Runcina

VOLUME 31

Weed Control Studies in

ALFALFA

SEED



PROGRESS REPORT 1985

HAY



UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION

FRESNO COUNTY

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Until the products and their uses given in this report appear on a registered pesticide label or other legal, supplementary direction for use, it is illegal to use the chemicals as described.

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October 1985
350 copies

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ACKNOWLEDGEMENTS

The applied research studies summarized in this Progress Report were generously supported by the California Alfalfa Seed Production Research Board. I am very greatful for their encouragement and confidence.

I wish to acknowledge the able assistance of Thomas A. Babb and Timothy Campbell, Extension Research Assistants, in conducting the trials.

The cooperation and managerial assistance of Richard Hoover and Fred Fischer of the West Side Field Station is greatly appreciated.

Without the collaboration and tolerance of numerous Fresno County farmers, some of the trials could not have been conducted.

I am thankful for the secretarial work of Mrs. Nancy Shaw and the talents of John Willson for the art work and printing.

The herbicides used were supplied without charge by their respective manufacturers; their generosity is greatfully acknowledged.

This is but a progress report and it does not contain recommendations for the use of herbicides in alfalfa seed or hay production. Its purpose is to inform alfalfa growers and other interested individuals of our applied research activities.

Bill B. Fischer
Farm Advisor

Runcina is the title of progress reports of applied research studies of weeding conducted in Fresno County. It contains no recommendations for the use of herbicides.

Rucina was the goddess of weeding worshipped during the Augustinian period. Variations such as runco, erunco and runciato acquired the meaning of weeding.

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ALFALFA - WEED CONTROL STUDIES

A Progress Report 1984-1985

Bill B. Fischer*

Gold seekers in the 1850's, unbeknown to them, brought "green gold" into California. At that time they called it "Chilean Clover". Forty years later nearly two million acres were covered with this "green gold" in 17 western states, by then they called it alfalfa.

Today in California alone approximately 1-1/4 million acres are planted with alfalfa grown for hay and seed. The alfalfa seed grown in California is sold in nearly every state in the United States as well as in many foreign countries on five continents.

The cultural practices pursued in producing alfalfa hay differ significantly from those used in growing alfalfa for seed production. However, the control of unwanted competing vegetation is just as essential to grow good quality, palatable hay as it is to produce high quality, viable weed-free alfalfa seed.

Weed control in alfalfa production, whether grown for hay or seed, during stand establishment and the first year differ from the weed control measures used in established alfalfa fields one year old or older.

A large number of herbicides have been evaluated during the past 25 years for the control of annual and perennial weeds as well as parasitic dodder in alfalfa. A fairly large number of them are labeled for use and can enable farmers to control nearly all the unwanted competing vegetation that infest alfalfa hay and alfalfa seed fields. However, they can be used most effectively and economically only in a well-planned integrated management system that encompasses:

- Proper field selection and rotation.
- Proper land and seedbed preparation.

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*Farm Advisor, University of California Cooperative Extension, Fresno County

- Good irrigation practices.
- Effective sanitation in and around the fields.
- Knowledge of the weed infestation and keeping records of their distribution on the farm.
- Proper herbicide selection and their timely application.
- Properly timed cuttings, fertilization, insect and disease control to promote the vigorous growth of the alfalfa.
- Following seed harvest, properly timed cultivations and incorporation of the straw and trash are essential.

Selective herbicides are extensively used and they significantly enhance the economical production of alfalfa, but not a single herbicide controls all species of weeds. Therefore, in many fields, combinations and/or sequential applications may be required to maintain good control. To select the most effective herbicide, or combination of herbicides, the importance of proper weed identification and keeping records of their distribution cannot be over-emphasized.

Weed infestation records can be used to select fields for planting that are not infested with parasitic dodder. Neither should fields heavily infested with fields bindweed be planted with alfalfa for seed production. Dodder can be controlled in hay as well as in seed fields but it is costly, delays the growth of the alfalfa and reduces the yield potential.

Vigorously growing alfalfa hay is an excellent competitor with weeds, even perennials like bermudagrass, field bindweed and nutsedge, especially when planted in the fall and it is well established in the spring when these weeds begin to regrow. However, in seed production where the alfalfa is planted in rows 30 to 40 inches apart, these perennials can be much more troublesome; therefore, if possible, fields infested with them should be avoided.

Results of earlier studies have been published and widely distributed not only in central California but in many other counties and neighboring

states. A partial list of earlier progress reports is given in the Appendix . From these studies two charts were developed and are reproduced on pages 4 and 5. They summarize the susceptibility of commonly occurring annual weeds to herbicides evaluated and the performance of herbicides in the central San Joaquin Valley. The information summarized in the charts is applicable to seed and hay fields as well; however, their application may vary. Therefore, directions printed on their labels should be carefully followed.

These charts should not be interpreted as recommendations for the use of the herbicides, but they can serve as guides in the selection of those herbicides that are registered for use in alfalfa. The charts were prepared for use in central California; herbicides such as Princep (simazine), Sencor (metribuzin) and Sinbar (terbacil), that may be registered, are not included because they caused injury to the alfalfa.

The applied research studies conducted in 1985 are reported in more detail beginning on Page 6.



Repeated diskings can provide effective volunteer alfalfa and weed control. However, the crowns of many plants are cut and injured predisposing the plants to invasion by disease organisms. The crowns of weaker plants can be severed from the root resulting in sparse stands.

SUMMARY OF HERBICIDE PERFORMANCE EVALUATED IN SEED ALFALFA PRODUCTION IN THE CENTRAL SAN JOAQUIN VALLEY*

METHOD OF APPLICATION	HERBICIDE	Conditions That Resulted in Most Effective Control	Conditions That Resulted in Poor Control or Injury
PREPLANT INCORP-ORATED	**Balan® OR Tolban®**	Shallow incorporatd in well prepared SEED BED. When Temperature was favorable for rapid seedling growth. Only susceptible weeds were present.	Cool temperature, deep incorporation, volunteer cereals and other resistant weed species were present.
	Eptam®	Thorough incorporation early fall or in spring pianted fields. Where nutsedge was present; where 4 to 8 weeks control was needed.	Winter application, cloddy seed bed and resistant weeds present. Where longer than 6 weeks of residual control was needed.
	Chemoe®	Where volunteer cereals and canary-grass were the only weeds present. Also, postemergence under sprinkler irrigation to control volunteer cereals.	Fields infested with broadleaf weeds. When used as a surface application and not irrigated within 24 hours. When unfavorable growing conditions prevailed, injury occurred.
POST-EMERGENCE	**Dow Selective® or Sinox-W®**	When alfalfa had two trifoliate leaves and the broadleaf weeds were in their seedling stage of growth.	When broadleaf weeds were beyond the seedling stage of growth. When grassy weeds were present.
	Butyrac 200® or ButoxoneEster®	When broadleaf weeds in their seedling stage were the only weeds present.	Broadleaf weeds beyong their seedling stage were present.
	Kerb®	When alfalfa had two trifoliate leaves and weeds were not emerged or in their seedling stage; rainfall or sprinkler irrigation was applied following treatment.	When alfalfa was in the seedleaf or unfoliate leaf stage of growth severe injury occurred. When weeds were beyond their seedling stage. When water was not applied soon after treatment.
	Brominal® Buctril®	When the Alfalfa had 2 to 3 trifoliate leaves and the broadleaf weeds were in their seedling stage. Applied in 60 gallons of water per acre and the alfalfa and broadleaf weeds were growing vigorously.	When grasses, chickweed and redmaids were prevalent. Weeds were beyond their seedling stage and air application in 10 gpa was used. When the temperature was above 80 °F temporary yellowing of the alfalfa was observed.
	Poast® Fusilade ®	When the grasses are in their seedling stage and growing vigorously.	Grasses beyond their seedling stage and moisture stressed.
ESTABLISHED STANDS	**Eptam®**	Applied in the irrigation water and only when thorough wetting of the bed top was obtained. Timely repeated application was made.	Poor water distribution and not wetting the bed top. Repeated application was not made.
	Furloe®	Applied on wet soil immediately following irrigation provided dodder control if applied prior to attachment and repeated applications were made.	Applied on dry soil and/or repeated applications were not made. Dodder attached prior to treatment.
	Karmex®	When applied on soil free of clods and volunteer alfalfa seed germination. Addition of dinitro general and weed oil improved weed control when groundsel was present.	Applied on trashy or cloddy soil. Applied after Feb. 1st on non-dormant varieties resulted in injury
	Treflan® or Tolban®	Thoroughly incorporated with rolling cultivators in fields free of established weeds. Summer annual grasses, pigweeds and lambsquarter, the only weeds present.	Not incorporated thoroughly or when resistant weed species predominated.
	Velpar®	Alfalfa was established one year or longer. Applied during December and January when the alfalfa growth was short (4 to 6 inches). Rainfall occurred shortly after application and weeds were 2 to 4 inches tall.	Established grasses were the predominant weeds. Broadleaf weeds 8 to 10 inches tall or taller. Applied after the middle of February.

*This is not a recommendation for the use of herbicides. It is a progress report of observations made in applied research trials conducted in Fresno County.

SUSCEPTIBILITY OF WEEDS TO HERBICIDES EVALUATED FOR SELECTIVE CONTROL OF WEEDS IN SEED ALFALFA PRODUCTION

■ = Effectively Controlled
▨ = Partially or Erratically Controlled
□ = Not Controlled

	PREPLANT INCORPORATED				POSTEMERGENCE						ESTABLISHED STAND					
	BALAN® (benefin)	CHEMHOE® (IPC)	EPTAM® (EPTC)	TOLBAN® (profluralin)	DOW SELECTIVE® or SINOX W® (dinoseb)	KERB® (pronamide)	BUTYRAC 200® or BUTOXONE ESTER® (24-DB ester)	BROMINAL® BUCTRIL® (bromoxynil)	FUSILADE® (fluazifop-butyl)	POAST® (sethyoxydim)	EPTAM® (EPTC)	FURLOE® (CIPC)	KARMEX® (diuron)	TREFLAN® (trifluralin)	TOLBAN® (profluralin)	VELPAR® (hexazinone)
BROADLEAF WEEDS																
CHEESEWEED	□	□	□	□	□	□	□	▨	□	□	□	□	▨	□	□	▨
CHICKWEED	■	■	■	■	■	■	▨	□	□	□	■	■	■	■	■	▨
COCKLEBUR	□	□	□	□	▨	□	▨	▨	□	□	□	□	▨	□	□	▨
CUDWEED	□	□	▨	□	▨	□	▨	▨	□	□	□	□	▨	□	□	▨
CLOVERS	□	□	□	□	□	□	□	□	□	□	□	□	▨	□	□	▨
FIDDLENECK	■	▨	■	■	■	■	▨	▨	□	□	■	■	■	■	■	▨
FILAREE	□	□	▨	□	▨	▨	▨	▨	□	□	▨	□	▨	□	□	▨
FLAX-LEAVED FLEABANE	□	□	▨	□	▨	▨	□	▨	□	□	▨	□	▨	□	□	▨
GOOSEFOOT	■	□	■	■	■	■	■	■	□	□	■	▨	■	■	■	■
GROUNDCHERRY	□	□	■	□	■	■	■	■	□	□	■	▨	■	□	□	■
GROUNDSEL	□	□	■	□	▨	▨	▨	▨	□	□	■	▨	▨	□	□	■
HENBIT	□	□	■	□	▨	▨	▨	□	□	□	■	▨	▨	□	□	■
KNOTWEED	■	□	▨	■	▨	■	▨	▨	□	□	▨	■	■	■	■	■
LAMBSQUARTER	■	□	■	■	■	■	■	■	□	□	■	▨	■	■	■	■
LONDON ROCKET	□	□	▨	□	■	■	■	■	□	□	▨	▨	▨	□	□	■
MARE'S TAIL	□	□	▨	□	▨	▨	▨	▨	□	□	■	□	□	□	□	■
MINERS LETTUCE	■	▨	▨	■	■	▨	□	■	□	□	▨	■	■	■	■	■
MUSTARD	□	□	□	□	■	■	■	■	□	□	□	■	■	□	□	■
NETTLE	□	▨	■	□	■	■	■	■	□	□	■	■	■	□	□	■
NIGHTSHADE	□	□	■	□	■	■	■	■	□	□	■	▨	■	□	□	■
PIGWEED	■	□	■	■	■	■	■	■	□	□	■	▨	■	■	■	■
PINEAPPLE WEED	□	□	▨	□	▨	□	□	□	□	□	▨	□	□	□	□	■
PRICKLY LETTUCE	□	□	■	□	■	■	■	■	□	□	■	■	■	□	□	■
PUNCTURE VINE	▨	□	▨	▨	■	■	■	■	□	□	□	□	□	▨	▨	■
PURSLANE	■	□	■	■	▨	■	▨	□	□	□	■	▨	■	■	■	■
RED MAIDS	■	▨	■	■	■	■	■	□	□	□	■	■	■	■	■	■
RUSSIAN THISTLE	▨	□	▨	▨	□	▨	▨	□	□	□	▨	□	□	▨	▨	▨
SHEPHERD'S PURSE	□	▨	▨	□	■	■	■	■	□	□	■	■	■	□	□	■
SOW THISTLE	□	□	■	□	■	■	■	■	□	□	■	▨	■	□	□	■
SPURGE	□	□	■	□	■	■	■	■	□	□	■	■	■	□	□	■
SPEEDWELL	□	□	■	□	■	■	■	■	□	□	■	■	■	▨	▨	■
WILD RADISH	□	□	■	□	■	■	■	■	□	□	■	■	■	▨	▨	■
GRASSY WEEDS																
ANNUAL BLUEGRASS	■	■	■	■	□	■	■	■	■	■	■	■	■	■	■	■
BARNYARDGRASS	■	□	■	■	□	■	■	■	■	▨	■	□	■	■	■	▨
BROMEGRASSES	■	■	■	■	□	■	■	■	▨	▨	■	▨	■	■	■	▨
CANARYGRASS	■	■	■	■	□	■	■	■	▨	▨	■	▨	■	■	■	▨
CRABGRASS	■	▨	■	■	□	■	■	■	▨	▨	■	▨	■	■	■	▨
FESCUES	■	■	■	■	□	■	■	■	▨	▨	■	▨	■	■	■	▨
FOXTAIL (BRISTLEGRASS)	■	■	■	■	□	■	■	■	▨	▨	■	▨	■	■	■	▨
LOVEGRASS	■	■	■	■	□	■	■	■	▨	▨	■	▨	■	■	■	▨
RABBITFOOTGRASS	■	■	■	■	□	■	■	■	■	■	■	■	■	■	■	■
RYEGRASS	■	▨	■	■	□	■	■	■	■	■	■	■	■	■	■	■
SANDBUR	■	▨	■	■	▨	■	■	■	■	■	■	▨	■	■	■	▨
WILD BARLEY (FOXTAIL)	■	■	■	■	□	■	■	■	■	■	■	▨	■	■	■	▨
WILD OATS	■	■	■	■	□	■	■	■	■	■	■	▨	■	■	▨	▨
WITCHGRASS	■	▨	■	■	□	■	■	■	■	■	■	▨	■	■	■	▨

