RESIDUES OF FORESTRY HERBICIDES IN PLANTS OF INTEREST TO NATIVE AMERICANS IN CALIFORNIA NATIONAL FORESTS

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STATE OF CALIFORNIA
California Environmental Protection Agency
Department of Pesticide Regulation
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Executive Summary

Purpose

The purpose of this study was to determine dissipation and off-site movement of four forestry herbicide products containing glyphosate, triclopyr, or hexazinone on native plant materials. This information will be used to determine if California Indians gathering and processing plant materials from inside and outside herbicide treatment areas are at risk from pesticide exposure.

Background

The United States Forest Service is responsible for conifer reforestation in units of land within the National Forests that have burned due to forest fires or have been heavily logged. Glyphosate, triclopyr, and hexazinone are commonly applied to barren sites as pre-plant herbicides to eliminate unwanted plants prior to conifer planting, and also as post-plant herbicides to control re-emerging weeds in young established conifer plantations. Typically, glyphosate is applied as the liquid Accord®, triclopyr as the liquid Garlon® 4, and hexazinone as the liquid Velpar® L and also as the granular Pronone® 10G. With the exception of granular hexazinone, which can by applied by ground or air (helicopter), all other herbicide products are ground applied by spray crews carrying backpack sprayers to treat targeted plant pests.

National Forests and other public lands are used by many California Indians as sites for gathering native plant materials for food, medicine, ceremonies, or basketry purposes. Herbicide exposure may occur to those gathering plants within or adjacent to treatment areas; therefore, California Indians are concerned with possible health risks associated with the traditional gathering, processing, and consuming of plant materials. Forestry herbicide registrants have not been required to address these unique exposure scenarios when registering herbicide products within the state. The United States Forest Service and the California Department of Pesticide Regulation recognize that plant-herbicide residue information is lacking for tribal cultural activities involving treated vegetation. Consequently, this forestry herbicide study was conducted to gather residue information on selected plants of importance to California Indians.

Study Methods

During 1997 to 2001, ground applications of glyphosate, triclopyr, and liquid hexazinone, and aerial applications of granular hexazinone were evaluated for resulting herbicide residue levels in bracken fern roots (rhizomes), buckbrush shoots, golden fleece foliage, and manzanita berries growing in herbicide application areas of the Eldorado, Sierra, and Stanislaus National Forests located in California.

Herbicide dissipation rates were determined for each plant-part and herbicide-product combination. Plant parts were collected at seven intervals: within 1-3 days (application-day sample), and 3-5, 7-9, 11-13, 19-21, 27-29, and 35-37 weeks following herbicide application for each herbicide product. Additional samples were collected beyond 35-37 weeks if herbicide residues persisted. Off-site herbicide movement for each herbicide product was also documented following application by analyzing plant material growing at specific intervals up to 100 feet (ft) down slope from the treatment edge.

Results

One to three days following application, the mean application-day herbicide concentration ranges in treated plants were 0.5 to 241 ppm for glyphosate, 0.2 to 81 ppm for liquid hexazinone, 0.1 to 19 ppm for triclopyr, and not detected to 0.3 ppm for granular hexazinone treated plants. Maximum residue levels for foliar-applied herbicides were generally observed on either application day or at week 4, the second sampling interval. Due to direct deposition of spray materials on shoots, foliage, and berries, and also possible rapid foliar uptake and transport to roots, plants receiving foliar herbicide treatments resulted in higher application-day residue levels than those plants treated by the granular herbicide applied by air. High glyphosate spray-day residue levels were attributed to application method in conjunction with a higher application rate than used for the other herbicides. Overall, plants treated with glyphosate, triclopyr, and either formulation of hexazinone showed a general concentration decline in roots, shoots, foliage, and berries during the study period.

Maximum residue levels for aerially applied granular hexazinone were reached at week 8 post-application after the compound was washed into the soil, absorbed by roots, and translocated within the plant. In contrast, maximum residue levels for liquid hexazinone treated plants were typically observed in application-day samples. However, at week 28 post-application, plants treated with either the granular or liquid hexazinone formulation showed similar residue levels in sampled roots, shoots, and foliage.

The longest observed dissipation period for an herbicide residue level to reach the non-detectable level commencing from the herbicide's maximum concentration in a plant medium was 130 weeks for shoots of liquid hexazinone-treated buckbrush. Herbicide half-life averages in plant media ranged from to 1 to 19 weeks. In general, buckbrush and bracken fern plants treated with liquid hexazinone showed the longest half-lives of 18 and 19 weeks, in buckbruch shoots and bracken fern roots, respectively, compared to plants treated with the other three herbicides products.

Residues of glyphosate, triclopyr, and granular hexazinone were detected in off-site plant materials sampled 1 to 3 days following application. Application-day samples showed the presence of triclopyr up to 50-100 ft down slope from the treatment sites. Glyphosate residues were also detected off-site in application-day samples collected at the 5-15 ft distance from the treatment edge. Glyphosate is suspected to have drifted distances equivalent to that of triclopyr at sites where both chemicals were co-applied and co-monitored, but glyphosate was probably undetected due to its higher MDL.

Residues from liquid hexazinone application were observed in off-site plant samples collected 12 weeks following treatment. It is possible that herbicide residues were transported off-site with runoff water/snowmelt and subsequently taken up by roots and translocated to sampled plant parts. Granular hexazinone was also detected up to 50-70 ft off-site on application day. It is possible that herbicide dust from aerial application may have drifted off-site from the treatment area. Overall, since residues were only detected in 8% of 240 off-site samples collected, off-site movement from drift and runoff was low.

Conclusions

Due to varied environmental conditions, different plant growth stages, and time of herbicide applications, results were highly variable. In general, low residue levels were detected in the roots, shoots, foliage, and berries of plants treated with granular hexazinone and also in roots of bracken fern treated with glyphosate, triclopyr, or liquid hexazinone. Although levels were low, residues persisted in many of the sampled media, with glyphosate remaining detectable in bracken fern roots at 67 weeks post-application, the last sampling period for that plant-herbicide combination.

Also, gatherers sampling shoots, foliage, and berries in glyphosate, triclopyr, or liquid hexazinone treatment areas may be exposed to herbicide. The highest residue levels were generally observed on application day or 4 weeks following application (second sampling interval) with residues remaining detectable in plant materials for several weeks thereafter. Consequently, herbicide residue data should be used for exposure assessment to determine if gatherers and basketweavers are exposed to hazardous levels of the four forestry herbicides.

As herbicide residues were found to move off-site to non-treatment areas, plant gatherers and basketweavers may want to select plants beyond the 100 ft down slope from treated areas for up to 12 weeks following treatment.

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INTRODUCTION

The United States Department of Agriculture Forest Service (US Forest Service) is responsible for reforestation within each of the National Forests. In general, units of land with fire-killed trees or land that has been heavily logged for timber sale do not meet the requirements of the National Forest Management Act. That act prescribes that the National Forests be maintained with the proper tree species, density, and growth rate (US Forest Service, 1994). Natural reforestation is a very slow process occurring over many decades. To quickly achieve maximum benefits equivalent to that of pre-fire or pre-logging status, human intervention is needed to reforest the land so that it may provide valuable renewable resources such as timber, watershed, wildlife, fish and wilderness (US Forest Service, 1994).

Most reforestation activities involve the use of herbicides applied at specific times to eliminate shrubs, grasses and other unwanted vegetation that would interfere with conifer growth (McWhorter and Gebhardt, 1987). These plants are undesirable because they compete for sunlight, nutrients, and soil moisture that are needed for young conifers to survive (US Forest Service, 1994). Reforestation herbicides such as glyphosate, triclopyr, and hexazinone are very effective in vegetation control. They have been used to prepare units of land prior to conifer planting ("site preparation"), and/or to eliminate re-invading plants in units with young established conifers ("conifer release"). In conifer release treatment units, plants growing within a five-foot (ft) radius around the conifer tree are treated with herbicide, while in site preparation units plant pests are treated in the entire unit.

Glyphosate, as Accord®, is a liquid formulated herbicide. It has non-selective, non-residual, post-emergent activity and may be applied to foliage at any growth stage. It is effective at controlling perennial, deep-rooted grasses, woody brush, and broadleaf weeds. Triclopyr, as Garlon® 4, is an emusifiable concentrate formulation that may be applied directly to foliage or soil where it is moved to the roots by rainfall to control woody brush and perennial broadleaf weeds. It provides little control on grasses (Byrd et al., 1974). Two formulations of hexazinone, Velpar® L and Pronone® 10G, are a liquid and granular formulation, respectively. The liquid formulation can act as a foliar contact or systemic herbicide and the granular formulation as a soil residual herbicide. It is effective for controlling broadleaf trees and bushes, as well as annual and perennial weeds (Gana, 1997). Hexazinone can be tolerated by many conifers without sustaining damage (Ashton and Craft, 1981).

Native Americans gather plant materials for food, medicine, ceremonies or basketry in or near National Forests and other public lands (Goode, 1992). Herbicide exposure may occur when they collect and handle plants from herbicide treated units. In California, the US Forest Service and some Native American Indians (California Indians) have begun a cooperative program to identify and protect sensitive gathering sites from herbicide application. This eliminates or reduces herbicide exposure for persons involved in the program. However, California Indians not participating in the cooperative program may be unintentionally exposed. Some of those not participating are, of course, unaware the program exists. There are others who choose not to disclose their gathering locations to the US Forest Service as these locations are considered sacred sites passed down in the family, clan or teacher (Goode, 1992). Consequently, those California Indians would like to know what health risks are associated with gathering, processing, and consuming plant materials from inside and adjacent to herbicide treatment areas.

Staff of the Department of Pesticide Regulation (DPR) monitored herbicide residues of glyphosate, triclopyr, and hexazinone in various plant species, determined herbicide dissipation rates in those species, and estimated the potential for herbicide residues to move off-site following application. This report summarizes data collected over a four-year period (1997-2001) from three California National Forests.

MATERIAL and METHODS

US Forest Service Herbicide Program Treatments

The US Forest Service applied four herbicide products: glyphosate applied as Accord®, triclopyr applied as Garlon® 4, and hexazinone applied as Velpar® L and as Pronone® 10G. Herbicide applications occurred during 1997-2000 in the Eldorado, Sierra, and Stanislaus National Forest (Figure 1). Applications were made by commercial pesticide applicators under contract with the US Forest Service.

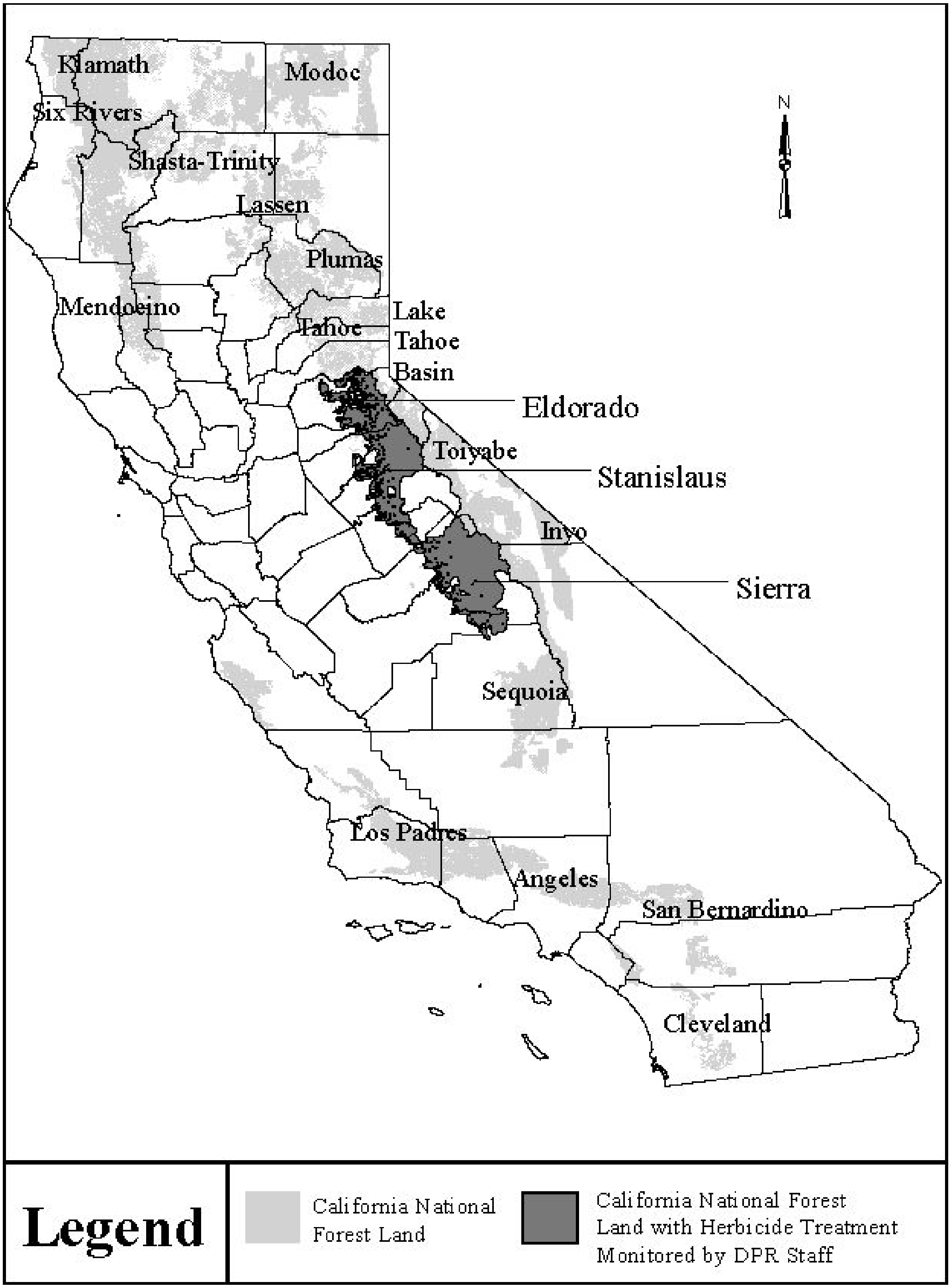


Figure 1. National Forest land herbicide treatment monitoring sites

With the exception of aerially applied granular hexazinone (Pronone® 10G), all other herbicide applications were made by ground crews (Table 1). Some applications of granular hexazinone were also applied by ground crews, but were not monitored in this study due to their limited use.

Table 1. Forestry herbicide active ingredient, formulation, application method, and location monitored

Herbicide Active Ingredient	Product Name	Formulation	Application Method	National Forest
Glyphosate	Accord®	Liquid	Ground	Eldorado, Sierra, and Stanislaus
Triclopyr	Garlon® 4	Liquid	Ground	Eldorado and Stanislaus
Hexazinone	Velpar® L	Liquid	Ground	Sierra and Stanislaus
Hexazinone	Pronone® 10G	Granular	Air	Stanislaus

Glyphosate (Accord®) and triclopyr (Garlon® 4) were directly applied to foliage with hand pressurized backpack sprayers to treat individual or clusters of unwanted plants. Tank mixes contained a color dye marker to stain vegetation indicating to spray crews which plants were treated. Also included were a surfactant, water as the carrier, and either glyphosate or triclopyr singly or in combination. By reducing surface tension, surfactants assist in spray solution movement into plant tissue (Greene and Bukovac, 1974). Accord® and Garlon® 4 both contain 4 pounds of active ingredient per gallon of product and were applied at the rates of 0.4 to 4.8 and 0.3 to 1.8 pounds active ingredient per treated acre, respectively. Application rates for all herbicides were obtained from US Forest Service staff.

Liquid hexazinone (Velpar® L) was used either undiluted or diluted with water, and like glyphosate and triclopyr, it was also mixed with a color dye marker. Concentrated hexazinone with no dilution was basally applied to the soil underneath the plant pest by spot gun application. By directing the gun to the soil, each draw of the gun's trigger delivered a pre-determined volume of herbicide material. The volume of material applied was dependent upon plant height. Following a rain event, the basally applied hexazinone is released into the soil and available for uptake by the plant root system.

In contrast, diluted hexazinone was applied by hand pressurized backpack sprayer to plant foliage so that foliar absorption would occur. Velpar® L contains 2 pounds of hexazinone per gallon of product and was applied at a rate of 1.5 to 3 pounds active ingredient per treated acre for diluted and undiluted hexazinone.

Pronone® 10G is composed of irregularly shaped granules coated with 10% hexazinone by weight (Feng *et al*., 1988). To reduce dust formation, the granules contain an additional exterior coating devoid of the active ingredient. Pronone® 10G granules were dispersed by helicopter using a hopper attachment. This method of application facilitated dispersal over large acreages and steep terrain at an application rate of 3 pounds active ingredient per treated acre.

DPR Dissipation Study

This dissipation study was conducted to address the potential exposure of California Indian plant gatherers and basketmakers to herbicide residues in plant materials collected in treated areas.

Following consultation with California Indians, four plant species of interest were selected for herbicide monitoring in the Eldorado, Sierra, and Stanislaus National Forests (Table 2). These readily available plants in the treatment areas represent one root-type plant (bracken fern rhizomes), one brush-type plant (buckbrush shoots), one foliage-type plant (golden fleece foliage), and one food-type plant (manzanita berries).

Table 2. Four plants and their parts used by California Indians

Common Name	Scientific Name	Sampled Plant Part	California Indian Use
Bracken Fern	*Pteridium aquilinum var. pubescens*	Roots	Basketry
Buckbrush	*Ceanothus cuneatus*	Shoots	Basketry
Golden Fleece	*Ericameria aborescens*	Foliage	Medicine
Manzanita	*Arctostaphylos spp.*	Berries	Food

The four plant parts were monitored for the four forestry herbicide products applied: glyphosate, triclopyr, and liquid hexazinone by ground and granular hexazinone by air (Table 1). Herbicide applications in selected monitoring sites occurred during 1997 to 2000.

Sixty-four monitoring sites (four sampling sites or replications for each plant part and herbicide product combination) were selected in the three National Forests as described in the study protocol (DPR, 1997). Sites were accessible, had the appropriate plants growing in the herbicide treatment area, and had an adequate supply of plant materials available for a minimum of seven sampling periods for chemical analyses. Selected manzanita berry sites had flowers or berries present at the time of herbicide application. Site locations are presented in Appendix A.

Anywhere from six to 20 buckbrush, golden fleece or manzanita plants at each monitoring site were tagged with flagging tape to identify them for sampling. Bracken fern was generally pervasive in an area, so a 10 to 20 ft diameter circle was marked off with flagging stakes so that root samples would be collected within this enclosed region. Plant samples were collected at seven intervals: within 1-3 days following herbicide application (application-day sample), and within 3-5, 7-9, 11-13, 19-21, 27-29, and 35-37 weeks following herbicide application.

Sixteen sites (one sampling site for each plant-herbicide combination) were monitored with 11 sites extended beyond the 35-37 week study period due to continued herbicide detections at several sites originally treated with herbicide in 1997 and 1998. Monitoring was later discontinued at these high residue sites due to lack of further herbicide detections, inaccessible roads due to snow or heavy rains or inadequate supply of plant material for further chemical analysis.

Table 3. Occurrence of extended monitoring

Chemical	Number of additional sampling periods beyond 35-37 week post-application period for 3 plant media		
	Bracken Fern Root	Buckbrush Shoot	Golden Fleece Foliage
Glyphosate	2	1	1
Triclopyr	1	2	1
Hexazinone – Velpar® L	-	3	2
Hexazinone – Pronone® 10G	2	3	2

Additional samples were collected only at the monitoring site that had the highest residue concentration for each plant-herbicide combination reported at 35-37 week sample period.
Additional manzanita berry samples were not collected beyond the 35-37 week sample period due to insufficient berry supply..

DPR Off-Site Movement Study

The second portion of this study addressed the potential for off-site movement of the four herbicide products from the application area due to drift at the time of application or due to other influences following application. This information would help in determining an acceptable distance to gather plant materials from treated areas.

From 1997 to 1999 DPR staff monitored native plant parts offsite in the three National Forests for the four forestry herbicide products applied: glyphosate, triclopyr, and liquid hexazinone by ground and granular hexazinone by air. Twenty-four off-site monitoring locations (6 sites per herbicide product) were selected for the study (DPR, 1997). Off-site herbicide residues were monitored in bracken fern roots, buckbrush shoots, and deerbrush shoots (*Ceanothus integerrimus*).

Off-site monitoring locations were selected prior to herbicide application. Monitoring sites were adjacent to the outside treatment area, easily accessible, had the targeted plants, and had an adequate supply of plant material available for chemical analyses for three sampling periods during the 12-week monitoring period. Off-site monitoring plants up to 100 ft down slope from the treatment area were marked at four distance ranges (5-15, 20-40, 50-70, and 80-100 ft) using flagging tape.

Plant samples were collected at each distance to determine herbicide movement from the edge of the application area. Samples were collected at four periods: prior to herbicide application (background sample), 1-3 days post-application (application day sample), and 3-5 and 11-13 weeks post-herbicide application. Background samples were randomly collected from the entire transect distance of 5-100 ft to determine if residues were present prior to treatment. Background plant samples were collected in 1998 and 1999, but not in 1997.

Dissipation and Off-Site Sampling Methods and Equipment Cleaning Procedures

Whenever possible, roots, shoots, foliage, and berries samples were collected from tagged plants with green vegetation, showing no signs of herbicide effects (e.g. brown discolored vegetation). If green vegetation was not available for sampling, plants were assumed to be dead and random plant samples was collected (over all or several of these tagged plants).

Clean disposable latex gloves were worn to collect approximately 0.2 pounds of plant material that were placed into 1-quart glass sample jars. Gloves were changed with each sample collected to prevent herbicide cross-contamination.

Clean hand-held pruning shears were used to cut buckbrush shoots, golden fleece foliage, and manzanita berries directly into the sample jar. Bracken fern roots and deerbrush shoots required additional handling. A clean shovel or hand trowel was used to expose bracken fern roots that were shaken to remove soil before being placed in the sample jar. Leaves from deerbrush shoots were removed with hand-held pruning shears and discarded in the field and then the barren shoots were placed into the sample jar. All sample jar openings were lined with an aluminum foil sheet and were then tightly sealed with a lid. Samples were placed on dry ice after collection and remained frozen until chemically extracted in the laboratory.

Sampling equipment was cleaned in the field using a deep plastic container lined with a disposable plastic bag used to hold the cleaning solution of de-ionized water and Liqui-Nox® soap. Disposable cleaning sponges and scouring pads were used to vigorously clean the sampling equipment to remove any herbicide or plant residue. Once washed, equipment was rinsed with de-ionized water, then alcohol, and then allowed to air dry before being placed in a clean plastic storage bag.

Chemical Analyses

The analyzing laboratory was the California Department of Food and Agriculture's Center for Analytical Chemistry in Sacramento, California. Laboratory personnel developed chemical analytical methods to determine residues of glyphosate, triclopyr, and hexazinone in several plant media (Appendix B). Appendix B also contains method validation results (percent herbicide recovery) for the three active ingredients. The minimum detection limit (MDL) for each plant-active ingredient combination is presented in Table 4. Levels ranged from 0.03 to 0.1 ppm and are the lowest amounts of a chemical that are detectable in each plant part using the analytical method.

Control charts were developed from method validation studies for ongoing quality control purposes. Lower and upper warning limits (mean $\pm$ 2 standard deviations) and control limits (mean $\pm$ 3 standard deviations) were created to determine if results were within an acceptable range. Field samples were extracted along with plant parts fortified with known herbicide addition(s) and also with unfortified plant parts containing no herbicide residue. If recoveries were outside the warning or control limits for the fortified samples or if residue was detected in unfortified samples, chemical analyses were redone. Ongoing quality control data and storage stability data are presented in Appendix B.

Table 4. Minimum detection limit (ppm) for three forestry herbicide active ingredients in various plant media

Chemical Active Ingredient	Plant Media	Minimum Detection Limit
Glyphosate (Accord®)	Bracken Fern Roots	0.1
	Buckbrush Shoots	0.1
	Golden Fleece Foliage	0.1
	Manzanita Berries	0.1
Triclopyr (Garlon® 4)	Bracken Fern Roots	0.03
	Buckbrush Shoots	0.05
	Golden Fleece Foliage	0.07
	Manzanita Berries	0.03
Hexazinone (Velpar® L/Pronone® 10G)	Bracken Fern Roots	0.05
	Buckbrush Shoots	0.1
	Golden Fleece Foliage	0.1
	Manzanita Berries	0.05

Statistical Analyses

The mean, standard deviation, and standard error of the mean were calculated for each plant part/herbicide product combination. When herbicides were not detectable in a medium, one-half the MDL was used in the calculations. Half-lives were determined using an exponential decay equation. Further statistical information and field data are provided in Appendix C.

RESULTS and DISCUSSION

Glyphosate, triclopyr, and hexazinone data are presented on a fresh weight basis. When herbicide residue levels were below the MDL in a medium, one-half the value of the MDL was used in statistical analyses. Also, data collected beyond the 35-37 week sample period for each plant part were taken from the site with the highest residue level for each plant-herbicide product combination and, therefore, may not be representative of a population.

Quality Control

Ongoing quality control information was obtained for the three forestry herbicide active ingredients in bracken fern roots, buckbrush shoots, golden fleece foliage, and manzanita berries. Average recoveries ranged from 69 to 95% (Table 5) for all plant-active ingredient combinations. Of the 634 dissipation and off-site monitoring samples collected, 48 individual samples (7%) were outside the set warning limits established for each plant-active ingredient combination. The quality control data fell outside the established warning limits more often for bracken fern roots than for the other three plant media with regard to all three active ingredients. Occurrences were below and above the lower and upper warning limits, respectfully, about an equal number of times with the majority of these occurrences noted during 1997 analyses. The data presented in this study were not adjusted based upon the laboratory quality control results.

Table 5. Average analytical method recoveries for three forestry herbicide active ingredients

Plant Media	Percent Recovery		
	Glyphosate	Triclopyr	Hexazinone
Bracken Fern Roots	79.1	75.2	90.5
Buckbrush Shoots	93.6	85.0	90.2
Deerbrush Shoots	94.8	87.8	89.2
Goldenfleece Foliage	93.9	68.8	92.9
Manzanita Berries	94.3	92.8	89.5

General

Monitoring sites were located inside or adjacent to treatment areas that ranged from 2 to 270 acres in size and were at elevations ranging from approximately 2,500 to 6,000 ft. Other differences between sites included month of herbicide application, climatic conditions, and stage of plant maturity.

Dissipation Monitoring

Dissipation data was collected from 53 monitoring sites located in the three National Forests. Overall, the four herbicide products showed a general decline in pesticide concentration in treated plant material during the course of the study (Table 6).

Glyphosate mean application-day residue levels ranged from 0.5 to 241 ppm for bracken fern roots, buckbrush shoots, golden fleece foliage, and manzanita berries sampled 1 to 3 days following application. Glyphosate levels were approximately 2 to 900 times greater than mean application-day residue levels for the three remaining herbicide products on the same media. High levels are attributed to direct deposition of glyphosate on plant materials using a generally higher application rate than used for triclopyr or liquid hexazinone, the other two foliar applied herbicides (Figures 2 and 3).

Foliar applied glyphosate was quickly translocated to roots of bracken fern plants where it was detected at a mean concentration of 0.5 ppm 1 to 3 days following treatment. At week 67 post-application, the last sampling date for bracken fern roots, glyphosate residue remained detectable at 0.4 ppm.

Mean glyphosate residue levels in buckbrush shoots, golden fleece foliage, and manzanita berries remained above 75 ppm during the first 20 weeks following herbicide application. By week 60, residues in buckbrush shoots declined to less than 1 ppm and residues in golden fleece foliage were undetectable. Mean glyphosate residue levels in manzanita berries were 31 ppm at week 36, the last sampling date that berries were available for sampling.

Table 6. Mean herbicide residue levels reported in sampled plant media.

Chemical	Weeks After Treatment	Mean Residue Level Detected in Sampled Plant Part (ppm)			
		Bracken Fern Roots	Buckbrush Shoots	Golden Fleece Foliage	Manzanita Berries
Glyphosate	0	0.5	241	173	74.4
	4	1.4	230	265	123
	8	0.3	165	157	150
	12	0.3	164	77	136
	20	0.2	100	203	150
	28	0.2	16.0	24.8	80.3
	33	0.4 (1)*	-	-	-
	36	ND (<0.05)	1.8	7.4	30.8 (1)
	41	0.7 (1)		-	-
	60	-	0.3 (1)	ND (<0.05)(1)	-
	67	0.4 (1)	-	-	-
Triclopyr	0	0.1	18.8	5.9	3.1
	4	0.1	13.6	1.7	1.9
	8	0.06	5.0	0.8	2.8
	12	0.07	14.0	0.5	1.9
	20	0.1	3.1	1.0	3.0
	28	ND (<0.015)	1.2	0.6	3.0
	32	ND (<0.015) (1)	-	-	
	36	ND (<0.015)	0.5	0.6	2.6 (1)
	41	ND (<0.015) (1)	-	-	-
	60	-	0.7 (1)	ND (<0.035) (1)	-
	80	-	0.6 (1)	-	-
Hexazinone Velpar® L	0	0.2	26.0	81.2	-
	4	0.3	2.1	11.6	-
	8	0.1	0.9	2.4	0.08
	12	0.2	0.8	3.1	0.2
	20	0.08	1.7	5.3	0.05
	28	0.09	0.1	ND (<0.05) (1)	ND (<0.025)
	36	0.07	0.2	0.7	0.1
	60	-	-	0.2 (1)	-
	62	-	0.2 (1)	-	-
	80	-	0.4 (1)	ND (<0.05) (1)	-
	130	-	ND (<0.05) (1)	-	-
Hexazinone Pronone® 10G	0	ND (<0.025)	0.3	0.2	-
	4	0.2	ND (<0.05)	0.2	-
	8	0.3	0.9	0.6	0.06
	12	0.2	0.6	0.5	ND (<0.025)
	20	0.2	0.5	0.09	ND (<0.025)
	28	0.2	0.3	ND (<0.05)	ND (<0.025)
	36	0.09	0.4	0.4	ND (<0.025)
	60	0.06 (1)	0.2 (1)	-	-
	62	-	-	0.2 (1)	-
	80	ND (<0.025) (1)	0.4 (1)	ND (<0.05) (1)	-
	130	-	ND (<0.05) (1)	-	-

ND is not detected. Value shown is one-half the MDL.
*(1) indicates that only one sample was collected.
- indicates that no sample was collected.

Triclopyr residues were detected in all four application-day media sampled with mean levels ranging from 0.1 to 19 ppm. As with glyphosate, triclopyr was detected in bracken fern root samples collected on application day at a mean concentration of 0.1 ppm, indicating that this systemic compound was quickly translocated from treated foliage to the underground root system. Bovey *et al*. (1983) also reported that triclopyr was rapidly translocated to the root system of the honey mesquite plant (*Prosopis juliflora* var. *glandulosa*) within 4 hours following triclopyr application to a single leaf. Residues were not detectable in bracken fern roots at 28-41 weeks after treatment.

Triclopyr residues in buckbrush shoots remained detectable at a concentration of 0.6 ppm at week 80 but were not detectable in goldenfleece foliage sampled at week 60, the last sampling dates for both media. No other samples were collected between weeks 36-60 for golden fleece foliage. In manzanita berries, triclopyr was detected at a mean residue level of 2.6 ppm at week 36, the last sampling date for that medium.

Mean application-day hexazinone residue ranges for liquid and granular hexazinone applications, respectively, were 0.2 to 81 ppm and not-detected to 0.3 ppm in sampled bracken fern roots, buckbrush shoots, and golden fleece foliage. Manzanita berries were not available for sampling on application day because they were unformed.

Buckbrush shoots and golden fleece foliage sampled 1 to 3 days following treatment with granular hexazinone showed the presence of residues in sampled plant parts. It is possible that application-day detections may have resulted from hexazinone dust residue settling on above ground sampled plant parts. Also, it is possible that granular material was washed into the soil and actual uptake occurred following aerial application, although hexazinone application-day detections were not reported in bracken fern roots. Feng *et al*. (1988) reported that any amount of moisture from rainfall, dew or condensation was enough to result in significant release of hexazinone from coated granules making it available for absorbtion by the plant root system (Ghassemi *et al*., 1989).

Granular-applied maximum mean hexazinone residue levels in sampled roots, shoots, and foliage were observed at week 8 post-application, when they were approximately three or four times greater than application-day residue levels. It is suspected that time was needed for the granules to be washed into the soil and taken up by the roots and translocated to the sampled above ground plant parts. By week 28, however, granular and liquid hexazinone treated plants showed similar residue levels in sampled plant parts with residues ranging from not-detected to 0.3 ppm in roots, shoots, and foliage. By weeks 80 and 130 post application, hexazinone residues were no longer detectable in golden fleece foliage and buckbrush shoots from either granular or liquid hexazinone applications. In bracken fern roots, residues remained detectable at a mean concentration of 0.07 ppm at week 36, the last sampling date for liquid hexazinone in root medium. Residues in bracken fern roots were not detected at week 80, the last sampling date for granular hexazinone in root media.

When manzanita berries were available for sampling starting at week 8 post-application, hexazinone residues were detected in berries in only 1 of 5 sampling periods for granular applied material while in comparison, detections were reported in 4 of 5 sampling periods for liquid applied hexazinone. Low granular hexazinone detections may indicate low uptake, low translocation, or rapid degradation with the plant (Sidhu and Feng, 1993) compared to liquid hexazinone treated plants. Sidhu and Feng (1993) reported that hazelnut (*Corylus cornuta* Marsh.) was less sensitive to hexazinone and absorbed and translocated less hexazinone to the foliage than other plant species tested. Baron and Monaco (1986) also reported that plant cuttings of rabbiteye blueberry (*Vaccinium Ashei* Reade) and highbush blueberry (*Vaccinium corymbosum* L.) absorbed less hexazinone from hexazinone root applications than did hollow goldenrod (*Solidago fistulosa* Miller) plant cuttings, resulting in less hexazinone residue translocated to the leaves of both species of blueberry plants. Baron and Monaco (1986) suggested that the low translocation of hexazinone from the root to the shoot may be due to the restricted translocation from the site of uptake (roots) to the site of action (chloroplasts).

Also examined at each monitoring location was the dissipation time in weeks observed for an herbicide to reach the non-detectable residue level, starting from the herbicide's maximum concentration in a plant part (Table 7). In general, large time variations existed between the number of weeks to reach the non-detectable level for each plant-herbicide product combination with elapsed time, ranging from 4 to 130 weeks. Herbicide residues appeared persistent in

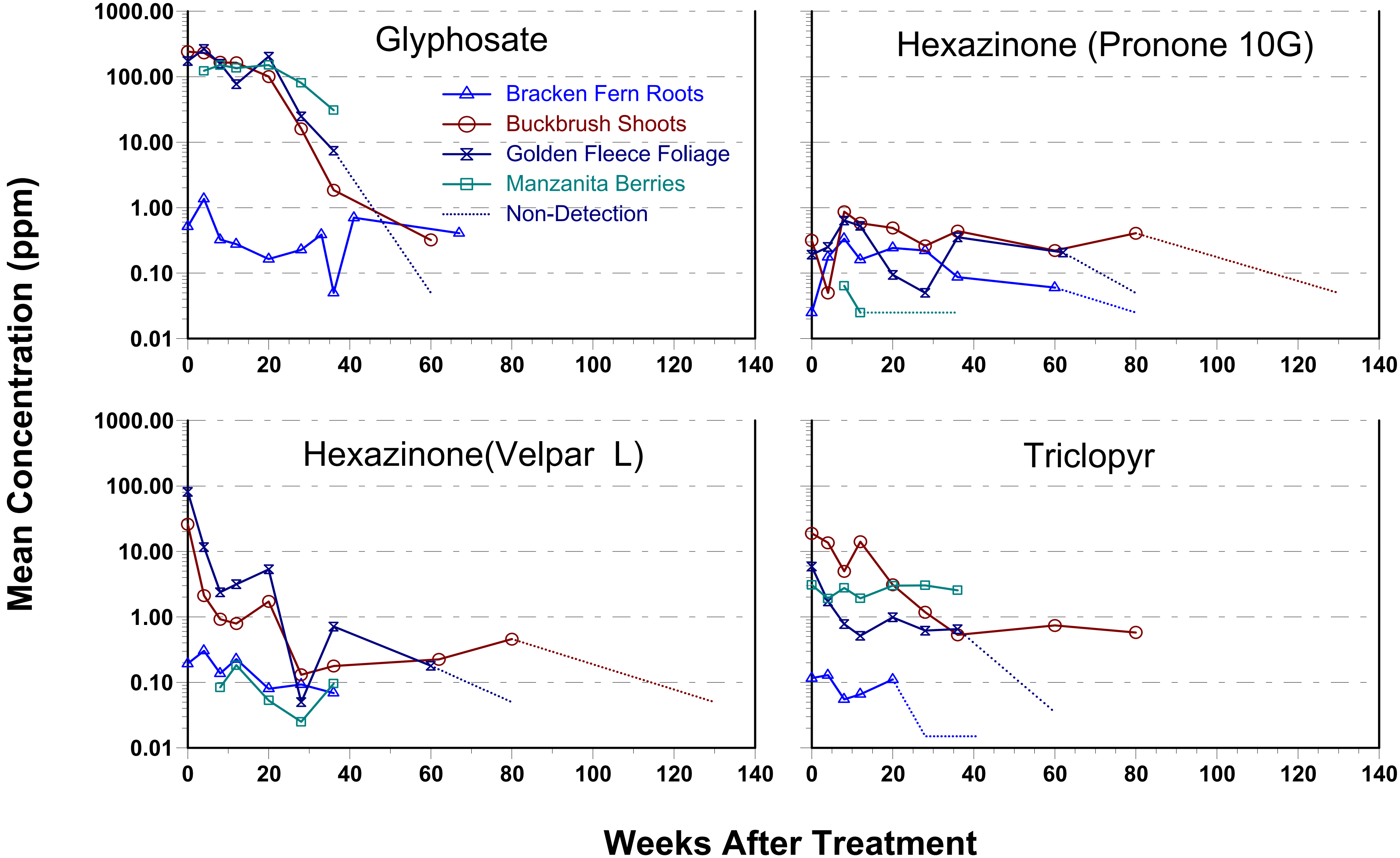


Figure 2. Dissipation of herbicide in plants, Eldorado, Sierra and Stanislaus National Forests, Calif., 1997-2001.

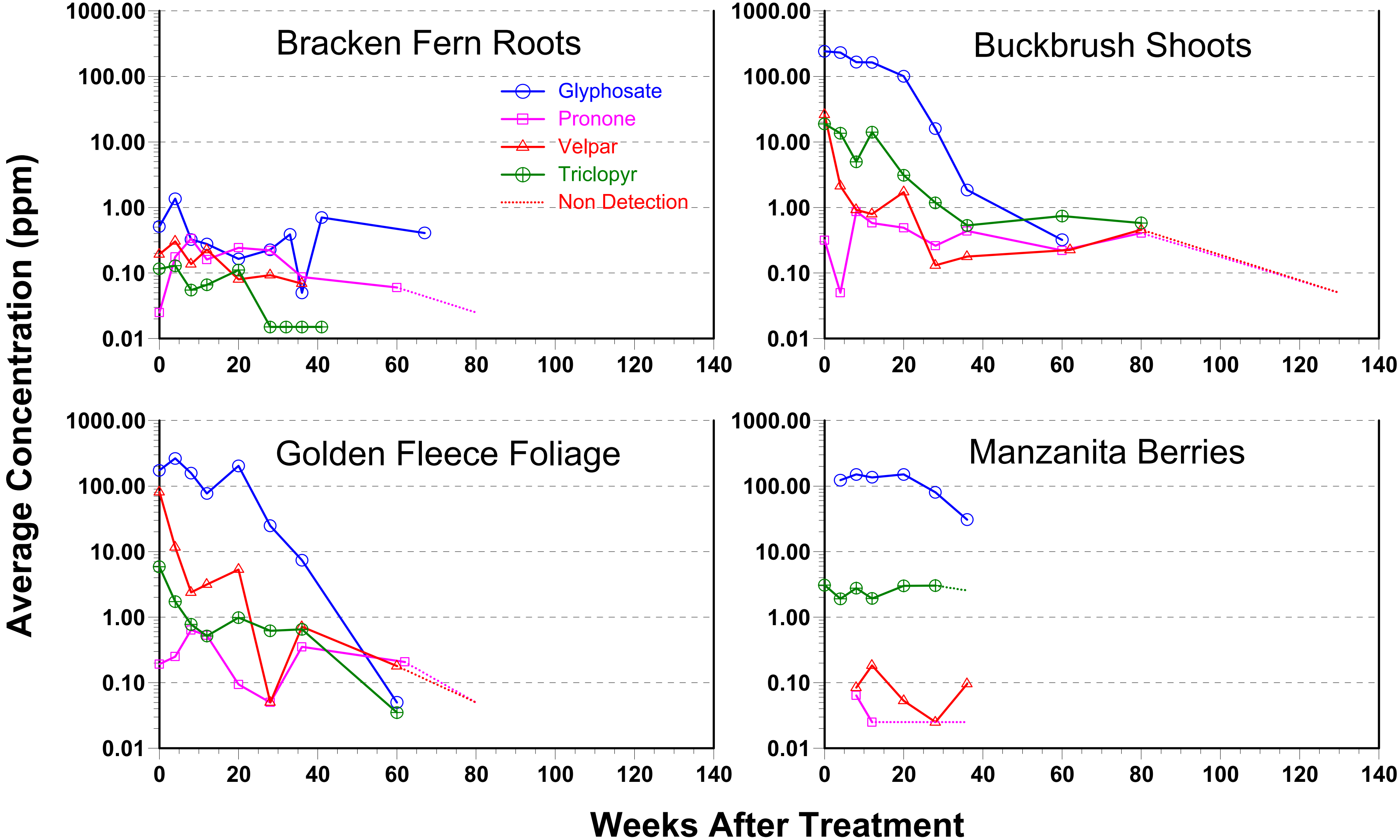


Figure 3. Plant materials on the dissipation of herbicides from Eldorado, Lassen, Sierra and Stanislaus in California, 1997-2001

buckbrush shoots treated with liquid hexazinone, as residues were detectable in shoots sampled at week 80, but residues were not detectable the following sampling period at 130 weeks post-application. This was the longest observed dissipation period for an herbicide residue level to reach the non-detectable level commencing from the herbicide's maximum concentration in a plant medium. Hexazinone dissipated from granular treated bracken fern roots within an average of 29 weeks after the maximum residue level was reached while it dissipated from liquid treated bracken fern roots within an average of 4 weeks after reaching the maximum residue level.

