

Weed Control in DIRECT-SEEDED PROCESSING and FRESH MARKET TRANSPLANT TOMATOES

DIRECT-SEEDED PROCESSING TOMATOES

Processing tomatoes, being direct-seeded and machine-harvested, require total weed control from planting to harvest. This major California crop is grown under a wide range of soil types and irrigation practices. Soils range from light sandy loam to heavy clays and peats. Irrigation ranges from sprinkler to furrow to spud ditches.

Control of annual weeds is a major problem in direct-seeded tomatoes. Yield reduction of 10 tons or more per acre is common in plantings on weed-infested ground. Lack of weed control delays tomato maturity and greatly reduces the efficiency of machine harvesting. Mechanical and hand-weeding controls are expensive, often reduce tomato stands, and are not always effective enough for maximum yields.

CULTURAL CONTROL METHODS

A history of weed species and their population densities should be kept on fields used for canning tomatoes. Fields infested with perennial weeds (johnsongrass, nutsedge, field bindweed) or fields whose previous crops have been infested with dodder or broomrape should be avoided. If time allows, form beds well ahead of planting so weeds will germinate, then apply a contact herbicide to kill them. This will reduce weed populations in the field.

MECHANICAL CONTROL METHODS

Cultivators are available for tilling the rows on either side of the plants. Power tillers can control young weeds and create a dry mulch that will keep

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new weeds from germinating. This method seems more effective on furrow-irrigated tomatoes. Tomato plants must be at least 1 1/2 inches high to reduce chances of covering them with soil when tilling. As tomato plants become older, rolling cultivators (Lillistons[®], etc.) can be used until the crop is laid by. Mechanical control is not feasible once annual weeds become 6 to 8 inches in height. Even with mechanical control some hand-weeding within the row is usually necessary.

CHEMICAL CONTROL METHODS

Herbicides may be applied before planting (preplant), after planting (postplant, preemergence) or after thinning. At present it is necessary to use preplant or preemergence herbicides to achieve control of annual weeds in the seeding row. Band treatment reduces the amount of herbicide needed, decreasing cost and potential soil residue, but supplementary cultivation is required on the remainder of the seedbed. Where a range of herbicide rates is listed, the lower rate should be used on light, sandy soils.

Preplant herbicides must be mixed into the soil mechanically (power tillers, rolling cultivators, or disk). Sprinkler irrigation has been an effective method of activating preemergence applications of diphenamid (DYMID[®], ENIDE[®]), CDEC (VEGADEX[®]), and bensulide (PREFAR[®]), particularly on light sandy soils. However herbicides like pebulate (TILLAM[®]) and napropamide (DEVRI[®]) must be mechanically incorporated for optimum weed control. (For best results use CDEC preemergence followed by sprinkler irrigation. Mechanical incorporation 2 inches deep also is quite effective).

[®] Registered trade name.

Bensulide (PREFAR[®]) for annual grass control can be applied preplant and incorporated 1 to 2 inches deep with a power-driven rotary tiller, or applied on the surface of the soil and sprinkler-irrigated. Bensulide is long-lived. To reduce possibility of injury to following crops, such as cereals (wheat, barley and oats), alfalfa, and sugar beets, band application is recommended on tomatoes, and after harvest deep tillage (preferably disk plowing) must be carried out.

CDEC (VEGADEX[®]) and pebulate (TILLAM[®]) will control certain annual weeds for 4 to 6 weeks, and usually each is applied with another preplant herbicide for broader, longer weed control.

Diphenamid (DYMID[®] or ENIDE[®]) can be applied preplant but is most effective applied preemergence to the soil surface and sprinkler-irrigated. When using furrow irrigation these materials should be mechanically incorporated 2 to 4 inches deep with a power-driven rotary tiller.

Napropamide (DEVRI[®]) should be applied preplant and incorporated 1 to 2 inches with a power-driven rotary tiller. When used as a pre-emergence herbicide, sprinkler irrigation applying 1 to 2 inches of water has been adequate to make napropamide effective. Napropamide is long-lived, so it should be band applied on not more than two-thirds of the gross field area, and after harvest deep tillage (preferably disk plowing) must be carried out.

Pebulate (TILLAM[®]) incorporation is critical. It is best applied preplant with a power tiller set to cut 2 to 3 inches on light soil and 3 to 4 inches on heavy soil. Although less effective on seedling weeds, pebulate can be applied broadcast and incorporated immediately by cross-disking with a

DIRECT-SEEDED PROCESSING TOMATOES

disk set to cut 6 inches, and followed by a spike tooth harrow. For maximum nutsedge (nutgrass) control deep incorporation is the most effective. Pebulate also can be incorporated lay-by after thinning.

