Washington State Department of Agriculture

# Monomethyl tetrachloroterephthalic acid (MTP) and Tetrachloroterephthalic acid (TPA) Groundwater Occurrence in Washington State

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# Monomethyl tetrachloroterephthalic acid (MTP) and Tetrachloroterephthalic acid (TPA) Groundwater Occurrence in Washington State

By

Kirk V. Cook, Licensed Hydrogeologist
Natural Resource Assessment Section

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## Acknowledgements

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- Gary Bahr – Water Quality Manager, Idaho Department of Agriculture
- Steve Riley – Water Quality Specialist, Oregon Department of Agriculture

## Summary

The Washington State Department of Agriculture (WSDA) has conducted an evaluation of groundwater data collected during the period 1988 – 2012. This data was collected by various federal, state, local and private entities with a majority collected by public water supply system operators, as required by the Washington State Department of Health (WDOH). The evaluation indicates that groundwater quality has been impacted in several areas of the state by the metabolite(s) of the broad spectrum herbicide, Dimethyl Tetrachloroterephthalate (DCPA) commonly known by the trade name Dacthal. The most affected areas are the highly agricultural tracts of Eastern Washington where Dacthal has been historically registered for use. Dacthal is typically used in those areas as a pre-emergence herbicide for crops such as onions and turf grass.

The detection of the metabolites, MTP and TPA, in both private and public water supply wells confirms that one or both are persistent in groundwater under certain conditions. In areas of Eastern Oregon and Western Idaho where Dacthal has been used extensively, state agencies have traced a majority of detections of MTP/TPA in groundwater to historic uses. These areas share similarities in agricultural activities, soil types, climate and hydrogeology with regions of Eastern Washington where Dacthal metabolites have been detected.

Data supplied to WSDA by WDOH confirms that in at least two areas of the state (City of Quincy and the area south of the City of Walla Walla) the health advisory limit (HAL) of 70 µg/L has been exceeded for Dacthal[1]. In multiple areas of Eastern Washington, including areas within Benton, Grant, and Walla Walla Counties, detections below the HAL but above Washington's *Pesticide Management Strategy* action level of 14 µg/L (20% of the HAL) have been noted. A statewide review of current and historic uses of Dacthal, current and historic cropping patterns, and WSDA's aquifer vulnerability assessment suggest that there may be other

[1] *The U.S. Environmental Protection Agency has established a Health Advisory Limit (HAL) for Dacthal at 70 µg/L. This limit is applied equally to the parent compound (DCPA) and any of its metabolites. To determine whether the limit has been exceed the detections of the parent and the detected metabolites are added if the sum meets or exceeds 70 µg/L, an exceedence of the HAL is considered to have occurred.*

areas of the state where groundwater has potentially been impacted by MTP/TPA but where monitoring data is insufficient to verify its presence and magnitude.

Discussions with the registrant American Vanguard Corporation (AMVAC), indicate that statewide applications of Dacthal are currently limited and that the herbicide is gradually being replaced by alternative control products. The decline in use is supported by WSDA's limited evaluation of declining sales records within the Quincy, Washington area.

Given the findings discussed in this report, WSDA's Natural Resource Assessment Section is recommending that the use of Dacthal be discontinued in Washington State beginning in the spring of 2015.

## Background

In 2010, data submitted to WSDA by WDOH indicated that concentrations of the Dacthal metabolite(s), MTP and TPA had exceed the federal drinking water health advisory level of 70 µg/L in at least one public water supply well near Quincy, Washington. Upon further review, significantly increased concentrations of MTP/TPA in several other public water supply wells owned and operated by the city of Quincy, were noted beginning in 2007 and continuing until the present.

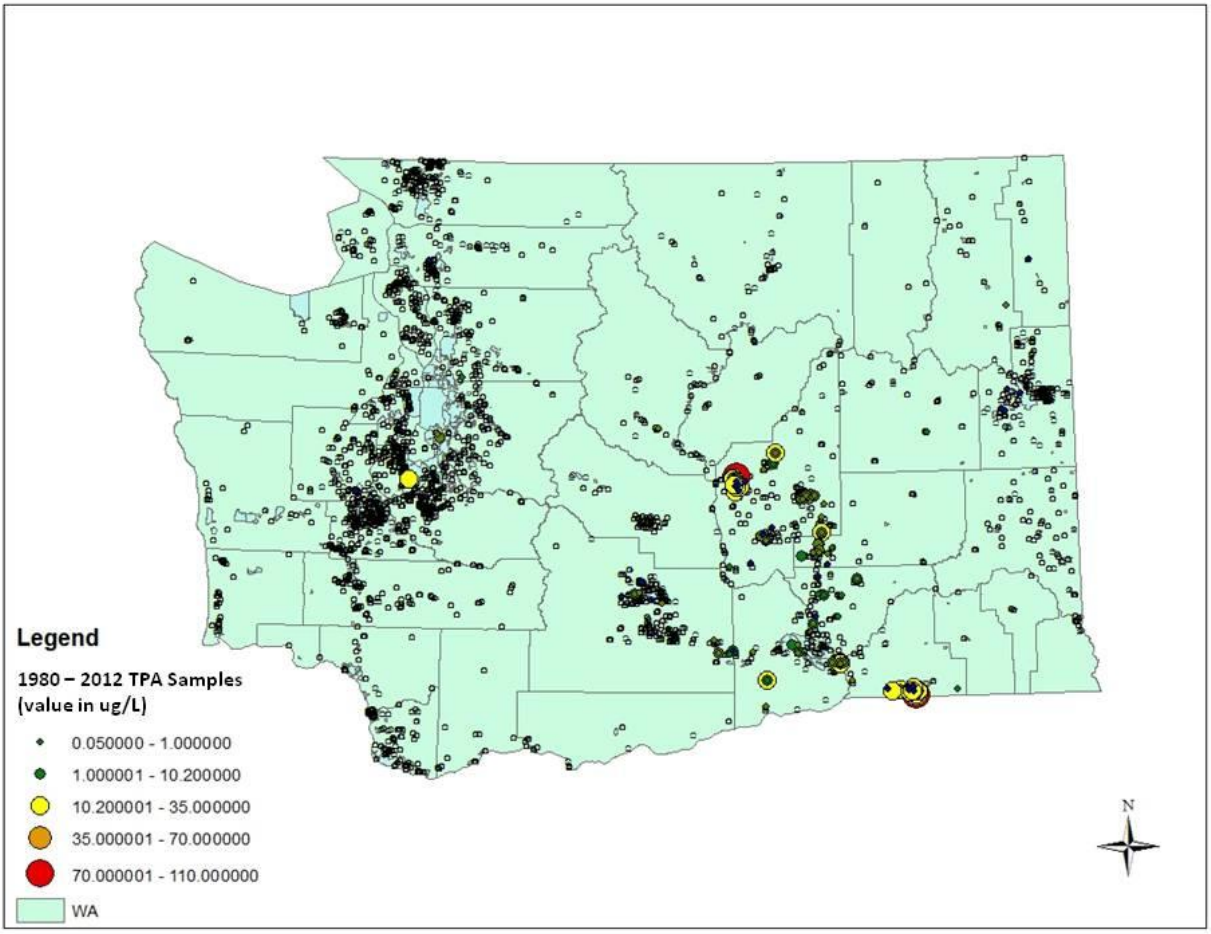


*Figure 1. Location of sampling sites for MTP/TPA from 1988 - 2012. Ranges specified between .05 – 1.0 ug/L are generally non-detects and represent the limits of the analytical method used.*

In 2012 increased levels of MTP/TPA were detected in several public water supply wells near the City of Walla Walla, Washington. In at least one of these locations MTP/TPA levels have steadily increased with numerous exceedences of the HAL. Samples collected by the operator of

the most impacted public water system in irrigation ditches near the drinking water supply well south of the city of Walla Walla, WA also indicated concentrations of Dacthal indicating recent application. Results of an investigation by WSDA and the Oregon Department of Agriculture were inconclusive and the source of this detection remains undetermined. In 2013 Dacthal was detected in surface water samples collected by the WSDA within Skagit County. As part of the agency's statewide surface water pesticide monitoring project. These detections have been traced to the use of Dacthal on seed crops within the area.

In 2012 and again in 2013, a review of WSDA's pesticide database identified a general upward trend in Dacthal metabolite levels in public water supply wells located within areas of intensive row cropping in Eastern Washington. Figure 1, shows approximately 24 years of groundwater data collected by state and federal agencies for Dacthal and Dacthal metabolite(s). The majority of the detections above the analytical threshold(s) are located in the south-central area of the state. The highest levels of MTP/TPA were detected, within Adams, Benton, Franklin, Grant, and Walla Walla counties where a majority of the commodities for which Dacthal has been registered are grown. In 2005 Dacthal label modifications by US Environmental Protection Agency. This modification removed several crops, grown in Washington, from legal application.

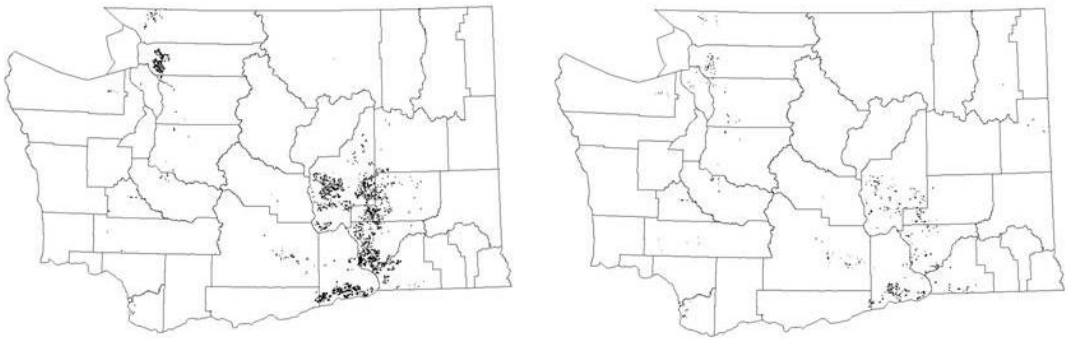

*Figure 2. The map on the left illustrates the distribution of crops registered for Dacthal use in 2005 (195,065 acres) prior to label modifications. The map on the right illustrates the distribution of crops registered for Dacthal use in 2012 (33,530 acres). Source: WSDA (2006, 2013)*

These modifications removed peppers, potatoes, squash, lettuce, soybeans, corn, rutabagas, and dry beans) from registration, but retained onions, turf grass, melons, strawberries, and tomatoes.

This label modification is one of the factors contributing to an 83% reduction in the land area to which Dacthal could conceivably be applied between 2005 and 2012 (Figure 2).

Occurrence of Dacthal and its metabolites has been documented previously in the Pacific Northwest most notably in Oregon and Idaho. In Oregon (Malheur County) groundwater contamination with both nitrate and Dacthal and its metabolites has been detected. These detections triggered the establishment of the Northern Malheur Groundwater Management Area in 1989. As a result of the implementation of numerous best management practices the area-wide contamination with Dacthal and its metabolites appears to be decreasing. This conclusion is based on four estimates of the area-wide trends that suggest concentrations of Dacthal and metabolites are decreasing at rates of 0.23 to 5.0 ppb per year. This conclusion is not definitive because trends at individual locations are mixed (i.e., 45% decreasing, 40% statistically insignificant, 12.5% increasing, and 2.5% flat).

Idaho has one Dacthal prohibition area established in 2007 located near Homedale, Idaho. From 2001 until 2006, the Idaho Department of Agriculture statewide groundwater sampling program identified 136 wells with Dacthal and Dacthal metabolite concentrations below 14 µg/L, 23 at concentrations between 14 µg/L and 35 µg/L, five between 35 µg/L and 70 µg/L, with one above 70 µg/L. Wells above 35 µg/L were centered around Homedale, ID prompting Idaho to declare a Dacthal prohibition zone surrounding the area. Monitoring results continue to show concentration fluctuations with a general slight trend downward, presumably due to the implementation of the prohibition.

## Chemical Characteristics

Dacthal is a pre-emergence herbicide. Monomethyl tetrachloroterephthalic acid (MTP) and Tetrachloroterephthalic acid (TPA) are the environmental degradates. At present the commonly employed analytical method for detection of TPA and MTP do not distinguish between the two compounds, therefore, results reported in this document are taken to be the terminal hydrolytic degradate TPA. Within the soil column, Dacthal is bound very strongly to organic matter and is almost immobile in soils with moderate to high organic matter content.

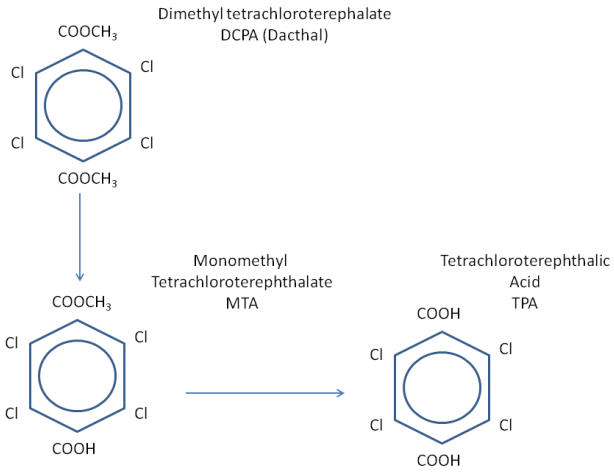


*Figure 3. Metabolic pathway for Dacthal in soils and groundwater*

A 1993 study by Wettasinghe and Tinsley cited in the USEPA Re-registration Eligibility Decision (RED), found that essentially all of the Dacthal was transformed to di-acid Dacthal (TPA) after 197 days, although minor amounts of mono-acid Dacthal (MTP) were observed (USEPA, 1998). In a 300-day study, the half-life of mono-acid Dacthal was about 2.8 days, while di-acid Dacthal was persistent and barely degraded at all (USEPA, 1998).

Two products are currently registered for use in Washington with Dacthal as the active ingredient: Dacthal Flowable Herbicide (EPA registration number 5481-487) and Dacthal W-75 Herbicide (EPA registration number 5481-490) (see Appendix One for labels).