*This chart is tentative, based on experiments conducted in the Central San Joaquin Valley. Proper timing and accurate application is imperative. Additional information may warrant changes.

APPLIED RESEARCH STUDIES - 1985

The objectives of the applied research studies conducted during 1985 were to conclude the evaluation of low rates of Velpar (hexazinone) plus Karmex (diuron) for the control of winter annual weeds in established alfalfa. The use of Dinitro General (dinoseb), in combination with a paraffin-based adjuvant (Surfel) instead of weed oil, as a contact herbicide was also studied.

Several trials were conducted evaluating the effectiveness of grass herbicides in combination with Brominal (bromoxynil) and 2,4D-B ester for the postemergence control of a broad spectrum of weeds in newly planted alfalfa.

Studies were conducted also to evaluate the effectiveness of Treflan (trifluralin) 10G, (a granular formulation) for the control of parasitic dodder (Cuscuta sp.) prior to attachment, and for foxtails (Setaria sp.) control. The effectiveness of low rates of Kerb (pronamide) and Roundup (glyphosate) for the control of attached dodder were investigated also. The tolerance of alfalfa to Roundup was studied at the West Side Field Station in a 3-year-old stand.

Herbicide residue studies initiated in 1984 were concluded this year and the results are included in this report. Some of the tables published in the 1984 report 1/ are reprinted in elaboration of studies conducted in 1985.

Procedures Used

All trials were conducted in replicated block designs. The herbicides were applied with a CO_2 constant pressure back-pack sprayer or an experimental sprayrig using compressed air as a propellant and agitation was provided with a mechanical shaker.

1/ Vegetation management in Alfalfa. A Progress Report of Applied Research Studies 1984, submitted to The Alfalfa Production Research Board December, 1984.

Herbicides used, rates of their application, dates of treatment, soil type, and other pertinent information are given in the tables summarizing the results obtained. Evaluations of weed control and the effect of the treatments on the alfalfa were assessed several times. The rates of herbicides applied are given as active ingredients per treated acre and the abbreviation "lbai/A" is used.

Observations were also made in many alfalfa seed and hay fields commercially treated with herbicides. These observations may be reflected in the following summary statements. The ultimate or most meaningful assessments of the results obtained in applied research are the effectiveness of their commercial application.

RESULTS AND OBSERVATIONS

Established Alfalfa

The effective use of Velpar for the pre-and-postemergence control of weeds in established alfalfa 7 to 8 months old or older, was repeatedly demonstrated. Velpar has long residual properties and many crops planted in rotation following alfalfa can be injured by small quantities that may remain in the soil.

It was demonstrated that low rates of Velpar, 0.125 to 0.25 lbai/A, in combination with Karmex, provided effective weed control without causing injury to subsequently planted crops. The tolerance of Velpar alone, and in combination with Karmex were also evaluated on more than 70 different alfalfa varieties since 1981 that ranged from nondormant to very dormant characteristics. (The most recent trial results are summarized in Table 3). The observations and results can be outlined as follows:

- Velpar at 0.125 plus Karmex at 1.5 lbai/A provided very good control of a broad spectrum of winter annual grasses and broadleaf weeds (see Table 1).

- Applied after cutting or grazing by sheep when regrowth is minimal no evidence of phytotoxicity was observed on the regrowth of the alfalfa.

- Velpar plus Karmex applied after regrowth occurred provided very good weed control but caused yellowing (chlorosis) and burning (necrosis) of the alfalfa foliage sprayed. These symptoms persisted for 4 to 6 weeks, but later growth was free of the symptoms.

- Velpar when applied singly at 0.125 and 0.25 lbai/A was less effective especially for the control of established chickweed and grasses.

- The addition of MCI-500 (triamine triazine 55-0-0) did not enhance the activity of Velpar (see Table 2).

- The granular formulation of triamine-triazine plus Velpar at 0.5 lbai/A was not as effective as Velpar liquid formulation applied alone at the same rate.

- Rainfall or irrigation after the application of Velpar plus Karmex resulted in more rapid weed control.

- Summer annual grasses, especially yellow and green foxtails, were not controlled adequately with Velpar plus Karmex applied during the dormant period.

- More than 70 different varieties of alfalfa were found to be tolerant to Velpar plus Karmex when treated during the winter months, between November 1 and February 15. These studies were conducted during the past 4 years, the most recent established in 1984 is summarized in Table 3.

- Dinitro General (dinoseb), in combination with Surfel (paraffin-based adjuvant), provided very good control of emerged weeds. However, reinfestation occurred shortly after treatment (see Table 1).

- Two quarts of adjuvant containing 80% or more of paraffin-base petroleum oil was substituted for 5 to 10 gallons of oil in combination with Dinitro General for the control of emerged weeds. The alfalfa foliage was killed back but regrowth from the crown occurred rapidly.

- Furloe (chlorpropham) plus Paraquat and an adjuvant evaluated in earlier studies effectively controlled emerged seedling weeds in established alfalfa and provided short-lived residual control.

Although Dinitro General and Furloe provided temporary control of weeds, their use may be desirable where short-lived control is acceptable to avoid problems that may be caused by the use of a more persistant herbicide and if the alfalfa is to be plowed up early to plant another crop.

Volunteer Alfalfa Control

In alfalfa seed production it is essential to maintain the purity of the variety. Volunteer alfalfa germinating from seeds lost due to natural shattering of pods or during harvest must be controlled. This can be accomplished by repeated cultivation and cross-disking; however, this can injure the crowns, subject it to invasion by disease organisms and weak plants can be destroyed resulting in a reduced stand.

Effective volunteer alfalfa control was obtained in numerous trials conducted earlier and in commercial fields with:

- Velpar at 0.5 to 0.75 lbai/A in combination with 1.5 to 2.4 lbai/A of Karmex when applied prior to the germination of the alfalfa seed.
- Applied after the alfalfa seedlings had 1 to 2 trifoliate leaves Velpar plus Karmex provided marginal control.
- The most effective control was obtained when the herbicides were applied with a ground-rig in fields free of trash and large clods.

To obtain effective volunteer alfalfa control with the use of herbicides it is essential that following harvest the field be cultivated to thoroughly incorporate the straw and trailings into the soil. The furrows need to be reestablished before the herbicides are applied.

In soils that crack severely upon drying seedlings may emerge from below the herbicide treated layer resulting in poor weed and seedling alfalfa control. This can be minimized by shallow cultivation or harrowing.

IN NEWLY PLANTED ALFALFA

Preplant

Newly planted alfalfa hay and seed fields can be infested with a broad spectrum of annual broadleaf weeds and grasses. Herbicides that can be applied preplant or postemergence are available for their control. However, certain species of weeds can be controlled most effectively

with preplant incorporated herbicides, knotweeds (Polygonum sp.) are good examples. Some species of weeds become more tolerant to postemergence herbicides once beyond their seedling stage; therefore, they can be more easily controlled when herbicides are applied prior to planting.

Balan (benefin), Eptam (EPTC) and Tolban (profluralin) preplant incorporated were evaluated in many trials over the years including 1985. They provided very effective control of knotweeds (Polygonum sp.), fiddleneck (Amnsinckia), chickweeds (Stellaria sp.), redmaid (Calandrinia sp.), annual bluegrass (Poa annua) and others: weeds that are more difficult to control with postemergence applied herbicides.

Balan and Tolban provided longer residual control than Eptam. During the winter months (November through February) Eptam failed to control the weeds adequately; therefore, it should be used only on early fall or spring planted fields.

Postemergence

During recent years a number of herbicides were introduced that provide good control of annual and perennial grasses with excellent selectivity on most broadleaf plants. Several of these grass herbicides were evaluated since 1978 in newly planted alfalfa for the control of annual grasses including volunteer cereals.

In more recent studies emphasis was placed on the evaluation of several grass herbicides in combination with 2,4D-B ester and Brominal (bromoxynil) for the postemergence control of the broad spectrum of weeds that infest newly planted alfalfa. Several trials were conducted during 1985 to study the compatibility of different combinations of herbicides, their effect on the alfalfa and the spectrum of weeds they control. The results obtained in the trials, summarized in Tables 4 through 9, and the observations made can be outlined as follows:

- Alfalfa seedlings in the cotyledon, unifoliate leaf and later stage of growth exhibited very good tolerance to the grass herbicides.

- The most effective grass control was obtained when treated while in their seedling stage and growing vigorously. However, more mature (6 to 12 inch tall) grasses were controlled also.

- The addition of a paraffin-based adjuvant to all grass herbicides was essential.

- Herbicidal activity was slow to develop especially during cooler temperature. Growth of the grasses stopped but it was 4 to 6 weeks before they died back completely.

- None of the grass herbicides controlled annual bluegrass (Poa annua).

- The grass herbicides did not control any of the broadleaf weeds.

- Brominal or 2,4D-B ester in combination with the grass herbicides provided very good control of a large spectrum of broadleaf weeds and grasses.

- Brominal did not control chickweed, redmaids, purslane, henbit, nettles and clovers (weeds that are frequently found infesting alfalfa), whether used alone or in combination with the grass herbicides.

- 2,4D-B ester failed to control the following commonly occurring weeds in newly planted alfalfa: chickweed, pineapple weed, miner's lettuce, speedwell, fiddleneck and clovers.

- Brominal alone and in combination with the grass herbicides caused yellowing (chlorosis) of the alfalfa. The symptoms were more pronounced when the temperature was above 70 F. Four to five weeks after treatment the symptoms were not evident.

- Grass control was somewhat less effective and slower when the grass herbicides were used in combination with Brominal or 2,4 D-B ester. This was more pronounced in trials when the grasses were beyond their seedling stage and began to tiller when treated.

- Goal (oxyfluorfen) evaluated at 0.5 and 1.0 lbai/A, in earlier trials, exhibited marginal selectivity on seedling alfalfa.

- Low rates of Goal (0.125 lbai/A) in combination with low rates of Brominal (0.25 lbai/A) provided very good control of a broader spectrum of weeds than was obtained with either herbicide used alone. The alfalfa tolerance was good. This combination warrants further evaluation.

- AC-263 499 provided good control of broadleaf weeds but it was somewhat less effective on grasses. The alfalfa tolerance was excellent. The further evaluation of this herbicide should be pursued.

