



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

OFFICE OF  
PREVENTION, PESTICIDES AND  
TOXIC SUBSTANCES

**MEMORANDUM**

PC Code: 122809  
DPBarcode: D291899

**SUBJECT:** Tier 1 Drinking Water Assessment for Fluazifop-p-butyl

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**DATE:** October 29, 2003

This memorandum presents EFED's Tier 1 drinking water assessment for the herbicide fluazifop-p-butyl (PC 122809). Fluazifop-p-butyl is rapidly (less than one day) degraded in soil to fluazifop acid, which is much more stable in soil and water environments than the parent. At present, all tolerances for fluazifop-p-butyl are expressed as the acid. Other degradates are formed in only minor amounts. Therefore, we have modeled the combined residue fluazifop-p-butyl plus fluazifop acid for the drinking water assessment. Because fluazifop acid is the form present for the great majority of the time, its physical properties have been used in the modeling.

*Data for Use in Risk Assessment.* The following expected environmental concentrations are recommended for use in the human health risk assessment: for surface water: 58 ppb acute and 12 ppb chronic (tree fruit use); for ground water, 0.58 ppb for acute and chronic effects.

Uses and Application Rates

Fluazifop-p-butyl is used as a post-emergence herbicide for the control of annual and perennial grasses, and is selective to most broadleaf crops. It has a systemic mode of action, in which it is transported from treated foliage into shoots, roots, rhizomes, stolons and other meristematic regions to inhibit growth.

Fluazifop-p-butyl is labeled as Fusilade DX herbicide, Fusilade II herbicide, and Fusion herbicide, which also contains the active ingredient fenoxaprop-p-ethyl. Fusilade DX is labeled for fruits, vegetables, nuts, coffee, soybeans, cotton, non-agricultural uses and on non-bearing orchards, vineyards, and tree farms. Fusion herbicide is labeled for use on soybeans, cotton, and for non-agricultural use (highway rights-of-way). Fusilade II is labeled for turf and ornamental uses (landscapes, roadsides, commercial and residential areas).

According to the registrant's SMART meeting presentation, the use rates for fluazifop-p-butyl may be summarized as in Table 1. The maximum single application rate is 0.375 lb active ingredient (a.i.) per acre, and the maximum annual use rate is 1.125 lb a.i. per acre. The maximum use rate is divided into 3 equal applications, as for tree fruits, or unequally, as for the asparagus 24(c) label. The major crop single maximum use rates (for soybean and cotton) are the same at 0.375 lb a.i. per acre, with annual maximums of 0.5 and 0.75 lb a.i. per acre, respectively.

The scenarios listed in bold type in Table 1 have been selected to represent all of these uses. Aerial application to soybeans at the maximum annual rate was chosen to represent this major crop. Aerial application to cotton at the maximum single rate and minimum application interval of 21 days was chosen to represent this major crop.

To represent minor crops, a ground application scenario (tree fruits) and an aerial scenario (asparagus) at the maximum rates and minimum intervals were chosen. The asparagus 24(c) label, which divides the maximum annual rate into 4 applications, rather than 3, was also modeled (the application rate modeled was 0.281 lb a.i. per acre).

### Annual Usage

According to data compiled by the U.S. Geological Survey in 1991-3 and 1995, about 75% of the national use of fluazifop-p-butyl was on soybeans, and another 21% was used on cotton. OPP/BEAD, in its 2003 preliminary Quantitative Usage Assessment (QUA) estimated that about 80% is used on soybeans, and 12% on cotton. These analyses agree that over 90% of fluazifop-p-butyl is used on these two major crops.

### Model Input Data

Table 2 presents the FIRST model input data for fluazifop acid, selected in accordance with the current Input Parameter Guidance. FIRST is EFED's screening-level (Tier 1) model for drinking water, and incorporates the Index Reservoir that is also used in Tier 2 PRZM-EXAMS modeling. As a Tier 1 model, results from FIRST are expected to be conservative (i.e., to be on the high end of actually expected concentrations).

The soil metabolism half-lives are based on the combined residue of fluazifop-p-butyl and fluazifop acid. The half-life in the reservoir is estimated as the pH 7 hydrolysis rate, 78 days, since this is greater than two times the soil metabolism half-life.

