



STATE OF MAINE
DEPARTMENT OF AGRICULTURE, CONSERVATION AND FORESTRY
BOARD OF PESTICIDES CONTROL
 28 STATE HOUSE STATION
 AUGUSTA, MAINE 04333

JANET T. MILLS
 GOVERNOR

AMANDA E. BEAL
 COMMISSIONER

To: Board of Pesticides Control Members
 From: Mary Tomlinson, Pesticides Registrar/Water Quality Specialist
 Re: Application for EPA Special Local Need (SLN) [FIFRA, Section 24(c)], use of Express Herbicide with TotalSol (FMC) (EPA Reg. No. 279-9594) for bunchberry control in wild blueberry
 Date: February 26, 2019

Enclosed are the above-referenced SLN application and supporting documents for your consideration.

In 2008, the Board first approved SLN ME-080003, for Express Herbicide with TotalSol (Dupont), EPA Reg. No. 352-632, for bunchberry control, in wild blueberries. A December 31, 2009 expiration date was stipulated by the Board due to groundwater concerns. However, many growers never had the opportunity to use Express on all their fields due to the late approval and the limitation that Express could applied no earlier than 365 days prior to harvest. In 2010, SLN ME-100002 was issued for two years and renewed in 2013. The SLN expired on December 31, 2018.

The federal registration for Express Herbicide with TotalSol was transferred from Dupont to FMC in 2018. This SLN application is for the product registered under FMC.

Use rates, application type, and timing of application have been expanded under this SLN label. The former SLN only permitted an application rate of 0.8-1.0 ounce per acre in the fall, after harvest, for control of bunchberry. The proposed SLN allows the same fall application for bunchberry control, but adds a spring application in the non-crop year at 1 ounce in 20-30 gallons of water and spot applications to control alders, bracken fern, wild rose, and yellow loosestrife at the rate of 1 ounce in 20 gallons of water during the summer and early fall. Application within 365 days of harvest is not permitted. Included with this application are two efficacy studies by Dr. David Yarborough and Jennifer D'Appollonio, with the University of Maine Cooperative Extension, that demonstrate effective bunchberry control with a spring application of Express and effective control of target weeds with post-emergent spot spray application.

Tribenuron methyl, the active ingredient in Express, was not detected in the 2011 blueberry monitoring program. However, the Montana Analytical Laboratory does not include this chemical in the MTUniversal method; therefore, the tribenuron methyl was not analyzed in the 2014 statewide and 2015 blueberry groundwater monitoring programs.

Field soil dissipation studies indicate that tribenuron methyl degrades fairly rapidly in loam soil and has limited potential for leaching; therefore, contamination of groundwater is not likely. Soil leaching studies are provided for your review. Dr. David Yarborough, has provided education for growers on timing of application and using spot treatments, when feasible, to prevent groundwater contamination.

MEGAN PATTERSON, DIRECTOR
 32 BLOSSOM LANE, MARQUARDT BUILDING



PHONE: (207) 287-2731
 WWW.THINKFIRSTSPRAYLAST.ORG

Please review the following documents and let me know if you have any questions.

- EPA Form 8570-25 FIFRA, Section 24(c) application
- FMC Express Herbicide with TotalSol draft Section 24(c) label
- Expired Dupont Express Herbicide with TotalSol Section 24(c) label (for comparison)
- Letter of request from David Yarborough, Wild Blueberry Specialist, Maine Cooperative Extension
- Letter of support from Bruce Hall, Agronomist, Jasper Wyman & Son
- Letter of support from FMC Corporation
- Toxicity Summary for tribenuron methyl
- Yarborough - Express bunchberry WBAC 2018 Final Report
- Yarborough - Express spot treatment WBAC 2018 Final Report
- Canada Weed Management Guide
- FMC Express Herbicide with Section 3 label
- FMC Express Herbicide with MSDS

The following confidential documents will be sent under separate cover for your review.

- Field soil dissipation AMR 1106-88- confidential
- Field soil dissipation DuPont-2646- confidential
- Field soil dissipation DuPont-2848 – confidential
- Soil column leaching study AMR 448-85 - confidential
- Efficacy study Dupont-26646 - confidential



United States Environmental Protection Agency
Office of Pesticide Programs, Registration Division (7505C)
Washington, DC 20460

**Application for/Notification of State Registration
of a Pesticide To Meet a Special Local Need**
*(Pursuant to section 24(c) of the Federal Insecticide,
Fungicide, and Rodenticide Act, as Amended)*

For State Use Only
Registration No. Assigned
Date Registration Issued

1. Name and Address of Applicant for Registration
Mike Zucker
State Registration Specialist
FMC Corporation
2929 Walnut Street
Philadelphia, PA 19104

2. Product is (Check one)
EPA-Registered
New (not EPA-registered) Attach EPA Form 8570-4, Confidential Statement of Formula for new products.
3. Active Ingredient(s) in Product
Tribenuron methyl
EPA Registration Number 279-9594
EPA Company Number 279

4. Product Name
Express® herbicide (w/TotalSol™ soluble granules)

5. If this is a food/feed use, a tolerance or other residue clearance is required. Cite appropriate regulations in 40 CFR Part 180, 185, and/or 186. This is not a food/feed use

6. Type of Registration (Give details in Item 13 or on a separate page, properly identified and attached to this form):
a. To permit use of a new product.
b. To amend EPA registrations for one or more of the following purposes:
 (1) To permit use on additional crops or animals.
 (2) To permit use at additional sites.
 (3) To permit use against additional pests.
 (4) To permit use of additional application techniques or equipment.
 (5) To permit use at different application rates.
 (6) Other (specify below)

7. Nature of Special Local Need (check one)
 There is no pesticide product registered by EPA for such use.
 There is no EPA-registered pesticide product which, under the conditions of use within the State, would be as safe and/or as efficacious for such use within the terms and conditions of EPA registration.
 An appropriate EPA-registered pesticide product is not available.

10. Has FIFRA section 24(c) registration for this use of the product ever, by another State, been (check appropriate box(es), if known):
 Sought Issued Denied Revoked
If any of the above are checked, list States in item 13 below.
 No FIFRA section 24(c) Action

8. If this registration is an amendment to an EPA-registered product, is it for a "new use" as defined in 40 CFR 152.3 ?
 Yes (discuss in item 13 below) No

9. Has an EPA Registration or Experimental Use Permit for this chemical ever been (check applicable box(es), if known):
 Sought Issued Denied Cancelled Suspended
 Registration Experimental Use Permit No Previous Permit Action

11. Endangered Species Act: (Give details in Item 13 or on a separate page, properly identified and attached to this form)
Identify the counties where this pesticide will be used. If Statewide, indicate "all." Provide a list of Federally protected endangered/threatened species which occur in the areas of proposed use.

Certification
I certify that the statements I have made on this form and all attachments thereto are true, accurate, and complete. I acknowledge that any knowingly false or misleading statement may be punishable by fine or imprisonment or both under applicable law.

12. Indicate use status of Special Local Need, i.e., planned dates of use:
From: 4/15/2019 To: 4/15/2024

Signature of Applicant or Authorized Representative
Michael C. Zucker

13. Comments (attach additional sheet, if needed)
Requested by David Yarborough, PhD., Blueberry Specialist, Prof. of Horticulture the UofME for control of bunchberry in wild blueberry fields and for the use in the non-bearing year for spot treatment of alders, wild rose and yellow loosestrife. These uses will allow for a spring application timing and for the control of weeds not otherwise being adequately controlled. Growers report that bunchberry is a major weed problem in their fields and need a solution. This herbicide has been registered in Canada (called Spartan) on blueberries for over 10 years without any adverse effects. At the rates and timing proposed on this labeling research has shown this

Title
State Registration Specialist
Telephone Number
(215) 299-5876
Date
02/07/19

Determination by State Agency
This registration is for a Special Local Need and is being issued in accordance with section 24(c) of FIFRA, as amended. To the best of our knowledge, the information above is correct, except as noted in "Comments" below or in attachments.