The grass herbicides evaluated in alfalfa and numerous other crops can be grouped according to their effectiveness in controlling annual and perennial grasses in the San Joaquin Valley as follows:

HERBICIDE		lbai/A	MOST ACTIVE	GRASSES NOT CONTROLLED 1/
Trade Name	Common Name			
Verdict	(haoloxyfop-methyl)	0.125-0.25		AnBl, BrGr
Assure		0.125-0.25		AnBl, BrGr
Fusilade 2000 IE	(fluazifop)	0.125-0.33		AnBl, BrGr
Poast	(sethoxydim)	0.25-0.5		AnBl, BrGr
Fusilade 4E	(fluazifop)	0.25-0.5		AnBl, BrGr
Trophy	(poppenate methyl)	0.25-0.5		AnBl, BrGr, RyGr
Selectone	(elopropoxidim)	0.30-0.5		AnBl, BrGr, JoGr
Whip	(fenoxaprop-ethyl)	0.30-0.5	Lesser in Activity	AnBl, BeGr, BrGr, RaGr, SpTo

1/ AnBl = Annual bluegrass, BrGr = bromegrasses, BeGr = Bermudagrass, JoGr = johnsongrass, RaGr = rabbitsfoot grass, RyGr = Ryegrass, SpTo = sprangletop.

IN CONCLUSION

The control of competing vegetation in alfalfa seed and hay production is essential to obtain optimum profitable yields. Effective tools, mechanical and chemical, as well as reliable information is available to growers that can enable them to control the broad spectrum of grass and broadleaf weeds that are infesting cropland.

Numerous herbicides are available that can significantly increase the

efficiency of weed control; however, their effective economical use can be accomplished only in a well planned vegetation management system. Knowledge of the weed infestation as well as proper timing of herbicide applications and accurate calibration of the spray equipment are very important.

The anticipated registration of Brominal and one or two grass herbicides will be a helpful addition to the tools for the control of unwanted competing vegetation in alfalfa hay and seed production.



Common groundsel and volunteer alfalfa infestation shown on the left was effectively controlled with the combination of 0.75 lbai/A of Velpar plus 2.0 lbai/A of Karmex.



Table 1

EFFECT OF POSTEMERGENCE APPLIED HERBICIDES ON WEED CONTROL IN ESTABLISHED ALFALFA

02, 425, 215, 10, 85-1

Location: West Side Field Station, Field 10
Soil Type: Panoche clay loam
Alfalfa Variety: Moapa 68
Irrigation Method: Basin flood
Alfalfa Planted: 4/16/81
Herbicides Applied: 12/5/84
Evaluated: See below*

Herbicides	Lb.ai/ Acre	WEED CONTROL EVALUATIONS 1/15/85 Brdlf. Control	1/15/85 Grass Control	3/5/85 Brdlf. Control	3/5/85 Grass Control
A Velpar Karmex	0.125 1.5	99	96	99	97
B Velpar Karmex	0.25 1.5	100	99	100	99
C Velpar Karmex	0.5 1.5	100	100	100	100
D Dinitro General Surfel	2.0 2 qts.	97	90	77	77
E Untreated	---	0	0	0	0

*Average of 4 replications.

Table 2

EFFECT OF POSTEMERGENCE APPLIED HERBICIDES ON WEED CONTROL IN ESTABLISHED ALFALFA

02, 425, 215, 10, 85-2

Location: West Side Field Station
Irrigation Method: Basin Flood
Soil Type: Panoche clay loam
Plot Size: 8' x 30', Reps 4
Variety: Moapa 69
Planted: 4/16/81
Herbicides Applied: 1/9 and 1/10/85
Evaluated: See below
Vol./A: 27GPA, A-F; 67GPA, G-K

		WEED CONTROL AND ALFALFA INJURY EVALUATIONS							
		2/8/85		2/28/85		3/20/85			
Herbicide	Lb.ai/ Acre	Percent Chickw. Contr.	Alf.* Injury	Percent Chickw. Contr.	Percent Grass Contr.	Percent Chickw. Contr.	Percent Brdlf. Contr.1/	Percent Grass Contr.	Alf.* Injury
A Velpar	0.125	7	2.0	12	25	20	25	30	0
B Velpar	0.25	44	6.0	49	23	55	85	35	0
C Velpar	0.5	87	8.0	96	34	99	90	40	0
D Velpar	1.0	91	8.5	99	75	100	100	80	1.0
E Velpar Karmex	0.25 2.0	92	8.5	99	80	100	100	95	0
F Velpar MCI 55-0-0	0.125 25.0	9	2.0	10	5	20	30	20	0
G Velpar MCI 55-0-0	0.25 25.0	27	7.0	34	46	40	80	45	0
H Velpar MCI 55-0-0	0.5 25.0	65	8.0	97	60	100	100	75	0
J Velpar MCI 55-0-0	1.0 25.0	86	8.5	91	84	100	100	90	1.0
K Velpar Karmex MCI 55-0-0	0.25 2.0 25.0	92	8.0	97	90	100	100	95	0
L MCI 55-0-0 Velpar/4%	0.5	61	6.5	73	69	80	85	75	0
M Untreated	---	0	0	0	0	0	0	0	0

*Injury rating based on a scale of 0-10; 0=no injury, 10=severely injured plants

1/Other broadleaf weeds: common groundsel, London rocket, shepherd's purse, sowthistle
grasses: annual bluegrass, Meriterranean barley, wild oats

Table 3

THE EFFECT OF POSTEMERGENCE APPLIED HERBICIDES ON WEED CONTROL AND TOLERANCE OF 48 VARIETIES OF ALFALFA

02, 425, 94, 10, 84-2

Trial Location: Westside Field Station
Soil Type: Panoche clay loam
Alfalfa Planted: 11-18-80

Plot Size: 5' x 3', Reps. 4
Herbicides Applied: 12-2-83

Alfalfa Varieties

1.	CW-8035	13.	WL-75 Ca A-2	25.	Pi UMNQ-1(Com-1)	37.	WL-512
2.	CW-8037	14.	WL-76 Ca K	26.	Rere	38.	Maxidor
3.	Moapa 69	15.	Pioneer Sm	27.	Siriver	39.	Amador
4.	Lahontan	16.	Pierce (79176)	28.	MeA 00	40.	Matador
5.	CUF-101	17.	NK C-80-628	29.	MeA MM	41.	Validor
6.	Granada	18.	NK C-80-631	30.	CUF-101A	42.	NC+ 8800 Br.
7.	UC-186	19.	NK C-79-616	31.	Baron	43.	Magnun
8.	UC-193	20.	C.M. A 21-R	32.	NC+ 8000 Br.	44.	D.S.-001
9.	UC-195	21.	Ardiente	33.	NC+ 6600 Br.	45.	D.S.-005
10.	UC-196	22.	ND-107 (80A6)	34.	Nova	46.	D.S.-012
11.	WL-515 (73 CaA)	23.	AS-13R	35.	Florida 77(66a)	47.	Cimarron
12.	WL-514	24.	Pioneer Br. 572	36.	Galaxy	48.	Hunter River

Herbicide	Lb.ai/ Acre	WEED CONTROL AND ALFALFA INJURY EVALUATION					
		12-21-83		2-14-84		4-10-84	
		% Weed Control[2]	Alfalfa Injury[1]	% Weed Control[2]	Alfalfa Injury[1]	% Weed Control[2]	Alfalfa Injury[1]
A Velpar	1.0	100	5.0	100	1.0	99	0
B Velpar Karmex	0.5 1.2	100	6.0	100	1.2	100	0
C Furloe Paraquat Surfel	4.0 0.5 2 qt	90	9.0	80	0	45	0
D Dinitro General Surfel	2.0 2 qt	98	9.8	40	0	0	0

1/ Rating based on a 0 to 10 scale: 0 = no injury; 10 = very severe injury. Ratings on 12-21 in treatments A and B reflect the chlorsis and necrosis of the alfalfa foliage. In treatment C and D the alfalfa foliage was dead.

2/ Weeds present were common groundsel, chickweed, annual bluegrass, London rocket, and knotweed.

Remarks: Altnough differences in the growth, vigor, and density of the alfalfa were evident among the varieties, the differences were due to the variations in the growth of the varieties and not the influence of the herbicides.

Table 4- EFFECT OF POSTEMERGENCE APPLIED HERBICIDES ON WEED CONTROL AND INJURY IN NEWLY PLANTED ALFALFA

02, 425, 215, 10, 85-3

Location: West Side Field Station, Field 20
Soil Type: Panoche clay loam
Variety: CUF-11
Herbicides Applied: 2/22/85

Irrigation Method: Basin Flood
Plot Size: 5' x 20', Reps 3
Planted: November, 1984
Evaluated: See below

		WEED CONTROL AND INJURY EVALUATIONS[1]					
		3/14/85			4/1/85		
Herbicide	Lb.ai/ Acre	Percent Barley Control	Percent Brdlf. Control	Alfalfa Injury*	Percent Barley Control	Percent Brdlf. Control	Brdlf. Weeds Present
A Fusilade 2000	0.5	70	60	0.3	100	65	Lr, Mu, Sp
Brominal 4E	0.5						
Surfel	1 qt.						
B Fusilade 2000	0.5	73	57	0.7	100	57	Lr, Sp
Brominal 2fl	0.5						
Surfel	1 qt.						
C Fusilade 2000	0.5	70	20	0.5	92	42	Lr, O, Sp
2,4D-B ester	0.75						
Surfel	1 qt.						
D Fusilade 2000	0.25	70	0	0	100	13	Lr, O, Sp
Surfel	1 qt.						
E Brominal 4E	0.5	0	83	1.7	0	64	Lr
F 2,4D-B ester	0.75	0	17	0	0	50	Lr, O, Sp
G Assure	0.25	73	70	1.3	100	62	Lr, Sp
Brominal 4E	0.5						
Surfel	1 qt.						
H Assure	0.25	77	0	0	100	0	--
Surfel	1 qt.						
J Assure	0.25	80	0	0	100	17	Lr, Sp
Surfel	1 qt.						
K Untreated	---	0	0	0	0	0	Lr, O, Sp

*Injury rating based on a scale of 0-10; 0=no injury, 10=severe injury.

1/In the 4/1/85 evaluation, there was no injury evident in any of the treatments.

WEEDS PRESENT: Lr=London rocket, Mu=mustard, O=common groundsel, Sp=shepherd's purse

Table 5- EFFECT OF PREPLANT AND POSTEMERGENCE APPLIED HERBICIDES ON WEED CONTROL IN ALFALFA

02, 42, 425, 94, 10, 85-7

Trial Location:	Westside Field Station	Irrigation:	Furrow
Soil Type:	Panoche Clay Loam	Plot Size:	5' x 20', REPS. 4
Alfalfa Planted:	2/19/85	Evaluated:	5/1/85
Alfalfa Variety:	CUF-101		
Herbicides Applied:	2/19, 3/20, 4/1/85		
	3/20 - alfalfa, unifoliate to 1 trifoliate		
	4/1 - alfalfa, 2 to 3 trifoliate		

HERBICIDE	Lb.ai/ Acre	Date of Treatment	Weed Control and Alfalfa Vigor Evaluation		
			% Broadleaf Control	% Grass Control	Alfalfa 1/ Vigor
A Balan 2,4-DB ester	1.5 0.75	2/19 4/1	93	58	10.0
B Balan 2,4-DB ester	1.5 0.75	2/19 3/20	86	55	9.5
C Tolban Brominal	0.75 0.50	2/19 4/1	99	57	9.7
D Tolban 2,4-DB ester	0.75 0.75	2/19 3/20	97	68	9.0
E Eptam Brominal	3.0 0.50	2/19 4/1	100	100	9.0
F Eptam 2,4-DB ester	3.0 0.75	2/19 3/20	99	99	8.5
G Poast * Brominal	0.3 0.5	3/20	98	93	10.0
H Poast * 2,4-DB ester	0.3 0.75	3/20	85	88	9.0
I Fusilade 2000* 2,4-DB ester	0.25 0.75	3/20	87	91	9.0
J Fusilade 2000*	0.25	3/20	0	99	10.0
K Poast * 2,4-DB ester	0.40 0.75	3/20	87	87	9.0
L AC-263 499 **	0.125	3/20	76	12	9.0
M AC-263 499 **	0.25	3/20	82	35	9.5

1/ Vigor evaluation based on a 0 to 10 scale. 0 = very poor vigor, 10 = vigorously growing alfalfa

2/ Weeds present: mustard, sowthistle, London rocket, shepherd's purse, pigweed, lambsquarter, ryegrass, barley

* Surfel added at 1 qt/A

** X-77 added at 1/2% of spray volume

(continued on following page)

