCPB + dinoseb than with any of these herbicides applied alone. There was less control of anoda weed with herbicide treatments in Trial 2 than in Trial 1 except for bentazone and mixtures with bentazone.

When applied at the 5-leaf stage, bentazone alone did not reduce the weed density, whereas the mixtures with bentazone did. Effectiveness of bentazone reduced from 95% at the 3½-leaf stage to 5% at the 5-leaf stage, although control with mixtures involving bentazone remained unchanged with this increase in weed size.

Table 2 Effect of herbicides on the density or fresh weight of hairy wandering jew expressed as percentage control

Treatment		Control (%)		
Herbicide	Rate (kg ha^{-1} a.i.)	Trial 3 2½- to 5-leaf stage	Trial 4 2½-leaf stage	Trial 5 2½- to 5-leaf stage
Untreated	—	0	0	0
2,4-D	0.125	89	92	63
Dinoseb	1.1	80	100	67
Bentazone	0.96	91	95	100
2,4-D + dinoseb	0.125 + 1.1	94	99	89
2,4-D + bentazone	0.125 + 0.96	97	98	100
Dinoseb + bentazone	1.1 + 0.96	92	100	100
2,4-D + dinoseb + bentazone	0.125 + 1.1 + 0.96	98	100	99
LSD P = 0.05[1]		ns[2]	ns	16

Note: Density (Trial 3) and fresh weights (Trial 4 and 5) in untreated plots were 30 plants m^{-2}, 1911 g m^{-2} and 276 g m^{-2} respectively.

[1] For comparisons other than with untreated.
[2] Not significant.

Trials 3 and 4 All treatments were equally effective in producing good control of hairy wandering jew in both trials (Table 2).

Trial 5 All treatments reduced the fresh weight of hairy wandering jew, but 2,4-D and dinoseb were not as effective as the other treatments. The mixture of 2,4-D + dinoseb gave better control of hairy wandering jew than either 2,4-D or dinoseb applied alone.

Weeds in this trial varied from the 2½- to 5-leaf stage. The 2,4-D and dinoseb treatments controlled the smaller weeds but only scorched the leaves of the larger weeds, whereas the mixture of 2,4-D + dinoseb controlled the smaller weeds and some of the larger weeds. Bentazone and mixtures with bentazone controlled all weeds present. Similar responses occurred in Trial 3.

CROP TOLERANCE TRIALS

Trials 6, 7 and 8 When applied alone, 2,4-D, 2,4-DB and MCPB caused the most crop injury, although this was less evident in Trial 8 (Table 3). However, in Trials 6 and 7, when these herbicides were used in mixtures, there was less effect on the crop. Bentazone caused no crop injury in the three trials. In Trial 8, dinoseb caused some injury and the mixtures dinoseb + bentazone, 2,4-D + dinoseb + bentazone, and MCPB + dinoseb produced more crop damage than any one of these herbicides.

Although the peanut crop suffered initial setback from most treatments, it subsequently recovered and only the mixture 2,4-D + bentazone in Trial 6 yielded significantly less than the control, although quality was sometimes affected. The percentage edible kernel decreased and the percentage oil kernel increased using 2,4-D, 2,4-DB, and dinoseb + bentazone in Trial 6, while 2,4-D and MCPB increased the percentage oil kernel in Trial 7. The crop value (which takes into account yield and percentage edible and oil kernel) was reduced only by 2,4-D and 2,4-D + bentazone in Trial 6.

Discussion

The results demonstrate that anoda weed and hairy wandering jew can be controlled in peanuts with postemergence herbicides. Anoda weed at the 2½- and 3½-leaf stages was controlled by bentazone which can be applied safely to six-week-old peanuts. No other herbicide effectively controlled anoda weed at these growth stages. Hairy wandering jew at the 2½-leaf stage was controlled by dinoseb and by bentazone, whereas only bentazone was effective at the 5-leaf stage. 2,4-D also controlled small hairy wandering jew but adversely affected the quality of peanuts.