### *Environmental Fate*

When water pH is between 5.0 and 9.0 there is virtually no chemical degradation of Dacthal. (AMVAC, 2007). In surface water the breakdown of Dacthal is due to the action of sunlight, with a half-life generally less than three days (AMVAC, 2007). In most soils the half-life of Dacthal ranges from 14 to 100 days (EXTOXNET, 1996) with degradation influenced by soil

moisture, soil temperature and soil microbial activity (AMVAC, 2007). Dacthal undergoes a two-step degradation process resulting in the breakdown products monomethyl tetrachloroterephthalate (acid ester or MTP) and tetrachloroterephthalate (di-acid or TPA) (AMVAC, 2007). Little breakdown of Dacthal occurs below a soil temperature of 50°F due to low levels of microbial activity (AMVAC, 2007). TPA is the dominant form of Dacthal occurring in groundwater and will leach to groundwater wherever Dacthal is used; it is extremely mobile and persistent in the environment.

### *Toxicological Information*

The U.S. Environmental Protection Agency has established a Health Advisory Level at 70 µg/L for Dacthal and its metabolites. The HAL is an EPA determined concentration in drinking water that is not expected to cause any adverse non-carcinogenic effects for a lifetime of exposure. The HAL is based on exposure of a 70 kg adult consuming 2 liters of water a day. The HAL for Dacthal was determined based on chronic and sub-chronic studies that demonstrated Dacthal can affect the lungs, liver, and thyroid in rats and the liver in mice. The agency has determined that neither MTP nor TPA is more toxic that the parent compound and therefore believes that the reference dose (RfD) for the compounds would be protective against exposure from the two metabolites.

## Data Analysis

### *MTP / TPA Occurrence*

The occurrence and concentration of MTP/TPA has increased in groundwater since sampling began in the late 1980's. However, this increase was not observed uniformly across the state. Larger increases in average concentration occurred in Adams, Benton, Franklin, Grant and Walla Walla Counties, with the greatest increases noted in Grant and Walla Walla Counties. The majority of the irrigated row crops for which Dacthal was historically registered for use in Washington State are grown in these counties (with the exception of Yakima) (Figure 2).

The counties where the largest increases in MTP/TPA concentration have occurred present similarities in soil type (course grained soils with low organic matter), annual temperature, precipitation, depth to shallow groundwater, and extensive irrigation applications. These factors tend to increase the vulnerability of shallow groundwater to MTP/TPA contamination and result in higher levels of leaching through surficial soils and into groundwater.

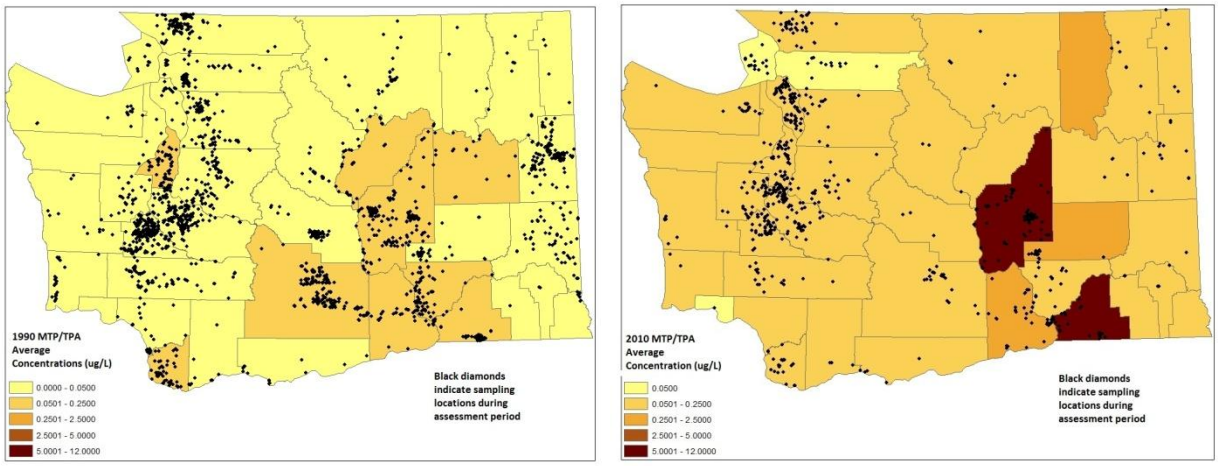


*Figure 4. The average concentration of MTP/TPA in groundwater samples (µg/L) analyzed since the late 1980's has increased in many of Washington's counties. The largest increases appear to have occurred within counties located in the south-central areas of the state.*

Historical and current labels for Dacthal contain language advising against the use of the product in areas where soils with low organic matter and high water tables exist. This language is

cautionary in nature and is not enforceable. The lack of specificity and regulatory language on the label is likely to have maintained the use of Dacthal in areas where its use was not advised. Below is an excerpt from the current label. This language has remained consistent in registration(s) since 2004.

> *" Tetrachloroterephthalic acid, a breakdown product of Dacthal is known to leach through soil as a result of agricultural and turf uses and has been found in groundwater which may be used for drinking water. Users are advised not to apply Dacthal to sand and loamy sand soil where the water table (groundwater) is close to the surface and where these soils are very permeable, i.e. well drained, Your local agricultural agencies can provide further information on the type of soil in your area and the location of groundwater used for drinking water"*

Because of the stability of the metabolites (TPA) and decreases in recorded sales of Dacthal since mid-2000's, the increases in average concentrations are more likely due to historical use than current applications (Figure 4). Given the current knowledge concerning TPA, it is reasonable to assume that detections of MTP/TPA

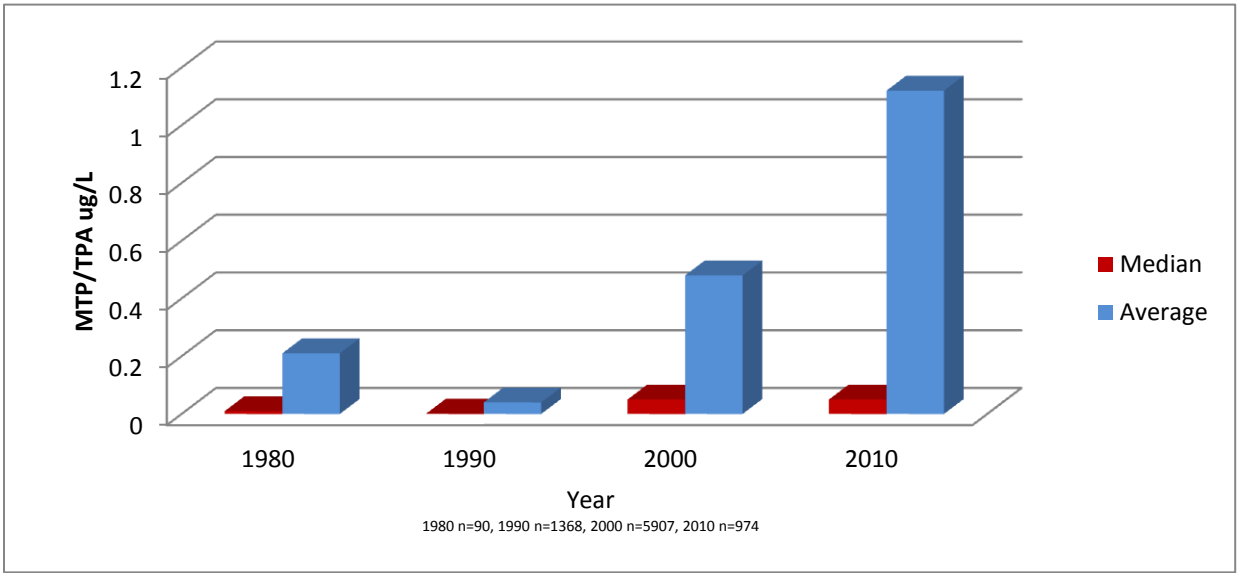


*Figure 5. Concentrations of all samples collected from 1988 – 2012. Median and average values include samples designated as "non-detect" for which ½ of detection limit was used as a reportable value.*

will continue until Dacthal use is discontinued and the metabolites have either broken down in the environment or have been transported through and discharged from impacted aquifers.

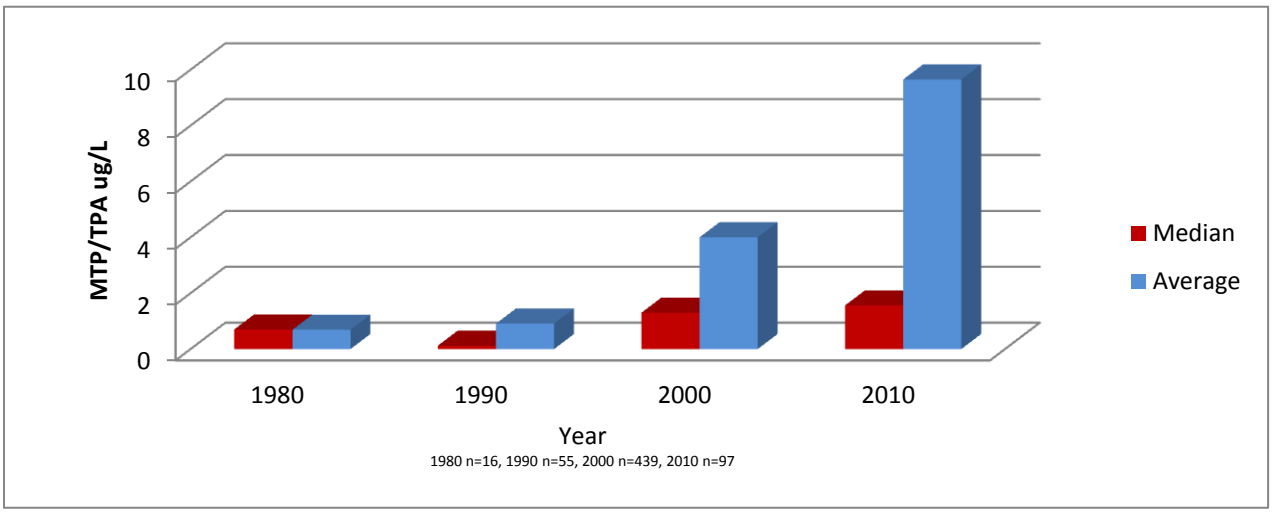


*Figure 6. Concentration of samples collected from1988 – 2012. Median and average values include only samples designated as "detects".*

2012. The concentrations at which detections occur also appear to have increased during the same time period. An evaluation of WSDA's pesticide and groundwater database reveals that while MTP/TPA has not consistently been the compound most detected during each sampling decade, its occurrence has steadily increased during the period of record as compared to other detected pesticides. Factors such as modifications to long term sampling programs (WDOH), or

*Table 1. Most Commonly Detected Pesticides 1988 – 2012*

| Decade | Chemical | Detection Ranking |
|---|---|---|
| 1980 | DCPA Metabolites | 1 |
| 1980 | EDB | 2 |
| 1990 | Atrazine and Metabolites | 1 |
| 1990 | DCPA Metabolites | 2 |
| 1990 | Simazine | 3 |
| 2000 | DCPA Metabolites | 1 |
| 2000 | EDB | 2 |
| 2000 | Atrazine and Metabolites | 3 |
| 2010 | DCPA Metabolites | 1 |
| 2010 | Picloram | 2 |

inclusion of focused studies within the database may account for inconsistencies in pesticide rankings or appearance from one decade to another.

### *Well Depth and Concentration*

WSDA reviewed data from 8329 records beginning in 1988 extending through 2012. Data results for MTP/TPA analysis indicate a strong relationship between well depth and concentration detected. Water supply wells constructed with intakes below 400 feet generally do not contain MTP/TPA concentrations above the detection limit(s) of the analytical method employed.

Wells with intakes above 150 feet are significantly more likely to have MTP/TPA detections in areas of current or historical Dacthal use. In some cases there is reason to suspect that well integrity may be compromised allowing shallow groundwater impacted by MTP/TPA to intermix with underlying aquifers.

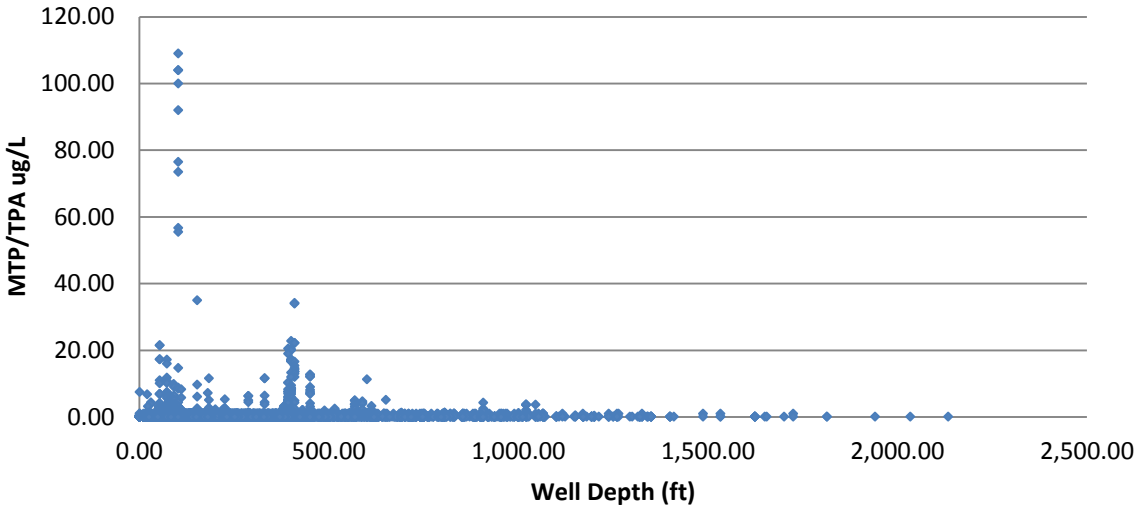


*Figure 7. Relationship between MTP/TPA occurrence and well depth*

Because of the persistence of TPA, deeper wells with intakes at depths not currently presenting evidence of MTP/TPA may be impacted in the future. This is especially true if those wells are not hydraulically isolated from impacted overlying aquifers.

