



Weed control in alfalfa (*Medicago sativa* L.) grown for seed  
by Mark Edward Stannard

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in  
Agronomy  
Montana State University  
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**Abstract:**

Hexazinone is a broad spectrum herbicide that was popular with the alfalfa (*Medicago sativa* L.) seed producers in Montana. Although hexazinone was a valuable herbicide, there were frequent reports of alfalfa injury from 1982 to 1984. Several factors were investigated to determine possible causes of injury. Three factors implicated in most cases were low soil organic matter, application of hexazinone to nondormant alfalfa, and application of hexazinone to alfalfa which endures stress conditions later that growing season.

Alfalfa seedlings are very sensitive to soil residues of chlorsulfuron. Approximately 20 million alfalfa seeds were sown into soil previously treated with 35 g ai/ha. chlorsulfuron. This mass selection technique produced 15 healthy alfalfa plants each representing a line. Each line was cloned and tested for tolerance to chlorsulfuron applied as a foliar spray and as a soil drench. Seven lines were tolerant to foliar application and six were tolerant to soil drench. Acetolactate synthase from two lines was more tolerant to chlorsulfuron than control lines.

A weed survey was conducted in 36 and 23 certified alfalfa seed production fields in 1985 and 1986, respectively. Fifty-six and 35 weed species were identified in fields in 1985 and 1986, respectively. Eight of the 10 most frequently occurring weeds of 1985 were among the 10 most frequently occurring weeds of 1986. Chemical weed control was the most common method of weed control. Canada thistle (*Cirsium arvense* L.) was perceived to be the most troublesome weed by producers.

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by

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in

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Bozeman, Montana

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This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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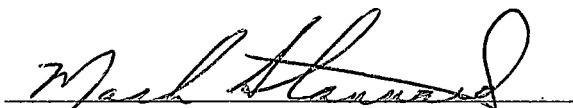
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## ABSTRACT

Hexazinone is a broad spectrum herbicide that was popular with the alfalfa (*Medicago sativa* L.) seed producers in Montana. Although hexazinone was a valuable herbicide, there were frequent reports of alfalfa injury from 1982 to 1984. Several factors were investigated to determine possible causes of injury. Three factors implicated in most cases were low soil organic matter, application of hexazinone to nondormant alfalfa, and application of hexazinone to alfalfa which endures stress conditions later that growing season.

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## CHAPTER 1

### LITERATURE REVIEW

#### Hexazinone

Hexazinone, [3-cyclohexyl-6-dimethylamino-1-methyl-1,3,5-triazine-2,4(1H,3H)-dione], is a broad spectrum herbicide developed by the E.I. DuPont Company (67). It was first labeled for noncropland use in 1975 and is marketed under the trade name of "Velpar" in liquid, dry flowable and pellet formulations (40). Hernandez et al. (30) described the herbicidal properties of hexazinone in 1974.

Hexazinone is the only triazine herbicide that has a cyclohexyl ring attached to the 3 position of the triazine ring (Figure 1) (50,57).

The solubility of hexazinone in water is 33,000 ppm at 25 C, the most water soluble triazine herbicide (7,8,33,40). Solubility decreases approximately 50% when water temperature is decreased 20 C (3). Because of its high water solubility and relatively low soil adsorption properties, hexazinone is very mobile in soil and leaches readily. Bouchard et al. (8) reported that 90% of the hexazinone applied to soil columns was leached below the top 10 cm of a gravelly fine-sandy loam soil 42 days after

application.

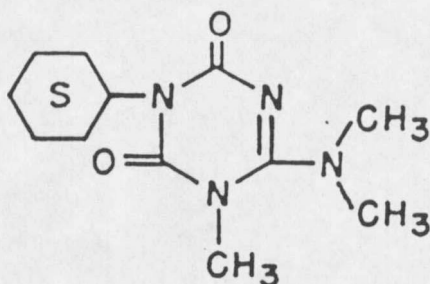


Figure 1. Structure of hexazinone.

Hexazinone is readily adsorbed by soil organic matter, especially organic matter that has undergone little decomposition (7). Hexazinone has less affinity for soil particles than for organic matter. Rhodes (59) reported the soil thin layer chromatography (TLC) Rf values for hexazinone, terbacil [3-tert-butyl-5-chloro-6-methyluracil], and diuron [3-(3,4-dichlorophenyl)-1,1-dimethylurea] are 0.68, 0.47, and 0.20 respectively on a Flanagan silt loam soil. Hexazinone is classified as a Class 4 mobile herbicide (59).

Hexazinone dissolved in distilled water is stable in light at temperatures up to 37 C (58). However, the addition of stream sediment or riboflavin to distilled water increased the decomposition rate of hexazinone three to seven fold (58). Rhodes (58) stated that riboflavin and stream sediments acted as photoinitiators which aided in the





























































































































































































































































