Table 7. The number of weeks observed from the maximum herbicide concentration to the non-detectable level

		Plant Part Sampled			
Chemical	Site	Bracken Fern Roots	Buckbrush Shoots	Golden Fleece Foliage	Manzanita Berries
Glyphosate	1	8	na*	na	na
	2	na	na	60	na
	3	na	na	na	na
	4	4	na	24	na
	Average	6	na	42	na
Triclopyr	1	8	na	na	na
	2	24	na	na	na
	3	8	na	56	-
	4	4	-**	-	-
	Average	11	na	56	na
Hexazinone Velpar® L	1	4	na	20	8
	2	na	na	20	4
	3	-	130	na	-
	4	-	-	-	-
	Average	4	130	20	6
Hexazinone Pronone® 10G	1	4	4	12	8
	2	na	4	16	8
	3	24	4	20	8
	4	60	4	12	-
	Average	29	4	15	8

*na denotes herbicide residue level was at or above the minimum detection limit.
**A dashed line indicates that a monitoring site was not selected.

Golden fleece plants treated with liquid hexazinone showed similar dissipation rates in foliage to those plants treated with granular hexazinone. Likewise, manzanita plants treated with liquid hexazinone showed similar dissipation rates to those treated with granular hexazinone. Additional data was not available to determine dissipation rates at about 40% of the monitoring locations because residue levels remained detectable at the last sampling period or as with manzanita berries, the fruit supply was depleted at week 36 post-application.

The means and standard errors for each plant-herbicide product combination are presented in Figures 4 to 7. Bracken fern roots were the only medium observed to have small standard error at each sampling period for all four herbicide products, with residue data showing low variability about the sample mean. Greater variability (large standard error) was observed with buckbrush shoots, golden fleece foliage, and manzanita berry residue data, making herbicide residue level inferences about a population less certain. Large variability was also observed in many instances where only two samples were collected on a sampling date. In situations where only one sample was collected, a single point is shown in the figures.

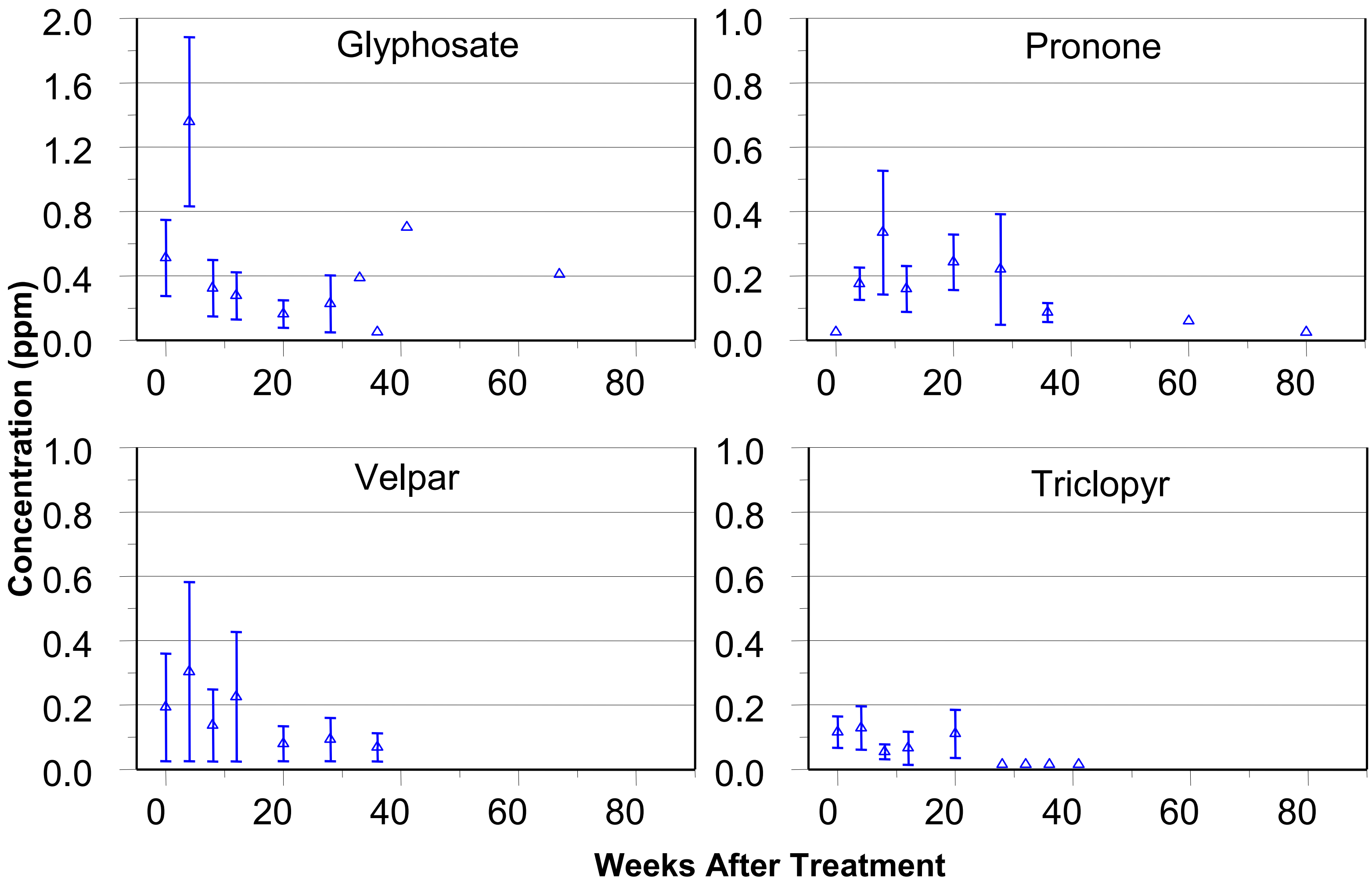


Figure 4. Herbicide residue distribution of sample means (mean ± standard error) for four forestry herbicide products in bracken fern roots

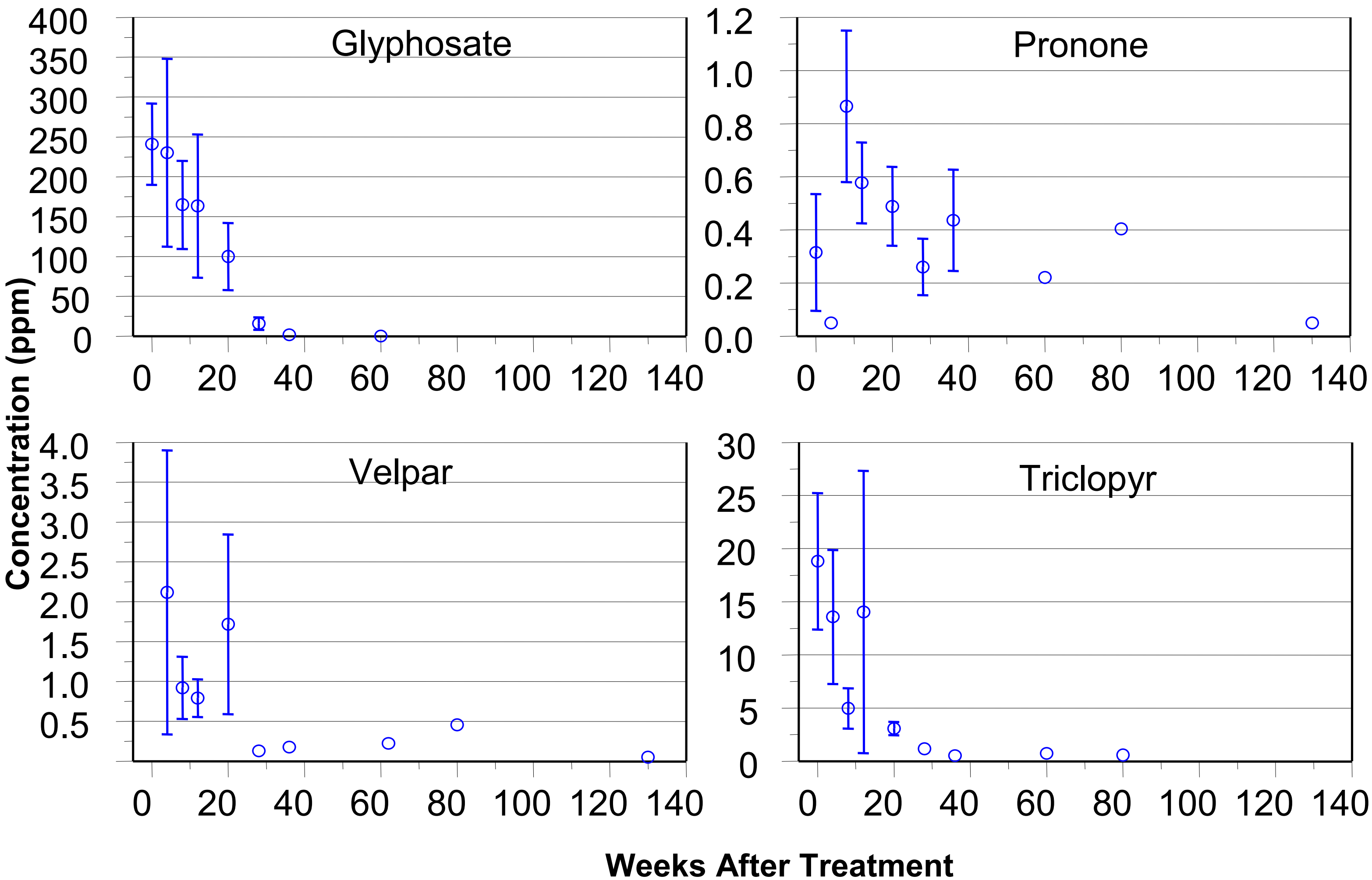


Figure 5. Herbicide residue distribution of sample means (mean ± standard error) for four forestry herbicide products in buckbrush shoots

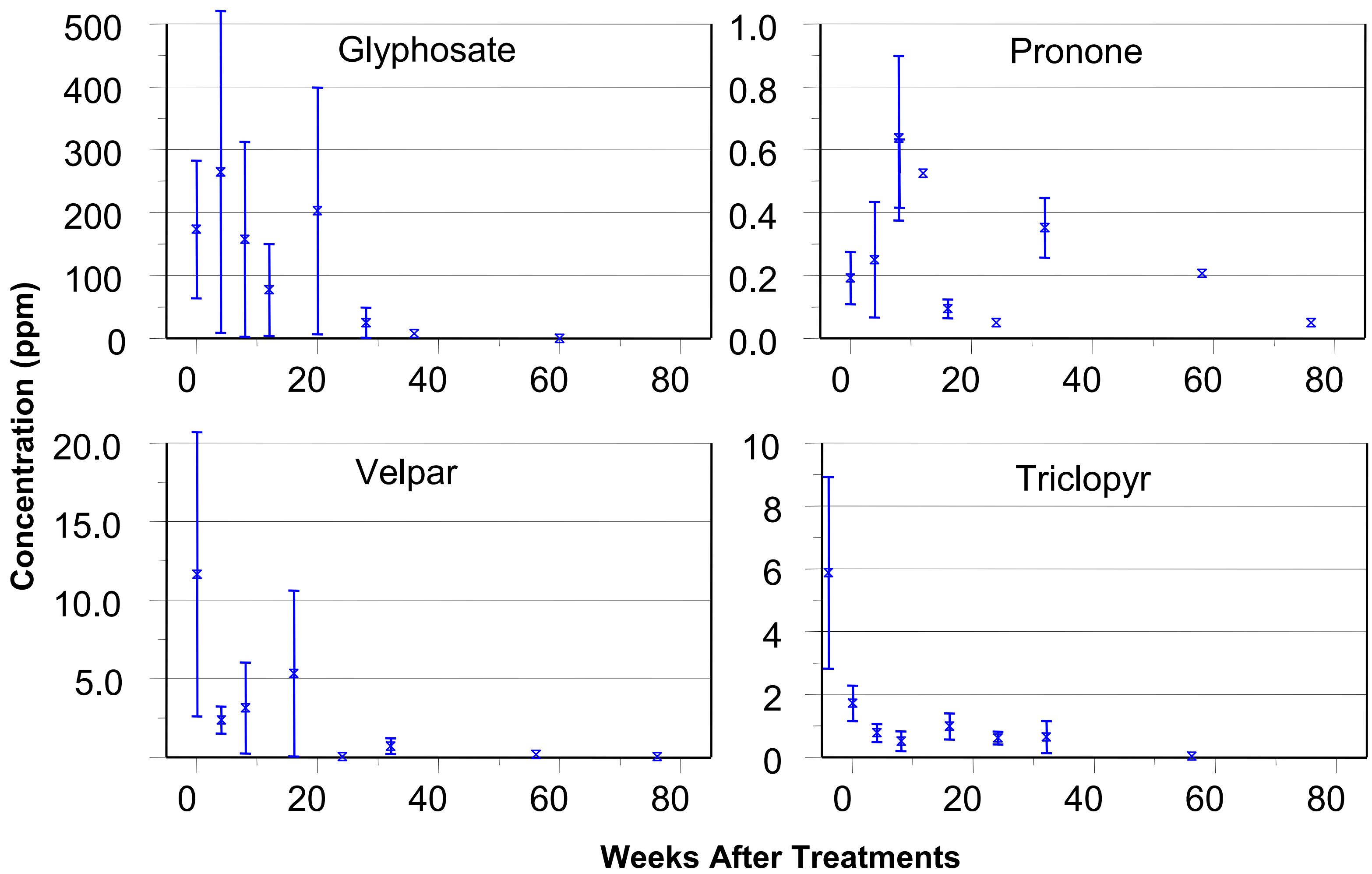


Figure 6. Herbicide residue distribution of sample means (mean ± standard error) for four forestry herbicide products in goldenfleece foliage

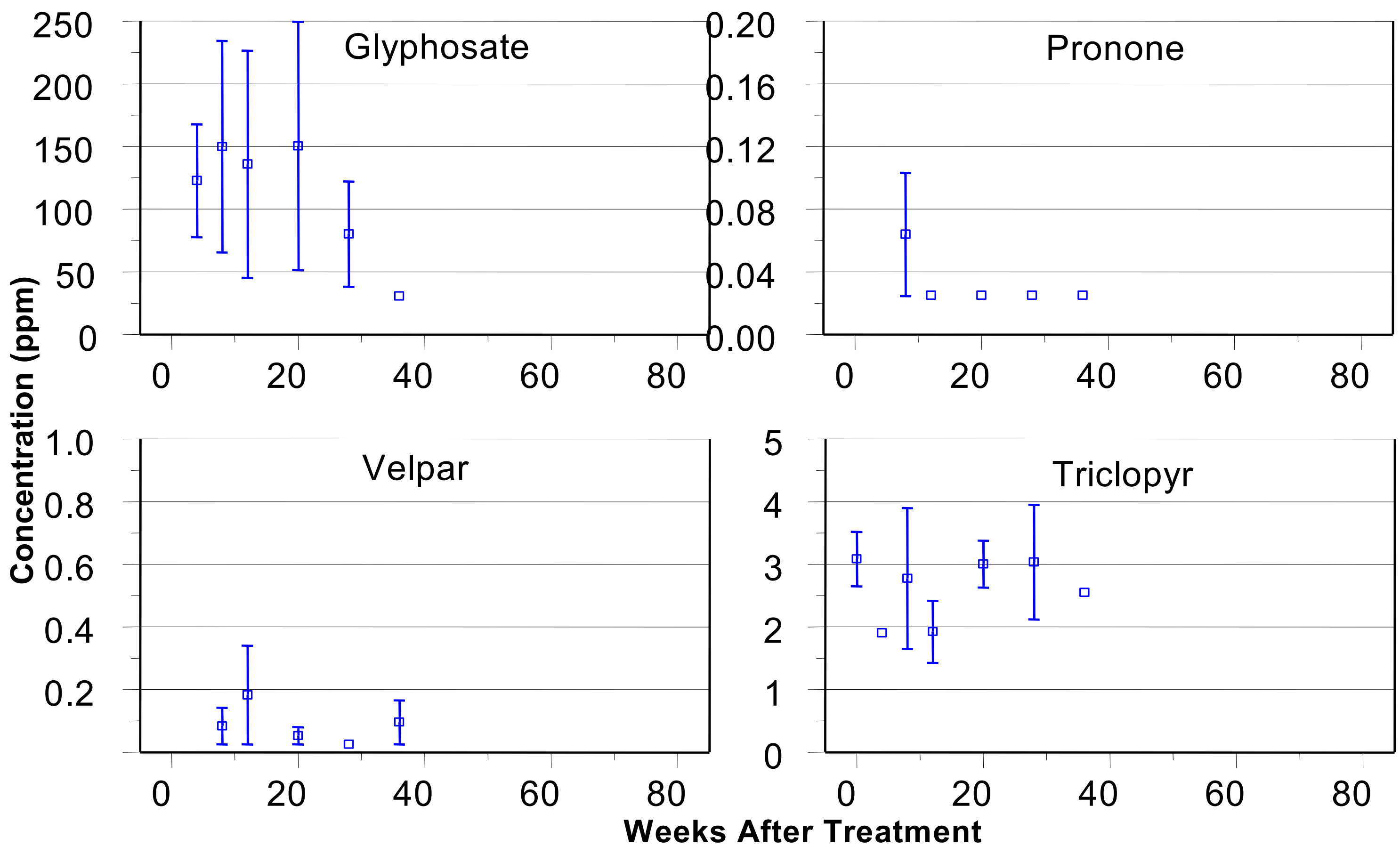


Figure 7. Herbicide residue distribution of sample means (mean ± standard error) for four forestry herbicide products in manzanita berries

Chemical half-life values in plant parts should be used with reservation due to the limited number of site specific data sets contributing to the half-life calculations at the 90% significance levels. Overall, average half-lives ranged from 1 to 19 weeks (Table 8) for the various plant part-herbicide product combinations. Half-lives were greater for bracken fern roots than they were for plant parts sampled above ground level. Half-lives were longest for liquid hexazinone treated plants (1 to 19 weeks), followed by glyphosate (8 to 12 weeks), and then triclopyr (2 to 6 weeks). Liquid hexazinone half-lives obtained in this study were longer than those observed by Michael (1990) who reported Velpar® L half-lives of less than 9 weeks in terminal shoots of dogwood (*cornus florida* L.), blueberry (*Vaccinium* sps.), and bracken fern (*pteridium aquilinum* L.).

Table 8. Average half-life of four forestry herbicides in plant parts used by California Indians

Herbicide	Average Half-Life for Plant Media Sampled (weeks)			
	Bracken Fern Roots	Buckbrush Shoots	Golden Fleece Foliage	Manzanita Berries
Glyphosate	11.5 (1)*	9.8 (3)	8.2 (2)	na**
Triclopyr	6.1 (2)	2.4 (3)	5.1 (3)	na
Hexazinone-Velpar® L	18.5 (1)	17.6 (2)	0.6 (2)	na
Hexazinone-Pronone® 10G	na	na	na	1.7 (1)

*The number in parentheses indicates the sample size used for the calculation of the mean.
**na denotes that no meaningful regression could be obtained and, therefore, no average half-life was calculated.

Off-Site Monitoring

Off-site monitoring was conducted at 20 locations. Herbicide residue levels in bracken fern roots, buckbrush shoots, and deerbrush shoots ranged from not detected to 2.7 ppm for the four herbicide products (Tables 9-12).

Glyphosate residues ranging in concentration from 0.1 to 2.7 ppm were detected in plant media sampled at three monitoring locations 1 to 3 days following application. Detections were at the 5-15 ft transect distance. At week 4 post-application, residue levels at two of the three sites remained detectable at 0.1 ppm and were undetectable at the third location. By week12, however, residues were not detectable at either of the two sites at the 5-15 ft distance. Contamination of sampling equipment may have been the cause of a glyphosate detection at the

20-40 ft distance at one of these sites at week 12 post-application. Glyphosate contamination may also have occurred resulting in the week 12 detection at the 20-40 ft distance at another unrelated monitoring location.

Triclopyr residues were also found off-site at two locations. Residues were detected up to 100 ft from the treatment area in sampled application-day media. The highest residue level of 1.6 ppm was observed at the 5-15 ft distance from the spray area with residue levels declining further away from treatment site. Residues were not detected at either of these two sites at weeks 4 or 12 post-application.

Monitoring for glyphosate was also conducted at these two locations (Stanislaus/Mi-Wok and Eldorado/Placerville) where triclopyr was detected, as glyphosate was co-applied in the tank mixes. Triclopyr residues were observed to have moved further off-site compared with glyphosate residues. However, it is suspected that both chemicals drift equivalent distances, but glyphosate remained undetected due to the chemical's higher MDL of 0.1 ppm in comparison to 0.03 ppm for triclopyr.

Liquid hexazinone was also detected off-site following application. At one monitoring location, hexazinone was detected at 0.7 ppm 12 weeks post-application and it is thought that rainfall and/or snowmelt was responsible for the off-site herbicide movement. The transect at this monitoring location was parallel rather than perpendicular to the treatment site. DPR staff observed prominent gullies leading from the treatment area to a section of the sampling transect at week 12 post-application; the washed out gullies were not present prior to week 12 sampling and also there were no prior hexazinone detections reported at this site. As hexazinone has a high potential to move off-site due to its high water solubility and low adsorption to soil (Worthing, 1979), it is thought that herbicide residues were transported with water to the 50-70 ft segment of the transect.

The application-day hexazinone detection at the 80-100 ft distance is thought to have been a result of sampling equipment contamination as the residue level was low at the MDL, and this detection could not be explained due to physical features in the surrounding sampling area.

Table 9. Off-site monitoring for glyphosate residues

National Forest/District	Plant Sampled (Application Year)	Weeks after Application	Concentration (ppm) Distance from Edge of Treatment Area			
			5-15 ft	20-40 ft	50-70 ft	80-100 ft
Sierra/Pineridge	Buckbrush Shoots (1997)	0	0.1	ND	ND	ND
		4	ND	ND	ND	ND
		12	ND	0.1	ND	ND
Eldorado/Pacific	Deerbrush Shoots (1997)	0	ND	ND	ND	ND
		4	ND	ND	ND	ND
		12	ND	0.1-1	ND	ND
Eldorado/Placerville	Deerbrush Shoots (1998)	0	2.7	ND	ND	ND
		4	0.1	ND	ND	ND
		12	ND	ND	ND	ND
Stanislaus/Mi-Wok	Deerbrush Shoots (1998)	0	0.2	ND	ND	ND
		4	0.1	ND	ND	ND
		12	ND	ND	ND	ND
Sierra/Kings River	Buckbrush Shoots (1999)	0	ND	ND	ND	ND
		4	ND	ND	ND	ND
		12	ND	ND	ND	ND
Stanislaus/Groveland	Buckbrush Shoots (1999)	0	ND	ND	ND	ND
		4	ND	ND	ND	ND
		12	ND	ND	ND	ND

ND is not detected.
Glyphosate minimum detection limit is 0.1 ppm for buckbrush and deerbrush shoots.

Table 10. Off-site monitoring for triclopyr residues

National Forest/District	Plant Sampled (Application Year)	Weeks after Application	Concentration (ppm) Distance from Edge of Treatment Area			
			5-15 ft	20-40 ft	50-70 ft	80-100 ft
Eldorado/Pacific	Deerbrush Shoots (1997)	0	ND	ND	ND	ND
		4	ND	ND	ND	ND
		12	ND	ND	ND	ND
Eldorado/Placerville	Deerbrush Shoots (1998)	0	1.6	0.07	0.06	0.03
		4	ND	ND	ND	ND
		12	ND	ND	ND	ND
Stanislaus/Mi-Wok	Deerbrush Shoots (1998)	0	0.03-0.3	0.03-0.3	0.03-0.3	ND
		4	ND	ND	ND	ND
		12	ND	ND	ND	ND

ND is not detected.
Triclopyr minimum detection limit is 0.03 ppm for deerbrush shoots.

Table 11. Off-site monitoring for liquid hexazinone (Velpar® L) residues

National Forest/District	Plant Sampled (Application Year)	Weeks after Application	Concentration (ppm) Distance from Edge of Treatment Area			
			5-15 ft	20-40 ft	50-70 ft	80-100 ft
Stanislaus/Groveland	Deerbrush Shoots (1997)	0	ND	ND	ND	ND
		4	ND	ND	ND	ND
		12	ND	ND	ND	ND
Stanislaus/Mi-Wok	Buckbrush Shoots (1997)	0	ND	ND	ND	0.1
		4	ND	ND	ND	ND
		12	ND	ND	ND	ND
Sierra/Pineridge	Buckbrush Shoots (1998)	0	ND	ND	ND	ND
		4	ND	ND	ND	ND
		12	ND	ND	0.7	ND
Stanislaus/Groveland	Deerbrush Shoots (1998)	0	ND	ND	ND	ND
		4	ND	ND	ND	ND
		12	ND	ND	ND	ND
Stanislaus/Groveland	Deerbrush Shoots (1998)	0	ND	ND	ND	ND
		4	ND	ND	ND	ND
		12	ND	ND	ND	ND

ND is not detected.
Hexazinone minimum detection limit is 0.1 ppm for buckbrush shoots and deerbrush shoots.

Table12. Off-site monitoring for granular hexazinone (Pronone® 10G) residues

National Forest/District	Plant Sampled (Application Year)	Weeks after Application	Concentration (ppm) Distance from Edge of Treatment Area			
			5-15 ft	20-40 ft	50-70 ft	80-100 ft
Stanislaus/Groveland	Bracken Fern Roots (1997)	0	ND	ND	ND	ND
		4	ND	ND	ND	Sample Lost
		12	ND	ND	ND	ND
Stanislaus/Mi-Wok	Bracken Fern Roots (1997)	0	ND	ND	ND	ND
		4	ND	ND	ND	ND
		12	ND	ND	ND	ND
Stanislaus/Mi-Wok	Deerbrush Shoots (1997)	0	0.1-1	ND	0.1-1	ND
		4	ND	ND	ND	ND
		12	ND	ND	ND	ND
Stanislaus/Mi-Wok	Deerbrush Shoots (1998)	0	ND	ND	ND	ND
		4	ND	ND	ND	ND
		12	ND	ND	ND	ND
Stanislaus/Mi-Wok	Deerbrush Shoots (1998)	0	ND	ND	ND	ND
		4	ND	ND	ND	ND
		12	ND	ND	ND	ND
Stanislaus/Mi-Wok	Buckbrush Shoots (1999)	0	ND	ND	0.1	ND
		4	ND	ND	ND	ND
		12	ND	ND	ND	ND

ND is not detected.
Hexazinone minimum detection limit is 0.05 ppm for bracken fern roots, and 0.1 ppm for buckbrush shoots and deerbrush shoots.

Hexazinone residues from granular aerial hexazinone applications were also observed off-site. Detections at two monitoring locations were found up to the 50-70 ft distance and are thought to have been the result of dust residue deposition on plant material.

Residues of glyphosate, triclopyr, and hexazinone were detected outside the treatment area immediately following application and up to 12 weeks following application, indicating that drift from sprays or granular material is a possibility with all herbicides and that off-site movement with rainfall/snowmelt may also occur. Of the 240 off-site samples collected, only 19 (7.9%) were positive for herbicide residues and approximately 33% of the detections were at or close to the MDL. Herbicide residues were not detected in any background plant samples collected at the off-site monitoring locations prior to treatment.

Additional Herbicide Residue Monitoring

California Indians also expressed concern about herbicide residue levels in oak acorns used for food and redbud (*Cercis occidentalis*) shoots used for basketry materials. Due to the difficulty in locating redbud plants growing in herbicide treatment areas, Sierra National Forest personnel stationed at the Kings River District basally applied hexazinone in 1997 to the soil underneath redbud shrubs using the spot gun treatment. Shoot samples collected at day 0, and at 4, 8, and 12 weeks following application showed no hexazinone residues in plant materials analyzed. The MDL for redbud is 0.05 ppm.

Each fall, DPR staff surveyed sites treated with herbicides and sampled available acorns that had fallen underneath the oak tree canopy. In 1997, acorns were collected 28 weeks post-application in two areas of the Stanislaus National Forest/Mi-Wok District where a liquid and granular hexazinone application had occurred, respectively. Hexazinone residues were not detected in these acorn samples.

Acorns were also collected at 36 week post-application from a 1998 liquid hexazinone treamtment area in the Sierra Forest/Pineridge District; hexazinone residues were not detected. In 1998, acorn samples from the Stanislaus Forest/Groveland District sampled 36 weeks after glyphosate application contained no glyphosate residues. The MDL for hexazinone and glyphosate in acorn is 0.1 ppm.

SUMMARY

Foliar-applied systemic herbicides resulted in higher application-day residue levels in sampled plant parts in comparison to granular applied material. Highest application-day residue levels were observed with glyphosate, followed by liquid hexazinone, triclopyr, and then granular hexazinone treated plants.

Granular hexazinone requires moisture to be released into the soil so that it could be taken up by the plant root system. This formulation had the lowest herbicide residue levels in all plant materials sampled with maximum concentrations reached at week 8 post-application. However, by week 28 post-application, similar residue levels were observed in roots, shoots, and foliage of plants treated with either granular or liquid hexazinone.

Overall, herbicide residues dissipated most slowly from the maximum residue concentration to the non-detectable level in buckbrush shoots compared with other plant parts sampled. Estimated herbicide half-lives were variable, ranging from 1 to 19 weeks. In decreasing order, half-lives were longest for liquid hexazinone, glyphosate, triclopyr, and then granular hexazinone treated plant materials. Because residue data were variable, a controlled study may be useful to either verify or refine results obtained in this field study.

Glyphosate, triclopyr, and hexazinone were detected off-site following application. Triclopyr residues were detected up to 50-100 ft from the spray area in regions where it was co-applied with glyphosate. It is assumed that glyphosate also traveled distances equivalent to that of triclopyr, but remained undetected due to its higher MDL. Hexazinone is also suspected to have been transported off site in rain runoff/snowmelt from a liquid hexazinone treatment site and also transported off-site in dust residue from a granular hexazinone treatment site during aerial application.

REFERENCES

Ashton, F.M. and A.S. Craft. 1981. The mode of action of herbicides. 2nd Edition. A. Wiley Interscience Publication. John Wiley and Sons. New York.

Baron, J.J. and T.J. Monaco. 1986. Uptake, translocation, and metabolism of hexazinone in blueberry (*Vaccinium* sp.) and hollow goldenrod (*Solidago fistulosa*). Weed Sci. 34:824-829.

Bovey, R.W., H. Hein Jr, and R.E. Meyer. 1983. Absorption and translocation of triclopyr in honey mesquite (*Prosopis juliflora* var. *glandulosa*). Weed Sci. 31:807-812.

Byrd, B.C., W.G. Wright, L.E. Warren. 1974. Vegetation control with 3,5,6-trichloropyridyloxy acetic acid. Proc. North Cent. Weed Control Conf. 29:137-138

Department of Pesticide Regulation. 1997. Study protocol for residues of forestry herbicides in plants of interest to Native Americans. Phase two: dissipation and off-site movement. Study 159. Revised December 12, 1997.

Feng, J.C., C.C. Feng, and S.S. Sidhu. 1988. Determination of hexazinone residue and its release from a granular formulation under forest conditions. Can. J. For. Res. 19:378-381.

Gana, C. 1997. Environmental fate of hexazinone. Department of Pesticide Regulation. Environmental Monitoring and Pest Management Branch. Sacramento, California.

Ghassemi, M., S. Quinlivan, and M. Dellario. 1982. Environmental effects of new herbicides for vegetation control in forest. Environ. Int. 7:389-401.

Goode, Ron. 1992. Cultural Traditions Endangered. Eagle Eye Enterprises. 133 Sierra, Clovis, CA 93612.

Greene, D.W. and M.J. Bukovac. 1974. Stomatal penetration: effect of surfactants and role in foliar absorption. Amer. J. Bot. 61:100-106.

Michael, J.L. 1990. Fate of hexazinone after application for pine planting site preparation. E.I. Du Pont and Company. Wilmington, DE. Report Number AMR 1786-90. Unpublished study. Department of Pesticide Regulation, Registration Branch Document Number 396-062, Sacaramento, CA.

Miller, J.H. and A.C. Bace, Jr. 1980. Streamwater contamination after aerial application of a pelletized herbicide. Southern Forest Experiment Station. SO-255. USDA Forest Service. New Orleans, LA 70113.

McWhorter, C.G. and M.R. Gebhardt. 1987. Methods of applying herbicides. WSSA Monograph 4. Weed Science Society of America, Champaign, IL.

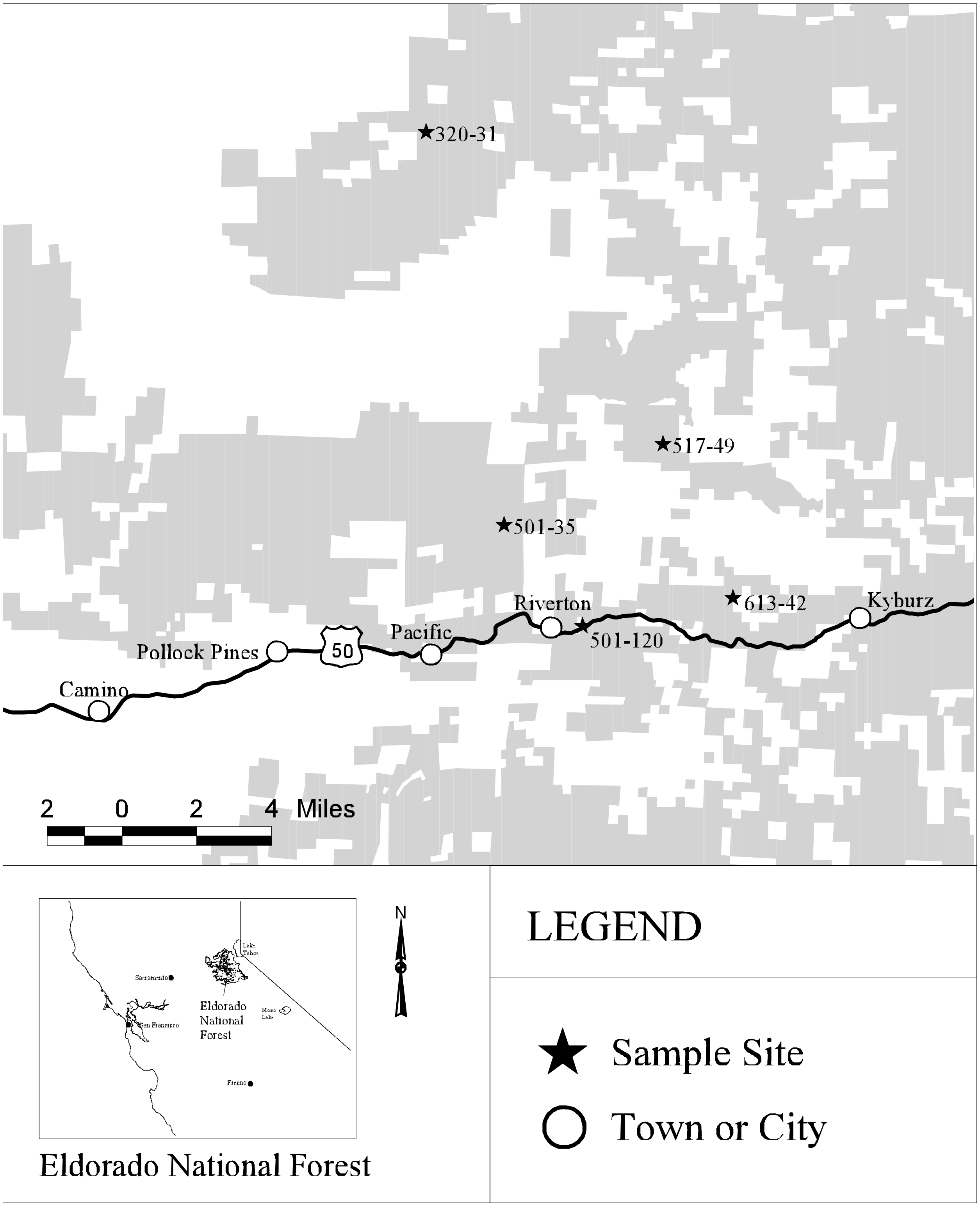
Sidhu, S.S. and J.C. Feng. 1993. Hexazinone and its metabolites in boreal forest vegetation. Weed Sci. 41:281-287.

United States Forest Service. United States Department of Agriculture. 1994. Hamm-Hasloe reforestation project and forest plan amendment – final environmental impact report. G019003. US Forest Service Pacific Southwest Region, Stanislaus National Forest.

