Efficiency of Triallate on Different Soil Types and Conditions. Robert Ingratta[1] and Terry Tollefson[2]

Chemical control of wild oats has increased dramatically over the past few years. However, the history of selective weed control with carbamates dates back to 1945 when IPC was initially tested. By 1950, over 100 different carbamates had been evaluated and thiocarbamates were being tested. In 1957, Monsanto introduced Canada to a new thiocarbamate herbicide, Avadex, and in 1961 Avadex BW was introduced.

Since 1961, a considerable amount of research has been done on Avadex (diallate) and Avadex BW (triallate), and the research continues. This paper was designed to summarize the current knowledge of Avadex BW and the factors which affect its efficacy in the field. The factors which will be considered are soil type, organic matter, soil moisture, pH, and salt levels.

Avadex BW (triallate) is a pre-emergent herbicide applied pre-plant incorporated in the spring to barley, flax, rapeseed, mustard, sugarbeets, and dry peas; and, post-plant incorporated to spring wheat and durum wheat. In the fall, it can be applied to all of the above crops as a pre-plant treatment. It is formulated as a liquid or granule.

Avadex BW is mainly absorbed as a vapor by emerging coleoptiles of grasses and is most toxic during cell division. The adsorption of Avadex BW to soil colloids and its low solubility limits the amount of leaching. It tends to persist in the soil for 6-8 weeks under normal prairie conditions.

Since Avadex BW is a soil-incorporated herbicide, the soil medium will be instrumental in effecting its efficacy and persistence. Smith (1974) at Regina studied three different Saskatchewan soil types and determined the effect of soil type on persistence of several herbicides. The soil types tested are listed in the table below:

	% Composition					
Soil Type	Clay	Silt	Sand	Organic Content	pH	Field Capacity Moisture %
Melfort Silty Clay	30	38	32	11.7	5.2	36
Regina Heavy Clay	69	26	5	4.2	7.7	40
Jameson Sandy Loam	6	9	85	3.2	7.5	11

Triallate was applied at 1.7 kg/ha in May, 1972, and residues from the top 5 cm of field plots were evaluated as listed in the following table:

	% of Triallate Remaining		
Soil Type	Oct./72	May/73	Oct./73
Melfort Silty Clay	35 $\pm$ 3	25 $\pm$ 4	12 $\pm$ 4
Regina Heavy Clay	18 $\pm$ 2	16 $\pm$ 1	12 $\pm$ 3
Jameson Sandy Loam	14 $\pm$ 3	7 $\pm$ 2	0

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Smith noted a higher residue in the Melfort silty clay and correlated this residue to a higher organic matter content. He concluded that organic matter was more important than clay content.

The importance of organic matter was substantiated by other workers. Holroyd (1964) indicated that organic matter was more important than mineral or soil texture with regard to adsorption. Banting (1967) found that the activity of Avadex BW was reduced when the percentage of organic matter in the soil was increased from 4-12%. He noted that Avadex activity appeared to be independent of clay content. Since Avadex and Avadex BW are closely associated thiocarbamates, we can assume similar results would be found with Avadex BW. Thus, an increase in organic matter may result in decreased activity due to a greater adsorption of Avadex BW and less availability for wild oat control. This concurs with our label in which we recommend a higher rate of Avadex BW under deep black soils of higher organic matter.

Another important factor affecting Avadex BW efficacy is soil moisture. Soil moisture will affect the amount of leaching, volatilization and ultimate activity of Avadex BW.

Banting (1967) observed wild oat control with Avadex at 15% moisture in Regina heavy clay soil. He indicated that 15% moisture is 5% below the wilting point of Regina clay. Thus, Avadex BW activity can be found at very low moisture levels; however, increased activity will occur at higher moisture levels. Miller and Nalewaja (1976) noted that Avadex BW efficacy increased with increasing soil moisture content and increasing temperature due to increased volatility. Under higher moisture levels, there may be competition between H^+ ions and Avadex BW for adsorptive sites on soil colloids. Thus, higher moisture and temperature would result in more Avadex BW in the soil solution and more Avadex BW available for volatilization and uptake by wild oats.

Avadex BW does not leach to any appreciable amount since it is relatively insoluble in water--4 ppm at 25°C. Smith (1969) reported only 5 to 7% and 12 to 13% Avadex BW leached from Weyburn loam and Regina Clay respectively when 22.9 cm of water was applied in column.

The effect of soil pH upon Avadex BW adsorption is still under some dispute. Grover (1974) concluded that soil pH would have little influence upon the sorption of Avadex BW to soil colloids. Similarly, Jordon and Day (1962) concluded that sorption of EPTC (a thiocarbamate) was not influenced by pH. However, Corbin et.al. (1971) found vernolate (a thiocarbamate) was more active at pH 4.3 than at pH 7.5, but they were unable to determine if the pH effect was due to differential sorption or differential degradation of vernolate by microorganisms.

Corbin and Upchurch (1967) indicated that soil pH may directly or indirectly influence detoxification of herbicides by causing dissociation of the herbicide into ionic moieties and by affecting the inherent capacity of microbes to detoxify a given chemical. Since bacteria detoxify vernolate and a pH of 7.5 is most suitable for bacteria, less activity of vernolate was observed at pH 7.5 due to maximum microbial breakdown.

If we assume that vernolate and Avadex BW respond similarly since they both are thiocarbamates, then maximum activity for Avadex BW would be observed at low pH's. Under these conditions, crop injury may occur since the crop would also be under stress at this pH.

Salt concentrations may also affect Avadex BW activity. McGregor (1976) found that the addition of Ca^{+2} as $CaCl_2$ or $Ca(OH)_2$ at 1 m.e. per 100 g. to a Scott acidic soil resulted in increased Avadex BW efficacy in growth chambers. The addition of electrophilic ions, such as Ca^{+2}, may compete with Avadex BW for adsorptive sites on the soil colloids, resulting in more Avadex BW available in the soil solution for wild oat uptake. This may be similar to the effect of H^{+} ions competing with Avadex BW for adsorptive sites under high moisture conditions.

There are other factors which may affect Avadex BW efficacy, however, time does not permit a discussion of every factor; therefore, the major factors have been considered. An important summation is that although the factors listed do affect Avadex BW, there is also an inter-relationship of the factors themselves which will ultimately control the activity of a soil-applied herbicide such as Avadex BW.

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