### *Statewide Aquifer Vulnerability*

As noted previously, the metabolites of Dacthal, especially TPA are highly leachable through the soil column into underlying groundwater aquifers. To assess the potential impacts to underground sources of water, WSDA evaluated its statewide aquifer susceptibility and vulnerability assessment combined with the mapped location of crops for which Dacthal was registered for use between 2005 and 2012. Because of the documented persistence of TPA, the 2005 crop map layer was deemed appropriate to use in order to capture a majority of metabolite residues potentially remaining within the soil column and underlying shallow groundwater.

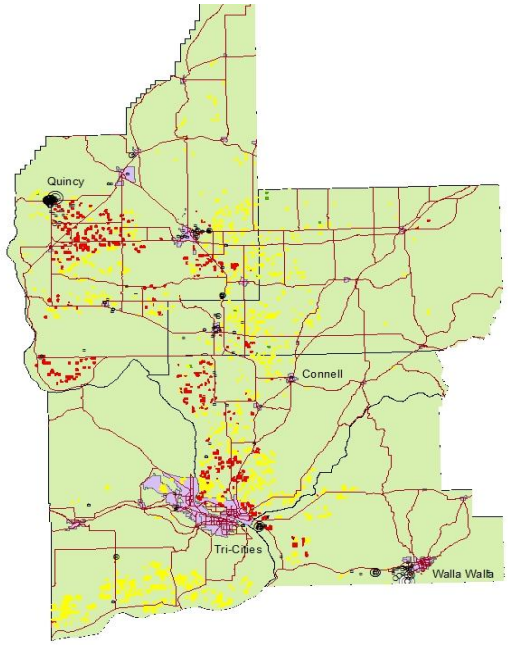


*Figure 8. South-Central areas of Washington State designated as high potential for MTA/TPA occurrence. Red indicates high vulnerability, yellow indicates medium-high to medium vulnerability.*

This assessment provides for a conservative analysis of areas where TPA concentrations are most likely to be encountered due to historical and current applications. Two areas of the state emerge as general locations with a high potential for TPA detection; the five county area (Figure 8) and the northwest portion of the state including the western areas of Skagit and Whatcom Counties (Figure 9). Detections exist within the south-central portions of the state and where monitoring data exists, detections generally coincide with areas designated as having a high to medium vulnerability. This relationship does not appear to hold true in the northwestern portions of the state. A single detection of MTP/TPA exists in the database near the city of Mt. Vernon (1994). Several reasons could account for this difference. First, the cropped areas where Dacthal could potentially be applied, were in fact not subjected to Dacthal application. Second, hydrogeologic, soil, and climatic conditions are not favorable for TPA formation.

Areas of the state not favorable for Dacthal application due to the risks of groundwater impacts are significantly more than those represented in Figure 8, and Figure 9 which only identify historic and current sites of potential application. Future cropping patterns could result in the application of Dacthal to fields not currently identified as having a potential for Dacthal use.

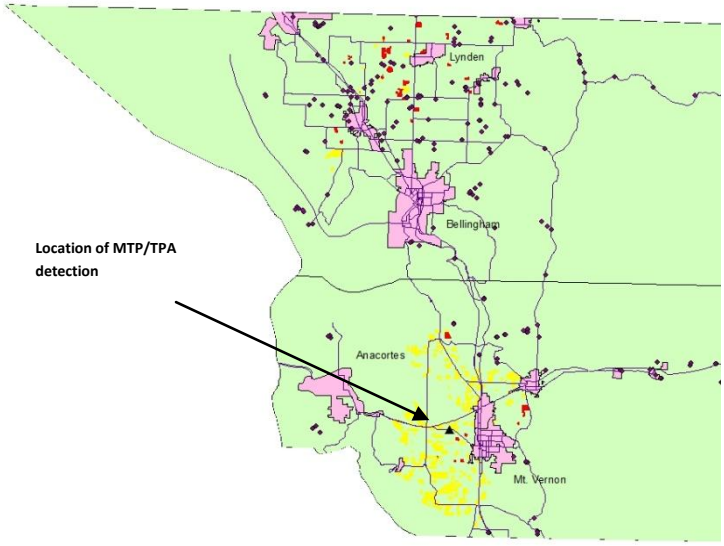


*Figure 9. Sampling sites for MTP/TPA in northwest Washington State. Note the single detection (1994)*

This could increase the areas of concern for groundwater impact. Figure 10. illustrates those areas of the state where Dachtal use represents a risk to groundwater quality based upon relative aquifer vulnerability.

***Vulnerability Ratings***

*Red – High Vulnerability*
*Yellow – Medium Vulnerability*
*Lt. Green – Low Vulnerability*
*Dk. Green – Very Low Vulnerability*

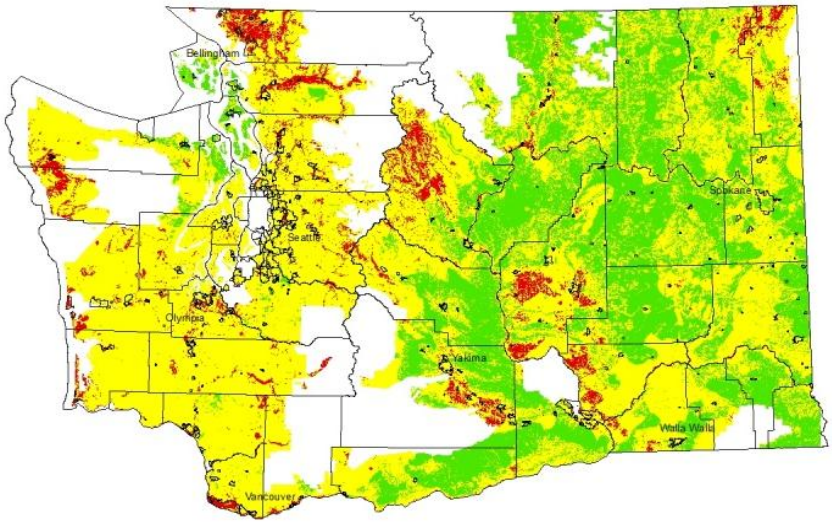


*Figure 10. Areas of Washington State vulnerable to MTP/TPA leaching.*

## Conclusion

The *Washington State Pesticide Management Strategy* requires WSDA to evaluate the known and potential risks of any pesticide that may impact ground and surface waters of the state. If the impact is deemed significant enough, a management plan potentially resulting in use restrictions prohibition is required.

Metabolites of the wide spectrum herbicide, Dacthal have been shown to leach into shallow groundwater. These compounds have been detected in numerous public water supply wells within areas were crops for which Dacthal has been approved for use have been grown. These occurrences are not unique to Washington State and have prompted Oregon and Idaho to implement management areas where Dacthal application is significantly limited or prohibited.

There is abundant evidence (water quality data, vulnerability risk assessment, and trend analysis) to warrant prohibiting the use of Dacthal in Washington State in the Quincy and Walla Walla areas with documented concentrations of metabolites approaching or exceeding the federal health advisory of 70 µg/L. Because of the metabolite persistence, detections especially within the Quincy and Walla Walla areas are expected to continue for some time. Given the history of Dacthal and the risk of impacting additional areas with MTP/TPA further applications of the herbicide should be only considered with a high degree of caution in Washington State in order to protect shallow groundwater and public drinking water supplies. Additional sampling above aquifers considered vulnerable to Dacthal leaching should be considered in support of potential expansion of recommended use prohibition areas.

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# Appendix One
# Dacthal Labels

## Current Dacthal Label

5481-487_Dacthal Flowable_20121022_30.pdf

# DACTHAL® FLOWABLE HERBICIDE

## AGRICULTURAL HERBICIDE

| ACTIVE INGREDIENT: | By Wt. |
|---|---|
| DCPA (dimethyl tetrachloroterephthalate) | 54.9% |
| INERT INGREDIENTS: | 45.1% |
| TOTAL | 100.0% |

Contains 6 lbs. DCPA per gallon.

**KEEP OUT OF REACH OF CHILDREN**

# CAUTION

| FIRST AID | |
|---|---|
| **If in eyes** | • Hold eye open and rinse slowly and gently with water for 15-20 minutes.<br>• Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.<br>• Call a poison control center or doctor for treatment advice. |
| **If inhaled** | • Move person to fresh air.<br>• If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible.<br>• Call a poison control center or doctor for further treatment advice. |
| **If on skin or clothing** | • Take off contaminated clothing.<br>• Rinse skin immediately with plenty of water for 15-20 minutes.<br>• Call a poison control center or doctor for treatment advice. |
| **If swallowed** | • Call a poison control center or doctor immediately for treatment advice.<br>• Have person sip a glass of water if able to swallow.<br>• Do not induce vomiting unless told to do so by the poison control center or doctor.<br>• Do not give anything by mouth to an unconscious person. |
| **EMERGENCY INFORMATION** | |
| Have the product container or label with you when calling a poison control center or doctor, or going for treatment.<br>**FOR THE FOLLOWING EMERGENCIES, PHONE 24 HOURS A DAY:**<br>**For Medical Emergencies phone: ..... 1-888-681-4261**<br>**For Transportation Emergencies, including spill, leak or fire, phone: CHEMTREC ..... 1-800-424-9300**<br>**For Product Use Information phone : AMVAC ..... 1-888-462-6822** | |

EPA Reg. No. 5481-487

EPA Est. No. ☐ 37429-GA-1
☐ 37429-GA-2

**PRECAUTIONARY STATEMENTS**

**HAZARDS TO HUMANS AND DOMESTIC ANIMALS**

**CAUTION:** Causes moderate eye irritation. Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling.

*SEE INSIDE BOOKLET FOR ADDITIONAL PRECAUTIONARY STATEMENTS, STORAGE & DISPOSAL AND DIRECTIONS FOR USE.*

AMVAC

4100 E. Washington Blvd.
Los Angeles, CA 90023 U.S.A
1-888-462-6822

**NET CONTENTS: 2.5 gallons**
11468-11

**PERSONAL PROTECTIVE EQUIPMENT (PPE)**
Applicators and other handlers must wear:
- Long-sleeved shirt and long pants,
- Chemical-resistant gloves made of any waterproof material,
- Shoes plus socks,
- A dust/mist respirator (MSHA/NIOSH approval number prefix TC-21C) or a NIOSH approved respirator with any N, R, P or HE filter.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

**Engineering Controls**
When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240 (d) (4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

**USER SAFETY RECOMMENDATIONS**

Users should:
- Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. Wash the outside of gloves before removing.
- Remove PPE immediately after handling this product. As soon as possible, wash thoroughly and change into clean clothing.

**ENVIRONMENTAL HAZARDS**
DO NOT apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark.

DO NOT contaminate water when disposing of equipment wastewater.

**Groundwater Advisory:** Tetrachloroterephthalic acid, a breakdown product of DACTHAL FLOWABLE is known to leach through soil as a result of agricultural and turf uses and has been found in groundwater which may be used for drinking water. Users are advised not to apply DACTHAL FLOWABLE to sand and loamy sand soils where the water table (groundwater) is close to the surface and where these soils are very permeable, i.e., well drained. Your local agricultural agencies can provide further information on the type of soil in your area and the location of groundwater used for drinking water.

**Surface Water Advisory:** DCPA can contaminate surface water through spray drift. Under some conditions, DCPA may also have a high potential to contaminate surface water through runoff (via both dissolution in runoff water and adsorption to eroding soil) for several weeks post-application. Users are advised not to apply DACTHAL FLOWABLE to poorly draining or wet soils with readily visible sloping towards adjacent surface waters, frequently flooded areas, areas over-laying extremely shallow groundwater, areas with in-field canals or ditches that drain to surface water, areas not separated from adjacent surface waters with vegetated filter strips, and highly erodible soils.

**DACTHAL FLOWABLE HERBICIDE**
A selective preemergence herbicide for control of annual grasses and certain broadleaved weeds in vegetable crops and ornamental turf.

**Read entire label carefully and use only as directed.**

**General Information**
DACTHAL FLOWABLE is a flowable formulation for use in preemergence application for control of crabgrass and other annual grasses and certain broadleaved weeds on mineral soils in vegetables, strawberries, agronomic crops, ornamental, turf, and nursery stock and as a post-emergence application for control of creeping speedwell (*Veronica filiformis*). Dacthal Flowable Herbicide is compatible with liquid nitrogen fertilizers commonly used by the lawn care industry.

**DIRECTIONS FOR USE**

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

DO NOT apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

This product is not for sale, use or distribution in Suffolk and Nassau County, Long Island, New York.

**AGRICULTURAL USE REQUIREMENTS**

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE) and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

DO NOT enter or allow worker entry into treated areas during the restricted entry interval (REI) of 12 hours. Exception: If the product is soil-incorporated, the Worker Protection Standard, under certain circumstances, allows workers to enter the treated area if there will be no contact with anything that has been treated.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is:
- Coveralls
- Chemical-resistant gloves made of any waterproof material, and
- Shoes plus socks

**Preparation and Application of the Spray:** DACTHAL FLOWABLE should be thoroughly mixed in the spray tank with water to provide for broadcast application of at least 20 gallons of water per acre, depending on equipment and local practices. Adequate agitation should be maintained during filling and spraying to keep material in uniform suspension. Use nozzles suitable for applying wettable powders so that the spray can be uniformly distributed over the properly prepared soil surface. Any screen or strainer in spray equipment should be no finer than 50 mesh to prevent clogging. It is essential that the sprayer be properly calibrated before making applications. Standard low-pressure (30-50 psi) boom-type sprayers are recommended.

A minimum of one-third to one-half inch of water, either as rain or irrigation, is necessary to activate DACTHAL FLOWABLE and thereby obtain preemergence control of weeds specified. Normally, water must be applied within 3 to 5 days of application if sufficient rainfall does not occur. However, when surface soil is dry but subsurface soil contains enough moisture to germinate weeds, water should be applied immediately. If furrow irrigation is used, the top of the bed must be thoroughly wet. If rainfall during this period does not occur and irrigation cannot be made, shallow incorporation, when recommended, will aid in weed control.

**Aircraft Application:** It is recommended that DACTHAL FLOWABLE be applied in a minimum of 10 gallons of spray per acre. Aircraft should be equipped with pumps with sufficient capacity to deliver at least 10 gallons per acre. Placement of nozzles should provide a uniform spray pattern. DACTHAL FLOWABLE should be premixed in a nurse tank or mixing tank equipped with mechanical or bypass agitation. Mixture can then be pumped into the aircraft. Screens on mixing tanks should be no finer than 50 mesh. Adequate agitation should be maintained in the mixing tank as well as the aircraft throughout the spraying operation. Regulations governing aerial application of herbicides are in effect in many states. Consult local regulatory

agencies concerning requirements before making applications. Avoid spray drift to adjacent fields; particular care should be exercised when adjacent fields contain edible crops or those that will be fed or grazed by livestock. Spray only on still days.