Trifluralin (TREFLAN®) at 0.25 lb/A will control certain annual weeds and often is combined with diphenamid as a broad-spectrum preplant treatment. Trifluralin, at 0.5 to 1.0 lb/A, can be applied lay-by as a directed spray between rows and under the plants, but followed immediately by thorough incorporation 1 to 2 inches deep. When furrowing, cut furrows no deeper than the depth of incorporation.

On lighter soil types, two Lilliston® rolling cultivator gangs set in tandem can be effectively used to incorporate diphenamid, napropamide, or bensulide, especially when followed by sprinkler irrigation.

Chemical usages suggested in this publication are based on active ingredient and the use of broadcast applications. The user must adjust for pounds of commercial product needed, and adjust further for band applications.

HERBICIDE	RATE LB/A ACTIVE INGREDIENT	REMARKS
bensulide (PREFAR®)	4 to 5	Controls annual grasses. Long-lived; may injure sensitive crops planted before 18 months. Band treatment reduces possibility of injury to following crops.
CDEC (VEGADEX®)	4 to 6	Good on dodder at 6 lb. rate, and some specific weed species (see chart). Short-lived, 4 to 6 weeks. Not effective in Imperial Valley.
CDEC (VEGADEX®) + pebulate (TILLAM®)	3 + 3	Controls a broad spectrum of weeds. Injury may occur if applied in cool weather.
diphenamid (DYMID®, ENIDE®)	4 to 6	Controls annual weeds. Small grains may be injured if planted immediately after tomato harvest.
napropamide (DEVIRINOL®)	1 to 2	Apply preplant for control of annual weeds. Long-lived. Do not seed field to alfalfa, small grains, sorghum, corn, lettuce, or sugar beets for 12 months after napropamide application.
napropamide (DEVIRINOL®) + pebulate (TILLAM®)	1 to 2 + 4 to 6	Controls a broader spectrum of weeds than either herbicide alone. Do not seed to alfalfa, small grains, sorghum, corn, lettuce or sugar beets for 12 months after application.
pebulate (TILLAM®)	4 to 6	Volatile, so most effective power-incorporated immediately after application. Good to fair on nutsedge and nightshade. Short-lived, 4 to 6 weeks.
trifluralin (TREFLAN®)	0.5 to 1.0	Should be applied lay-by (after thinning). Long-lived; sensitive crops planted after tomato harvest may be damaged. See label.
trifluralin (TREFLAN®) + diphenamid (DYMID®, ENIDE®) or (TREFMID®)	0.25 + 4.0	Controls a broad spectrum of weeds. Trifluralin usually suppresses growth of early crop plantings under cool conditions. Do not use on sandy soils or soils with more than 5% organic matter. Small grains may be injured if planted immediately after tomato harvest.

FRESH MARKET TRANSPLANT TOMATOES

Early fresh market tomatoes are transplanted in the field. Often covers are used to warm the soil and protect the plant from frost. The transplant crop is grown on a wide range of soils, from sandy loams to heavy clay soils. Irrigation is usually by furrow. However, sprinklers are sometimes used.

Control of annual weeds under the plant covers is essential to early plant growth. Control of annual grasses facilitates staking and tying, and hand or machine harvest. The early spring crop is usually grown tied to poles or trellised to keep the fruits off the soil.

CULTURAL CONTROL METHODS

A history of weed species and their population densities should be kept on fields used for transplant tomatoes. Fields infested with perennial weeds (johnsongrass, nutsedge, field bindweed) or fields whose previous crops have been infested with dodder or broomrape should be avoided. If time allows, form beds well ahead of planting so weeds will germinate, then apply a contact herbicide to kill them. This will reduce weed populations in the field.

MECHANICAL CONTROL METHODS

Hand-weeding or hoeing is done as the plant covers are removed. High-clearance cultivators that clear the stakes are used in the summer to

cultivate two or more rows. Smaller equipment may be used between the rows. Irrigation furrows are made during cultivation.

CHEMICAL CONTROL METHODS

Preplant herbicides can eliminate the need for hand-weeding under plant covers. Herbicides are usually applied and incorporated before the transplants are set.

Weed oil can be used between the rows as a contact after the first irrigation following the final cultivation. Trifluralin (TREFLAN®) and bensulide (PREFAR®) usually give season-long control of most grasses.

