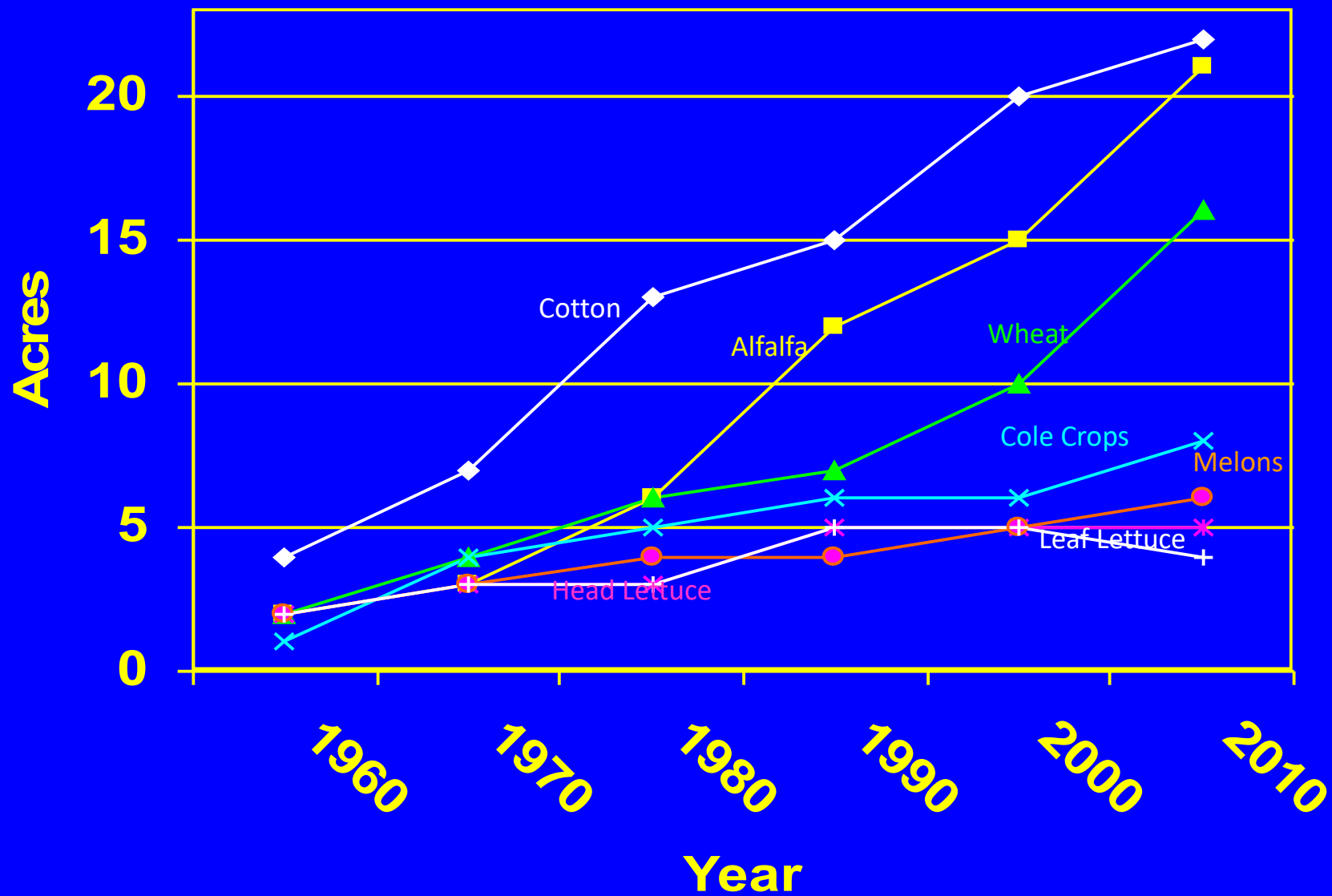


The Affect of Changing Production Practices on Herbicides

B.Tickes

U of Arizona Cooperative Extension

Herbicide Registrations



Vegetable Herbicides

No Change

- Active Ingredients

Change

- Formulations
- Production
Practices(irrigation)
- Technology







Alfalfa grown on beds



Subsurface Drip Irrigation









Two factors that have major impact on how irrigation affects herbicides are:

- Vaporization
- Adsorption to soil

Vapor Pressure

Vapor Pressure

- The tendency of a substance to volatilize is expressed by its vapor pressure. This is usually expressed in mmHg at 77 F



Vapor Pressure is affected by:

- Temperature
- Moisture
- Climate
- Soil type
- Adsorption
- Water solubility
- How applied

Vapor Pressure of Herbicides

Herbicide	Vapor Pressure(mm Hg)
Eptam	0.034
Trifluralin	0.00014
Kerb	0.000085
Balan	0.000085
Prowl	0.0000094
Dacthal	0.0000025
Goal	0.0000020
Prefar	0.00000080

Vapor Pressure above 0.00001 is
considered volatile



Vapor Pressure References can be misleading because:

- Active ingredients can react with water to change volatility.
- Other ingredients can be contained in the formulation
- Different formulations can have different volatility



Kerb 50W

Rates: 1-2 lbs.



Kerb 3.3

Rates: 1.2 - 2.4 pts.



Prowl H₂O



Prowl 3.3



Stauffer
CHEMICALS

Prefar
4-E

EMULSIFIABLE LIQUID
SELECTIVE HERBICIDE FOR CONTROL OF
ANNUAL GRASSES AND BROADLEAF WEEDS

KEEP OUT OF REACH OF CHILDREN
CAUTION

STATEMENT OF PRACTICAL TREATMENT

5 GAL. NET 18.9 L

STAUFFER CHEMICAL.COM

Prefar
4-E

Selective Herbicide

emulsifiable liquid for
control of annual grasses
and broadleaf weeds

Keep Out of Reach of Children
CAUTION
Hazardous if
Ingested or
Absorbed
Through Skin