Table 5 - (Cont'd) EFFECT OF PREPLANT AND POSTEMERGENCE APPLIED HERBICIDES ON WEED CONTROL IN ALFALFA

02, 42, 425, 94, 10, 85-7
(continued from preceding page)

Trial Location: Westside Field Station
Soil Type: Panoche Clay Loam
Alfalfa Planted: 2/19/85
Alfalfa Variety: CUF-101
Herbicides Applied: 2/19, 3/20, 4/1/85
3/20 - alfalfa, unifoliate to 1 trifoliate
4/1 - alfalfa, 2 to 3 trifoliate

Irrigation: Furrow
Plot Size: 5' x 20', REPS. 4
Evaluated: 5/1/85

	HERBICIDE	Lb.ai/ Acre	Date of Treatment	Weed Control and Alfalfa Vigor Evaluation		
				% Broadleaf Control	% Grass Control	Alfalfa 1/ Vigor
N	2,4-DB ester	0.75	3/20	71	0	9.0
O	Brominal	0.50	3/20	97	0	10.0
P	Poast *	0.30	4/1	98	88	10.0
	Brominal	0.50				
Q	Poast *	0.3	4/1	85	80	9.0
	2,4-DB ester	0.75				
R	Fusilade 2000 *	0.25	4/1	98	92	10.0
	Brominal	0.50				
S	Fusilade 2000*	0.25	4/1	65	82	9.0
	2,4-DB ester	0.75				
T	Assure *	0.25	4/1	75	88	9.0
	2,4-DB ester	0.75				
U	Assure *	0.25	4/1	98	90	10.0
	Brominal	0.50				
V	AC-263 499 **	0.125	4/1	70	32	10.0
W	AC-263 499 **	0.25	4/1	80	77	10.0
Y	Trophy	0.5	4/1	95	75	10.0
	Brominal	0.5				
Z	Goal	0.25	4/1	97	35	9.0
	Brominal	0.25				
AA	Goal	0.25	4/1	62	20	8.0
BB	Goal	0.125	4/1	100	96	9.0
	Brominal	0.25				
	Poast *	0.40				
X	Untreated			0	0	10.0

1/ Vigor evaluation based on a 0 to 10 scale. 0 = very poor vigor, 10 = vigorously growing alfalfa
* Surfel added at 1 qt/A
** X-77 added at 1/2% of spray volume

Table 6- EFFECT OF POSTEMERGENCE APPLIED HERBICIDES ON ALFALFA WEED CONTROL

02, 42, 425, 94, 10, 85-5

Location: 4435 S. Elm, M. Coehlo (E. side of Hwy 41)
Irrigation Method: Basin Flood
Soil Type: Hesperia fine sandy loam
Plot Size: 5' x 20', Reps 4
Planted: January, 1985
Herbicides Applied: 3-13-85
Evaluated: See below

		WEED CONTROL EVALUATIONS IN ALFALFA									
		3-23-85				4-6-85				5-11-85	
Herbicide	Lb.ai/ Acre	% BRDLF. CONTR.	% GRASS CONTR.	INJ.*	BRDLF. WEEDS PRES.	% BRDLF. CONTR.	% CONTROL BYNGR. SDL.	% CONTROL BYNGR. JHNGR	% CONTROL RHYZ. JHNSGR.	BRDLF. WEEDS PRES.	% BRDLF. CONTR.	% 1/ CONTR. JOHNSGR.
A Poast	0.3	0	18	0	Fn,R,Sp,Y	0	90		52	Chw,Lr, Sp, Y	0	69
Surfel	1 qt.											
B Poast	0.4	0	20	0	Fn,R,Sp,Y	0	98		52	Chw,Fn, Sp,R,Y	0	69
Surfel	1 qt.											
C Poast												
2,4D-B ester.	0.75	55	20	0.5	R,Y	76	90		52	R,Y	71	49
Surfel	1 qt.											
D Poast												
2,4D-B ester.	0.75	55	20	0.7	R,Y	77	85		46	R,Y	75	47
Surfel	1 qt.											
E Poast	0.4											
Brominal	0.5	87	22	1.5	R	85	95		61	R	90	55
Surfel	1 qt.											
F Poast	0.4											
Brominal	0.5	87	25	2.0	R	85	95		56	Chw,R	87	75
Surfel	1 qt.											
G Untreated	---	0	7	0	Fn,R,Sp,Y	0	0		0	Fn,R,Sp,Y	0	0

WEEDS PRESENT: Chw=chickweed, FN=fiddleneck, LR=London rocket, R=redmaids, SP=shepherd's purse, Y=pineappleweed

*Injury rating based on a scale of 0-10. 0=no injury, 10=severe injury to alfalfa

1/ Weeds present: wild mustard, pineappleweed, chickweed, redmaid, fiddleneck, London rocket. Grasses present: johnsongrass, barnyardgrass.

Table 7

EFFECT OF POSTEMERGENCE APPLIED HERBICIDES ON ALFALFA WEED CONTROL

02, 42, 425, 94, 10, 85-6

Location: 4435 S. Elm, M. Coehlo (E side of Hwy. 41) Irrigation Method: Basin Flood

Soil Type: Hesperia fine sandy loam Plot Size: 5' x 20', Reps 4

Planted: January, 1985 Evaluated: See below

Herbicides Applied: 3/20/85

		WEED CONTROL EVALUATIONS AND WEEDS PRESENT IN ALFALFA						
		4/6/85				5/11/85		
Herbicide	Lbai/ Acre	%Brdlf. Contr.	%Barnyard-grass Sdlg. Control	%Rhizom. Johnson-grass Control	Brdlf.* Weeds Present	% Brdlf. Control	%Rhizom. Johnson-grass Control	Brdlf.* Weeds Present
A Poast Surfel	0.3 1 qt.	0	95	77	Fn,L,Lr, R,Y	0	80	Chw,Fn,L,Lr, R, Sp, Y
B Poast Surfel	0.4 1 qt.	0	98	62	Fn,L,Lr, R,Y	0	75	Chw,Fn,L,Lr, R, Sp, Y
C Poast 2,4-DB ester Surfel	0.3 0.75 1 qt.	56	90	60	Fn,R,Y	67	49	Chw,Fn,R,Sp,Y
D Poast 2,4-DB ester Surfel	0.4 0.75 1 qt.	52	90	61	Fn,R,Y	80	66	Chw,Fn,R,Sp,Y
E Poast Brominal Surfel	0.3 0.5 1 qt.	80	95	74	R	84	70	Chw,R
F Poast Brominal Surfel	0.4 0.5 1 qt.	84	95	74	R	87	76	Chw,R
G Untreated	----	0	0	0	Fn,L,Lr, R,Y	0	0	Chw,Fn,L,Lr, R, Sp, Y

*WEEDS PRESENT (4/6/85): Fn-fiddleneck, L-lambsquarter, Lr-London rocket, R=redmaids, Y=pineappleweed

*WEEDS PRESENT (5/11/85): Chickweed, fiddleneck, lambsquarter, pineappleweed, redmaid, shepherd's purse,

NOTE: Injury rating "0" in all plots

Table 8- EFFECT OF POSTEMERGENCE APPLIED HERBICIDES ON ALFALFA WEED CONTROL

02, 42, 425, 94, 10, 85-8

Location: 4435 S. Elm, M. Coehlo (E. side of Hwy 41) Irrigation Method: Basin flood

Soil Type: Hesperia fine sandy loam Plot Size: 5' x 20'

Planted: January, 1985 Herbicides Applied: 3-29-85

Evaluated: See below

		WEED CONTROL AND INJURY EVALUATIONS IN ALFALFA						
		4-6-85			5-11-85			
		%	%		%	% GRASS CONTR. 1/		Brdlf.
Herbicide	Lb. ai. Acre	Brdlf. Contr.	Grass Contr.	Injury*	Brdlf. Contr.	BYNGR. SDL.JNSGR.	RHYZ. JNSGR.	Weeds Present
A Poast 2,4-DB ester	0.3 0.75	34	65	--	62	80	66	Fn,Lr,R,Y
B Poast Brominal	0.3 0.5	85	67	0	91	90	72	Fn,Lr,R,Y
C Poast 2,4-DB ester	0.4 0.75	42	69	3.0	60	85	70	R,Sp,Y
D Poast Brominal	0.4 0.5	76	66	1.0	72	98	79	Chw,R
E Fusilade 2000 2,4-DB ester	0.25 0.75	35	60	0	74	85	75	Chw,Fn,R,Sp,Y
F Fusilade 2000 Brominal	0.25 0.5	86	67	3.5	91	95	77	Chw,R
G Goal Brominal Poast	0.125 0.25 0.4	82	67	0	99	100	80	R,Y
H Poast	0.5	0	66	--	0	95	75	Chw,Fn,Lr, R,Sp,Y
J Untreated	---	0	0	--	0	0	0	Chw,Fn,Lr, R,Sp,Y

NOTES: Surfel @ 1 qt/A added to all treatments. Chlorosis evident in Treatments B, C, D, E and F.

*Injury ratings based on a scale of 0-10. 0=no injury, 10=severe injury to alfalfa.

Weeds Present: Chw=chickweed, Fn=fiddleneck, Lr=London rocket, R=redmaids, Sp=shepherd's purse, Y=pineappleweed.

1/ In plots treated with grass herbicides the barnyardgrass was killed; however, the johnsongrass has either germinated since the application or there was some regrowth from the earlier treatment. The broadleaf weeds in the Brominal treated trials were primarily chickweed and redmaids. In the 2,4-DB ester treated areas the predominant weeds were pineappleweed, some chickweed and redmaids.

SECTION II

DODDER CONTROL STUDIES

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DODDER CONTROL STUDIES

Dodder (Cuscuta sp.) is an obligate parasite. It obtains all its nutrients and moisture from alfalfa and other host plants by penetrating their tissues with root-like structures call haustoria. Dodder is an annual and has to reproduce every year from its abundantly produced seeds. It is one of the most destructive, difficult to control weeds that infest alfalfa hay and seed fields. Once it becomes attached to its host plant the only way it can be controlled, with presently available tools, is by killing the vegetative parts penetrated by the haustoria.

The most effective control measure is to avoid planting crops that are hosts of dodder into fields that are infested with seeds of dodder. Since it is an annual, prevention of seed production is also essential. This requires the destruction of the host plant; however, alfalfa being a perennial will rapidly regrow from its crown after its dodder infested vegetative parts are destroyed. Dodder does not penetrate the roots of alfalfa.

Dodder seeds can survive in the soil for decades; therefore, constant vigilance and monitoring is essential especially in fields with a history of infestation.

Numerous investigators have evaluated a large number of herbicides and different methods of control. Several of them were found to control dodder before they become attached to the host plant. Some herbicides controlled the growth and prevented the spread of dodder after attachment. The development of some promising herbicides were not pursued by their manufacturer, others provide partial or short-lived control and still others are expensive to use.

Dodder infestations generally occur in limited areas in fields, seldom exceeding 2 to 5% of the total acreage. To control them by treating the entire field would be necessary prior to attachment but very expensive unless the herbicide provides long residual control not only of dodder but other annual weeds as well.

Herbicides, available on the market that provided control of dodder are: Dacthal (chlorthal), Furloe (chlorpropham) and Kerb (pronamide). Studies evaluating their performance have been reported by numerous investigators.

The most extensively used method of control in alfalfa is treating the infested areas with contact herbicides such as: dinitro general (dinoseb), weed oil, diesel fuel, propane and butane burners. Thorough destruction of the alfalfa foliage is essential. In hay fields this should be done as soon as possible after cutting.

STUDIES CONDUCTED IN 1985

Trials were conducted to evaluate the effectiveness of Treflan 10G (trifluralin 10% granular formulation) for the control of dodder before they become attached to the alfalfa. Low rates of Kerb (pronamide) and Roundup (glyphosate) were used in a trial to study their effectiveness in controlling attached dodder.

Greenhouse studies by numerous investigators indicated that low rates of Roundup arrested the growth of dodder with minimal or no injury to the host plant. However, under field conditions I found that very low rates of Roundup (0.01 and 0.02 lbai/A) failed to provide adequate control of dodder and caused temporary growth retardation and deformity of the rapidly growing tissue (meristem) on tomato, melon and alfalfa plants. A trial was conducted to evaluate the effect of different rates of Roundup on alfalfa.

Procedures Used

Treflan 10G was applied with a fixed wing airplane at 2.0 and 4.0 lbai/A in an alfalfa field that was heavily infested with dodder in 1984. The accuracy of the rate of application is difficult to ascertain. The plane was calibrated to deliver 20 lb/A of material. To obtain 4.0 lbai/A, two passes were made. The herbicide was applied April 6 following the second

cutting. The timing of application was somewhat late but thorough examination of the field revealed only two colonies of attached dodder. The field was irrigated (basin flood) within 24 hours after treatment. The effectiveness of dodder and foxtail (Setaria sp.) control was assessed several times (see Table 1).

