Dicamba is a selective herbicide used for post-emergence weed control in a number of agricultural crops, including barley, canary grass, fescue, oats, rye, wheat, corn, and sorghum (Alberta Agriculture 1989). Target weeds include buckwheat, cleavers, cow cockle, lady’s-thumb, corn spurry, smartweeds, bindweed, ragwort, goldenrod, thistles, knapweed, poverty weed, pasture sage, sheep sorrel, and spurge. It is also used for brush control in pastures, rangeland, forest lands, roadsides, railways, and utility rights-of-way and in turf to control the growth of broadleaf weeds, brush, and vines (OMAF 1989).

Dicamba has low persistence, with a mean half-life of approximately 25 d (Altom and Stritzke 1973). Dicamba dissipation depends on the application rate, soil moisture content, temperature, organic matter content, and type of soil (Burnside and Lavy 1966; Nash 1989). It has a low affinity for most soil types and the potential to be highly mobile in soils, with greater mobility evident at higher pH (Grover 1977; Murray and Hall 1989). Low soil–water partition coefficients ($K_d$) for dicamba ($0–0.11 \text{ mL g}^{-1}$), coupled with a high water solubility, give dicamba the potential to leach through agricultural soils and contaminate groundwater sources (Grover 1977; Rao and Davidson 1980). Microbial degradation appears to be the most important process controlling the fate of dicamba in agricultural soils (Smith 1973, 1974; Krueger et al. 1989). Suitable conditions of pH, temperature, soil moisture, percent organic matter, and soil composition that promote microbial growth in soil generally favour herbicide dissipation (Torstensson 1988) and have been reported to favour dicamba degradation in soil (Krueger et al. 1989). Photodegradation, hydrolysis, and volatilization appear to be relatively minor routes of dicamba degradation in soils (Scifres et al. 1973; Chau and Thompson 1978).

For more information on the use, environmental concentrations, and chemical properties of dicamba, see the fact sheet on dicamba in Chapter 4 of *Canadian Environmental Quality Guidelines*.

**Water Quality Guideline Derivation**

The Canadian water quality guidelines for dicamba for the protection of agricultural water uses were developed based on the CCME protocol (CCME 1993a).

**Irrigation Water**

Data exist for each of the three principal groups of nontarget crops that are irrigated in Canada: cereals, tame hay, and pastures; legumes; and other crop species. Cereal crops were relatively resistant to dicamba. In wheat, a NOEAR of 0 and a LOEAR of 0.12 kg ha$^{-1}$ a.i. per year were reported, based on an increase in deformed wheat plant heads (Ivany and Nass 1984). In the legume group, the soybean NOEAR and LOEAR were 0 and 0.011 kg ha$^{-1}$ a.i., respectively, based on a decrease in total yield (Auch and Arnold 1978). Of the “other crop species” tested, sunflowers were the most sensitive, with a NOEAR and LOEAR of 0.0004 and 0.0008 kg ha$^{-1}$ a.i., respectively, based on significant decreases (20 and 42%) in the dry weight of seedlings (Derksen 1989).

The geometric means of the LOEAR and the NOEAR for the three principal groups were divided by an uncertainty factor of 10 to determine the acceptable application rate (AAR). The AARs are then divided by the approximate Canadian annual irrigation rate of 10$^7$ L ha$^{-1}$ per year to calculate the SMATC. The resulting SMATCs were adopted as the guideline for that crop group, namely 0.6 µg L$^{-1}$ for cereals, tame hays and pastures, 0.06 µg L$^{-1}$ for legumes, and 0.006 µg L$^{-1}$ for other crops. The lowest value of 0.006 µg L$^{-1}$ is recommended as the overall Canadian water quality guideline for irrigation (CCME 1993b). Since this guideline is at the lowest detection limit of dicamba in water (0.01 µg L$^{-1}$), it should be considered in conjunction with a site-specific evaluation until better analytical detection methods are developed.

**Livestock Water**

Dicamba is readily absorbed, only partially metabolized, and rapidly excreted by mammals (Makary et al. 1986).

**Table 1. Water quality guidelines for dicamba for the protection of agricultural water uses (CCME 1993b).**

<table>
<thead>
<tr>
<th>Use</th>
<th>Guideline value (µg L$^{-1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation water</td>
<td>0.006</td>
</tr>
<tr>
<td>Livestock water</td>
<td>122</td>
</tr>
</tbody>
</table>

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Dicamba does not bioaccumulate to an appreciable extent in animals according to the data available (St. John and Lisk 1969; Oehler and Ivie 1980).

Dicamba is low to moderately toxic to mammals and birds. Acute oral toxicities of dicamba to mammals indicate that sensitivities are similar across taxonomic groups (Worthing and Hance 1991). Acute oral LD₅₀ₐₙₜₕ for mice, guinea pigs, and rabbits ranged from 566 to >4600 mg·kg⁻¹ (Hayes 1982; USDE 1983). Acute oral LD₅₀₈ of dicamba in birds ranged from 673 mg·kg⁻¹ in female pheasants (Pimental 1971) to >10 000 mg·kg⁻¹ in mallard ducks and bobwhite quail (Ghassemi et al. 1981).

Rabbits were more sensitive to the developmental effects of dicamba than any other mammalian or avian species. Reduced fetal body weights and post-implantation losses of dicamba than any other mammalian or avian species. Reduced fetal body weights and post-implantation losses of dicamba than any other mammalian or avian species. Reduced fetal body weights and post-implantation losses of dicamba than any other mammalian or avian species. Reduced fetal body weights and post-implantation losses of dicamba than any other mammalian or avian species.

Reduced fetal body weights and post-implantation losses of dicamba than any other mammalian or avian species.

References


Derksen, D.A. 1989. Dicamba, chlorosulfuron, and clopyralid as sprayer contaminants on sunflower (Helianthus annuus), mustard (Brassica juncea), and lentil (Lens culinaris), respectively. Weed Sci. 37:616–621.


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