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HERBICIDES	RATE LB/A ACTIVE INGREDIENT	REMARKS
bensulide (PREFAR®)	4 to 6	Controls annual grasses. It is long-lived and damage could occur to sensitive crops planted before 18 months. Band treatment will reduce the possibility of injury to following crops.
diphenamid (DYMID®), ENIDE®)	5 to 6	Controls annual weeds. Small grains may be injured if planted immediately after harvest.
pebulate (TILLAM®)	4 to 6	Volatile; incorporate immediately 2 to 3 inches deep. Cross disk and harrow. Control 4 to 6 weeks. DO NOT USE WITH HOT CAPS.
trifluralin (TREFLAN®)	0.5 to 1.0	Apply and incorporate immediately, before transplanting. Disk in two directions set to incorporate 2 to 3 inches deep. Long-lived; sensitive crops planted after harvest may be damaged. See label.

SENSITIVITY OF WEEDS TO SELECTIVE HERBICIDES USED IN TOMATOES

	Preplant Incorporated								Postplant (Sprinkler or Rainfall Activated)				Post Thinning	
	DEVIRINOL [®]	DYDID [®]	ENIDE [®]	PREFAR [®]	TILLAM [®]	VEGADEX [®]	TREFMID [®]	PLANAVIN [®] + DIPHENAMID	DEVIRINOL [®]	DYDID [®]	ENIDE [®]	VEGADEX [®]	PLANAVIN [®]	TREFLAN [®]
<u>BROADLEAF WEEDS</u>														
chickweed	C	C	C	C	C	C	C	C	C	C	C	C	C	C
cocklebur	P	N	N	N	N	P	N	N	N	N	N	P	N	N
fat hen	C	C	C	P	C	P	C	C	C	C	C	P	C	C
fiddleneck	C	C	C	C	C	C	C	C	C	C	C	C	C	C
goosefoot	P	C	C	C	C	C	C	C	P	C	C	C	C	C
ground cherry	N	N	N	N	P	P	N	N	N	N	N	P	N	N
groundsel	C	P	P	N	C	N	N	N	C	P	P	N	N	N
henbit	N	C	C	P	C	P	C	C	N	C	C	P	N	N
knotweed	C	C	C	P	P	P	C	C	C	C	C	P	C	C
lambsquarter	C	C	C	C	C	C	C	C	C	C	C	C	C	C
London rocket	P	N	N	N	N	P	N	N	P	N	N	P	N	N
marestalk	N	N	N	N	P	P	N	N	N	N	N	P	N	N
mustard	P	N	N	N	N	N	N	N	P	N	N	N	N	N
nettle	P	C	C	P	C	P	C	C	P	C	C	C	P	P
nightshade	N	N	N	N	P	P	N	N	N	N	N	N	N	N
pigweed	C	C	C	P	C	P	C	C	C	C	C	P	C	C
pineapple weed	C	P	P	N	C	P	P	P	C	P	P	P	N	N
prickly lettuce	C	N	N	N	C	P	N	N	C	N	N	N	N	N
purslane	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Russian thistle	C	P	P	N	P	P	P	P	P	P	P	P	P	P
shepherdspurse	P	P	P	N	P	N	P	P	P	P	P	N	N	N
sow thistle	C	N	N	N	C	P	N	N	C	N	N	P	N	N
sunflower	P	N	N	N	N	N	N	N	N	N	N	N	N	N
tolguacha	N	N	N	N	N	N	N	N	N	N	N	N	N	N
<u>GRASSY WEEDS</u>														
annual bluegrass	C	C	C	C	C	C	C	C	C	C	C	C	C	C
barnyardgrass	C	C	C	C	C	C	C	C	C	C	C	C	C	C
canarygrass	C	C	C	C	C	C	C	C	C	C	C	C	C	C
crabgrass	C	C	C	C	C	C	C	C	C	C	C	C	C	C
feather fingergrass	C	C	C	C	C	P	C	C	C	C	C	C	C	C
foxtail (bristlegrass)	C	C	C	C	C	P	C	C	C	C	C	P	C	C
johnsongrass (seed)	C	C	C	C	C	P	C	C	C	C	C	P	C	C
lovegrass	C	C	C	C	C	C	C	C	C	C	C	C	C	C
nutsedge	N	N	N	N	P	N	N	N	N	N	N	N	N	N
rabbitfootgrass	C	C	C	C	C	C	C	C	C	C	C	C	C	C
ryegrass	C	C	C	C	C	P	C	C	C	C	C	P	C	C
volunteer cereals	C	C	C	N	C	P	C	C	C	C	C	P	N	N
wild oats	C	C	C	P	C	P	C	C	C	C	C	P	P	P

C = controlled
P = partially controlled
N = not controlled

*OTHER HERBICIDES REGISTERED FOR USE
IN TOMATOES IN CALIFORNIA*

The herbicides listed below can provide acceptable results under specific local conditions. The user should obtain performance information for his own locality since tests indicate poor weed control or crop injury may result under some California conditions.