Table 1: Labeled uses of Fluazifop-p-butyl. Modeled Uses are in Bold Type.

| Crops or Use   | Max. Single Application Rate, lb a.i./acre | Max. No. of Applications per crop cycle | Max. Annual Load, lb a.i./acre | Minimum Application Interval | Application Method   |
|--|--|---|--------------------------------|------------------------------|----------------------|
| <b>Apricot, Cherry, Nectarine, Peach, Plum/Prune, Pecan</b>                      | <b>0.375</b>                               | <b>3</b>                                | <b>1.125</b>                   | <b>21</b>                    | <b>ground</b>        |
| <b>Asparagus</b>   | <b>0.375</b>                               | <b>2</b>                                | <b>0.75</b>                    | <b>14</b>                    | <b>ground or air</b> |
| <b>24(c) label</b>   | <b>0.375</b>                               | <b>4</b>                                | <b>1.125</b>                   | <b>21</b>                    | <b>ground or air</b> |
| Carrot, <b>Cotton</b> , Endive, Garlic, Onion, Sweet Potato, Tabasco Pepper, Yam | <b>0.375</b>                               | <b>2</b>                                | <b>0.75</b>                    | <b>21</b>                    | <b>ground or air</b> |
| <b>Soybeans</b>  | <b>0.375</b>                               | <b>2</b>                                | <b>0.5</b>                     | <b>21</b>                    | <b>ground or air</b> |
| Coffee, Macadamia nut  | 0.375                                      | 2                                       | 0.75                           | 21                           | ground               |
| Coffee 24(c) label   | 0.25                                       | 3                                       | 0.75                           | 21                           | ground               |
| Rhubarb  | 0.375                                      | 2                                       | 0.562                          | 21                           | ground or air        |
| Turf: Zoysia Grass   | 0.078                                      | 3.2 implied at max. rate                | 0.25                           | 28                           | ground               |
| Turf: Tall fescue  | 0.094                                      | 2 implied at max. rate                  | 0.1875                         | 150                          | ground               |
| Ornamental Plants  | 0.375                                      | 3 implied at max. rate                  | 1.125                          | not applicable               | ground               |
| Alfalfa and Clover (seed) 24(c)  | 0.1875                                     | 2                                       | 0.3125                         | 14                           | ground or air        |
| Fescue (seed) 24(c)  | 0.25                                       | 4                                       | 1.0                            | 21                           | ground or air        |
| Bentgrass (seed) 24(c)   | 0.375                                      | 2                                       | 0.75                           | 21                           | ground or air        |
| Vegetable seed 24(c)   | 0.25                                       | 2                                       | 0.5                            | 21                           | ground or air        |
| Kenaf (non-food) 24(c)   | 0.1875                                     | not stated                              | not stated                     | 14                           | ground or air        |
| Non-crop   | 0.375                                      | 3 implied at max. rate                  | 1.125                          | not applicable               | ground               |

Table 2: FIRST and SCIGROW Model Input Parameters for Fluazifop Acid

| Property   | Value  | Reference   |
|--|--|---|
| Organic Carbon Partitioning Coefficient: Koc<br>FIRST : lowest value for non-sand soil<br>SCIGROW: lowest value if over 3-fold variation                           | FIRST: 8.3 mL/g<br><br>SCIGROW: 8.3 mL/g               | MRID 41900604   |
| Solubility in Water  | parent: 2 mg/L<br><br>acid: 40 mg/L                    | USDA Pesticide Properties Database<br>EPIWIN estimate from experimental log Kow, supported by pKa = 2.8 (MRID 41900604) |
| Soil Half-life<br><u>FIRST</u> : (90% upper confidence limit on mean of 5 values) for combined parent plus fluazifop acid.<br><u>SCIGROW</u> : mean soil half-life | <u>FIRST</u> : 22 days<br><br><u>SCIGROW</u> : 18 days | MRID 92067032<br>Addendum #1  |
| Aqueous Half-life  | 78 days  | hydrolysis half-life at pH7 (MRID 41598001)   |
| Photolysis Half-life   | acid is stable   | MRID 41598002   |

## Results

*Surface Water (Index Reservoir).* Table 3 presents the results of the FIRST model runs for the selected crops. The highest expected acute and chronic concentrations are for tree fruits and asparagus. This is due in part to the default assumption of 87% cropped area in the watershed of the drinking water reservoir. The major crops, soybeans and cotton, give lower concentrations in accordance with their lower application rates and percent cropped areas.

*Ground Water.* The SCIGROW model, using a total application rate of 1.125 lb a.i. per acre per year, a mean soil half-life of 18 days, and a Koc of 8.3 mL/g for fluazifop acid, predicts a concentration of 0.58 ppb in ground water.