Worthing, C.R. 1979. The pesticide manual. A World Compendium. The British Crop Protection Council, 6th Edition

APPENDIX A

Site Locations



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San Francisco
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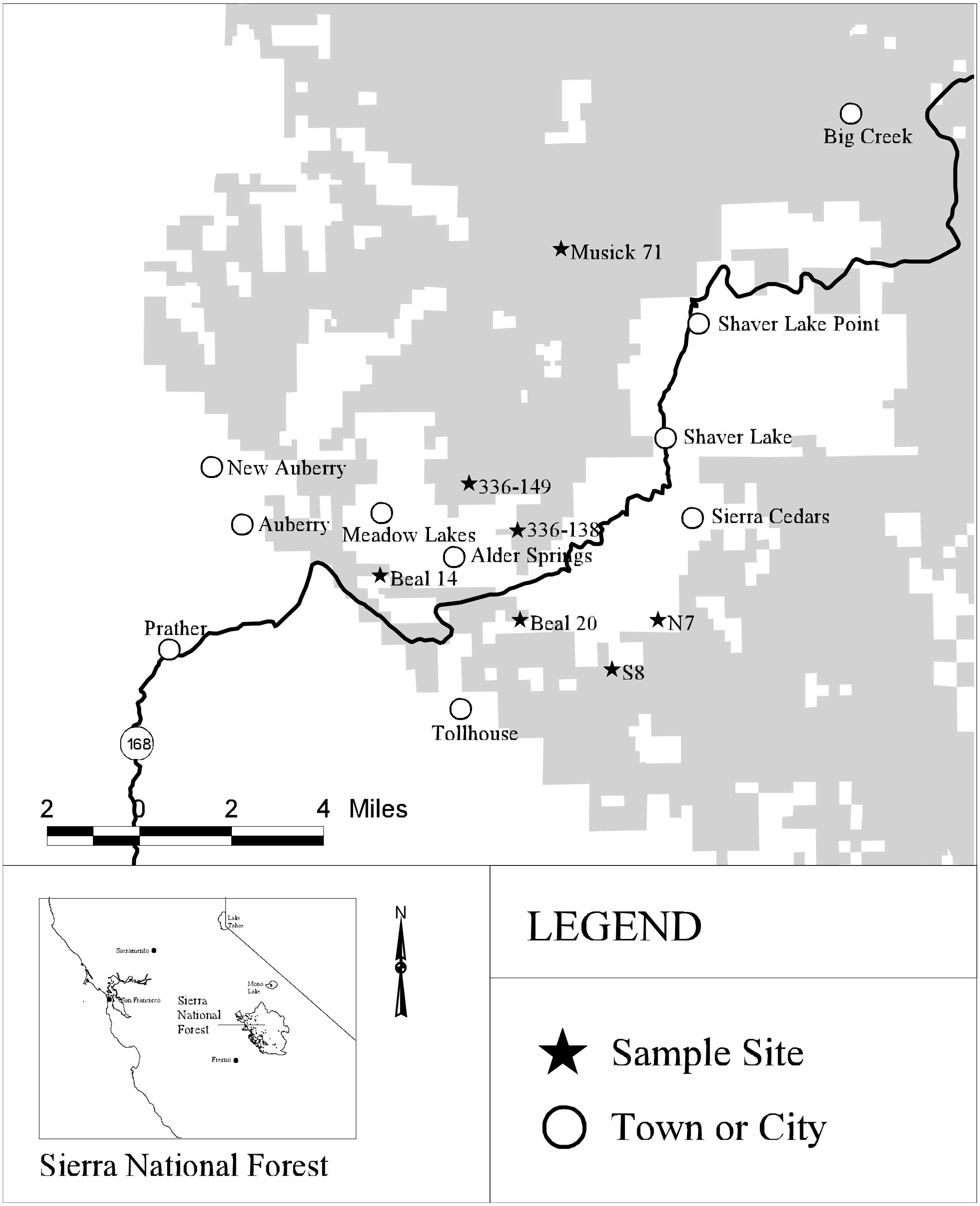
Sample Site
Town or City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New Auberry
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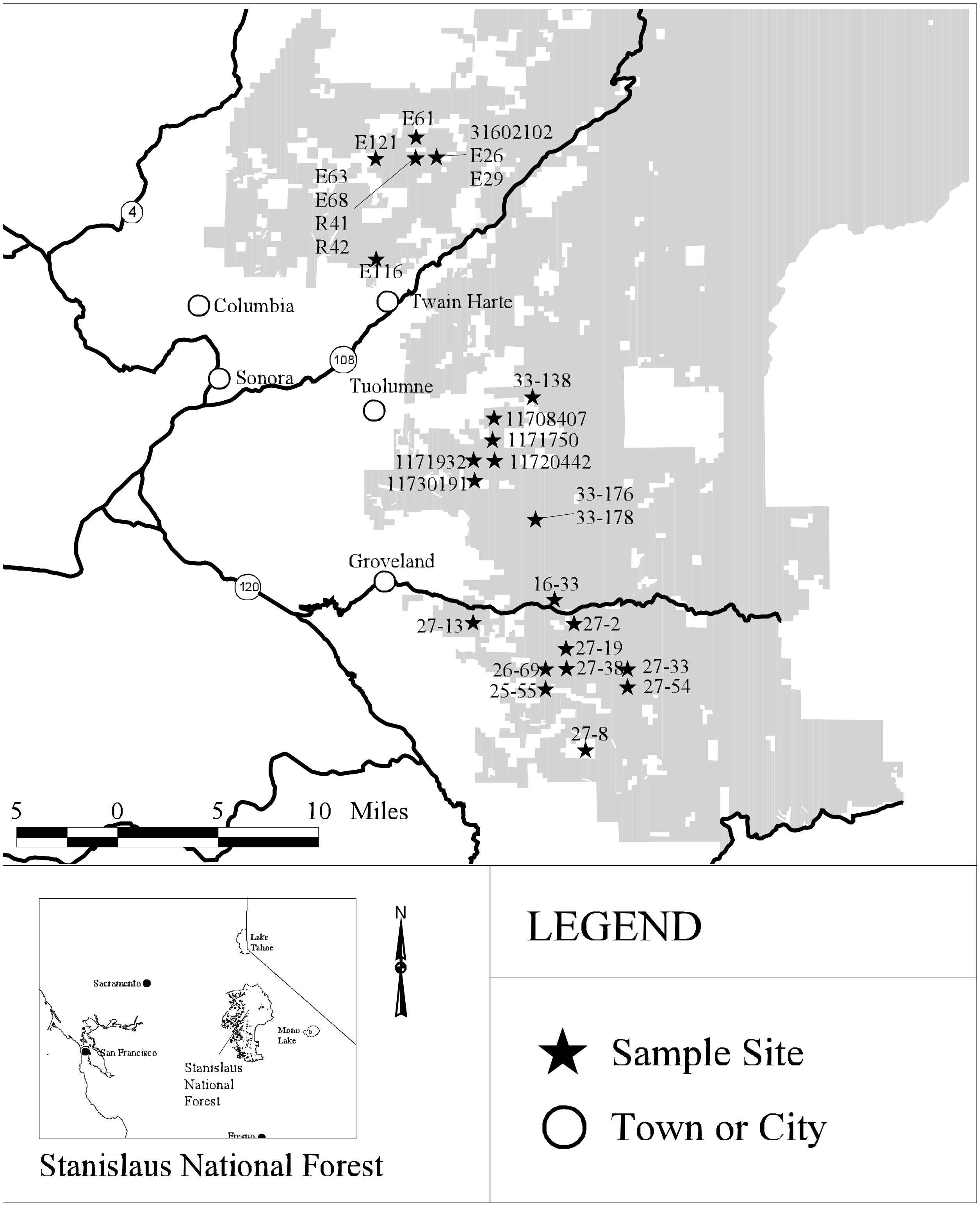
Auberry
Meadow Lakes
336-138
Sierra Cedars
Alder Springs
Beal 14
Prather
Beal 20
N7
S8
168
Tollhouse
2 0 2 4 Miles
Sierra
National
Forest
N
LEGEND
Sample Site
Town or City
Sierra National Forest



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E26
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E68
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E116
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Sonora
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1171750
1171932
11720442
11730191
33-176
33-178
Groveland
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27-13
27-2
27-19
26-69
27-38
27-33
25-55
27-54
27-8
5 0 5 10 Miles
N
Lake Tahoe
Sacramento
San Francisco
Mono Lake
Stanislaus National Forest
Fresno
Stanislaus National Forest
LEGEND
Sample Site
Town or City

APPENDIX B

Chemical Analytical Methods
Method Validation
Ongoing Quality Control
Storage Stability

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Method #: 32.6
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Determination of Glyphosate (N-phosphonomethyl glycine) and AMPA (Aminomethyl phosphonic acid) in Plant Material by HPLC, with Post-column Derivatization and Fluorescence Detection

Scope: This method is for the determination of glyphosate and AMPA in following matrices; acorn, bittercherry, bracken fern, buckbrush, deerbrush, deergrass, dogwood, elderberry, golden fleece, manzanita berry, soaproot, pearly everlasting, and willow; using HPLC with post-column derivatization and fluorescence detection. The reporting limit for glyphosate and AMPA is 0.1ppm, except for acorn and elderberry where the RL is 0.12 ppm for AMPA.

Principles: A 20 gram sample of vegetation is extracted with 0.1 N Hydrochloric acid, and concentrated on a Chelex 100 (iron form) resin column. The residues, along with iron, are eluted with 6 N HCl. The $Fe(Cl)_4^-$, is removed from the residues by passing through an AG 1 x 8 resin column, an anion exchanger. The eluate is evaporated to dryness on a rotary evaporator. The residues, glyphosate and AMPA, are isolated with an Dowex-50W column, a cation exchanger. The eluate is evaporated to dryness on a rotary evaporator and redissolved in water. The analysis is done using HPLC with a post column derivatization system.

Reagents, Equipment and Instrument:

Reagents: All reagents must be suitable for pesticide residue analysis. Although some specific name brands are listed, equivalent supplies can be used:

1. Glyphosate, CAS # 1071-83-6, 1.0 mg/mL in water, obtained from CDFA Standard Repository (Center for Analytical Chemistry, California Department of Food and Agriculture).
2. AMPA, CAS # 1066-51-9, 1.0 mg/mL in water, obtained from CDFA Standard Repository (Center for Analytical Chemistry, California Department of Food and Agriculture).
3. Chelex® 100 resin, sodium form or iron form, 100-200 mesh BioRad Laboratories, 2000 Alfred Nobel Dr., Hercules, Ca 94547. Contact the BioRad Laboratories for the sodium form to iron form conversion procedure.
4. Anion exchanger, AG® 1-X8 resin, Cl form, 200-400 mesh, BioRad Laboratories, 2000 Alfred Nobel Dr., Hercules, Ca 94547.
5. Cation exchanger, Dowex-50W resin, Hydrogen form, 100-200 mesh, 50X8-200, Sigma Chemical Company, P.O. Box 14508, St. Louis, Mo 63178-9916
6. Hydrochloric acid.
7. Deionized water, DI water.
8. Mobile phase: 0.005 M KH_2PO_4, pH 2.0, Pickering # K200.

Reagents:continued

9. Column regenerant: Pickering RG019.
10. Hypochlorite diluent: pH 11.6, Pickering GA116, or dissolve 1.36 g KH_2PO_4, 11.6 g NaCl and 0.4 g NaOH in 500 mL DI water and dilute to 1000 mL with DI water.
11. Sodium hypochlorite: 5.25 % solution, Clorox™. or equivalent.
12. Hypochlorite solution: add 120 µL of 5.25% sodium hypochlorite to 950 mL of hypochlorite diluent.
13. O-phthalaldehyde diluent: Pickering GA104, pH 10.4, or dissolve 19.1 g of sodium borate ($Na_2B_4O_7 \bullet 10\ H_2O$) in 1.0 L of DI water and adjust pH to 10.4 with 1 N NaOH solution.
14. OPA reaction solution: dissolve 100 mg of o-phthalaldehyde in 10 mL methanol. Pour this methanol solution to 950 mL OPA diluent and mix well. Pour the solution into the reagent reservoir and add 2 g of Thiofluor directly into it. Mix well (alternate: 1 mL of 2-Mercaptoethanol can be substituted for 2 g of Thiofluor).
15. Thiofluor™, N,N-Dimethyl-2-mercaptoethylamine-Hydrochloride, Pickering Laboratories, part# 3700-2000.
16. 2-Mercaptoethanol.
17. O-phthalaldehyde, Pierce Chemical Company.
18. Ferric chloride.
19. Dry ice

Equipment: Some specific name brands of equipment are listed, however, in most cases, equivalent equipment and supplies from various venders may be used.

1. Cuisinart™ food processor (Model DLC 7)
2. Sorvall® Omi-Mixer
3. Pint mason jars- narrow mouth.
4. Beakers, 150 mL and 500 mL.
5. Flask, 550 mL, round, flat-bottom.
6. weighing dish, aluminum, 57 mm.
7. Oven, Lab-line®, @ 105 °C
8. Columns, chromatographic, with removable stopcock of PTFE and replaceable glass tip, 11 mm ID x 300 mm length, and 22 mm ID x 300 mm length, with 300 mL reservoir.
9. Steam bath with a nitrogen stream manifold.
10. Vacuum rotary evaporator, Büchi-Brinkman, RE 111.
11. Microfilter, 0.2 µm nylon Acrodisc®, Gelman

Instrument:

1. HPLC: Perkin Elmer Series 4 with column oven.
2. Post column system: Pickering dual pumps with a reaction coil after each pump. The first reaction coil is temperature controlled.
3. Analytical column: Cation exchanger, K^+ form, 4 x 150 mm, Pickering 1954150.
4. Tubing, stainless steel or PEEK, 0.010" ID or less after columns and 0.020" ID before

Instrument:continued

columns.

5. Autosampler, Perkin Elmer ISS-100.
6. Guard column: Pickering # 1953020.
7. Fluorescence Detector: The Toshiba model # 1000 was used . Any compatible detector capable of excitation at 340 nm and detecting an emission ≥ 455 nm may be used.
8. Integrator: A HP 3396 series 2 integrator

Analysis:

Preparation of Chelex 100 Resin column:

1. Plug column (2.2 cm OD x 25 cm with 300 mL reservoir) with glass wool.
2. Transfer ~ 20 mL DI water into the column. Measure and transfer 11 grams of Chelex 100 resin (Fe form) into the column. Rinse down any resin on the walls with DI water. Drain and discard the water.

Sample Preparation:

1. Chop the entire sample into small pieces about 1 cm in length. Blend them in a Cuisinart food processor with dry ice until particles are as fine as possible.
2. Transfer the blended sample to a one quart Mason jar, cover it with a piece of aluminum foil and cap loosely. Store in a freezer overnight to allow the dry ice to sublime.

Moisture Determination:

1. Weigh approximately 5 g of the ground sub sample into a preweighed aluminum weighing dish and record the wet weight.
2. Place the weighing dish with sample into a oven @ 105 °C for at least six hours. Remove the dish from oven and allow to cool in a desiccator. Weigh the dried sample and record the weight.

Sample Extraction:

1. Weigh 20 gram of sample to a one pint Mason jar. Add 30 mL methylene chloride and 150 mL 0.1 N hydrochloric acid. Blend with Omni mixer at moderate to high speed for 3 minutes.
2. Transfer the mixture to a 250 mL centrifuge tube. The centrifuge must be balanced within 0.1 g. It may be balanced by adding water to the centrifuge buckets.
3. Centrifuge at 4000 rpm for 10 minutes
4. After centrifuge, filter supernatant (aqueous layer) thru a 18.5 cm Whatman #4 paper into a graduated cylinder. Collect approximately 125 mL of the aqueous solution into the cylinder.
5. Tare a 600-mL beaker on a top load balance. Pour the filtered sample into the beaker and record the weight. This weight will be used for calculation.
6. Add 300 mL DI water. (For soap root make sure the pH is 2.0 - 2.3, add hydrochloric acid when it is not in this range.)

Sample Concentration with Chelex 100 Resin:

1. Pour the acidified sample onto the chelex column and elute at a rate of ~ 8 mL per minute.
2. After the sample has eluted, rinse the column walls with 50 mL DI water. Then turn the stopcock wide open and rinse with 100 mL 0.1 N HCl.
3. Add 3 mL 6N HCl carefully not to disturb the column and elute at a rate of ~ 10 drops per minute. Discard. Add 4 more mL and discard.
4. Elute the glyphosate with 6 mL of 6 N HCl at a rate of ~ 10 drops per minute, collect the eluate in a 150 mL beaker. Repeat 2 more times collecting all eluate.
5. Add an additional ~ 5 mL 6 of N HCl onto the column and collect the eluate into the previously collected fraction. Add ~ 5 mL concentrated HCl to the eluate to ensure the eluted iron complex is in the negatively charged form.

Preparation of Anion exchange column:

1. Plug column (1.1 cm ID x 30 cm) with glass wool and add ~ 5 mL of DI water.
2. Transfer 7 g of AG 1-X8 anion exchange resin into the column.
3. With the stopcock wide open, rinse with at least 20 mL water.
4. Rinse the column 2 xs with ~ 30 mL of 6 N HCl.
5. With the stopcock wide open, rinse the column with ~ 10 mL of 6 N HCl shortly before applying the sample.

Sample clean-up with an anion exchange column: AG 1x8 Resin

1. Transfer the sample onto the anion exchange column and elute with stopcock wide open. Collect the eluate into a 500-mL flat bottom flask.
2. Rinse the sample container with ~ 6 mL of 6 N HCl and apply to the column.
3. Rinse the sample container with an additional ~ 6 mL of 6 N HCl and apply to the column.
4. Collect the rinse eluates into the corresponding 500-mL flasks.

Concentration of the sample:

1. Evaporate the sample just to dryness on a rotary vacuum evaporator in a 65-70 °C water bath with 28-29 inches of vacuum. **To avoid sudden bumping, immerse the flask approximately 2-3 cm into the water for the first 3-5 minutes of evaporation** then lower further.
2. Place the flask on a 90 °C steam bath under a gentle stream of N_2 for about 2-3 minutes to dry completely, then remove and dissolve the sample in 5 mL 0.01 N HCl.

Preparation of Cation Exchanger column:

1. Plug column (2.2 cm OD x 25 cm with 300 mL reservoir) with glass wool.
2. Transfer approximately 20 mL DI water into the column. Measure and transfer 20 grams of Dowex 50 W (50 X 8, 100-200 mesh). Rinse down any resin on the walls with DI water. Drain and discard the water. Put a glass wool plug on the top of the resin bed.
3. Wash the column with ~ 400 mL of 0.1 N HCl. Repeat the wash again.
   Rinse the column with ~ 100 mL of 0.01 N HCl. Repeat the rinse again.

Purification of the sample with Cation Exchanger column: The chemist must determine the elution profile for each resin lot. Load 5 mL of 10 ng/µL combination standards that has been prepared in 0.01N HCl onto the column and elute with 0.01 N HCl. Check the profile in the fraction of 10-15, 15-20, 20-25, 25-30, 30-40, and each 10 increment there after until 120 mL collected.

1. Apply the sample extract to the column and let it drain with stopcock wide open until it stops draining. Discard the eluent.
2. Rinse the sample container with 5 mL 0.01 N HCl into the column and elute with stopcock wide open until it stops draining. Discard the eluent. Repeat two more times.
3. Introduce 120 mL of 0.01 N HCl into the column, elute with stopcock wide open and collect all eluate into a 500-mL flat bottomed round flask.

Final Concentration of the sample:

1. Evaporate sample to near dryness on a rotary vacuum evaporator at 65-70°C and 28-29 inches of vacuum.
2. Place the flask on a 90°C steam bath under a gentle stream of nitrogen for 2-3 minutes to dry completely.
3. Cool the flask to room temperature and add 2.0 mL DI water to dissolve the residues. Make sure this 2 mL water has rinsed all surfaces of the flask, otherwise low recovery may occure. Filter the solution thru a 0.2 micron Acrodisc into a 2.0-mL autosampler vial for analysis.

Instrument Conditions:

Instrument: Perkin Elmer Series 4 HPLC with column oven and a Pickering post column system
Detector: Fluorescence Detector: Excition, 340 nm & Emission, 465 nm
Column:Pickering Potassium Cation Exchange 4mm x 150 mm x 8 um
Guard Column: Glyphosate guard column k^+ form 3 x 20 mm
Column Temperature: 55 °C
Mobile Phase:

Eluent A: 0.005 M KH_2PO_4, pH 2.0
Eluent B: Column regenerant, or RG019

Time (min.)	Eluent A %	Eluent B %
1.0	100	0.0
15	100	0.0
2	0.0	100
6	100	0.0

Flow rate: 0.4 mL/min.
Injection volume: 10 uL

Post Column System: Pickering

Derivatization Reagents: Hypochlorite solution & OPA solution.
Flow Rate: 0.3 mL/min.
Reaction Temp: 31 °C

Retention time: Glyphosate, 7.9 ± 0.3 minutes and AMPA, 16.4 ± 0.3 minutes

Calculation:

$$\% \text{ Moisture} = \frac{(\text{wt. of undried sample + pan}) - (\text{wt. of dried sample + pan})}{(\text{wt. of undried sample + pan}) - (\text{wt. of pan})} \times 100$$

$$\text{ppm (glyphosate or AMPA)} = \frac{\text{peak area of sample} \times \text{final volume (mL)}}{\text{response factor} \times \text{aliquot sample weight (g)}}$$

Where: $$\text{response factor (area response/ng)} = \frac{\sum (\text{peak area}_n / \text{std concentration}_n)}{n}$$

n = number of standards

aliquot sample weight = sample wt. x aliquot of extract/(150 + sample wt. x % moisture)
Sample wt., aliquot sample wt., and aliquot of extract are in grams.
assume the specific gravity of aqueous extract is 1.0

Method Performance:

Quality Control:

1. A 4 point calibration curve of 0.5, 1.0, 2.0, and 4.0 ug/mL glyphosate was obtained at the beginning and the end of each set of samples.
2. Each sample shall be injected two times to insure reliability of the analysis. If the signal of a sample is greater than that of the highest standard in the calibration curve, dilute the sample. Reinject the diluted sample together with standards twice more. A sample set is usually comprised of 8 samples, a blank and a spike.

Method Detection Limit (MDL):

Method Detection Limit (MDL) refers to the lowest concentration of analytes that a method can detect reliably in either a sample or blank. To determine the MDL, 7 samples each containing 20 g of background matrix were spiked with 0.2 ppm glyphosate. The standard deviation derived from the 7 spikes was used to calculate the MDL using the following equation:

$$MDL = S\ t$$

where:
t is the student's "t" value for the 99% confidence level with n-1 degrees of freedom ($n-1$, $1-\alpha = 0.99$). n represents the number of replicates.
S denotes the standard deviation obtained from replicate analyses.

Results for the standard deviation and the MDL are in appendix 1.

Reporting Limit (RL):

RL refers to the level above which quantitative results may be obtained. The MDL was used as a guide for determining the RL. The reporting limit for this method is 0.1 ppm for glyphosate and AMPA for all vegetation listed in this method except acorn and elderberry where the RL for AMPA is 0.12ppm.

Recovery Data:

The analytical method was validated using only 4 matrices, brackenfern, buckbrush, golden fleece and manzanita berry. Three sets of spike samples were prepared for each matrix. Each set contained 3 levels of spikes and a matrix blank. The matrix background was supplied by the Dept. of Pesticide Regulation. Each set was processed through the entire analytical method. Results for the method validation are shown in appendix 2.

Discussion:

AG 1-X8 and Dowex 50 W was successfully regenerated in our study. The regeneration of the AG 1-X8 was acomplished by adding approximately 30 mL of DI water to the column to wash off the iron. If the column starts to change back to its original color regeneration is possible. Let the water drain ~ half way down and then add~ 10mL of 6 N HCL. The column should turn a light yellow color. Let this solution drain completely and then wash the column with ~ 30 mL of DI water. The column should be back to the original color. Continue with step 4 in *Preparation of Anion Exchange Column* and the column is ready to reuse. The Dowex 50 W resin was successfully regenerated by just following step 3 of *Preparation of Cation Exchanger column.* However, the chemist must be alert to any adverse effect after several times of reuse.

The HPLC column should be stored in regenerant solution when not in use to prolong the life of the column. The column may need to be treated with Restore occassionaly when peak shapes start to broaden.. Treat the column with Restore for 60 minutes, then rinse with the mobile phase for 30 minutes and try the column again If this does not work it may be necessary to replace the column.

Irreversible damage to the column may be caused by solvent passing through the analytical column or running the column at high flow rates.

Chromatographic columns are cleaned by rinsing well with tap water and then distilled water. They are then placed in a hood for reuse. The blades used to blend the samples are washed with soap and water, rinsed well with distilled water and then used to blend distilled water for a few seconds for thorough cleaning. The blades are dried using a clean towel before blending the next sample.

References:

1. Cowell, J., et al., "*Validation of an Analytical Residue Method for Analysis of Glyphosate and Metabolite: An Interlaboratory Study*", J. Agric. Food Chem. 1986, 34, 955-960.

2. Jerry R. Steinmetz "*Analytical Method for Glyphosate and AMPA in Raw Agricultural Commodities, and Their Processed Fractions, Document #Res-008- 90*", Environmental Science Department, Monsanto Company, 700 Chesterfield Parkway North, St. Louis, Missouri 63198. Fax Number: (314) 537-6134.

References:continued

3. US Environmental Protection Agency, " *Determination of Glyphosate in Drinking Water by Direct-Aqueous-Injection HPLC, Post-Column Derivatization, and Fluorescence Detection*", EPA-500 Series Supplement I, July 1990.

4. Communication with *Donna Harding of BioRad Laboratories* during September 1995, Customer Technical Support, BioRad Laboratories.

5. Communication with *Tony Le and Mark Tracy of Pickering Laboratories* during September 1995, 1951 Colony Street, Suite S, Mountain View, California 94043.

6. Mark E Oppenhuizen and John E. Cowell "*Liquid Chromatographic Determination of Glyphosate and Aminomethylphosphonic Acid (AMPA) in Environmental Water: Collaborative Study*" J. Assoc. Off. Anal. Chem. 74, January/ February 1991 Issue.

7. Pickering Laboratories "*Post-Column LC Systems for Environmental Pesticide Analysis" B-CA5, 1993,* 1951 Colony Street, Suite S, Mountain View, California 94043.

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Appendix 1
Glyphosate & AMPA Spike Results (ppm) for MDL Determination

Spike	Acorn		Bittercherry		Bracken Fern	
	Glyphosate	AMPA	Glyphosate	AMPA	Glyphosate	AMPA
1	0.185	0.173	0.189	0.133	0.161	0.090
2	0.137	0.100	0.194	0.174	0.169	0.125
3	0.122	0.072	0.167	0.159	0.186	0.115
4	0.178	0.095	0.193	0.186	0.135	0.100
5	0.158	0.100	0.203	0.208	0.174	0.110
6	0.135	0.072	0.198	0.201	0.179	0.150
7	0.166	0.131	0.190	0.190	0.182	0.154
SD	0.024	0.036	0.011	0.026	0.017	0.024
MDL	0.075	0.112	0.036	0.082	0.054	0.076

Spike	Buckbrush		Deerbrush		Deergrass	
	Glyphosate	AMPA	Glyphosate	AMPA	Glyphosate	AMPA
1	0.152	0.144	0.152	0.139	0.179	0.161
2	0.145	0.148	0.192	0.111	0.178	0.157
3	0.153	0.160	0.184	0.177	0.194	0.189
4	0.166	0.165	0.159	0.102	0.189	.0.174
5	0.168	0.172	0.150	0.129	0.185	0.171
6	0.172	0.193	0.167	0.155	0.176	0.166
7	0.153	0.162	0.144	0.133	0.181	0.172
SD	0.010	0.016	0.018	0.025	0.007	0.010
MDL	0.032	0.051	0.057	0.079	0.020	0.033

Spike	Dogwood		Elderberry		Golden Fleece	
	Glyphosate	AMPA	Glyphosate	AMPA	Glyphosate	AMPA
1	0.180	0.162	0.158	0.086	0.186	0.158
2	0.177	0.140	0.174	0.123	0.182	0.176
3	0.178	0.161	0.164	0.132	0.173	0.162
4	0.155	0.143	0.181	0.165	0.186	0.176
5	0.159	0.133	0.176	0.181	0.174	0.159
6	0.148	0.128	0.183	0.181	0.195	0.184
7	0.115	0.149	0.175	0.169	0.195	0.184
SD	0.023	0.013	0.009	0.036	0.009	0.011
MDL	0.073	0.041	0.028	0.112	0.028	0.036

Appendix 1 continued:

Spike	**Soaproot**		**Willow**		**Manzanita Berry**	
	Glyphosate	AMPA	Glyphosate	AMPA	Glyphosate	AMPA
1	0.160	0.172	0.158	0.135	0.113	0.057
2	0.182	0.172	0.164	0.165	0.152	0.089
3	0.147	0.154	0.167	0.169	0.159	0.112
4	0.155	0.162	0.181	0.171	0.153	0.120
5	0.171	0.174	0.165	0.160	0.158	0.105
6	0.170	0.182	0.172	0.161	0.137	0.084
7	0.168	0.168	0.162	0.166	0.191	0.075
SD	0.012	0.009	0.007	0.012	0.024	0.022
MDL	0.037	0.028	0.024	0.039	0.074	0.070

Spike	**Pearly Everlasting**	
	Glyphosate	AMPA
1	0.168	0.167
2	0.178	0.163
3	0.181	0.163
4	0.165	0.119
5	0.156	0.159
6	0.174	0.150
7	0.167	0.160
SD	0.009	0.016
MDL	0.027	0.052

Appendix 2
Validation Results for Glyphosate

	Bracken Fern		Buckbrush		Golden Fleece		Manzanita Berry	
spike level	results (ppm)	recovery (%)	results (ppm)	recovery (%)	results (ppm)	recovery (%)	results (ppm)	recovery (%)
0.3	0.217	72.3	0.286	95.3	0.268	89.3	0.285	95.0
	0.247	82.3	0.266	88.7	0.271	90.3	0.288	96.0
	0.249	83.0	0.252	84.0	0.283	94.3	0.311	103.7
3.0	1.98	66.0	2.81	93.7	2.55	85.0	2.89	96.3
	2.25	75.0	2.68	89.3	2.50	83.3	2.82	94.2
	2.65	88.3	2.49	83.0	2.72	90.7	2.82	94.0
30.0	20.2	67.3	28.7	95.7	24.3	81.0	26.8	89.3
	25.0	83.3	21.8	72.7	27.3	91.0	28.1	93.7
	22.4	74.7	22.5	75.0	31.4	104.7	28.7	95.7

Validation Results for AMPA

	Bracken Fern		Buckbrush		Golden Fleece		Manzanita Berry	
spike level	results (ppm)	recovery (%)	results (ppm)	recovery (%)	results (ppm)	recovery (%)	results (ppm)	recovery (%)
0.3	0.169	56.3	0.280	93.3	0.257	85.7	0.272	90.7
	0.217	72.3	0.271	90.3	0.274	91.3	0.329	109.7
	0.187	62.3	0.230	76.7	0.294	98.0	0.278	92.7
3.0	1.71	57.0	2.97	99.0	2.53	84.3	2.56	85.3
	2.03	67.7	2.73	91.0	2.54	84.7	2.72	90.7
	2.02	67.3	2.81	93.7	2.41	80.3	2.27	75.7
30.0	12.9	43.0	22.0	73.3	25.3	84.3	25.1	83.7
	16.3	54.3	23.3	77.7	23.7	79.0	25.1	83.7
	13.0	43.3	24.3	81.0	26.4	88.0	16.1	53.7

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Method #: 50.5
Original Date: 02/07/97
Revised:

The Determination of Triclopyr in Plant Materials

Scope: This method is for the analysis of triclopyr in acorn, bittercherry, bracken fern, buckbrush, deerbrush, deergrass, dogwood, elderberry, golden fleece and manzanita berry, soaproot, pearly everlasting, and willow. The reporting limit for bracken fern and manzanita berry is 0.03 ppm, golden fleece is 0.07 ppm and buck brush is 0.05 ppm.

Principle: The plant materials were chopped into small pieces and homogenized in a cuisinart with dry ice. Triclopyr was extracted from the ground sample by blending with benzene and sulfuric acid. An aliquot of the benzene extract was cleaned up by extracting with the sodium bicarbonate solution and ethyl ether. The extract was acidified with sulfuric acid. Methylene chloride was used to extract the residue from the acidified aqueous solution. The resulting extract was concentrated then derivatied with diazomethane and quantitated by GLC/ECD and GC/MSD

Reagents, Equipment and Instrument:

Reagents: All reagents must be suitable for pesticide residue analysis.

1. Solvent: Benzene (It is recognized as a carcinogen, review MSDS before handling), Ethyl Ether, Hexane, Methylene chloride, Iso-octane, pesticide grade or equivalent
2. Sulfuric acid (1:1), reagent grade
3. Sodium bicarbonate solution, 4% (w/v)
4. Triclopyr stock solution (1 mg/mL): Obtain standard from Standard Repository CDFA. 3292 Meadowview Rd. Sac., CA 95832.
5. Sodium Sulfate, anhydrous, granular (ACS)
6. Diazomethane (carcinogenic and explosive reagent, review MSDS before handling)
7. Dry ice

Equipment:

1. Nitrogen evaporator Organomation Model # 12
2. Rotary evaportor (Büchi/Brinkmann, R110)
3. Cuisinart™ food processor (Model DLC 7)
4. Sorvall® Omi-Mixer - pint mason jars
5. Separatory funnel, 500 mL
6. Flat-bottomed round flask, 500 mL
7. Graduated conical centrifuge tubes, 15 mL
8. Mixing cylinder, 100 mL
9. Filter paper, Whatman # 1

Reagent, Equipment and Instrument: continued

Instrument:

1. Hewlett Packard Gas Chromatograph Model 6890 with autosampler and a electron capture detector (ECD).
2. Hewlett Packard Gas Chromatograph Model 6890 with autosampler and a mass selective detector (MSD).

Analysis:

Sample Extraction:

1. Cut entire plant sample into small pieces. Grind the sample in a Cuisinart with dry ice until the sample becomes homogeneous.
2. Transfer the ground sample to a mason jar cover it with a piece of aluminum foil and apply lid loosely. Store in a freezer overnight to allow carbon dioxide to dissipate.
3. Weigh 40 g of ground elderberry, 35g of acorn, bracken fern, deerbrush, deergrass, dogwood, manzanita berry, willow, or 20g of bitterrcherry, golden fleece, soaproot, or 15g of buckbrush, or 10 g of pearly everlasting plant sample into a pint size mason jar. Then add 100 mL of benzene and 1.5 mL of 1:1 sulfuric acid.
4. Blend with Omi-mixer for 4 minutes at a setting of 3.5.
5. Filter the extract through a funnel lined with # 1 Whatman filter paper containing 10 g sodium sulfate into a graduate mixing cylinder.
6. Remove a 50 mL aliquot of extract from the cylinder to a 500 mL separatory funnel.
7 Extract with 200 mL of 4% sodium bicarbonate solution by shaking for 1.5 minute, venting often to relieve pressure. Drain lower aqueous layer into a 600 mL beaker.
8. Add another 100 mL of sodium bicarbonate soln. to separatory funnel and shake 1 minute. Add lower aqueous layer to the beaker and discard benzene in a proper waste container.
9. Pour contents of beaker back into separatory funnel and add 100 mL ethyl ether. Shake gently for 1 minute and vent often.
10. Drain aqueous layer into the beaker and discard ether.
11. Add 3 mL of 1:1 sulfuric acid to aqueous extract carefully and swirl. **Beware-- there will be foaming!** Continue adding sulfuric acid until aqueous soln. is acidic (~ 10 mL) and foaming stop.
12. Pour acidifed aqueous solution back into separatory funnel.
13. Add 100 mL methylene chloride and shake vigorously for 1 minute.
14. Allow layers to separate. Drain the organic layer into a 500 mL flask.
15. Repeat steps 12 and 13 two more times using 80 mL methylene chloride.
16. Add 5 mL of iso-octane to the flask.
17. Rotoevaporate the extract to ~ 4 mL at 35 °C under approximately 15 inches of Hg vacuum.
18. Add 1 mL diazomethane solution into the flask. Cover the flask with aluminum foil and swirl it gently. Allow the reaction mixture to stand in a fumehood for 30 minutes. (If the brownish-yellow color has disappeared within 30 minutes, add additional diazomethane solution and let the reaction mixture stand for another 30 minutes.)
19 Evaporate the solvent and the excess reagent to just dryness at ambient temperature using a gentle stream of nitrogen.
20. Pipet 5 mL of hexane into flask and swirl. Transfer the extract immediately to an autosampler vial for GLC analysis.

Analysis: continued

Instrument Condition:

Primary Analysis:

Hewlett Packard 5890 GC with ECD
Column: HP-1 (Crosslinked methyl silicone gum) 30 m x 0.53 mm x 0.88 μm
Carrier gas: Helium, column flow rate 1.5 mL/min
Injector temperature: 220 °C
Detector temperature: 300 °C
Column oven temperature:

Ramp 1	Initial temperature:	150 °C hold for 2 min
	Rate:	5 °C / min
Ramp 2	Initial temperature	190 °C
	Rate	30 °C / min
	Final temperature	250 °C hold for 4 min

Injection volume: 1 μL
Retention times: 8.420 ± 0.10 min

Confirmation Analysis:

Hewlett Packard 6890 gas chromatograph with mass selective detector (MSD).
Column: HP-Utra-1 25 m x 0.2 mm x 0.33 μm
Carrier gas: Helium, flow rate: 1 mL/min Constant Pressure
Injector temperature: 250 °C
Detector temperature: 280 °C
Column oven temperature:

Initial temperature:	70 °C hold for 1.5 min
Ramp rate:	20 °C / min
Final temperature	250 °C hold for 2 min

Purge: Initial off
On time 0.5 minute
Acquisition Parameters: 271.1,212.1,210.0
Run table Time 6.0 min mass spec on
Time 12 min mass spec off
Injection volume: 1 μL
Retention time: 9.66 ± 0.10 min

Calculations:

$$\text{ppm} = \frac{(\text{Peak height of sample}) \times (\text{Std conc}) \times (\text{Std vol. injected}) \times (\text{Initial Vol}) \times (\text{Final Vol of sample})}{(\text{Peak height of Std}) \times (\text{Sample vol injected}) \times (\text{Sample weight (g)}) \times (\text{aliquot Vol.})}$$

Method Performance:

Quality Control:

1. A four-point calibration curve of 0.1, 0.25, 0.5 and 1.0 ηg/μL triclopyr was obtained at the beginning and the end of each set of samples.

Method Performance: continued

Quality Control:

2. Each sample was analyzed two times to insure reliability of the chromatography. If the signal of the sample was greater than that of the highest concentration of the calibration curve, the sample was diluted within the calibration range and reanalyzed.
3. For each set of samples, one matrix blank and one matrix spike were included, and each set of samples did not contain more than twelve samples.
4. Positive sample result was confirmed by MSD.

Method Detection Limit (MDL)

Method Detection Limit refers to the lowest concentration of analyte that a method can detect reliably in either a sample or blank. This was determined by fortifying seven aliquots of background sample matrix with 5 ug of triclopyr and processing through the entire method along with a blank. The standard deviation derived from the 7 spiked samples was used to calculate the MDL using the following equation:

$$\mathbf{MDL} = t\,S$$

where:

t is the Students' t value for the 99% confidence level with n-1 degrees of freedom (n-1, $1 - \alpha = 0.99$), which is 3.143. n represents the number of replicates.

S denotes the standard deviation obtained from replicate analyses.

Results of the standard deviation and the MDL are in appendix 1.

Reporting Limit (RL):

It refers to the level above which quantitative results may be obtained.

The sample size, MDL and RL for each matrix were tabulated as follow:

Matrix	Sample size (g)	MDL (ppm)	RL (ppm)
Acorn	35	0.01	0.01
Bittercherry	20	0.066	0.07
Bracken Fern	35	0.0147	0.03
Buck Brush	15	0.049	0.05
Deerbrush	35	0.0197	0.03
Deergrass	35	0.045	0.05
Dogwood	35	0.023	0.03
Elderberry	40	0.01	0.01
Golden Fleece	20	0.07	0.07
Manzanita berry	35	0.022	0.03
Pearly Everlasting	10	0.065	0.07
Soaproot	20	0.027	0.03
Willow	35	0.03	0.03

Method Performance: continued

Recovery Data:

Method validation was performed by spiking the background plants; bracken fern, buckbrush, golden fleece and manzanita berry, with three different levels (0.3, 3.0, and 30 ppm) of triclopyr for three replicates.

Results of the method validation are summarized in appendix II.

Discussion:

The sample sizes of this method varied in different plant matrices, because some of the plant matrices contain oil or other unknown materials which interfered with the analysis. A sample size of 35 g was used for most of the matrices. Buckbrush sample size was decreased due to the imitation of background matrix during the determination of the MDL.

References:

Determination of Phenoxies in Vegetation, Pesticide Residue Laboratory Method, Center for Analytical Chemistry, California Dept. of Food and Agriculture.