**Aerial Drift Reduction Advisory:** Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment and weather-related factors determine the potential for spray drift. The applicator and the grower are responsible for considering all these factors when making aerial application decisions.

The following drift management requirements must be followed to avoid off-target drift movement from aerial applications to agricultural field crops. These requirements do not apply to forestry applications, public health uses or to applications using dry formulations.

1. The distance of the outer-most nozzles on the boom must not exceed 3/4 the length of the wingspan or rotor.
2. Nozzles must always point backward parallel with the air stream and never be pointed downwards more than 45 degrees.

**INFORMATION ON DROPLET SIZE**

The most effective way to reduce drift potential is to apply large droplets. The best drift management strategy is to apply the largest droplets that provide sufficient coverage and control. Applying larger droplets reduces drift potential, but will not prevent drift if applications are made improperly, or under unfavorable environmental conditions (see Wind, Temperature and Humidity, and Temperature Inversions).

**CONTROLLING DROPLET SIZE**

**Volume:** Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.

**Pressure:** Do not exceed the nozzle manufacturer's recommended pressures. For many nozzle types lower pressure produces larger droplets. When higher flow rates are needed, use higher flow rate nozzles instead of increasing pressure.

**Number of Nozzles:** Use the minimum number of nozzles that provide uniform coverage.

**Nozzle Orientation:** Orienting nozzles so that the spray is released parallel to the airstream produces larger droplets than other orientations and is the recommended practice. Significant deflection from horizontal will reduce droplet size and increase drift potential.

**Nozzle Type:** Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles. Solid stream nozzles oriented straight back produce the largest droplets and the lowest drift.

**BOOM LENGTH**

For some use patterns, reducing the effective boom length to less than 3/4 of the wingspan or rotor length may further reduce drift without reducing swath width.

**Application Height**

Applications should not be made at a height greater than 10 feet above the top of the largest plants unless a greater height is required for aircraft safety. Making applications at the lowest height that is safe reduces exposure of droplets to evaporation and wind.

**Swath Adjustment**

When applications are made with a crosswind, the swath will be displaced downward. Therefore, on the up and downwind edges of the field, the applicator must compensate for this displacement by adjusting the path of the aircraft upwind. Swath adjustment distance should increase, with increasing drift potential (higher wind, smaller drops, etc.)

**Wind**

Drift potential is lowest between wind speeds of 2-10 mph. However, many factors including droplet size and equipment type determine drift potential at any given speed. Application should be avoided below 2 mph due to variable wind direction and high inversion potential. NOTE: Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect spray drift.

**Temperature and Humidity**

When making applications in low relative humidity, set up equipment to produce larger droplets to compensate for evaporation. Droplet evaporation is most severe when conditions are both hot and dry.

**Temperature Inversions**

Applications should not occur during a temperature inversion because drift potential is high. Temperature inversions restrict vertical air mixing, which causes small, suspended droplets to remain in a concentrated cloud. This cloud can move in unpredictable directions due to the light variable winds common during inversions. Temperature inversions are characterized by increasing temperatures with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.

**Sensitive Areas**

The pesticide should only be applied when the potential for drift to adjacent sensitive areas (e.g., bodies of water, known habitat for threatened or endangered species, non-target crops) is minimal (e.g., when wind is blowing away from the sensitive areas).

DO NOT apply when wind speed favors drift beyond the area intended for treatment.

**Soil Preparation:** Prior to making application, the soil should be cultivated to provide a weed-free and uniform surface since DACTHAL FLOWABLE herbicide is effective only when applied before weed seed germination occurs. Unless incorporated, DACTHAL FLOWABLE should be applied within two to three days following cultivation, to prevent subsurface germinating weeds from becoming established. When cultivating between rows, use shields on cultivator to prevent untreated soil from covering treated bands. Cultural practices, such as forming crop beds, should be completed prior to DACTHAL FLOWABLE application in order to avoid exposing untreated soil in the bottom of the furrow and concentrating the sprayed soil within the bed.

**Soil Incorporation:** DO NOT incorporate deeper than 2 inches. Shallow soil incorporation, when recommended (see specific crop recommendation), often gives more consistent results. Depending on crop and time of application, several incorporation methods may be used.

**Preplant Incorporation:** This type of incorporation often provides better weed control on irrigated land, and also on non-irrigated land when dry weather is anticipated following planting. When recommended, DACTHAL FLOWABLE can be sprayed on the soil surface and then incorporated into the soil using a disc harrow or related tillage equipment. To insure complete incorporation, double disc in two directions. For incorporating banded treatments, hooded-power driven rotary tillers or ground tillers are essential.

**Delayed Preemergent Incorporation:** For crops where preplant incorporation can be used (see specific crop recommendation). Incorporation at this time should be used when adequate rainfall or irrigation is not available within 3 to 5 days after planting. Lightly incorporate (to 1 inch deep) with drag harrow, rotary hoe or other suitable tillage equipment.

**Layby Incorporation:** (Just prior to stage when plant growth would prevent further cultivation). Cultivate soil to remove established weeds. Apply DACTHAL FLOWABLE over top of foliage and lightly incorporate with suitable equipment.

**Off-Site Movement Under California Growing Conditions:** Current research indicates a propensity for off-site movement of certain soil-applied pesticides in California's unique growing conditions. Pesticides, such as DACTHAL FLOWABLE, may be moved off-site through a process called co-distillation. This phenomenon has been shown to occur where bare soil is treated (crops not present) and the soil surface is very hot. The pesticides, though not highly volatile, appear to be carried from the soil surface with water molecules during rapid evaporation that occurs immediately after irrigation. Banding applications of preemergence herbicides, such as DACTHAL FLOWABLE, significantly reduces the potential for off-site movement by reducing the amount of product used to treat a given crop area.

**Rates of Application and Weeds Controlled:** DACTHAL FLOWABLE is recommended at rates of 6-14 pints/A depending on soil type and weeds to be controlled. The following table outlines general recommendations for the use of DACTHAL FLOWABLE on various soil types. The maximum rate for each soil type should be used when moderately susceptible weeds are present. Specific recommendations for each crop should be consulted. ***DACTHAL FLOWABLE should not be applied to certain crops under conditions of cool, wet weather when plants are not actively growing***. Refer to specific label recommendations for seeded melons, tomatoes, onions and eggplants for further details.

| Soil Type | Organic Matter % | Broadcast Rate of DACTHAL FLOWABLE/A |
|---|---|---|
| Light-sand or sandy loam | 0-3 | 6-8 pints |
| Medium-silt loam | 0-3 | 8-10 pints |
| Heavy-clay loam | 0-3 | 10-14 pints |
| Heavy-silt loam | 3-5 | 12-14 pints |

**Weed Control Spectrum**

DACTHAL FLOWABLE is a preemergence herbicide which provides effective control of annual grasses and certain broadleaved weeds. The following weeds are grouped according to their susceptibility to DACTHAL FLOWABLE:

**Susceptible Weeds**

Controlled at Lowest Recommended Rates for Each Soil Type

Carpetweed
Chickweed, Common
Crabgrass, Large
Crabgrass, Smooth
Foxtail, Green
Foxtail, Yellow
Lambsquarters, Common
Lovegrass
Nettle, Burning
Pansy, Field
Purslane
Pusley, Florida
Witchgrass

**Moderately Susceptible Weeds**

Highest Recommended Rates for Each Soil Type Required for Effective Control

Barnyardgrass
Bluegrass, Annual
Cheeseweed (Malva parviflora)
Copperleaf, Rhombic
Copperleaf, Virginia
(three-seeded mercury)
Dodder
Deadnettle, Purple
Deadnettle, Spotted
Goosegrass
Groundcherry
Johnsongrass (from seed)
Knotweed, Prostrate
Nightshade, Black
Panicum, Brown Top
Pigweed, Redroot
Sandbur
Spurge, Nodding
Spurge, Prostrate
Spurge, Spotted

**Difficult to Control Weeds**

Commercially acceptable control of the following weeds may not always be obtained but weed populations will be suppressed when applied at the maximum-labeled rate, thus resulting in less competition with the emerging and growing crop.

Buckwheat, Wild
Canarygrass, Littleseed
Dock, Curly (from seed)
Foxtail, Giant
Goosefoot, Nettleleaf
Henbit
Knotweed, Silversheath
Ladysthumb
Panicum, Fall
Panicum, Texas
Polypogon, Rabbitfoot
Rocket, London
Shepherdspurse
Sowthistle, Annual
Vaseygrass
Witchweed

**Weeds Not Controlled with DACTHAL FLOWABLE**

Galinsoga
Jimsonweed
Johnsongrass (from rhizomes)
Mustards
Nutsedge
Ragweed, Common
Smartweed
Velvetleaf

**Replanting:** Replanting crops other than those included on this label in DACTHAL FLOWABLE treated soil within 8 months of application may result in crop injury. If replanting is required because of an early crop failure, the planting of onions, seeded cucurbits, potatoes, tomatoes, eggplants or peppers at this time may result in crop injury. However, all crops on this label may be planted following harvest of a DACTHAL FLOWABLE treated crop.

**Ornamental Turf (such as Lawns [non-residential], Golf Courses, Cemeteries, Athletic Fields, Parks, Sod Farms, and Institutional Areas where turf is grown):** Application at the rate of 14 pts of DACTHAL FLOWABLE in 40 to 100 gallons of water per acre (1 pt./3 to 7 gals/3,000 sq. ft.) gives excellent control of crabgrass and other weeds as listed on this label. In California, DACTHAL FLOWABLE applications to turf should be watered within 4 hours with 0.1 to 0.2 inches of water by irrigation. One application applied in early spring before weed seed germination usually provides seasonal control. Crabgrass seed germination usually coincides with the time when Forsythia blossoms start to fall. In areas which commonly experience stands of late-germinating crabgrass and other annual weedy grasses, a second application at half the regular rate can be safely made two months after the first application. In order to control annual bluegrass (*Poa annua)* and other erratic or late-germinating grasses and weeds in northern states, a late summer or early fall application before weed seed germination of 10 quarts of DACTHAL FLOWABLE in 40 to 100 gallons of water per acre (1/2 pts/3 to 7 gals./3,000 sq. ft.) should supplement the early spring application. Earlier applications are required in southern United States. Consult agricultural experiment station or extension service weed specialist for date *Poa annua* seed germinates in your area and make application at least two weeks prior to this date.

Early spring application of DACTHAL FLOWABLE may be made to new turfgrass seedlings after the grasses have exhibited a uniform greening of the newly sprouted grass, preferably when 1 to 2 inches in height. Such DACTHAL FLOWABLE applications give control of crabgrass without injury to newly-emerged grass. Fall sowing of permanent grasses can follow early spring application of DACTHAL FLOWABLE.

Where some spring seeding is necessary, there should be a delay of approximately 60 days after the application of most preemergence herbicides, including DACTHAL FLOWABLE. This delay increases the survival of desirable grasses.

DACTHAL FLOWABLE is not recommended for use on putting greens.

DACTHAL FLOWABLE is not recommended for use on bentgrasses mowed at putting green height. For control of creeping speedwell (*Veronica filiformis*), apply 16 pints of DACTHAL FLOWABLE in 40 to 100 gallons of water per acre as a postemergence spray when creeping speedwell is growing vigorously. Spring or early fall applications are usually suitable, provided temperatures are between 65° and 90°F, and there is ample soil moisture. Thorough coverage is essential. Delayed control of creeping speedwell is to be expected and will be manifested first by a gradual loss of color and vigor.

| For Use on Turf (Non-Residential) | To Control | When to Apply | Rate of DACTHAL FLOWABLE | Remarks |
|---|---|---|---|---|
| Established Turf | Crabgrass | Early spring, before crabgrass and other spring annual weed seeds germinate. | 14 pts./Acre or 1 pt. in 3 to 7 gals. per 3,000 sq. ft. | Apply when Forsythia blossoms. A second application at half the recommended rate may be made 2 months after the first application if necessary. |
| | Annual Bluegrass (*Poa annua*) | Late summer or early fall in Northern states before weed seed germination. Consult agricultural experiment station or extension weed specialist for date *Poa annua* germinates in your area and make application at least two weeks prior to this date. | 20 pts./Acre or 1/2 pints in 3 to 7 gals. per 1,000 sq. ft. | Should be used following an early spring application for crabgrass control. |
| | Creeping Speedwell (*Veronica filiformis*) | As a postemergence spray in spring or early fall when creeping speedwell is growing vigorously, there is ample soil moisture and temperature is between 65° and 90°F. | 16 pts./Acre or 18 fluid ounces in 3 to 7 gals. per 3,000 sq. ft. | Apply spray to obtain thorough coverage of foliage. Delayed control of creeping speedwell, approximately 30 days, is to be expected and will be noticed first by a gradual loss of color and vigor. |
| | Spotted Spurge or Prostrate Spurge (*Euphorbia maculata, E. supina*) | Mid-April or before seed germination of annual weeds. Repeat applications in 6 to 8 weeks. | 14 to 16 pts./Acre or 15 to 18 ozs. in 3 to 7 gals. per 3,000 sq. ft. | Apply first application before germination of annual weed seeds, such as crabgrass. Repeat application at the same rate 6 to 8 weeks later. In addition to control of spotted spurge or prostrate spurge, crabgrass control is also obtained. |
| Newly seeded turf | Crabgrass | After new turfgrass seedings have exhibited a greening of the newly-sprouted grass (about 1 to 2 inches high). | 14 pts./Acre or 1 pt. in 3 to 7 gals. per 3,000 sq. ft. | Allows crabgrass control without injury to the new turf. |

IMPORTANT: After DACTHAL FLOWABLE treatment, wait approximately 60 days before any new seeding is undertaken.

DO NOT use on Dichondra. See recommendations on bentgrass before using on this species.

**Nursery Stock:** DACTHAL FLOWABLE can be applied to a wide range of nursery stock at the rate of 7 to 8 pints to 100 gallons of water per acre of area treated (1 pint in 3 to 7 gallons of water per 3,000 sq. ft.).