Following the fourth cutting in another area of the same field Kerb and Roundup were applied in an area where the dodder was attached to the alfalfa stubble. A back-pack CO_2 constant pressure sprayer was used to apply the herbicides in 33 gallons of water per acre. At the time of treatment the alfalfa ranged between 3 to 6 inches in height. The last evaluation of the effect of treatment was made two days prior to cutting (see Table 2).

The tolerance of alfalfa to Roundup was investigated in a four year old alfalfa stand. The herbicide was applied following the removal of the baled hay when the alfalfa regrowth ranged between 4 to 8 inches. An experimental sprayrig using compressed air as a propellent was used to apply the herbicide in 22.5 gallons of water per acre. Numerous evaluations were made that are summarized in Table 3.

DISCUSSION OF RESULT OBSERVED

The evaluation of the trials are summarized in the following three tables. The results obtained and observations made indicate that:

- Treflan 10G can provide effective control of dodder if applied prior to attachment.
- Treflan 10G at 2.0 and 4.0 lbai/A provided approximately three (3) months of residual control.
- Multiple applications of Treflan 10G need to be investigated for season long dodder control in central California.
- No adverse effect from the application of Treflan 10G was detectable on the alfalfa.
- Treflan 10G also provided temporary control of yellow and green foxtails (Setaria sp.).

- The earlier application of Treflan 10G could have resulted in better foxtail and dodder control. Further evaluation and multiple applications should be pursued.

- Kerb applied at 0.25 and 0.5 lbai/A arrested the growth of the attached dodder, however, only for a short period of time (see Table 2).

- The evaluation of low rates of Kerb on dodder in earlier stage of growth as well as multiple applications should be investigated.

- Roundup at 0.02 lbai/A failed to provide adequate dodder control (see Table 2).

- Roundup adversely affected the growth and yield of alfalfa at all rates included in the trial as shown in Table 3.

- Statistically significant yield reduction was obtained at 0.1 lbai/A rate of application.

- It is questionable whether Roundup could be used for dodder control in alfalfa.

COMMENTS AND CONCLUSIONS

Dodder continues to be a very serious problem in both alfalfa hay and seed production. In hay fields Treflan 10G, and possibly other dintroaniline herbicides, look very promising not only for dodder control but for the control of summer annual grasses as well, especially green and yellow foxtail.

In the further investigation of the use of relatively high rates of dinitroaniline herbicide in alfalfa, their residual properties under this method of application should be studied.

Table 1

EVALUATION OF TREFLAN 10G FOR DODDER AND FOXTAIL CONTROL IN ALFALFA

02, 425, 215, 10, 85-9

Location: Bishop Ave., 1/2 mi. N. of Lincoln
Soil Type: Hesperia fine sandy loam
Herbicide Applied: 4/6/85
Irrigation Method: Basin flood
Plot Size: 40' x 600'
Evaluated: See below

		DODDER CONTROL EVALUATIONS					
		5/16/85		6/11/85		6/21/85	
Herbicide	Lbai/ Acre	No. of 1/ Colonies	Percent Control	No. of 1/ Colonies	Percent Control	No. of 1/ Colonies	Percent Control
Treflan 10G	2.0	1.5	90	3.6	85	36	25
Treflan 10G	4.0	0.5	98	2.3	90	28	50
Untreated	---	24.0	0	75.0	0	70	0

1/Average number of colonies counted in the treated areas.

		PERCENT YELLOW AND GREEN FOXTAIL CONTROL 2/		
Herbicide	Lbai/ Acre	5/16/85 Percent Control	6/11/85 Percent Control	6/21/85 Percent Control
Treflan 10G	2.0	98	90	70
Treflan 10G	4.0	100	95	80
Untreated	---	0	0	0

2/Evaluated as percent of the untreated

REMARKS: The roots of the yellow and green foxtail that became established in the trial were retarded in growth and the plants could be readily dislodged. However, following the cutting in June, the roots and the foliage began to grow more vigorously.

Table 2

EVALUATION OF HERBICIDES FOR DODDER CONTROL IN ALFALFA

02, 425, 215, 10, 85-10

Location: Bishop Ave., 1/4 mi. N. of Lincoln Ave. Irrigation Method: Basin flood

Soil Type: Hesperia fine sandy loam Plot Size: 10' x 60', Reps 3

Herbicides Applied: 7/16/85 Evaluated: See below

Alfalfa Height: 3 to 6 inches

Dodder Growth: 6 to 10 inch long strands

Herbicide	Lbai/ Acre	DODDER CONTROL AND ALFALFA INJURY EVALUATIONS[1/] 7/21/85 Percent Dodder Control	7/21/85 Alfalfa[2/] Injury	8/13/85 Percent Dodder Control	8/13/85 Alfalfa[2/] Injury
A Kerb X-77	0.25 ½%	50	0	10	0
B Kerb X-77	0.5 ½%	65	0	25	0
C Roundup X-77	0.02 ½%	25	2.0	0	0
D Untreated	---	0	0	0	0

1/Evaluation expressed as percent of infestation compared to the untreated area.

2/Injury evaluation based on a scale of 0 to 10. 0 = no injury, 10 = very severe injury. The expression of injury in the Roundup treated areas was slight growth retardation.

Table 3

EVALUATION OF THE TOLERANCE OF ALFALFA TO ROUNDUP (GLYPHOSATE)

02, 425, 215, 10, 85-11

Location: West Side Field Station
Soil Type: Panoche clay loam
Alfalfa Variety: Moapa 69
Alfalfa Planted: 1981

Irrigation Method: Basin flood
Plot Size: 10' x 60', Reps 4
Herbicide Applied: 8/26/85
Evaluated: See below

		ALFALFA GROWTH, VIGOR AND YIELD EVALUATIONS					
		9/5/85	9/9/85		9/16/85		9/26/85
Herbicides	Lbai/ Acre	Vigor Percent of Untreated	Height In Inches	Height Percent of Untreated	Yield Lbs. in 4 ft. of Row	Tons/A Green	Vigor Percent of Untreated
Roundup	0.05	80	22.3	94.5	0.99	5.4	85
Roundup	0.1	75	22.2	94.0	0.91	4.9	80
Roundup	0.2	60	21.8	92.3	0.81	4.4	57
Roundup	0.4	35	17.1	72.4	0.46	2.5	37
Roundup	0.8	20	11.4	48.3	0.26	1.4	20
Untreated	---	100	23.6	100.0	1.01	5.5	100

LSD 1%. 0.255
LSD 5%. 0.162

SECTION III

HERBICIDE RESIDUE STUDIES

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HERBICIDE RESIDUE STUDIES

Alfalfa is grown in rotation with more than two dozen crops in central Calfiornia. Herbicides that vary greatly in their residual properties are extensively used in the production of all crops. Small quantities of certain herbicides remaining in the soil beyond the harvest of the crop in which it was applied can adversely affect the emergence and growth of the crop that follows in rotation.

Poor emergence, erratic stand, distorted plants, chlorotic, necrotic and curled seedlings, and twisted sugarbeets caused by residual herbicides are not uncommon occurrences. Therefore, it is essential to study the residual properties of herbicides to determine safe cropping sequences before they are used. This is a demanding task, especially in an area where a large number of crops are grown.

Field bioassay studies have been conducted at the West Side Field Station to study the residual properties of herbicides to enable us to answer the innumerable questions about safe cropping sequences. These studies were initiated many years ago and most of the herbicides used in crop production in California have been evaluated in these studies.

Procedures Used

Herbicides used were included at the rates used (in case of experimental compounds at the anticipated rate) and four times (4X) use rate. Over the years, the individual plots varied in size. In the past, the herbicides were applied with CO_2 constant pressure sprayers. More recently an experimental sprayer was used with compressed air as a propellent and mechanical shaker to keep the herbicides in suspension. The herbicides were incorporated with power- or ground-driven rotary tillers or applied after planting if their anticipated use was preemergence or post-emergence. Each treatment was replicated four times in randomized block designs.

The selection of eight different crops planted on 30" beds in each plot was governed by the season when planting occurred, but they always included two monocots such as barley, wheat, sorghum or millet. A wide variety of dicots were used, cotton was included in the spring and summer plantings. The area was sprinkler irrigated once or twice to obtain a stand after seeding, but subsequent irrigations were by furrow.

The crops were grown for 3 to 3 1/2 months during which time stand counts plus two or three visual assessments of vigor and phytotoxicity symptoms were made. The trial area was then tilled in such a manner as to maintain the integrity of the individual plots.

After a four to six week interval, the plots were planted again with eight crops. Hence, during the year the area was cropped three times. The recropping continued until no evidence of herbicidal activity was observed by any herbicide used in the trial. A large quantity of data has been generated from the trials.

OBSERVATIONS AND DISCUSSION

Over the years it was found that numerous widely used herbicides can have adverse effect on crops planted in rotation following a crop in which they were used. The most sensitive crops were sugar beets, lettuce, melons and tomatoes. The most often encountered residue problems were caused by:

- Dinitroanilines (Treflan, Prowl, Cobex, etc.)
- Triazines (Princep, Simazine, Aatrex, Velpar)
- Amides (Devrinol)
- Ureas (Karmex, Lorox, Spike)
- Aryl aliphatic acids (Benzac, Banvel, Trysben)
- Chlorsulfuron (Glean, Oust)

There are numerous factors that influence the residual properties of herbicides. The most important of these are:

- rate of application,
- time of application as related to harvest,

- frequency and method of irrigation,
- method of application - such as band or broadcast, preplant incorporated or surface applied,
- chemical properties of the herbicide such as adsorptive capacity, leachability and mode of degradation,
- soil type and salinity.

Considering these factors, one can appreciate the need for the development of local information, especially in an area where a large number of crops are grown on soils very low (1% or less) in organic matter. Although all crops are irrigated, they receive different amounts of water. Also, the temperature during the summer exceeds 90^{o} to 100^{o} F for prolonged periods. Over the years, results obtained in these residue trials have been incorporated into the cropping restriction statements of many herbicide lables. However, it is recognized that some of the statements are over-restrictive and growers have difficulty observing them. This is especially true for those that limit planting of certain crops for 12 to 24 months and require that the field be plowed 12" deep. A good example is restrictions on the use of Velpar following its use in alfalfa.

The Dilemma With Dinitroanilines

Dinitroanilines, especially Treflan and Prowl, are used in cotton, tomatoes, melons, safflower, alfalfa, beans, and sugar beets. They are applied prior to planting, preemergence, soon after emergence and/or lay-by. It would be desirable if growers could plan either their cropping sequence at least two years in advance, or when selecting herbicides in a specific crop, they would consider subsequent croppings. Another effective way to minimize problems arising from residual herbicides would be to use the minimum rate suggested on the label or use lower than the recommended rate. However, the grower or user assumes responsibility or liability for poor performance when using a rate lower than indicated on the label.

The degradation of dinitroaniline herbicides is greatly influenced by soil moisture. Therefore, adverse residual effects from Treflan or Prowl will be influenced by the frequency of irrigation and the length of time the crop is grown as well as the rate and time of application. Crops in which dinitroaniline herbicides are used can be ranked according to residue problems encountered on sugar beets as follows:

Crop	Most Frequently Encountered
Beans	
Safflower	
Alfalfa (Seed)	
Cotton	
Alfalfa (Hay)	
Cantaloupes	
Tomatoes	Least Frequently Encountered

Treflan is extensively used post-thinning in sugar beets but no residue problems have been encountered on any subsequently planted crops.

The effect of Treflan and Prowl residues on sugar beets following their use in cotton, beans and safflower are frequently observed. Slight twisting of the taproot of sugar beets, a typical symptom, has not resulted in statistically significant yield reductions. The most severe injury (loss of taproot) or loss of stand are generally encountered in areas of the field where an excessive amount of herbicide was applied as a result of:

- miscalibration of sprayer
- overlapping during application
- not shutting off the sprayer while turning at the ends of the fields
- "dressing up" the field
- using follow-up applications in mid-season

Residue problems caused by herbicides can be minimized or avoided by:

- applying them at the minimum rate that will provide effective weed control
- carefully calibrating the sprayer and avoiding overlapping

Problems With Other Herbicides

Napropamide (Devrinol) at 1.0 to 2.0 lbai/A, is extensively used in tomatoes and peppers and has caused injury to sugar beets, lettuce and cereals planted following their harvest. The most serious problems are encountered following tomatoes planted in two rows on 50 to 66" beds. During irrigations on certain soils, the surface two inches of soil in the center of the beds remain dry resulting in very slow breakdown of the herbicide. Therefore, if possible, beets, lettuce and cereals should not be planted following peppers and tomatoes, especially on saline soils where the bed-tops remain dry during irrigation. In soils that are wetted thoroughly during irrigations, applying the minimum label rate of Devrinol has not resulted in injury. No injury was encountered on cotton following the use of Devrinol on tomatoes or peppers.