5 GAL. NET 18.9 L

Prefar
4-E

Selective Herbicide

Emulsifiable Liquid for Control of
Annual Grasses and Broadleaf Weeds

CAUTION

Gowan

Prefar
6-E

Selective Herbicide

Emulsifiable Liquid for Control of
Annual Grasses and Broadleaf Weeds

CAUTION

Gowan

Dacthal



DACTHAL FLOWABLE
DACTHAL FLOWABLE

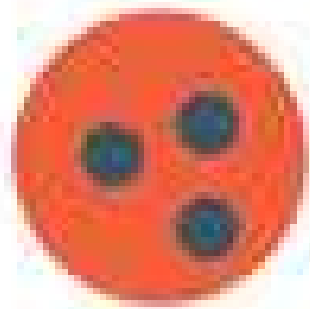


DACTHAL W 75
Dacthal W 75



Adsorption

- Physical
- Chemical

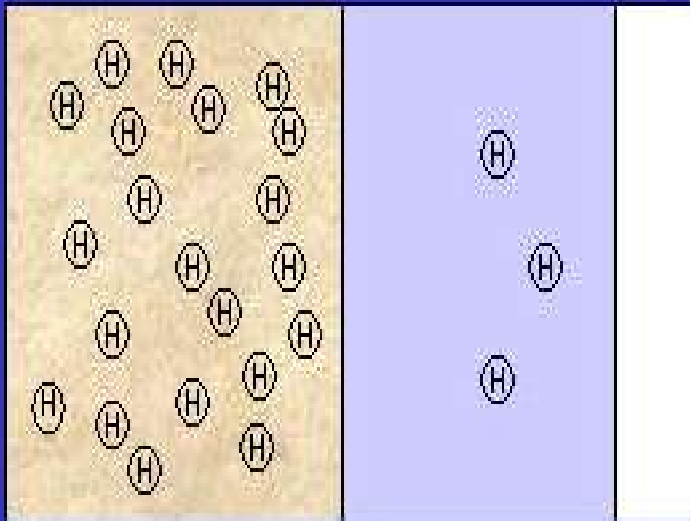


Absorption



Adsorption

$$K_{oc} = \text{Amount on soil} / \text{Amount in water}$$



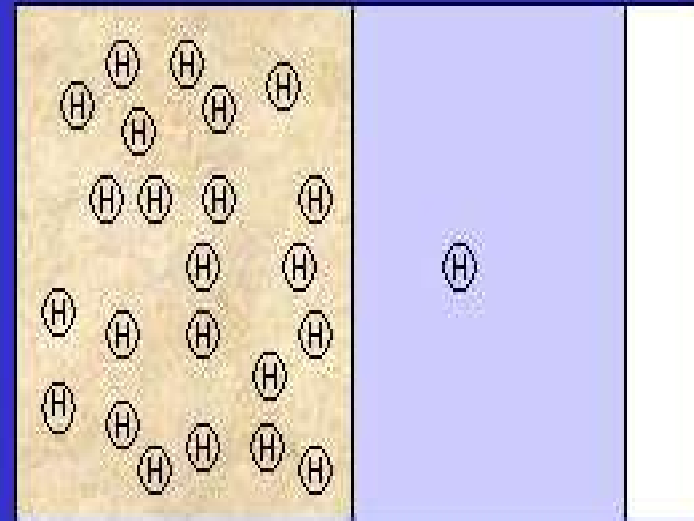
Soil

H₂O

Air

$$K_{oc} = 7$$

21 molecules bound / 3 free



Soil

H₂O

Air

$$K_{oc} = 24$$

24 molecules bound / 1 free

Adsorption Coefficient(K_{oc})

Herbicide	K _{oc}
Paraquat	1,000,000
Goal	100,000
Glyphosate	24,000
Balan	9000
Trifluralin	7000
Prowl	5000
Dacthal	5000
Prefar	1000
Kerb	800
Eptam	200

Eptam

Volatilization of *S*-Ethyl *N,N*-Dipropylthiocarbamate from Water and Wet Soil during and after Flood Irrigation of an Alfalfa Field

Mark M. Cliath,* William F. Spencer, Walter J. Farmer, Thomas D. Shoup, and Raj Grover

The herbicide *S*-ethyl *N,N*-dipropylthiocarbamate (EPTC) was applied to alfalfa in irrigation water. The actual vapor loss rate was assessed using an aerodynamic technique to estimate the EPTC vapor flux from the field during and after 2.19 ppm EPTC was applied by flood irrigation. The EPTC vapor flux 59.5 cm above the field varied from 37 to 259 g ha⁻¹ h⁻¹ while surface water was present. The EPTC vapor flux values measured over wet soil after irrigation ranged from 2 to 103 g ha⁻¹ h⁻¹ and was highest at night. Of the 3.04 kg ha⁻¹ EPTC applied, 7.0% was removed in tailwater runoff and 73.6% volatilized during the 52 hours of observation. This indicates that using surface irrigation water to apply EPTC to alfalfa is an inefficient method.

Measurement of loss of field applied pesticides by volatilization into the atmosphere has been an active area of agricultural research since Willis et al. (1971, 1972) first measured concentrations of pesticides in the air above treated soil plots. Actual vapor flux densities were measured above plots and fields of bare soil and corn (Caro et al., 1971; Parmele et al., 1972; Taylor et al., 1976), soybeans (Harper et al., 1976; White et al., 1977), and orchard grass (Taylor et al., 1977). These studies were recently summarized and evaluated by Taylor (1978).

In 1977, Soderquist et al. reported finding the thiocarbamate herbicide molinate in the air above a flooded rice field and speculated that loss by volatilization from field water was "the major route of dissipation".

Applying *S*-ethyl *N,N*-dipropylthiocarbamate (EPTC) to alfalfa in flood-irrigation water (called herbigation) is often the preferred application method in California's Imperial Valley. Alfalfa is irrigated about 25 times annually and as many as six cuttings are removed each year. The soil is often treated with a preemergent herbicide, like EPTC, after each second or third cutting, by adding the herbicide to the irrigation water. EPTC is considered a volatile thiocarbamate herbicide, moderately soluble in water [320 mg L⁻¹ at 30 °C, Freed et al. (1967)] with a saturation vapor pressure of 2.97×10^{-2} mmHg at 30 °C (Hamaker, 1972). EPTC vapor flux densities in the atmosphere above an alfalfa field during flood herbigation were reported by Cliath in 1978. This report presents information on total volatilization losses during and after EPTC was applied.

METHODS AND MATERIALS

Experimental Site and Treatment. The experimental site was located at Brawley, CA, at the USDA Imperial Valley Conservation Research Center. The site was about 162 m long (N-S) and 126 m wide (E-W) and included a 2.04-ha area planted to alfalfa, as shown in Figure 1. Outside the west edge of the field, 24 12-m² basins with borders spaced 3.3 m apart were also planted to alfalfa and provided additional fetch from the windward direction. The soil was Holtville clay loam (Typic Torrfluvents). The field contained a poor-to-medium stand of alfalfa that had not been irrigated for 10-14 days. EPTC was applied to the alfalfa field by herbigation 7 days after cutting when the plants were approximately 15-25 cm high.

U.S. Department of Agriculture, Science and Education Administration, University of California, Riverside, California 92521.

A weighing lysimeter was located about 100 m W and 75 m S of the NE corner as shown in Figure 1. The meteorological equipment, which included radiometers, wind run anemometers, soil heat flux plates, air temperature and relative humidity sensors, and a wind direction indicator, were located near the lysimeter.

To measure irrigation water runoff from the field, two 10.2-cm Parshall flumes were installed 23 and 80 m W and 10 m S of the NE corner of the field.

A pesticide collection mast assembly was positioned on the expected downwind side of the field 85 m S and 25 m W of the NE corner of the field. The pesticide collection mast assembly was a modification of the setup reported by Turner and Glotfelty (1977). A detailed description was reported by Cliath (1978). Basically, the pesticide collection mast consisted of six polyurethane foam plug collectors attached to a vacuum source and positioned at 10, 18, 30, 45, 70, and 100 cm above the soil surface. The collectors positioned at 10 and 18 cm were within the crop canopy. Air was drawn through each of these collectors at 2 L min⁻¹.

Beginning at 0730 h on May 25, 1977, 3.04 kg/ha EPTC was applied at an average concentration of 2.17 ppm by adding about 14 mL min⁻¹ of a 0.84 kg L⁻¹ (7 lb gal⁻¹) EC formulation through a Dripolator to irrigation water in the head ditch flowing at 0.066 m³ s⁻¹ (2 cfs). The herbigation of the alfalfa progressed from west to east across the field until the equivalent of 13 cm (5.2 in.) of irrigation water was applied to the field surface. Herbigation ceased when the head flume was closed at 1630 h.