Name, Title, and Address of State Agency Official	Comments (by State Agency Only)	Received by EPA
Mary E. Tomlinson Maine Board of Pesticides Control Maine Department of Agriculture, Conservation and Forestry 28 State House Station Augusta, ME 04333-0028		
Title Pesticides Registrar/Water Quality Specialist		
Telephone Number 207-287-7544	Date February 26, 2019	



With TotalSol™ Soluble Granules

FIFRA 24(c) Special Local Need Label (SLN)

For Distribution and Use only in the State of Maine
For Spot Application and Bunchberry Control in Lowbush Blueberry
Only in the State of Maine

EPA REG No. 279-9594

SLN No. ME-XXXXX

(REGISTRATION TRANSFERRED FROM EPA REG. NO. 352-632 ON MAY 25, 2018)

This label expires and must not be distributed or used in accordance with this SLN registration after December 31, 2023

DIRECTIONS FOR USE:

- It is a violation of Federal law to use this product in a manner inconsistent with its labeling
- This state-specific 24(c) labeling must be in the possession of the user at the time of application
- Follow all applicable directions, restrictions, and precautions on the EPA registered label for EPA Reg No. 279-9594

GENERAL INFORMATION

EXPRESS® Herbicide with TotalSol™ soluble granules) (EXPRESS® herbicide) is recommended for selective postemergence control/suppression of certain broadleaf weeds in lowbush blueberry (also known as wild blueberry). EXPRESS® herbicide may be used on lowbush blueberry providing user accepts all risk of possible crop injury

USE RATES AND APPLICATION TIMING

Apply EXPRESS® herbicide at 1.0 ounce per acre in the Fall after blueberry harvest, until a killing frost occurs, after which bunchberry control will not occur. EXPRESS® herbicide applied earlier in the Fall will result in increased blueberry cover and increased bunchberry control the year following application. The degree and duration of effect are dependent upon the rate used, sensitivity and size of the target weeds and environmental conditions at the time and following application.

Spot applications

EXPRESS® herbicide can be used as a directed spot spray with a backpack sprayer or handgun to control alders, bracken fern, wild rose and yellow loosestrife. Mix the equivalent of 1 oz in 20 gallons (1.5 grams in 1 gallon) of water plus a non-ionic surfactant at the label rate. To apply, spray to thoroughly wet the foliage. Apply only during the summer of the prune year when the weed foliage is fully expanded. Alders and wild rose can be controlled with early fall applications as they retain their leaves longer. Bracken fern shows few symptoms after application but control the following year is excellent. Foliage of the other species turns yellow or red and the stem terminals die soon after application. Control of vetch, poplars, willows, goldenrods and fly honeysuckle has been erratic and others like chokepear, bayberry, black bulrush, sweet fern, and birch, are resistant. Blueberries growing among treated weeds generally show few symptoms. However, when the blueberry plant is sprayed directly, it may be stunted, with reduced bloom and yield.

Spring non-crop year application

Apply EXPRESS® herbicide at 1 oz per acre in 20 to 30 gal of water with a surfactant in the spring of the non-crop year. For best results, applications should be made when the majority of the emerged bunchberry plant leaves have unfolded to form a 45 degree angle, but no later than when the first white blossoms are visible on the most advanced plants. Bunchberry plants generally turn pinkish red to yellow following spraying but may take weeks to die down. If EXPRESS® herbicide applications are made too late, bunchberry plants turn red and remain so for the entire

season and reduced control can be expected. If EXPRESS® herbicide is applied too early, bunchberry regrowth can be expected later in the season.

EXPRESS® herbicide should also be applied before blueberry emerging stems exceed one inch in height. Some stem height reduction, with yellowing and reddening of the blueberry leaves, may be observed for 6 to 8 weeks after application. This is more likely to occur if there have been prolonged cool temperatures or wide fluctuations in day and night temperatures just prior to or soon after treatment. Blueberry plants, however, recover and fruit bud numbers and potential yields are not generally affected. Recommended fertilizer applications before or after EXPRESS® herbicide applications will help the blueberry plants recover. Applications made at later stages of blueberry development or applications in spring-burnt fields should not be made due to potential crop injury and potential yield reductions.

WEEDS CONTROLLED

The following weeds are controlled in addition to the weeds listed on the EPA registered package label:

Bunchberry

Surfactant

Always use a nonionic surfactant of at least 80% active ingredient at the rate of 0.25% volume/volume (1 quart per 100 gallons of spray solution)

PRECAUTIONS/RESTRICTIONS

- **Do Not** use methylated seed oil (MSO) or crop oils with Express® herbicide on lowbush blueberry as these adjuvants may produce unsatisfactory crop injury
- **Do Not** apply more than 1.0 ounce of EXPRESS® herbicide per acre per growing season
- **Do Not** graze or cut for hay, or feed associated by-products to livestock, after application
- **Do Not** apply within 365 days of blueberry harvest
- **Do Not** apply EXPRESS® herbicide in a tank mix with organophosphate insecticides as severe crop injury may occur
- **Do Not** apply to lowbush blueberry that is under stress from severe weather conditions, drought, low fertility, water saturated soil, disease, or insect damage, as crop injury may result. Under certain conditions such as prolonged cool weather (daily high temperature less than 50°F) or wide fluctuations in day/night temperatures just prior to or soon after treatment, temporary yellowing and/or crop stunting may occur.
- EXPRESS® herbicide may degrade in water and so should be applied the same day it is mixed.

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Sold By:

FMC Corporation
2929 Walnut Street
Philadelphia, PA 19104

SPECIAL LOCAL NEED 24(C)LABELING

DuPont Crop Protection

DUPONT™ EXPRESS® HERBICIDE
(with TotalSol™ Soluble Granules)
FOR BUNCHBERRY CONTROL IN
LOWBUSH BLUEBERRY
IN THE STATE OF MAINE

FOR DISTRIBUTION AND USE ONLY WITHIN THE STATE OF MAINE

DUPONT™ EXPRESS® HERBICIDE with TotalSol™ (soluble granules)

EPA Reg. No. 352-632

SLN No. **ME-100002**

FOR BUNCHBERRY CONTROL IN LOWBUSH BLUEBERRY ONLY IN THE STATE OF MAINE

This label is valid **until December 31, 2018** or until otherwise revised, amended, cancelled or suspended.

GENERAL INFORMATION

DuPont™ EXPRESS® Herbicide (with TotalSol™ soluble granules) (EXPRESS®) is recommended for selective postemergence control/suppression of certain broadleaf weeds in lowbush blueberry (or also known as, wild blueberry).

EXPRESS® may be used on lowbush blueberry providing user accepts all risk of possible crop injury.

USE RATES AND APPLICATION TIMING

Apply EXPRESS® at 0.8 to 1.0 ounce per acre in the fall after blueberry harvest, until a killing frost occurs, after which bunchberry control will not occur.

EXPRESS® applied earlier in the fall will result in increased blueberry cover and increased bunchberry control in the following year. The degree and duration of effect are dependent upon the rate used, sensitivity and size of the target weeds, and environmental conditions at the time and following application.

WEEDS CONTROLLED

The following weeds are controlled in addition to the weeds listed on the EPA registered package label.

Bunchberry

Surfactant

Always use a nonionic surfactant of at least 80% active ingredient at the rate of 0.25% volume/volume (1 quart per 100 gallon of spray solution).

Precautions/Restrictions

The use of methylated seed oil (MSO) or crop oil is not recommended with EXPRESS® on lowbush blueberry as these adjuvants may produce unsatisfactory crop injury.

Do not apply more than 1.0 ounce of EXPRESS® per acre per growing season.

Do not graze or cut for hay, or feed associated by-products to livestock, after application.

Do not apply within 365 days of blueberry harvest.

Do not apply EXPRESS® in a tank mix with organophosphate insecticides as severe crop injury may occur.

Do not apply to lowbush blueberry that is under stress from severe weather conditions, drought, low fertility, water saturated soil, disease or insect damage, as crop injury may result. Under certain conditions such as prolonged cool weather (daily high temperature less than 50° F) or wide fluctuations in day/night temperatures just prior to or soon after treatment, temporary yellowing and/or crop stunting may occur.

For product information call 1-888-6-DUPONT

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**IMPORTANT
BEFORE USING EXPRESS®, READ AND
FOLLOW ALL APPLICABLE DIRECTIONS,
RESTRICTIONS AND PRECAUTIONS ON THE
EPA-REGISTERED LABEL.**

This bulletin contains new or supplemental instructions for use of this product which do not appear on the EPA-registered package label. Follow the instructions carefully.

This labeling must be in the possession of the user at the time of pesticide application.

Read the Limitation of Warranty and Liability on the Section 3 Federal product label before buying or using THIS product. If terms are not acceptable, return the unopened package at once to Seller for full refund of purchase price paid. Otherwise, use by Buyer or any other User constitutes acceptance of the terms of the Limitation of Warranty and Liability on the Section 3 Federal product label.

(Replaces: R-807 072408 09-15-08)



Wild Blueberry Office Deering Hall University of Maine, Orono 04469

January 23, 2019

Mary E. Tomlinson
Pesticide Registrar/Water Quality Specialist
Maine Board of Pesticides Control
28 State House Station
Augusta, ME 04333

Dear Mary:

I support the FMC request for the 24(c) SLN renewal and expansion of the Express TotalSol™ Soluble Granules for use in Lowbush blueberries in Maine that was previously held by DuPont and approved by the Board of Pesticide Control. The label has been expanded to allow for the use in the non-bearing year for bunchberry and for spot treatment of alders, wild rose and yellow loosestrife. These additional uses will allow for a spring application timing and for the control of weeds not being adequately controlled by other methods. These uses have been registered in Atlantic Canada for over 10 years without incidence and so this label harmonizes the use allowed on wild blueberries on both sides of the border. We have conducted additional studies in 2018 in Maine that support this use which I have included in support of this label.