Applications should be made to soil recently cultivated to a uniform texture. These can be made immediately following lining-out of stock. With established plantings, application should be made following proper cultivation to remove existing weeds. Where possible, this should be done early in the spring. Late summer application may prove beneficial for control of fall germinating weeds, if made following cultivation. Weed control up to three months or more may be expected following proper application.

DACTHAL FLOWABLE is specifically recommended for weed control with the following:

Abelia
Ageratum
Alyssum
Andromeda, Jap.
Arborvitae
Ash
Aster
Azalea
Babysbreath
Barberry
Bellflower
Birch
Bleedingheart
Bloodleaf
Boxwood
Bugloss
Camellia
Candytufts
Chrysanthemum
Cinquefoil
Coleus
Columbine
Coneflower, Purple
Coreopsis
Coralbells
Cosmos
Cotoneaster
Cottonwood
Cuphea
Cypress
Dahlia
Delphinium
Deutzia
Dogwood
Elaeagnus
Elm
Euonymus
Evening Primrose
Feverfew
Fir
Forget-Me-Not
Forsythia
Four-O'Clock
Foxglove
Gaillardia
Geranium
Gladiolus
Golddust
Goldentuft
Gum
Hawthorn
Heath, Pink
Holly
Hydrangea
Honeysuckle
Iris
Ivy, Baltic
Ivy, Boston
Ivy, English
Ivy, Wilson
Juniper
Lantana
Larkspur, Candle
Lavendercotton
Lilac
Lily
Locust
Lupine
Magnolia
Maple
Marguerite, Golden
Marigold
Mockorange

Morningglory
Moss, Rose
Mother-of-Thyme
Mountain Laurel
Mourning Bride
Nasturtium
Oak
Orpine
Pachistima
Pachysandra
Peony
Petunia
Pine
Pittosporum
Podocarpus
Poker Plant
Poplar
Privet
Privet, variegated
Redbud
Rhododendron
Rose
Russian Olive
Sage, Scarlet
Snapdragon
Spiderwort, Va.
Spirea
Spruce
Stonecrop
Strawflower
Sundrops
Sunflower
Sweet Pea
Sycamore
Tree Peony
Tulip Tree
Viburnum
Violet, African
Weigela
Willow
Wormwood
Yarrow, Fernleaf
Yew
Zinnia

Do not use on the following plants:
Bugleweed
Button Pink
Carnation
Geum
Germander
Mesembryanthemum
Pansy
Phlox
Sweet William
Telanthera

Amount of DACTHAL FLOWABLE to Use in Treating Small Areas

| Area to be Treated* | Recommended Rate DACTHAL FLOWABLE HERBICIDE/A | Amount of DACTHAL FLOWABLE HERBICIDE to Apply |
|---|---|---|
| 1000 sq. ft. (from 1 to 2 gallons of water should be used to spray 1000 sq. ft.) | 12 to 14 pts. (heavy soil)<br>8 to 10 pts. (medium soil)<br>6 pts. (sandy soil) | 5 oz.<br>4 oz.<br>4 oz. |
| 250 sq. ft. (from 1/4 to 1/2 gallon of water should be used to spray 250 sq. ft.) | 12 to 14 pts. (heavy soil)<br>8 to 10 pts. (medium soil)<br>6 pts. (sandy soil) | 1-1/4 oz.<br>1 oz.<br>1 oz. |

NOTE: In treating small areas it is important to use care in measuring out required quantity for area to be treated, properly mixing it in water and keeping it adequately agitated during application.

*Other size areas to be treated can be calculated from the above table. For example:

To treat 5,000 sq. ft. at the 14 pts./acre rate, use 1-1/2 pts. in 5 to 10 gallons of water.

To treat 500 sq. ft. at the 14 pts./acre rate, use 2-1/2 oz. in 1/2 to 1 gallon of water.

Rates of application can be reduced by banding. See Conversion Chart.

**CONVERSION CHART FOR DACTHAL FLOWABLE**

For a 12-inch band of spray, use this amount of DACTHAL FLOWABLE per acre.

| Row Width | If overall rate is: | | | |
|---|---|---|---|---|
| | 6 pts. per acre | 8 pts. per acre | 10 pts. per acre | 12 pts. per acre |
| 24 inches | 3 pts. | 4 pts. | 5 pts. | 6 pts. |
| 32 inches | 2-1/2 pts. | 3 pts. | 3-3/4 pts. | 4-1/2 pts. |
| 36 inches | 2 pts. | 2-2/3 pts. | 3-1/3 pts. | 4 pts. |
| 40 inches | 1-3/4 pts. | 2-1/2 pts. | 3 pts. | 3-2/3 pts. |

**Special Precautions:** DO NOT feed treated foliage to livestock or graze treated areas. Apply according to directions and under conditions favorable to good plant growth. DACTHAL FLOWABLE will not harm crops for which its use is recommended. ***However, conditions such as high salt concentration, seeding disease, cold weather, deep planting, excessive moisture or drought may injure or weaken crops normally tolerant to DACTHAL FLOWABLE, thereby increasing the possibility of herbicide damage. Under any of these conditions, one or more of the following may result: delayed crop development, reduced yields or reduced quality.***

**RECOMMENDATIONS**

**Any Application of DACTHAL FLOWABLE Should Be Made Prior to Weed Seed Germination**

| Crops | When To Apply | Rate Per Acre | Remarks |
|---|---|---|---|
| Broccoli, Brussels Sprouts, Cauliflower, Cabbage and all other Brassica (cole) leafy vegetables in this crop group[1] | At seeding or transplanting | 6-14 pts. FLOWABLE* | Apply uniformly to the soil as a spray. DACTHAL FLOWABLE can be sprayed directly over transplants without injury. If weeds have emerged, soil should be clean cultivated or weeded prior to application. Can be preplant incorporated. In California, applications must be banded and incorporated as described above. |

*(continued)*

| Crops | When To Apply | Rate Per Acre | Remarks |
|---|---|---|---|
| Seeded melons: (cantaloupe, honeydew, watermelons) | When plants have 4-5 true leaves (see remarks) | 6-14 pts. FLOWABLE* | Apply only when plants have 4-5 true leaves, are well-established, and growing conditions are favorable for good plant growth. (If applied earlier than recommended and/or growing conditions are unfavorable, crop injury may result.) If weeds have emerged, crop should be cultivated and weeded prior to the DACTHAL FLOWABLE application. Incorporation not recommended. In California, applications must be banded. |
| Collards, kale, mustard greens, turnips (greens and roots) including turnip greens (broccoli raab (raab, raab salad), hanover salad and turnip tops) | At seeding | 6-14 pts. FLOWABLE* | Apply uniformly to the soil as a spray at time of seeding. Can be preplant incorporated. In California, applications must be banded and incorporated as described above. |
| Horseradish | At planting | 6-14 pts. FLOWABLE* | Apply uniformly to the soil as a spray at time of seeding. Preplant incorporation not recommended. In California, applications must be banded. |
| Onions [dry bulb onions, dry bulb shallots and green onions (green onions, leeks, spring onions or scallions, Japanese bunching onions, green shallots or green eschalots)] | At seeding or transplanting and/or at layby | See preemergence rate and weeds controlled. In sandy loam soils, however, maximum preemergence rate of 10 pints FLOWABLE per acre is recommended | Apply uniformly to the soil as a spray. DACTHAL FLOWABLE can be sprayed directly over transplants without injury. A layby application can be made on onions either alone or in addition to a DACTHAL FLOWABLE preemergence treatment up to 14 weeks after planting at rates up to 14 pts. per acre on any soil type. If weeds emerge prior to layby, the onions should be cultivated or weeded prior to application. Use 1/4 inch of overhead irrigation to incorporate Dacthal into the soil. Where onion emergence is expected to be slow due to cold and wet soil conditions, delay application until seed begins to germinate to reduce the risk of crop injury. Preplant incorporation is not recommended for onions.<br>Broadcast applications permitted in California for onions in certain counties from August through December. Due to potential for off-site movement through co-distillation and deposition on unlabeled crops, DACTHAL FLOWABLE should be applied as a band application to onions in all counties with the following exception. During the period from August 1 through December 31, broadcast applications of DACTHAL FLOWABLE may be made in the following counties: Fresno, Tulare, Kern, San Bernardino, Los Angeles, Riverside, San Diego and Imperial. A minimum of 50 gallons of water per acre should be used for broadcast applications. During the period from January 1 through July 31, DACTHAL FLOWABLE applications should be applied as a banded application in all counties. |
| Radish | At seeding or up to three-leaf stage | 6-14 pts. FLOWABLE per acre | Apply uniformly to the soil as a spray in 20 to 30 gallons of water per acre. If weeds have emerged, soil should be clean cultivated or weeded prior to application to permit uniform coverage of soil. Preplant incorporation not recommended. DO NOT graze on treated areas or feed plant refuse to livestock. DO NOT harvest within 25 days of application.<br>Based upon available residue data, the use of DACTHAL FLOWABLE for weed control in radishes is limited to the State of California. In California, applications must be banded. |
| Sweet Potatoes | At transplanting and layby | See Rates of Application and Weeds Controlled | Apply uniformly to the soil as a spray at transplanting. DACTHAL FLOWABLE can be sprayed directly over transplants without injury. Layby applications can be made up to 6 weeks after transplanting. If weeds are present, the crop should be weeded or cultivated prior to DACTHAL FLOWABLE application. Incorporation of layby applications not recommended. In California, applications must be banded. |
| Tomatoes, tomatillos and eggplant | 4-6 weeks after transplanting or on direct seeded plants at 4-6 inches in height (see remarks) | See Rates of Application and Weeds Controlled | Application uniformly to the soil should be confined to a period of 4-6 weeks after transplanting. Plants should be well-established and growing conditions favorable for good plant growth. DACTHAL FLOWABLE can be sprayed directly over transplants without injury. If weeds have emerged, the crop should be cultivated or weeded prior to making the DACTHAL FLOWABLE application. DO NOT apply to seeded plants until plants are 4-6 inches in height, well established and growing conditions are favorable for good plant growth. In California, applications must be banded. |
| Strawberries:<br>New Plantings | At transplanting | 12 pints FLOWABLE per acre | Apply uniformly to the soil as a spray. For new beds apply 12 pints at transplanting. Can be preplant incorporated. In California, applications must be banded and incorporated as described above. |
| Strawberries:<br>Established Plantings | Fall and early Spring | 8-12 pints FLOWABLE per acre | Application of 8-12 pints per acre may be applied to control late summer or early fall germinating weeds. Application to established plantings should be made in fall and early spring. DO NOT apply after first bloom through harvest. Applications may be made directly over the plants without injury. In California, applications must be banded. |
| Note: Rates can be reduced by banding. | | | Layby used in this table refers to the time just prior to the stage when crop plant size would prevent further cultivation. |

*See Rates of Application and Weeds Controlled

[1] Brassica leafy vegetables crop group includes broccoli, Chinese (gai lon, white flowering) broccoli, broccoli raab (rapini), Brussels sprouts, cabbage, Chinese cabbage (bok choy, napa, tight-heading varieties), Chinese mustard cabbage (gai choy), cauliflower, cavalo broccolo, collards, kale, kohlrabi, mizuna, mustard greens, mustard spinach and rape greens.

[2] Fruits of the gourd (*Cucurbitaceae*) family that are consumed when immature, 100% of the fruit is edible either cooked or raw, once picked it cannot be stored, has a soft rind which is easily penetrated, and if seeds were harvested they would not germinate; e.g., *Lagenaria* spp. (i.e., hyotan, cucuzza); *Luffa* spp. (i.e., hechima, Chinese okra); *Momordica* spp. (i.e., bitter melon, balsam pear, balsam apple, Chinese cucumber); *Sechium edule* (chayote); and other cultivars and/or hybrids of these.

**APPLICATION AND CALIBRATION TECHNIQUES FOR SPRINKLER IRRIGATION**

Apply DACTHAL FLOWABLE only through center pivot, motorized lateral move, solid set or portable (side roll, end tow or hand move) irrigation systems. DO NOT apply this product through any other type of irrigation system.

Crop injury or lack of effectiveness can result from non-uniform distribution of treated water.

If you have questions about calibration, you should contact State Extension Service specialists, equipment manufacturers or other experts.

DO NOT apply this product through irrigation systems connected to a public water system. "Public water system" means a system for the provision to the public of piped water for human consumption if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days per year.

A person knowledgeable of the chemigation system and responsible for its operation, or under the supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise.

The system must contain a functional check valve, vacuum relief valve, and low-pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from backflow.

The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump.

The pesticide injection pipeline must also contain a functional, normally-closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.

Always inject DACTHAL FLOWABLE into irrigation water after it discharges from the irrigation pump and after it passes through the check valve. Never inject pesticides into the intake line of the suction side of the pump.

The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops.

The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected.

Systems must use a metering pump, such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.

DO NOT apply when wind speed favors drift beyond the area intended for treatment.

Spray mixture in the chemical supply tank must be agitated at all times, otherwise settling and uneven application may occur.

DACTHAL FLOWABLE may be used through two basic types of sprinkler irrigation systems as outlined in Sections A and B below. Determine which type of system is in place, then refer to the appropriate directions provided for each type. The tank containing DACTHAL FLOWABLE must be equipped with effective mechanical agitation to keep the wettable powder in suspension. Premixing DACTHAL FLOWABLE as instructed under ground application will insure that a uniform suspension is obtained. The injection equipment which contains the DACTHAL FLOWABLE suspension should be connected to the discharge side of the irrigation pump or other pressurized equipment attached to the irrigation line.

**A. Center Pivot and Motorized Lateral Move Irrigation Equipment**

For injection of pesticides, these continuously moving systems must use a positive displacement injection pump, of either diaphragm or piston type, constructed of materials that are compatible with pesticides and capable of injection at pressures approximately 2-3 times those encountered within the irrigation water line. Venturi applicator units cannot be used on these systems.

Fill chemical supply tank of injection equipment with water. Operate system for one complete revolution or run across the field, measuring time required, amount of water injected, and acreage covered. Thoroughly mix recommended amount of DACTHAL FLOWABLE for acreage to be covered into same amount of water used during calibration and inject into system continuously for one revolution or run. Mixture in the chemical supply tank must be continuously agitated during the injection run. Shut off injection equipment after one revolution or run, but continue to operate irrigation system until DACTHAL FLOWABLE has been cleared from last sprinkler head.