Hexazinone (Velpar) is a very effective herbicide for the control of winter annual weeds in alfalfa, consequently, it is used extensively in alfalfa fields on farms where cotton is also grown. To avoid problems, growers should not apply Velpar during the last year of the stand. However, we have learned that Velpar can provide very effective control of common groundsel (Senecio vulgaris L), one of the most troublesome winter annuals in alfalfa, and other broadleaf weeds at 0.125 to 0.25 labi/A. At these low rates we encountered no residue problems on cotton and other broadleaf crops 8 to 10 months following their application in alfalfa hay fields.

Triazines, Aliphatic Acids and Ureas

Herbicides with long residual properties to which many crops are very sensitive are rarely used on farms in central California. Simazine (Princep), atrazine (Aatrex), tebuthiuron (Spike), picloram (Tordon),

chlorsulfuron (Glean) and dicamba (Banvel) are examples of herbicides with long residual properties.

More Recently Conducted Study

A trial was established May 30, 1984, on Panoche clay loam soil, with less that 1% organic matter to study the soil persistence of ten herbicides and to evaluate the relative tolerance of numerous crops that could be planted in rotation following their use in a specific crop.

The herbicides were applied in 20' X 30' with a 3' buffer between plots, at rates that are used commercially (in case of experimental compounds, at their anticipated commercial use rate) and four times (4X) those rates. The exact rates applied are given in the following tables. Each treatment was replicated four times in a randomized block design. The individual plots contained eight 30-inch beds. The herbicides were applied in 54 gallons of water per acre with an experimental sprayer using compressed air as a propellant.

Following the application of the herbicides they were incorporated with sectioned rolling cultivators (Lillistons). Following incorporation the beds were rolled to firm the soil and facilitate planting. Eight different crops (monocots and dicots) were planted in each plot. The field was sprinkler irrigated.

The emerged seedlings were counted July 6 and vigor evaluations were made July 6 and July 27. Following the July 27 evaluation, the beds were tilled and the area was left idle until September 5, 1985, when seven crops and ryegrass were planted in each plot. The second planting was made February 5, 1985, and evaluated March 4 and 29. The last planting made May 30, 1985, was evaluated June 5 and 19. Each time the beds were tilled in such a manner as to maintain the integrity of each treatment. The herbicides used, rates of application and the crops planted are given in the tables that contain summaries of the evaluations. The results obtained and observations indicate that:

FMC-57020 (dimethazone) - caused severe injury to all crops planted. Bleaching and white blotches on the foliage of the surviving plants were obvious. In areas treated with 2.0 lbai/A these symptoms persisted through May 30, 1985. Beans appeared more tolerant to this herbicide than the other crops included in the study.

Racer (fluorochloridane - R-40244) - caused severe stand and vigor reduction of most crops. Safflower and carrots exhibited the most tolerance to Racer 3 1/2 months after application. At 4.0 lbai/A this herbicide appeared the most persistent.

DPX-M6316-24 at 0.047 lbai/A (3/4 oz. ai/A) reduced the stand and vigor of most broadleaf crops except blackeye beans and alfalfa. Monocots, millet and grain sorghum, in addition to barnyardgrass, appear most tolerant. In the second and later plantings, no stand or vigor reductions were observed in the 0.047 lbai/A or 0.188 lbai/A treated areas.

Tackle (acifluorfen) at 1.0 lbai/A caused stand and vigor reduction of all crops planted the same day it was applied and incorporated. Alfalfa appeared the most tolerant. In the second planting 3 1/2 months after application, spinach, sugar beets and lettuce were severely retarded in growth in the 1.0 lbai/A treated areas. Wheat, ryegrass and carrots were least affected in the 4.0 lbai/A treated areas. At 4.0 lbai/A it caused reduction in the vigor of several crops and chlorosis one year after application.

Dual (metolachlor) at 3.0 lbai/A exhibited most tolerance to blackeye beans and sugar beets. These two crops also showed good tolerance at 12.0 lbai/A. Three and a half months after application only ryegrass was adversely affected in the 3.0 lbai/A treated areas; in the 12.0 lbai/A treated plots wheat, lettuce and ryegrass were most severely affected. One year after application, no evidence of residual activity was observed on any crop.

Lasso ME (alachlor micro-encapsulated) exhibited similar activity and persistence as was observed in the Dual treated areas. However, Dual was somewhat more selective on sugar beets.

SC-1102 was included in the trial only at 3.0 lbai/A. Its herbicidal activity and selectivity was similar to Dual and Lasso. Alfalfa and tomatoes appear to be somewhat more tolerant to SC-1102 than to Dual or Lasso.

Sonalan (ethalfluralin) was applied at 1.0 and 4.0 lbai/A. Cotton and blackeye beans grew vigorously in the 1.0 lbai/A treated areas, alfalfa and cantaloupes were retarded in growth at emergence. All crops were adversely affected at 4.0 lbai/A. In the later planting spinach growth was reduced. In the 4.0

lbai/A treated plots, with the exception of broccoli and safflower, all other crops were adversely affected in the February 5, 1985, planting, but in the May, 30, 1985, planting, only slight reduction in the vigor of millet, grain sorghum and sugar beets was observed.

- Treflan Pro 5 was used only at 1.0 lbai/A. In the first planting the emergence and vigor of all crops were reduced. In the late planting safflower exhibited the most tolerance followed by carrots and broccoli. Sugar beets, spinach and ryegrass were the most severely retarded in growth. This persisted through the May 30, 1985, planting.

  Banvel (dicamba) at 2.0 lbai/A reduced the stand and vigor of all crops in the first planting. In the second planting no evidence of herbicidal activity could be observed. Banvel may have been leached by repeated irrigations, and if the crops would have been allowed to grow longer and their roots proliferated the soil, symptoms may have developed.

The other herbicides (see the following tables) did not adversely affect the growth of the crops and weeds.

In Conclusion

Farmers rely more and more on the use of selective herbicides to grow crops profitably. An ideal herbicide would be one that could control all unwanted competing vegetation and disappear from the soil when the crop in which it was used is harvested.

Until such a herbicide is discovered, farmers, fieldmen and pest control advisors need to consider carefully the residual properties of herbicides before they are used. This is especially true in a diversified cropping system. They need to acquaint themselves with the environmental conditions and managerial techniques that influence the degradation and residual effects of herbicides. They also need to carefully monitor the calibration and application methods used to avoid over-treatments that result in serious residue problems.

TABLE 1 EVALUATION OF RESIDUAL PROPERTIES OF HERBICIDES AND THEIR EFFECT ON CROPPING SEQUENCES

08, 453, 10, 84-1

Location:	Westside Field Station	Irrigation Method:	Sprinkler, Furrow
Soil Type:	Panoche clay loam	Plot Size:	20' x 30'
Herbicides Applied:	5-30-84	Planted:	5-30-84
Crops:	Cotton, sugar beets, alfalfa, cantaloupes, millet, sorghum, tomato, blackeye	Evaluated:	7-6-84

Herbicide	Lb.ai/ Acre	STAND COUNT IN A 4' X 6" AREA AVERAGE OF FOUR REPLICATIONS[1/]							
		Cotton	Sugar Beet	Alfalfa	Cant.	Millet	Sorghum	Tomato	Blackeye
A FMC 57020	0.5	11.0i,r	15.5i	16.7i	5.2i	9.7i	1.7i	5.5i	14.0i
B FMC 57020	2.0	0	5.2i	7.5i	6.5i,r	0	1.5i	0.7r	11.2i
C DPX-M6316-24	0.047	12.0r	9.2r	29.2	2.5i,r	26.5	7.0r	4.7r	12.7
D DPX-M6316-24	0.188	7.2	7.0r	26.7r	3.7r	22.2	5.2r	6.2r	11.7r
E Racer	1.0	14.5	1.0i,r	9.7i,r	0.5i	11.0i	8.7i	0	10.0i
F Racer	4.0	10.0i	0	0	0	0	2.5i	0	11.7i,r
G Tackle	1.0	14.0r	3.2i	20.0	3.7r	19.2i	5.2i	5.2r	15.5
H Tackle	1.0	18.2i	0	14.5i,r	0.2r	11.2i	3.5i	3.7i,r	9.0r
J SC-1102	3.0	5.7r	18.5	23.0r	5.7r	1.0r	4.5r	6.0r	13.2
K Treflan-Pro5	1.0	9.0i,r	7.2r	5.2	1.7r	2.2r	3.5r	2.5r	13.2i
L Dual	3.0	4.7r	13.5	10.7r	3.2r	10.7i,r	7.2r	7.0r	13.0
M Dual	12.0	19.0r	10.7r	17.0r	2.0r	6.7r	4.7r	1.5r	12.0r
N Lasso ME	3.0	12.5	11.5r	9.0r	3.2r	9.2r	5.2r	2.0r	13.0r
P Lasso ME	12.0	14.5r	4.2r	7.2r	2.2r	0.7i,r	3.7r	0	9.7r
Q Sonalan	1.0	26.2r	9.0r	17.7r	3.2r	0.7r	2.0r	0	10.5
R Sonalan	4.0	22.2r	0.7r	2.5r	1.7r	0	0	0	8.5r
S Banvel	2.0	10.7r	8.0r	1.0r	0.5r	14.7r	7.5r	3.0r	6.2r
X Untreated	--	21.6r	14.5	19.7	7.7	28.0	6.5r	6.2r	14.7

i = injury
r = retarded

[1/] Counts made in a 4' X 6" area in the center of each row in each plot.

TABLE 2 EVALUATION OF RESIDUAL PROPERTIES OF HERBICIDES AND THEIR EFFECT ON CROPPING SEQUENCES

08, 453, 10, 84-1

Location:	Westside Field Station	Irrigation Method:	Sprinkler, Furrow
Soil Type:	Panoche clay loam	Plot Size:	20' x 30'
Herbicides Applied:	5-30-84	Date Planted:	5-30-84
Crops:	Cotton, sugar beets, alfalfa, Cantaloupes, millet, sorghum, tomato, blackeye	Evaluated:	7-6-84

VIGOR RATINGS - AVERAGE OF FOUR REPLICATIONS[1/]

Herbicide	Lb.ai/ Acre	Cot.	Sug. Bt.	Alf.	Cant.	Millet	Sorg.	Tom.	% Weed Control Blk. Eye	Grass	Brdlf	Weeds Prsnt
A FMC 57020	0.5	3.0	8.0	2.2	3.5	0.5	0.5	0.5	7.0	100	75	I
B FMC 57020	2.0	0.2	1.5	0.2	1.5	0	0	0	3.5	100	100	---
C DPX-M6316-24	0.047	5.0	2.7	8.2	3.0	9.2	7.5	0	8.2	0	66	I,La,Pl
D DPX-M6316-24	0.188	3.5	0.5	7.7	1.5	9.2	5.0	2.0	6.5	50	92	I,La,Pl
E Racer	1.0	4.5	2.2	6.2	1.0	2.2	5.7	1.2	4.5	95	92	I
F Racer	4.0	4.2	0	0.5	0	0	0	0	0.7	100	100	---
G Tackle	1.0	7.5	1.0	4.0	3.2	4.2	2.7	1.7	9.2	75	25	B,I,La,Pl
H Tackle	1.0	7.5	0	0.7	0	0.5	0.5	0	6.2	76	82	I,La,Pl
J SC-1102	3.0	4.0	9.2	6.2	7.0	1.0	5.0	2.2	9.2	97	76	I,La,Pl
K Treflan-Pro5	1.0	7.2	2.7	4.0	5.2	1.5	2.0	3.0	9.5	98	97	B, Pl
L Dual	3.0	4.2	9.7	4.0	6.7	4.2	6.5	0.5	9.0	100	80	I,La,Pl
M Dual	12.0	5.2	5.5	0	0.5	1.0	3.7	0	7.5	99	94	I
N Lasso ME	3.0	7.2	8.0	3.7	4.7	6.7	8.0	0	9.5	91	60	I,La,Pl
P Lasso ME	12.0	3.2	0.7	0	0	0.5	3.5	0	6.5	100	96	Pl
Q Sonalan	1.0	9.2	1.0	7.5	7.7	0	0	0	9.2	96	95	I,La
R Sonalan	4.0	8.5	0	0.7	1.0	0	0	0	6.5	100	100	---
S Banvel	2.0	4.5	1.0	0.5	0	5.5	4.5	0	2.5	20	75	B,I,La,Pl
X Untreated	--	10.0	9.5	9.7	10.0	10.0	9.7	10.0	10.0	0	0	B,I,La,Pl

WEEDS PRESENT:
B = barnyardgrass
I = pigweed
La = lambsquarter
Pl = purslane

[1/] Ratings based on a 0 to 10 scale: 0 = very poor vigor, 10 = vigorously growing plants.