Sincerely,

David Yarborough PhD
Wild Blueberry Specialist
Professor of Horticulture
the University of Maine
5722 Deering Hall Rm. 414
Orono, ME 04469-5722

Phone: [207-581-2923](tel:207-581-2923)
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One of Maine's public universities

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January 25, 2019

Mary E. Tomlinson
Pesticide Registrar/Water Quality Specialist
Maine Board of Pesticides Control
28 State House Station
Augusta, ME 04333

Dear pMary:

I support the FMC request for the 24(c) SLN renewal and expansion of the Express TotalSol™ Soluble Granules for use in Lowbush blueberries in Maine that was previously held by DuPont and approved by the Board of Pesticide Control. The label has been expanded to allow for the use in the non-bearing year for bunchberry and for spot treatment of alders, wild rose and yellow loosestrife. Wyman's has been using spring application timing of this product on our farms in Atlantic Canada for a number of years to control weeds not being adequately controlled by other methods. Additionally, spring application proves a useful tool in resistance management. In conjunction with Dr. David Yarborough we conducted studies in 2018 in Maine.

Sincerely,

Bruce Hall
Agronomist
Jasper Wyman & Son
PO Box 100
Milbridge, ME 04658



Jasper Wyman & Son
PO BOX 100, Milbridge, ME 04658
www.wymans.com



FMC Corporation
2929 Walnut Street
Philadelphia, PA 19104

February 7, 2019

Mary E. Tomlinson
Pesticide Registrar / Water Quality Specialist
Maine Board of Pesticides Control / 28 SHS / Augusta, ME 04333

Subject: Application for Special Local Need (SLN) Registration (Section 24(c)) for the use of Express® Herbicide with TotalSol™ Soluble Granules (279-9594) in Spot Application and Bunchberry Control in Lowbush Blueberry only in the State of Maine

Dear Ms. Tomlinson,

FMC Corporation is herein applying for a FIFRA Section 24(c) Special Local Need (SLN) registration for Express® Herbicide with TotalSol™ (soluble granules), EPA Reg. No. 279-9594 (Express®). This SLN Registration would allow the use of Express® only in the state of Maine Spot Application and Bunchberry Control in Lowbush Blueberry (also known as, wild blueberry) only in the State of Maine. This herbicide has been registered in Canada (called Spartan) on blueberries for 10 years without any adverse effects. This SLN has been previously approved for Bunchberry control in Maine under EPA Company number 352. The registration for this product was transferred to Company number 279 on May 25, 2018.

Occurrence of bunchberry lowers the value of a blueberry harvest. In addition, bunchberry infestation in a wild blueberry field competes with the crop for nutrients and other resources. Wild blueberry growers have for many years consistently indicated that bunchberry is a major weed problem and have requested a solution.

David Yarborough, PhD., Blueberry Specialist, Prof. of Horticulture the University of Maine requested this specific use for control of bunchberry and other weeds in wild blueberry fields. Dr. Yarborough has done extensive research with tribenuron methyl (the active ingredient in this product) using the specific rates and timing specified in this proposed SLN labeling and has found results to be safe and effective. Dr. Yarborough has written a letter supporting this registration using the proposed labeling in this package (attached for reference).

Application will primarily be in the fall of a non-bearing year, or in the fall after blueberry harvest, until a killing frost occurs, after which bunchberry control will not occur. Using Express® applied in early fall will result in increased blueberry coverage and increased bunchberry control in the following year according to our testing. The label has also been expanded to allow for the use in the non-bearing year for bunchberry and for spot treatment of alders, wild rose and yellow loosestrife. These additional uses will allow for a spring application timing and for the control of weeds not being adequately controlled by other methods. Current regulatory data supports the maximum rate of 1.0 ounce of Express® per acres (1/2 ounce active ingredient; tribenuron-methyl) per growing season. Attached is a recent federally approved supplemental label for Express® for use in sunflower hybrids with 1.0 ounce per acre of Express® maximum per growing season as an example for reference. This is included along with the Section 3 labeling in the Federal Label Section of this package.

Currently there is not a safe, effective, and affordable option to manage bunchberry infestation for Maine wild blueberry growers.

Express® is currently registered in the states of Maine for various crop and fallow uses. Since SLN use prohibits application within 180 days of blueberry harvest which is in the fall of a non-bearing year, or in the fall after blueberry harvest, it does not involve application to a food or feed crop, no tolerance information will be provided with this application.

To my knowledge, a registration for the same use has not previously been denied, suspended or cancelled by the U. S. EPA, or voluntarily cancelled by the registrant subsequent to issuance by U.S. EPA of a notice of intent to cancel that registration because of health or environmental concerns about an ingredient contained in the pesticide product.

Also, to the best of my knowledge, this SLN application is in accordance with the purposes of FIFRA.

Enclosed is a copy of the following:

- A completed "Application for / Notification of State Registration of a Pesticide to Meet a Special Local Need", EPA Form 8570-25
- The proposed supplemental SLN labeling for this use of Express® (label code DR-4191 011519)
- A Letter of Support from David Yarborough, PhD., Blueberry Specialist, Professor of Horticulture the University of Maine
- The current Express FIFRA Section 3 labeling approved by USEPA (SL-4043-1 120718 11-08-18)
- Efficacy and crop safety data in support of this application
- An Express® Material Safety Data Sheet (MSDS)

Should you have questions, please contact me at 215-299-5876 or e-mail at mike.zucker@fmc.com.

Sincerely,



Michael C. Zucker
State Registration Specialist

Summary of Acute Toxicity Data for Tribenuron Methyl			
Test	MRID	Results	Category
Oral LD ₅₀ -rat (870.1100)	00149670	LD ₅₀ >5000 mg/kg (limit test)	IV
Dermal LD ₅₀ -rabbit (870.1200)	00148632	LD ₅₀ >2000 mg/kg (limit test)	III
Inhalation LC ₅₀ -rat (870.1300)	00148634	LC ₅₀ >6.7 mg/L gravimetric concentration (4-hour nose-only limit test); MMAD = 3.5 μ m	III
Eye Irritation-rabbit (870.2400)	40357401	Mild irritation in washed and unwashed eyes, redness with vessel injection at 1 and 4 hours.	IV
Dermal irritation-rabbit (870.2500)	40357402	Non-irritating	IV
Dermal sensitization-guinea pig (870.2600)	42364302	Sensitizer	Not applicable

Subchronic, chronic, and Other Toxicology Profile for Tribenuron Methyl			
Type of Study/Guideline	Study Title	MRID	Results
870.3100	90-Day oral toxicity, Rat	00148638	NOAEL=100 ppm (7/8 mg/kg/day, M/F, respectively) LOAEL=1750 ppm (118/135 mg/kg/day, M/F, respectively) for decreased body weight gain, food consumption and food efficiency; decreased absolute heart, liver, and kidney weights; increase relative brain, heart, liver, kidney, testes, and spleen weights; decreased serum glucose and globulin; no histopathologic lesions; likely cachexia
870.3150	13-week subchronic oral toxicity, Dog	00148639	NOAEL>2500 ppm (73.3/78.0 mg/kg/day in M/F, respectively) HDT

Subchronic, chronic, and Other Toxicology Profile for Tribenuron Methyl			
Type of Study/Guideline	Study Title	MRID	Results
870.3200	28-Day Dermal, Rabbit	42243101	Limit dose, 1000 mg/kg/day, resulted in serious toxicity and death. No NOAEL and LOAEL defined. Toxicity included treatment site lesions, hypokinesia, decreased body weights and food consumption, and kidney pathology, but the cause of death could not be determined. Although this study is Core Supplementary, another study is not needed. Worker exposure is expected to be 4-5 orders of magnitude lower than the limit dose.
870.3700a	Developmental Toxicity, Rat	00148640	Maternal NOAEL=20 mg/kg/day Maternal LOAEL=125 mg/kg/day (decreased maternal body weight gain and food consumption) Developmental NOAEL=20 mg/kg/day Developmental LOAEL=125 mg/kg/day (decreased body weight) At 500 mg/kg/day (HDT) there were increased resorption, fetal deaths, and incomplete ossifications.
870.3700b	Developmental Toxicity, Rabbit	40245514	Maternal NOAEL=20 mg/kg/day Maternal LOAEL=80 mg/kg/day (HDT-decreased food consumption, increased abortions (GD 19-29)) Developmental NOAEL=20 mg/kg/day Developmental LOAEL=80 mg/kg/day (HDT-10% decrease in body weight compared to controls, not statistically significant) Abortions were increased at 80 mg/kg/day. Teratogenicity was not observed.
870.3800	2-Generation Reproduction, Rat	40245515	Parental NOAEL=25 ppm (2 mg/kg/day) Parental LOAEL=250 ppm (21 mg/kg/day) -decreased body weight gain in F1a adult females) Reproductive NOAEL=25 ppm (2.5 mg/kg/day) Reproductive LOAEL=250 ppm (25 mg/kg/day) - decreased body weight gain during lactation for F1b and F2b pups) Offspring NOAEL= 25 ppm (2.5 mg/kg/day) Offspring LOAEL= 250 ppm (25 mg/kg/day) - decreased absolute splenic weights.