HERBICIDES	REMARKS
CDAA (RANDOX®)	Has not given broad spectrum weed control in most tests. Virtually unaffected by high organic soils.
chloramben (AMIBEN®)	Marginal safety on tomatoes depending upon rainfall in relation to size of tomato. Effective on nightshade weeds.
DCPA (DACTHAL®)	Injury has resulted to tomatoes in some tests as swelling of the hypocotyl (stem); plants become brittle and break off. This is particularly prevalent on early (cool-season) plantings.
nitralin (PLANAVIN®)	Similar weed spectrum and safety as trifluralin. Has been applied preplant with diphenamid or as lay-by treatment.
paraquat* (PARAQUAT®)	Contact herbicide applied to fallow ground prior to planting for volunteer cereal control.

* Restricted herbicide; permit required

COMBINATIONS OF HERBICIDES

Combinations of herbicides can legally be made only with those labeled for use independently in tomatoes. When using combinations do not reduce the rate of an included herbicide that controls a specific problem weed species. Information on combinations and sensitivity for tomatoes is available in progress reports MA-60 and MA-60a, or from your local farm advisor. Herbicides should not be combined with other herbicides or pesticides unless information is available which assures crop safety and beneficial use.

WARNING ON THE USE OF CHEMICALS AND SUGGESTIONS FOR PROPER USE

Pesticides are poisonous and always should be used with caution. The following suggestions for the use and handling of herbicides will help minimize the likelihood of injury to man, animals, and crops other than the pest species to be destroyed, from exposure to such chemicals.

ALWAYS read and follow exactly all precautionary directions on the label before using sprays. Note warnings and cautions before opening the container. Repeat the process every time, no matter how often you use a pesticide, or how familiar you think you are with the directions. Apply material only in amounts and at times specified.

PERSONAL SAFETY - Avoid inhaling sprays. When directed on the label, wear protective clothing and a proper mask.

Never smoke, eat, or chew while spraying or mixing spray materials.

APPLICATION - Do not use the mouth to siphon liquids from containers or to blow out clogged lines, nozzles, etc.

Do not spray with leaking hoses or connections.

Do not work in the drift of a spray.

Confine chemicals to the property being treated and avoid drift by stopping treatment if the weather conditions are not favorable.

Do not apply pesticides over fish ponds, canals, streams or lakes, and do not apply them to fields being irrigated if drain water runs off field.

Observe label directions and follow recommendations in order to keep the residue on edible portions of plants within the limits permitted by law.

DECONTAMINATION - Should pesticides be accidentally spilled on the skin or clothing remove contaminated clothing *immediately* and wash the contaminated skin thoroughly. If splashed in the eye, wash thoroughly with a stream of water for at least 15 minutes.

Bathe and change to clean clothing after spraying. If it is not possible to bathe, wash hands and face thoroughly and change clothes. Also wash clothing each day before re-use.

IN CASE OF ILLNESS - If symptoms of illness occur during or shortly after spraying, call a physician or get the patient to a hospital *immediately*.

DISPOSAL OF EMPTY CONTAINERS - Always dispose of empty containers so that they pose no hazard to humans, animals, valuable plants or wildlife.

STORAGE - Keep pesticides out of reach of children, pets, unauthorized persons, and livestock. Pesticides should be stored outside the house, away from food and feed, and under lock and key.

ALWAYS store sprays in their original containers and keep them tightly closed. NEVER keep them in anything but the original container.

HERBICIDE RESIDUES

New materials and formulations continually appear and these will be included in the guide only after they have been properly registered, proven effective, and if their registered use when applied under California conditions as directed will not result in a residue that exceeds the legal tolerance.

These suggestions for weed control are based on the best information currently available for each herbicide listed. If followed carefully they should result in satisfactory control and should not leave residues that will exceed the tolerance established for any particular chemical on this crop. To avoid excessive residues on the harvested crop, follow directions explicitly with respect to dosage levels, number of applications, and minimum interval between application and harvest.