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TITLE: Agricultural Chemist II

APPROVED BY: Catherine Cooper

Catherine Cooper

TITLE: Agricultural Chemist III Supervisor

APPENDIX I *Triclopyr Spike Results (ppm) for MDL Determination*

Spike	Acorn	Bittercherry	Bracken Fern	Buckbrush	Deerbrush
1	0.096	0.202	0.108	0.140	0.101
2	0.089	0.178	0.115	0.133	0.112
3	0.096	0.199	0.106	0.159	0.099
4	0.095	0.228	0.112	0.132	0.112
5	0.092	0.202	0.103	0.132	0.111
6	0.094	0.236	0.104	0.118	0.106
7	0.091	0.186	0.103	0.110	0.116
SD	0.003	0.021	0.005	0.016	0.006
MDL	0.010	0.066	0.015	0.050	0.020

Spike	Deergrass	Dogwood	Elderberry	Golden Fleece	Soaproot
1	0.219	0.116	0.096	0.150	0.226
2	0.213	0.120	0.090	0.144	0.164
3	0.233	0.128	0.096	0.170	0.224
4	0.257	0.126	0.095	0.185	0.221
5	0.241	0.107	0.092	0.165	0.220
6	0.231	0.119	0.094	0.210	0.234
7	0.237	0.111	0.091	0.160	0.240
SD	0.015	0.008	0.002	0.022	0.008
MDL	0.046	0.023	0.008	0.070	0.027

Spike	Willow	Manzanita Berry	Pearly Everlasting
1	0.116	0.111	0.202
2	0.122	0.112	0.178
3	0.116	0.110	0.199
4	0.106	0.112	0.228
5	0.099	0.130	0.202
6	0.110	0.115	0.236
7	0.096	0.116	0.186
SD	0.010	0.007	0.021
MDL	0.300	0.022	0.066

APPENDIX II *Method Validation Results*

	Bracken Fern		Buckbrush	
Spike Level (ppm)	Result (ppm)	Recovery (%)	Result (ppm)	Recovery (%)
0.3	0.247	82.3	0.260	86.7
	0.214	71.3	0.278	92.7
	0.230	76.7	0.246	82.0
3.0	2.30	76.6	2.36	78.8
	2.19	73.1	2.55	85.1
	2.57	85.7	2.69	89.8
30	24.0	80.1	26.9	89.8
	22.4	74.8	26.2	87.4
	23.9	79.9	24.9	83.2

	Golden Fleece		Manzanita Berry	
Spike Level (ppm)	Result (ppm)	Recovery (%)	Result (ppm)	Recovery (%)
0.3	0.202	67.3	0.240	80.0
	0.190	63.3	0.305	102
	0.238	79.3	0.243	81.0
3.0	2.01	67.1	2.52	83.4
	1.88	62.8	2.69	89.7
	2.11	70.2	2.44	81.2
30	22.1	73.6	24.3	81.0
	20.3	67.7	28.2	93.8
	22.8	76.0	25.2	84.2

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Method # : 34.3
Revised:
Original Date: 12/18/95

Determination of Hexazinone in Plant Material by HPLC

Scope: This method is for the determination of hexazinone in following matrices: acorn, bittercherry, buckbrush, bracken fern, deerbrush, deergrass, dogwood, elderberry, manzanita berry, pearly everlasting, redbud, watercress and willow. The reporting limits for this method are: 0.05 ppm for bracken fern, deergrass, elderberry, manzanita berry, redbud, willow,watercress, 0.1 ppm for acorn, bittercherry, buckbrush, deerbrush, dogwood and 0.2 ppm for pearly everlasting. CAS registered number for hexazinone is 51235-04-2

Principle: The plant materials are cut into small pieces and homogenized with dry ice using a cuisinart. A portion of homogeneous sample is extracted with acetonitrile. The acetonitrile extract is evaporated to almost dryness on a nitrogen steambath and cleaned up by passing through an aminopropyl Bond Elut®. Then hexazinone is eluted with a mixture of methanol and methylene chloride. The final extract is primarily analyzed by a reverse-phase HPLC/UV detector.

Reagents and Equipments:

Reagents:

1. Acetonitrile, HPLC grade
2. Methanol, Pesticide grade
3. Methylene Chloride
4. Sodium Sulfate, granular, anhydrous
5. Sodium Chloride, granular, anhydrous
6. Dry ice

Equipments:

1. Mason jar: One pint, narrow mouth with cap
2. Blender: Omni-Mixer
3. Vacuum manifold: Vac Elut SPS 24. Varian
4. Bond Elut®: Aminopropyl Bond Elut 10 cc/ 500 mg. Varian®
5. Filter paper. Whatman # 4
6. Acrodisc®, 0.2 µm filter. Gelman Sciences
7. Crusinart™ food processer (Model DLC 7)
8. Steam bath with a nitrogen stream manifold

Analysis:

Sample Extraction:

1. Cut entire sample into small pieces (less than one inch in length). Homogenize the sample with dry ice using a cuisinart until obtaining the smallest particles possible. Store the sample in a freezer overnight with a loose cap to allow the CO_2 to dissipate.
2. Weigh out 25.0 g of the homogenous sample into a narrow mouth, one pint mason jar. Add 100 mL of acetonitrile and blend the sample for 10 minutes using Omni-Mixer set at medium speed.
3. Decant the liquid layer through a funnel which contains a # 4 filter paper and 20 g of sodium sulfate into a 100 mL graduated cylinder (for elderberry, manzanita berry, and watercress, add 20 g of sodium chloride to a 100 mL graduated cylinder before decant the liquid layer through a funnel which contains a # 4 filter paper into the graduated cylinder . Shake the graduated cylinder vigorously for two minutes and allow two phases distinctly separated).
4. Pipette 10 mL of the acetonitrile extract into a 50 mL beaker (upper phase in case of elderberry, manzanita berry, watercress). Evaporate to about 0.5 mL under nitrogen on a steambath set a 60 °C. Add 5 mL of 5% methanol in methylene chloride to the beaker (for acorn, use 10% methanol in methylene chloride) and sonicate the beaker for 3 minutes. Note: *When evaporating and sonicating the sample, do not let water get into the beaker.*
5. Set the vacuum manifold at *discard position*. Condition an aminopropyl Bond Elut® by adding 10 mL of 5% methanol in methylene chloride solution to the Bond Elut®(for acorn, use 10% methanol in methylene chloride).
6. Set the flow about 3 mL per minute by adjusting the vacuum pressure. Turn off vacuum and switch the vacuum manifold to *collect position* just before the Bond Elut® goes to dryness. Immediately transfer the sample from the beaker to the conditioned Bond Elut® and collect the eluant in a 15 mL test tube. Add 10 mL more of the 5% solution (for acorn, use the 10% solution) to the beaker, sonicate for 1 minute and then transfer to the Bond Elut® (wait until the first 5 mL just goes through the Bond Elut® before transfering). Collect the eluant in the 15 mL test tube.
7. Evaporate the eluant to ~ 0.1 mL using a N-EVAP set at 40 °C. Bring to a final volume of 2 mL with methanol. Mix well for 20 seconds. Filter through a 0.2 µm acrodisc HPLC filter into an autosampler vial.
8. Analyzed by HPLC with a Variable UV detector.

Instrument Conditions:

HPLC parameter for acorn, elderberry, deerbrush, deergrass, dogwood, bracken fern, manzanita berry, and willow:

Hewlett Packard HPLC 1050 with Variable UV detector
Column: Beckman ODS Hypersil 25 cm x 4.6 mm x 5 µm
Guard column ODS Hypersil 5 cm x 4.6 mm x 5 µm

Mobile phase gradient:	Time (min.)	%Water	%Acetonitrile
	0.00	90.0	10.0
	15.0	60.0	40.0
	20.0	10.0	90.0
	25.0	90.0	10.0

Analysis:

Instrument Conditions: (con't)

Flow rate: 1 mL per minute
Wavelength: 254 nm
Column oven temperature: 40 °C
Injection volume: 20 µL
Retention times: 15.65 minutes

HPLC parameter for bittercherry, buckbrush, pearly everlasting, redbud, and watercress:
Hewlett Packard HPLC 1050 with Variable UV detector
Column: Beckman ODS Hypersil 25 cm x 4.6 mm x 5 µm
Guard column ODS Hypersil 5 cm x 4.6 mm x 5 µm
Mobile phase gradient:

Time (min.)	%Water	%Acetonitrile
0.00	90.0	10.0
28.0	60.0	40.0
36.0	90.0	10.0
40.0	90.0	10.0

Flow rate: 1 mL per minute
Wavelength: 254 nm
Column oven temperature: 40 °C
Injection volume: 20 µL
Retention times: 22.08 minutes

GC parameter for acorn, elderberry, deerbrush, deergrass, dogwood, bracken fern, willow, manzanita berry, bittercherry, buckbrush, redbud, pearly everlasting and watercress:
Hewlett Packard gas chromatography 6890 with a nitrogen-phosphate detector
Column: DB-17 (50%-phenyl)-methyl polysiloxane, 30 m x .25 mm x 0.25 µm film thickness.
Carrier gas: Helium: 1.8 mL / min.
Detector gases: Air: 60 mL/ min.
Hydrogen: 3 mL/ min.
Helium as make up: 28.2mL/ min.
Oven temperature program:
Initial temperature: 100°C . Initial hold time: 1 min.
Rate: 15°C per min.
Final temperature: 260°C. Final hold time: 15 min.
Injector temperature: 250°C
Detector temperature: 300°C
Injection volume: 2 µL
Retention time: 19.87 min

Calculations:

$$\text{ppm } (\mu g/g) = \frac{\mu g/mL \text{ (from the standard curve) x aliquot final volume (mL)}}{\text{Aliquot sample weight (g)}}$$

For this method, aliquot final volume is 2 mL, aliquot sample weight is 2.5 g

Method Performance:

Quality Control:

1. A 4 - point calibration curve : 0.1 ng/µL, 0.5 ng/µL, 1 ng/µL and 2 ng/µL shall be run at the beginning and the end of each set of samples.
2. Each sample shall be injected two times to insure reliability of the analysis. If the signal of a sample is greater than that of the highest standard, dilute the sample. Reinject the diluted sample with standards as directed above.
3. Sample storage: All field samples shall be kept frozen at -10 °C. Thaw the samples in a refrigerator overnight before grinding.
4. Sample extracts: All extracts shall be kept frozen at -10 °C until analyzed.
5. Freezer, refrigerator and oven temperatures shall be monitored and recorded daily.
6. For each set of samples, one matrix blank and 1 matrix spike shall be included, and each set of samples shall not contain more than twelve samples.
7. To avoid cross contamination, all glassware and grinding equipments shall be rinsed with water several times followed by an acetone or methanol rinse before grinding the next sample.

Recovery data:

The analytical method was validated using only *four* matrices, bracken fern, buckbrush, manzanita berry, and redbud. Three sets of fortified samples were prepared for each matrix. Each set contained three levels of fortification and a matrix blank. The matrix background was provided by Dept. of Pesticide Regulation. All fortified and matrix blank samples were processed through the entire analytical method and the results were tabulated below:

Recovery data of method validation of hexazinone in manzanita berry

Fortified Levels (µg/g)	Results (µg/g)	Recovery (%)
0.3	0.268	89.3
0.3	0.248	82.7
0.3	0.239	79.7
3.0	2.467	82.2
3.0	2.700	90.0
3.0	2.749	91.6
30.0	29.44	98.1
30.0	30.80	103
30.0	28.04	93.5

Recovery data of method validation of hexazinone in bracken fern

Fortified Levels (µg/g)	Results (µg/g)	Recovery (%)
0.3	0.282	94.0
0.3	0.261	87.0
0.3	0.273	91.0
3.0	2.934	97.8
3.0	2.611	87.0
3.0	2.557	85.2
30.0	25.16	83.9
30.0	24.52	81.7
30.0	25.56	85.2

Method Performance:

Recovery data:(con't)

Recovery data of method validation of hexazinone in redbud

Fortified Levels (μg/g)	Results (μg/g)	Recovery (%)
0.3	0.299	99.7
0.3	0.284	94.7
0.3	0.282	94.0
3.0	2.760	92.0
3.0	2.654	88.5
3.0	2.906	96.9
30.0	25.44	84.8
30.0	25.37	84.6
30.0	25.16	83.9

Recovery data of method validation of hexazinone in buckbrush

Fortified Levels (μg/g)	Results (μg/g)	Recovery (%)
0.3	0.344	115
0.3	0.218	72.7
0.3	0.285	95.0
3.0	2.963	98.8
3.0	3.030	101
3.0	2.697	89.9
30.0	24.00	80.0
30.0	24.20	80.7
30.0	34.75	116

Method Detection Limit:

Method Detection Limit (MDL) refers to the lowest concentration of analytes that a method can detect reliably. To determine the MDL, for each matrix, 7 replicated background samples were fortified at 0.2 ppm. The standard deviation derived from the fortified samples was used to calculate the MDL using the following equation:

$$\mathbf{MDL} = t\ S$$

where:

t is the Student t value for the 99% confidence level with n-1 degrees of freedom (n-1, $1 - \alpha = 0.99$) which is 3.143, n represents the number of replicates which is 7

S denotes the standard deviation obtained from replicate analyses.

The MDL and RL for each matrix were tabulated as follow:

Matrix	Method detection limit (ppm)	*Reporting limit (ppm)
Redbud	0.05	0.05
Bracken fern	0.02	0.05
Manzanita berry	0.05	0.05
Buckbrush	0.04	0.10

**Reporting Limit:* Reporting Limit (RL) refers to the level which quantitative results may be obtained usually 1-5 times the MDL.

Dicussion:

1. The clean up procedure in this method is based on the background matrices provided during the method development. Actual samples, collected at other locations during different seasons, could yield different backgrounds from those used during the method development. If unexpected interferences are seen, acorn, elderberry, deerbrush, deergrass, dogwood, bracken fern, manzanita berry, and willow samples can be analyzed by using the hplc parameter which was set up for buckbrush, redbud, bittercherry, pearly everlasting, and watercress samples. This hplc parameter gives a better separation but is time consuming. A GC/NPD parameter is also added to the method and is used as a back up instrument in case the HPLC has problems with separation. Standards for quantitation of hexazinone by the GC/NPD must be made from the matrix blank extracts to compensate for the matrix enhanced response.

2. This method was used to determine the method detection limits (MDLs)/reporting limits (RLs) for the following matrices (method validation has not been done for these matrices). The results were tabulated below:

Matrix	Method detection limit (ppm)	Reporting limit (ppm)
Willow	0.05	0.05
Deergrass	0.03	0.05
Deerbrush	0.05	0.10
Dogwood	0.05	0.10
Elderberry	0.05	0.05
Acorn	0.02	0.10
Pearly everlasting	0.13	0.20
Bittercherry	0.07	0.10
Watercress	0.05	0.05

See appendix I for recovery data of MDL determination

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Duc Tran

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Title: Agricultural Chemist III

Appendix I: ***Recovery data for determination of method detection limits***

Hexazinone in mazanita berry

Fortified Levels (µg/g)	Results (µg/g)	Recovery (%)
0.2	0.174	87.0
0.2	0.218	109
0.2	0.228	114
0.2	0.193	96.5
0.2	0.211	106
0.2	0.201	101
0.2	0.195	97.5

Hexazinone in bracken fern

Fortified Levels (µg/g)	Results (µg/g)	Recovery (%)
0.2	0.202	101
0.2	0.197	98.5
0.2	0.185	92.5
0.2	0.184	92.0
0.2	0.194	97.0
0.2	0.188	94.0
0.2	0.199	99.5

Hexazinone in redbud

Fortified Levels (µg/g)	Results (µg/g)	Recovery (%)
0.2	0.189	94.5
0.2	0.181	90.5
0.2	0.181	90.5
0.2	0.191	95.5
0.2	0.171	85.5
0.2	0.176	88.0
0.2	0.173	86.5

Appendix I: ***Recovery data for determination of method detection limits (con't)***

Hexazinone in buckbrush

Fortified Levels (µg/g)	Results (µg/g)	Recovery (%)
0.2	0.184	92.0
0.2	0.199	99.5
0.2	0.188	94.0
0.2	0.198	99.0
0.2	0.176	88.0
0.2	0.171	85.5
0.2	0.171	85.5

Hexazinone in willow

Fortified Levels (µg/g)	Results (µg/g)	Recovery (%)
0.2	0.184	92.0
0.2	0.190	95.0
0.2	0.214	107
0.2	0.186	93.0
0.2	0.195	97.5
0.2	0.194	97.0
0.2	0.184	92.0

Hexazinone in deergrass

Fortified Levels (µg/g)	Results (µg/g)	Recovery (%)
0.2	0.215	108
0.2	0.221	111
0.2	0.209	104
0.2	0.189	94.5
0.2	0.203	102
0.2	0.211	106
0.2	0.208	104

Appendix I: ***Recovery data for determination of method detection limits*** *(con't)*

Hexazinone in dogwood

Fortified Levels (µg/g)	Results (µg/g)	Recovery (%)
0.2	0.218	109
0.2	0.193	96.5
0.2	0.221	111
0.2	0.203	102
0.2	0.182	91.0
0.2	0.232	116
0.2	0.205	103

Hexazinone in elderberry

Fortified Levels (µg/g)	Results (µg/g)	Recovery (%)
0.2	0.193	96.5
0.2	0.183	91.5
0.2	0.179	89.5
0.2	0.216	108
0.2	0.176	88.0
0.2	0.178	89.0
0.2	0.185	92.5

Hexazinone in acorn

Fortified Levels (µg/g)	Results (µg/g)	Recovery (%)
0.2	0.164	82.0
0.2	0.156	78.0
0.2	0.172	86.0
0.2	0.156	78.0
0.2	0.151	75.5
0.2	0.165	82.5
0.2	0.157	78.5

Appendix I: ***Recovery data for determination of method detection limits (con't)***

Hexazinone in pearly everlasting

Fortified Levels (µg/g)	Results (µg/g)	Recovery (%)
0.4	0.389	97.3
0.4	0.346	86.5
0.4	0.340	85.0
0.4	0.397	99.3
0.4	0.408	102
0.4	0.286	71.5
0.4	0.352	88.0

Hexazinone in bittercherry

Fortified Levels (µg/g)	Results (µg/g)	Recovery (%)
0.2	0.180	90.0
0.2	0.192	96.0
0.2	0.173	86.5
0.2	0.154	77.0
0.2	0.211	106
0.2	0.187	93.5
0.2	0.214	107

Hexazinone in watercress

Fortified Levels (µg/g)	Results (µg/g)	Recovery (%)
0.2	0.204	102
0.2	0.179	89.5
0.2	0.177	88.5
0.2	0.187	93.5
0.2	0.197	98.5
0.2	0.218	109
0.2	0.190	95.0

Appendix I: ***Recovery data for determination of method detection limits*** *(con't)*

Hexazinone in deerbrush

Fortified Levels (µg/g)	Results (µg/g)	Recovery (%)
0.2	0.187	93.5
0.2	0.188	94.0
0.2	0.187	93.5
0.2	0.210	105
0.2	0.220	110
0.2	0.196	98.0
0.2	0.227	114

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Determination of Hexazinone in Golden fleece and Soaproot by GC

Scope: This method is for the determination of hexazinone in golden fleece and soaproot. The reporting limits of this method are 0.10 ppm for golden fleece and 0.05 ppm for soaproot. CAS registry # for hexazinone is 51235-04-2

Principle: The plant material is cut into small pieces and homogenized with dry ice using a cuisinart. A portion of homogeneous sample is extracted with acetonitrile. The acetonitrile extract is evaporated to almost dryness on a nitrogen steambath and cleaned up by passing through an aminopropyl Bond Elut®. Then hexazinone is eluted with a mixture of methanol and methylene chloride. The final extract is analyzed by gas chromatography with a nitrogen-phosphate detector.

Reagents and Equipments:

Reagents:

1. Acetonitrile, HPLC grade
2. Methanol, Pesticide grade
3. Methylene Chloride
4. Sodium Sulfate, granular, anhydrous
5. Sodium Chloride, granular, anhydrous
6. Dry ice

Equipments:

1. Mason jar: One pint, narrow mouth with cap
2. Blender: Omni-Mixer
3. Vacuum manifold: Vac Elut SPS 24. Varian
4. Bond Elut®: Aminopropyl Bond Elut 10 cc/ 500 mg. Varian®
5. Filter paper. Whatman # 4
6. Acrodisc®, 0.2 µm filter. Gelman Sciences
7. Crusinart™ food processer (Model DLC 7)
8. Steam bath with a nitrogen stream manifold

Analysis:

Sample Extraction:

1. Cut entire sample into small pieces (less than one inch in length). Homogenize the sample with dry ice using a cuisinart until obtained the smallest particles possible. Store the sample in a freezer overnight with a loose cap to allow the CO_2 to dissipate.

Analysis:

Sample Extraction: (con't)

2. Weigh out 25.0 g of the homogenous sample into a narrow mouth, one pint mason jar. Add 100 mL of acetonitrile and blend the sample for 10 minutes using Omni-Mixer set at medium speed.
3. Decant the liquid layer through a funnel which contains a # 4 filter paper and 20 g of sodium sulfate into a 100 mL graduated cylinder (for soaproot, add 20 g of sodium chloride to a 100 mL graduated cylinder before decant the liquid layer through a funnel which contains a # 4 filter paper into the graduated cylinder).
4. Pipette 5 mL of the acetonitrile extract into a 50 mL beaker (upper phase in case of soaproot). Evaporate to about 0.5 mL on a nitrogen steambath set a 60 °C. Add 4 mL of 5% methanol in methylene chloride to the beaker. Sonicate the beaker for 3 minutes. For working matrix standards preparation: to four 50 mL beakers, pipette 5 mL of the blank matrix acetonitrile extract into each beaker and treat them as actual samples.
   Note: *When evaporating and sonicating the sample, do not let water get into the beaker.*
5. Set the vacuum manifold at *discard position*. Condition an aminopropyl Bond Elut® by adding 10 mL of 5% methanol in methylene chloride. Switch the vacuum manifold to *collect position* just before the Bond Elut® goes to dryness. Immediately transfer the sample from the beaker to the conditioned Bond Elut® and collect the sample in a 15 mL test tube. Add 10 mL of 5% solution to the beaker, sonicate for 1 minute and then transfer to the Bond Elut® (wait until the first 4 mL just goes through the Bond Elut® before transfering). Collect the eluant in the 15 mL test tube.
6. Evaporate the eluant to ~ 0.1 mL using a N-EVAP set at 40 °C. Bring the volume to 2 mL with methanol. Mix well for 20 seconds. Filter through a 0.2 µm acrodisc filter into an autosampler vial. For working matrix standards preparation: evaporate the eluants to dryness, add 2 mL of the following working standards: 0.1 ng/µL, 0.5 ng/µL, 1 ng/µL and 2 ng/µL to each 15 mL test tube. Mix well and filter through a 0.2 µm acrodisc filter into an autosampler vial.
7. Analyze by gas chromatography with a nitrogen-phosphate detector as described bellow.

Equipment Conditions:

Hewlett Packard 5890 gas chromatography with a nitrogen-phosphate detector
Column: DB-17 (50%-phenyl)-methyl polysiloxane, 30 m x .25 mm x 0.25 µm film thickness.
Carrier gas: Helium: 1.5 mL / min.
Detector gases: Air: 102 mL/ min.(36 psi)
Hydrogen: 4 mL/ min.(21 psi)
Helium as make up: 28.2mL/ min.(30 psi)
Oven temperature program:
Initial temperature: 150 °C . Initial hold time: 1 min.
Rate: 15 °C per min.
Final temperature: 260 °C. Final hold time: 10 min.
Injector temperature: 250 °C
Detector temperature: 300 °C
Injection volume: 2 µL
Retention time: 14.15 min.

Analysis:

Calculations:

$$\text{ppm } (\mu g/g) = \frac{\mu g / mL \text{ (from standard curve) x aliquot final volume (mL)}}{\text{Aliquot sample weight (g)}}$$

For this method, aliquot final volume is 2 mL, aliquot sample weight is 1.25 g

Method Performance:

Quality Control:

1. A 4 - point calibration curve: 0.1 ng/µL, 0.5 ng/µL, 1 ng/µL and 2 ng/µL working matrix standards shall be run at the beginning and the end of each set of samples.
2. Each sample shall be injected two times to insure reliability of the analysis. If the signal of a sample is greater than that of the highest standard, dilute the sample. Reinject the diluted sample with standards as directed above.
3. Sample storage: All field samples shall be kept frozen at -10 °C. Thaw the samples in a refrigerator overnight before grinding.
4. Sample extracts: All extracts shall be kept frozen at -10 °C until analyzed.
5. Freezer, refrigerator and oven temperatures shall be monitored and recorded daily.
6. For each set of samples, one matrix blank and 1 matrix spike shall be included, and each set of samples shall not contain more than twelve samples.
7. To avoid cross contamination, all glassware and grinding equipments shall be rinsed with water several times followed by an acetone or methanol rinse before grinding the next sample.

Recovery data:

The analytical method was validated using only *one* matrix golden fleece. Three sets of fortified samples were prepared for each matrix. Each set contained three levels of fortification and a matrix blank. The matrix background was provided by Dept. of Pesticide Regulation. All fortified and matrix blank samples were processed through the entire analytical method and the results were tabulated below:

Spike Level (µg/g)	Result (µg/g)	Recovery (µg/g)
0.3	0.269	89.9
0.3	0.293	97.6
0.3	0.294	98.0
3.0	2.557	85.2
3.0	3.056	102
3.0	2.831	94.4
30	24.24	80.8
30	23.42	78.1
30	23.50	78.3

Method Performance:

Method Detection Limit:

Method Detection Limit (MDL) refers to the lowest concentration of analytes that a method can detect reliably. To determine the MDL, 7 replicated background samples were fortified at 0.2 ppm. The standard deviation derived from the 7 fortified samples was used to calculate the MDL using the following equation:

$$\mathbf{MDL} = t\,S$$

where:

t is the Student t value for the 99% confidence level with n-1 degrees of freedom (n-1, $1 - \alpha = 0.99$) which is 3.143, n represents the number of replicates which is 7

S denotes the standard deviation obtained from replicate analyses.

The MDL was tabulated as follow:

Matrix	Method detection limit (ppm)	* Reporting limit (ppm)
Golden fleece	0.04	0.1

**Reporting Limit:*

Reporting Limit (RL) refers to the level above which quantitative results may be obtained usually 1-5 times the MDL.

Dicussion:

Some golden fleece samples were found extremely greasy. The chromatograms of these samples were characterized by a fat peak which almost overlapped the peak of interest. This interference was not observed in the provided background golden fleece during the method development. To separate this interference, a GC-NPD with different columns and HPLC-UV reverse phase with a C18 column were tried but were not successful. This interference was sequently eliminated by reducing the sample size to 1.25 g (5 mL of the acetonitrile extract). Reducing the sample size allows a greater separation. The reporting limit for hexazinone in golden fleece is set at 0.1 ppm.

This method was used to determine the method detection limit (MDL)/reporting limit (RL) for soaproot. Method validation for this matrix has not been done. The results were tabulated below:

Matrix	Method detection limit (ppm)	Reporting limit (ppm)
Soaproot	0.05	0.05

See appendix I for recovery data of MDL determination

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Appendix I: ***Recovery data for determination of method detection limits***

Hexazinone in golden fleece

Fortified Levels (µg/g)	Results (µg/g)	Recovery (%)
0.2	0.195	97.5
0.2	0.192	96.0
0.2	0.183	91.5
0.2	0.198	99.0
0.2	0.209	105
0.2	0.217	109
0.2	0.213	108

Hexazinone in soaproot

Fortified Levels (µg/g)	Results (µg/g)	Recovery (%)
0.2	0.191	95.5
0.2	0.184	92.0
0.2	0.211	106
0.2	0.231	116
0.2	0.205	103
0.2	0.227	114
0.2	0.208	104

Method Validation
Glyphosate

Glyphosate Method Validation

Medium	Spike Level (ppm)	Percent Recovery Rep 1	Rep 2	Rep 3	Average	SD	CV
Bracken Fern Roots	0.3	83.0	82.3	72.3	79.2	6.0	7.6
	3.0	88.3	75.0	66.0	76.4	11.2	14.7
	30.0	74.7	83.3	67.3	75.1	8.0	10.7
	Overall				76.9	7.7	10.0
	Bracken Fern Roots – Glyphosate Control Limits Lower Control Limit 53.7% Lower Warning Limit 61.5% Upper Control Limit 100.1% Upper Warning Limit 92.4%						
Buckbrush Shoots	0.3	95.3	88.7	84.0	89.3	5.7	6.4
	3.0	93.7	89.3	83.0	88.7	5.4	6.1
	30.0	95.7	72.7	75.0	81.1	12.7	15.6
	Overall				86.4	8.4	9.8
	Buckbrush Shoots – Glyphosate Control Limits Lower Control Limit 61.1% Lower Warning Limit 69.5% Upper Control Limit 111.6% Upper Warning Limit 103.2%						
Manzanita Berries	0.3	103.7	96.0	95.0	98.2	4.8	4.8
	3.0	94.0	94.0	96.3	94.8	1.3	1.4
	30.0	95.7	93.7	89.3	92.9	3.3	3.5
	Overall				95.3	3.8	4.0
	Manzanita Berries – Glyphosate Control Limits Lower Control Limit 84.0% Lower Warning Limit 87.7% Upper Control Limit 106.6 % Upper Warning Limit 102.9%						
Golden Fleece Foliage	0.3	94.3	90.3	89.3	91.3	2.6	2.9
	3.0	90.7	83.3	85.0	86.3	3.9	4.5
	30.0	104.7	91.0	81.0	92.2	11.9	12.9
	Overall				90.0	7.0	7.7
	Golden Fleece Foliage – Glyphosate Control Limits Lower Control Limit 69.1% Lower Warning Limit 76.0% Upper Control Limit 110.8% Upper Warning Limit 103.9%						

Method Validation
Triclopyr

Triclopyr Method Validation

Medium	Spike Level (ppm)	Percent Recovery Rep 1	Rep 2	Rep 3	Average	SD	CV
Bracken Fern Roots	0.3	76.7	71.3	82.3	76.8	5.5	7.2
	3.0	85.7	73.1	76.6	78.5	6.5	8.3
	30.0	79.9	74.8	80.1	78.3	3.0	3.8
	Overall				77.8	4.6	5.9
	Bracken Fern Roots – Triclopyr Control Limits Lower Control Limit 64.1% Lower Warning Limit 68.7% Upper Control Limit 91.6% Upper Warning Limit 87.0%						
Buckbrush Shoots	0.3	86.7	92.7	82.0	87.1	5.4	6.2
	3.0	78.8	85.1	89.8	84.6	5.5	6.5
	30.0	89.8	87.4	83.2	86.8	3.3	3.8
	Overall				86.2	4.4	5.1
	Buckbrush Shoots- Triclopyr Control Limits Lower Control Limit 73.1% Lower Warning Limit 77.4% Upper Control Limit 99.3% Upper Warning Limit 94.9%						
Manzanita Berries	0.3	80.0	101.7	81.0	87.6	12.3	14.0
	3.0	83.4	89.7	81.2	84.8	4.4	5.2
	30.0	81.0	93.8	84.2	86.3	6.7	7.7
	Overall				86.2	7.4	8.6
	Manzanita Berries – Triclopyr Control Limits Lower Control Limit 64.0% Lower Warning Limit 71.4% Upper Control Limit 108.5% Upper Warning Limit 101.0%						
Golden Fleece Foliage	0.3	67.3	63.3	79.3	70.0	8.3	11.9
	3.0	67.1	62.8	70.2	66.7	3.7	5.6
	30.0	73.6	67.7	76.0	72.4	4.3	5.9
	Overall				69%.7	5.6	8.1
	Golden Fleece Foliage – Triclopyr Control Limits Lower Control Limit 52.8% Lower Warning Limit 58.5% Upper Control Limit 86.6% Upper Warning Limit 80.9%						

Method Validation
Hexazinone

Hexazinone Method Validation

Medium	Spike Level (ppm)	Percent Recovery Rep 1	Rep 2	Rep 3	Average	SD	CV
Bracken Fern Roots	0.3	91.0	87.0	94.0	90.7	3.5	3.9
	3.0	85.2	87.0	97.8	90.0	6.8	7.6
	30.0	85.2	81.7	83.9	83.6	1.8	2.1
	Overall				88.1	5.2	5.9
	Bracken Fern Roots- Hexazinone Control Limits Lower Control Limit 72.5% Lower Warning Limit 77.7% Upper Control Limit 103.6% Upper Warning Limit 98.5%						
Buckbrush Shoots	0.3	115.0	72.7	95.0	94.2	21.2	22.5
	3.0	98.8	101.0	89.9	96.6	5.9	6.1
	30.0	80.0	80.7	116.0	92.2	20.6	22.3
	Overall				94.3	15.2	16.1
	Buckbrush Shoots – Hexazinone Control Limits Lower Control Limit 48.8% Lower Warning Limit 64.0% Upper Control Limit 139.8% Upper Warning Limit 124.7%						
Manzanita Berries	0.3	89.3	82.7	79.7	83.9	4.9	5.9
	3.0	82.2	90.0	91.6	87.9	5.0	5.7
	30.0	98.1	102.7	93.3	98.0	4.7	4.8
	Overall				90.0	7.6	8.4
	Manzanita Berries – Hexazinone Control Limits Lower Control Limit 67.2% Lower Warning Limit 74.8% Upper Control Limit 112.7% Upper Warning Limit 105.1%						
Golden Fleece Foliage	0.3	89.9	97.6	98.0	95.2	4.6	4.8
	3.0	85.2	102.0	94.4	93.9	8.4	9.0
	30.0	80.8	78.1	78.3	79.1	1.5	1.9
	Overall				89.4	9.1	10.2
	Golden Fleece Foliage – Hexazinone Control Limits Lower Control Limit 62.0% Lower Warning Limit 71.1% Upper Control Limit 116.8% Upper Warning Limit 107.6%						
Redbud Shoots	0.3	94.7	99.7	94.0	96.1	3.1	3.2
	3.0	92.0	88.5	96.9	92.5	4.2	4.6
	30.0	84.8	84.6	83.9	84.4	0.5	0.6
	Overall				91.0	5.8	6.4
	Redbud Shoots – Hexazinone Control Limits Lower Control Limit 73.6% Lower Warning Limit 79.4% Upper Control Limit 108.4% Upper Warning Limit 102.6%						

Glyphosate Continuing Quality Control Data

Matrix	Extraction Date	Analysis Date	Date of Report	EHAP Sample Name	Analyte	Spike Level (ppm)	Result (ppm)	Recovery (%)	Reporting Limit (ppm)	Sample Numbers
Bracken Fern Root	9/18/1997	9/19-24/97	9/30/1997	Blank	Glyphosate	0.0	ND		0.10	121 and 123
Bracken Fern Root	9/18/1997	9/19-24/97	9/30/1997	Spike	Glyphosate	3.0	2.86	95.3	0.10	121 and 123
Bracken Fern Root	11/10/1997	11/13/1997	11/14/1997	Blank	Glyphosate	0.0	ND		0.10	140
Bracken Fern Root	11/10/1997	11/13/1997	11/14/1997	Spike	Glyphosate	3.0	2.63	87.7	0.10	140
Bracken Fern Root	1/6-7/98	1/7-23/98	1/28/1998	Blank	Glyphosate	0.0	ND		0.10	138, 143, and 205
Bracken Fern Root	1/6-7/98	1/7-23/98	1/28/1998	Spike	Glyphosate	3.0	2.54	84.7	0.10	138, 143, and 205
Bracken Fern Root	10/26-27/98	10/29/1998	11/2/1998	Blank	Glyphosate	0.0	ND		0.1	298,637, and 649
Bracken Fern Root	10/26-27/98	10/29/1998	11/2/1998	Spike	Glyphosate	3.0	2.28	76.0	0.1	298,637, and 649
Bracken Fern Root	12/22-23/98	1/21-22/99	2/2/1999	Blank	Glyphosate	0.0	ND		0.1	704
Bracken Fern Root	12/22-23/98	1/21-22/99	2/2/1999	Spike	Glyphosate	3.0	2.35	78.3	0.1	704
Bracken Fern Root	12/3-4/98	12/4/1998	12/7/1998	Blank	Glyphosate	0.0	ND		0.1	640
Bracken Fern Root	12/3-4/98	12/4/1998	12/7/1998	Spike	Glyphosate	3.0	2.67	89.0	0.1	640
Bracken Fern Root	2/5-6/98	2/10-27/98	2/27/1998	Blank	Glyphosate	0.0	ND		0.10	207
Bracken Fern Root	2/5-6/98	2/10-27/98	2/27/1998	Spike	Glyphosate	3.0	2.26	75.3	0.10	207
Bracken Fern Root	2/9-10/00	2/10/2000	3/20/2000	Blank	Glyphosate	0.0	ND		0.1	583
Bracken Fern Root	2/9-10/00	2/10/2000	3/20/2000	Spike	Glyphosate	3.0	1.62	54.0	0.1	583
Bracken Fern Root	4/13-14/98	4/14/1998	4/15/1998	Blank	Glyphosate	0.0	ND		0.10	265
Bracken Fern Root	4/13-14/98	4/14/1998	4/15/1998	Spike	Glyphosate	3.0	2.3	76.7	0.10	265
Bracken Fern Root	4/24-24/98	4/24/1998	5/18/1998	Blank	Glyphosate	0.0	ND		0.10	209
Bracken Fern Root	4/24-24/98	4/24/1998	5/18/1998	Spike	Glyphosate	3.0	2.23	74.3	0.10	209
Bracken Fern Root	4/26-27/99	4/27-28/99	5/21/1999	Blank	Glyphosate	0.0	ND		0.1	686
Bracken Fern Root	4/26-27/99	4/27-28/99	5/21/1999	Spike	Glyphosate	3.0	1.98	66.0	0.1	686
Bracken Fern Root	5/12-13/98	5/26-28/98	6/2/1998	Blank	Glyphosate	0.0	ND		0.10	156
Bracken Fern Root	5/12-13/98	5/26-28/98	6/2/1998	Spike	Glyphosate	3.0	2.44	81.3	0.10	156
Bracken Fern Root	6/17-18/97	6/19/1997	6/24/1997	Blank	Glyphosate	0.0	ND		0.10	8 and 425
Bracken Fern Root	6/17-18/97	6/19/1997	6/24/1997	Spike	Glyphosate	3.0	2.35	78.3	0.10	8 and 425
Bracken Fern Root	6/3-4/99	6/9/1999	6/11/1999	Blank	Glyphosate	0.0	ND		0.1	690
Bracken Fern Root	6/3-4/99	6/9/1999	6/11/1999	Spike	Glyphosate	3.0	2.75	91.7	0.1	690
Bracken Fern Root	7/2-3/97	7/7-10/97	7/10/1997	Blank	Glyphosate	0.0	ND		0.10	70 and 100
Bracken Fern Root	7/2-3/97	7/7-10/97	7/10/1997	Spike	Glyphosate	3.0	1.93	64.3	0.10	70 and 100
Bracken Fern Root	8/11-12/97	8/13/1997	8/14/1997	Blank	Glyphosate	0.0	ND		0.10	119 and 374
Bracken Fern Root	8/11-12/97	8/13/1997	8/14/1997	Spike	Glyphosate	3.0	2.33	77.7	0.10	119 and 374
Bracken Fern Root	8/27-28/97	9/2-4/97	9/5/1997	Blank	Glyphosate	0.0	ND		0.10	71
Bracken Fern Root	8/27-28/97	9/2-4/97	9/5/1997	Spike	Glyphosate	3.0	2.79	93.0	0.10	71
Bracken Fern Root	9/22-23/98	9/23-24/98	9/29/1998	Blank	Glyphosate	0.0	ND		0.1	217,499,613, and 678
Bracken Fern Root	9/22-23/98	9/23-24/98	9/29/1998	Spike	Glyphosate	3.0	2.39	79.7	0.1	217,499,613, and 678
Buckbrush Shoot	1/15-16/98	2/10-27/98	2/27/1998	Blank	Glyphosate	0.0	ND		0.10	139 and 208
Buckbrush Shoot	1/15-16/98	2/10-27/98	2/27/1998	Spike	Glyphosate	3.0	2.77	92.3	0.10	139 and 208
Buckbrush Shoot	1/20-21/99	1/21-22/99	2/2/1999	Blank	Glyphosate	0.0	ND		0.1	712
Buckbrush Shoot	1/20-21/99	1/21-22/99	2/2/1999	Spike	Glyphosate	3.0	2.78	92.7	0.1	712
Buckbrush Shoot	11/16-17/98	11/17-18/98	11/19/1998	Blank	Glyphosate	0.0	ND		0.1	700
Buckbrush Shoot	11/16-17/98	11/17-18/98	11/19/1998	Spike	Glyphosate	3.0	2.86	95.3	0.1	700