Subchronic, chronic, and Other Toxicology Profile for Tribenuron Methyl			
Type of Study/Guideline	Study Title	MRID	Results
870.4100b	Chronic Feeding, Dog	40245512	NOAEL (M) = 25 ppm (0.79 mg/kg/day) NOAEL (F) = 250 ppm (8.16 mg/kg/day) LOAEL (M) = 250 ppm (8.18 mg/kg/day)- elevated serum bilirubin, AST, and urinary volume, reduced body weight gain (20%). LOAEL (F) = 1500 ppm (52.02 mg/kg/day)- increased serum creatinine, bilirubin, AST, and globulin, decreased body weight gain of 18.2%)
870.4200b	Carcinogenicity, Mouse	40245513	NOAEL =20 ppm (3 mg/kg/day) M LOAEL = 200 ppm (30 mg/kg/day) - bilateral seminiferous degeneration and oligospermia. Although frank toxicity was not observed in the females, HED peer review judged the dose levels to be adequate. There was no evidence of carcinogenicity.
870.4300	Chronic Feeding/Carcinogenicity, Rat	40245511	NOAEL=25 ppm(0.95/1.2 mg/kg/day, M/F) LOAEL=250 ppm (10/13 mg/kg/day, M/F- decreased body weight gain in both sexes. Statistically significant increase in mammary gland adenocarcinomas in female rats at 1250 ppm (76 mg/kg/day, HDT)
870.4300	Supplement-Estrogenic Activity in Rats	41181901	Dose levels: 0 and 390 mg/kg/day for 90 days. Weak estrogenic activity was observed in female rats. The technical and 7 metabolites may be agonists for the estrogen receptor.
870.5100	Gene Mutation Bacterial Reverse Mutation Assay	00148641	Negative (<i>S. typhimurium</i>).
870.5300	Gene Mutation <i>in vitro</i> Mammalian Cell (Chinese Hamster Ovary)	00149671	Negative.
870.5395	Cytogenetics, Mouse Micronucleus Bone Marrow	00148644	Negative.
870.5395	Cytogenetics, Rat Micronucleus Bone Marrow	00148642	Negative.
870.5550	Other Effects – Unscheduled DNA Rat Hepatocyte	00148643	Negative.

Subchronic, chronic, and Other Toxicology Profile for Tribenuron Methyl

Type of Study/Guideline	Study Title	MRID	Results
870.7485	Metabolism Study - Rat	40245516	Single oral dose readily absorbed, low dose (20 mg/kg) single and repeated dose 26-33 hours (half-life); single high (1700-2000 mg/kg) 51-54 males and 69-96 females. Major excretion via urine (2-4 x feces). Tissue levels inc. with dose. No accumulation in any particular tissue. Major metabolites in urine and feces included metsulfuron methyl, saccharin and O-demethyl triazine amine. No evidence of glucuronide or sulfate conjugation.

WEED MANAGEMENT

INVESTIGATORS: David E. Yarborough, Professor of Horticulture
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xx. TITLE: Evaluation of spring Express application on control of bunchberry (*Cornus canadensis*) in wild blueberry fields.

METHODS: Bunchberry (*Cornus canadensis*) is a major weed pest species in wild blueberry. It is a low-growing perennial that can form a dense understory and compete with blueberry plants for resources. It also has red berries at the same time as wild blueberry, and the harvesters pick up the bunchberries along with the blueberries so they have to be sorted out on the processing line. Express (tribenuron-methyl) is registered in the US for bunchberry control, but only as a summer/fall treatment in the prune year. Spartan (tribenuron-methyl), registered in Canada for bunchberry control, can be applied in either the spring or fall of the prune year, although a fall application is preferred due to better weed control and a wider application window. If a spring application is made, the New Brunswick Wild Blueberry IPM Weed Management Guide (NBDAAF 2017) notes the following. The majority of bunchberry leaves should be unfolded to a 45° angle but no later than when the first white blossoms appear. The plants turn pinkish red to yellow after application but may take several weeks to die down. If application is made too late, the plants turn red for the entire season and control is reduced; applied too early, and bunchberry regrowth can be expected later in the season. Application should be made before wild blueberry emergence exceeds 2 cm (approx. ¾"), and some height reduction and yellowing/reddening of leaves may be observed for 6-8 weeks post-application (more likely during prolonged cool temps or large temp fluctuations). Tribenuron-methyl should not be applied to spring-burnt fields or at later stages of blueberry development.

Wyman's of Maine manages land in both Canada and the US, and they requested that the University of Maine conduct a joint trial in which Wyman's would apply Express on a large scale to a mowed prune year wild blueberry field at different spring timings, and University personnel would evaluate its effects on blueberry and bunchberry. In spring 2018, Wyman's applied Express 1 oz/a + the surfactant Liberate 6.4 oz/a to sections of their Town Line West 3 field at three treatment timings: on 14 May (bunchberry plants emerged but no leaves expanded); 22 May (bunchberry leaves expanded at an angle <90°); and 31 May (bunchberry leaves fully expanded/flat but prior to flowering, blueberry emerged). So, the 2nd application was made at the timing recommended in New Brunswick (NB), the 1st application represented an earlier than optimal timing, and the 3rd application represented a later than optimal timing. After the applications were made, ten 1 m² plots containing blueberry and bunchberry were established in each treatment, as well as ten check plots in an untreated section of the field. Because all three applications were made adjacent to a tree line, the check plots were also located next to a tree line. Plots were assessed for wild blueberry and bunchberry cover and phytotoxicity on 21 June and 11 July. Cover data were determined by using the Daubenmire Cover Scale converted to percent; phytotoxicity was assessed by using a scale of 0-10 (0=no damage, 10=100% damaged/dead) converted to percent. Tukey's tests were conducted for significant treatment differences ($\alpha=0.05$).

RESULTS AND DISCUSSION: There were no significant differences in blueberry cover among treatments at either evaluation (Figure 1). Blueberry cover increased from the first to second evaluation in all treatments except the latest application timing, 31 May, with the highest cover in the 22 May treatment (optimal application timing). At the June evaluation, there was significantly more injury to blueberry in the first two application timings (14 and 22 May, Photo 1) compared to 31 May or the check (Figure 1, Photo 2), and injury was observed as reddened leaves and delay of filling in. At the July evaluation, the blueberry plants had essentially recovered in the 14 May and 22 May treatments and injury presented as having very small leaves compared to adjacent untreated plants (Photo 3), but the 22 May treatment still had significantly more phytotoxicity than the check. By contrast, phytotoxicity in the latest application timing treatment (31 May) increased from the June to July evaluation and was significantly higher than all other treatments. The blueberry plants in this treatment had small leaves but were also stunted. The stunting effect matches the Weed Management Guide which states that a reduction in height may be observed for 6-8 weeks, although the earlier applications were made when the weather was much cooler compared to the latest application and they were not stunted (stunting is more likely to occur under prolonged cool temps or large temp fluctuations near application date. The air temp was 79° F at the time of the 31 May application but it is unknown if there was large temp fluctuations). The Weed Management Guide language does not mention tiny blueberry leaves as a symptom, and personal communication with Gavin Graham, New Brunswick Dept. of Agriculture, Aquaculture and Fisheries who studies wild blueberry weeds and indicated that he had not seen this effect either. Differences in soil texture did not explain the phytotoxicity, as soils were the same throughout the field. The most likely explanation is that the blueberry plants were emerged at the 31 May treatment date.

Figure 1. Wild blueberry cover and phytotoxicity after spring Express application at three bunchberry plant development timings ($\alpha=0.05$).