TABLE 3 EVALUATION OF RESIDUAL PROPERTIES OF HERBICIDES AND THEIR EFFECT ON CROPPING SEQUENCES

08, 453, 10, 84-1

Location:	Westside Field Station	Irrigation Method:	Sprinkler, Furrow
Soil Type:	Panoche clay loam	Plot Size:	20' x 30'
Herbicides Applied:	5-30-84	Date Planted:	5-30-84
Crops:	Cotton, sugar beets, alfalfa, Cantaloupes, millet, sorghum, tomato, blackeye	Evaluated:	7-27-84

VIGOR RATINGS - AVERAGE OF FOUR REPLICATIONS[1/]

Herbicide	Lb.ai/ Acre	Cot.	Sug. Bt.	Alf.	Cant.	Millet	Sorg.	Tom.	Blk. Eye	% Weed Control Grass	% Weed Control Brdlf	Weeds Prsnt
A FMC 57020	0.5	4.7	7.7	3.0	3.7	1.0	0.7	0.5	8.7	100.0	47.5	I
B FMC 57020	2.0	0	0.7	0.5	1.2	0	0	0	5.2	100.0	99.7	I
C DPX-M6316-24	0.047	4.2	4.5	8.5	4.7	9.2	8.2	1.5	8.7	0	85.0	I,La
D DPX-M6316-24	0.188	2.2	1.2	5.2	2.0	9.5	6.2	4.0	9.5	0	98.7	I,La
E Racer	1.0	4.5	1.2	7.0	0.2	4.5	7.5	0.5	5.5	85.0	92.5	I,La
F Racer	4.0	4.2	0	0	0	0	0.5	0	0.5	99.7	100	---
G Tackle	1.0	7.5	0.7	6.5	1.5	5.0	4.0	2.7	9.0	0	21.2	I,La,Pl
H Tackle	1.0	5.7	0	3.2	0.5	0.5	0.2	1.5	5.7	30.0	85.0	I,La
J SC-1102	3.0	4.2	9.7	6.5	7.7	2.7	8.2	4.7	10.0	98.2	72.5	Gr,I,La,Pl
K Treflan-Pro5	1.0	6.7	2.0	4.0	7.5	1.2	3.0	2.7	9.0	93.2	88.7	Gr,I,La,Pl
L Dual	3.0	3.7	9.5	4.2	4.5	7.5	7.5	1.2	9.0	93.2	88.7	Gr,I,La,Pl
M Dual	12.0	4.0	7.0	1.2	1.5	4.2	5.2	0	9.0	100.0	93.2	I,La,Pl
N Lasso ME	3.0	7.7	8.0	2.5	7.2	8.2	9.0	1.5	10.0	97.5	76.2	I,La,Pl
P Lasso ME	12.0	3.0	1.5	1.2	1.7	2.0	6.7	0	7.7	100.0	91.2	I,La,Pl
Q Sonalan	1.0	9.7	1.5	7.7	9.0	1.7	1.5	1.0	9.5	95.2	93.7	I,La,Pl
R Sonalan	4.0	9.0	0	3.0	4.2	0	0	0.2	5.5	100.0	100.0	---
S Banvel	2.0	6.0	0	0.5	0	6.2	7.0	0	4.2	0	86.2	Gr,I,Pl
X Untreated	--	7.0	7.0	7.0	7.0	7.0	9.5	7.0	9.5	0	0	Gr,I,La

WEEDS PRESENT:
Gr = groundcherry
I = pigweed
La = lambsquarter
Pl = purslane

1/ Ratings based on a 0 to 10 scale: 0 = very poor vigor, 10 = vigorously growing plants.

TABLE 4 EVALUATION OF RESIDUAL PROPERTIES OF HERBICIDES AND THEIR EFFECT ON CROPPING SEQUENCES

08, 453, 10, 85-1

Location:	Westside Field Station	Irrigation Method:	Furrow
Soil Type:	Panoche clay loam	Plot Size:	20' x 30'
Herbicides Applied:	5-30-84	Date Planted:	9-5-84
Crops:	Safflower, broccoli, sugarbeets, ryegrass, carrots, lettuce, spinach, wheat, grasses	Evaluated:	9-24-84

		STAND COUNT IN 4' X 6" AREA[1/] - AVERAGE OF FOUR REPLICATIONS								
Herbicide	Lb.ai/ Acre	Saff.	Broc.	Sug. Beets	Rye-Grass	Carrot	Let.	Spin.	Wht.	Grass**
A FMC 57020	0.5	19.7	10.5	11.2	8.7	12.5	0	6.2	11.5*	75.5
B FMC 57020	2.0	17.2	7.5	5.5	0	10.7	0	4.0	25.2*	7.7
C DPX-M6316-24	0.047	18.0	11.7	7.5	28.7	10.0	16.0	2.5	20.5	37.2
D DPX-M6316-24	0.188	18.0	7.5	4.0	45.7	13.5	13.7	4.7	26.2	25.7
E Racer	1.0	21.0	3.5	1.0	55.7	21.7	0	2.0	33.7	5.5
F Racer	4.0	16.5	0	0	21.7*	12.5	0	0	21.5*	2.2
G Tackle	1.0	14.5	7.0	5.0	3.2	14.5	14.2	2.5	34.5	60.7
H Tackle	4.0	11.7	6.2	12.7	23.7	11.2	3.7	0	28.0	14.0
J SC-1102	3.0	24.0	9.0	6.0	34.7*	14.5	12.0	3.5	30.0	58.5
K Treflan-Pro5	1.0	21.0	9.7	6.7	32.0	14.5	15.5	6.5	26.5	18.7
L Dual	3.0	13.2	10.0	3.5	22.7	14.2	17.2	4.0	26.7	90.2
M Dual	12.0	19.0	12.7	9.7	11.5	13.7	20.2	2.7	27.5	25.2
N Lasso ME	3.0	15.2	10.2	6.5	40.7	6.2	9.0	2.7	20.5	35.2
P Lasso ME	12.0	16.0	9.7	6.2	14.0	17.7	6.0	4.5	27.2	18.7
Q Sonalan	1.0	10.0	13.0	24.2	24.2	20.0	22.0	5.5	36.7	38.2
R Sonalan	4.0	41.0	10.5	6.7	2.0	14.5	22.0	2.7	26.0	15.5
S Banvel	2.0	16.2	9.0	4.5	34.2	17.0	14.5	5.0	24.5	24.7
X Untreated	--	19.5	8.0	4.0	44.2	9.2	15.5	2.2	26.0	103.2

[1/] Ratings based on a 0 to 10 scale: 0 = very poor vigor, 10 = vigorously growing plants.

* Dead

** Barnyardgrass and millet

TABLE 5 EVALUATION OF RESIDUAL PROPERTIES OF HERBICIDES AND THEIR EFFECT ON CROPPING SEQUENCES

08, 453, 10, 84-1

Location:	Westside Field Station	Irrigation Method:	Furrow
Soil Type:	Panoche clay loam	Plot Size:	20' x 30'
Herbicides Applied:	5-30-84	Date Planted:	9-5-84
Crops:	Wheat, spinach, lettuce, carrots, ryegrass, sugar beets, broccoli, safflower	Evaluated:	10-3-84

Herbicide	Lb.ai/ Acre	VIGOR RATINGS - AVERAGE OF FOUR REPLICATIONS[1/]							Weed Control	
		Wht.	Spin.	Let.	Carr.	Rye Grass	Sug. Beet	Broc.	Saff.	% Grass** Contr.	% Brdlf.* Contr.
A FMC 57020	0.5	2.7	4.2	1.0	5.7	0.5	8.7	8.0	8.5	86	26
B FMC 57020	2.0	0	0	0	2.0	0	1.5	2.2	4.5	97	93
C DPX-M6316-24	0.047	9.2	8.7	9.5	10.0	7.0	9.7	10.0	9.7	0	19
D DPX-M6316-24	0.188	9.7	8.0	8.0	8.2	8.7	9.0	8.7	8.7	0	26
E Racer	1.0	6.7	0.5	0	8.0	8.0	4.7	3.0	9.0	51	91
F Racer	4.0	0	0	0	5.5	0.7	0	0	8.2	98	98
G Tackle	1.0	9.7	5.0	6.2	9.7	7.0	2.7	9.0	9.5	10	8
H Tackle	4.0	9.5	0	1.2	7.2	8.0	0	3.7	7.2	86	83
J SC-1102	3.0	10.0	8.2	9.0	9.2	5.3	9.5	10.0	9.7	39	19
K Treflan-Pro5	1.0	6.0	4.2	5.5	8.5	3.5	4.2	7.0	10.0	90	89
L Dual	3.0	8.2	7.7	9.7	9.7	4.0	10.0	9.7	9.1	26	40
M Dual	12.0	5.0	7.0	5.0	8.0	0.5	8.5	8.2	8.5	71	30
N Lasso ME	3.0	9.7	8.5	8.7	9.5	8.2	9.7	10.0	9.5	0	0
P Lasso ME	12.0	9.7	6.2	1.0	6.7	2.5	4.2	5.0	5.7	76	59
Q Sonalan	1.0	9.7	7.0	9.5	9.5	5.7	9.2	10.0	10.0	54	29
R Sonalan	4.0	5.5	0	7.7	6.2	0	0	8.7	9.7	95	76
S Banvel	2.0	9.5	7.0	9.7	10.0	9.0	9.5	9.7	10.0	20	30
X Untreated	--	9.7	8.5	9.7	9.7	8.5	8.2	9.0	8.7	0	

1/ Vigor ratings are based on a scale of 0 - 10. 0 = very poor vigor, 10 = vigorously growing plants.

* Broadleaf weeds present = London rocket, purslane, shepherd's purse, sowthistle, pigweed

** Grasses present = Japanese millet, barnyardgrass

TABLE 6 EVALUATION OF THE PREPLANT RESIDUAL PROPERTIES OF HERBICIDES

08, 453, 10, 84-1

Location:	Westside Field Station	Irrigation Method:	Furrow
Soil Type:	Panoche clay loam	Plot Size:	20' x 30', Reps 4
Herbicides Applied:	5/30/84	Planted:	2/05/85
Varieties:	Alfalfa, Ryegrass, Onion, Mustard, Carrot, Barley, Sugar Beet, Tomato	Evaluated:	3/04/85

% STAND COUNT EVALUATIONS (Per 4' of Row)

Herbicide	Lb.ai/ Acre	Alfalfa	Ryegrass	Onion	Mustard	Carrot	Barley	Sug.Beet	Tomato
A FMC 57020	0.5	52	68	35	90	28	32	31	37
B FMC 57020	2.0	48	38	32	84	35	32	40	36
C DPX-M6316-24	0.047	54	42	30	84	36	33	40	39
D DPX-M6316-24	0.188	48	48	29	89	38	30	41	42
E Racer	1.0	54	36	31	88	35	37	44	40
F Racer	4.0	47	48	35	34	39	32	37	30
G Tackle	1.0	57	55	34	87	37	40	36	33
H Tackle	4.0	45	37	26	88	31	32	20	30
J SC-1102	3.0	48	50	27	74	35	29	31	38
K Treflan-Pro5	1.0	49	41	32	96	34	36	33	43
L Dual	3.0	54	37	35	88	46	23	33	33
M Dual	12.0	56	55	33	90	34	29	26	29
N Lasso ME	3.0	61	43	31	82	31	37	33	36
P Lasso ME	12.0	56	50	34	98	36	34	30	31
Q Sonalan	1.0	51	43	29	78	38	33	32	25
R Sonalan	4.0	54	24	31	92	43	35	37	34
S Banvel	2.0	56	43	28	88	46	35	34	37
X Untreated	----	54	54	29	73	41	34	37	41

TABLE 7 EVALUATION OF THE PREPLANT RESIDUAL PROPERTIES OF HERBICIDES

08, 453, 10, 84-1

Location:	Westside Field Station	Irrigation Method:	Furrow
Soil Type:	Panoche clay loam	Plot Size:	20' x 30', Reps 4
Herbicides Applied:	5/30/84	Planted:	2/05/85
Varieties:	Alfalfa, Ryegrass, Onion, Bok Choi, Carrot, Barley, Sugar Beet, Tomato	Evaluated:	3/29/85

VIGOR RATINGS AND WEED CONTROL EVALUATIONS (Per 4' of Row)