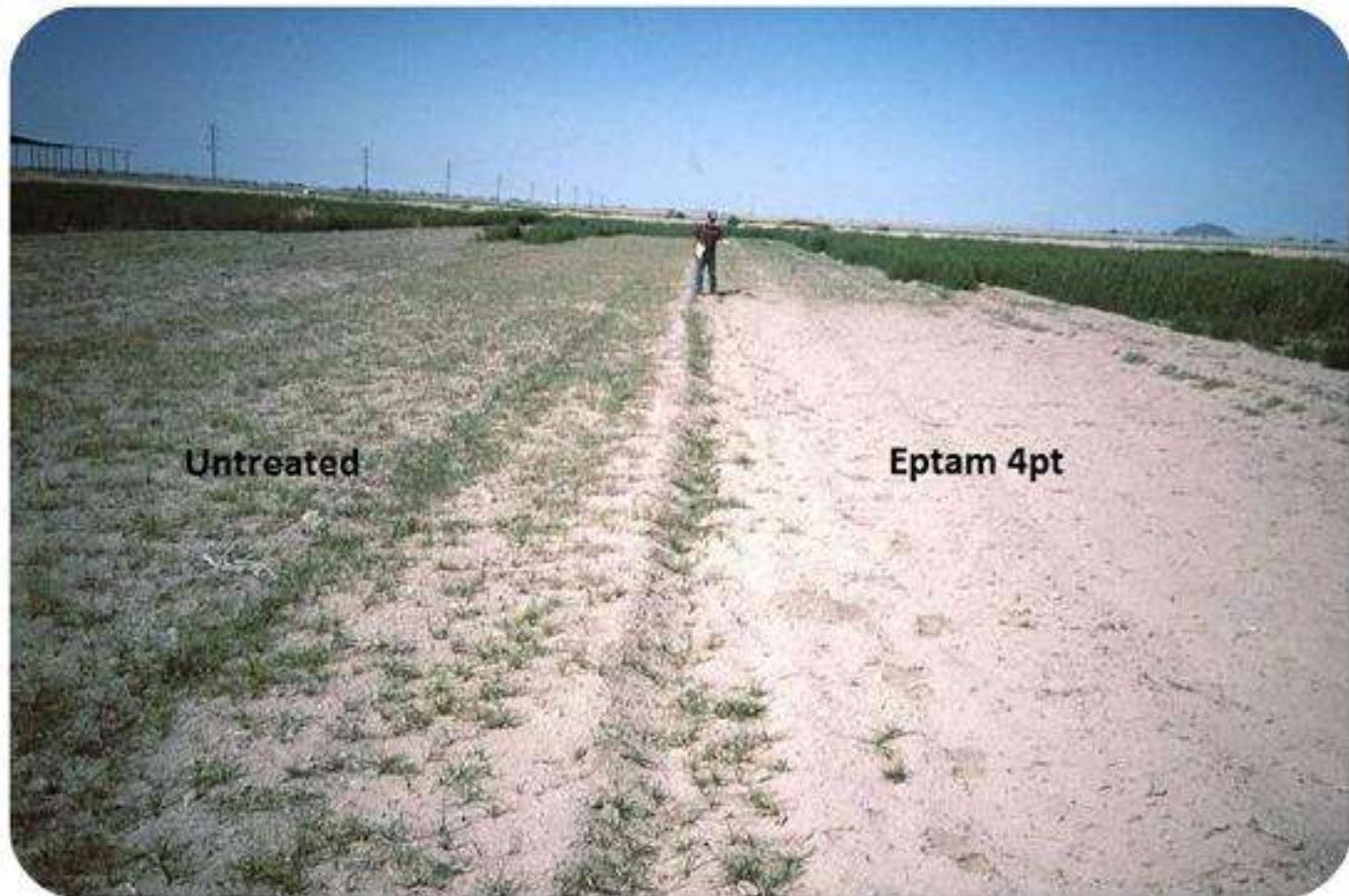
Beginning at 0930 h on May 25, 1977, we measured wind speed (\bar{u}), temperature (\bar{T}), and atmospheric temperature lapse rate (ΔT) every 30 min until 1900 h on May 27. The wind speed was measured with six calibrated Casella rotating cup anemometers located at 40, 60, 80, 100, 130, and 200 cm above the soil surface. Temperatures were measured with Bowen temperature sensors spaced 35 cm apart and located 45 and 80 cm above the soil surface. Details of the meteorological instrumentation were reported by Cliath (1978).

Runoff from irrigation water began at 1300 h and continued until about 0100 h the next day. We obtained 3.8-L grab samples of runoff each hour until 1504 h and every 2 h afterward until 0144 h on May 26 when runoff ceased. Staff gauge records were made at each sampling to calculate total pesticide runoff from flow volumes and herbicide concentrations in the irrigation tailwater.

Vaporized EPTC was sampled beginning at 1445 h on May 25, when the irrigation water passed the sampling

Eptam Losses in "water run" Flood Irrigated Alfalfa

- Volatilized from water 28.4%
- Volatilized from wet soil 45.2%
- Runoff in tailwater 7.0 %
- Total Lost 80.6%



Untreated

Eptam 4pt



Carrots

C
a
r
r
o

Untreated

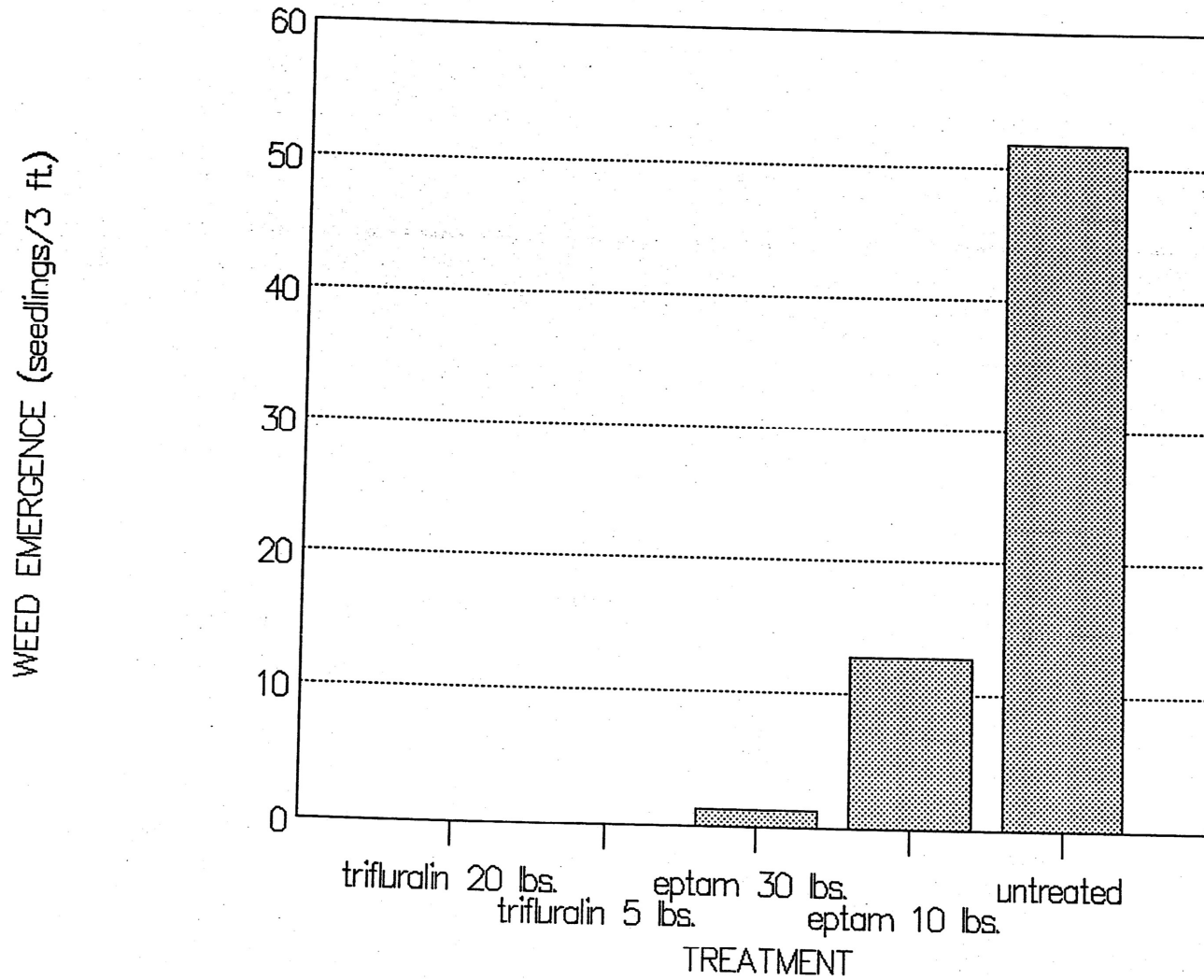
Eptam 3.5 pt. (3X)