Glyphosate Continuing Quality Control Data

Matrix	Extraction Date	Analysis Date	Date of Report	EHAP Sample Name	Analyte	Spike Level (ppm)	Result (ppm)	Recovery (%)	Reporting Limit (ppm)	Sample Numbers
Buckbrush Shoot	12/2-3/99	12/6/1999	12/7/1999	Blank	Glyphosate	0.0	ND		0.1	578 and 580
Buckbrush Shoot	12/2-3/99	12/6/1999	12/7/1999	Spike	Glyphosate	3.0	2.83	94.3	0.1	578 and 580
Buckbrush Shoot	3/15-16/99	3/16-17/99	3/22/1999	Blank	Glyphosate	0.0	ND		0.1	305
Buckbrush Shoot	3/15-16/99	3/16-17/99	3/22/1999	Spike	Glyphosate	3.0	2.82	94.0	0.1	305
Buckbrush Shoot	4/13-14/00	4/14/2000	4/19/2000	Blank	Glyphosate	0.0	ND		0.1	731,733,739, and 741
Buckbrush Shoot	4/13-14/00	4/14/2000	4/19/2000	Spike	Glyphosate	3.0	3	100.0	0.1	731,733,739, and 741
Buckbrush Shoot	6/10-11/97	6/11/1997	6/16/1997	Blank	Glyphosate	0.0	ND		0.10	421, 422, 423,424, and 427
Buckbrush Shoot	6/10-11/97	6/11/1997	6/16/1997	Spike	Glyphosate	3.0	2.78	92.6	0.10	421, 422, 423,424, and 427
Buckbrush Shoot	6/10-11/99	6/11/1999	6/17/1999	Blank	Glyphosate	0.0	ND		0.1	687,688,689,692, and 693
Buckbrush Shoot	6/10-11/99	6/11/1999	6/17/1999	Spike	Glyphosate	3.0	2.88	96.0	0.1	687,688,689,692, and 693
Buckbrush Shoot	6/21-22/99	6/23/1999	7/8/1999	Blank	Glyphosate	0.0	ND		0.1	519,520,521, and 522
Buckbrush Shoot	6/21-22/99	6/23/1999	7/8/1999	Spike	Glyphosate	3.0	2.67	89.0	0.1	519,520,521, and 522
Buckbrush Shoot	6/4-5/97	6/5/1997	6/9/1997	Blank	Glyphosate	0.0	ND		0.10	1,2,3,4, and 7
Buckbrush Shoot	6/4-5/97	6/5/1997	6/9/1997	Spike	Glyphosate	3.0	2.73	91.0	0.10	1,2,3,4, and 7
Buckbrush Shoot	7/12-13/99	7/14/1999	7/15/1999	Blank	Glyphosate	0.0	ND		0.1	538,539,540,541,726, and 727
Buckbrush Shoot	7/12-13/99	7/14/1999	7/15/1999	Spike	Glyphosate	3.0	2.55	85.0	0.1	538,539,540,541,726, and 727
Buckbrush Shoot	7/28-29/97	7/31/1997	8/1/1997	Blank	Glyphosate	0.0	ND		0.10	78,79,80,369, and 373
Buckbrush Shoot	7/28-29/97	7/31/1997	8/1/1997	Spike	Glyphosate	3.0	2.81	93.7	0.10	78,79,80,369, and 373
Buckbrush Shoot	7/8-9/97	7/15/1997	7/17/1997	Blank	Glyphosate	0.0	ND		0.10	101
Buckbrush Shoot	7/8-9/97	7/15/1997	7/17/1997	Spike	Glyphosate	3.0	2.82	94.0	0.10	101
Buckbrush Shoot	8/10-11/99	8/11-12/99	8/16/1999	Blank	Glyphosate	0.0	ND		0.1	565,566,567, and 568
Buckbrush Shoot	8/10-11/99	8/11-12/99	8/16/1999	Spike	Glyphosate	3.0	2.8	93.3	0.1	565,566,567, and 568
Buckbrush Shoot	8/17,18/99	8/19,20/99	8/25/1999	Blank	Glyphosate	0.0	ND		0.1	311,552,555,562, and 569
Buckbrush Shoot	8/17-18/99	8/19-20/99	8/25/1999	Spike	Glyphosate	3.0	2.9	96.7	0.1	311,552,555,562, and 569
Buckbrush Shoot	9/15-16/99	9/17/1999	9/21/1999	Blank	Glyphosate	0.0	ND		0.1	548,553,586,587, and 595
Buckbrush Shoot	9/15-16/99	9/17/1999	9/21/1999	Spike	Glyphosate	3.0	2.81	93.7	0.1	548,553,586,587, and 595
Buckbrush Shoot	9/17,18/98	9/18-24/98	9/28/1998	Blank	Glyphosate	0.0	ND		0.1	187,264,497,633, and 673
Buckbrush Shoot	9/17-18/98	9/18-24/98	9/28/1998	Spike	Glyphosate	3.0	2.7	90.0	0.1	187,264,497,633, and 673
Buckbrush Shoot	9/23-24/97	9/26/1997	9/30/1997	Blank	Glyphosate	0.0	ND		0.10	125
Buckbrush Shoot	9/23-24/97	9/26/1997	9/30/1997	Spike	Glyphosate	3.0	2.83	94.3	0.10	125
Buckbrush Shoot	9/8-9/99	9/10/1999	9/20/1999	Blank	Glyphosate	0.0	ND		0.1	545,546,547,588,589,590, and 591
Buckbrush Shoot	9/8-9/99	9/10/1999	9/20/1999	Spike	Glyphosate	3.0	3	100.0	0.1	545,546,547,588,589,590, and 591
Golden Fleece Foliage	10/16/1997	10/17/1997	10/20/1997	Blank	Glyphosate	0.0	ND		0.10	136
Golden Fleece Foliage	10/16/1997	10/17/1997	10/20/1997	Spike	Glyphosate	3.0	2.65	88.3	0.10	136
Golden Fleece Foliage	1/20-21/99	1/21-22/99	2/22/1999	Blank	Glyphosate	0.0	ND		0.1	714
Golden Fleece Foliage	1/20-21/99	1/21-22/99	2/22/1999	Spike	Glyphosate	3.0	2.9	96.7	0.1	714
Golden Fleece Foliage	10/22,23/98	10/26/1998	10/27/1998	Blank	Glyphosate	0.0	ND		0.1	635
Golden Fleece Foliage	10/22-23/98	10/26/1998	10/27/1998	Spike	Glyphosate	3	2.8	93.3	0.1	635
Golden Fleece Foliage	11/16-17/98	11/17-18/98	11/19/1998	Blank	Glyphosate	0.0	ND		0.1	701
Golden Fleece Foliage	11/16-17/98	11/17-18/98	11/19/1998	Spike	Glyphosate	3.0	2.65	88.3	0.1	701
Golden Fleece Foliage	12/23-24/97	2/10-27/98	2/27/1998	Blank	Glyphosate	0.0	ND		0.10	248
Golden Fleece Foliage	12/23-24/97	2/10-27/98	2/27/1998	Spike	Glyphosate	3.0	2.71	90.3	0.10	248

Glyphosate Continuing Quality Control Data

Matrix	Extraction Date	Analysis Date	Date of Report	EHAP Sample Name	Analyte	Spike Level (ppm)	Result (ppm)	Recovery (%)	Reporting Limit (ppm)	Sample Numbers
Golden Fleece Foliage	12/29-30/99	12/30/99-1/11/00	1/14/2000	Blank	Glyphosate	0.0	ND		0.1	579,581,732, and 734
Golden Fleece Foliage	12/29-30/99	12/30/99-1/11/00	1/14/2000	Spike	Glyphosate	3.0	2.6	86.7	0.1	579,581,732, and 734
Golden Fleece Foliage	3/10-11/98	3/11-12/98	3/12/1998	Blank	Glyphosate	0.0	ND		0.10	148
Golden Fleece Foliage	3/10-11/98	3/11-12/98	3/12/1998	Spike	Glyphosate	3.0	2.89	96.3	0.10	148
Golden Fleece Foliage	3/15-16/99	3/16-17/99	3/22/1999	Blank	Glyphosate	0.0	ND		0.1	302
Golden Fleece Foliage	3/15-16/99	3/16-17/99	3/22/1999	Spike	Glyphosate	3.0	3.19	106.0	0.1	302
Golden Fleece Foliage	3/21-22/00	3/23/2000	3/27/2000	Blank	Glyphosate	0.0	ND		0.1	740 and 742
Golden Fleece Foliage	3/21-22/00	3/23/2000	3/27/2000	Spike	Glyphosate	3.0	2.93	97.7	0.1	740 and 742
Golden Fleece Foliage	6/17-18/97	6/19-20/97	6/24/1997	Blank	Glyphosate	0.0	ND		0.10	419
Golden Fleece Foliage	6/17-18/97	6/19-20/97	6/24/1997	Spike	Glyphosate	3.0	2.75	91.7	0.10	419
Golden Fleece Foliage	7/20-21/99	7/22/1999	7/30/1999	Blank	Glyphosate	0.0	ND		0.1	312,517,563, and 570
Golden Fleece Foliage	7/20-21/99	7/22/1999	7/30/1999	Spike	Glyphosate	3.0	2.67	89.0	0.1	312,517,563, and 570
Golden Fleece Foliage	7/8-9/97	7/15/1997	7/17/1997	Blank	Glyphosate	0.0	ND		0.10	109
Golden Fleece Foliage	7/8-9/97	7/15/1997	7/17/1997	Spike	Glyphosate	3.0	2.81	93.7	0.10	109
Golden Fleece Foliage	8/27-28/97	9/2-4/97	9/5/1997	Blank	Glyphosate	0.0	ND		0.10	372
Golden Fleece Foliage	8/27-28/97	9/2-4/97	9/5/1997	Spike	Glyphosate	3.0	3.19	106.3	0.10	372
Golden Fleece Foliage	8/6/-7/97	8/8-11/97	8/12/1997	Blank	Glyphosate	0.0	ND		0.10	103
Golden Fleece Foliage	8/6/-7/97	8/8-11/97	8/12/1997	Spike	Glyphosate	3.0	3.03	101.0	0.10	103
Golden Fleece Foliage	9/10-11/98	9/18-21/98	9/24/1998	Blank	Glyphosate	0.0	ND		0.1	185,495,621, and 675
Golden Fleece Foliage	9/10-11/98	9/18-21/98	9/24/1998	Spike	Glyphosate	3.0	2.7	90.0	0.1	185,495,621, and 675
Golden Fleece Foliage	9/1-2/99	9/2/1999	9/8/1999	Blank	Glyphosate	0.0	ND		0.1	557and 592
Golden Fleece Foliage	9/1-2/99	9/2/1999	9/8/1999	Spike	Glyphosate	3.0	2.62	87.3	0.1	557and 592
Manzanita Berry	5/29/1997	5/29-6/2/97	6/4/1997	Blank	Glyphosate	0.0	ND		0.10	5 and 428
Manzanita Berry	5/29/1997	5/29-6/2/97	6/4/1997	Spike	Glyphosate	3.0	2.95	98.4	0.10	5 and 428
Manzanita Berry	11/18-19/99	11/22-23/99	11/29/1999	Blank	Glyphosate	0.0	ND		0.1	582 and 584
Manzanita Berry	11/18-19/99	11/22-23/99	11/29/1999	Spike	Glyphosate	3.0	3.01	100.0	0.1	582 and 584
Manzanita Berry	12/9-10/97	12/10/97-1/14/98	1/16/1998	Blank	Glyphosate	0.0	ND		0.10	142
Manzanita Berry	12/9-10/97	12/10/97-1/14/98	1/16/1998	Spike	Glyphosate	3.0	2.85	95.0	0.10	142
Manzanita Berry	3/16-17/00	3/17/2000	3/20/2000	Blank	Glyphosate	0.0	ND		0.1	735,736, and 743
Manzanita Berry	3/16-17/00	3/17/2000	3/20/2000	Spike	Glyphosate	3.0	3.08	103.0	0.1	735,736, and 743
Manzanita Berry	7/15-16/99	7/19-20/99	7/23/1999	Blank	Glyphosate	9.0	ND		0.1	518,542,550,564,571,and 682
Manzanita Berry	7/15-16/99	7/19-20/99	7/23/1999	Spike	Glyphosate	3.0	2.95	98.3	0.1	518,542,550,564,571,and 682
Manzanita Berry	7/8-9/97	7/15/1997	7/17/1997	Blank	Glyphosate	0.0	ND		0.10	102
Manzanita Berry	7/8-9/97	7/15/1997	7/17/1997	Spike	Glyphosate	3.0	2.69	89.7	0.10	102
Manzanita Berry	8/24-25/99	8/26/1999	8/30/1999	Blank	Glyphosate	0.0	ND		0.1	551,554,556, and 572
Manzanita Berry	8/24-25/99	8/26/1999	8/30/1999	Spike	Glyphosate	3.0	2.7	90.0	0.1	551,554,556, and 572
Manzanita Berry	8/6-7/97	8/8-11/97	8/12/1997	Blank	Glyphosate	0.0	ND		0.10	375
Manzanita Berry	8/6-7/97	8/8-11/97	8/12/1997	Spike	Glyphosate	3.0	2.66	88.7	0.10	375
Manzanita Berry	9/20-21/99	9/22-23/99	9/24/1999	Blank	Glyphosate	0.0	ND		0.1	573 and 593
Manzanita Berry	9/20-21/99	9/22-23/99	9/24/1999	Spike	Glyphosate	3.0	2.46	82.0	0.1	573 and 593
Manzanita Berry	9/23-24/97	9/26/1997	9/30/1997	Blank	Glyphosate	0.0	ND		0.10	124
Manzanita Berry	9/23-24/97	9/26/1997	9/30/1997	Spike	Glyphosate	3.0	2.94	98.0	0.10	124

Triclopyr Continuing Quality Control Data

Matrix	Extraction Date	Analysis Date	Date of Report	EHAP Sample Name	Analyte	Spike Level (ppm)	Result (ppm)	Recovery (%)	Reporting Limit (ppm)	Sample Numbers
Bracken Fern Root	6/10/1997	6/10-11/97	6/12/1997	Spike	Triclopyr	0.0	ND		0.03	414
Bracken Fern Root	6/10/1997	6/10-11/97	6/12/1997	Blank	Triclopyr	3.0	1.94	64.7	0.03	414
Bracken Fern Root	7/7/1997	7/8-9/97	7/10/1997	Blank	Triclopyr	0.0	ND		0.03	69 and 98
Bracken Fern Root	7/7/1997	7/8-9/97	7/10/1997	Spike	Triclopyr	3.0	2.04	68.0	0.03	69 and 98
Bracken Fern Root	7/28/1997	7/28-29/97	7/29/1997	Blank	Triclopyr	0.0	ND		0.03	67 and 120
Bracken Fern Root	7/28/1997	7/28-29/97	7/29/1997	Spike	Triclopyr	3.0	1.98	66.0	0.03	67 and 120
Bracken Fern Root	8/26/1997	8/26-27/97	8/27/1997	Blank	Triclopyr	0.0	ND		0.03	72 and 370
Bracken Fern Root	8/26/1997	8/26-27/97	8/27/1997	Spike	Triclopyr	3.0	2.26	75.3	0.03	72 and 370
Bracken Fern Root	9/23/1997	8/24/1997	9/25/1997	Blank	Triclopyr	0.0	ND		0.03	122
Bracken Fern Root	9/23/1997	8/24/1997	9/25/1997	Spike	Triclopyr	3.0	2.4	80.0	0.03	122
Bracken Fern Root	10/22/1997	10/22-23/97	10/24/1997	Blank	Triclopyr	0.0	ND		0.03	135
Bracken Fern Root	10/22/1997	10/22-23/97	10/24/1997	Spike	Triclopyr	3.0	2.45	81.7	0.03	135
Bracken Fern Root	11/11/1997	11/12/1997	11/13/1997	Blank	Triclopyr	0.0	ND		0.03	141
Bracken Fern Root	11/11/1997	11/12/1997	11/13/1997	Spike	Triclopyr	3.0	2.5	82.0	0.03	141
Bracken Fern Root	1/6/1998	1/6-7/98	1/7/1998	Blank	Triclopyr	0.0	ND		0.03	252 and 206
Bracken Fern Root	1/6/1998	1/6-7/98	1/7/1998	Spike	Triclopyr	3.0	2.23	74.3	0.03	252 and 206
Bracken Fern Root	2/17/1998	2/17-18/98	2/20/1998	Blank	Triclopyr	0.0	ND		0.03	147
Bracken Fern Root	2/17/1998	2/17-18/98	2/20/1998	Spike	Triclopyr	3.0	2.36	78.7	0.03	147
Bracken Fern Root	7/6/1998	7/7-8/98	7/8/1998	Blank	Triclopyr	0.0	ND		0.03	254
Bracken Fern Root	7/6/1998	7/7-8/98	7/8/1998	Spike	Triclopyr	3.0	2.21	73.7	0.03	254
Bracken Fern Root	8/31/1998	8/31, 9/1/98	9/2/1998	Blank	Triclopyr	0.0	ND		0.03	500,508,672, and 677
Bracken Fern Root	8/31/1998	8/31, 9/1/98	9/2/1998	Spike	Triclopyr	3.0	2.35	78.3	0.03	500,508,672, and 677
Bracken Fern Root	10/8/1998	10/8-9/98	10/9/1998	Blank	Triclopyr	0.0	ND		0.03	661and 662
Bracken Fern Root	10/8/1998	10/8,9/98	10/9/1998	Spike	Triclopyr	3.0	2.64	88.0	0.03	661and 662
Bracken Fern Root	12/4/1998	12/7/1998	12/10/1998	Blank	Triclopyr	0.0	ND		0.03	297 and 698
Bracken Fern Root	12/4/1998	12/7/1998	12/10/1998	Spike	Triclopyr	3.0	2.11	70.3	0.03	297 and 698
Bracken Fern Root	12/22/1998	12/30/1998	12/31/1998	Blank	Triclopyr	0.0	ND		0.03	703
Bracken Fern Root	12/22/1998	12/30/1998	12/31/1998	Spike	Triclopyr	3.0	2.54	84.7	0.03	703
Bracken Fern Root	3/18/1999	3/18-19/99	3/19/1999	Blank	Triclopyr	0.0	ND		0.03	301 and 711
Bracken Fern Root	3/18/1999	3/18,19/99	3/19/1999	Spike	Triclopyr	3.0	2.11	70.3	0.03	301 and 711
Bracken Fern Root	4/6/1999	4/6/1999	4/7/1998	Blank	Triclopyr	0.0	ND		0.03	685
Bracken Fern Root	4/6/1999	4/6/1999	4/7/1998	Spike	Triclopyr	3.0	2.1	70.0	0.03	685
Bracken Fern Root	5/20/1999	5/21-24/99	5/24/1999	Blank	Triclopyr	0.0	ND		0.03	691
Bracken Fern Root	5/20/1999	5/21-24/99	5/24/1999	Spike	Triclopyr	3.0	2.16	72.0	0.03	691
Buckbrush Shoot	7/10/1997	7/10-11/97	7/11/1997	Blank	Triclopyr	0.0	ND		0.05	97
Buckbrush Shoot	7/10/1997	7/10-11/97	7/11/1997	Spike	Triclopyr	3.0	2.58	86.0	0.05	97
Buckbrush Shoot	7/28/1997	7/28-29/97	7/29/1997	Blank	Triclopyr	0.0	ND		0.05	68
Buckbrush Shoot	7/28/1997	7/28-29/97	7/29/1997	Spike	Triclopyr	3.0	2.69	89.7	0.05	68
Buckbrush Shoot	9/4/1997	9/4-5/97	9/9/1997	Blank	Triclopyr	0.0	ND		0.05	367
Buckbrush Shoot	9/4/1997	9/4-5/97	9/9/1997	Spike	Triclopyr	3.0	2.76	92.0	0.05	367
Buckbrush Shoot	10/22/1997	10/22-23/97	10/24/1997	Blank	Triclopyr	0.0	ND		0.05	133
Buckbrush Shoot	10/22/1997	10/22-23/97	10/24/1997	Spike	Triclopyr	3.0	2.46	82.0	0.05	133
Buckbrush Shoot	1/6/1998	1/6-7/98	1/7/1998	Blank	Triclopyr	0.0	ND		0.05	250

Triclopyr Continuing Quality Control Data

Matrix	Extraction Date	Analysis Date	Date of Report	EHAP Sample Name	Analyte	Spike Level (ppm)	Result (ppm)	Recovery (%)	Reporting Limit (ppm)	Sample Numbers
Buckbrush Shoot	1/6/1998	1/6-7/98	1/7/1998	Spike	Triclopyr	3.0	2.42	80.7	0.05	250
Buckbrush Shoot	2/11/1998	2/17-18/98	2/20/1998	Blank	Triclopyr	0.0	ND		0.05	145
Buckbrush Shoot	2/11/1998	2/17-18/98	2/20/1998	Spike	Triclopyr	3.0	2.58	86.0	0.05	145
Buckbrush Shoot	7/6/1998	7/7-8/98	7/8/1998	Blank	Triclopyr	0.0	ND		0.05	186 and 191
Buckbrush Shoot	7/6/1998	7/7-8/98	7/8/1998	Spike	Triclopyr	3.0	2.48	82.7	0.05	186 and 191
Buckbrush Shoot	8/4/1998	8/4-5/98	8/5/1998	Blank	Triclopyr	0.0	ND		0.05	505,507, and 496
Buckbrush Shoot	8/4/1998	8/4-5/98	8/5/1998	Spike	Triclopyr	3.0	2.50	83.3	0.05	505,507, and 496
Buckbrush Shoot	8/27/1998	8/27-28/98	9/1/1998	Blank	Triclopyr	0.0	ND		0.05	671 and 674
Buckbrush Shoot	8/27/1998	8/27-28/98	9/1/1998	Spike	Triclopyr	3.0	2.62	87.3	0.05	671 and 674
Buckbrush Shoot	9/24/1998	9/24-25/98	9/25/1998	Blank	Triclopyr	0.0	ND		0.05	634 and 681
Buckbrush Shoot	9/24/1998	9/24-25/98	9/25/1998	Spike	Triclopyr	3.0	2.49	83.0	0.05	634 and 681
Buckbrush Shoot	12/7/1998	12/7, 10/98	12/10/1998	Blank	Triclopyr	0.0	ND		0.05	697and 699
Buckbrush Shoot	12/7/1998	12/7, 10/98	12/10/1998	Spike	Triclopyr	3.0	2.63	87.7	0.05	697and 699
Buckbrush Shoot	12/16/1998	12/16/1998	12/16/1998	Blank	Triclopyr	0.0	ND		0.05	645
Buckbrush Shoot	12/16/1998	12/16/1998	12/16/1998	Spike	Triclopyr	3.0	2.37	79.0	0.05	645
Buckbrush Shoot	1/14/1999	1/14-15/99	1/19/1999	Blank	Triclopyr	0.0	ND		0.1	713 and 716
Buckbrush Shoot	1/14/1999	1/14-15/99	1/19/1999	Spike	Triclopyr	3.0	2.39	79.7	0.1	713 and 716
Buckbrush Shoot	3/25/1999	3/29/1999	3/30/1999	Blank	Triclopyr	0.0	ND		0.05	304 and 306
Buckbrush Shoot	3/25/1999	3/29/1999	3/30/1999	Spike	Triclopyr	3.0	2.51	83.7	0.05	304 and 306
Buckbrush Shoot	6/12,16/97	6/12-17/97	6/17/1997	Blank	Triclopyr	0.0	ND		0.05	431 and 432
Buckbrush Shoot	6/12,16/97	6/12-17/97	6/17/1997	Spike	Triclopyr	3.0	2.78	92.7	0.05	431 and 432
Golden Fleece Foliage	6/10/1997	6/10-11/97	6/12/1997	Blank	Triclopyr	0.0	ND		0.07	420
Golden Fleece Foliage	6/10/1997	6/10-11/97	6/12/1997	Spike	Triclopyr	3.0	2.43	81.0	0.07	420
Golden Fleece Foliage	7/10/1997	7/10-11/97	7/11/1997	Blank	Triclopyr	0.0	ND		0.07	110
Golden Fleece Foliage	7/10/1997	7/10-11/97	7/11/1997	Spike	Triclopyr	3.0	2.49	83.0	0.07	110
Golden Fleece Foliage	7/31/1997	7/31/97, 8/1/97	8/1/1997	Blank	Triclopyr	0.0	ND		0.07	104
Golden Fleece Foliage	7/31/1997	7/31/97, 8/1/97	8/1/1997	Spike	Triclopyr	3.0	2.19	73.0	0.07	104
Golden Fleece Foliage	9/4/1997	9/4-5/97	9/9/1997	Blank	Triclopyr	0.0	ND		0.07	371
Golden Fleece Foliage	9/4/1997	9/4,5/97	9/9/1997	Spike	Triclopyr	3.0	1.88	62.7	0.07	371
Golden Fleece Foliage	10/15/1997	10/16-17/97	10/17/1997	Blank	Triclopyr	0.0	ND		0.07	137
Golden Fleece Foliage	10/15/1997	10/16-17/97	10/17/1997	Spike	Triclopyr	3.0	1.93	64.3	0.07	137
Golden Fleece Foliage	1/8/1998	1/8-9/98	1/12/1998	Blank	Triclopyr	0.0	ND		0.07	249
Golden Fleece Foliage	1/8/1998	1/8-9/98	1/12/1998	Spike	Triclopyr	3.0	1.79	59.7	0.07	249
Golden Fleece Foliage	2/18/1998	2/18-19/98	2/20/1998	Blank	Triclopyr	0.0	ND		0.07	149
Golden Fleece Foliage	2/18/1998	2/18-19/98	2/20/1998	Spike	Triclopyr	3.0	2.4	80.0	0.07	149
Golden Fleece Foliage	7/3/1998	7/3/98, 7/6/98	7/7/1998	Blank	Triclopyr	0.0	ND		0.07	184 and 253
Golden Fleece Foliage	7/3/1998	7/3/98, 7/6/98	7/7/1998	Spike	Triclopyr	3.0	2.22	74.0	0.07	184 and 253
Golden Fleece Foliage	8/20/1998	8/20-21/98	8/25/1998	Blank	Triclopyr	0.0	ND		0.07	494,506,622,670, and 676
Golden Fleece Foliage	8/20/1998	8/20-21/98	8/25/1998	Spike	Triclopyr	3.0	1.96	65.3	0.07	494,506,622,670, and 676
Golden Fleece Foliage	10/1/1998	10/1/1998	10/2/1998	Blank	Triclopyr	0.0	ND		0.07	636 and 658
Golden Fleece Foliage	10/1/1998	10/1/1998	10/2/1998	Spike	Triclopyr	3.0	1.83	61.0	0.07	636 and 658
Golden Fleece Foliage	12/14/1998	12/14/1998	12/15/1998	Blank	Triclopyr	0.0	ND		0.07	696 and 702
Golden Fleece Foliage	12/14/1998	12/14/1998	12/15/1998	Spike	Triclopyr	3.0	1.89	63.0	0.07	696 and 702

Triclopyr Continuing Quality Control Data

Matrix	Extraction Date	Analysis Date	Date of Report	EHAP Sample Name	Analyte	Spike Level (ppm)	Result (ppm)	Recovery (%)	Reporting Limit (ppm)	Sample Numbers
Golden Fleece Foliage	3/17/1999	3/18-19/99	3/19/1999	Blank	Triclopyr	0.0	ND		0.07	715,717,303, and 307
Golden Fleece Foliage	3/17/1999	3/18-19/99	3/19/1999	Spike	Triclopyr	3.0	1.76	58.7	0.07	715,717,303, and 307
Manzanita Berry	6/10/1997	6/10-11/97	6/12/1997	Blank	Triclopyr	0.0	ND		0.03	417
Manzanita Berry	6/10/1997	6/10-11/97	6/12/1997	Spike	Triclopyr	3.0	2.75	91.7	0.03	417
Manzanita Berry	7/7/1997	7/8-10/97	7/10/1997	Blank	Triclopyr	0.0	ND		0.03	99
Manzanita Berry	7/7/1997	7/8-10/97	7/10/1997	Spike	Triclopyr	3.0	2.56	85.3	0.03	99
Manzanita Berry	7/31/1997	7/31/97, 8/1/97	8/1/1997	Blank	Triclopyr	0.0	ND		0.03	77
Manzanita Berry	7/31/1997	7/31/97, 8/1/97	8/1/1997	Spike	Triclopyr	3.0	2.9	96.7	0.03	77
Manzanita Berry	9/4/1997	9/4-5/97	9/9/1997	Blank	Triclopyr	0.0	ND		0.03	368
Manzanita Berry	9/4/1997	9/4-5/97	9/9/1997	Spike	Triclopyr	3.0	2.37	79.0	0.03	368
Manzanita Berry	10/15/1997	10/15-16/97	10/17/1997	Blank	Triclopyr	0.0	ND		0.03	134
Manzanita Berry	10/15/1997	10/15-16/97	10/17/1997	Spike	Triclopyr	3.0	2.48	82.7	0.03	134
Manzanita Berry	1/8/1998	1/8-9/98	1/12/1998	Blank	Triclopyr	0.0			0.03	251
Manzanita Berry	1/8/1998	1/8-9/98	1/12/1998	Spike	Triclopyr	3.0	2.86	95.3	0.03	251
Manzanita Berry	2/18/1998	2/18-19/98	2/20/1998	Blank	Triclopyr	0.0	ND		0.03	146
Manzanita Berry	2/18/1998	2/18-19/98	2/20/1998	Spike	Triclopyr	3.0	2.63	87.7	0.03	146
Manzanita Berry	9/20/2000	9/20-22/01	9/22/2000	Blank	Triclopyr	0	ND		0.03	745
Manzanita Berry	9/20/2000	9/20-22/01	9/22/2000	Spike 1	Triclopyr	3.0	2.72	90.7	0.03	745
Manzanita Berry	9/20/2000	9/20-22/01	9/22/2000	Spike 2	Triclopyr	3.0	2.77	92.3	0.03	745
Manzanita Berry	7/11-12/00	7/12-13/00	7/13/2000	Blank	Triclopyr	0.0	ND		0.03	747 and 748
Manzanita Berry	7/11-12/00	7/12-13/00	7/13/2000	Spike 1	Triclopyr	3.0	2.88	96.0	0.03	747 and 748
Manzanita Berry	7/11-12/00	7/12-13/00	7/13/2000	Spike 2	Triclopyr	3.0	2.98	99.3	0.03	747 and 748
Manzanita Berry	7/27,31/00	8/1/2000	8/2/2000	Blank	Triclopyr	0.0	ND		0.03	749
Manzanita Berry	7/27,31/00	8/1/2000	8/2/2000	Spike 1	Triclopyr	3.0	2.76	92.0	0.03	749
Manzanita Berry	7/27,31/00	8/1/2000	8/2/2000	Spike 2	Triclopyr	3.0	2.7	90.0	0.03	749
Manzanita Berry	8/18-22/00	8/22/2000	8/23/2000	Blank	Triclopyr	0.0	ND		0.03	751
Manzanita Berry	8/18-22/00	8/22/2000	8/23/2000	Spike	Triclopyr	3.0	2.61	87.0	0.03	751
Manzanita Berry	1/10/2001	1/11-12/01	1/12/2001	Blank	Triclopyr	0.0	ND		0.03	754
Manzanita Berry	1/10/2001	1/11-12/01	1/12/2001	Spike 1	Triclopyr	3.00	3.07	102	0.03	754
Manzanita Berry	1/10/2001	1/11-12/01	1/12/2001	Spike 2	Triclopyr	3.00	3.12	104	0.03	754
Manzanita Berry	11/27/2000	11/28-30/00	11/30/2000	Blank	Triclopyr	0.0	ND		0.03	752
Manzanita Berry	11/27/2000	11/28-30/00	11/30/2000	Spike 1	Triclopyr	3.00	2.72	90.7	0.03	752
Manzanita Berry	11/27/2000	11/28-30/00	11/30/2000	Spike 2	Triclopyr	3.00	3.24	108	0.03	752

Hexazinone Continuing Quality Control Data

Matrix	Extraction Date	Analysis Date	Date of Report	EHAP Sample Name	Analyte	Spike Level (ppm)	Result (ppm)	Recovery (%)	Reporting Limit (ppm)	Sample Numbers
Bracken Fern Root	4/17/1997	4/18/1997	4/22/1997	Blank	Hexazinone	0.0	ND		0.05	15,16,22,433,446,448,449,450,454,455, and 456
Bracken Fern Root	4/17/1997	4/18/1997	4/22/1997	Spike	Hexazinone	3.0	2.75	91.7	0.05	15,16,22,433,446,448,449,450,454,455, and 456
Bracken Fern Root	5/6/1997	5/7/1997	5/12/1997	Blank	Hexazinone	0.0	ND		0.05	24,325,326,327,329,330,331,332,353, and 360
Bracken Fern Root	5/6/1997	5/7/1997	5/12/1997	Spike	Hexazinone	3.0	3.08	103.0	0.05	24,325,326,327,329,330,331,332,353, and 360
Bracken Fern Root	6/11/1997	6/12/1997	6/17/1997	Blank	Hexazinone	0.0	ND		0.05	36,339, and 342
Bracken Fern Root	6/11/1997	6/12/1997	6/17/1997	Spike	Hexazinone	3.0	3.02	101.0	0.05	36,339, and 342
Bracken Fern Root	6/23/1997	6/26/1997	6/30/1997	Blank	Hexazinone	0.0	ND		0.05	73,74,75,76,88,96,391,400,401,402, and 403
Bracken Fern Root	6/23/1997	6/26/1997	6/30/1997	Spike	Hexazinone	3.0	2.7	90.0	0.05	73,74,75,76,88,96,391,400,401,402, and 403
Bracken Fern Root	8/22/1997	8/26/1997	8/27/1997	Blank	Hexazinone	0.0	ND		0.05	315, 362, and 366
Bracken Fern Root	8/22/1997	8/26/1997	8/27/1997	Spike	Hexazinone	3.0	2.72	91.0	0.05	315, 362, and 366
Bracken Fern Root	9/30/1997	10/2/1997	10/8/1997	Blank	Hexazinone	0.0	ND		0.05	132,195, and 199
Bracken Fern Root	9/30/1997	10/2/1997	10/8/1997	Spike	Hexazinone	3.0	2.589	86.3	0.05	132,195, and 199
Bracken Fern Root	12/16/1997	12/22/1997	12/30/1997	Blank	Hexazinone	0.0	ND		0.05	246,247, and 281
Bracken Fern Root	12/16/1997	12/22/1997	12/30/1997	Spike	Hexazinone	3.0	2.56	85.3	0.05	246,247, and 281
Bracken Fern Root	4/22/1998	4/23/1998	4/24/1998	Blank	Hexazinone	0.0	ND		0.05	457 and 477
Bracken Fern Root	4/22/1998	4/23/1998	4/24/1998	Spike	Hexazinone	3.0	3.0	100.0	0.05	457 and 477
Bracken Fern Root	6/23/1998	6/25/1998	6/30/1998	Blank	Hexazinone	0.0	ND		0.05	153,155, and 181
Bracken Fern Root	6/23/1998	6/25/1998	6/30/1998	Spike	Hexazinone	3.0	2.49	83.0	0.05	153,155, and 181
Bracken Fern Root	8/21/1998	8/24/1998	9/15/1998	Blank	Hexazinone	0.0	ND		0.05	612
Bracken Fern Root	8/21/1998	8/24/1998	9/15/1998	Spike	Hexazinone	3.0	2.66	88.7	0.05	612
Bracken Fern Root	10/22/1998	10/23/1998	11/9/1998	Blank	Hexazinone	0.0	ND		0.05	638 and 648
Bracken Fern Root	10/22/1998	10/23/1998	11/9/1998	Spike	Hexazinone	3.0	2.88	96.0	0.05	638 and 648
Bracken Fern Root	2/24/1999	2/25/1999	3/2/1999	Blank	Hexazinone	0.0	ND		0.05	639
Bracken Fern Root	2/24/1999	2/25/1999	3/2/1999	Spike	Hexazinone	3.0	2.18	72.7	0.05	639
Bracken Fern Root	5/13/1999	5/13/1999	5/27/1999	Blank	Hexazinone	0.0	ND		0.05	300,310,718,724,725, and 728
Bracken Fern Root	5/13/1999	5/13/1999	5/27/1999	Spike	Hexazinone	3.0	2.47	82.3	0.05	300,310,718,724,725, and 728
Bracken Fern Root	7/13/1999	7/15/1999	7/22/1998	Blank	Hexazinone	0.0	ND		0.05	683 and 684
Bracken Fern Root	7/13/1999	7/15/1999	7/22/1998	Spike	Hexazinone	3.0	2.74	91.3	0.05	683 and 684
Bracken Fern Root	8/10/1999	8/11/1999	8/17/1999	Blank	Hexazinone	0.0	ND		0.05	543 and 544
Bracken Fern Root	8/10/1999	8/11/1999	8/17/1999	Spike	Hexazinone	3.0	2.96	98.7	0.05	543 and 544
Bracken Fern Root	12/10/1999	12/13/1999	1/27/2000	Blank	Hexazinone	0.0	ND		0.1	475,574,575,597, and 730
Bracken Fern Root	12/10/1999	12/13/1999	1/27/2000	Spike	Hexazinone	3.0	2.63	87.7	0.1	475,574,575,597, and 730
Buckbrush Shoot	4/23/1997	4/23/1997	5/2/1997	Blank	Hexazinone	0.0	ND		0.10	23,40,42,43,44,333,349,350,352, and 359
Buckbrush Shoot	4/23/1997	4/23/1997	5/2/1997	Spike	Hexazinone	3.0	2.82	94.0	0.10	23,40,42,43,44,333,349,350,352, and 359
Buckbrush Shoot	5/13/1997	5/15/1997	5/21/1997	Blank	Hexazinone	0.0	ND		0.1	438,440,441,442,443,444,451, and 452
Buckbrush Shoot	5/13/1997	5/15/1997	5/21/1997	Spike	Hexazinone	3.0	3.13	104.0	0.1	438,440,441,442,443,444,451, and 452
Buckbrush Shoot	6/19/1997	6/19/1997	6/23/1997	Blank	Hexazinone	0.0	ND		0.10	9,30,54,56, and 347
Buckbrush Shoot	6/19/1997	6/19/1997	6/23/1997	Spike	Hexazinone	3.0	3.2	107.0	0.10	9,30,54,56, and 347
Buckbrush Shoot	7/15/1997	7/17/1997	7/18/1997	Blank	Hexazinone	0.0	ND		0.10	86,93,386,393,394,395,396,404, and 406
Buckbrush Shoot	7/15/1997	7/17/1997	7/18/1997	Spike	Hexazinone	3.0	2.72	90.7	0.10	86,93,386,393,394,395,396,404, and 406
Buckbrush Shoot	8/13/1997	8/13/1997	8/18/1997	Blank	Hexazinone	0.0	ND		0.10	314,317,320,323, and 364
Buckbrush Shoot	8/13/1997	8/13/1997	8/18/1997	Spike	Hexazinone	3.0	3.18	106.0	0.10	314,317,320,323, and 364

Hexazinone Continuing Quality Control

Matrix	Extraction Date	Analysis Date	Date of Report	EHAP Sample Name	Analyte	Spike Level (ppm)	Result (ppm)	Recovery (%)	Reporting Limit (ppm)	Sample Numbers
Buckbrush Shoot	10/1/1997	10/2/1997	10/8/1997	Blank	Hexazinone	0.0	ND		0.10	128,131,196,200, and 384
Buckbrush Shoot	10/1/1997	10/2/1997	10/8/1997	Spike	Hexazinone	3.0	3.03	101.0	0.10	128,131,196,200, and 384
Buckbrush Shoot	12/23/1997	12/31/1997	1/5/1998	Blank	Hexazinone	0.0	ND		0.10	286,278,241,245, and 283
Buckbrush Shoot	12/23/1997	12/31/1997	1/5/1998	Spike	Hexazinone	3.0	2.30	76.7	0.10	286,278,241,245, and 283
Buckbrush Shoot	4/27/1998	4/27/1998	4/29/1998	Blank	Hexazinone	0.0	ND		0.10	270,481, and 484
Buckbrush Shoot	4/27/1998	4/27/1998	4/29/1998	Spike	Hexazinone	3.0	2.37	79.0	0.10	270,481, and 484
Buckbrush Shoot	6/4/1998	6/10/1998	6/11/1998	Blank	Hexazinone	0.0	ND		0.10	154, 485, 486,487,488,489, and 490
Buckbrush Shoot	6/4/1998	6/10/1998	6/11/1998	Spike	Hexazinone	3.0	2.55	85.0	0.10	154, 485, 486,487,488,489, and 490
Buckbrush Shoot	6/5/1998	6/17/1998	6/18/1998	Blank	Hexazinone	0.0	ND		0.10	157,158,159,160,162,.170, and 171
Buckbrush Shoot	6/5/1998	6/17/1998	6/18/1998	Spike	Hexazinone	3.0	2.61	87.0	0.10	157,158,159,160,162,.170, and 171
Buckbrush Shoot	7/23/1998	7/29/1998	8/5/1998	Blank	Hexazinone	0.0	ND		0.10	164,218,229,230,231,232, and 233
Buckbrush Shoot	7/23/1998	7/29/1998	8/5/1998	Spike	Hexazinone	3.0	2.65	88.3	0.10	164,218,229,230,231,232, and 233
Buckbrush Shoot	8/21/1998	8/24/1998	9/3/1998	Blank	Hexazinone	0.0	ND		0.1	611
Buckbrush Shoot	8/21/1998	8/24/1998	9/3/1998	Spike	Hexazinone	3.0	3.68	123.0	0.1	611
Buckbrush Shoot	10/22/1998	10/23/1998	11/9/1998	Blank	Hexazinone	0.0	ND		0.1	235,647,651, and 654
Buckbrush Shoot	10/22/1998	10/23/1998	11/9/1998	Spike	Hexazinone	3.0	2.51	83.7	0.1	235,647,651, and 654
Buckbrush Shoot	2/5/1999	2/8-10/99	2/16/1999	Blank	Hexazinone	0.0	ND		0.1	644 and 708
Buckbrush Shoot	2/5/1999	2/8-10/99	2/16/1999	Spike	Hexazinone	3.0	2.16	72.0	0.1	644 and 708
Buckbrush Shoot	3/10/1999	3/10/1999	3/15/1999	Blank	Hexazinone	0.0	ND		0.1	308
Buckbrush Shoot	3/10/1999	3/10/1999	3/15/1999	Spike	Hexazinone	3.0	2.27	75.7	0.1	308
Buckbrush Shoot	4/30/1999	5/3/1999	5/11/1999	Blank	Hexazinone	0.0	ND		0.1	309,655,656,657,720,721,722, and 723
Buckbrush Shoot	4/30/1999	5/3/1999	5/11/1999	Spike	Hexazinone	3.0	2.12	70.7	0.1	309,655,656,657,720,721,722, and 723
Buckbrush Shoot	7/14/1999	7/15/1999	7/22/1998	Blank	Hexazinone	0.0	ND		0.1	523,524,525, and 526
Buckbrush Shoot	7/14/1999	7/15/1999	7/22/1998	Spike	Hexazinone	3.0	2.93	97.7	0.1	523,524,525, and 526
Buckbrush Shoot	12/9/1999	12/13/1999	1/27/2000	Blank	Hexazinone	0.0	ND		0.1	576 and 577
Buckbrush Shoot	12/9/1999	12/13/1999	1/27/2000	Spike	Hexazinone	3.0	2.46	82.0	0.1	576 and 577
Golden Fleece Foliage	5/5/1997	5/6/1997	5/19/1997	Blank	Hexazinone	0.0	ND		0.10	17,39,41,334,351,358,439,445,447,and 453
Golden Fleece Foliage	5/5/1997	5/6/1997	5/19/1997	Spike	Hexazinone	3.0	3.13	104.0	0.10	17,39,41,334,351,358,439,445,447,and 453
Golden Fleece Foliage	5/30/1997	5/30/1997	6/6/1997	Blank	Hexazinone	0.0	ND		0.10	29,53,58,336, and 340
Golden Fleece Foliage	5/30/1997	5/30/1997	6/6/1997	Spike	Hexazinone	3.0	2.43	81.0	0.10	29,53,58,336, and 340
Golden Fleece Foliage	7/1/1997	7/1/1997	7/10/1997	Blank	Hexazinone	0.0	ND		0.10	66,95,385,392, and 408
Golden Fleece Foliage	7/1/1997	7/1/1997	7/10/1997	Spike	Hexazinone	3.0	2.59	86.3	0.10	66,95,385,392, and 408
Golden Fleece Foliage	8/29/1997	8/29/1997	9/2/1997	Blank	Hexazinone	0.0	ND		0.10	313,316,321,361,and 363
Golden Fleece Foliage	8/29/1997	8/29/1997	9/2/1997	Spike	Hexazinone	3.0	2.67	89.1	0.10	313,316,321,361,and 363
Golden Fleece Foliage	10/1/1997	10/2/1997	10/8/1997	Blank	Hexazinone	0.0	ND		0.10	127,129,193,197, and 198
Golden Fleece Foliage	10/1/1997	10/2/1997	10/8/1997	Spike	Hexazinone	3.0	3.3	110	0.01	127,129,193,197, and 198
Golden Fleece Foliage	12/17/1997	12/30/1997	1/2/1998	Blank	Hexazinone	0.0	ND		0.10	243,279,280,285, and 288
Golden Fleece Foliage	12/17/1997	12/30/1997	1/2/1998	Spike	Hexazinone	3.0	3.19	106.3	0.10	243,279,280,285, and 288
Golden Fleece Foliage	4/27/1998	4/27/1998	4/29/1998	Blank	Hexazinone	0.0	ND		0.10	215 and 276
Golden Fleece Foliage	4/27/1998	4/27/1998	4/29/1998	Spike	Hexazinone	3.0	2.43	81.0	0.10	215 and 276