**B. Solid Set and Portable (Side Roll, End Tow or Hand Move) Irrigation Equipment**

Determine acreage covered by sprinkler. Fill tank of injection equipment with water and adjust flow to use contents over a 30 to 45-minute period. Mix desired amount of DACTHAL FLOWABLE for acreage to be covered into quantity of water used during calibration and operate entire system at normal pressures recommended by the manufacturer of injection equipment used for amount of time established during calibration. DACTHAL FLOWABLE can be injected at the beginning or end of the irrigation cycle or as a separate application. Stop injection equipment after treatment is completed and continue to operate irrigation system until DACTHAL FLOWABLE has been cleared from last sprinkler head.

**STORAGE AND DISPOSAL**

DO NOT contaminate water, food or feed by storage or disposal. Open dumping is prohibited.

**PESTICIDE STORAGE:** Store in a dry place.

**PESTICIDE DISPOSAL:** Wastes resulting from the use of this product may be disposed of at an approved waste disposal facility. DO NOT contaminate water when disposing of equipment washwaters.

**CONTAINER DISPOSAL:** Nonrefillable container. Do not reuse or refill this container.
Triple rinse container (or equivalent) promptly after emptying. Triple rinse as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container ¼ full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain 10 seconds after the flow begins to drip. Repeat this procedure two more times. Then offer for recycling if available or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

**LIMITED WARRANTY AND DISCLAIMER**

The manufacturer warrants (a) that this product conform to the chemical description on the label; (b) that this product is reasonably fit for the purposes set forth in the directions for use, subject to the inherent risks referred to herein, when it is used in accordance with such directions; and (c) that the directions, warnings, and other statements on this label are based upon responsible experts' evaluations of reasonable tests of effectiveness, of toxicity to laboratory animals and to plants and residues on food crops, and upon reports of field experience. Tests have not been made on all varieties of food crops and plants, or in all states or under all conditions.

**THERE ARE NO EXPRESS WARRANTIES OTHER THAN THOSE SET FORTH HEREIN. THE MANUFACTURER NEITHER MAKES NOR INTENDS, NOR DOES IT AUTHORIZE ANY AGENT OR REPRESENTATIVE, TO MAKE ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, AND IT EXPRESSLY EXCLUDES AND DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY OF FITNESS FOR A PARTICULAR PURPOSE, OR ANY WARRANTY OF QUALITY OR PERFORMANCE. THIS WARRANTY DOES NOT EXTEND TO, AND THE BUYER SHALL BE SOLELY RESPONSIBLE FOR, ANY AND ALL LOSS OR DAMAGE WHICH RESULTS FROM THE USE OF THIS PRODUCT IN ANY MANNER WHICH IS INCONSISTENT WITH THE LABEL DIRECTIONS, WARNINGS OR CAUTIONS.**

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AMVAC offers this product, and Buyer accepts it, subject to the foregoing Limited Warranty and Disclaimer which may be varied only by agreement in writing signed by an authorized representative of AMVAC.

Dacthal® is a registered trademark of Amvac Chemical Corporation.

Amvac Chemical Corporation
4100 E. Washington Boulevard
Los Angeles, CA 90023 U.S.A.
1-888-462-6822

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# DACTHAL® FLOWABLE HERBICIDE

**AGRICULTURAL HERBICIDE**

NOTIFICATION
MAR 18 2004

| ACTIVE INGREDIENT: | By Wt. |
|---|---|
| DCPA (dimethyl tetrachloroterephthalate) | 54.9% |
| INERT INGREDIENTS: | 45.1% |
| Total | 100.0% |

Contains 6 lbs. DCPA per gallon.

**KEEP OUT OF REACH OF CHILDREN**

## CAUTION

## PRECAUTIONARY STATEMENTS

### HAZARDS TO HUMANS AND DOMESTIC ANIMALS

**CAUTION:** Causes moderate eye irritation. Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling.

| FIRST AID | |
|---|---|
| **If inhaled** | • Move person to fresh air.<br>• If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible.<br>• Call a poison control center or doctor for further treatment advice. |
| **If on skin or clothing** | • Take off contaminated clothing.<br>• Rinse skin immediately with plenty of water for 15-20 minutes.<br>• Call a poison control center or doctor for treatment advice. |
| **If in eyes** | • Hold eye open and rinse slowly and gently with water for 15-20 minutes.<br>• Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.<br>• Call a poison control center or doctor for treatment advice. |
| **If swallowed** | • Call a poison control center or doctor immediately for treatment advice.<br>• Have person sip a glass of water if able to swallow.<br>• Do not induce vomiting unless told to do so by the poison control center or doctor.<br>• Do not give anything by mouth to an unconscious person. |
| **EMERGENCY INFORMATION** | |
| Have the product container or label with you when calling a poison control center or doctor, or going for treatment.<br>FOR THE FOLLOWING EMERGENCIES, PHONE 24 HOURS A DAY:<br>Transportation: CHEMTREC.....1-800-424-9300<br>Other: AMVAC.....1-323-264-3910 | |

SEE SIDE/BACK PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS AND DIRECTIONS FOR USE.

EPA Reg. No. 5481-487

EPA Est. No. 37429-GA-1

**NET CONTENTS:** _____

AMVAC
4100 E. Washington Blvd.
Los Angeles, CA 90023 U.S.A
1-323-264-3910 • www.amvac-chemical.com

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## PERSONAL PROTECTIVE EQUIPMENT (PPE)

Applicators and other handlers must wear:

- Long-sleeved shirt and long pants,
- Chemical-resistant gloves made of any waterproof material,
- Shoes plus socks,
- A dust/mist respirator (MSHA/NIOSH approval number prefix TC-21C) or a NIOSH approved respirator with any N, R, P or HE filter.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

### Engineering Controls

When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240 (d) (4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

### User Safety Recommendations

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. Wash the outside of gloves before removing.
- Remove PPE immediately after handling this product. As soon as possible, wash thoroughly and change into clean clothing.

## ENVIRONMENTAL HAZARDS

DO NOT apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. DO NOT contaminate water when disposing of equipment wastewater.

**Groundwater Advisory:** Tetrachloroterephthalic acid, a breakdown product of DACTHAL FLOWABLE is known to leach through soil as a result of agricultural and turf uses and has been found in groundwater which may be used for drinking water. Users are advised not to apply DACTHAL FLOWABLE to sand and loamy sand soils where the water table (groundwater) is close to the surface and where these soils are very permeable, i.e., well drained. Your local agricultural agencies can provide further information on the type of soil in your area and the location of groundwater used for drinking water.

**Surface Water Advisory:** DCPA can contaminate surface water through spray drift. Under some conditions, DCPA may also have a high potential to contaminate surface water through runoff (via both dissolution in runoff water and adsorption to eroding soil) for several weeks post-application. Users are advised not to apply DACTHAL FLOWABLE to poorly draining or wet soils with readily visible sloping towards adjacent surface waters, frequently flooded areas, areas over-laying extremely shallow groundwater, areas with in-field canals or ditches that drain to surface water, areas not separated from adjacent surface waters with vegetated filter strips, and highly erodible soils.

## DACTHAL FLOWABLE HERBICIDE

A selective preemergence herbicide for control of annual grasses and certain broadleaved weeds in vegetable crops and ornamental turf.

**Read entire label carefully and use only as directed.**

### General Information

DACTHAL FLOWABLE is a flowable formulation for use in preemergence application for control of crabgrass and other annual grasses and certain broadleaved weeds on mineral soils in vegetables, strawberries, agronomic crops, ornamental, turf, and nursery stock and as a post-emergence application for control of creeping speedwell (*Veronica filiformis*). Dacthal Flowable Herbicide is compatible with liquid nitrogen fertilizers commonly used by the lawn care industry.

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## DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

DO NOT apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

This product is not for sale, use or distribution in Suffolk and Nassau County, Long Island, New York.

### AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE) and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

DO NOT enter or allow worker entry into treated areas during the restricted entry interval (REI) of 12 hours. Exception: If the product is soil-incorporated, the Worker Protection Standard, under certain circumstances, allows workers to enter the treated area if there will be no contact with anything that has been treated.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is:

- Coveralls
- Chemical-resistant gloves made of any waterproof material, and
- Shoes plus socks

**Preparation and Application of the Spray:** DACTHAL FLOWABLE should be thoroughly mixed in the spray tank with water to provide for broadcast application of at least 20 gallons of water per acre, depending on equipment and local practices. Adequate agitation should be maintained during filling and spraying to keep material in uniform suspension. Use nozzles suitable for applying wettable powders so that the spray can be uniformly distributed over the properly prepared soil surface. Any screen or strainer in spray equipment should be no finer than 50 mesh to prevent clogging. It is essential that the sprayer be properly calibrated before making applications. Standard low-pressure (30-50 psi) boom-type sprayers are recommended.

A minimum of one-third to one-half inch of water, either as rain or irrigation, is necessary to activate DACTHAL FLOWABLE and thereby obtain preemergence control of weeds specified. Normally, water must be applied within 3 to 5 days of application if sufficient rainfall does not occur. However, when surface soil is dry but subsurface soil contains enough moisture to germinate weeds, water should be applied immediately. If furrow irrigation is used, the top of the bed must be thoroughly wet. If rainfall during this period does not occur and irrigation cannot be made, shallow incorporation, when recommended, will aid in weed control.

**Aircraft Application:** It is recommended that DACTHAL FLOWABLE be applied in a minimum of 10 gallons of spray per acre. Aircraft should be equipped with pumps with sufficient capacity to deliver at least 10 gallons per acre. Placement of nozzles should provide a uniform spray pattern. DACTHAL FLOWABLE should be premixed in a nurse tank or mixing tank equipped with mechanical or bypass agitation. Mixture can then be pumped into the aircraft. Screens on mixing tanks should be no finer than 50 mesh. Adequate agitation should be maintained in the mixing tank as well as the aircraft throughout the spraying operation. Regulations governing aerial application of herbicides are in effect in many states. Consult local regulatory agencies concerning requirements before making applications. Avoid spray drift to adjacent fields; particular care should be exercised when adjacent fields contain edible crops or those that will be fed or grazed by livestock. Spray only on still days.

**Aerial Drift Reduction Advisory:** Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment and weather-related factors determine the potential for spray drift. The applicator and the grower are responsible for considering all these factors when making aerial application decisions.

The following drift management requirements must be followed to avoid off-target drift movement from aerial applications to agricultural field crops. These requirements do not apply to forestry applications, public health uses or to applications using dry formulations.

1. The distance of the outer-most nozzles on the boom must not exceed 3/4 the length of the wingspan or rotor.
2. Nozzles must always point backward parallel with the air stream and never be pointed downwards more than 45 degrees.

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**INFORMATION ON DROPLET SIZE**

The most effective way to reduce drift potential is to apply large droplets. The best drift management strategy is to apply the largest droplets that provide sufficient coverage and control. Applying larger droplets reduces drift potential, but will not prevent drift if applications are made improperly, or under unfavorable environmental conditions (see Wind, Temperature and Humidity, and Temperature Inversions).

**CONTROLLING DROPLET SIZE**

**Volume:** Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.

**Pressure:** Do not exceed the nozzle manufacturer's recommended pressures. For many nozzle types lower pressure produces larger droplets. When higher flow rates are needed, use higher flow rate nozzles instead of increasing pressure.

**Number of Nozzles:** Use the minimum number of nozzles that provide uniform coverage.

**Nozzle Orientation:** Orienting nozzles so that the spray is released parallel to the airstream produces larger droplets than other orientations and is the recommended practice. Significant deflection from horizontal will reduce droplet size and increase drift potential.

**Nozzle Type:** Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles. Solid stream nozzles oriented straight back produce the largest droplets and the lowest drift.

**BOOM LENGTH**

For some use patterns, reducing the effective boom length to less than 3/4 of the wingspan or rotor length may further reduce drift without reducing swath width.

**Application Height**

Applications should not be made at a height greater than 10 feet above the top of the largest plants unless a greater height is required for aircraft safety. Making applications at the lowest height that is safe reduces exposure of droplets to evaporation and wind.

**Swath Adjustment**

When applications are made with a crosswind, the swath will be displaced downward. Therefore, on the up and downwind edges of the field, the applicator must compensate for this displacement by adjusting the path of the aircraft upwind. Swath adjustment distance should increase, with increasing drift potential (higher wind, smaller drops, etc.)

**Wind**

Drift potential is lowest between wind speeds of 2-10 mph. However, many factors including droplet size and equipment type determine drift potential at any given speed. Application should be avoided below 2 mph due to variable wind direction and high inversion potential. NOTE: Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect spray drift.

**Temperature and Humidity**

When making applications in low relative humidity, set up equipment to produce larger droplets to compensate for evaporation. Droplet evaporation is most severe when conditions are both hot and dry.

**Temperature Inversions**

Applications should not occur during a temperature inversion because drift potential is high. Temperature inversions restrict vertical air mixing, which causes small, suspended droplets to remain in a concentrated cloud. This cloud can move in unpredictable directions due to the light variable winds common during inversions. Temperature inversions are characterized by increasing temperatures with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.

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**Sensitive Areas**

The pesticide should only be applied when the potential for drift to adjacent sensitive areas (e.g., residential areas, bodies of water, known habitat for threatened or endangered species, non-target crops) is minimal (e.g., when wind is blowing away from the sensitive areas).

DO NOT apply when wind speed favors drift beyond the area intended for treatment.

**Soil Preparation:** Prior to making application, the soil should be cultivated to provide a weed-free and uniform surface since DACTHAL FLOWABLE herbicide is effective only when applied before weed seed germination occurs. Unless incorporated, DACTHAL FLOWABLE should be applied within two to three days following cultivation, to prevent subsurface germinating weeds from becoming established. When cultivating between rows, use shields on cultivator to prevent untreated soil from covering treated bands. Cultural practices, such as forming crop beds, should be completed prior to DACTHAL FLOWABLE application in order to avoid exposing untreated soil in the bottom of the furrow and concentrating the sprayed soil within the bed.

**Soil Incorporation:** DO NOT incorporate deeper than 2 inches. Shallow soil incorporation, when recommended (see specific crop recommendation), often gives more consistent results. Depending on crop and time of application, several incorporation methods may be used.