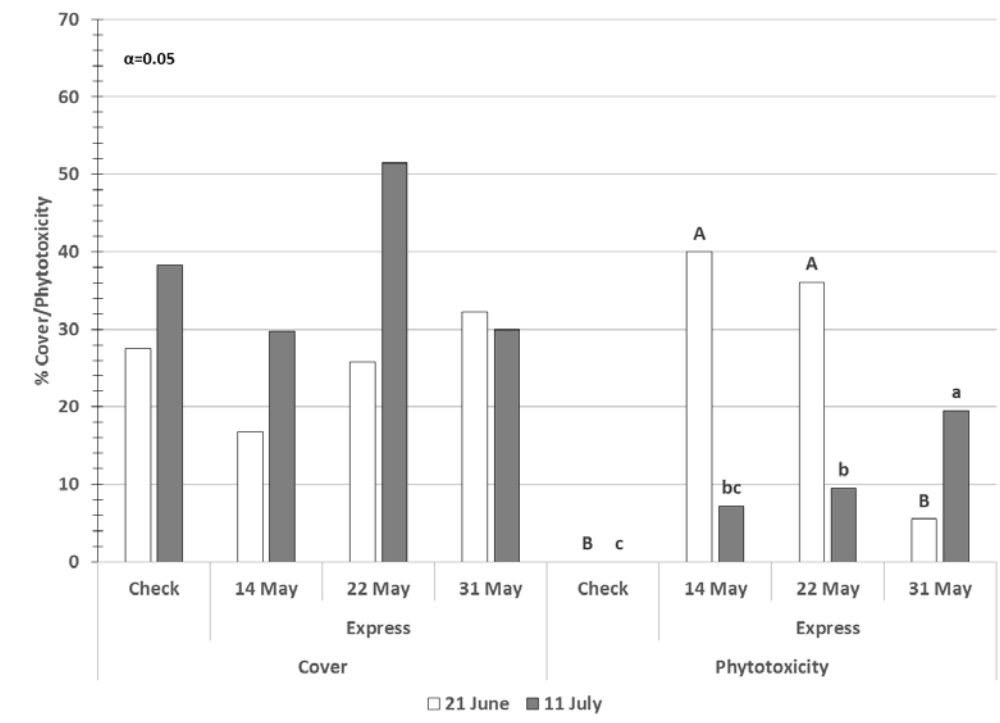


Photo 1. Example of wild blueberry and bunchberry injury in the 22 May treatment in June. Blueberry injury presented as reddening of leaves and delay in filling in; bunchberry injury was reddening/yellowing of leaves, curling and necrosis.

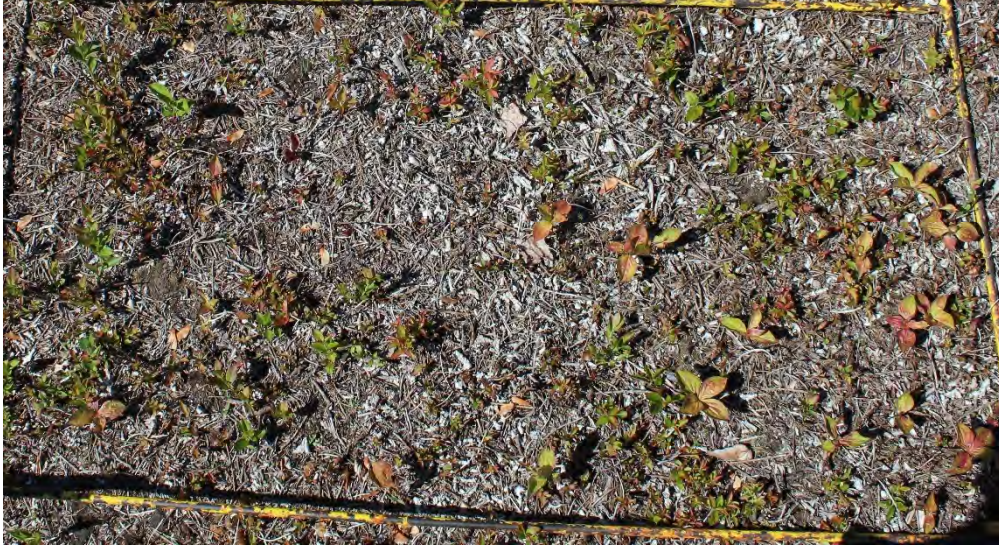


Photo 2. An untreated check plot in June.



Photo 3. A 22 May treatment plot in July. Note the very small blueberry leaves, injured mature bunchberry in lower right, and new unaffected bunchberry in upper left.



In June there were no significant differences in bunchberry cover among treatments, but cover was highest in the check and the three Express treatments were within 5% cover (Figure 2). Bunchberry injury was greatest at the earliest application timing (Photo 4), and the 14 and 22 May treatments (Photo 3) had significantly more injury than the 31 May treatment or the check. This agrees with the NB IPM Weed Management Guide language stating that when applied too late, bunchberry control is reduced. However, the plants were only slightly reddened along the veins and leaf curling was more widespread (Photo 5). The bunchberry plants in the 14 and 22 May treatments were much more reddened and curled, and there was also widespread necrosis, which also agrees with the Weed Management Guide language stating that plants may take several weeks to die down (Photos 1, 4). This is borne out by the results of the July evaluation, in which the 14 May treatment increased in bunchberry cover and decreased in overall phytotoxicity, while the 31 May treatment decreased in bunchberry cover and increased in phytotoxicity. The 14 May application was too early and resulted in a flush of new growth; this presented as some plants having 90% injury while others in the same plot had new growth which was not affected (Photo 6). The 31 May application timing was no longer significantly different in cover or phytotoxicity from the other two timings; more injury to bunchberry was seen than in June, which was expected since it takes several weeks for bunchberry to die down. Although bunchberry cover among the three timings was not significantly different, the 22 May “optimal” timing resulted in a reduction of bunchberry cover plus the greatest injury by July. New unaffected plants also recovered in this treatment, but the average injury to the older plants (70%) was higher overall than in the 14 May pre-optimal timing (47%) or 31 May post-optimal timing (40%).

Photo 4. Bunchberry injury in the 14 May treatment in June. Symptoms are reddening, curling and necrosis.



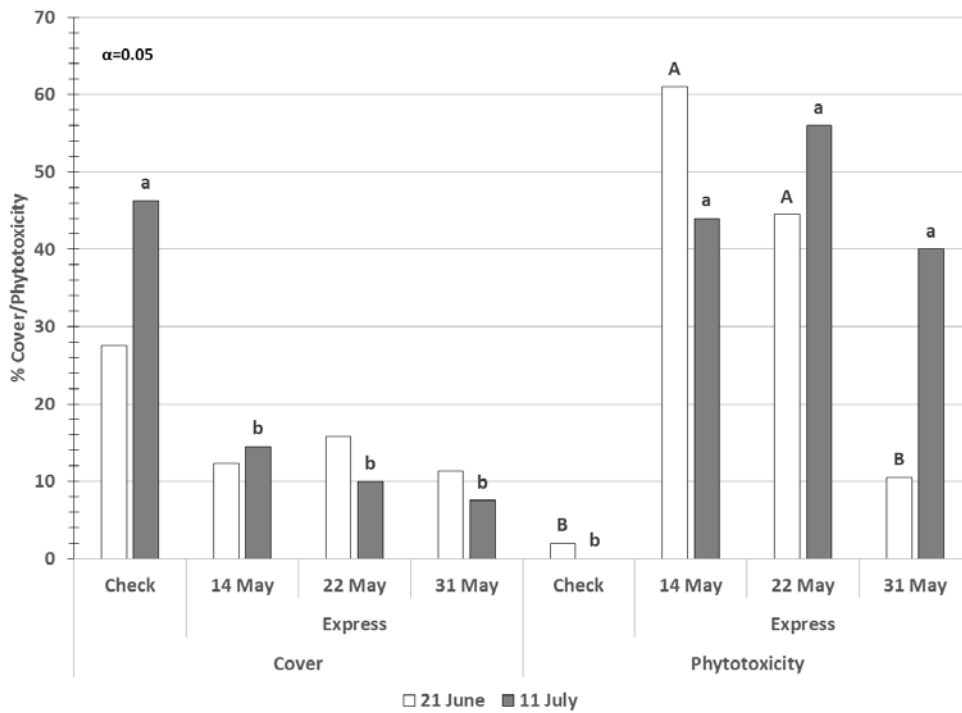
Photo 5. Bunchberry phytotoxicity in June in the 31 May treatment. Symptoms are yellowing, only slight reddening and leaf curling.



Photo 6. A 14 May treatment plot in July. Note the extensive injury to older bunchberry plants, with a flush of new unaffected plants.



Figure 2. Bunchberry cover and phytotoxicity after spring Express application at three bunchberry plant development timings ($\alpha=0.05$).



CONCLUSIONS AND RECOMMENDATIONS: In general, the results of this trial agree with the recommendations in the New Brunswick Wild Blueberry IPM Weed Management Guide for spring application of Express. The 22 May application timing, which correlates to the bunchberry leaves unfolded to roughly a 45° angle, resulted in the greatest long-term injury to mature bunchberry plants, while striking a balance between a new flush of growth from applying too early vs increased crop injury/reduced bunchberry control from applying too late.

It should be noted that there was a confounding edge effect in this trial. Because all of the treatments were applied adjacent to a tree line, it was difficult to separate early post-treatment phytotoxicity to wild blueberry from field edge effects. At the first evaluation, a delay of filling in by blueberry plant was noted, but it was initially unclear whether the effect was from the Express or shading by the tree line. We were ultimately able to find the “boom line” mark where crop injury effects ended, approximately 60’ into the field from the tree line (aka width of boom from tree line) and concluded that the delay in filling in was from the herbicide application (Photo 7). However, if this trial is repeated we recommend the following: the applications should be made away from the field edge, and the plots should be established prior to application. In this manner, edge effects are negated and a pairwise comparison of bunchberry cover could be made. Because of the flush of new growth, it would be better to know the amount of bunchberry cover present prior to treatment; then at intervals after treatment, cover can be tracked for both existing and new plants. It also would be beneficial to compare a fall vs spring treatment of Express to determine which is the most effective. Once all of these data and the data from the Express spot treatment trial are compiled and examined, we will likely pursue a label change to allow for spring applications.