Hexazinone Continuing Quality Control Data

Matrix	Extraction Date	Analysis Date	Date of Report	EHAP Sample Name	Analyte	Spike Level (ppm)	Result (ppm)	Recovery (%)	Reporting Limit (ppm)	Sample Numbers
Golden Fleece Foliage	7/8/1998	7/9/1998	8/4/1998	Blank	Hexazinone	0.0	ND		0.10	152,161,165,169,172,491, and 492
Golden Fleece Foliage	7/8/1998	7/9/1998	8/4/1998	Spike	Hexazinone	3.0	2.70	90.0	0.10	152,161,165,169,172,491, and 492
Golden Fleece Foliage	7/28/1998	7/29/1998	8/4/1998	Blank	Hexazinone	0.0	ND		0.10	234
Golden Fleece Foliage	7/28/1998	7/29/1998	8/4/1998	Spike	Hexazinone	3.0	2.67	89.0	0.10	234
Golden Fleece Foliage	8/25/1998	8/27/1998	9/10/1998	Blank	Hexazinone	0.0	ND		0.1	610
Golden Fleece Foliage	8/25/1998	8/27/1998	9/10/1998	Spike	Hexazinone	3.0	2.46	82.0	0.1	610
Golden Fleece Foliage	11/3/1998	11/4/1998	11/10/1998	Blank	Hexazinone	0.0	ND		0.1	236,646,652, and 653
Golden Fleece Foliage	11/3/1998	11/4/1998	11/10/1998	Spike	Hexazinone	3.0	2.79	93.0	0.1	236,646,652, and 653
Golden Fleece Foliage	2/19/1999	2/22/1999	2/26/1999	Blank	Hexazinone	0.0	ND		0.1	643 and 709
Golden Fleece Foliage	2/19/1999	2/22/1999	2/26/1999	Blank	Hexazinone	3.0	3.08	103.0	0.1	643 and 709
Manzanita Berry	5/21/1997	5/22/1997	5/23/1997	Blank	Hexazinone	0.0	ND		0.05	31,55,57,341, and 348
Manzanita Berry	5/21/1997	5/22/1997	5/23/1997	Spike	Hexazinone	3.0	2.69	89.7	0.05	31,55,57,341, and 348
Manzanita Berry	6/17/1997	6/19/1997	6/23/1997	Blank	Hexazinone	0.0	ND		0.05	85,87,94,405, and 407
Manzanita Berry	6/17/1997	6/19/1997	6/23/1997	Spike	Hexazinone	3.0	3.1	103.0	0.05	85,87,94,405, and 407
Manzanita Berry	8/8/1997	8/8/1997	8/12/1997	Blank	Hexazinone	0.0	ND		0.05	318,319,322,324, and 365
Manzanita Berry	8/8/1997	8/8/1997	8/12/1997	Spike	Hexazinone	3.0	2.64	88.0	0.05	318,319,322,324, and 365
Manzanita Berry	9/30/1997	10/2/1997	10/8/1997	Blank	Hexazinone	0.0	ND		0.05	126,130,194,201, and 203
Manzanita Berry	9/30/1997	10/2/1997	10/8/1997	Spike	Hexazinone	3.0	2.472	82.4	0.05	126,130,194,201, and 203
Manzanita Berry	12/16/1997	12/22/1997	1/2/1998	Blank	Hexazinone	0.0	ND		0.05	242,244,282,284, and 287
Manzanita Berry	12/16/1997	12/22/1997	1/2/1998	Spike	Hexazinone	3.0	2.53	84.3	0.05	242,244,282,284, and 287

Storage Stability
Glyphosate

Glyphosate Storage Stability

Medium	Time (week)	Spike Level (ppb)	Percent Recovery		
			Rep 1	Rep 2	Average
Bracken Fern Roots	0	3.0	67.0	68.0	67.5
	3	3.0	69.3	70.7	70.0
	6	3.0	74.0	60.0	67.0
	9	3.0	62.0	65.3	63.7
Buckbrush Shoots	0	3.0	81.3	77.3	79.3
	3	3.0	74.0	77.3	75.7
	6	3.0	88.7	95.3	92.0
	9	3.0	70.3	82.0	76.2
Golden Fleece Foliage	0	3.0	90.0	88.7	89.4
	3	3.0	89.7	84.7	87.2
	6	3.0	83.7	78.3	81.0
	9	3.0	100.7	92.0	96.4
Manzanita Berries	0	3.0	88.3	86.0	87.2
	3	3.0	89.3	89.3	89.3
	6	3.0	98.7	90.7	94.7
	9	3.0	88.0	88.6	88.3

Storage Stability
Triclopyr

Medium	Time (week)	Spike Level (ppb)	Percent Recovery Rep 1	Rep 2	Average
Bracken Fern Roots	0	3.0	68.0	70.0	69.0
	3	3.0	70.0	68.3	69.2
	6	3.0	71.0	72.0	71.5
	9	3.0	63.7	62.3	63.0
Buckbrush Shoots	0	3.0	82.0	89.0	85.5
	3	3.0	80.3	83.0	81.7
	6	3.0	75.7	80.7	78.2
	9	3.0	77.3	79.7	78.5
Golden Fleece Foliage	0	3.0	55.7	60.0	57.9
	3	3.0	68.3	68.0	68.2
	6	3.0	55.3	53.7	54.5
	9	3.0	66.3	63.7	65.0
Manzanita Berries	0	3.0	81.3	84.7	83.0
	3	3.0	73.0	74.7	73.9
	6	3.0	80.3	77.0	78.7
	9	3.0	81.7	83.7	82.7

Storage Stability
Hexazinone

Medium	Time (week)	Spike Level (ppb)	Percent Recovery		
			Rep 1	Rep 2	Average
Bracken Fern Roots	0	3.0	81.7	83.3	82.5
	3	3.0	84.3	87.7	86.0
	6	3.0	86.7	87.7	87.2
	9	3.0	86.0	94.3	90.2
Buckbrush Shoots	0	3.0	88.0	101.0	94.5
	3	3.0	67.7	76.7	72.2
	6	3.0	62.3	61.7	62.0
	9	3.0	71.0	66.0	68.5
Golden Fleece Foliage	0	3.0	81.3	85.3	83.3
	3	3.0	84.0	94.0	89.0
	6	3.0	97.3	99.7	98.5
	9	3.0	86.7	83.3	85.0
Manzanita Berries	0	3.0	81.0	87.0	84.0
	0.71	3.0	22.7	29.0	25.9
	1.43	3.0	23.0	26.0	24.5
	2.14	3.0	19.3	19.7	19.5
	3	3.0	17.7	20.3	19.0
	6	3.0	19.0	22.0	20.5
	9	3.0	19.8	24.0	21.9
Redbud Shoots	0	3.0	82.7	86.3	84.5
	3	3.0	81.7	76.3	79.0
	6	3.0	92.7	94.3	93.5
	9	3.0	69.3	74.0	71.7

APPENDIX C

Statistical Analyses
Field Data

The mean herbicide residue concentration for each plant part/herbicide product combination was calculated as the arithmetic average of replicates using equation (1), where 'n' is the number of replicates or sites, varying in number from 1 to 4.

$$\overline{Y} = \frac{\sum_{i=1}^{n} Y_i}{n} \quad (1)$$

The sample standard deviation and the standard error of the mean (SEM) are expressed in equations (2) (3), respectively. The SEM measures the dispersion of the sampling distribution and is an index of variability of $\overline{Y}$ from sample to sample (Zar, 1996).

$$s = \sqrt{\frac{\sum (Y_i - \overline{Y})^2}{n-1}} \quad (2)$$

$$\sigma_{\overline{Y}} = \frac{s}{\sqrt{n}} \quad (3)$$

Herbicide residue half-lives were determined using the exponential decay equation (4), the most common formula for chemical decomposition determination.

$$c = c_{\max} e^{-at} \quad (4)$$

'C' is the herbicide residue concentration at the time of 't', 'cmax' is the maximum residue concentration, and 'a' is the decay coefficient. Usually, 'cmax' is detected immediately after herbicide treatment, however, herbicide absorption and transport into plant tissues to various plant parts may not always be immediate, particularly with the application of granular hexazinone. Therefore, for granular hexazinone treated plants, 't' was measured at the time when the maximum hexazinone level was observed in the sampled plant part following herbicide application. For the remaining three herbicide products, 't' was measured from the time of treatment. The decay coefficient 'a' dictates the rate of concentration decline and a large 'a' value indicates more rapid dissipation and, subsequently, less time for an herbicide residue level to reach the non-detectable level in comparison to a small 'a' value.

The Marquardts Compromise method was employed to fit equation (4). The process involved the iterative calculation of parameter 'cmax' and 'a'. For a set of initial values of 'cmax' and 'a', the calculation was repeated until the sum of error squares using current parameter values was close enough to that of the previous parameter values. If the process did not converge after a large number of iterations, the first data pair was dropped and the process repeated with the same set of initial values. The residue half-life, 't(1/2)' was calculated by letting 'c=1/2 cmax' in equation (4) and solving for 't'. For each sampling site, there was a time series representing the variability of herbicide residue concentrations over the sampling period. The site specific data set was used to fit equation (4), and then the herbicide residue half-life was calculated using equation (5).

$$t_{1/2} = \frac{\ln 2}{a} \qquad (5)$$

It was common to get different parameter values and thus different half-lives if calculated separately from each of the (up to) four sampling sites. In order to estimate the half-life for a particular plant part/herbicide product combination, the weighted average half-life from different sampling sites was calculated using equation (6), where the $\bar{t}½$ is the average half-life, ‘t1/2(j)’ is the half-life calculated from residue concentration data collected at site ‘j’, ‘Rj’ is the coefficient of determination (r2) when fitting equation (4), an ‘m’ is the number of sites.

$$\bar{t}_{1/2} = \frac{\sum_{j=1}^{m} R_j t_{1/2}^{(j)}}{\sum_{j=1}^{m} R_j} \qquad (6)$$

Two screening processes were performed when using model (6) to calculate the weighted average. First, some data fitting attempts for equation (4) may not have generated a significant regression, and thus the herbicide half-life calculated using that set of coefficients would have low credibility, and would be excluded from the weighted average calculation. Second, if a regression was significant, but the half-life was negative in value, it was not included in equation (6).

The screening procedure is summarized in equation (7), where ‘r_j’ is the correlation coefficient and r0.10 is the critical correlation value with a 90% significant level, which varied with sample size (Table 1). Half-lives were undeterminable if all sites failed to pass the screening criteria.

$$R_j = \left\{ \begin{matrix} r_j^2 & if\ r_j \geq r_{0.10} \\ 0 & if\ r_j < r_{0.10}\ or\ t_{1/2}^{j} < 0 \end{matrix} \right\} \qquad (7)$$

Table 1. Ninety percent significant correlation levels for varying sample size

Sample Size (n)	Degrees of Freedom (df)	$r_{0.10}$	$r^2_{0.10}$
4	2	0.900	0.81
5	3	0.805	0.65
6	4	0.729	0.53
7	5	0.669	0.45
8	6	0.621	0.39
9	7	0.582	0.34
10	8	0.549	0.30

Source: Steel and Torrie (1960)

Because of the large variability in resulting data and the difficulty of including site specific factors (e.g. climatic data, application date) in data analysis, the mean concentrations were not used to fit equation (4). It was more appropriate to fit the equation with residue data from the same sampling site so that the effect of site specific factors was excluded. Using a nonlinear regression technique, coefficients in equation (4) were estimated and the half-life was calculated for each plant part/herbicide product combination (Table 2).

Table 2. Regression coefficients of model (4) and half-life estimated using site specific data

Herbicide	Plant Part Sampled	Site	c_{max}	a	$t_{1/2}$ (Weeks)	r^2	n
Glyphosate - Accord®	Bracken Fern Roots	1	0.144	0.060	11.46	0.72	7
	Bracken Fern Roots	2	1.269	0.044	15.86	0.34	6
	Bracken Fern Roots	3	0.753	0.014	49.26	0.24	6
	Bracken Fern Roots	4	0.929	0.069	10.10	0.15	7
	Buckbrush Shoots	1	311.274	0.122	5.69	0.65	6
	Buckbrush Shoots	2	740.236	0.078	8.84	0.87	6
	Buckbrush Shoots	3	40.294	0.034	20.36	0.43	7
	Buckbrush Shoots	4	235.839	0.044	15.80	0.60	6
	Golden Fleece Foliage	1	7.626	0.026	27.09	0.07	6
	Golden Fleece Foliage	2	5.940	0.115	6.03	0.83	7
	Golden Fleece Foliage	3	1178.00	0.062	11.26	0.61	6
	Golden Fleece Foliage	4	7.478	0.036	19.42	0.24	7
	Manzanita Berries	1	54.263	-0.007	-92.95	0.11	5
	Manzanita Berries	2	397.896	0.028	24.65	0.47	6
	Manzanita Berries	3	65.953	0.046	15.19	0.47	5
	Manzanita Berries	4	n/a	n/a	n/a	n/a	n/a
Triclopyr - Garlon®	Bracken Fern Roots	1	0.149	0.019	35.95	0.07	7
	Bracken Fern Roots	2	0.277	0.060	11.56	0.73	7
	Bracken Fern Roots	3	0.099	0.379	1.83	0.96	6
	Bracken Fern Roots	4	n/a	n/a	n/a	n/a	n/a
	Buckbrush Shoots	1	9.856	0.273	2.53	0.89	9
	Buckbrush Shoots	2	n/a	n/a	n/a	n/a	n/a
	Buckbrush Shoots	3	87.355	0.317	2.19	0.99	6
	Buckbrush Shoots	4	16.226	28.039	0.02	0.00	5
	Golden Fleece Foliage	1	4.176	0.466	1.49	0.83	7
	Golden Fleece Foliage	2	11.800	17.477	0.04	0.97	7
	Golden Fleece Foliage	3	2.020	0.047	14.63	0.83	8
	Golden Fleece Foliage	4	n/a	n/a	n/a	n/a	n/a
	Manzanita Berries	1	2.525	-0.007	-100.91	0.07	7
	Manzanita Berries	2	2.620	0.008	84.26	0.08	6
	Manzanita Berries	3	n/a	n/a	n/a	n/a	n/a
	Manzanita Berries	4	n/a	n/a	n/a	n/a	n/a

Continued
Table 2. Regression coefficients of model (4) and half-life estimated using site specific data

Herbicide	Plant Part Sampled	Site	c_{max}	a	$t_{1/2}$ (Weeks)	r^2	n
Hexazinone - Pronone® 10G	Bracken Fern Roots	1	0.040	0.017	40.25	0.15	7
	Bracken Fern Roots	2	0.387	-0.003	-229.29	0.00	7
	Bracken Fern Roots	3	0.124	0.011	62.28	0.05	7
	Bracken Fern Roots	4	0.183	0.010	70.29	0.14	9
	Buckbrush Shoots	1	0.617	0.008	81.91	0.20	10
	Buckbrush Shoots	2	0.461	0.002	287.37	0.00	7
	Buckbrush Shoots	3	0.568	0.005	133.27	0.01	7
	Buckbrush Shoots	4	0.126	-0.019	-36.21	0.17	7
	Golden Fleece Foliage	1	0.063	-0.038	-18.13	0.30	7
	Golden Fleece Foliage	2	0.302	0.007	100.19	0.05	9
	Golden Fleece Foliage	3	0.422	0.012	59.82	0.02	7
	Golden Fleece Foliage	4	0.702	0.037	18.89	0.35	7
	Manzanita Berries	n/a	n/a	n/a	n/a	n/a	n/a
	Manzanita Berries	n/a	n/a	n/a	n/a	n/a	n/a
	Manzanita Berries	3	3.705	0.407	1.70	0.96	5
	Manzanita Berries	4	n/a	n/a	n/a	n/a	n/a
Hexazinone – Velpar® L	Bracken Fern Roots	1	n/a	n/a	n/a	n/a	n/a
	Bracken Fern Roots	2	0.472	0.037	18.50	0.58	7
	Bracken Fern Roots	3	n/a	n/a	n/a	n/a	n/a
	Bracken Fern Roots	4	n/a	n/a	n/a	n/a	n/a
	Buckbrush Shoots	1	3.833	0.104	6.69	0.48	7
	Buckbrush Shoots	2	0.937	-0.011	-60.86	0.03	7
	Buckbrush Shoots	3	1.086	0.023	30.51	0.41	9
	Buckbrush Shoots	4	n/a	n/a	n/a	n/a	n/a
	Golden Fleece Foliage	1	31.730	11.400	0.06	1.00	7
	Golden Fleece Foliage	2	5.200	-0.008	-87.74	0.02	6
	Golden Fleece Foliage	3	291.000	0.571	1.21	1.00	8
	Golden Fleece Foliage	4	n/a	n/a	n/a	n/a	n/a
	Manzanita Berries	1	0.149	0.012	56.54	0.01	5
	Manzanita Berries	2	0.190	0.068	10.25	0.49	5
	Manzanita Berries	3	n/a	n/a	n/a	n/a	n/a
	Manzanita Berries	4	n/a	n/a	n/a	n/a	n/a

n/a means the data fitting process for equation (4) did not converge during the iteration or there were an insufficient number of samples for a meaningful regression, or no monitoring site was selected.

For some sites, using the time series of concentration data did not generate significant regressions. In other cases, iterations for the nonlinear regression did not converge, so regression coefficients for equation (4) could not be obtained. In general, low correlations were associated with low residue concentrations. For example, glyphosate and triclopyr had higher residue concentrations in plant materials and the associated correlation coefficients were generally higher. Hexazinone concentrations from granular hexazinone treated plants were the lowest, and correlations were also poor. Residue levels in sampled plants were always near the minimum reporting limit during the study period. Therefore, it was difficult to obtain an accurate concentration measurement and data did not present a logical decline tendency with time and regressions were poor. Conversely, glyphosate residue concentration was much greater and the variation was relatively small compared to the concentration itself, so for glyphosate, a decline pattern was evident and the regression fit was better than for granular hexazinone.

The average herbicide half-lives in each plant part was calculated based on equations (6) and (7). Only a few site specific data sets contributed to the calculation of average half-lives at the 90% significance level. In some cases, as with granular hexazinone, no regression could be used, with the exception of manzanita berries.

References

Steel, R.G.D. and J.H. Torrie. 1960. Principles and procedures of statistics with special reference to the biological sciences. McGraw-Hill Book Company, Inc.

Zar, J.H. 1996. Biostatistical analysis. Third Edition. Prentice Hall.

Sample Number	Sample Date	National Forest	District	Stand	Inside/Outside Treatment Area	Distance Off-Site (ft)	Weeks After Treatment	Plant	Plant Part	Phytoxicity	Tare Wt	Container and Sample Wt	Pesticide	Concentration (ppm)	RL
13	01-Mar-97	Sierra	Kings River	redbud	inside	---	0	redbud	shoots	3	424	528	hexazinone	ND	0.05
14	01-Mar-97	Sierra	Kings River	redbud	inside	---	0	redbud	shoots	3	425	473	hexazinone	ND	0.05
433	14-Mar-97	Stanislaus	Groveland	027-008	inside	---	0	bracken fern	roots	3	422	483	hexazinone	ND	0.05
434	14-Mar-97	Stanislaus	Groveland	027-008	outside	05 - 15	0	deerbrush	shoots	3	486	424	hexazinone	ND	0.1
435	14-Mar-97	Stanislaus	Groveland	027-008	outside	20 - 40	0	deerbrush	shoots	3	426	503	hexazinone	ND	0.1
436	14-Mar-97	Stanislaus	Groveland	027-008	outside	50 - 70	0	deerbrush	shoots	3	424	518	hexazinone	ND	0.1
437	14-Mar-97	Stanislaus	Groveland	027-008	outside	80 - 100	0	deerbrush	shoots	3	426	476	hexazinone	ND	0.1
438	14-Mar-97	Stanislaus	Groveland	027-008	inside	---	0	buckbrush	shoots	3	425	513	hexazinone	2.62	0.1
439	14-Mar-97	Stanislaus	Groveland	027-008	inside	---	0	golden fleece	foliage	2	426	544	hexazinone	31.73	0.1
445	14-Mar-97	Stanislaus	Mi Wok	E029	inside	---	0	golden fleece	foliage	3	431	538	hexazinone	211.8	0.1
440	16-Mar-97	Stanislaus	Mi Wok	E121	outside	05 - 15	0	buckbrush	shoots	3	431	519	hexazinone	ND	0.1
441	16-Mar-97	Stanislaus	Mi Wok	E121	outside	20 - 40	0	buckbrush	shoots	3	428	518	hexazinone	ND	0.1
442	16-Mar-97	Stanislaus	Mi Wok	E121	outside	50 - 70	0	buckbrush	shoots	3	428	503	hexazinone	ND	0.1
443	16-Mar-97	Stanislaus	Mi Wok	E121	outside	80 - 100	0	buckbrush	shoots	3	429	499	hexazinone	0.124	0.1
444	16-Mar-97	Stanislaus	Mi Wok	E121	inside	---	0	buckbrush	shoots	3	426	502	hexazinone	75.4	0.1
446	17-Mar-97	Stanislaus	Mi Wok	033-138	outside	50 - 70	0	bracken fern	roots	3	427	586	hexazinone	ND	0.05
448	17-Mar-97	Stanislaus	Mi Wok	033-138	outside	05 - 15	0	bracken fern	roots	3	429	528	hexazinone	ND	0.05
449	17-Mar-97	Stanislaus	Mi Wok	033-138	outside	20 - 40	0	bracken fern	roots	3	430	591	hexazinone	ND	0.05
450	17-Mar-97	Stanislaus	Mi Wok	033-138	outside	80 - 100	0	bracken fern	roots	3	429	587	hexazinone	ND	0.05
447	17-Mar-97	Stanislaus	Mi Wok	033-176	inside	---	0	golden fleece	foliage	3	431	535	hexazinone	0.366	0.1
451	17-Mar-97	Stanislaus	Mi Wok	033-176	inside	---	0	buckbrush	shoots	3	423	521	hexazinone	0.128	0.1
452	18-Mar-97	Stanislaus	Groveland	016-033	inside	---	0	buckbrush	shoots	3	430	532	hexazinone	0.976	0.1
453	18-Mar-97	Stanislaus	Groveland	016-033	inside	---	0	golden fleece	foliage	3	430	535	hexazinone	ND	0.1
15	18-Mar-97	Stanislaus	Groveland	025-055	outside	50 - 70	0	bracken fern	roots	3	426	569	hexazinone	ND	0.05
16	18-Mar-97	Stanislaus	Groveland	025-055	outside	20 - 40	0	bracken fern	roots	3	426	548	hexazinone	ND	0.05
454	18-Mar-97	Stanislaus	Groveland	025-055	inside	---	0	bracken fern	roots	3	431	641	hexazinone	ND	0.05
455	18-Mar-97	Stanislaus	Groveland	025-055	outside	80 - 100	0	bracken fern	roots	3	430	619	hexazinone	ND	0.05
456	18-Mar-97	Stanislaus	Groveland	025-055	outside	05 - 15	0	bracken fern	roots	3	430	601	hexazinone	ND	0.05
23	20-Mar-97	Stanislaus	Mi Wok	E026	inside	---	0	buckbrush	shoots	3	424	530	hexazinone	0.111	0.1
17	20-Mar-97	Stanislaus	Mi Wok	R041	inside	---	0	golden fleece	foliage	3	425	566	hexazinone	0.3	0.1
18	20-Mar-97	Stanislaus	Mi Wok	R041	outside	80 - 100	0	deerbrush	shoots	3	424	579	hexazinone	ND	0.1
19	20-Mar-97	Stanislaus	Mi Wok	R041	outside	50 - 70	0	deerbrush	shoots	3	425	518	hexazinone	0.1 - 1	0.1
20	20-Mar-97	Stanislaus	Mi Wok	R041	outside	20 - 40	0	deerbrush	shoots	3	426	521	hexazinone	ND	0.1
21	20-Mar-97	Stanislaus	Mi Wok	R041	outside	05 - 15	0	deerbrush	shoots	3	424	505	hexazinone	0.1 - 1	0.1
22	20-Mar-97	Stanislaus	Mi Wok	R042	inside	---	0	bracken fern	roots	3	425	520	hexazinone	ND	0.05
37	02-Apr-97	Sierra	Kings River	redbud	inside	---	4	redbud	shoots	3	428	541	hexazinone	ND	0.05
38	02-Apr-97	Sierra	Kings River	redbud	inside	---	4	redbud	shoots	3	428	559	hexazinone	ND	0.05
40	15-Apr-97	Stanislaus	Mi Wok	E026	inside	---	4	buckbrush	shoots	3	424	508	hexazinone	ND	0.1
39	15-Apr-97	Stanislaus	Mi Wok	E029	inside	---	4	golden fleece	foliage	3	427	548	hexazinone	29.6	0.1
42	15-Apr-97	Stanislaus	Mi Wok	E121	inside	---	4	buckbrush	shoots	3	427	524	hexazinone	0.510	0.1
43	15-Apr-97	Stanislaus	Mi Wok	E121	outside	80 - 100	4	buckbrush	shoots	3	428	521	hexazinone	ND	0.1
44	15-Apr-97	Stanislaus	Mi Wok	E121	outside	50 - 70	4	buckbrush	shoots	3	428	520	hexazinone	ND	0.1
349	15-Apr-97	Stanislaus	Mi Wok	E121	outside	05 - 15	4	buckbrush	shoots	3	428	538	hexazinone	ND	0.1
350	15-Apr-97	Stanislaus	Mi Wok	E121	outside	20 - 40	4	buckbrush	shoots	3	430	562	hexazinone	ND	0.1
41	15-Apr-97	Stanislaus	Mi Wok	R041	inside	---	4	golden fleece	foliage	0	428	525	hexazinone	0.8	0.1
45	15-Apr-97	Stanislaus	Mi Wok	R041	outside	80 - 100	4	deerbrush	shoots	3	427	561	hexazinone	ND	0.1
46	15-Apr-97	Stanislaus	Mi Wok	R041	outside	50 - 70	4	deerbrush	shoots	3	425	523	hexazinone	ND	0.1
47	15-Apr-97	Stanislaus	Mi Wok	R041	outside	20 - 40	4	deerbrush	shoots	3	425	545	hexazinone	ND	0.1
48	15-Apr-97	Stanislaus	Mi Wok	R041	outside	05 - 15	4	deerbrush	shoots	3	426	574	hexazinone	ND	0.1
24	15-Apr-97	Stanislaus	Mi Wok	R042	inside	---	4	bracken fern	roots	3	421	515	hexazinone	0.200	0.05
351	16-Apr-97	Stanislaus	Groveland	016-033	inside	---	4	golden fleece	foliage	3	430	600	hexazinone	ND	0.1
352	16-Apr-97	Stanislaus	Groveland	016-033	inside	---	4	buckbrush	shoots	3	427	514	hexazinone	ND	0.1
325	16-Apr-97	Stanislaus	Groveland	025-055	outside	05 - 15	4	bracken fern	roots	3	431	578	hexazinone	ND	0.05
326	16-Apr-97	Stanislaus	Groveland	025-055	outside	20 - 40	4	bracken fern	roots	3	429	584	hexazinone	ND	0.05

Sample Number	Sample Date	National Forest	District	Stand	Inside/Outside Treatment Area	Distance Off-Site (ft)	Weeks After Treatment	Plant	Plant Part	Phytoxicity	Tare Wt	Container and Sample Wt	Pesticide	Concentration (ppm)	RL
327	16-Apr-97	Stanislaus	Groveland	025-055	outside	50 - 70	4	bracken fern	roots	3	431	583	hexazinone	ND	0.05
360	16-Apr-97	Stanislaus	Groveland	025-055	inside	---	4	bracken fern	roots	3	430	546	hexazinone	0.07	0.05
353	16-Apr-97	Stanislaus	Groveland	027-008	inside	---	4	bracken fern	roots	3	429	526	hexazinone	ND	0.05
354	16-Apr-97	Stanislaus	Groveland	027-008	outside	05 - 15	4	deerbrush	shoots	3	429	540	hexazinone	ND	0.1
355	16-Apr-97	Stanislaus	Groveland	027-008	outside	80 - 100	4	deerbrush	shoots	3	428	574	hexazinone	ND	0.1
356	16-Apr-97	Stanislaus	Groveland	027-008	outside	50 - 70	4	deerbrush	shoots	3	430	609	hexazinone	ND	0.1
357	16-Apr-97	Stanislaus	Groveland	027-008	outside	20 - 40	4	deerbrush	shoots	3	429	554	hexazinone	ND	0.1
358	16-Apr-97	Stanislaus	Groveland	027-008	inside	---	4	golden fleece	foliage	3	429	524	hexazinone	0.667	0.1
359	16-Apr-97	Stanislaus	Groveland	027-008	inside	---	4	buckbrush	shoots	2	430	535	hexazinone	5.68	0.1
329	17-Apr-97	Stanislaus	Mi Wok	033-138	outside	05 - 15	4	bracken fern	roots	3	432	510	hexazinone	ND	0.05
330	17-Apr-97	Stanislaus	Mi Wok	033-138	outside	20 - 40	4	bracken fern	roots	3	430	549	hexazinone	ND	0.05
331	17-Apr-97	Stanislaus	Mi Wok	033-138	outside	80 - 100	4	bracken fern	roots	3	433	540	hexazinone	ND	0.05
332	17-Apr-97	Stanislaus	Mi Wok	033-138	outside	50 - 70	4	bracken fern	roots	3	431	534	hexazinone	ND	0.05
333	17-Apr-97	Stanislaus	Mi Wok	033-176	inside	---	4	buckbrush	shoots	3	425	551	hexazinone	ND	0.1
334	17-Apr-97	Stanislaus	Mi Wok	033-176	inside	---	4	golden fleece	foliage	3	426	570	hexazinone	0.1	0.1
335	29-Apr-97	Sierra	Kings River	redbud	inside	---	8	redbud	shoots	3	430	560	hexazinone	ND	0.05
1	30-Apr-97	Sierra	Pineridge	Musick 071	outside	05 - 15	0	buckbrush	shoots	3	429	527	glyphosate	0.10	0.1
2	30-Apr-97	Sierra	Pineridge	Musick 071	outside	20 - 40	0	buckbrush	shoots	3	427	524	glyphosate	ND	0.1
3	30-Apr-97	Sierra	Pineridge	Musick 071	outside	50 - 70	0	buckbrush	shoots	0	429	521	glyphosate	ND	0.1
4	30-Apr-97	Sierra	Pineridge	Musick 071	outside	80 - 100	0	buckbrush	shoots	3	429	519	glyphosate	ND	0.1
5	01-May-97	Sierra	Pineridge	Jose 138	inside	---	0	manzanita	berries	3	428	623	glyphosate	79.0	0.1
7	01-May-97	Sierra	Pineridge	Jose 138	inside	---	0	buckbrush	shoots	3	428	560	glyphosate	154	0.1
8	01-May-97	Sierra	Pineridge	Jose 138	inside	---	0	bracken fern	roots	3	428	580	glyphosate	ND	0.1
53	13-May-97	Stanislaus	Mi Wok	033-176	inside	---	8	golden fleece	foliage	2	424	539	hexazinone	0.222	0.1
54	13-May-97	Stanislaus	Mi Wok	033-176	inside	---	8	buckbrush	shoots	2	426	540	hexazinone	1.03	0.1
55	13-May-97	Stanislaus	Mi Wok	033-176	inside	---	8	manzanita	berries	3	425	598	hexazinone	ND	0.05
9	13-May-97	Stanislaus	Mi Wok	E026	inside	---	8	buckbrush	shoots	2	427	545	hexazinone	0.27	0.1
336	13-May-97	Stanislaus	Mi Wok	E029	inside	---	8	golden fleece	foliage	3	427	558	hexazinone	3.01	0.1
341	13-May-97	Stanislaus	Mi Wok	E116	inside	---	8	manzanita	berries	2	430	674	hexazinone	0.143	0.06
347	13-May-97	Stanislaus	Mi Wok	E121	inside	---	8	buckbrush	shoots	1	430	538	hexazinone	1.58	0.1
348	13-May-97	Stanislaus	Mi Wok	E121	inside	---	8	manzanita	berries	2	430	574	hexazinone	0.142	0.05
340	13-May-97	Stanislaus	Mi Wok	R041	inside	---	8	golden fleece	foliage	2	430	529	hexazinone	0.925	0.1
339	13-May-97	Stanislaus	Mi Wok	R042	inside	---	8	bracken fern	roots	3	427	519	hexazinone	0.204	0.05
56	14-May-97	Stanislaus	Groveland	016-033	inside	---	8	buckbrush	shoots	2	428	555	hexazinone	0.58	0.1
57	14-May-97	Stanislaus	Groveland	016-033	inside	---	8	manzanita	berries	3	428	584	hexazinone	ND	0.05
58	14-May-97	Stanislaus	Groveland	016-033	inside	---	8	golden fleece	foliage	0	429	534	hexazinone	0.171	0.1
36	14-May-97	Stanislaus	Groveland	025-055	inside	---	8	bracken fern	roots	3	402	507	hexazinone	ND	0.05
29	14-May-97	Stanislaus	Groveland	027-008	inside	---	8	golden fleece	foliage	1	401	517	hexazinone	0.677	0.1
30	14-May-97	Stanislaus	Groveland	027-008	inside	---	8	buckbrush	shoots	2	402	527	hexazinone	0.23	0.1
31	14-May-97	Stanislaus	Groveland	027-008	inside	---	8	manzanita	berries	2	403	557	hexazinone	ND	0.05
342	14-May-97	Stanislaus	Groveland	027-008	inside	---	8	bracken fern	roots	3	430	506	hexazinone	ND	0.05
425	22-May-97	Sierra	Pineridge	Jose 138	inside	---	4	bracken fern	roots	2	422	528	glyphosate	2.52	0.1
427	22-May-97	Sierra	Pineridge	Jose 138	inside	---	4	buckbrush	shoots	1	424	558	glyphosate	30.5	0.1
428	22-May-97	Sierra	Pineridge	Jose 138	inside	---	4	manzanita	berries	1	423	559	glyphosate	58.0	0.1
421	22-May-97	Sierra	Pineridge	Musick 071	outside	05 - 15	4	buckbrush	shoots	2	425	564	glyphosate	ND	0.1
422	22-May-97	Sierra	Pineridge	Musick 071	outside	20 - 40	4	buckbrush	shoots	2	424	522	glyphosate	ND	0.1
423	22-May-97	Sierra	Pineridge	Musick 071	outside	50 - 70	4	buckbrush	shoots	2	422	543	glyphosate	ND	0.1
424	22-May-97	Sierra	Pineridge	Musick 071	outside	80 - 100	4	buckbrush	shoots	2	424	525	glyphosate	ND	0.1
429	22-May-97	Sierra	Kings River	redbud	inside	---	12	redbud	shoots	3	429	521	hexazinone	ND	0.1
431	27-May-97	Stanislaus	Groveland	027-002	inside	---	0	buckbrush	shoots	3	430	550	triclopyr	10.0	0.05
432	27-May-97	Stanislaus	Groveland	027-002	inside	---	0	buckbrush	shoots	3	429	501	triclopyr	14.2	0.05
414	28-May-97	Stanislaus	Groveland	026-069	inside	---	0	bracken fern	roots	3	427	514	triclopyr	0.1	0.03
417	28-May-97	Stanislaus	Groveland	026-069	inside	---	0	manzanita	berries	3	428	659	triclopyr	2.65	0.03
59	29-May-97	Eldorado	Pacific	501-120	outside	05 - 15	0	deerbrush	shoots	3	428	634	glyphosate	ND	0.1
60	29-May-97	Eldorado	Pacific	501-120	outside	05 - 15	0	deerbrush	shoots	3	428	668	triclopyr	ND	0.03