**Preplant Incorporation:** This type of incorporation often provides better weed control on irrigated land, and also on non-irrigated land when dry weather is anticipated following planting. When recommended, DACTHAL FLOWABLE can be sprayed on the soil surface and then incorporated into the soil using a disc harrow or related tillage equipment. To insure complete incorporation, double disc in two directions. For incorporating banded treatments, hooded-power driven rotary tillers or ground tillers are essential.

**Delayed Preemergent Incorporation:** For crops where preplant incorporation can be used (see specific crop recommendation). Incorporation at this time should be used when adequate rainfall or irrigation is not available within 3 to 5 days after planting. Lightly incorporate (to 1 inch deep) with drag harrow, rotary hoe or other suitable tillage equipment.

**Layby Incorporation:** (Just prior to stage when plant growth would prevent further cultivation). Cultivate soil to remove established weeds. Apply DACTHAL FLOWABLE over top of foliage and lightly incorporate with suitable equipment.

**Off-Site Movement Under California Growing Conditions:** Current research indicates a propensity for off-site movement of certain soil-applied pesticides in California's unique growing conditions. Pesticides, such as DACTHAL FLOWABLE, may be moved off-site through a process called co-distillation. This phenomenon has been shown to occur where bare soil is treated (crops not present) and the soil surface is very hot. The pesticides, though not highly volatile, appear to be carried from the soil surface with water molecules during rapid evaporation that occurs immediately after irrigation. Banding applications of preemergence herbicides, such as DACTHAL FLOWABLE, significantly reduces the potential for off-site movement by reducing the amount of product used to treat a given crop area.

**Rates of Application and Weeds Controlled:** DACTHAL FLOWABLE is recommended at rates of 6-14 pints/A depending on soil type and weeds to be controlled. The following table outlines general recommendations for the use of DACTHAL FLOWABLE on various soil types. The maximum rate for each soil type should be used when moderately susceptible weeds are present. Specific recommendations for each for each crop should be consulted. ***DACTHAL FLOWABLE should not be applied to certain crops under conditions of cool, wet weather when plants are not actively growing.*** Refer to specific label recommendations for seeded melons, tomatoes, peppers, onions and eggplants for further details.

| Soil Type | Organic Matter % | Broadcast Rate of DACTHAL FLOWABLE/A |
|---|---|---|
| Light-sand or sandy loam | 0-3 | 6-8 pints |
| Medium-silt loam | 0-3 | 8-10 pints |
| Heavy-clay loam | 0-3 | 10-14 pints |
| Heavy-silt loam | 3-5 | 12-14 pints |

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**Weed Control Spectrum**

DACTHAL FLOWABLE is a preemergence herbicide which provides effective control of annual grasses and certain broadleaved weeds. The following weeds are grouped according to their susceptibility to DACTHAL FLOWABLE:

**Susceptible Weeds**

Controlled at Lowest Recommended Rates for Each Soil Type

Carpetweed
Chickweed, Common
Crabgrass, Large
Crabgrass, Smooth
Foxtail, Green
Foxtail, Yellow
Lambsquarters, Common
Lovegrass
Nettle, Burning
Pansy, Field
Purslane
Pusley, Florida
Witchgrass

**Moderately Susceptible Weeds**

Highest Recommended Rates for Each Soil Type Required for Effective Control

Barnyardgrass
Bluegrass, Annual
Cheeseweed (Malva parviflora)
Copperleaf, Rhombic
Copperleaf, Virginia
(three-seeded mercury)
Dodder
Deadnettle, Purple
Deadnettle, Spotted
Goosegrass
Groundcherry
Johnsongrass (from seed)
Knotweed, Prostrate
Nightshade, Black
Panicum, Brown Top
Pigweed, Redroot
Sandbur
Spurge, Nodding
Spurge, Prostrate
Spurge, Spotted

**Difficult to Control Weeds**

Commercially acceptable control of the following weeds may not always be obtained but weed populations will be suppressed when applied at the maximum-labeled rate, thus resulting in less competition with the emerging and growing crop.

Buckwheat, Wild
Canarygrass, Littleseed
Dock, Curly (from seed)
Foxtail, Giant
Goosefoot, Nettleleaf
Henbit
Knotweed, Silversheath
Ladysthumb
Panicum, Fall
Panicum, Texas
Polypogon, Rabbitfoot
Rocket, London
Shepherdspurse
Sowthistle, Annual
Vaseygrass
Witchweed

**Weeds Not Controlled with DACTHAL FLOWABLE**

Galinsoga
Jimsonweed
Johnsongrass (from rhizomes)
Mustards
Nutsedge
Ragweed, Common
Smartweed
Velvetleaf

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**Replanting:** Replanting crops other than those included on this label in DACTHAL FLOWABLE treated soil within 8 months of application may result in crop injury. If replanting is required because of an early crop failure, the planting of onions, seeded cucurbits, potatoes, tomatoes, eggplants or peppers at this time may result in crop injury. However, all crops on this label may be planted following harvest of a DACTHAL FLOWABLE treated crop.

**Ornamental Turf (such as Lawns, Golf Courses, Cemeteries, Athletic Fields, Parks, Sod Farms, Home Lawns and Institutional Areas where turf is grown):** Application at the rate of 14 pts of DACTHAL FLOWABLE in 40 to 100 gallons of water per acre (1 pt./3 to 7 gals/3,000 sq. ft.) gives excellent control of crabgrass and other weeds as listed on this label. In California, DACTHAL FLOWABLE applications to turf should be watered within 4 hours with 0.1 to 0.2 inches of water by irrigation. One application applied in early spring before weed seed germination usually provides seasonal control. Crabgrass seed germination usually coincides with the time when Forsythia blossoms start to fall. In areas which commonly experience stands of late-germinating crabgrass and other annual weedy grasses, a second application at half the regular rate can be safely made two months after the first application. In order to control annual bluegrass (*Poa annua)* and other erratic or late-germinating grasses and weeds in northern states, a late summer or early fall application before weed seed germination of 10 quarts of DACTHAL FLOWABLE in 40 to 100 gallons of water per acre (1/2 pts/3 to 7 gals./3,000 sq. ft.) should supplement the early spring application. Earlier applications are required in southern United States. Consult agricultural experiment station or extension service weed specialist for date *Poa annua* seed germinates in your area and make application at least two weeks prior to this date.

Early spring application of DACTHAL FLOWABLE may be made to new turfgrass seedlings after the grasses have exhibited a uniform greening of the newly sprouted grass, preferably when 1 to 2 inches in height. Such DACTHAL FLOWABLE applications give control of crabgrass without injury to newly-emerged grass. Fall sowing of permanent grasses can follow early spring application of DACTHAL FLOWABLE.

Where some spring seeding is necessary, there should be a delay of approximately 60 days after the application of most preemergence herbicides, including DACTHAL FLOWABLE. This delay increases the survival of desirable grasses.

DACTHAL FLOWABLE is not recommended for use on putting greens.

DACTHAL FLOWABLE is not recommended for use on bentgrasses mowed at putting green height. For control of creeping speedwell (*Veronica filiformis*), apply 16 pints of DACTHAL FLOWABLE in 40 to 100 gallons of water per acre as a postemergence spray when creeping speedwell is growing vigorously. Spring or early fall applications are usually suitable, provided temperatures are between 65° and 90°F, and there is ample soil moisture. Thorough coverage is essential. Delayed control of creeping speedwell is to be expected and will be manifested first by a gradual loss of color and vigor.

| **For Use on Turf** | To Control | When to Apply | Rate of DACTHAL FLOWABLE | Remarks |
|---|---|---|---|---|
| Established Turf | Crabgrass | Early spring, before crabgrass and other spring annual weed seeds germinate. | 14 pts. /Acre or 1 pt. in 3 to 7 gals. per 3,000 sq. ft. | Apply when Forsythia blossoms. A second application at half the recommended rate may be made 2 months after the first application if necessary. |
| | Annual Bluegrass (*Poa annua*) | Late summer or early fall in Northern states before weed seed germination. Consult agricultural experiment station or extension weed specialist for date *Poa annua* germinates in your area and make application at least two weeks prior to this date. | 20 pts. /Acre or 1/2 pints in 3 to 7 gals. per 1,000 sq. ft. | Should be used following an early spring application for crabgrass control. |

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| For Use on Turf | To Control | When to Apply | Rate of DACTHAL FLOWABLE | Remarks |
|---|---|---|---|---|
| | Creeping Speedwell *(Veronica filiformis)* | As a postemergence spray in spring or early fall when creeping speedwell is growing vigorously, there is ample soil moisture and temperature is between 65° and 90°F. | 16 pts. /Acre or 18 fluid ounces in 3 to 7 gals. per 3,000 sq. ft. | Apply spray to obtain thorough coverage of foliage. Delayed control of creeping speedwell, approximately 30 days, is to be expected and will be noticed first by a gradual loss of color and vigor. |
| | Spotted Spurge or Prostrate Spurge *(Euphorbia maculata, E. supina)* | Mid-April or before seed germination of annual weeds. Repeat applications in 6 to 8 weeks. | 14 to 16 pts. /Acre or 15 to 18 ozs in 3 to 7 gals. per 3,000 sq. ft. | Apply first application before germination of annual weed seeds, such as crabgrass. Repeat application at the same rate 6 to 8 weeks later. In addition to control of spotted spurge or prostrate spurge, crabgrass control is also obtained. |
| Newly seeded turf | Crabgrass | After new turfgrass seedings have exhibited a greening of the newly-sprouted grass (about 1 to 2 inches high). | 14 pts. /Acre or 1 pt. in 3 to 7 gals. per 3,000 sq. ft. | Allows crabgrass control without injury to the new turf. |

IMPORTANT: After DACTHAL FLOWABLE treatment, wait approximately 60 days before any new seeding is undertaken. DO NOT use on Dichondra. See recommendations on bentgrass before using on this species.

**Nursery Stock:** DACTHAL FLOWABLE can be applied to a wide range of nursery stock at the rate of 7 to 8 pints to 100 gallons of water per acre of area treated (1 pint in 3 to 7 gallons of water per 3,000 sq. ft.).

Applications should be made to soil recently cultivated to a uniform texture. These can be made immediately following lining-out of stock. With established plantings, application should be made following proper cultivation to remove existing weeds. Where possible, this should be done early in the spring. Late summer application may prove beneficial for control of fall germinating weeds, if made following cultivation. Weed control up to three months or more may be expected following proper application.

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DACTHAL FLOWABLE is specifically recommended for weed control with the following:

| | | |
|---|---|---|
| Abelia | Dahlia | Larkspur, Candle |
| Ageratum | Delphinium | Lavendercotton |
| Alyssum | Deutzia | Lilac |
| Andromeda, Jap. | Dogwood | Lily |
| Arborvitae | Elaeagnus | Locust |
| Ash | Elm | Lupine |
| Aster | Euonymus | Magnolia |
| Azalea | Evening Primrose | Maple |
| Babysbreath | Feverfew | Marguerite, Golden |
| Barberry | Fir | Marigold |
| Bellflower | Forget-Me-Not | Mockorange |
| Birch | Forsythia | Morningglory |
| Bleedingheart | Four-O'Clock | Moss, Rose |
| Bloodleaf | Foxglove | Mother-of-Thyme |
| Boxwood | Gaillardia | Mountain Laurel |
| Bugloss | Geranium | Mourning Bride |
| Camellia | Gladiolus | Nasturtium |
| Candytufts | Golddust | Oak |
| Chestnut | Goldentuft | Orpine |
| Chrysanthemum | Gum | Pachistima |
| Cinquefoil | Hawthorn | Pachysandra |
| Coleus | Heath, Pink | Peony |
| Columbine | Holly | Petunia |
| Coneflower, Purple | Hydrangea | Pine |
| Coreopsis | Honeysuckle | Pittosporum |
| Coralbells | Iris | Podocarpus |
| Cosmos | Ivy, Baltic | Poker Plant |
| Cotoneaster | Ivy, Boston | Poplar |
| Cottonwood | Ivy, English | Privet |
| Crabapple | Ivy, Wilson | Privet, variegated |
| Cuphea | Juniper | Redbud |
| Cypress | Lantana | Rhododendron |
| Rose | Strawflower | Violet, African |
| Russian Olive | Sundrops | Walnut |
| Sage, Scarlet | Sunflower | Weigela |
| Snapdragon | Sweet Pea | Willow |
| Spiderwort, Va. | Sycamore | Wormwood |
| Spirea | Tree Peony | Yarrow, Fernleaf |
| Spruce | Tulip Tree | Yew |
| Stonecrop | Viburnum | Zinnia |

Do <u>not</u> use on the following plants:

| | |
|---|---|
| Bugleweed | Mesembryanthemum |
| Button Pink | Pansy |
| Carnation | Phlox |
| Geum | Sweet William |
| Germander | Telanthera |

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Amount of DACTHAL FLOWABLE to Use in Treating Small Areas

| Area to be Treated* | Recommended Rate DACTHAL FLOWABLE HERBICIDE/A | Amount of DACTHAL FLOWABLE HERBICIDE to Apply |
|---|---|---|
| 1000 sq. ft. (from 1 to 2 gallons of water should be used to spray 1000 sq. ft.) | 12 to 14 pts. (heavy soil)<br>8 to 10 pts. (medium soil)<br>6 pts. (sandy soil) | 5 oz.<br>4 oz.<br>4 oz. |
| 250 sq. ft. (from ¼ to ½ gallon of water should be used to spray 250 sq. ft.) | 12 to 14 pts. (heavy soil)<br>8 to 10 pts. (medium soil)<br>6 pts. (sandy soil) | 1¼ oz.<br>1 oz.<br>1 oz. |

NOTE: In treating small areas it is important to use care in measuring out required quantity for area to be treated, properly mixing it in water and keeping it adequately agitated during application.

*Other size areas to be treated can be calculated from the above table. For example:

To treat 5,000 sq. ft. at the 14 pts./acre rate, use 1½ pts. in 5 to 10 gallons of water.

To treat 500 sq. ft. at the 14 pts./acre rate, use 2½ oz. in ½ to 1 gallon of water.

Rates of application can be reduced by banding. See Conversion Chart.