The SCIGROW model predicts the impact on ground water from a single season's use of a chemical. The properties of fluazifop acid, namely high mobility and long persistence in water (78-day hydrolysis half-life at pH 7) and anaerobic soil (half-life 1 to 3 years, MRID 92067033) indicate that it might persist from year to year in the subsurface, and move with flowing ground water. Thus, the screening value of 0.58 ppb may not adequately describe the expected behavior of fluazifop acid.

*Monitoring Data.* The registrant reported that a search of U.S. Geological Survey data bases yielded no monitoring data on fluazifop-p-butyl. The Agency for Toxic Substances and Disease Registry (ATSDR) found fluazifop in the community drinking water wells of McFarland, Kern County, California, an agricultural community, in 1995. Concentrations of 0.06, 0.16, and 0.17 ppb were found, which are about the same order of magnitude as the SCI-GROW screening

concentration.

*Hawaii.* The drinking water assessment methods used by EFED are generally geared to the continental United States. The results presented here may be less applicable to registered uses in Hawaii (macadamia nuts and coffee).

*Data for Use in Risk Assessment.* The following expected environmental concentrations are recommended for use in the human health risk assessment: for surface water: 58 ppb acute and 12 ppb chronic (tree fruit use); for ground water, 0.58 ppb for acute and chronic effects.

Table 3: Modeled Acute and Chronic Drinking Water Concentrations in Surface Water(Tier 1)

| Crop   | % Cropped Area | Acute: $\mu\text{g/L}$ or ppb | Chronic: $\mu\text{g/L}$ or ppb |
|--|----------------|-------------------------------|---------------------------------|
| 1. Soybeans (1 application at total seasonal rate) | 41%            | 20                            | 4.3                             |
| 3. Cotton  | 20%            | 11                            | 2.4                             |
| 4. Tree Fruit                                      | 87% (default)  | 58                            | 12                              |
| 5. Asparagus                                       | 87% (default)  | 53                            | 11                              |
| 6. Asparagus 24(c)                                 | 87% (default)  | 48                            | 10                              |

Appendix A: FIRST runs for Five Crops

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RUN No.    1 FOR fluazifop acid    ON    tree fruit    * INPUT VALUES *
-----
RATE (#/AC)  No.APPS &  SOIL  SOLUBIL  APPL TYPE  %CROPPED INCORP
ONE (MULT)  INTERVAL  Koc   (PPM )   (%DRIFT)  AREA   (IN)
-----
.375(   .668)  3  21      8.3   40.0   ABLAST( 6.3)  87.0   .0
    
```

FIELD AND RESERVOIR HALFLIFE VALUES (DAYS)

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-----
METABOLIC  DAYS UNTIL  HYDROLYSIS  PHOTOLYSIS  METABOLIC  COMBINED
(FIELD)    RAIN/RUNOFF (RESERVOIR) (RES.-EFF)  (RESER.)  (RESER.)
-----
22.00      2           78.00      .00-       .00        .00       78.00
    
```

UNTREATED WATER CONC (MICROGRAMS/LITER (PPB)) Ver 1.0 AUG 1, 2001

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-----
PEAK DAY (ACUTE)          ANNUAL AVERAGE (CHRONIC)
CONCENTRATION             CONCENTRATION
-----
57.958                    12.316
    
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RUN No.    2 FOR asparagus        ON    asparagus    * INPUT VALUES *
-----
RATE (#/AC)  No.APPS &  SOIL  SOLUBIL  APPL TYPE  %CROPPED INCORP
ONE (MULT)  INTERVAL  Koc   (PPM )   (%DRIFT)  AREA   (IN)
-----
.375(   .616)  2  14      8.3   40.0   AERIAL(16.0)  87.0   .0
    
```

FIELD AND RESERVOIR HALFLIFE VALUES (DAYS)

```

-----
METABOLIC  DAYS UNTIL  HYDROLYSIS  PHOTOLYSIS  METABOLIC  COMBINED
(FIELD)    RAIN/RUNOFF (RESERVOIR) (RES.-EFF)  (RESER.)  (RESER.)
-----
22.00      2           78.00      .00-       .00        .00       78.00
    
```

UNTREATED WATER CONC (MICROGRAMS/LITER (PPB)) Ver 1.0 AUG 1, 2001

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-----
PEAK DAY (ACUTE)          ANNUAL AVERAGE (CHRONIC)
CONCENTRATION             CONCENTRATION
-----
53.327                    11.336
    
```