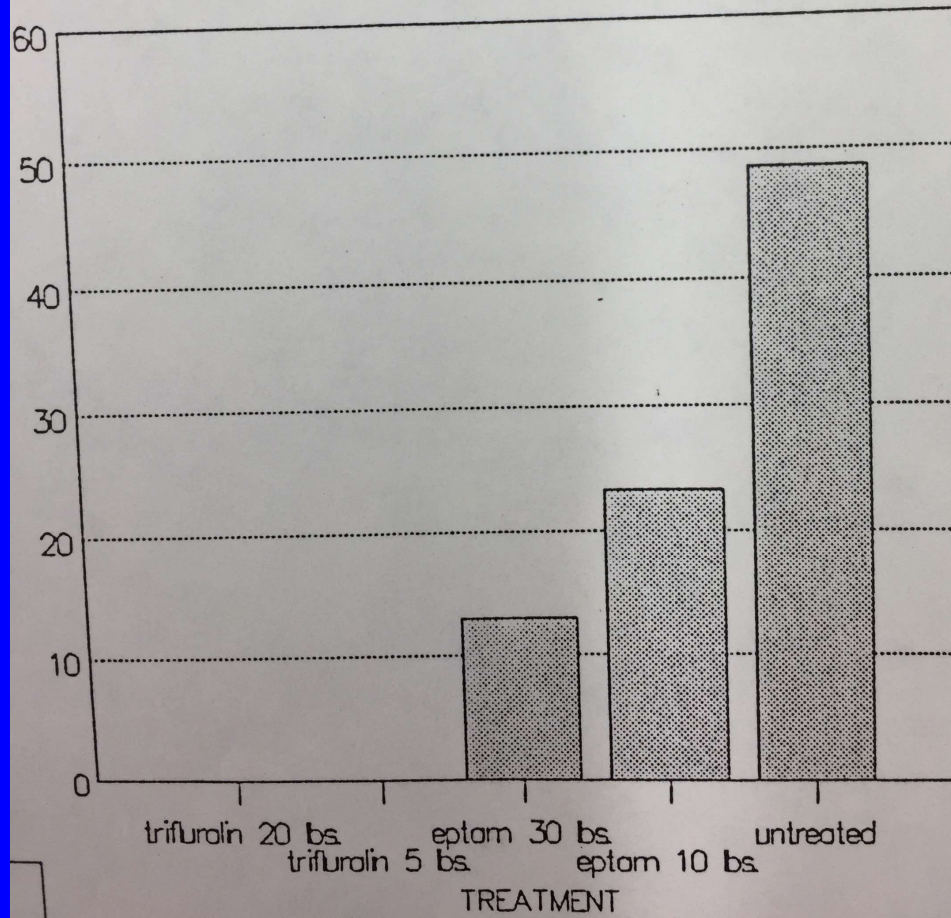
Treflan



12 hours

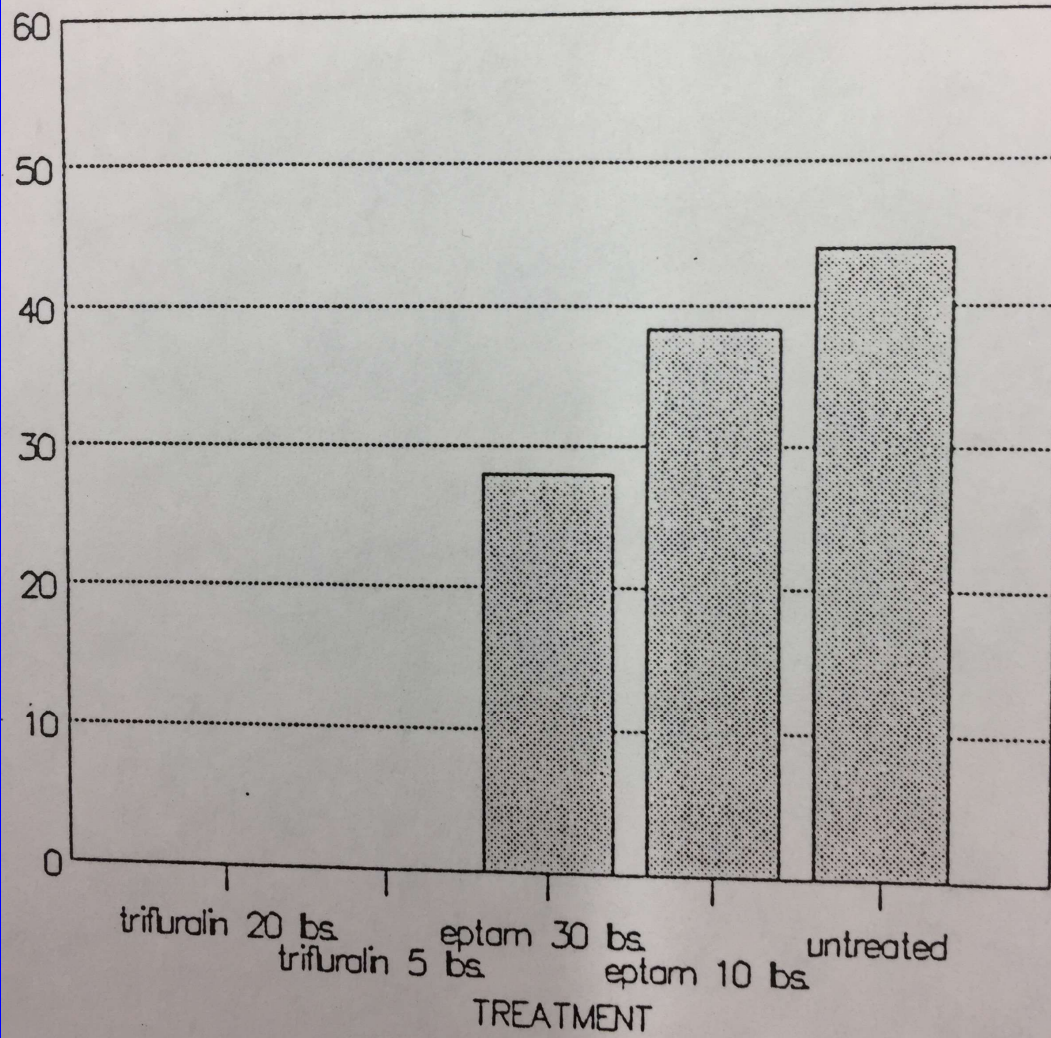


3 DAYS

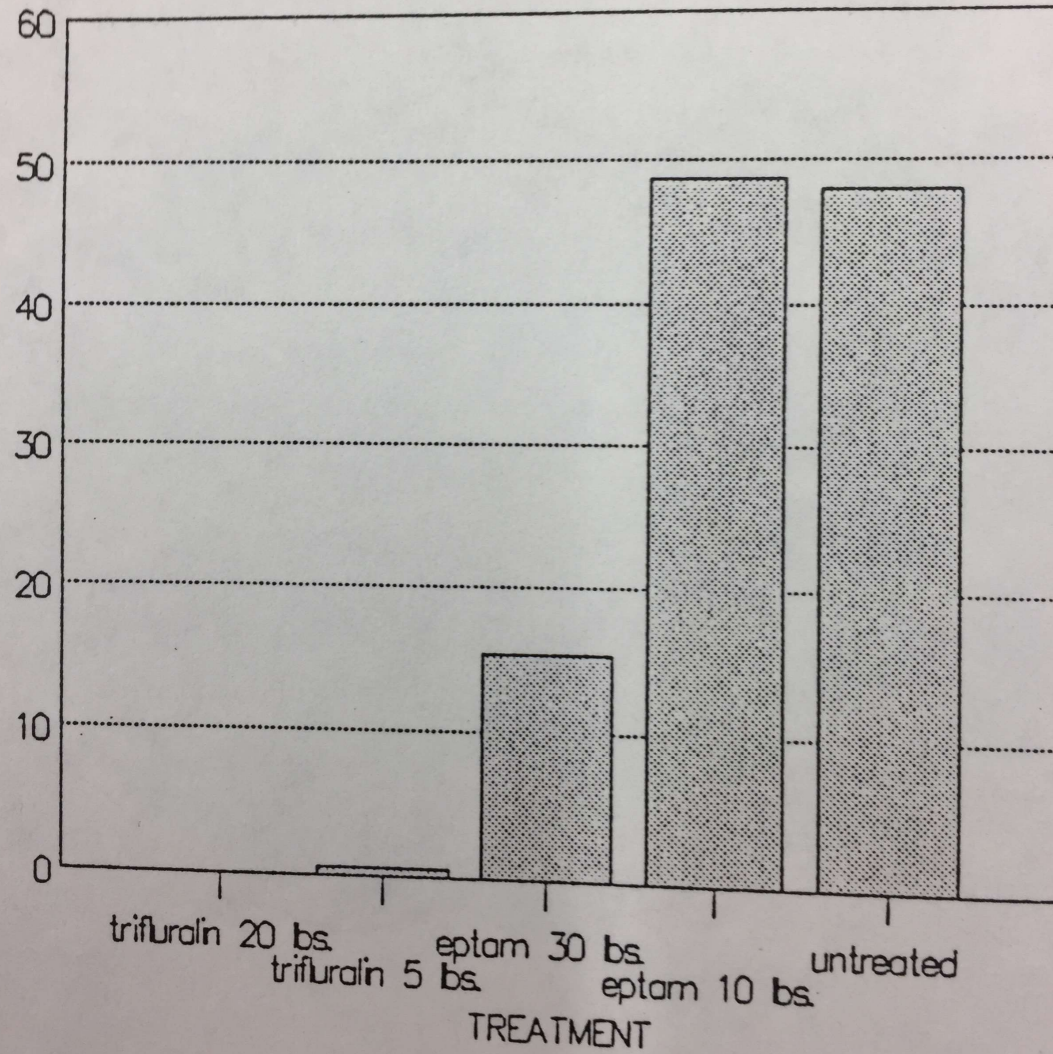


WEED E

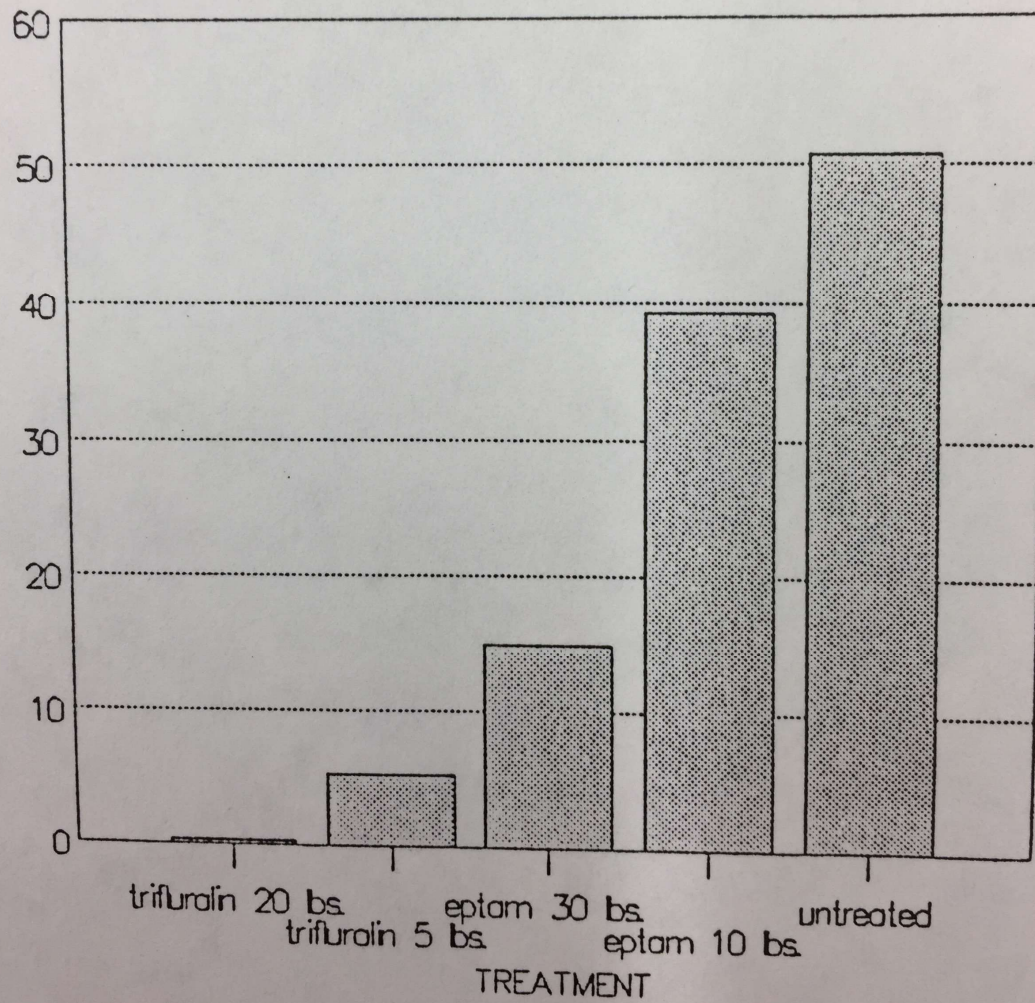
5 DAYS



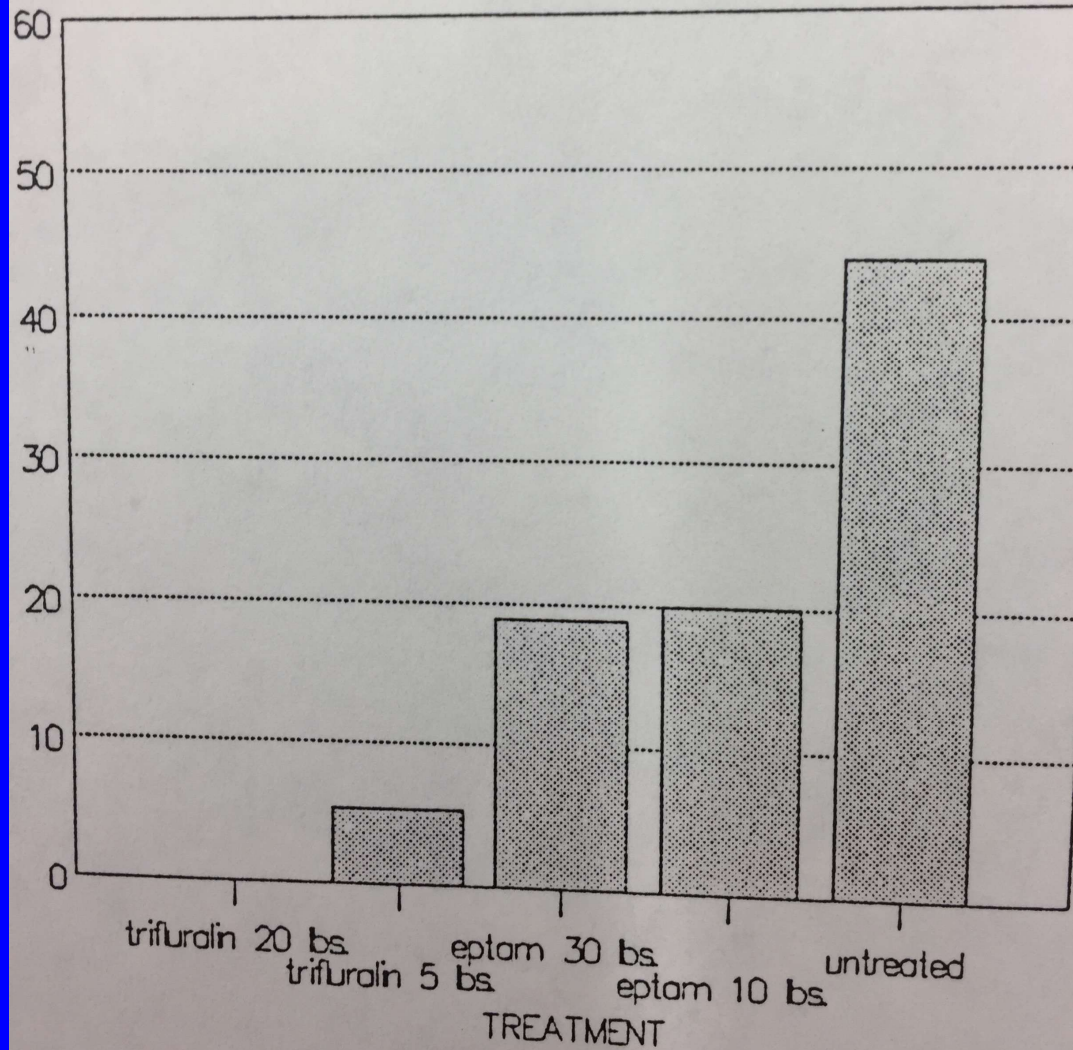
