TOLERANCE OF SOME WINTER CEREAL, LEGUME AND OILSEED CROPS TO PRE-SOWING APPLICATIONS OF DICAMBA

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Summary. Studies of crop and variety tolerance of pre-sowing applications of dicamba were conducted at Turretfield, South Australia, to determine the minimum safe period between application and sowing in minimum tillage systems.

Dicamba at the commonly used pre-sowing rate of 0.14 kg ha^{-1} did not damage winter cereal crops. Rates up to 0.28 kg ha^{-1} were safe at 3 days pre-sowing, and 0.56 kg ha^{-1} was safe after 7 days.

Linseed (*Linum usitatissimum*) and safflower (*Carthamus tinctorious*) were tolerant to dicamba at rates up to 0.56 kg ha^{-1} at 5 weeks pre-sowing. At 4 weeks pre-sowing, safflower was tolerant to 0.14 kg ha^{-1}, and rape (*Brassica napus* var. *napus*), chick peas (*Cicer arietinum*) and field pea (*Pisum sativum*) were tolerant to 0.56 kg ha^{-1}.

INTRODUCTION

Over the past three years, Australia has witnessed a wide spreading acceptance of conservation tillage systems by the farming community. This has led to an increase in the use of herbicides in place of tillage, either through opportunity applications or planned reduced tillage.

Dicamba can be used for broadleaf weed control in reduced tillage systems and is currently registered for the control of clover in direct drill and minimum tillage. A limitation to this use pattern may be the minimum safe period before a crop can be planted (known in the U.S.A. as the plant back period). Crop and variety would be the primary determinants of minimum safe period for a specified rate of application of dicamba. The period would vary with the soil and climatic factors which influence the degradation of dicamba.

The main mechanism of detoxification of dicamba in the soil is by microbial activity (Burnside and Lavy 1966; Chirchrillo 1968). Altom and Stritzke (1973) found in controlled environment conditions, that the half life of dicamba varied in three soils from 17 to 32 days with an average of 25 days. Dicamba is most rapidly detoxified at pH 5.3 whereas minimal detoxification rates occur at pH 7.5 (Corbin and Upchurch 1967).

With these factors in mind the following experiment was designed to evaluate the tolerance of a range of crops and varieties to pre-sowing applications of dicamba.

MATERIALS AND METHODS

The trial site was selected for its uniformity in soil type (relatively level with a gentle slope to the south). In Experiment 1, the soil was classified as a clay-loam of pH 6.8 to 7.0. The soil type in Experiment 2 was classified as a silty loam of pH 7.9 to 8.0.

Trial design was simple to allow for ease of visual assessments and harvesting. Each winter cereal cultivar was sown in a strip 2 m wide by 65 m long, with a 0.67 m space between cultivars. Each oilseed and legume cultivar was sown in a strip 1.5 m wide by 86 m long with a 1 m space between cultivars. Treatments were applied across the crop rows in a strip 2 m wide; that is, plot size was 2 by 2 m for winter cereals and 2 by 1.5 m for oilseed and legume crops. Within each cultivar a 1 m buffer area was left between each plot. The first plot of each cultivar and thereafter every seventh plot was left as an untreated control. Each block of six plots was treated at the one time with two replicates of three rates.

Dicamba was applied using a boom sprayer with Spraying System T-jet 80015 nozzles in a volume of 150 L ha^{-1} at a pressure of 195 kPa.

Experiment 1. As winter cereals are generally tolerant of dicamba, only application intervals of 3, 7 and 14 days pre-sowing were studied. Crop varieties were sown on June 26, 1980 and were: Wheat - Condor, WR 24/43, Kite, Millewa, Warimba, Warigal, Halbred, Oxley, Egret, Festiqay, Lance, Olympic, RAC 311, MKR 122/16, Zenith; Barley - Weeah, Clipper, WI 2231, WI 2468, Dampier, Parwan, Shannon; Oats - Stout, Saia, N.Z. Cape, Cassia, 69-19-2, Avon, Swan, Coolabah, Moore, West.

Blocks treated at 3 and 7 days pre-sowing received one cultivation more than the 14 days pre-sowing application of dicamba to control an emergence of weeds.

Experiment 2. Legumes and oilseed crops are generally sensitive to dicamba so periods up to 4 weeks between application and sowing were considered for assessment. Planting was delayed by rain to July 10, 1980, with 4, 5, 7 and 8 weeks pre-sowing intervals being the result.

The legume and oilseed crops and varieties sown were: Field Peas - Early Dun, Dundale and Derrimut; Chick Peas - Line 5008 and Line 56318; Rape - Wesreo, Midas, Wesway; Linseed - Glenelg, and Safflower - Gila. An area of 1.9 m^2 per plot was harvested using a Hege harvester.

RESULTS

Experiment 1. (*Winter Cereals*): Heavy rain immediately following the sowing of the cereals washed some top soil in the middle of the experiment, particularly in the wheat and barley cultivars. To offset the effect of this, results were compared with a yield curve of the control plots. The variations of the treated crops from the control curve are shown in Table 1.