RUN No. 3 FOR fluazifop acid ON 24(c) aspa \* INPUT VALUES \*

| RATE (#/AC)<br>ONE (MULT) | No.APPS &<br>INTERVAL | SOIL<br>Koc | SOLUBIL<br>(PPM ) | APPL TYPE<br>(%DRIFT) | %CROPPED<br>AREA | INCRP<br>(IN) |
|---------------------------|-----------------------|-------------|-------------------|-----------------------|------------------|---------------|
| .281 ( .539)              | 4 21                  | 8.3         | 40.0              | AERIAL(16.0)          | 87.0             | .0            |

FIELD AND RESERVOIR HALFLIFE VALUES (DAYS)

| METABOLIC<br>(FIELD) | DAYS UNTIL<br>RAIN/RUNOFF | HYDROLYSIS<br>(RESERVOIR) | PHOTOLYSIS<br>(RES.-EFF) | METABOLIC<br>(RESER.) | COMBINED<br>(RESER.) |
|----------------------|---------------------------|---------------------------|--------------------------|-----------------------|----------------------|
| 22.00                | 2                         | 78.00                     | .00-                     | .00                   | 78.00                |

UNTREATED WATER CONC (MICROGRAMS/LITER (PPB)) Ver 1.0 AUG 1, 2001

| PEAK DAY (ACUTE)<br>CONCENTRATION | ANNUAL AVERAGE (CHRONIC)<br>CONCENTRATION |
|-----------------------------------|---|
| 48.036                            | 10.214                                    |

RUN No. 4 FOR fluazifop acid ON cotton \* INPUT VALUES \*

| RATE (#/AC)<br>ONE (MULT) | No.APPS &<br>INTERVAL | SOIL<br>Koc | SOLUBIL<br>(PPM ) | APPL TYPE<br>(%DRIFT) | %CROPPED<br>AREA | INCRP<br>(IN) |
|---------------------------|-----------------------|-------------|-------------------|-----------------------|------------------|---------------|
| .375 ( .569)              | 2 21                  | 8.3         | 40.0              | AERIAL(16.0)          | 20.0             | .0            |

FIELD AND RESERVOIR HALFLIFE VALUES (DAYS)

| METABOLIC<br>(FIELD) | DAYS UNTIL<br>RAIN/RUNOFF | HYDROLYSIS<br>(RESERVOIR) | PHOTOLYSIS<br>(RES.-EFF) | METABOLIC<br>(RESER.) | COMBINED<br>(RESER.) |
|----------------------|---------------------------|---------------------------|--------------------------|-----------------------|----------------------|
| 22.00                | 2                         | 78.00                     | .00-                     | .00                   | 78.00                |

UNTREATED WATER CONC (MICROGRAMS/LITER (PPB)) Ver 1.0 AUG 1, 2001

| PEAK DAY (ACUTE)<br>CONCENTRATION | ANNUAL AVERAGE (CHRONIC)<br>CONCENTRATION |
|-----------------------------------|---|
| 11.353                            | 2.413                                     |

RUN No. 5 FOR fluazifop acid ON soybeans \* INPUT VALUES \*

| RATE (#/AC)<br>ONE (MULT) | No.APPS &<br>INTERVAL | SOIL<br>Koc | SOLUBIL<br>(PPM ) | APPL TYPE<br>(%DRIFT) | %CROPPED<br>AREA | INCORP<br>(IN) |
|---------------------------|-----------------------|-------------|-------------------|-----------------------|------------------|----------------|
| .500( .500)               | 1 1                   | 8.3         | 40.0              | AERIAL(16.0)          | 41.0             | .0             |

FIELD AND RESERVOIR HALFLIFE VALUES (DAYS)

| METABOLIC<br>(FIELD) | DAYS UNTIL<br>RAIN/RUNOFF | HYDROLYSIS<br>(RESERVOIR) | PHOTOLYSIS<br>(RES.-EFF) | METABOLIC<br>(RESER.) | COMBINED<br>(RESER.) |
|----------------------|---------------------------|---------------------------|--------------------------|-----------------------|----------------------|
| 22.00                | 2                         | 78.00                     | .00-                     | .00                   | 78.00                |

UNTREATED WATER CONC (MICROGRAMS/LITER (PPB)) Ver 1.0 AUG 1, 2001

| PEAK DAY (ACUTE)<br>CONCENTRATION | ANNUAL AVERAGE (CHRONIC)<br>CONCENTRATION |
|-----------------------------------|---|
| 20.204                            | 4.295                                     |