Photo 7. “Boom line” mark in the 22 May treatment at the June evaluation, showing blueberry injury as delay of filling in (to left).



LITERATURE CITED:

NBDAAF. 2017. Wild Blueberry IPM Weed Management Guide. New Brunswick Department of Agriculture, Aquaculture and Fisheries Wild Blueberry Fact Sheet C.4.2.0. pp. 22-23.

WEED MANAGEMENT

INVESTIGATORS: David E. Yarborough, Professor of Horticulture
Jennifer L. D'Appollonio, Assistant Scientist

xx. TITLE: Evaluation of post-emergence Express application on control of target weeds in wild blueberry fields.

METHODS: Express (tribenuron-methyl) is registered in the U.S. for bunchberry control only, and only as a summer/fall treatment in the prune year. In Report No. X, we discussed spring Express application effects on wild blueberry and bunchberry, but we also investigated whether Express would be effective as a post-emergence spot spray treatment on other broadleaf weeds. The New Brunswick Wild Blueberry IPM Weed Management Guide (NBDAAF 2017) notes that in New Brunswick, tribenuron-methyl may be used in the summer of the sprout year as a spot treatment for certain species such as alder, bracken fern, wild rose and yellow loosestrife. In all but bracken fern, the foliage turns yellow or red and the stem terminals die soon after application. Control of vetch, poplars, willows, goldenrods and fly honeysuckle has been erratic in their experience. With these parameters in mind, we scouted Downeast for prune year wild blueberry fields containing large enough populations of these species to support a spot treatment trial. We found three species to test on Wyman's land: cow vetch (*Vicia cracca*) on Town Line East; lance-leaved goldenrod (*Euthamia graminifolia*) on Town Line West 3; and whorled loosestrife (*Lysimachia quadrifolia*, closely related to yellow loosestrife) on Big Rock 1. The three trials were set up in a Completely Randomized Design with twenty 1 m² plots each containing both blueberry and the target weed, ten of which were sprayed with Express 1 oz/a + NIS 0.25% v/v on 15 June 2018. It should be noted that the weeds should have been small at the time of application. The goldenrod and loosestrife were 6" tall or less at the time of application, but the vetch had grown exponentially in the week between trial set-up and spray and were knee-high at the time of application, so reduced control was expected. Furthermore, the vetch only occurred in a large bare area with no blueberry plants, so effects on blueberry could not be assessed at this site. The loosestrife was located among large boulders on a small hill with very steep slopes, so the plots could not be completely randomized because the slope was too steep to be confident the correct Express rate would be applied to those plots. Therefore, seven of the ten check plots were on the steep slope, and seven of the ten treated plots were on top of the hill. The goldenrod tended to occur in low wet bare spots, so the plots were situated to encompass both the low-lying goldenrod and blueberry plants on dry hummocks.

The plots were evaluated for blueberry and target weed cover and phytotoxicity approximately two weeks (29 June) and four weeks (11 and 12 July) after Express application. Cover data were determined by using the Daubenmire Cover Scale converted to percent; phytotoxicity was assessed by using a scale of 0-10 (0=no damage, 10=100% damaged/dead) converted to percent. T-tests were conducted on each weed separately for significant treatment differences between Express and the untreated check ($\alpha=0.05$).

RESULTS AND DISCUSSION:

Cow vetch

As mentioned previously, the cow vetch was located in a large bare area with no blueberry plants, so only effects on the weed are discussed here. There were no significant

differences in vetch cover between Express treatment and the check at either evaluation (Figure 1), and cover remained almost the same from the first to second evaluation. The vetch injury noted in the check was dead leaves in the vetch understory; the vetch had formed a solid mat about two feet above the ground and the leaves underneath had died from lack of light (Photo 1). This could not be separated from treatment effects so was recorded as background injury. Nevertheless, there was still significantly more injury in the Express treatment than the check at both evaluations (Figure 1). Phytotoxicity was expressed as a reduction in or lack of flowering. At the July evaluation the vetch was in full flower, but there were almost no flowers in the treated plots and plant height was slightly reduced (Photo 2). Some slender vetch (*Vicia tetrasperma*) was interspersed with the cow vetch, and showed the same responses to Express.

As a side note, it was observed at the July evaluation that the Express treatment killed red sorrel (*Rumex acetosella*) in the plots, but it is not known whether the overwintering rosettes were affected (Photo 3).

Figure 1. Cow vetch cover and phytotoxicity following a post-emergence spot treatment with Express ($\alpha=0.05$).

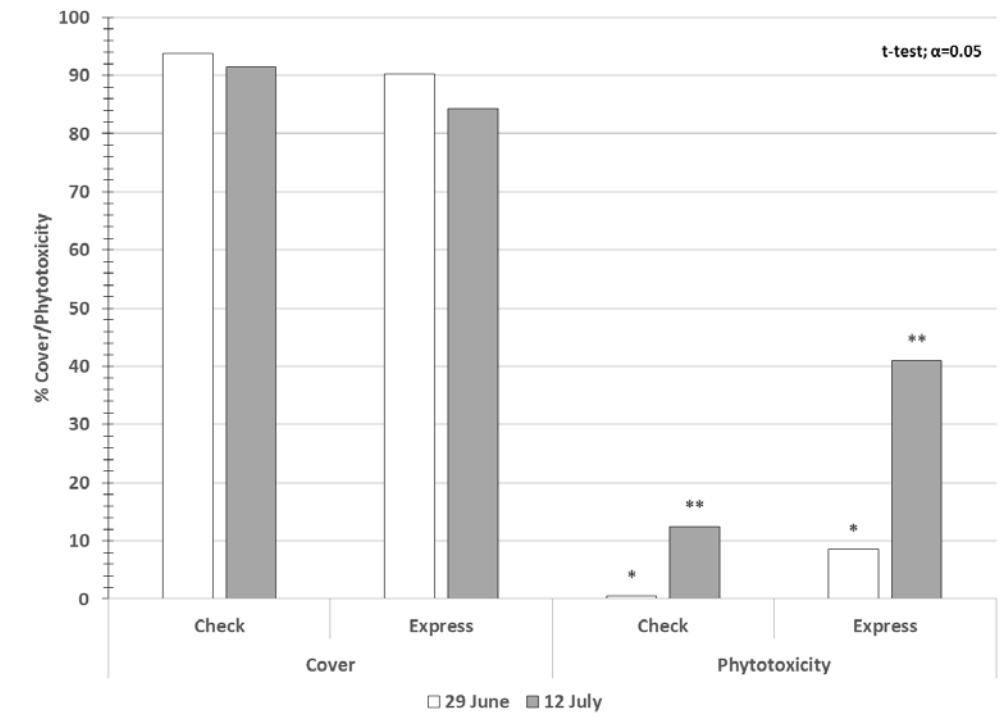


Photo 1. Background injury in the untreated check, from lack of light.



Photo 2. An Express treated plot in July, showing reduced height and lack of flowering.



Photo 3. Red sorrel in the Express-treated plots was severely injured or killed.



Lance-leaved goldenrod

There was more blueberry cover overall in the Express plots compared to the check, but the difference wasn't significant at either evaluation (Figure 2). As previously mentioned, blueberry cover was low because the goldenrod was mostly in low-lying wet bare depressions, so most plots were situated on the border between the bare area with goldenrod and drier hummocks with blueberry. Blueberry phytotoxicity was significantly greater in the Express treatment at both evaluations, but at <10% the level of injury was minor and expressed mostly as reddened upper leaves (Figure 2, Photo 4). It was observed that *V. myrtilloides* was more affected than *V. angustifolium*, with more extensive reddening as well as twisting, but neither showed the stunting and very small leaves seen the bunchberry trial.

Lance-leaved goldenrod cover was initially comparable, but by July cover was significantly lower in the Express treatment (Figure 3). Phytotoxicity was significantly higher in the Express treatment at both evaluations, but did not exceed ~30% injury. Initial symptoms for goldenrod injury included minor stunting, chlorosis, curled tops and occasional necrosis. At the July evaluation the treated plants were yellowed, had apical twisting and necrosis, and did not have flowers while the untreated plants were in early flower (Photos 5-6). There was extensive orange-grass St. Johnswort (*Hypericum gentianoides*) cover in the trial area, but it appeared unaffected (see Photo 6).

Figure 2. Wild blueberry cover and phytotoxicity following post-emergence Express spot treatment for control of lance-leaved goldenrod ($\alpha=0.05$).