Sample Number	Sample Date	National Forest	District	Stand	Inside/Outside Treatment Area	Distance Off-Site (ft)	Weeks After Treatment	Plant	Plant Part	Phytoxicity	Tare Wt	Container and Sample Wt	Pesticide	Concentration (ppm)	RL
61	29-May-97	Eldorado	Pacific	501-120	outside	20 - 40	0	deerbrush	shoots	3	429	634	glyphosate	ND	0.1
62	29-May-97	Eldorado	Pacific	501-120	outside	20 - 40	0	deerbrush	shoots	3	429	683	triclopyr	ND	0.03
63	29-May-97	Eldorado	Pacific	501-120	outside	50 - 70	0	deerbrush	shoots	3	428	573	glyphosate	ND	0.1
64	29-May-97	Eldorado	Pacific	501-120	outside	50 - 70	0	deerbrush	shoots	3	428	632	triclopyr	ND	0.03
65	29-May-97	Eldorado	Pacific	501-120	outside	80 - 100	0	deerbrush	shoots	3	429	574	glyphosate	ND	0.1
418	29-May-97	Eldorado	Pacific	501-120	outside	80 - 100	0	deerbrush	shoots	3	430	592	triclopyr	ND	0.03
419	29-May-97	Eldorado	Pacific	501-120	inside	---	0	golden fleece	foliage	3	428	579	glyphosate	54.9	0.1
420	29-May-97	Eldorado	Pacific	501-120	inside	---	0	golden fleece	foliage	3	429	563	triclopyr	1.65	0.07
386	10-Jun-97	Stanislaus	Mi Wok	E026	inside	---	12	buckbrush	shoots	1	430	590	hexazinone	0.183	0.1
385	10-Jun-97	Stanislaus	Mi Wok	E029	inside	---	12	golden fleece	foliage	2	429	645	hexazinone	0.31	0.1
87	10-Jun-97	Stanislaus	Mi Wok	E116	inside	---	12	manzanita	berries	1	426	608	hexazinone	ND	0.05
85	10-Jun-97	Stanislaus	Mi Wok	E121	inside	---	12	manzanita	berries	1	429	632	hexazinone	ND	0.05
86	10-Jun-97	Stanislaus	Mi Wok	E121	inside	---	12	buckbrush	shoots	1	429	540	hexazinone	0.70	0.1
393	10-Jun-97	Stanislaus	Mi Wok	E121	outside	05 - 15	12	buckbrush	shoots	2	430	532	hexazinone	ND	0.1
394	10-Jun-97	Stanislaus	Mi Wok	E121	outside	20 - 40	12	buckbrush	shoots	2	429	561	hexazinone	ND	0.1
395	10-Jun-97	Stanislaus	Mi Wok	E121	outside	50 - 70	12	buckbrush	shoots	2	431	540	hexazinone	ND	0.1
396	10-Jun-97	Stanislaus	Mi Wok	E121	outside	80 - 100	12	buckbrush	shoots	2	431	534	hexazinone	ND	0.1
387	10-Jun-97	Stanislaus	Mi Wok	R041	outside	20 - 40	12	deerbrush	shoots	3	429	541	hexazinone	ND	0.1
388	10-Jun-97	Stanislaus	Mi Wok	R041	outside	05 - 15	12	deerbrush	shoots	3	429	509	hexazinone	ND	0.1
389	10-Jun-97	Stanislaus	Mi Wok	R041	outside	50 - 70	12	deerbrush	shoots	3	429	572	hexazinone	ND	0.1
390	10-Jun-97	Stanislaus	Mi Wok	R041	outside	80 - 100	12	deerbrush	shoots	3	428	599	hexazinone	ND	0.1
392	10-Jun-97	Stanislaus	Mi Wok	R041	inside	---	12	golden fleece	foliage	2	431	594	hexazinone	0.68	0.1
391	10-Jun-97	Stanislaus	Mi Wok	R042	inside	---	12	bracken fern	roots	2	429	498	hexazinone	0.15	0.05
66	11-Jun-97	Stanislaus	Groveland	016-033	inside	---	12	golden fleece	foliage	1	426	590	hexazinone	0.21	0.1
404	11-Jun-97	Stanislaus	Groveland	016-033	inside	---	12	buckbrush	shoots	1	431	523	hexazinone	0.615	0.1
405	11-Jun-97	Stanislaus	Groveland	016-033	inside	---	12	manzanita	berries	1	430	682	hexazinone	ND	0.05
96	11-Jun-97	Stanislaus	Groveland	025-055	inside	---	12	bracken fern	roots	3	428	504	hexazinone	ND	0.05
400	11-Jun-97	Stanislaus	Groveland	025-055	outside	05 - 15	12	bracken fern	roots	3	430	527	hexazinone	ND	0.05
401	11-Jun-97	Stanislaus	Groveland	025-055	outside	20 - 40	12	bracken fern	roots	3	430	518	hexazinone	ND	0.05
402	11-Jun-97	Stanislaus	Groveland	025-055	outside	50 - 70	12	bracken fern	roots	3	430	522	hexazinone	ND	0.05
403	11-Jun-97	Stanislaus	Groveland	025-055	outside	80 - 100	12	bracken fern	roots	3	430	524	hexazinone	ND	0.05
88	11-Jun-97	Stanislaus	Groveland	027-008	inside	---	12	bracken fern	roots	3	426	523	hexazinone	ND	0.05
89	11-Jun-97	Stanislaus	Groveland	027-008	outside	05 - 15	12	deerbrush	shoots	2	427	609	hexazinone	ND	0.1
90	11-Jun-97	Stanislaus	Groveland	027-008	outside	20 - 40	12	deerbrush	shoots	2	429	551	hexazinone	ND	0.1
91	11-Jun-97	Stanislaus	Groveland	027-008	outside	50 - 70	12	deerbrush	shoots	3	428	530	hexazinone	ND	0.1
92	11-Jun-97	Stanislaus	Groveland	027-008	outside	80 - 100	12	deerbrush	shoots	3	428	517	hexazinone	ND	0.1
93	11-Jun-97	Stanislaus	Groveland	027-008	inside	---	12	buckbrush	shoots	1	428	537	hexazinone	0.440	0.1
94	11-Jun-97	Stanislaus	Groveland	027-008	inside	---	12	manzanita	berries	1	428	629	hexazinone	0.34	0.05
95	11-Jun-97	Stanislaus	Groveland	027-008	inside	---	12	golden fleece	foliage	1	428	589	hexazinone	0.19	0.1
73	12-Jun-97	Stanislaus	Mi Wok	033-138	outside	05 - 15	12	bracken fern	roots	3	428	540	hexazinone	ND	0.05
74	12-Jun-97	Stanislaus	Mi Wok	033-138	outside	20 - 40	12	bracken fern	roots	3	428	595	hexazinone	ND	0.05
75	12-Jun-97	Stanislaus	Mi Wok	033-138	outside	50 - 70	12	bracken fern	roots	3	427	580	hexazinone	ND	0.05
76	12-Jun-97	Stanislaus	Mi Wok	033-138	outside	80 - 100	12	bracken fern	roots	3	429	560	hexazinone	ND	0.05
406	12-Jun-97	Stanislaus	Mi Wok	033-176	inside	---	12	buckbrush	shoots	1	428	517	hexazinone	0.923	0.1
407	12-Jun-97	Stanislaus	Mi Wok	033-176	inside	---	12	manzanita	berries	1	429	622	hexazinone	ND	0.05
408	12-Jun-97	Stanislaus	Mi Wok	033-176	inside	---	12	golden fleece	foliage	1	428	581	hexazinone	0.55	0.1
69	18-Jun-97	Eldorado	Georgetown	320-031	inside	---	0	bracken fern	roots	2	426	610	triclopyr	0.1	0.03
70	18-Jun-97	Eldorado	Georgetown	320-031	inside	---	0	bracken fern	roots	2	426	564	glyphosate	0.99	0.1
98	23-Jun-97	Stanislaus	Groveland	026-069	inside	---	4	bracken fern	roots	1	430	522	triclopyr	0.21	0.03
99	23-Jun-97	Stanislaus	Groveland	026-069	inside	---	4	manzanita	berries	1	430	565	triclopyr	1.86	0.03
97	23-Jun-97	Stanislaus	Groveland	027-002	inside	---	4	buckbrush	shoots	1	428	548	triclopyr	2.67	0.05
100	24-Jun-97	Sierra	Pineridge	Jose 138	inside	---	8	bracken fern	roots	2	424	522	glyphosate	ND	0.1
101	24-Jun-97	Sierra	Pineridge	Jose 138	inside	---	8	buckbrush	shoots	1	423	551	glyphosate	21.3	0.1
102	24-Jun-97	Sierra	Pineridge	Jose 138	inside	---	8	manzanita	berries	1	423	537	glyphosate	54.9	0.1
109	26-Jun-97	Eldorado	Pacific	501-120	inside	---	4	golden fleece	foliage	1	426	526	glyphosate	3.31	0.1

Sample Number	Sample Date	National Forest	District	Stand	Inside/Outside Treatment Area	Distance Off-Site (ft)	Weeks After Treatment	Plant	Plant Part	Phytoxicity	Tare Wt	Container and Sample Wt	Pesticide	Concentration (ppm)	RL
110	26-Jun-97	Eldorado	Pacific	501-120	inside	---	4	golden fleece	foliage	1	425	522	triclopyr	2.26	0.07
111	26-Jun-97	Eldorado	Pacific	501-120	outside	50 - 70	4	deerbrush	shoots	3	426	522	glyphosate	ND	0.1
112	26-Jun-97	Eldorado	Pacific	501-120	outside	50 - 70	4	deerbrush	shoots	3	425	515	triclopyr	ND	0.03
113	26-Jun-97	Eldorado	Pacific	501-120	outside	80 - 100	4	deerbrush	shoots	3	425	542	glyphosate	ND	0.1
114	26-Jun-97	Eldorado	Pacific	501-120	outside	80 - 100	4	deerbrush	shoots	3	426	532	triclopyr	ND	0.03
115	26-Jun-97	Eldorado	Pacific	501-120	outside	20 - 40	4	deerbrush	shoots	3	425	517	glyphosate	ND	0.1
116	26-Jun-97	Eldorado	Pacific	501-120	outside	20 - 40	4	deerbrush	shoots	3	426	556	triclopyr	ND	0.03
117	26-Jun-97	Eldorado	Pacific	501-120	outside	05 - 15	4	deerbrush	shoots	3	425	519	glyphosate	ND	0.1
118	26-Jun-97	Eldorado	Pacific	501-120	outside	05 - 15	4	deerbrush	shoots	3	425	552	triclopyr	ND	0.03
103	18-Jul-97	Eldorado	Pacific	501-120	inside	---	8	golden fleece	foliage	2	0	0	glyphosate	3.64	0.1
104	18-Jul-97	Eldorado	Pacific	501-120	inside	---	8	golden fleece	foliage	2	0	0	triclopyr	1.18	0.07
119	21-Jul-97	Eldorado	Georgetown	320-031	inside	---	4	bracken fern	roots	2	428	532	glyphosate	1.85	0.1
120	21-Jul-97	Eldorado	Georgetown	320-031	inside	---	4	bracken fern	roots	2	428	527	triclopyr	ND	0.03
67	22-Jul-97	Stanislaus	Groveland	026-069	inside	---	8	bracken fern	roots	1	427	501	triclopyr	0.103	0.03
77	22-Jul-97	Stanislaus	Groveland	026-069	inside	---	8	manzanita	berries	1	430	562	triclopyr	3.9	0.03
68	22-Jul-97	Stanislaus	Groveland	027-002	inside	---	8	buckbrush	shoots	1	429	523	triclopyr	1.28	0.05
373	23-Jul-97	Sierra	Pineridge	Jose 138	inside	---	12	buckbrush	shoots	1	424	515	glyphosate	34.6	0.1
374	23-Jul-97	Sierra	Pineridge	Jose 138	inside	---	12	bracken fern	roots	2	425	522	glyphosate	ND	0.1
375	23-Jul-97	Sierra	Pineridge	Jose 138	inside	---	12	manzanita	berries	1	425	562	glyphosate	13.5	0.1
78	23-Jul-97	Sierra	Pineridge	Musick 071	outside	05 - 15	12	buckbrush	shoots	2	428	515	glyphosate	ND	0.1
79	23-Jul-97	Sierra	Pineridge	Musick 071	outside	20 - 40	12	buckbrush	shoots	2	426	518	glyphosate	0.11	0.1
80	23-Jul-97	Sierra	Pineridge	Musick 071	outside	50 - 70	12	buckbrush	shoots	3	427	522	glyphosate	ND	0.1
369	23-Jul-97	Sierra	Pineridge	Musick 071	outside	80 - 100	12	buckbrush	shoots	3	427	513	glyphosate	ND	0.1
320	05-Aug-97	Stanislaus	Mi Wok	033-176	inside	---	20	buckbrush	shoots	1	425	511	hexazinone	0.464	0.1
321	05-Aug-97	Stanislaus	Mi Wok	033-176	inside	---	20	golden fleece	foliage	1	426	606	hexazinone	0.1	0.1
322	05-Aug-97	Stanislaus	Mi Wok	033-176	inside	---	20	manzanita	berries	1	427	555	hexazinone	ND	0.05
314	05-Aug-97	Stanislaus	Mi Wok	E026	inside	---	20	buckbrush	shoots	1	430	576	hexazinone	0.219	0.1
313	05-Aug-97	Stanislaus	Mi Wok	E029	inside	---	20	golden fleece	foliage	2	430	606	hexazinone	ND	0.1
319	05-Aug-97	Stanislaus	Mi Wok	E116	inside	---	20	manzanita	berries	1	428	547	hexazinone	ND	0.05
317	05-Aug-97	Stanislaus	Mi Wok	E121	inside	---	20	buckbrush	shoots	1	429	524	hexazinone	1.1	0.1
318	05-Aug-97	Stanislaus	Mi Wok	E121	inside	---	20	manzanita	berries	1	430	514	hexazinone	0.08	0.05
316	05-Aug-97	Stanislaus	Mi Wok	R041	inside	---	20	golden fleece	foliage	2	431	593	hexazinone	ND	0.1
315	05-Aug-97	Stanislaus	Mi Wok	R042	inside	---	20	bracken fern	roots	2	428	507	hexazinone	0.363	0.05
323	06-Aug-97	Stanislaus	Groveland	016-033	inside	---	20	buckbrush	shoots	1	430	538	hexazinone	0.365	0.1
324	06-Aug-97	Stanislaus	Groveland	016-033	inside	---	20	manzanita	berries	1	431	556	hexazinone	ND	0.05
361	06-Aug-97	Stanislaus	Groveland	016-033	inside	---	20	golden fleece	foliage	2	427	591	hexazinone	ND	0.1
362	06-Aug-97	Stanislaus	Groveland	027-008	inside	---	20	bracken fern	roots	2	425	543	hexazinone	ND	0.05
363	06-Aug-97	Stanislaus	Groveland	027-008	inside	---	20	golden fleece	foliage	1	428	514	hexazinone	ND	0.1
364	06-Aug-97	Stanislaus	Groveland	027-008	inside	---	20	buckbrush	shoots	1	428	532	hexazinone	0.153	0.1
365	06-Aug-97	Stanislaus	Groveland	027-008	inside	---	20	manzanita	berries	1	430	517	hexazinone	ND	0.05
71	12-Aug-97	Eldorado	Georgetown	320-031	inside	---	8	bracken fern	roots	2	430	512	glyphosate	0.411	0.1
72	12-Aug-97	Eldorado	Georgetown	320-031	inside	---	8	bracken fern	roots	2	428	545	triclopyr	ND	0.03
368	19-Aug-97	Stanislaus	Groveland	026-069	inside	---	12	manzanita	berries	1	429	503	triclopyr	1.43	0.03
370	19-Aug-97	Stanislaus	Groveland	026-069	inside	---	12	bracken fern	roots	1	429	533	triclopyr	ND	0.03
367	19-Aug-97	Stanislaus	Groveland	027-002	inside	---	12	buckbrush	shoots	1	429	517	triclopyr	1.23	0.05
371	21-Aug-97	Eldorado	Pacific	501-120	inside	---	12	golden fleece	foliage	2	428	528	triclopyr	1.13	0.07
372	21-Aug-97	Eldorado	Pacific	501-120	inside	---	12	golden fleece	foliage	2	426	599	glyphosate	0.665	0.1
376	21-Aug-97	Eldorado	Pacific	501-120	outside	05 - 15	12	deerbrush	shoots	3	428	562	glyphosate	ND	0.1
377	21-Aug-97	Eldorado	Pacific	501-120	outside	20 - 40	12	deerbrush	shoots	3	429	533	glyphosate	0.1 - 1	0.1
378	21-Aug-97	Eldorado	Pacific	501-120	outside	50 - 70	12	deerbrush	shoots	3	428	551	glyphosate	ND	0.1
379	21-Aug-97	Eldorado	Pacific	501-120	outside	80 - 100	12	deerbrush	shoots	3	427	568	glyphosate	ND	0.1
380	21-Aug-97	Eldorado	Pacific	501-120	outside	05 - 15	12	deerbrush	shoots	3	427	551	triclopyr	ND	0.03
381	21-Aug-97	Eldorado	Pacific	501-120	outside	20 - 40	12	deerbrush	shoots	3	429	511	triclopyr	ND	0.03
382	21-Aug-97	Eldorado	Pacific	501-120	outside	50 - 70	12	deerbrush	shoots	3	427	530	triclopyr	ND	0.03
383	21-Aug-97	Eldorado	Pacific	501-120	outside	80 - 100	12	deerbrush	shoots	3	428	540	triclopyr	ND	0.03

Sample Number	Sample Date	National Forest	District	Stand	Inside/Outside Treatment Area	Distance Off-Site (ft)	Weeks After Treatment	Plant	Plant Part	Phytoxicity	Tare Wt	Container and Sample Wt	Pesticide	Concentration (ppm)	RL
121	11-Sep-97	Eldorado	Georgetown	320-031	inside	---	12	bracken fern	roots	2	429	523	glyphosate	0.664	0.1
122	11-Sep-97	Eldorado	Georgetown	320-031	inside	---	12	bracken fern	roots	2	431	528	triclopyr	ND	0.03
123	16-Sep-97	Sierra	Pineridge	Jose 138	inside	---	20	bracken fern	roots	2	429	603	glyphosate	ND	0.1
124	16-Sep-97	Sierra	Pineridge	Jose 138	inside	---	20	manzanita	berries	1	431	584	glyphosate	39.0	0.1
125	16-Sep-97	Sierra	Pineridge	Jose 138	inside	---	20	buckbrush	shoots	1	429	519	glyphosate	48.31	0.1
126	24-Sep-97	Stanislaus	Mi Wok	033-176	inside	---	28	manzanita	berries	1	427	563	hexazinone	ND	0.05
127	24-Sep-97	Stanislaus	Mi Wok	033-176	inside	---	28	golden fleece	foliage	1	428	608	hexazinone	ND	0.1
128	24-Sep-97	Stanislaus	Mi Wok	033-176	inside	---	28	buckbrush	shoots	1	428	484	hexazinone	0.106	0.1
129	25-Sep-97	Stanislaus	Groveland	016-033	inside	---	28	golden fleece	foliage	2	428	615	hexazinone	ND	0.1
130	25-Sep-97	Stanislaus	Groveland	016-033	inside	---	28	manzanita	berries	2	427	528	hexazinone	ND	0.05
131	25-Sep-97	Stanislaus	Groveland	016-033	inside	---	28	buckbrush	shoots	1	428	502	hexazinone	0.448	0.1
195	25-Sep-97	Stanislaus	Groveland	025-055	inside	---	28	bracken fern	roots	2	425	631	hexazinone	ND	0.05
132	25-Sep-97	Stanislaus	Groveland	027-008	inside	---	28	bracken fern	roots	2	429	538	hexazinone	ND	0.05
193	25-Sep-97	Stanislaus	Groveland	027-008	inside	---	28	golden fleece	foliage	1	425	601	hexazinone	ND	0.1
194	25-Sep-97	Stanislaus	Groveland	027-008	inside	---	28	manzanita	berries	1	426	527	hexazinone	ND	0.05
384	25-Sep-97	Stanislaus	Groveland	027-008	inside	---	28	buckbrush	shoots	1	429	513	hexazinone	0.105	0.1
196	26-Sep-97	Stanislaus	Mi Wok	E026	inside	---	28	buckbrush	shoots	1	424	549	hexazinone	ND	0.1
197	26-Sep-97	Stanislaus	Mi Wok	E029	inside	---	28	golden fleece	foliage	1	426	661	hexazinone	ND	0.1
203	26-Sep-97	Stanislaus	Mi Wok	E116	inside	---	28	manzanita	berries	1	426	0	hexazinone	ND	0.05
204	26-Sep-97	Stanislaus	Mi Wok	E116	inside	---	28	oak	acorns	3	426	955	hexazinone	ND	0.1
200	26-Sep-97	Stanislaus	Mi Wok	E121	inside	---	28	buckbrush	shoots	1	427	531	hexazinone	0.157	0.1
201	26-Sep-97	Stanislaus	Mi Wok	E121	inside	---	28	manzanita	berries	1	426	490	hexazinone	ND	0.05
202	26-Sep-97	Stanislaus	Mi Wok	E121	inside	---	28	oak	acorns	3	426	859	hexazinone	ND	0.1
198	26-Sep-97	Stanislaus	Mi Wok	R041	inside	---	28	golden fleece	foliage	2	425	672	hexazinone	ND	0.1
199	26-Sep-97	Stanislaus	Mi Wok	R042	inside	---	28	bracken fern	roots	2	424	585	hexazinone	0.100	0.05
134	09-Oct-97	Stanislaus	Groveland	026-069	inside	---	20	manzanita	berries	1	429	497	triclopyr	3.38	0.03
135	09-Oct-97	Stanislaus	Groveland	026-069	inside	---	20	bracken fern	roots	2	429	487	triclopyr	0.33	0.03
133	09-Oct-97	Stanislaus	Groveland	027-002	inside	---	20	buckbrush	shoots	1	427	495	triclopyr	3.45	0.05
136	10-Oct-97	Eldorado	Pacific	501-120	inside	---	20	golden fleece	foliage	1	429	600	glyphosate	0.418	0.1
137	10-Oct-97	Eldorado	Pacific	501-120	inside	---	20	golden fleece	foliage	1	429	541	triclopyr	1.11	0.07
140	04-Nov-97	Eldorado	Georgetown	320-031	inside	---	20	bracken fern	roots	2	428	516	glyphosate	0.409	0.1
141	04-Nov-97	Eldorado	Georgetown	320-031	inside	---	20	bracken fern	roots	2	427	502	triclopyr	ND	0.03
138	18-Nov-97	Sierra	Pineridge	Jose 138	inside	---	28	bracken fern	roots	1	426	529	glyphosate	ND	0.1
139	18-Nov-97	Sierra	Pineridge	Jose 138	inside	---	28	buckbrush	shoots	1	426	529	glyphosate	3.93	0.1
142	18-Nov-97	Sierra	Pineridge	Jose 138	inside	---	28	manzanita	berries	1	427	540	glyphosate	19.6	0.1
143	18-Nov-97	Sierra	Pineridge	Jose 138	inside	---	28	bracken fern	roots	1	424	615	glyphosate	ND	0.1
285	24-Nov-97	Stanislaus	Mi Wok	033-176	inside	---	36	golden fleece	foliage	1	398	533	hexazinone	0.623	0.1
286	24-Nov-97	Stanislaus	Mi Wok	033-176	inside	---	36	buckbrush	shoots	1	399	479	hexazinone	0.410	0.1
287	24-Nov-97	Stanislaus	Mi Wok	033-176	inside	---	36	manzanita	berries	1	398	515	hexazinone	ND	0.05
278	24-Nov-97	Stanislaus	Mi Wok	E026	inside	---	36	buckbrush	shoots	1	403	487	hexazinone	0.327	0.1
279	24-Nov-97	Stanislaus	Mi Wok	E029	inside	---	36	golden fleece	foliage	1	404	582	hexazinone	0.384	0.1
282	24-Nov-97	Stanislaus	Mi Wok	E121	inside	---	36	manzanita	berries	1	401	504	hexazinone	ND	0.05
283	24-Nov-97	Stanislaus	Mi Wok	E121	inside	---	36	buckbrush	shoots	1	399	482	hexazinone	0.255	0.1
280	24-Nov-97	Stanislaus	Mi Wok	R041	inside	---	36	golden fleece	foliage	1	406	601	hexazinone	0.182	0.1
281	24-Nov-97	Stanislaus	Mi Wok	R042	inside	---	36	bracken fern	roots	1	399	546	hexazinone	0.151	0.05
241	25-Nov-97	Stanislaus	Groveland	016-033	inside	---	36	buckbrush	shoots	1	429	518	hexazinone	0.959	0.1
242	25-Nov-97	Stanislaus	Groveland	016-033	inside	---	36	manzanita	berries	1	429	593	hexazinone	ND	0.05
288	25-Nov-97	Stanislaus	Groveland	016-033	inside	---	36	golden fleece	foliage	1	400	588	hexazinone	0.332	0.1
247	25-Nov-97	Stanislaus	Groveland	025-055	inside	---	36	bracken fern	roots	1	430	629	hexazinone	ND	0.05
243	25-Nov-97	Stanislaus	Groveland	027-008	inside	---	36	golden fleece	foliage	1	429	532	hexazinone	ND	0.1
244	25-Nov-97	Stanislaus	Groveland	027-008	inside	---	36	manzanita	berries	1	430	573	hexazinone	0.166	0.05
245	25-Nov-97	Stanislaus	Groveland	027-008	inside	---	36	buckbrush	shoots	1	429	519	hexazinone	0.1	0.1
246	25-Nov-97	Stanislaus	Groveland	027-008	inside	---	36	bracken fern	roots	1	427	570	hexazinone	ND	0.05
248	11-Dec-97	Eldorado	Pacific	501-120	inside	---	28	golden fleece	foliage	1	431	551	glyphosate	0.130	0.1
249	11-Dec-97	Eldorado	Pacific	501-120	inside	---	28	golden fleece	foliage	1	430	556	triclopyr	0.34	0.07

Sample Number	Sample Date	National Forest	District	Stand	Inside/Outside Treatment Area	Distance Off-Site (ft)	Weeks After Treatment	Plant	Plant Part	Phytoxicity	Tare Wt	Container and Sample Wt	Pesticide	Concentration (ppm)	RL
251	12-Dec-97	Stanislaus	Groveland	026-069	inside	---	28	manzanita	berries	1	427	513	triclopyr	3.95	0.03
252	12-Dec-97	Stanislaus	Groveland	026-069	inside	---	28	bracken fern	roots	0	428	535	triclopyr	ND	0.03
250	12-Dec-97	Stanislaus	Groveland	027-002	inside	---	28	buckbrush	shoots	1	427	510	triclopyr	0.99	0.05
205	30-Dec-97	Eldorado	Georgetown	320-031	inside	---	28	bracken fern	roots	1	427	537	glyphosate	0.58	0.1
206	30-Dec-97	Eldorado	Georgetown	320-031	inside	---	28	bracken fern	roots	1	427	524	triclopyr	ND	0.03
207	09-Jan-98	Sierra	Pineridge	Jose 138	inside	---	36	bracken fern	roots	1	427	584	glyphosate	ND	0.1
208	09-Jan-98	Sierra	Pineridge	Jose 138	inside	---	36	buckbrush	shoots	1	426	533	glyphosate	1.62	0.1
148	04-Feb-98	Eldorado	Pacific	501-120	inside	---	36	golden fleece	foliage	1	430	576	glyphosate	0.141	0.1
149	04-Feb-98	Eldorado	Pacific	501-120	inside	---	36	golden fleece	foliage	1	430	564	triclopyr	0.13	0.07
146	04-Feb-98	Stanislaus	Groveland	026-069	inside	---	36	manzanita	berries	1	426	620	triclopyr	2.55	0.03
147	04-Feb-98	Stanislaus	Groveland	026-069	inside	---	36	bracken fern	roots	1	427	603	triclopyr	ND	0.03
145	04-Feb-98	Stanislaus	Groveland	027-002	inside	---	36	buckbrush	shoots	1	428	0	triclopyr	0.58	0.05
150	04-Mar-98	Stanislaus	Groveland	027-033	outside	05 - 100	-1	deerbrush	shoots	3	429	526	hexazinone	ND	0.1
151	04-Mar-98	Stanislaus	Groveland	027-054	outside	05 - 100	-1	deerbrush	shoots	3	427	504	hexazinone	ND	0.1
481	10-Mar-98	Sierra	Pineridge	336-149	outside	05 - 70	-1	buckbrush	shoots	3	430	553	hexazinone	ND	0.1
469	10-Mar-98	Stanislaus	Groveland	027-033	outside	05 - 15	0	deerbrush	shoots	3	430	509	hexazinone	ND	0.1
470	10-Mar-98	Stanislaus	Groveland	027-033	outside	20 - 40	0	deerbrush	shoots	3	431	482	hexazinone	ND	0.1
471	10-Mar-98	Stanislaus	Groveland	027-033	outside	50 - 70	0	deerbrush	shoots	3	432	493	hexazinone	ND	0.1
472	10-Mar-98	Stanislaus	Groveland	027-033	outside	80 - 100	0	deerbrush	shoots	3	431	483	hexazinone	ND	0.1
473	11-Mar-98	Stanislaus	Groveland	027-054	outside	05 - 15	0	deerbrush	shoots	3	430	486	hexazinone	ND	0.1
474	11-Mar-98	Stanislaus	Groveland	027-054	outside	20 - 40	0	deerbrush	shoots	3	430	480	hexazinone	ND	0.1
475	11-Mar-98	Stanislaus	Groveland	027-054	outside	50 - 70	0	deerbrush	shoots	3	429	513	hexazinone	ND	0.1
476	11-Mar-98	Stanislaus	Groveland	027-054	outside	80 - 100	0	deerbrush	shoots	3	430	516	hexazinone	ND	0.1
477	14-Mar-98	Stanislaus	Groveland	027-019	inside	---	0	bracken fern	roots	3	430	557	hexazinone	0.360	0.05
478	17-Mar-98	Stanislaus	Mi Wok	11708407	outside	05 - 100	-1	deerbrush	shoots	3	429	544	hexazinone	ND	0.1
479	17-Mar-98	Stanislaus	Mi Wok	11720442	outside	05 - 100	-1	deerbrush	shoots	3	429	526	hexazinone	ND	0.1
265	20-Mar-98	Stanislaus	Groveland	027-038	inside	---	0	bracken fern	roots	0	402	611	glyphosate	0.166	0.1
266	20-Mar-98	Stanislaus	Mi Wok	11720442	outside	05 - 15	0	deerbrush	shoots	0	403	531	hexazinone	ND	0.1
267	20-Mar-98	Stanislaus	Mi Wok	11720442	outside	20 - 40	0	deerbrush	shoots	0	403	512	hexazinone	ND	0.1
268	20-Mar-98	Stanislaus	Mi Wok	11720442	outside	50 - 70	0	deerbrush	shoots	0	401	502	hexazinone	ND	0.1
269	20-Mar-98	Stanislaus	Mi Wok	11720442	outside	80 - 100	0	deerbrush	shoots	0	401	519	hexazinone	ND	0.1
270	20-Mar-98	Stanislaus	Mi Wok	11730191	inside	---	0	buckbrush	shoots	0	398	514	hexazinone	ND	0.1
271	23-Mar-98	Stanislaus	Mi Wok	11708407	outside	05 - 15	0	deerbrush	shoots	3	402	482	hexazinone	ND	0.1
272	23-Mar-98	Stanislaus	Mi Wok	11708407	outside	20 - 40	0	deerbrush	shoots	3	404	495	hexazinone	ND	0.1
273	23-Mar-98	Stanislaus	Mi Wok	11708407	outside	50 - 70	0	deerbrush	shoots	3	402	483	hexazinone	ND	0.1
274	23-Mar-98	Stanislaus	Mi Wok	11708407	outside	80 - 100	0	deerbrush	shoots	3	404	500	hexazinone	ND	0.1
276	23-Mar-98	Stanislaus	Mi Wok	11708407	inside	---	0	golden fleece	foliage	3	402	520	hexazinone	ND	0.1
457	08-Apr-98	Stanislaus	Groveland	027-019	inside	---	4	bracken fern	roots	3	429	598	hexazinone	0.582	0.05
458	08-Apr-98	Stanislaus	Groveland	027-033	outside	05 - 15	4	deerbrush	shoots	0	432	534	hexazinone	ND	0.1
459	08-Apr-98	Stanislaus	Groveland	027-033	outside	20 - 40	4	deerbrush	shoots	0	431	535	hexazinone	ND	0.1
460	08-Apr-98	Stanislaus	Groveland	027-033	outside	50 - 70	4	deerbrush	shoots	3	431	522	hexazinone	ND	0.1
461	08-Apr-98	Stanislaus	Groveland	027-033	outside	80 - 100	4	deerbrush	shoots	0	431	525	hexazinone	ND	0.1
462	08-Apr-98	Stanislaus	Groveland	027-054	outside	05 - 15	4	deerbrush	shoots	0	430	436	hexazinone	ND	0.1
463	08-Apr-98	Stanislaus	Groveland	027-054	outside	20 - 40	4	deerbrush	shoots	0	427	534	hexazinone	ND	0.1
464	08-Apr-98	Stanislaus	Groveland	027-054	outside	50 - 70	4	deerbrush	shoots	0	429	545	hexazinone	ND	0.1
465	08-Apr-98	Stanislaus	Groveland	027-054	outside	80 - 100	4	deerbrush	shoots	0	429	548	hexazinone	ND	0.1
209	15-Apr-98	Stanislaus	Groveland	027-038	inside	---	4	bracken fern	roots	0	427	614	glyphosate	0.113	0.1
211	15-Apr-98	Stanislaus	Mi Wok	11708407	outside	05 - 15	4	deerbrush	shoots	3	428	526	hexazinone	ND	0.1
212	15-Apr-98	Stanislaus	Mi Wok	11708407	outside	20 - 40	4	deerbrush	shoots	3	427	508	hexazinone	ND	0.1
213	15-Apr-98	Stanislaus	Mi Wok	11708407	outside	50 - 70	4	deerbrush	shoots	3	426	531	hexazinone	ND	0.1
214	15-Apr-98	Stanislaus	Mi Wok	11708407	outside	80 - 100	4	deerbrush	shoots	0	427	525	hexazinone	ND	0.1
215	15-Apr-98	Stanislaus	Mi Wok	11708407	inside	---	4	golden fleece	foliage	0	426	548	hexazinone	ND	0.1
216	16-Apr-98	Stanislaus	Mi Wok	11720442	outside	05 - 15	4	deerbrush	shoots	0	427	524	hexazinone	ND	0.1
466	16-Apr-98	Stanislaus	Mi Wok	11720442	outside	20 - 40	4	deerbrush	shoots	0	429	535	hexazinone	ND	0.1
467	16-Apr-98	Stanislaus	Mi Wok	11720442	outside	50 - 70	4	deerbrush	shoots	0	430	534	hexazinone	ND	0.1

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468	16-Apr-98	Stanislaus	Mi Wok	11720442	outside	80 - 100	4	deerbrush	shoots	0	430	523	hexazinone	ND	0.1
484	16-Apr-98	Stanislaus	Mi Wok	11730191	inside	---	4	buckbrush	shoots	3	429	538	hexazinone	ND	0.1
485	22-Apr-98	Sierra	Pineridge	336-149	outside	05 - 100	-1	buckbrush	shoots	3	430	541	hexazinone	ND	0.1
486	22-Apr-98	Sierra	Pineridge	336-149	outside	05 - 15	0	buckbrush	shoots	0	430	529	hexazinone	ND	0.1
487	22-Apr-98	Sierra	Pineridge	336-149	outside	20 - 40	0	buckbrush	shoots	0	431	551	hexazinone	ND	0.1
488	22-Apr-98	Sierra	Pineridge	336-149	outside	50 - 70	0	buckbrush	shoots	0	432	535	hexazinone	ND	0.1
489	22-Apr-98	Sierra	Pineridge	336-149	outside	80 - 100	0	buckbrush	shoots	0	430	529	hexazinone	ND	0.1
490	22-Apr-98	Sierra	Pineridge	336-149	inside	---	0	buckbrush	shoots	0	431	558	hexazinone	0.10	0.1
491	22-Apr-98	Sierra	Pineridge	336-149	inside	---	0	golden fleece	foliage	0	430	550	hexazinone	0.136	0.1
152	06-May-98	Stanislaus	Mi Wok	E029	inside	---	60	golden fleece	foliage	2	327	455	hexazinone	0.179	0.1
153	06-May-98	Stanislaus	Mi Wok	R042	inside	---	60	bracken fern	roots	2	427	649	hexazinone	0.060	0.05
154	07-May-98	Stanislaus	Groveland	016-033	inside	---	60	buckbrush	shoots	2	428	530	hexazinone	0.221	0.1
155	07-May-98	Stanislaus	Groveland	027-019	inside	---	8	bracken fern	roots	2	428	627	hexazinone	0.249	0.05
156	07-May-98	Stanislaus	Groveland	027-038	inside	---	8	bracken fern	roots	2	429	642	glyphosate	ND	0.1
157	19-May-98	Sierra	Pineridge	336-149	outside	05 - 15	4	buckbrush	shoots	3	428	520	hexazinone	ND	0.1
158	19-May-98	Sierra	Pineridge	336-149	outside	20 - 40	4	buckbrush	shoots	3	428	551	hexazinone	ND	0.1
159	19-May-98	Sierra	Pineridge	336-149	outside	50 - 70	4	buckbrush	shoots	3	428	523	hexazinone	ND	0.1
160	19-May-98	Sierra	Pineridge	336-149	outside	80 - 100	4	buckbrush	shoots	3	427	531	hexazinone	ND	0.1
161	19-May-98	Sierra	Pineridge	336-149	inside	---	4	golden fleece	foliage	2	426	575	hexazinone	4.69	0.1
162	19-May-98	Sierra	Pineridge	336-149	inside	---	4	buckbrush	shoots	3	426	537	hexazinone	0.167	0.1
169	19-May-98	Stanislaus	Mi Wok	11708407	inside	---	8	golden fleece	foliage	1	431	541	hexazinone	1.23	0.1
170	19-May-98	Stanislaus	Mi Wok	11730191	inside	---	8	buckbrush	shoots	1	423	524	hexazinone	1.582	0.1
172	27-May-98	Stanislaus	Mi Wok	033-176	inside	---	62	golden fleece	foliage	1	428	573	hexazinone	0.207	0.1
171	27-May-98	Stanislaus	Mi Wok	E121	inside	---	62	buckbrush	shoots	1	432	558	hexazinone	0.225	0.1
181	28-May-98	Stanislaus	Groveland	027-019	inside	---	12	bracken fern	roots	3	429	545	hexazinone	0.427	0.05
173	28-May-98	Stanislaus	Groveland	027-033	outside	05 - 15	12	deerbrush	shoots	2	432	536	hexazinone	ND	0.1
174	28-May-98	Stanislaus	Groveland	027-033	outside	20 - 40	12	deerbrush	shoots	2	432	517	hexazinone	ND	0.1
175	28-May-98	Stanislaus	Groveland	027-033	outside	80 - 100	12	deerbrush	shoots	2	433	566	hexazinone	ND	0.1
176	28-May-98	Stanislaus	Groveland	027-033	outside	50 - 70	12	deerbrush	shoots	2	432	512	hexazinone	ND	0.1
177	28-May-98	Stanislaus	Groveland	027-054	outside	05 - 15	12	deerbrush	shoots	2	430	544	hexazinone	ND	0.1
178	28-May-98	Stanislaus	Groveland	027-054	outside	20 - 40	12	deerbrush	shoots	0	429	520	hexazinone	ND	0.1
179	28-May-98	Stanislaus	Groveland	027-054	outside	50 - 70	12	deerbrush	shoots	2	432	534	hexazinone	ND	0.1
180	28-May-98	Stanislaus	Groveland	027-054	outside	80 - 100	12	deerbrush	shoots	2	430	521	hexazinone	ND	0.1
217	05-Jun-98	Stanislaus	Groveland	027-038	inside	---	12	bracken fern	roots	3	401	493	glyphosate	ND	0.1
221	10-Jun-98	Stanislaus	Mi Wok	11720442	outside	05 - 15	12	deerbrush	shoots	3	407	577	hexazinone	ND	0.1
222	10-Jun-98	Stanislaus	Mi Wok	11720442	outside	20 - 40	12	deerbrush	shoots	3	403	570	hexazinone	ND	0.1
223	10-Jun-98	Stanislaus	Mi Wok	11720442	outside	50 - 70	12	deerbrush	shoots	2	401	511	hexazinone	ND	0.1
224	10-Jun-98	Stanislaus	Mi Wok	11720442	outside	80 - 100	12	deerbrush	shoots	3	402	506	hexazinone	ND	0.1
218	10-Jun-98	Stanislaus	Mi Wok	11730191	inside	---	12	buckbrush	shoots	1	396	504	hexazinone	0.590	0.1
163	12-Jun-98	Stanislaus	Mi Wok	11708407	outside	80 - 100	12	deerbrush	shoots	3	426	533	hexazinone	ND	0.1
225	12-Jun-98	Stanislaus	Mi Wok	11708407	outside	05 - 15	12	deerbrush	shoots	3	402	538	hexazinone	ND	0.1
226	12-Jun-98	Stanislaus	Mi Wok	11708407	outside	20 - 40	12	deerbrush	shoots	3	428	533	hexazinone	ND	0.1
227	12-Jun-98	Stanislaus	Mi Wok	11708407	outside	50 - 70	12	deerbrush	shoots	3	428	551	hexazinone	ND	0.1
492	12-Jun-98	Stanislaus	Mi Wok	11708407	inside	---	12	golden fleece	foliage	1	431	546	hexazinone	0.658	0.1
164	15-Jun-98	Sierra	Pineridge	336-149	inside	---	8	buckbrush	shoots	2	426	522	hexazinone	0.960	0.1
165	15-Jun-98	Sierra	Pineridge	336-149	inside	---	8	golden fleece	foliage	1	427	518	hexazinone	3.44	0.1
184	16-Jun-98	Stanislaus	Mi Wok	1171932	inside	---	0	golden fleece	foliage	3	427	522	triclopyr	4.18	0.07
185	16-Jun-98	Stanislaus	Mi Wok	1171932	inside	---	0	golden fleece	foliage	3	429	508	glyphosate	146	0.1
186	16-Jun-98	Stanislaus	Mi Wok	1171932	inside	---	0	buckbrush	shoots	1	431	560	triclopyr	37.9	0.05
187	16-Jun-98	Stanislaus	Mi Wok	1171932	inside	---	0	buckbrush	shoots	1	427	537	glyphosate	152	0.1
188	18-Jun-98	Stanislaus	Mi Wok	1171750	outside	05 - 100	-1	deerbrush	shoots	3	428	539	glyphosate	ND	0.1
189	18-Jun-98	Stanislaus	Mi Wok	1171750	outside	05 - 100	-1	deerbrush	shoots	3	427	508	triclopyr	ND	0.03
191	22-Jun-98	Stanislaus	Mi Wok	31602102	inside	---	0	buckbrush	shoots	1	428	568	triclopyr	13.2	0.05
253	22-Jun-98	Stanislaus	Mi Wok	31602102	inside	---	0	golden fleece	foliage	1	433	582	triclopyr	11.8	0.07
254	23-Jun-98	Stanislaus	Mi Wok	1171750	inside	---	0	bracken fern	roots	1	429	562	triclopyr	0.25	0.03