7DAYS



10 DAYS



14 DAYS



Balan Injury to lettuce



Goal







Imported Chemigation Rig with Manual Agitation



GoalTender 6oz.

Untreated



Onions/Bard, Ca. 2009. Goal 2XL-16oz.



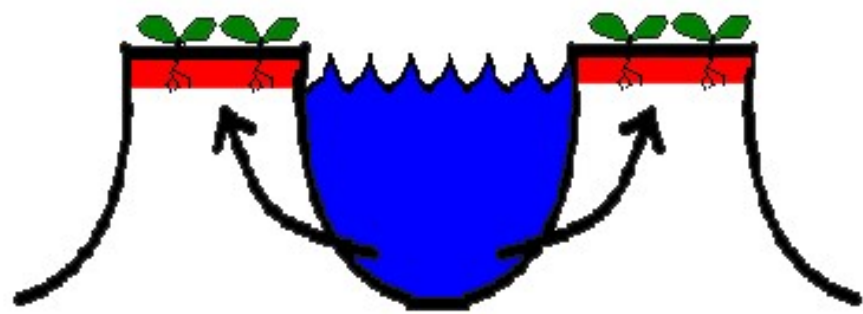


Movement

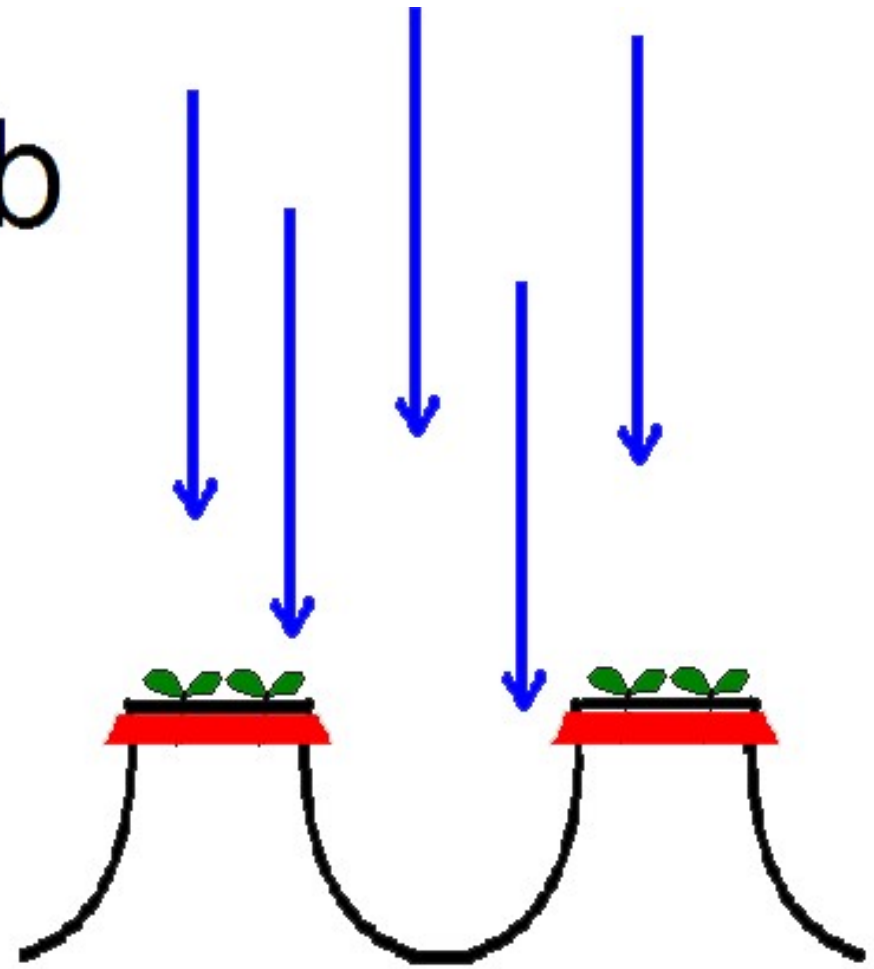
Goal 2 XL 1.0 lb/a.i.

Kerb

Kerb



Furrow




Sprinkler



Sprinklers



Furrow



Applied 5 days
after
sprinklers started

Chemigation Equipment



Snyder's Kerb Application Method (SKAM)