## CONVERSION CHART FOR DACTHAL FLOWABLE

For a 12-inch band of spray, use this amount of DACTHAL FLOWABLE per acre.

| Row Width | If overall rate is: | | | |
|---|---|---|---|---|
| | 6 pts. per acre | 8 pts. per acre | 10 pts. per acre | 12 pts. per acre |
| 24 inches | 3 pts. | 4 pts. | 5 pts. | 6 pts. |
| 32 inches | 2-1/2 pts. | 3 pts. | 3-3/4 pts. | 4-1/2 pts. |
| 36 inches | 2 pts. | 2-2/3 pts. | 3-1/3 pts. | 4 pts. |
| 40 inches | 1-3/4 pts. | 2-1/2 pts. | 3 pts. | 3-2/3 pts. |

**Special Precautions:** DO NOT feed treated foliage to livestock or graze treated areas. Apply according to directions and under conditions favorable to good plant growth. DACTHAL FLOWABLE will not harm crops for which its use is recommended. ***However, conditions such as high salt concentration, seeding disease, cold weather, deep planting, excessive moisture or drought may injure or weaken crops normally tolerant to DACTHAL FLOWABLE, thereby increasing the possibility of herbicide damage. Under any of these conditions, one or more of the following may result: delayed crop development, reduced yields or reduced quality.***

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**Recommendations**

**Any Application of DACTHAL FLOWABLE Should Be Made Prior to Weed Seed Germination**

| Crops | When To Apply | Rate Per Acre | Remarks |
|---|---|---|---|
| Broccoli, Brussels Sprouts, Cauliflower, Cabbage and all other Brassica (cole) leafy vegetables in this crop group[1] | At seeding or transplanting | 6-14 pts. FLOWABLE* | Apply uniformly to the soil as a spray. DACTHAL FLOWABLE can be sprayed directly over transplants without injury. If weeds have emerged, soil should be clean cultivated or weeded prior to application. Can be preplant incorporated. In California, applications must be banded and incorporated as described above. |
| Field beans, snap beans, mungbeans, Southern peas (black-eyed) | At seeding | 6-14 pts. FLOWABLE* | Apply uniformly to the soil as a spray at time of planting. Can be preplant incorporated. In California, applications must be banded and incorporated as described above. |
| Seeded melons: (cantaloupe, honeydew, watermelons), cucumbers, summer squash[2], winter squash. | When plants have 4-5 true leaves (see remarks) | 6-14 pts. FLOWABLE* | Apply only when plants have 4-5 true leaves, are well-established, and growing conditions are favorable for good plant growth. (If applied earlier than recommended and/or growing conditions are unfavorable, crop injury may result.) If weeds have emerged, crop should be cultivated and weeded prior to the DACTHAL FLOWABLE application. Incorporation not recommended. In California, applications must be banded. |

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| Crops | When To Apply | Rate Per Acre | Remarks |
|---|---|---|---|
| Collards, kale, mustard greens, turnips (greens and roots) including turnip greens (broccoli raab (raab, raab salad), hanover salad and turnip tops) | At seeding | 6-14 pts. FLOWABLE* | Apply uniformly to the soil as a spray at time of seeding. Can be preplant incorporated. In California, applications must be banded and incorporated as described above. |
| Garlic | At seeding or transplanting and/or at layby | 6-14 pts. FLOWABLE* | Apply uniformly to the soil as a spray. DACTHAL FLOWABLE can be sprayed directly over transplants without injury. If weeds emerge prior to layby (when garlic plants have 3 to 5 true leaves), the crop should be cultivated or weeded before application. Preplant incorporation is not recommended. DO NOT graze on treated areas or feed plant refuse to livestock. In California, applications must be banded. |
| Horseradish | At planting | 6-14 pts. FLOWABLE* | Apply uniformly to the soil as a spray at time of seeding. Preplant incorporation not recommended. In California, applications must be banded. |
| Onions [dry bulb onions, dry bulb shallots and green onions (green onions, leeks, spring onions or scallions, Japanese bunching onions, green shallots or green eschalots)] | At seeding or transplanting and/or at layby | See preemergence rate and weeds controlled. In sandy loam soils, however, maximum preemergence rate of 10 pints FLOWABLE per acre is recommended | Apply uniformly to the soil as a spray. DACTHAL FLOWABLE can be sprayed directly over transplants without injury. A layby application can be made on onions either alone or in addition to a DACTHAL FLOWABLE preemergence treatment up to 14 weeks after planting at rates up to 14 pts. per acre on any soil type. If weeds emerge prior to layby, the onions should be cultivated or weeded prior to application. Preplant incorporation not recommended.<br><br>Broadcast applications permitted in California for onions in certain counties from August through December. Due to potential for off-site movement through co-distillation and deposition on unlabeled crops, DACTHAL FLOWABLE should be applied as a band application to onions in all counties with the following exception. During the period from August 1 through December 31, broadcast applications of DACTHAL FLOWABLE may be made in the following counties: Fresno, Tulare, Kern, San Bernardino, Los Angeles, Riverside, San Diego and Imperial. A minimum of 50 gallons of water per acre should be used for broadcast applications. During the period from January 1 through July 31, DACTHAL FLOWABLE applications should be applied as a banded application in all counties. |

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| Crops | When To Apply | Rate Per Acre | Remarks |
|---|---|---|---|
| Potatoes* (whole or cut pieces)<br><br>*Not for use on potatoes in California. | At planting, drag-off or layby | See Rates of Application and Weeds Controlled | Apply uniformly to the soil as a spray at planting or following planting. If the tops of the beds are to be dragged off, DACTHAL FLOWABLE should be applied after drag-off. Layby applications can be made up to 9 weeks after planting. If weeds have emerged before application, the crop should be weeded or cultivated prior to application. The initial sprinkler irrigation following DACTHAL FLOWABLE should not exceed 1 inch. In the Pacific Northwest under dry conditions, DACTHAL FLOWABLE should not be applied until just prior to the initial sprinkler irrigation. Under furrow irrigation in the Pacific Northwest, shallow incorporation (no greater than inch deep) while the sprouts are still well below the soil surface may be desirable. Preplant incorporation not recommended. |
| Radish | At seeding or up to three-leaf stage | 6-14 pts. FLOWABLE per acre | Apply uniformly to the soil as a spray in 20 to 30 gallons of water per acre. If weeds have emerged, soil should be clean cultivated or weeded prior to application to permit uniform coverage of soil. Preplant incorporation not recommended. DO NOT graze on treated areas or feed plant refuse to livestock. DO NOT harvest within 25 days of application.<br><br>Based upon available residue data, the use of DACTHAL FLOWABLE for weed control in radishes is limited to the State of California. In California, applications must be banded. |
| Sweet Potatoes and Yams | At transplanting and layby | See Rates of Application and Weeds Controlled | Apply uniformly to the soil as a spray at transplanting. DACTHAL FLOWABLE can be sprayed directly over transplants without injury. Layby applications can be made up to 6 weeks after transplanting. If weeds are present, the crop should be weeded or cultivated prior to DACTHAL FLOWABLE application. Incorporation of layby applications not recommended. In California, applications must be banded. |

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| Crops | When To Apply | Rate Per Acre | Remarks |
|---|---|---|---|
| Tomatoes; tomatillos; eggplant and peppers (all varieties of peppers including pimentos and bell, hot and sweet peppers) | 4-6 weeks after transplanting or on direct seeded plants at 4-6 inches in height (see remarks) | See Rates of Application and Weeds Controlled | Application uniformly to the soil should be confined to a period of 4-6 weeks after transplanting. Plants should be well-established and growing conditions favorable for good plant growth. DACTHAL FLOWABLE can be sprayed directly over transplants without injury. If weeds have emerged, the crop should be cultivated or weeded prior to making the DACTHAL FLOWABLE application. DO NOT apply to seeded plants until plants are 4-6 inches in height, well established and growing conditions are favorable for good plant growth. In California, applications must be banded. |
| Strawberries: New Plantings | At transplanting | 12 pints FLOWABLE per acre | Apply uniformly to the soil as a spray. For new beds apply 12 pints at transplanting. Can be preplant incorporated. In California, applications must be banded and incorporated as described above. |
| Strawberries: Established Plantings | Fall and early Spring | 8-12 pints FLOWABLE per acre | Application of 8-12 pints per acre may be applied to control late summer or early fall germinating weeds. Application to established plantings should be made in fall and early spring. DO NOT apply after first bloom through harvest. Applications may be made directly over the plants without injury. In California, applications must be banded. |
| Cotton | At seeding and layby | See Rates of Application and Weeds Controlled | Apply uniformly to the soil at time of planting. Higher rates of 10-14 pints are recommended for areas under irrigation. Layby application at 6-10 pints can be made, but not after peak bloom or within 45 days of harvest. If weeds are present, the cotton should be weeded or cultivated prior to making layby application. Can be preplant incorporated. In California, applications must be banded and incorporated as described above. |
| Note: Rates can be reduced by banding. | | | Layby used in this table refers to the time just prior to the stage when crop plant size would prevent further cultivation. |

*See Rates of Application and Weeds Controlled

[1]Brassica leafy vegetables crop group includes broccoli, Chinese (gai lon, white flowering) broccoli, broccoli raab (rapini), Brussels sprouts, cabbage, Chinese cabbage (bok choy, napa, tight-heading varieties), Chinese mustard cabbage (gai choy), cauliflower, cavalo broccolo, collards, kale, kohlrabi, mizuna, mustard greens, mustard spinach and rape greens.

[2]Summer Squash: Fruits of the gourd (*Cucurbitaceae*) family that are consumed when immature, 100% of the fruit is edible either cooked or raw, once picked it cannot be stored, has a soft rind which is easily penetrated, and if seeds were harvested they would not germinate; e.g., *Cucurbita pepo* (i.e., crookneck squash, straightneck squash, scallop squash, and vegetable marrow); *Lagenaria* spp. (i.e., spaghetti squash, hyotan, cucuzza); *Luffa* spp. (i.e., hechima, Chinese okra); *Momordica* spp. (i.e., bitter melon, balsam pear, balsam apple, Chinese cucumber); *Sechium edule* (chayote); and other cultivars and/or hybrids of these.

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## APPLICATION AND CALIBRATION TECHNIQUES FOR SPRINKLER IRRIGATION

Apply DACTHAL FLOWABLE only through center pivot, motorized lateral move, solid set or portable (side roll, end tow or hand move) irrigation systems. DO NOT apply this product through any other type of irrigation system.

Crop injury or lack of effectiveness can result from non-uniform distribution of treated water.

If you have questions about calibration, you should contact State Extension Service specialists, equipment manufacturers or other experts.

DO NOT apply this product through irrigation systems connected to a public water system. "Public water system" means a system for the provision to the public of piped water for human consumption if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days per year.

A person knowledgeable of the chemigation system and responsible for its operation, or under the supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise.

The system must contain a functional check valve, vacuum relief valve, and low-pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from backflow.

The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump.

The pesticide injection pipeline must also contain a functional, normally-closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.

Always inject DACTHAL FLOWABLE into irrigation water after it discharges from the irrigation pump and after it passes through the check valve. Never inject pesticides into the intake line of the suction side of the pump.

The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops.

The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected.

Systems must use a metering pump, such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.

DO NOT apply when wind speed favors drift beyond the area intended for treatment.

Spray mixture in the chemical supply tank must be agitated at all times, otherwise settling and uneven application may occur.

DACTHAL FLOWABLE may be used through two basic types of sprinkler irrigation systems as outlined in Sections A and B below. Determine which type of system is in place, then refer to the appropriate directions provided for each type. The tank containing DACTHAL FLOWABLE must be equipped with effective mechanical agitation to keep the wettable powder in suspension. Premixing DACTHAL FLOWABLE as instructed under ground application will insure that a uniform suspension is obtained. The injection equipment which contains the DACTHAL FLOWABLE suspension should be connected to the discharge side of the irrigation pump or other pressurized equipment attached to the irrigation line.

### A. Center Pivot and Motorized Lateral Move Irrigation Equipment

For injection of pesticides, these continuously moving systems must use a positive displacement injection pump, of either diaphragm or piston type, constructed of materials that are compatible with pesticides and capable of injection at pressures approximately 2-3 times those encountered within the irrigation water line. Venturi applicator units cannot be used on these systems.

Fill chemical supply tank of injection equipment with water. Operate system for one complete revolution or run across the field, measuring time required, amount of water injected, and acreage covered. Thoroughly mix recommended amount of DACTHAL FLOWABLE for acreage to be covered into same amount of water used during calibration and inject into system continuously for one revolution or run. Mixture in the chemical supply tank must be continuously agitated during the injection run. Shut off injection equipment after one revolution or run, but continue to operate irrigation system until DACTHAL FLOWABLE has been cleared from last sprinkler head.

### B. Solid Set and Portable (Side Roll, End Tow or Hand Move) Irrigation Equipment

Determine acreage covered by sprinkler. Fill tank of injection equipment with water and adjust flow to use contents over a 30 to 45-minute period. Mix desired amount of DACTHAL FLOWABLE for acreage to be covered into quantity of water used during

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calibration and operate entire system at normal pressures recommended by the manufacturer of injection equipment used for amount of time established during calibration. DACTHAL FLOWABLE can be injected at the beginning or end of the irrigation cycle or as a separate application. Stop injection equipment after treatment is completed and continue to operate irrigation system until DACTHAL FLOWABLE has been cleared from last sprinkler head.

## STORAGE AND DISPOSAL

DO NOT contaminate water, food or feed by storage or disposal. Open dumping is prohibited.

**PESTICIDE STORAGE:** Store in a dry place.

**PESTICIDE DISPOSAL:** Wastes resulting from the use of this product may be disposed of at an approved waste disposal facility. DO NOT contaminate water when disposing of equipment washwaters.

**CONTAINER DISPOSAL:** Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

## LIMITED WARRANTY AND DISCLAIMER

The manufacturer warrants (a) that this product conform to the chemical description on the label; (b) that this product is reasonably fit for the purposes set forth in the directions for use, subject to the inherent risks referred to herein, when it is used in accordance with such directions; and (c) that the directions, warnings, and other statements on this label are based upon responsible experts' evaluations of reasonable tests of effectiveness, of toxicity to laboratory animals and to plants and residues on food crops, and upon reports of field experience. Tests have not been made on all varieties of food crops and plants, or in all states or under all conditions.

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