Sample Number	Sample Date	National Forest	District	Stand	Inside/Outside Treatment Area	Distance Off-Site (ft)	Weeks After Treatment	Plant	Plant Part	Phytoxicity	Tare Wt	Container and Sample Wt	Pesticide	Concentration (ppm)	RL
256	23-Jun-98	Stanislaus	Mi Wok	1171750	outside	05 - 15	0	deerbrush	shoots	3	432	531	glyphosate	0.197	0.1
257	23-Jun-98	Stanislaus	Mi Wok	1171750	outside	05 - 15	0	deerbrush	shoots	3	432	526	triclopyr	0.03 - 0.3	0.03
258	23-Jun-98	Stanislaus	Mi Wok	1171750	outside	20 - 40	0	deerbrush	shoots	3	432	526	glyphosate	ND	0.1
259	23-Jun-98	Stanislaus	Mi Wok	1171750	outside	20 - 40	0	deerbrush	shoots	3	432	511	triclopyr	0.03 - 0.3	0.03
260	23-Jun-98	Stanislaus	Mi Wok	1171750	outside	50 - 70	0	deerbrush	shoots	3	431	545	glyphosate	ND	0.1
261	23-Jun-98	Stanislaus	Mi Wok	1171750	outside	50 - 70	0	deerbrush	shoots	3	432	553	triclopyr	0.03 - 0.3	0.03
262	23-Jun-98	Stanislaus	Mi Wok	1171750	outside	80 - 100	0	deerbrush	shoots	3	432	537	glyphosate	ND	0.1
263	23-Jun-98	Stanislaus	Mi Wok	1171750	outside	80 - 100	0	deerbrush	shoots	3	432	550	triclopyr	ND	0.03
264	24-Jun-98	Sierra	Pineridge	Jose 138	inside	---	60	buckbrush	shoots	1	431	561	glyphosate	0.321	0.1
229	13-Jul-98	Sierra	Pineridge	336-149	outside	05 - 15	12	buckbrush	shoots	2	402	474	hexazinone	ND	0.1
230	13-Jul-98	Sierra	Pineridge	336-149	outside	20 - 40	12	buckbrush	shoots	2	404	484	hexazinone	ND	0.1
231	13-Jul-98	Sierra	Pineridge	336-149	outside	50 - 70	12	buckbrush	shoots	2	404	538	hexazinone	0.673	0.1
232	13-Jul-98	Sierra	Pineridge	336-149	outside	80 - 100	12	buckbrush	shoots	2	402	560	hexazinone	ND	0.1
233	13-Jul-98	Sierra	Pineridge	336-149	inside	---	12	buckbrush	shoots	1	404	516	hexazinone	1.24	0.1
234	13-Jul-98	Sierra	Pineridge	336-149	inside	---	12	golden fleece	foliage	1	402	502	hexazinone	8.94	0.1
507	14-Jul-98	Stanislaus	Groveland	027-002	inside	---	60	buckbrush	shoots	1	426	503	triclopyr	0.74	0.05
505	14-Jul-98	Stanislaus	Mi Wok	31602102	inside	---	4	buckbrush	shoots	1	400	503	triclopyr	13.6	0.05
506	14-Jul-98	Stanislaus	Mi Wok	31602102	inside	---	4	golden fleece	foliage	1	400	617	triclopyr	2.31	0.07
508	15-Jul-98	Stanislaus	Mi Wok	1171750	inside	---	4	bracken fern	roots	1	427	531	triclopyr	0.277	0.03
509	15-Jul-98	Stanislaus	Mi Wok	1171750	outside	05 - 15	4	deerbrush	shoots	3	407	512	triclopyr	ND	0.03
510	15-Jul-98	Stanislaus	Mi Wok	1171750	outside	05 - 15	4	deerbrush	shoots	3	427	521	glyphosate	0.101	0.1
511	15-Jul-98	Stanislaus	Mi Wok	1171750	outside	20 - 40	4	deerbrush	shoots	3	428	518	triclopyr	ND	0.03
512	15-Jul-98	Stanislaus	Mi Wok	1171750	outside	20 - 40	4	deerbrush	shoots	3	402	492	glyphosate	ND	0.1
513	15-Jul-98	Stanislaus	Mi Wok	1171750	outside	50 - 70	4	deerbrush	shoots	2	427	538	triclopyr	ND	0.03
514	15-Jul-98	Stanislaus	Mi Wok	1171750	outside	50 - 70	4	deerbrush	shoots	2	428	552	glyphosate	ND	0.1
515	15-Jul-98	Stanislaus	Mi Wok	1171750	outside	80 - 100	4	deerbrush	shoots	2	428	533	triclopyr	ND	0.03
516	15-Jul-98	Stanislaus	Mi Wok	1171750	outside	80 - 100	4	deerbrush	shoots	2	427	541	glyphosate	ND	0.1
494	15-Jul-98	Stanislaus	Mi Wok	1171932	inside	---	4	golden fleece	foliage	1	431	622	triclopyr	0.60	0.07
495	15-Jul-98	Stanislaus	Mi Wok	1171932	inside	---	4	golden fleece	foliage	0	431	604	glyphosate	10.6	0.1
496	15-Jul-98	Stanislaus	Mi Wok	1171932	inside	---	4	buckbrush	shoots	1	431	590	triclopyr	24.5	0.05
497	15-Jul-98	Stanislaus	Mi Wok	1171932	inside	---	4	buckbrush	shoots	1	431	576	glyphosate	158	0.1
621	21-Jul-98	Eldorado	Pacific	501-120	inside	---	60	golden fleece	foliage	3	0	0	glyphosate	ND	0.1
622	21-Jul-98	Eldorado	Pacific	501-120	inside	---	60	golden fleece	foliage	3	0	0	triclopyr	ND	0.07
623	27-Jul-98	Eldorado	Placerville	613-042	outside	05 - 100	-1	deerbrush	shoots	3	428	548	glyphosate	ND	0.1
624	27-Jul-98	Eldorado	Placerville	613-042	outside	05 - 100	-1	deerbrush	shoots	3	425	541	triclopyr	ND	0.03
499	30-Jul-98	Eldorado	Placerville	613-042	inside	---	0	bracken fern	roots	2	430	610	glyphosate	0.845	0.1
500	30-Jul-98	Eldorado	Placerville	613-042	inside	---	0	bracken fern	roots	2	430	590	triclopyr	ND	0.03
625	30-Jul-98	Eldorado	Placerville	613-042	outside	20 - 40	0	deerbrush	shoots	0	428	549	triclopyr	0.07	0.03
626	30-Jul-98	Eldorado	Placerville	613-042	outside	20 - 40	0	deerbrush	shoots	3	427	545	glyphosate	ND	0.1
627	30-Jul-98	Eldorado	Placerville	613-042	outside	50 - 70	0	deerbrush	shoots	0	427	531	triclopyr	0.06	0.03
628	30-Jul-98	Eldorado	Placerville	613-042	outside	50 - 70	0	deerbrush	shoots	0	424	525	glyphosate	ND	0.1
629	30-Jul-98	Eldorado	Placerville	613-042	outside	80 - 100	0	deerbrush	shoots	0	425	502	triclopyr	0.03	0.03
630	30-Jul-98	Eldorado	Placerville	613-042	outside	80 - 100	0	deerbrush	shoots	0	427	502	glyphosate	ND	0.1
504	31-Jul-98	Eldorado	Placerville	613-042	outside	05 - 15	0	deerbrush	shoots	0	428	530	triclopyr	1.56	0.03
632	31-Jul-98	Eldorado	Placerville	613-042	outside	05 - 15	0	deerbrush	shoots	0	425	538	glyphosate	2.68	0.1
612	04-Aug-98	Stanislaus	Groveland	027-019	inside	---	20	bracken fern	roots	0	427	511	hexazinone	0.134	0.05
613	04-Aug-98	Stanislaus	Groveland	027-038	inside	---	20	bracken fern	roots	0	428	517	glyphosate	ND	0.1
610	04-Aug-98	Stanislaus	Mi Wok	11708407	inside	---	20	golden fleece	foliage	1	426	528	hexazinone	0.176	0.1
611	04-Aug-98	Stanislaus	Mi Wok	11730191	inside	---	20	buckbrush	shoots	1	427	527	hexazinone	0.908	0.1
672	11-Aug-98	Stanislaus	Mi Wok	1171750	inside	---	8	bracken fern	roots	1	422	601	triclopyr	0.086	0.03
673	11-Aug-98	Stanislaus	Mi Wok	1171932	inside	---	8	buckbrush	shoots	1	422	538	glyphosate	218	0.1
674	11-Aug-98	Stanislaus	Mi Wok	1171932	inside	---	8	buckbrush	shoots	1	426	518	triclopyr	7.68	0.05
675	11-Aug-98	Stanislaus	Mi Wok	1171932	inside	---	8	golden fleece	foliage	1	425	541	glyphosate	1.63	0.1
676	11-Aug-98	Stanislaus	Mi Wok	1171932	inside	---	8	golden fleece	foliage	1	426	540	triclopyr	0.22	0.07
670	11-Aug-98	Stanislaus	Mi Wok	31602102	inside	---	8	golden fleece	foliage	1	425	650	triclopyr	0.93	0.07

Sample Number	Sample Date	National Forest	District	Stand	Inside/Outside Treatment Area	Distance Off-Site (ft)	Weeks After Treatment	Plant	Plant Part	Phytoxicity	Tare Wt	Container and Sample Wt	Pesticide	Concentration (ppm)	RL
671	11-Aug-98	Stanislaus	Mi Wok	31602102	inside	---	8	buckbrush	shoots	1	426	520	triclopyr	5.97	0.05
615	18-Aug-98	Eldorado	Placerville	613-042	outside	05 - 15	4	deerbrush	shoots	1	426	509	glyphosate	0.121	0.1
616	18-Aug-98	Eldorado	Placerville	613-042	outside	20 - 40	4	deerbrush	shoots	3	427	520	glyphosate	ND	0.1
617	18-Aug-98	Eldorado	Placerville	613-042	outside	20 - 40	4	deerbrush	shoots	3	426	525	triclopyr	ND	0.03
618	18-Aug-98	Eldorado	Placerville	613-042	outside	50 - 70	4	deerbrush	shoots	3	427	526	glyphosate	ND	0.1
619	18-Aug-98	Eldorado	Placerville	613-042	outside	50 - 70	4	deerbrush	shoots	3	427	538	triclopyr	ND	0.03
620	18-Aug-98	Eldorado	Placerville	613-042	outside	80 - 100	4	deerbrush	shoots	3	428	505	triclopyr	ND	0.03
677	18-Aug-98	Eldorado	Placerville	613-042	inside	---	4	bracken fern	roots	1	427	592	triclopyr	ND	0.03
678	18-Aug-98	Eldorado	Placerville	613-042	inside	---	4	bracken fern	roots	1	427	552	glyphosate	0.952	0.1
679	18-Aug-98	Eldorado	Placerville	613-042	outside	05 - 15	4	deerbrush	shoots	1	426	515	triclopyr	ND	0.03
680	18-Aug-98	Eldorado	Placerville	613-042	outside	80 - 100	4	deerbrush	shoots	3	427	500	glyphosate	ND	0.1
235	01-Sep-98	Sierra	Pineridge	336-149	inside	---	20	buckbrush	shoots	1	403	512	hexazinone	3.91	0.1
236	01-Sep-98	Sierra	Pineridge	336-149	inside	---	20	golden fleece	foliage	1	403	540	hexazinone	15.9	0.1
658	09-Sep-98	Stanislaus	Mi Wok	31602102	inside	---	12	golden fleece	foliage	1	426	584	triclopyr	0.312	0.07
681	09-Sep-98	Stanislaus	Mi Wok	31602102	inside	---	12	buckbrush	shoots	1	426	553	triclopyr	40.6	0.05
659	10-Sep-98	Stanislaus	Mi Wok	1171750	outside	80 - 100	12	deerbrush	shoots	2	426	518	glyphosate	ND	0.1
660	10-Sep-98	Stanislaus	Mi Wok	1171750	outside	80 - 100	12	deerbrush	shoots	2	426	536	triclopyr	ND	0.03
662	10-Sep-98	Stanislaus	Mi Wok	1171750	inside	---	12	bracken fern	roots	1	425	534	triclopyr	0.22	0.03
663	10-Sep-98	Stanislaus	Mi Wok	1171750	outside	05 - 15	12	deerbrush	shoots	2	427	524	glyphosate	ND	0.1
664	10-Sep-98	Stanislaus	Mi Wok	1171750	outside	05 - 15	12	deerbrush	shoots	2	427	529	triclopyr	ND	0.03
665	10-Sep-98	Stanislaus	Mi Wok	1171750	outside	20 - 40	12	deerbrush	shoots	2	426	516	glyphosate	ND	0.1
666	10-Sep-98	Stanislaus	Mi Wok	1171750	outside	20 - 40	12	deerbrush	shoots	2	427	530	triclopyr	ND	0.03
667	10-Sep-98	Stanislaus	Mi Wok	1171750	outside	50 - 70	12	deerbrush	shoots	2	426	548	glyphosate	ND	0.1
668	10-Sep-98	Stanislaus	Mi Wok	1171750	outside	50 - 70	12	deerbrush	shoots	2	427	535	triclopyr	ND	0.03
633	10-Sep-98	Stanislaus	Mi Wok	1171932	inside	---	12	buckbrush	shoots	1	426	545	glyphosate	0.614	0.1
634	10-Sep-98	Stanislaus	Mi Wok	1171932	inside	---	12	buckbrush	shoots	1	427	529	triclopyr	0.315	0.05
635	10-Sep-98	Stanislaus	Mi Wok	1171932	inside	---	12	golden fleece	foliage	1	427	554	glyphosate	0.186	0.1
636	10-Sep-98	Stanislaus	Mi Wok	1171932	inside	---	12	golden fleece	foliage	1	426	536	triclopyr	0.104	0.07
637	23-Sep-98	Eldorado	Placerville	613-042	inside	---	8	bracken fern	roots	1	424	573	glyphosate	0.785	0.1
661	23-Sep-98	Eldorado	Placerville	613-042	inside	---	8	bracken fern	roots	1	425	587	triclopyr	ND	0.03
651	29-Sep-98	Stanislaus	Groveland	016-033	inside	---	80	buckbrush	shoots	1	428	511	hexazinone	0.405	0.1
648	29-Sep-98	Stanislaus	Groveland	027-019	inside	---	28	bracken fern	roots	2	426	543	hexazinone	0.160	0.05
649	29-Sep-98	Stanislaus	Groveland	027-038	inside	---	28	bracken fern	roots	3	426	609	glyphosate	ND	0.1
646	29-Sep-98	Stanislaus	Mi Wok	E029	inside	---	80	golden fleece	foliage	1	421	508	hexazinone	ND	0.1
647	29-Sep-98	Stanislaus	Mi Wok	E121	inside	---	80	buckbrush	shoots	1	426	516	hexazinone	0.458	0.1
653	30-Sep-98	Stanislaus	Mi Wok	033-176	inside	---	80	golden fleece	foliage	1	422	532	hexazinone	ND	0.1
652	30-Sep-98	Stanislaus	Mi Wok	11708407	inside	---	28	golden fleece	foliage	1	428	538	hexazinone	ND	0.1
654	30-Sep-98	Stanislaus	Mi Wok	11730191	inside	---	28	buckbrush	shoots	1	423	512	hexazinone	0.441	0.1
638	10-Oct-98	Stanislaus	Mi Wok	R042	inside	---	80	bracken fern	roots	2	426	557	hexazinone	ND	0.05
289	20-Oct-98	Eldorado	Placerville	613-042	outside	05 - 15	12	deerbrush	shoots	1	400	494	triclopyr	ND	0.03
290	20-Oct-98	Eldorado	Placerville	613-042	outside	05 - 15	12	deerbrush	shoots	1	401	487	glyphosate	ND	0.1
291	20-Oct-98	Eldorado	Placerville	613-042	outside	20 - 40	12	deerbrush	shoots	3	401	491	triclopyr	ND	0.03
292	20-Oct-98	Eldorado	Placerville	613-042	outside	20 - 40	12	deerbrush	shoots	3	402	491	glyphosate	ND	0.1
293	20-Oct-98	Eldorado	Placerville	613-042	outside	50 - 70	12	deerbrush	shoots	3	400	478	triclopyr	ND	0.03
294	20-Oct-98	Eldorado	Placerville	613-042	outside	50 - 70	12	deerbrush	shoots	3	401	481	glyphosate	ND	0.1
295	20-Oct-98	Eldorado	Placerville	613-042	outside	80 - 100	12	deerbrush	shoots	3	400	486	triclopyr	ND	0.03
296	20-Oct-98	Eldorado	Placerville	613-042	outside	80 - 100	12	deerbrush	shoots	3	404	493	glyphosate	ND	0.1
297	20-Oct-98	Eldorado	Placerville	613-042	inside	---	12	bracken fern	roots	1	398	537	triclopyr	ND	0.03
298	20-Oct-98	Eldorado	Placerville	613-042	inside	---	12	bracken fern	roots	1	401	574	glyphosate	0.342	0.1
696	04-Nov-98	Stanislaus	Mi Wok	31602102	inside	---	20	golden fleece	foliage	1	426	581	triclopyr	0.21	0.07
697	04-Nov-98	Stanislaus	Mi Wok	31602102	inside	---	20	buckbrush	shoots	1	428	532	triclopyr	3.96	0.05
698	05-Nov-98	Stanislaus	Mi Wok	1171750	inside	---	20	bracken fern	roots	2	422	536	triclopyr	0.083	0.03
699	05-Nov-98	Stanislaus	Mi Wok	1171932	inside	---	20	buckbrush	shoots	1	425	535	triclopyr	1.86	0.05
700	05-Nov-98	Stanislaus	Mi Wok	1171932	inside	---	20	buckbrush	shoots	1	422	528	glyphosate	19.4	0.1
701	05-Nov-98	Stanislaus	Mi Wok	1171932	inside	---	20	golden fleece	foliage	1	423	512	glyphosate	14.9	0.1

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702	05-Nov-98	Stanislaus	Mi Wok	1171932	inside	---	20	golden fleece	foliage	1	424	519	triclopyr	1.64	0.07
639	23-Nov-98	Stanislaus	Groveland	027-019	inside	---	36	bracken fern	roots	2	426	562	hexazinone	0.113	0.05
640	23-Nov-98	Stanislaus	Groveland	027-038	inside	---	36	bracken fern	roots	2	426	593	glyphosate	ND	0.1
641	23-Nov-98	Stanislaus	Groveland	027-038	inside	---	36	oak	acorns	0	426	967	glyphosate	ND	0.1
643	24-Nov-98	Stanislaus	Mi Wok	11708407	inside	---	36	golden fleece	foliage	1	428	536	hexazinone	0.271	0.1
644	24-Nov-98	Stanislaus	Mi Wok	11730191	inside	---	36	buckbrush	shoots	1	423	520	hexazinone	ND	0.1
284	24-Nov-98	Stanislaus	Mi Wok	E116	inside	---	36	manzanita	berries	1	400	537	hexazinone	ND	0.05
645	09-Dec-98	Stanislaus	Groveland	027-002	inside	---	80	buckbrush	shoots	1	425	480	triclopyr	0.58	0.05
703	16-Dec-98	Eldorado	Placerville	613-042	inside	---	20	bracken fern	roots	1	423	651	triclopyr	ND	0.03
704	16-Dec-98	Eldorado	Placerville	613-042	inside	---	20	bracken fern	roots	1	424	631	glyphosate	0.145	0.1
708	29-Dec-98	Sierra	Pineridge	336-149	inside	---	36	buckbrush	shoots	1	426	489	hexazinone	0.179	0.1
709	29-Dec-98	Sierra	Pineridge	336-149	inside	---	36	golden fleece	foliage	1	424	530	hexazinone	1.70	0.1
710	29-Dec-98	Sierra	Pineridge	336-149	inside	---	36	oak	acorns	3	0	0	hexazinone	ND	0.1
711	30-Dec-98	Stanislaus	Mi Wok	1171750	inside	---	28	bracken fern	roots	2	422	596	triclopyr	ND	0.03
712	30-Dec-98	Stanislaus	Mi Wok	1171932	inside	---	28	buckbrush	shoots	1	427	512	glyphosate	1.38	0.1
713	30-Dec-98	Stanislaus	Mi Wok	1171932	inside	---	28	buckbrush	shoots	1	428	526	triclopyr	1.23	0.05
714	30-Dec-98	Stanislaus	Mi Wok	1171932	inside	---	28	golden fleece	foliage	1	428	504	glyphosate	2.16	0.1
715	30-Dec-98	Stanislaus	Mi Wok	1171932	inside	---	28	golden fleece	foliage	1	425	512	triclopyr	1.02	0.07
716	30-Dec-98	Stanislaus	Mi Wok	31602102	inside	---	28	buckbrush	shoots	1	425	510	triclopyr	1.31	0.05
717	30-Dec-98	Stanislaus	Mi Wok	31602102	inside	---	28	golden fleece	foliage	1	426	535	triclopyr	0.49	0.07
301	23-Feb-99	Stanislaus	Mi Wok	1171750	inside	---	36	bracken fern	roots	1	405	620	triclopyr	ND	0.03
302	23-Feb-99	Stanislaus	Mi Wok	1171932	inside	---	36	golden fleece	foliage	1	404	468	glyphosate	0.376	0.1
303	23-Feb-99	Stanislaus	Mi Wok	1171932	inside	---	36	golden fleece	foliage	1	403	485	triclopyr	0.15	0.07
305	23-Feb-99	Stanislaus	Mi Wok	1171932	inside	---	36	buckbrush	shoots	1	401	482	glyphosate	0.628	0.1
306	24-Feb-99	Stanislaus	Mi Wok	31602102	inside	---	36	buckbrush	shoots	1	407	490	triclopyr	0.59	0.05
307	24-Feb-99	Stanislaus	Mi Wok	31602102	inside	---	36	golden fleece	foliage	1	402	489	triclopyr	1.67	0.07
308	24-Feb-99	Stanislaus	Mi Wok	E061	outside	05 - 100	-1	buckbrush	shoots	3	401	530	hexazinone	ND	0.1
685	17-Mar-99	Eldorado	Placerville	613-042	inside	---	28	bracken fern	roots	1	426	691	triclopyr	ND	0.03
686	17-Mar-99	Eldorado	Placerville	613-042	inside	---	28	bracken fern	roots	1	426	634	glyphosate	0.388	0.1
309	18-Mar-99	Stanislaus	Mi Wok	E061	outside	05 - 15	0	buckbrush	shoots	3	402	531	hexazinone	ND	0.1
655	18-Mar-99	Stanislaus	Mi Wok	E061	outside	80 - 100	0	buckbrush	shoots	0	427	535	hexazinone	ND	0.1
656	18-Mar-99	Stanislaus	Mi Wok	E061	outside	50 - 70	0	buckbrush	shoots	3	427	531	hexazinone	0.131	0.1
657	18-Mar-99	Stanislaus	Mi Wok	E061	outside	20 - 40	0	buckbrush	shoots	3	428	538	hexazinone	ND	0.1
300	18-Mar-99	Stanislaus	Mi Wok	E063	inside	---	0	bracken fern	roots	3	398	528	hexazinone	ND	0.05
310	18-Mar-99	Stanislaus	Mi Wok	E068	inside	---	0	bracken fern	roots	3	403	548	hexazinone	ND	0.05
304	23-Mar-99	Stanislaus	Mi Wok	1171932	inside	---	36	buckbrush	shoots	1	400	491	triclopyr	0.43	0.05
720	14-Apr-99	Stanislaus	Mi Wok	E061	outside	05 - 15	4	buckbrush	shoots	3	428	553	hexazinone	ND	0.1
721	14-Apr-99	Stanislaus	Mi Wok	E061	outside	20 - 40	4	buckbrush	shoots	3	429	573	hexazinone	ND	0.1
722	14-Apr-99	Stanislaus	Mi Wok	E061	outside	50 - 70	4	buckbrush	shoots	3	429	590	hexazinone	ND	0.1
723	14-Apr-99	Stanislaus	Mi Wok	E061	outside	80 - 100	4	buckbrush	shoots	3	426	580	hexazinone	ND	0.1
718	14-Apr-99	Stanislaus	Mi Wok	E063	inside	---	4	bracken fern	roots	2	427	592	hexazinone	0.304	0.05
724	14-Apr-99	Stanislaus	Mi Wok	E068	inside	---	4	bracken fern	roots	2	427	682	hexazinone	0.129	0.05
728	10-May-99	Stanislaus	Mi Wok	E063	inside	---	8	bracken fern	roots	3	389	526	hexazinone	0.896	0.05
725	10-May-99	Stanislaus	Mi Wok	E068	inside	---	8	bracken fern	roots	3	426	589	hexazinone	0.214	0.05
690	13-May-99	Eldorado	Placerville	613-042	inside	---	41	bracken fern	roots	2	422	635	glyphosate	0.702	0.1
691	13-May-99	Eldorado	Placerville	613-042	inside	---	41	bracken fern	roots	2	423	561	triclopyr	ND	0.03
687	17-May-99	Stanislaus	Groveland	027-013	outside	05 - 100	-1	buckbrush	shoots	3	428	539	glyphosate	ND	0.1
688	18-May-99	Stanislaus	Groveland	027-013	outside	05 - 15	0	buckbrush	shoots	3	426	568	glyphosate	ND	0.1
689	18-May-99	Stanislaus	Groveland	027-013	outside	20 - 40	0	buckbrush	shoots	3	427	535	glyphosate	ND	0.1
692	18-May-99	Stanislaus	Groveland	027-013	outside	50 - 70	0	buckbrush	shoots	3	427	527	glyphosate	ND	0.1
693	18-May-99	Stanislaus	Groveland	027-013	outside	80 - 100	0	buckbrush	shoots	3	426	549	glyphosate	ND	0.1
726	01-Jun-99	Sierra	Kings River	S8	outside	05 - 100	-1	buckbrush	shoots	3	427	588	glyphosate	ND	0.1
729	01-Jun-99	Sierra	Kings River	S8	outside	05 - 100	-1	buckbrush	shoots	3	427	588	glyphosate	ND	0.1
727	02-Jun-99	Sierra	Kings River	N7	inside	---	0	buckbrush	shoots	3	424	591	glyphosate	336	0.1
517	03-Jun-99	Sierra	Kings River	S8	inside	---	0	golden fleece	foliage	3	398	537	glyphosate	3.36	0.1

Sample Number	Sample Date	National Forest	District	Stand	Inside/Outside Treatment Area	Distance Off-Site (ft)	Weeks After Treatment	Plant	Plant Part	Phytoxicity	Tare Wt	Container and Sample Wt	Pesticide	Concentration (ppm)	RL
518	03-Jun-99	Sierra	Kings River	S8	inside	---	0	manzanita	berries	3	398	645	glyphosate	16.6	0.1
519	03-Jun-99	Sierra	Kings River	S8	outside	05 - 15	0	buckbrush	shoots	3	425	576	glyphosate	ND	0.1
520	03-Jun-99	Sierra	Kings River	S8	outside	20 - 40	0	buckbrush	shoots	3	400	566	glyphosate	ND	0.1
521	03-Jun-99	Sierra	Kings River	S8	outside	50 - 70	0	buckbrush	shoots	3	426	586	glyphosate	ND	0.1
522	03-Jun-99	Sierra	Kings River	S8	outside	80 - 100	0	buckbrush	shoots	3	426	584	glyphosate	ND	0.1
312	07-Jun-99	Sierra	Pineridge	Beal 14	inside	---	0	golden fleece	foliage	3	402	537	glyphosate	489	0.1
682	07-Jun-99	Sierra	Pineridge	Beal 14	inside	---	0	manzanita	berries	3	427	593	glyphosate	170	0.1
311	07-Jun-99	Sierra	Pineridge	Beal 20	inside	---	0	buckbrush	shoots	0	402	521	glyphosate	323	0.1
550	08-Jun-99	Eldorado	Pacific	501-035	inside	---	-1	manzanita	berries	3	400	666	glyphosate	ND	0.1
523	09-Jun-99	Stanislaus	Mi Wok	E061	outside	05 - 15	12	buckbrush	shoots	3	400	501	hexazinone	ND	0.1
524	09-Jun-99	Stanislaus	Mi Wok	E061	outside	20 - 40	12	buckbrush	shoots	3	400	541	hexazinone	ND	0.1
525	09-Jun-99	Stanislaus	Mi Wok	E061	outside	50 - 70	12	buckbrush	shoots	3	433	570	hexazinone	ND	0.1
526	09-Jun-99	Stanislaus	Mi Wok	E061	outside	80 - 100	12	buckbrush	shoots	3	427	527	hexazinone	ND	0.1
683	09-Jun-99	Stanislaus	Mi Wok	E063	inside	---	12	bracken fern	roots	3	426	535	hexazinone	0.360	0.05
684	09-Jun-99	Stanislaus	Mi Wok	E068	inside	---	12	bracken fern	roots	3	427	570	hexazinone	0.106	0.05
538	15-Jun-99	Stanislaus	Groveland	027-013	outside	05 - 15	4	buckbrush	shoots	3	403	524	glyphosate	ND	0.1
539	15-Jun-99	Stanislaus	Groveland	027-013	outside	20 - 40	4	buckbrush	shoots	3	402	511	glyphosate	ND	0.1
540	15-Jun-99	Stanislaus	Groveland	027-013	outside	50 - 70	4	buckbrush	shoots	3	402	524	glyphosate	ND	0.1
541	15-Jun-99	Stanislaus	Groveland	027-013	outside	80 - 100	4	buckbrush	shoots	3	404	536	glyphosate	ND	0.1
542	23-Jun-99	Eldorado	Pacific	501-035	inside	---	0	manzanita	berries	3	404	691	glyphosate	31.9	0.1
562	01-Jul-99	Sierra	Kings River	N7	inside	---	4	buckbrush	shoots	1	430	540	glyphosate	161	0.1
563	01-Jul-99	Sierra	Kings River	S8	inside	---	4	golden fleece	foliage	1	430	546	glyphosate	11.5	0.1
564	01-Jul-99	Sierra	Kings River	S8	inside	---	4	manzanita	berries	1	431	502	glyphosate	154	0.1
565	01-Jul-99	Sierra	Kings River	S8	outside	05 - 15	4	buckbrush	shoots	3	431	562	glyphosate	ND	0.1
566	01-Jul-99	Sierra	Kings River	S8	outside	20 - 40	4	buckbrush	shoots	3	432	590	glyphosate	ND	0.1
567	01-Jul-99	Sierra	Kings River	S8	outside	50 - 70	4	buckbrush	shoots	3	434	572	glyphosate	ND	0.1
568	01-Jul-99	Sierra	Kings River	S8	outside	80 - 100	4	buckbrush	shoots	3	433	534	glyphosate	ND	0.1
570	02-Jul-99	Sierra	Pineridge	Beal 14	inside	---	4	golden fleece	foliage	1	431	524	glyphosate	1033	0.1
571	02-Jul-99	Sierra	Pineridge	Beal 14	inside	---	4	manzanita	berries	1	429	525	glyphosate	236	0.1
569	02-Jul-99	Sierra	Pineridge	Beal 20	inside	---	4	buckbrush	shoots	1	432	536	glyphosate	572	0.1
551	21-Jul-99	Eldorado	Pacific	501-035	inside	---	4	manzanita	berries	1	401	594	glyphosate	43.1	0.1
552	29-Jul-99	Sierra	Kings River	N7	inside	---	8	buckbrush	shoots	1	399	489	glyphosate	143	0.1
553	29-Jul-99	Sierra	Kings River	S8	inside	---	8	golden fleece	foliage	1	398	498	glyphosate	1.56	0.1
554	29-Jul-99	Sierra	Kings River	S8	inside	---	8	manzanita	berries	1	398	469	glyphosate	89.7	0.1
556	30-Jul-99	Sierra	Pineridge	Beal 14	inside	---	8	manzanita	berries	1	400	511	glyphosate	402	0.1
557	30-Jul-99	Sierra	Pineridge	Beal 14	inside	---	8	golden fleece	foliage	1	399	489	glyphosate	623	0.1
555	30-Jul-99	Sierra	Pineridge	Beal 20	inside	---	8	buckbrush	shoots	1	397	496	glyphosate	278	0.1
544	04-Aug-99	Stanislaus	Mi Wok	E063	inside	---	20	bracken fern	roots	2	404	518	hexazinone	0.398	0.05
543	04-Aug-99	Stanislaus	Mi Wok	E068	inside	---	20	bracken fern	roots	1	400	542	hexazinone	0.185	0.05
545	09-Aug-99	Stanislaus	Groveland	027-013	outside	05 - 15	12	buckbrush	shoots	3	401	484	glyphosate	ND	0.1
546	09-Aug-99	Stanislaus	Groveland	027-013	outside	20 - 40	12	buckbrush	shoots	3	400	516	glyphosate	ND	0.1
547	09-Aug-99	Stanislaus	Groveland	027-013	outside	50 - 70	12	buckbrush	shoots	3	402	517	glyphosate	ND	0.1
548	09-Aug-99	Stanislaus	Groveland	027-013	outside	80 - 100	12	buckbrush	shoots	0	403	517	glyphosate	ND	0.1
572	18-Aug-99	Eldorado	Pacific	501-035	inside	---	8	manzanita	berries	1	433	590	glyphosate	53.7	0.1
586	26-Aug-99	Sierra	Kings River	N7	inside	---	12	buckbrush	shoots	1	431	535	glyphosate	234	0.1
587	26-Aug-99	Sierra	Kings River	S8	inside	---	12	golden fleece	foliage	1	424	523	glyphosate	11.1	0.1
588	26-Aug-99	Sierra	Kings River	S8	outside	20 - 40	12	buckbrush	shoots	3	428	535	glyphosate	ND	0.1
589	26-Aug-99	Sierra	Kings River	S8	outside	05 - 15	12	buckbrush	shoots	3	428	545	glyphosate	ND	0.1
590	26-Aug-99	Sierra	Kings River	S8	outside	50 - 70	12	buckbrush	shoots	0	427	520	glyphosate	ND	0.1
591	26-Aug-99	Sierra	Kings River	S8	outside	80 - 100	12	buckbrush	shoots	0	426	524	glyphosate	ND	0.1
592	27-Aug-99	Sierra	Pineridge	Beal 14	inside	---	12	golden fleece	foliage	1	427	540	glyphosate	296	0.1
593	27-Aug-99	Sierra	Pineridge	Beal 14	inside	---	12	manzanita	berries	1	430	544	glyphosate	313	0.1
595	27-Aug-99	Sierra	Pineridge	Beal 20	inside	---	12	buckbrush	shoots	1	421	549	glyphosate	385	0.1
573	15-Sep-99	Eldorado	Pacific	501-035	inside	---	12	manzanita	berries	1	431	528	glyphosate	81.4	0.1
577	29-Sep-99	Stanislaus	Groveland	016-033	inside	---	130	buckbrush	shoots	1	421	501	hexazinone	ND	0.1
574	29-Sep-99	Stanislaus	Mi Wok	E063	inside	---	28	bracken fern	roots	0	426	570	hexazinone	0.734	0.05

Sample Number	Sample Date	National Forest	District	Stand	Inside/Outside Treatment Area	Distance Off-Site (ft)	Weeks After Treatment	Plant	Plant Part	Phytoxicity	Tare Wt	Container and Sample Wt	Pesticide	Concentration (ppm)	RL
575	29-Sep-99	Stanislaus	Mi Wok	E068	inside	---	28	bracken fern	roots	1	423	581	hexazinone	ND	0.05
576	29-Sep-99	Stanislaus	Mi Wok	E121	inside	---	130	buckbrush	shoots	1	417	530	hexazinone	ND	0.1
578	21-Oct-99	Sierra	Kings River	N7	inside	---	20	buckbrush	shoots	1	428	541	glyphosate	127	0.1
579	21-Oct-99	Sierra	Kings River	S8	inside	---	20	golden fleece	foliage	1	420	517	glyphosate	4.30	0.1
581	22-Oct-99	Sierra	Pineridge	Beal 14	inside	---	20	golden fleece	foliage	1	425	510	glyphosate	792	0.1
582	22-Oct-99	Sierra	Pineridge	Beal 14	inside	---	20	manzanita	berries	1	425	516	glyphosate	348	0.1
580	22-Oct-99	Sierra	Pineridge	Beal 20	inside	---	20	buckbrush	shoots	1	427	535	glyphosate	206	0.1
583	04-Nov-99	Eldorado	Placerville	613-042	inside	---	67	bracken fern	roots	2	428	533	glyphosate	0.408	0.1
584	05-Nov-99	Eldorado	Pacific	501-035	inside	---	20	manzanita	berries	1	426	533	glyphosate	64.4	0.1
730	18-Nov-99	Stanislaus	Mi Wok	E063	inside	---	36	bracken fern	roots	1	427	526	hexazinone	0.119	0.05
597	18-Nov-99	Stanislaus	Mi Wok	E068	inside	---	36	bracken fern	roots	1	429	530	hexazinone	0.051	0.05
731	16-Dec-99	Sierra	Kings River	N7	inside	---	28	buckbrush	shoots	1	425	530	glyphosate	29.8	0.1
732	16-Dec-99	Sierra	Kings River	S8	inside	---	28	golden fleece	foliage	1	424	511	glyphosate	ND	0.1
734	17-Dec-99	Sierra	Pineridge	Beal 14	inside	---	28	golden fleece	foliage	1	421	512	glyphosate	96.8	0.1
735	17-Dec-99	Sierra	Pineridge	Beal 14	inside	---	28	manzanita	berries	1	427	521	glyphosate	161	0.1
733	17-Dec-99	Sierra	Pineridge	Beal 20	inside	---	28	buckbrush	shoots	1	423	535	glyphosate	28.9	0.1
736	04-Jan-00	Eldorado	Pacific	501-035	inside	---	28	manzanita	berries	1	427	517	glyphosate	60.2	0.1
739	10-Feb-00	Sierra	Kings River	N7	inside	---	36	buckbrush	shoots	1	424	591	glyphosate	3.15	0.1
740	10-Feb-00	Sierra	Kings River	S8	inside	---	36	golden fleece	foliage	1	420	503	glyphosate	ND	0.1
742	11-Feb-00	Sierra	Pineridge	Beal 14	inside	---	36	golden fleece	foliage	1	422	503	glyphosate	29.0	0.1
743	11-Feb-00	Sierra	Pineridge	Beal 14	inside	---	36	manzanita	berries	1	424	570	glyphosate	30.8	0.1
741	11-Feb-00	Sierra	Pineridge	Beal 20	inside	---	36	buckbrush	shoots	1	423	544	glyphosate	1.99	0.1
747	20-Jun-00	Eldorado	Pacific	517-049	inside	---	-1	manzanita	berries	3	422	672	triclopyr	ND	0.03
748	30-Jun-00	Eldorado	Pacific	517-049	inside	---	0	manzanita	berries	1	426	610	triclopyr	3.52	0.03
749	26-Jul-00	Eldorado	Pacific	517-049	inside	---	4	manzanita	berries	1	426	640	triclopyr	1.95	0.03
751	18-Aug-00	Eldorado	Pacific	517-049	inside	---	8	manzanita	berries	1	425	531	triclopyr	1.65	0.03
745	17-Sep-00	Eldorado	Pacific	517-049	inside	---	12	manzanita	berries	1	429	589	triclopyr	2.42	0.03
752	08-Nov-00	Eldorado	Pacific	517-49	inside	---	19	manzanita	berries	1	445	546	triclopyr	2.63	0.03
754	03-Jan-01	Eldorado	Pacific	517-049	inside	---	27	manzanita	berries	1	426	617	triclopyr	2.12	0.03
ND is not detected															