Mixtures were as effective as or sometimes better than the best component in controlling weeds, but there appeared to be an antagonistic effect of mixing other herbicides with 2,4-D, 2,4-DB and MCPB as shown by crop injury ratings. Use of mixtures for increased weed control was not necessary except on anoda weed at the 5-leaf stage, when it was effectively controlled by dinoseb + bentazone and dinoseb + bentazone + 2,4-D but not by these herbicides applied alone. As dinoseb + bentazone reduced peanut quality, the latter mixture would be preferable.

Proper timing of postemergence herbicide application was necessary for effective weed control. Control of anoda weed by bentazone decreased from 95% at the 3½-leaf stage to 5% at the 5-leaf stage. These results support those of Chandler and Oliver (1979) who reported that control with bentazone decreased from 98% at the 1-leaf stage to 75% and 25% at the 3- and 5-leaf stages respectively. There was less control of anoda weed with most treatments in Trial 2 than in Trial 1, which may reflect differences in weed size between the two trials. A similar reduction in control of hairy wandering jew by dinoseb and 2,4-D was experienced as weed size increased from the 2½- to 5-leaf stage. These reductions in herbicide effectiveness with increased weed size

Table 3 Effect of herbicides on weed-free peanuts

Treatment: Herbicide	Rate ($kg\ ha^{-1}$ a.i.)	Crop injury rating[1] 0 - 100 Scale: Trial 6	Trial 7	Trial 8	Nut-in-shell yield ($kg\ ha^{-1}$): Trial 6	Trial 7	Trial 8	Percentage edible kernel: Trial 6	Trial 7	Trial 8	Percentage oil kernel: Trial 6	Trial 7	Trial 8	Crop value ($\$\ ha^{-1}$): Trial 6	Trial 7	Trial 8
Untreated	—	0	0	0	2719	2222	2473	59.3	67.1	49.8	7.4	6.2	15.0	1241	1049	831
2,4-D	0.125	30.0	36.7	20.0	2421	2399	2377	55.1[2]	64.8	51.5	10.1[2]	8.5[2]	13.7	1033[2]	1101	822
Dinoseb	1.1	3.3	0	10.0	2525	2295	2509	56.6	65.9	51.9	9.3	5.7	14.3	1097	1060	881
Bentazone	0.96	0	0	0	2826	2174	2308	58.5	65.6	50.6	8.3	7.2	16.0	1266	1004	794
2,4-DB	0.84	23.3	26.7	10.0	2475	2396	2553	55.7[2]	67.2	51.2	9.8[2]	6.6	15.5	1066	1084	888
MCPB	1.12	30.0	16.7	10.0	2498	1906	2463	57.9	65.9	51.8	8.3	7.8[2]	14.5	1108	884	862
2,4-D + dinoseb	0.125 + 1.1	11.7	10.0	10.0	2512	2649	2366	60.0	66.1	50.9	7.5	6.1	14.7	1152	1245	812
2,4-D + bentazone	0.125 + 0.96	16.7	26.7	10.0	2282[2]	2260	2738	60.1	66.3	53.2	7.2	7.1	13.5	1047[2]	1066	983
Dinoseb + bentazone	1.1 + 0.96	6.7	0	20.0	2664	2497	2252	55.4[2]	66.5	49.7	9.6[2]	6.3	14.6	1137	1157	750
2,4-D + dinoseb + bentazone	0.125 + 1.1 + 0.96	16.7	10.0	26.7	2769	2326	2472	59.8	67.9	52.5	7.9	6.6	14.2	1266	1110	878
2,4-DB + dinoseb	0.84 + 1.1	15.0	0	13.3	2840	2260	2579	58.2	66.1	50.8	7.8	7.3	15.1	1268	1050	885
MCPB + dinoseb	1.12 + 1.1	16.7	0	23.3	2850	2278	2366	57.7	66.8	51.6	8.4	7.0	14.3	1258	1083	823
LSD P = 0.05																
for comparisons with untreated		6.9	5.8	5.0	416	ns[3]	ns	3.3	ns	ns	2.0	1.3	ns	186	ns	ns
for all other comparisons		6.9	5.8	5.0	481	ns	ns	3.8	ns	ns	2.3	1.5	ns	214	ns	ns

[1] Rating scale of 0 (no damage) to 100 (complete crop destruction).