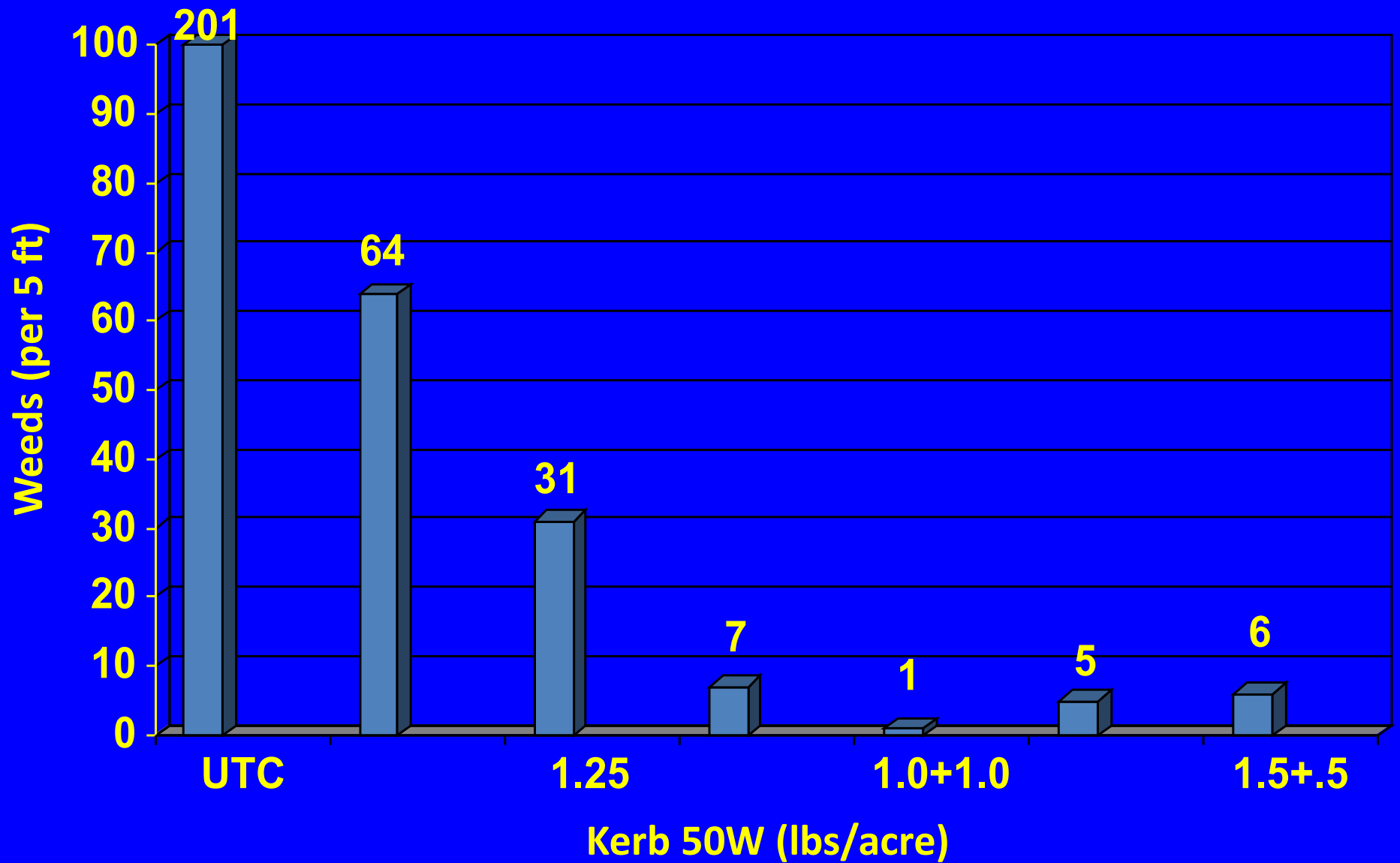




Untreated

1.0 + 1.0

Kerb Split Application Trial Summary



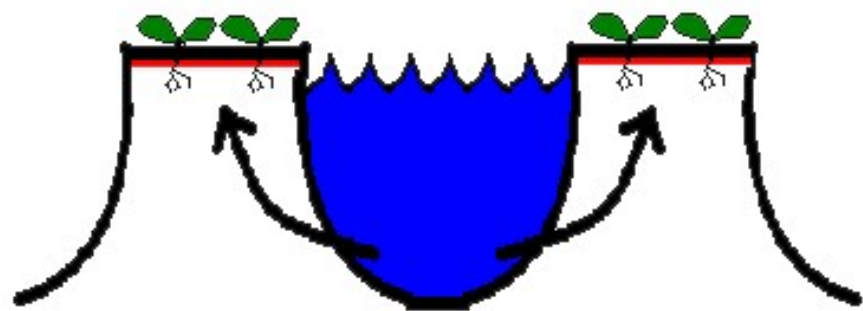
Prefar



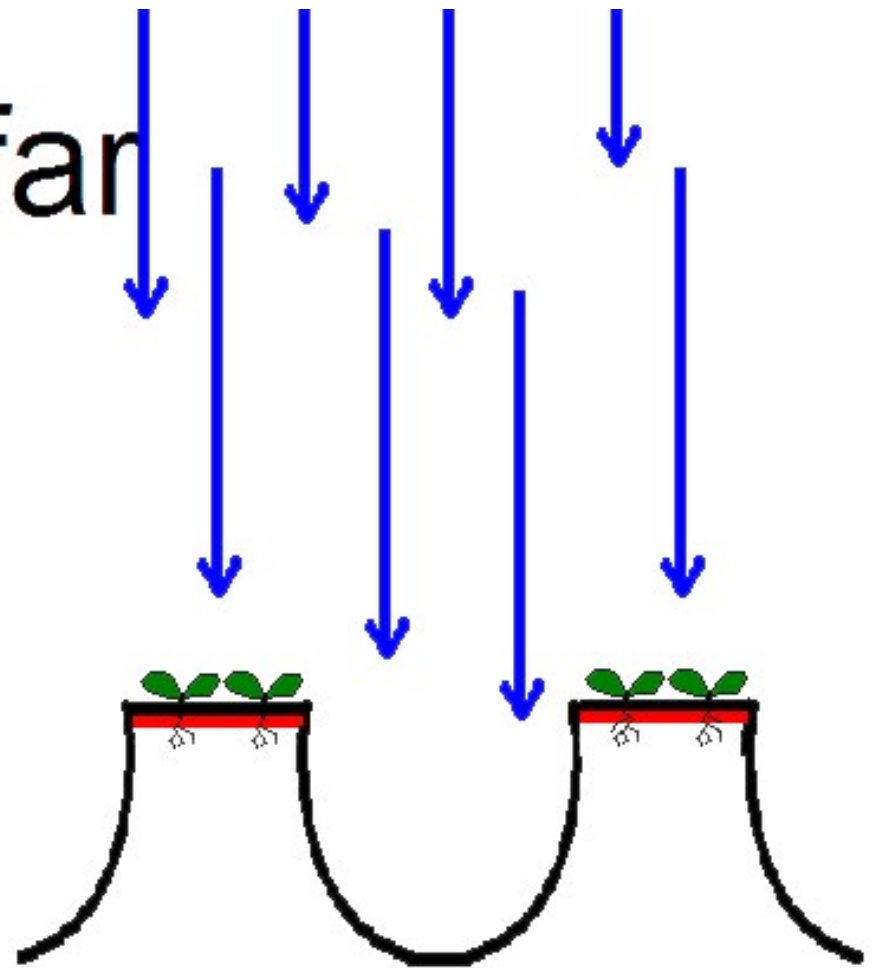
Prefar
6 qts.