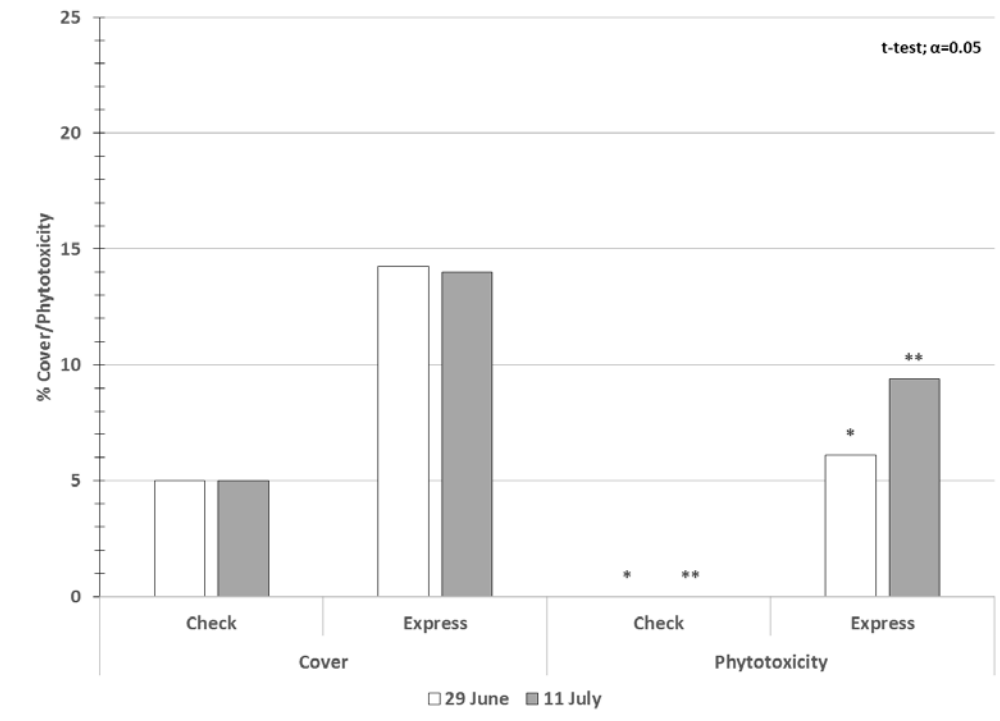


Photo 4. Wild blueberry initial injury from Express was reddened upper leaves.



Figure 3. Lance-leaved goldenrod cover and phytotoxicity following post-emergence Express spot treatment ($\alpha=0.05$).

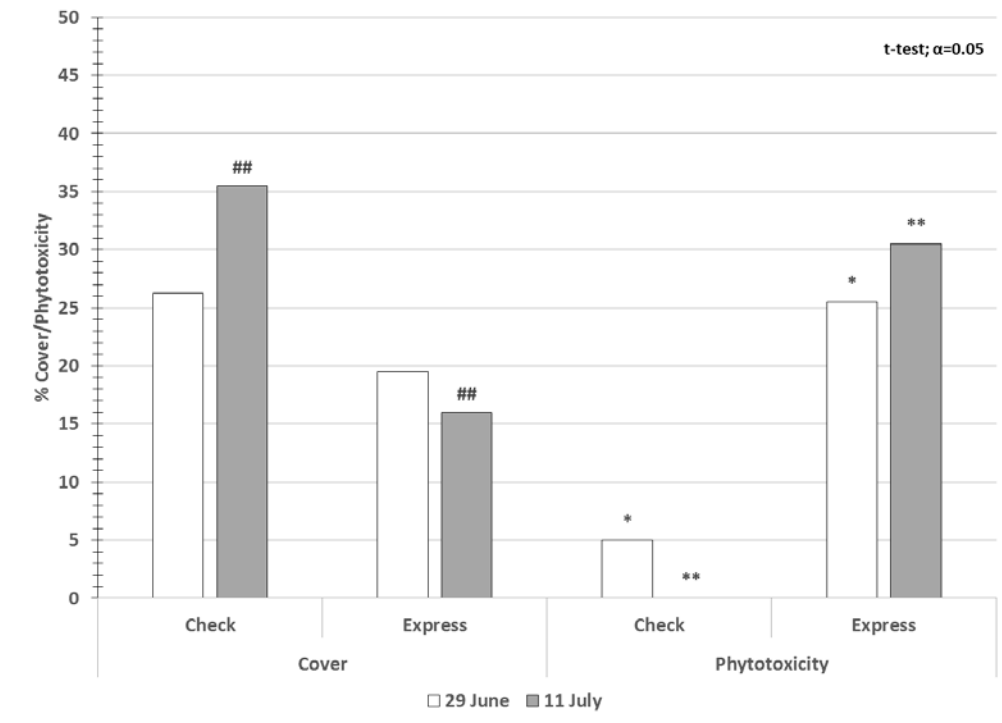


Photo 5. An untreated check plot in July, in early flower.



Photo 6. An Express-treated goldenrod plant in July showing typical injury symptoms. The lower leaves are yellowed and the top is dead. Orange-grass St. Johnswort in the understory appeared unaffected.



Whorled loosestrife

Wild blueberry cover followed some of the same trends in this trial as in the lance-leaved goldenrod trial. There were no significant differences in wild blueberry cover between the check and Express treatment at either evaluation, cover was initially higher in the Express treatment and Express blueberry cover decreased slightly from June to July (Figures 2, 4). However, in this trial blueberry cover in the check increased from June to July, while cover in the goldenrod trial did not change. Blueberry phytotoxicity was significantly higher in the Express treatment, but was minor (Figure 4). Phytotoxicity in this trial ended up at the same level in July as in the goldenrod trial (~10 %), but the trend from June to July was the opposite (Figures 2, 4). In this trial, injury decreased from June to July, while in the goldenrod trial it increased. The difference may be because in this trial, we did observe the phytotoxicity expressed as very small leaves that we saw in the bunchberry trial, as well as leaf reddening (Photo 7). At the second evaluation, the leaf reddening seemed to be in plots with greater whorled loosestrife/other weed cover, and the

small leaves tended to occur in plots with a more open canopy; the blueberry plants in the latter plots intercepted more spray than in the former plots.

Figure 4. Wild blueberry cover and phytotoxicity following post-emergence Express spot treatment for control of whorled loosestrife ($\alpha=0.05$).

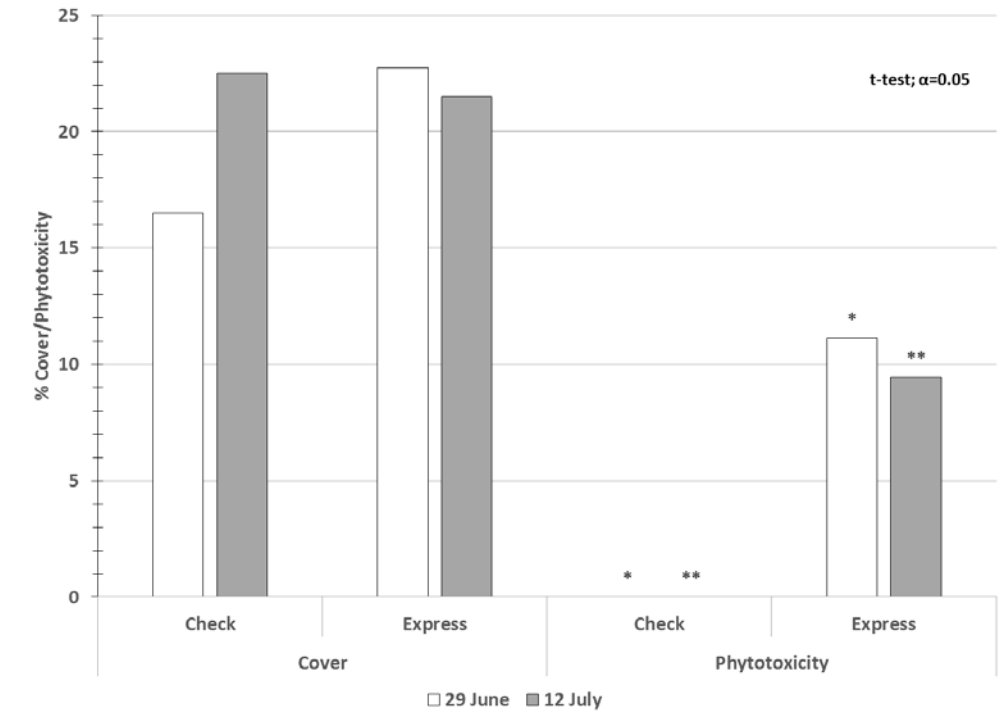


Photo 7. Express injury to wild blueberry; note reddened and small terminal leaves (bottom).