Herbicide	Lb.ai/ Acre	Alfalfa	Ryegrass	Onion	Bok Choi	Carrot	Barley	Sug.Beet	Tomato	% Brd. Control
A FMC 57020	0.5	*7.7	*7.2	*4.7	*6.2	*7.7	*3.2	8.2	8.51	37
B FMC 57020	2.0	*3.5	*1.2	*1.0	*2.5	*4.2	*1.0	*6.2	*4.5	80
C DPX-M6316-24	0.047	9.7	9.2	9.7	10.0	9.7	10.0	9.7	10.0	7
D DPX-M6316-24	0.188	10.0	9.5	9.7	9.7	10.0	10.0	10.0	10.0	0
E Racer	1.0	9.2	9.7	9.2	8.5	9.0	9.7	9.0	9.7	10
F Racer	4.0	8.5	*4.2	*1.7	*0.5	*4.5	*0.7	*3.7	*7.0	96
G Tackle	1.0	9.5	9.5	9.7	10.0	9.7	9.0	9.2	9.7	0
H Tacke	4.0	9.5	8.7	9.7	9.5	8.7	8.5	*3.7	9.2	53
J SC-1102	3.0	8.7	10.0	10.0	10.0	9.7	9.7	9.2	9.5	0
K Treflan-Pro5	1.0	9.0	7.0	9.5	9.0	9.0	8.7	5.7	9.2	32
L Dual	3.0	10.0	9.0	9.7	10.0	9.7	9.2	9.7	10.0	9
M Dual	12.0	9.7	9.7	9.7	10.0	9.7	9.7	10.0	9 7	12
N Lasso ME	3.0	9.2	9.5	9.5	10.0	10.0	10.0	9.7	10.0	0
P Lasso ME	12.0	9.5	9.7	10.0	10.0	9.0	10.0	8.0	9.5	0
Q Sonalan	1.0	9.7	10.0	10.0	9.7	9.5	9.5	*7.5	8.7	0
R Sonalan	4.0	10.0	*6.0	*5.2	9.5	*7.7	*5.0	*2.7	*7.5	57
S Banvel	2.0	9.2	8.5	9.5	9.0	9.0	8.7	*7.2	9.2	20
X Untreated	----	10.0	9.0	9.7	10.0	9.2	9.0	8.7	9.5	12

*Chlorotic

Weeds present: filaree, groundsel, lambsquarter, London rocket, millet monolapis, pigweed, purselane, shepherd's purse, sowthistle

3228A(P3)

TABLE 8 EVALUATION OF THE RESIDUAL PROPERTIES OF HERBICIDES

08, 453, 10, 85-1

Location:	Westside Field Station	Irrigation Method:	Furrow
Soil Type:	Panoche clay loam	Plot Size:	20' x 30', Reps 3
Herbicides Applied:	5/30/84	Planted:	5/30/85
Varieties:	Cotton, Sorghum, Tomato, Safflower, Melon, Millet, Sugar Beets, Blackeye	Evaluated:	6/05/85

STAND COUNT & WEED CONTROL EVALUATIONS (Per 4' of Row)

		STAND COUNT									
Herbicide	Lb.ai/ Acre	Cot.	Sorg.	Tomato	Saffl.	Melon	Millet	Sug.Beet	Blk.Eye	% Brd. Control	% Grass Control
A FMC 57020	0.5	17.0	16.5	18.5	21.7	8.7	6.2	7.0	9.7	31	3
B FMC 57020	2.0	12.7	8.0	17.5	14.2	10.2	4.7	10.7	9.7	14	0
C DPX-M6316-24	0.047	13.5	11.7	9.5	10.2	8.0	7.5	6.5	13.0	16	30
D DPX-M6316-24	0.188	14.0	9.7	10.5	11.7	6.2	8.0	11.5	9.7	22	31
E Racer	1.0	15.7	7.5	10.5	8.5	7.2	7.0	9.5	8.5	5	9
F Racer	4.0	11.7	8.7	15.2	13.2	7.2	5.5	10.0	11.7	1	2
G Tackle	1.0	15.0	12.0	20.2	15.7	7.0	6.5	8.5	10.7	27	21
H Tackle	4.0	13.7	9.0	9.5	18.5	6.7	8.0	9.5	11.7	9	18
J SC-1102	3.0	12.7	10.7	16.2	13.0	5.2	9.2	10.0	9.0	23	2
K Treflan-Pro5	1.0	11.5	8.5	12.2	16.5	7.5	5.2	10.2	8.5	4	3
L Dual	3.0	11.7	10.2	7.7	17.5	12.5	8.7	8.0	10.2	21	2
M Dual	12.0	12.0	7.2	7.5	13.2	11.0	7.5	6.2	9.0	15	2
N Lasso ME	3.0	12.2	7.7	8.2	10.2	4.2	7.5	10.0	9.5	16	2
P Lasso ME	12.0	13.0	8.0	4.7	8.0	7.2	8.2	9.0	6.7	11	3
Q Sonalan	1.0	9.2	5.7	5.7	14.2	5.2	6.5	9.0	7.7	8	4
R Sonalan	4.0	13.0	6.7	6.2	17.0	8.5	5.5	10.5	7.7	8	1
S Banvel	2.0	12.2	7.7	5.5	9.2	6.0	10.0	7.0	8.5	9	25
X Untreated	----	14.0	9.0	9.7	14.2	5.5	6.0	6.5	9.2	37	15

Weeds Present: pigweed, lambsquarter, nightshade, purslane, puncturevine, sowthistle, barnyardgrass

3228A(P2)

TABLE 9 EVALUATION OF THE RESIDUAL PROPERTIES OF HERBICIDES

08, 453, 10, 84-1

Location:	Westside Field Station	Irrigation Method:	Furrow
Soil Type:	Panoche clay loam	Plot Size:	20' x 30', Reps 3
Herbicides Applied:	5/30/84	Planted:	5/30/85
Varieties:	Cotton, Sorghum, Tomato, Safflower, Melon, Millet, Sugar Beets, Blackeye	Evaluated:	6/19/85

VIGOR AND WEED CONTROL EVALUATIONS (Per 4' of Row)

		VIGOR RATINGS									
Herbicide	Lb.ai/ Acre	Cot.	Sorg.	Tomato	Saffl.	Melon	Millet	Sug.Beet	Blk.Eye	% Brd. Control	% Grass Control
A FMC 57020	0.5	10	10	10	10	10	10	10	10	0	12
B FMC 57020	2.0	9.0	*3.0	*3.0	*3.5	*6.5	*6.0	9.2	9.2	0	76
C DPX-M6316-24	0.047	10	10	10	10	10	10	10	10	0	0
D DPX-M6316-24	0.188	10	10	9.5	10	9.7	9.5	9.5	10	0	0
E Racer	1.0	10	10	10	10	10	10	10	10	0	0
F Racer	4.0	9.5	10	*7.0	9.5	*3.7	7.5	*1.2	*3.0	64	51
G Tackle	1.0	10	10	10	10	10	10	10	10	0	0
H Tackle	4.0	9.2	*7.0	9.5	10	10	*7.0	*6.7	*8.5	0	0
J SC-1102	3.0	10	10	10	10	10	10	10	10	0	0
K Treflan-Pro5	1.0	10	5.7	9.2	10	9.2	7.0	8.0	10	17	36
L Dual	3.0	10	10	10	10	10	10	10	10	0	0
M Dual	12.0	10	10	10	10	9.7	10	10	10	0	0
N Lasso ME	3.0	10	9.2	10	10	9.5	10	10	10	0	0
P Lasso ME	12.0	10	10	9.7	10	9.7	10	10	10	0	0
Q Sonalan	1.0	10	10	10	10	10	10	10	10	0	0
R Sonalan	4.0	10	9.2	9.7	10	10	8.5	9.2	10	6	15
S Banvel	2.0	9.7	10	9.7	9.7	10	10	10	10	0	0
X Untreated	----	10	10	10	10	10	10	10	10	0	0

*Chlorotic

Weeds present: pigweed, lambsquarter, purslane, barnyardgrass

1/ Vigor ratings are based on a 0 to 10 scale. 0 = very poor vigor, 10 = vigorously growing plants.

APPENDIX

Applied research studies for weed control in alfalfa seed and hay production have been conducted in Fresno County since the early 1970's. Progress reports of the trials have been reported at numerous meetings and symposia. They were published in many proceedings, popular journals and early volumes of Runcina. For additional information please read:

.Vegetation Management in Certified Alfalfa Seed Production - A Progress Report - 1975, UCCE Fresno

.Dodder and Other Unwanted Vegetation Control in Alfalfa Seed Fields - A Progress Report - 1976, Runcina Vol. 11, UCCE Fresno

.Vegetation Management in Alfalfa Seed Production, 8th Annual Interstate Alfalfa Seed Growers Winter Seed School - Jan. 1977, Winnemucca, Nevada

.Weed Biology and Vegetation Management in Alfalfa Hay Production, 7th Cal. Alf. Symp., December, 1977, Fresno

.Evaluation of Herbicides of Vegetation Management in Alfalfa Seed Production - A Progress Report, 1978, UCCE Fresno

.Strategies for Controlling Fiddleneck and Groundsel in Alfalfa, 9th Cal. Alf. Symp., December, 1979, Fresno

.Integrated Vegetation Management in Seed Alfalfa Production Proceedings - Alfalfa Seed Prod. Symp, March 1981, Fresno

.Weed Control Studies in Alfalfa Seed Production - A Progress Report, 1981, Runcina Vol. 23, UCCE Fresno

.Residual Properties of Herbicides and Alfalfa Hay Production, 12th Cal. Alf. Symp., Dec. 1982, Fresno

.The Use, Misuse and Abuse of Herbicides in Alfalfa Seed Production - Proceedings Alf. Seed Prod. Symp, March, 1983, Fresno

.Vegetation Management in Alfalfa - A Progress Report of Applied Research Studies, 1984, UCCE Fresno

Toward More Effective WEED CONTROL

Without knowledge of the weed infestation it isn't possible to intelligently plan an economical weed control program.

To help identify weeds, the University of California's "Growers Weed Identification Handbook" may be helpful. It contains colored photographs and descriptions of 231 commonly occurring weeds in different stages of their growth. The pictures in a sturdy, 3-ring binder, can be purchased from Agricultural and Natural Resources, 6701 San Pablo, Oakland, California, 94608.

Being able to identify weeds is but the first step. Keeping records of their presence is essential to use selective herbicides intelligently. Cards, such as the one illustrated below, can be used to keep records of weed infestations. They are available from Cooperative Extension offices, from pest control advisors and distributors of herbicides.

WEED INFESTATION RECORD

FIELD LOCATION _____ CROP _____ HERBICIDE USED _____

DATE PLANTED _____ DATE NOTES TAKEN _____ PREVIOUS CROP _____

BROADLEAF ANNUALS	Anise	Atriplex	Bassia Five Hook	Black Bindweed	Bristly Oxtongue	Burweed	Carpetweed	Cat's Ear	Cheeseweed
Chickweed	Clover	Cocklebur	Corn Spurry	Cudweed	Dandelion	Dock	Dodder	Fat Hen	Fiddleneck
Filaree	Flaxleaved Fleabane	Ground-cherry	Groundsel	Hemlock	Henbit	Jimson Weed	Knotweeds	Lambsquarters	Lettuce Wild
London Rocket	Mare's Tail	Mayweed	Milk Thistle	Minerslettuce	Morning Glory	Mustard	Nettle	Nettleleaf Goosefoot	Nightshade
Nuttalls Monolepis	Phacelia	Pigweed	Pineapple Weed	Plantain	Puncture Vine	Purslane	Red Maids	Russian Thistle	Scarlet Pimpernel
Shepherd's Purse	Sow Thistle	Spiny Clotbur	Spurge	Sunflower, Common	Tarweed	Telegraph-plant	Toadflax	Turkey Mullein	Velvet Leaf
Venice Mallow	Veronica	Willow Herb	Yellow Starthistle						
GRASSES ANNUAL	Annual Bluegrass	Barley, Volunteer	Barnyard-grass	Bromegrass	Canarygrass	Cupgrass	Dallisgrass	Diffuse Lovegrass	Feather Finger-grass
Foxtails (Bristle-grass)	Jungle Rice	Orcutts Lovegrass	Rabbitfootgrass	Ripgut Brome	Ryegrass	Sandbur	Sprangletop	Wild Barley (Foxtails)	Wild Oats
Witchgrass									
PERENNIALS	Alkali Sida	Bermudagrass	BINDWEED (Morning Glory)	Cattail	Chickory	Heliotrope	Hoary Cress	Johnsongrass	Nutsedge, Purple
Nutsedge, Yellow	Russian Knapweed	Saltgrass	SILVERLEAF NIGHTSHADE (Horsenettle)	Swamp Smart-weed (Kelp)	Tolgoucha	Tule			

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