Table 1. Yields of winter cereals treated pre-sowing with dicamba.

Days pre-sowing	Dicamba (kg ha^{-1})	Average control yield (kg ha^{-1}) and treatment effects relative to the control (%) Crop: Wheat	Barley	Oats
14	0	2403	3684	2680
	.14	- 6.5	+ 8.5	- 2.2
	.28	+ 2.0	+14.5	- 1.2
	.56	+ 5.4	+10.9	+ 1.4
7	0	2152	3490	2605
	.14	+ 2.7	+ 2.1	+ 4.8
	.28	+ 3.0	- 2.0	+ 3.5
	.56	- 5.0	+ 0.2	+ 2.9
3	0	2172	4011	2565
	.14	+ 3.6	- 2.7	- 3.5
	.28	+ 6.3	+ 0.8	- 5.0
	.56	- 5.7 *[1]	- 4.0	- 8.2

[1] Significant yield reduction at P = 0.05.

At the pre-sowing application intervals tested (3, 7 and 14 days), yields of barley and oats were not significantly affected by rates of dicamba up to 0.56 kg ha^{-1}.

Wheat yield was reduced by dicamba applied at 0.56 kg ha^{-1} 3 days pre-sowing (Table 1); this was the only significant effect of dicamba on winter cereals. A slight thinning of wheat and a lesser thinning in barley and oats was noted in visual observations made throughout the experiment. There were no significant differences between cultivars in their tolerance of dicamba.

Experiment 2. (*Legumes and Oilseeds*): The season was dry during August/September with heavy rains during October. These factors predisposed the experiment to variability. Yields are given in Table 2.

Linseed. At 4 weeks pre-sowing, dicamba at all rates significantly reduced yields compared with the untreated control yield. These yield reductions were anticipated from visual observations throughout the growing season. Dicamba did not affect linseed at other application times.

Safflower. Significant reductions in yield were caused by dicamba at 0.28 and 0.56 kg ha^{-1} applied at 4 weeks pre-sowing. There were no other effects of dicamba.

Table 2. Yield of winter legume and oilseed crops treated pre-sowing with dicamba.

Weeks pre-sow	Dicamba (kg ha^{-1})	Grain yield (kg ha^{-1})				
		Linseed	Safflower	Rape	Field peas	Chick peas
8	0	358	2158	1305	1372	1337
	0.14	353	2537	1004	1540	1408
	0.28	458	2679	1351	2091	1853
	0.56	521	2800	1646	2014	1492
7	0	558	2442	1528	1396	1589
	0.14	453	2021	1605	1779	1703
	0.28	684	2742	1672	1735	1750
	0.56	753	2453	1642	1532	2008
5	0	495	2616	1628	1702	1734
	0.14	553	1968	1502	1795	1732
	0.28	311	2205	1602	1782	1868
	0.56	384	2095	1570	1847	2126
4	0	516	2674	1723	1609	1658
	0.14	174 ***[1]	2242	1661	1389	1905
	0.28	242 **	1816 *	1604	1242	1547
	0.56	158 ***	1579 **	1684	1014	1847

[1] Significant yield reduction at P = 0.05 (*), P = 0.01 (**) or P = 0.001 (***).

Rape. The tolerance of rape to pre-sowing applications of dicamba was excellent. Dicamba had no effects on yields. This corresponded with visual observations.

Field Peas. Visual observations showed crop deformity from dicamba at 0.56 kg ha^{-1} when applied 4, 5 and 7 weeks pre-sowing. Yields from the 4 week pre-sowing applications decreased with increasing rate of dicamba, but the differences were not significant.

Chick Peas. Seasonal conditions favoured chick peas and the growth of both cultivars was even and satisfactory throughout. The application of dicamba pre-sowing was not detrimental (Table 2).

DISCUSSION

This work indicated that winter cereals can be sown as early as 3 days after an application of dicamba at up to 0.28 kg ha^{-1}. When dicamba at 0.56 kg ha^{-1} is used, the minimum safe period for wheat was shown to be 7 days. The adoption of this period for similar applications in barley and oats would be prudent although this work shows 3 days to be safe for dicamba at 0.56 kg ha^{-1}.

In safflowers, 4 weeks was the minimum safe period for dicamba at 0.14 kg ha^{-1} only. Rates up to 0.56 kg ha^{-1} were safe at 5 weeks pre-sowing.

The minimum safe period for dicamba applied pre-sowing to linseed was 5 weeks for rates up to 0.56 kg ha^{-1}.

Rape, chick peas and field peas showed no significant differences in

yield from dicamba at up to 0.56 kg ha^{-1} applied 4 weeks pre-sowing. As this 4 week period was the minimum interval between treatment and sowing, the minimum safe period for these three crops has yet to be established. Yield data (Table 2) suggests that rape and chick peas in particular may tolerate much reduced intervals between treatment and sowing.

These experiments have established guidelines for defining the minimum safe period when dicamba is used pre-sowing. Further work will establish recommendations for this useage pattern. Consideration also is required for the tolerance of crops to the sequential application of dicamba, pre-sowing and post-emergence.

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