[2] These values are significantly different to untreated for yield, percentage edible and oil kernel, and crop value.

[3] Not significant.

necessitate early application of postemergence herbicides to anoda weed and hairy wandering jew for worthwhile control.

Acknowledgements

I am grateful to Mr G. R. Harch for technical assistance and to my colleagues in the Queensland Department of Primary Industries for their advice.

References

Chandler, J.M. and Oliver, L.R. (1979). Spurred Anoda — A potential weed in southern crops. *Science and Education Administration, Agricultural Reviews and Manuals, Southern Series, No. 2.*

Gummesson, G. (1976). Weed control in peas and field beans. Weeds and weed control. *Proceedings of the 17th Swedish Weed Conference* **17**:66–9.

Lubigan, R.T., and Mercado, B.L. (1977). Chemical control of *Scirpus maritimus* and mixed *S. maritimus-Echinochloa crus-galli* populations in lowland transplanted rice. *Philippine Agriculturist* **60**:280–4.

McWhorter, C.G. and Barrentine, W.L. (1979). Weed control in soybeans *(Glycine max)* with mefluidide applied postemergence. *Weed Science* **27**:42–7.

Oliver, L.R., Lambert, W.M. and Mathis, W.D. (1976). Overtop herbicide applications for cocklebur control in soybean. *Proceedings 29th Annual Meeting Southern Weed Science Society* **29**:96–102.

Rawson, J.E., Langford, S., Saint-Smith, J.H., Colbran, R.C. and McCarthy, G.J.P. (1972). Peanut growing. *Queensland Agricultural Journal* **98**:506–12.

REVIEWS

Perspectives and priorities in weed research and control

The First Council of Australian Weed Science Societies Oration, given at the Seventh Conference of the Asian-Pacific Weed Science Society, Sydney, 1979.

S. L. Everist
Consultant Botanist, Corinda, Queensland 4075

In their challenging preface to *The World's Worst Weeds*, Holm, Plucknett, Pancho and Herberger (1977) questioned the priorities of a world that can put man on the moon but cannot feed all its people. They suggested that this situation may have arisen because weeds have always been rather casually accepted as an inevitable nuisance whereas the knowledge needed to construct and operate enormous buildings, supersonic aircraft and space vehicles has been developed comparatively recently. We build these things, not because we really need them but because we have the technology to do so.

Furthermore, many millions of dollars are spent on research into the biology and control of a few species of weeds of secondary importance for world food production but several of the world's most destructive weeds cannot be controlled in many of the crops where they are found. They asked bluntly 'Have weed scientists got their priorities right?'

From the distant hill of retirement, I make bold to take up this challenge, to look at weed problems in perspective and to make some personal comments on priorities. I have no new facts to offer and most of the points I shall make have been made before. I do not expect everyone to agree with what I say but perhaps I may leave you with some food for thought.

My comments are based on the concept that without man there are no weeds — they are merely plants. Just as beauty is in the eye of the beholder, so our perception of a plant as a weed depends on our point of view.

In 1608, William Shakespeare described in poetic terms the fate of neglected farm land and the impact of weeds (*King Henry the Fifth*, Act V, Scene II). Describing the state of France after years of war, the Duke of Burgundy lamented

> And all her husbandry doth lie on heaps,
> Corrupting in its own fertility.
> .... her fallow leas
> The darnel, hemlock and rank fumitory,
> Doth root upon, while that the coulter rusts
> That should deracinate such savagery;
> The even mead, ...
> Wanting the scythe, all uncorrected, rank,
> Conceives by idleness and nothing teems
> But hateful docks, rough thistles, kecksies, burrs,
> Losing both beauty and utility.

Plants become weeds only when they affect man's activities by restricting the quantity or quality of food, fibre or industrial materials he grows for his use, by affecting his health or by offending him in some other way.

Virtually all aspects of weed research, management and control are influenced by this concept. If we forget it or ignore it, we may either fail