Prefar



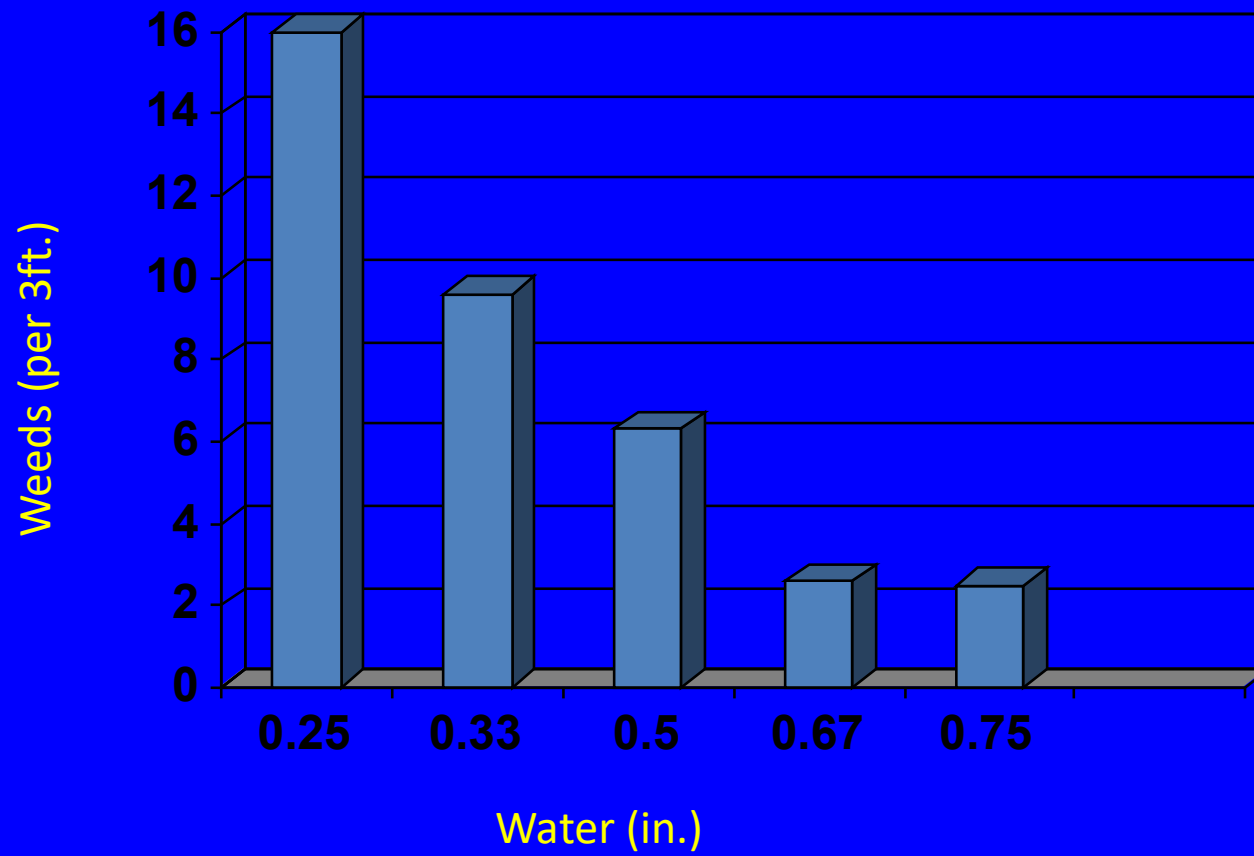
Furrow



Sprinkler

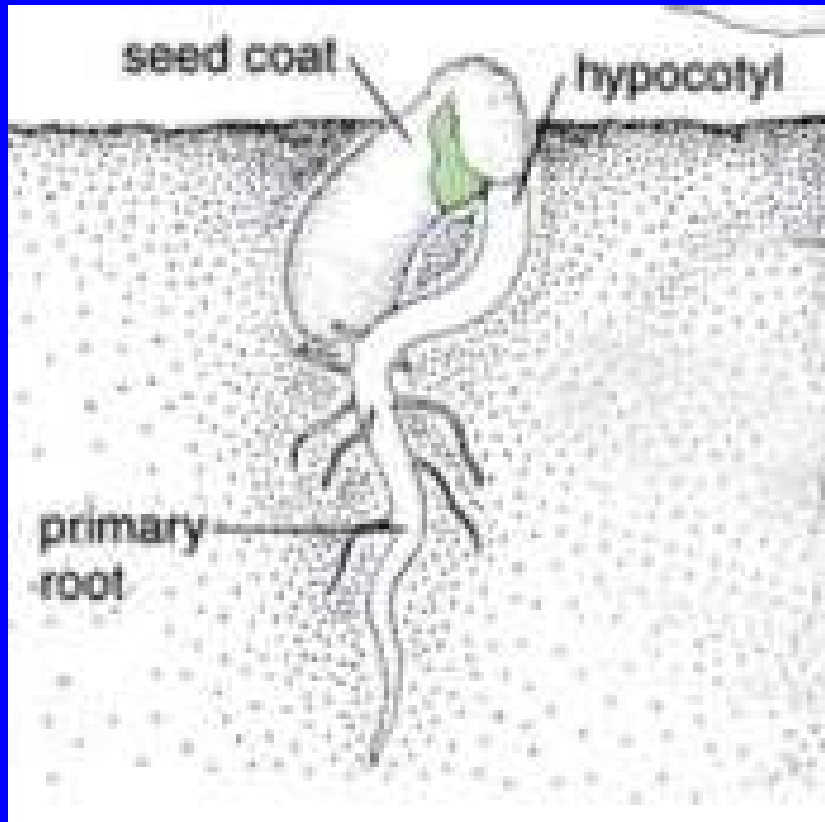


Prefar- Water interaction

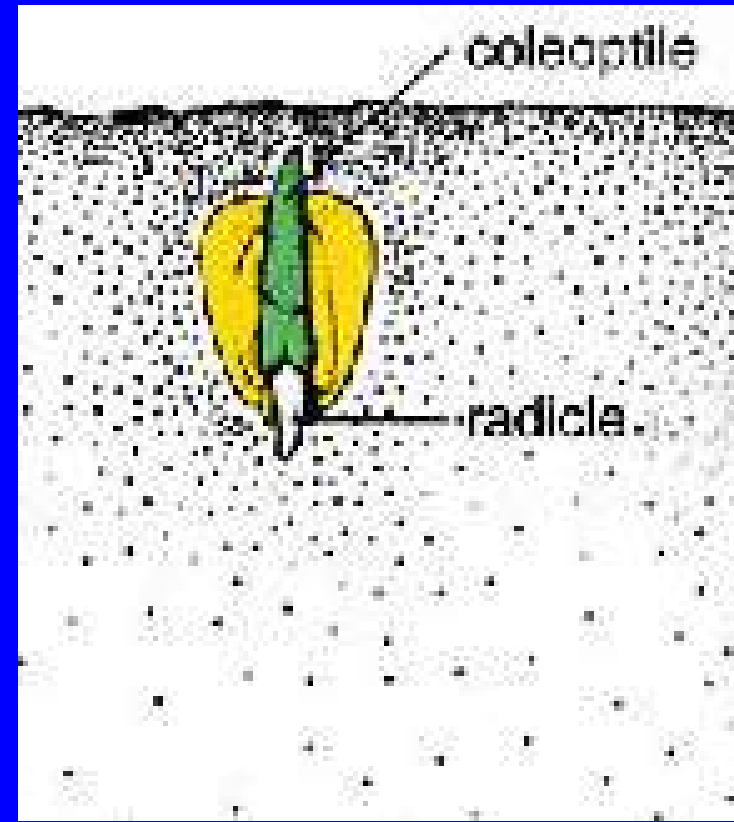




Dacthal



Broadleaf



Grass



Furrow Irrigated



Sprinkler Irrigated

Dacthal/ Lettuce



EPA Reg. No. 279-3241

SLN # AZ-130003

This label expires and must not be distributed or used in accordance with this SLN registration after 12/31/2018.

- It is a violation of Federal law to use this product in a manner inconsistent with its labeling.
- This state-specific Section 24(c) labeling must be in the possession of the user at the time of application.
- Follow all applicable directions, restrictions, and precautions on the EPA registered label for Aim EC Herbicide (EPA Reg. No. 279-3241) and this label.

For Agricultural Use Only

CROP	DO NOT APPLY MORE Aim EC Herbicide THAN INDICATED BELOW	SPRAY VOLUME
Lettuce – For use in lettuce thinning machines	1.0 fl oz (0.016 lb ai) per broadcast acre.	Minimum of 1 gallons / acre

Directions For Use

Use Aim EC Herbicide to remove unwanted lettuce plants. Applications must be made with a sprayer designed for thinning lettuce. The machine must accurately spray unwanted plants without injuring desirable lettuce plants.

Vapor Pressure of Carfentrazone
is 1.2×10^{-7}

Above 1.0×10^5 is considered
volatile

END