THE GROWER IS RESPONSIBLE for residues on his own crop as well as for problems caused by drift from his property to other properties or crops.

RESTRICTED MATERIAL

No restricted material shall be applied under any circumstances or in any location where damage, illness or injury appears likely to result, through direct application, drift or residue, to persons, animals (including honeybees) or crops other than the pest or vegetation which the material is intended to destroy.

Restricted materials, or emptied containers or parts thereof, shall not be dumped or left unattended at any place or under any conditions where they may present a hazard to persons, animals (including honeybees) or crops.

Before any restricted material is applied, the person responsible for making the application shall give warning to all persons known to be on the property to be treated.

PERMIT REQUIREMENT: Some herbicides require a permit for purchase and use; those mentioned in this publication are designated by an asterisk (). Permits are obtained from your County Agricultural Commissioner.*

HERBICIDE STORAGE, TRANSPORTATION AND DISPOSAL

(a) Each person who controls the use of any property or premises is responsible for all containers on the property which hold or have held

a pesticide. Unless all such containers are under his personal control so as to avoid contact by unauthorized persons, he shall

1. Provide a person responsible to him to maintain such control over the containers at all times or,
2. Store all containers under locked conditions.

(b) Pesticide storage locations shall be posted with visible warning notices readable from a distance of 25 feet from any direction and be substantially as follows.

DANGER

POISON STORAGE AREA

ALL UNAUTHORIZED PERSONS KEEP OUT

KEEP DOOR LOCKED WHEN NOT IN USE

(c) Empty pesticide containers shall be rinsed and drained by the user at the time of use by the triple rinse method.

(d) Used pesticide containers that have been properly rinsed may be disposed of in accordance with regulations of the California Department of Food and Agriculture. Never burn pesticide containers.

PROTECT HONEYBEES, BENEFICIAL INSECTS, AND WILDLIFE FROM PESTICIDE DAMAGE

The farmer, beekeeper, and pesticide salesman should cooperate to protect insect pollinators, predators, and parasites as well as wildlife. The least toxic pesticides should be used with the safest methods and time of application for pollinators of crops or other beneficial insects, wildlife, and fish. Pesticides should be applied only to the area to be treated. Drinking water of wildlife and bees should not be contaminated by drift or drainage from treated fields into canals, streams, and pools. Special precautions are given in the remarks column immediately following recommendations.

For further information on how to protect honeybees, see University of California Division of Agricultural Sciences publication entitled "Protecting Honey Bees from Pesticides", formerly AXT-251.

DRIFT OF HERBICIDES

No pesticide can be applied by either aerial or ground equipment without some drift occurring; however, less drift occurs from a ground application than from an aerial application.

Drift can be kept to a minimum and the contamination to forage crops reduced if certain precautions are observed in the selection of the pesticide, method of application, type of formulation (spray or granular), timing of treatment, wind direction and velocity, and the distance between the point of application and the nearest forage crop downwind.

It is the responsibility of the farmer and the applicator to consider the above points before applying a herbicide. For most pests, this program offers several alternatives for control. The herbicide which will best meet the requirements for a safe application in respect to surrounding crop, animal farming operations, beneficial insects and wildlife should be selected.

UNIVERSITY POLICY FOR MAKING PEST CONTROL RECOMMENDATIONS

Pest control recommendations made by University of California personnel are based upon those materials for which there are specific data regarding: effectiveness under California conditions, residues that will remain on the crop at harvest, phytotoxicity, and wherever possible, the effects upon beneficial predators, parasites, honeybees, fish and other wildlife. Recommended chemicals must also be registered and labeled for use both by the United States Department of Agriculture and by the California State Department of Food and Agriculture.

SPECIAL PROBLEMS OF PROCESSED CROPS

Some processors will not accept a crop treated with certain chemicals. If your crop is going to a processor, be sure to check with the company representative before making pesticide applications.

PHYTOTOXICITY: Certain chemicals may cause crop injury or less than optimum weed control if used: at the wrong stage of plant development; in certain soils; or when temperatures are too high. Injury also may result from: excessive rates, wrong formulation, or mixing of incompatible materials. Additive ingredients such as wetting agents, spreaders, emulsifiers, diluents, and solvents can cause plant injury. Since formulations often are changed by manufacturers, it is possible that plant injury may occur even though no injury was noted in previous seasons with the same or similar material.

COOPERATIVE EXTENSION

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