Whorled loosestrife cover was reduced by roughly 10% in the Express treatment compared to the check at both evaluations, but the differences were not significant (Figure 5). However, phytotoxicity was significantly higher in the Express treatment at both evaluations, and increased from June to July until loosestrife injury exceeded 60%, so this species may not show full control until the following year. Initial phytotoxicity presented as shorter plants, and later symptoms included necrosis of upper leaves/stem and chlorosis of lower leaves (Photo 8, also Photo 9 for comparison to untreated plants). From the first to second evaluation, we observed necrosis spreading from just the upper leaves to the lower leaves as well. We also observed that wild strawberry (*Fragaria* spp.) showed reddening of veins (Photo 10), bunchberry was reddened but not killed (this matches NBDAAF (2017) which states that when applied too late, bunchberry is reddened throughout the season and control is reduced), and lambkill (*Kalmia angustifolia*) had apical twisting (Photo 11).

Figure 5. Whorled loosestrife cover and phytotoxicity following post-emergence Express spot treatment ($\alpha=0.05$).

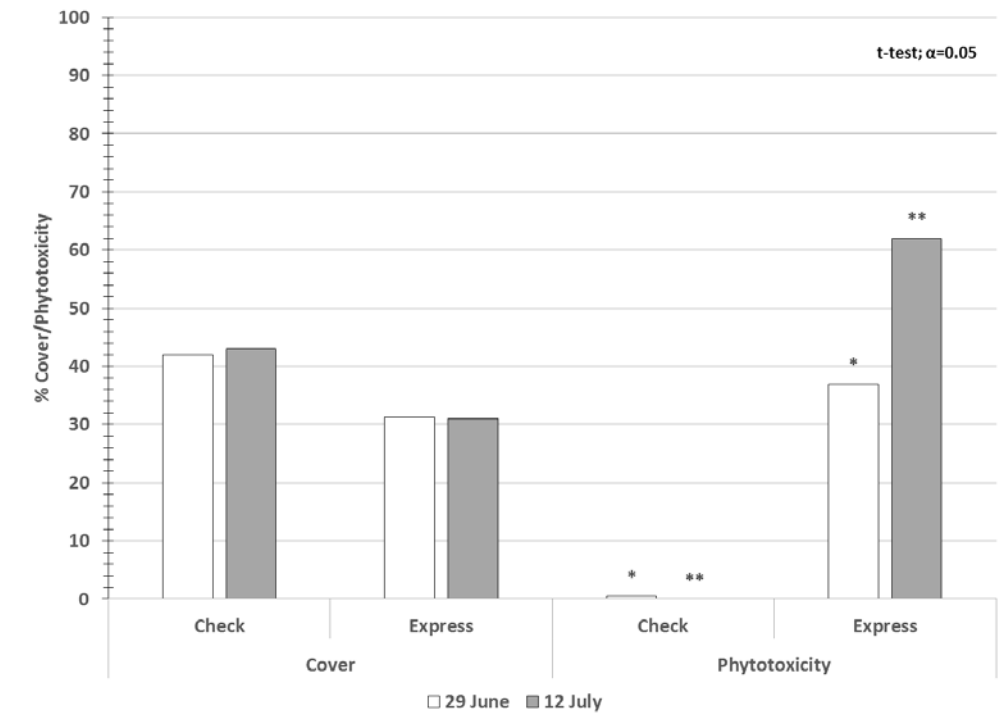


Photo 8. Whorled loosestrife injury in July, showing necrosis of upper leaves/stem and chlorosis of lower leaves.



Photo 9. An example of an untreated whorled loosestrife plot in July.



Photo 10. Symptoms of Express injury on wild strawberry in June.



Photo 11. Symptoms of Express injury on whorled loosestrife (yellowed plants), bunchberry and lambkill (taller green plants to left) in July.



CONCLUSIONS AND RECOMMENDATIONS: Because both cow vetch and lance-leaved goldenrod occurred in bare areas, wild blueberry yield effects could not reliably be determined and so the trial was terminated in fall 2018. Express was most effective on whorled loosestrife and least effective on lance-leaved goldenrod. Injury to the target weed was highest in the

whorled loosestrife trial at 62% in July, compared to 41% in cow vetch and 30% in lance-leaved goldenrod. Injury symptoms were more severe over the entire loosestrife plant by July compared to cow vetch, which still had plenty of green unaffected tissue in July, and lance-leaved goldenrod, which had dead tops and slightly affected lower leaves. We expect that the whorled loosestrife was too damaged to recover, but both whorled loosestrife and cow vetch had naturally senesced by fall 2018 so we do not yet know if complete control of loosestrife will occur next year. The trial site will be examined visually in spring 2019 to determine if carryover effects are visible.

Therefore, if the label change discussed in the Express bunchberry trial allows for it, Express could be used as a post-emergence spot spray for whorled loosestrife control and control of the closely related yellow loosestrife listed in NDBAAF (2017). According to the stunting and lack of flowering observed in 2018, Express may be more effective on cow vetch if applied earlier to small plants. Express could also be used as spot spray on lance-leaved goldenrod and other goldenrods on a case-by-case basis; not all species will react the same so Express will have to be tested on a small area of the target goldenrod. Express may not kill the entire goldenrod plant, but it will kill the tops which will reduce height and prevent flowering.

Finally, the effects on non-target weeds such as red sorrel, wild strawberry and lambkill suggest that Express may be effective on them as well. Other species such as raspberry (*Rubus* spp.), common cinquefoil (*Potentilla simplex*), orange-grass St. Johnswort and bladder campion (*Silene vulgaris*) appeared unaffected, so control of weeds will have to be assessed on a case-by-case basis.

LITERATURE CITED:

NBDAAF. 2017. Wild Blueberry IPM Weed Management Guide. New Brunswick Department of Agriculture, Aquaculture and Fisheries Wild Blueberry Fact Sheet C.4.2.0. pp. 22-23.



Wild Blueberry IPM Weed Management Guide



Recommendations in this Guide are given for general information only. All herbicides used must be applied in accordance with label directions. The New Brunswick Department of Agriculture, Aquaculture and Fisheries by printing this publication does not offer any warranty or guarantee and does not assume liability for crop loss, animal loss, health, safety, or environmental hazards caused by the listed herbicides or practices. Trade names used in this Guide are given as a convenience to producers and are neither an endorsement of the product nor a suggestion that similar not mentioned products are not as effective.

Table of Contents

Introduction	3
Components of an Integrated Weed Management Program.....	3
I. Weed Identification and Biology.....	3
II. Scouting and Weed Mapping	5
III. Weed Thresholds and Action Levels.....	5
IV. Control Methods	6
Herbicide Use	9
1. Methods of Application	9
2. Sprayer Calibration	10
3. Best Management Practices.....	11
4. Tank Mixing	12
Notes on Herbicides Registered for Use on Wild Blueberry	13
1. Authority 480 (sulfentrazone).....	13
2. Callisto 480 SC (mesotrione).....	14
3. Casoron G-4 (dichlobenil)	15
4. Chateau (flumioxazin).....	15
5. Dicamba (Banvel II, Hawkeye, Oracle).....	16
6. Garlon (triclopyr).....	17
7. Glyphosate (Roundup, etc.)	17
8. Ignite SN Herbicide (glufosinate).....	19
9. Kerb SC (propryzamide)	20
10. Lontrel 360 EC (clopyralid).....	20
11. Option 2.25 OD + UAN (foramsulfuron).....	20
12. Poast Ultra + Merge (sethoxydim)	21
13. Princep Nine-T (simazine)	22
14. Sinbar WDG (terbacil).....	22
15. Spartan + Agral 90 (tribenuron methyl).....	22
16. Ultim 75 DF + Agral 90 (nicosulfuron/rimsulfuron)	23
17. Velpar DF and Pronone 10G (hexazinone).....	24
18. Venture L (fluazifop-p-butyl)	26
Notes on Herbicide Tables	27
Tables	
Table 1. Herbicide Effect on Common Blueberry Field Weeds	28
Table 2. Herbicides Registered for Broadcast Application	29
Table 3. Herbicides Registered for Spot Application.....	30
Table 4. Additional Information for Herbicides Used on Wild Blueberry	31
Pesticide Emergency Information	32
Helpful Conversions	32
Abbreviations	32

Introduction

The weed flora in wild blueberry fields is unique compared to that found in other agricultural fields. Producers manage a native perennial crop that grows in low pH soils without associated tillage or cultivation. Weeds which prefer this habitat thrive if not controlled. Weeds can shade and compete with the crop, reduce bud/flower production and yield, reduce quality and can interfere with harvesting. The origin of a field often determines the weed flora. Fields developed from abandoned hayfields or pastures typically have a large number of grasses and herbaceous perennial weeds. Fields developed from woodland often have plants commonly associated with the woodland undergrowth such as bunchberry, ferns, lambkill, rhodora, and other woody plants and shrubs.

A weed survey conducted in the year 2000 recorded more than 250 species in blueberry fields, compared to only 115 species in a 1985 survey. The number of many of the traditional woody weeds has decreased due to herbicide use, but this has been off-set by greater numbers of herbaceous annuals and perennials. Not all non-traditional species are considered as significant weed problems but some, like lamb's quarters and herbicide resistant fescue grasses, have the potential of becoming major problems. This change in weedy vegetation resulted from herbicide use, especially hexazinone (Velpar/Pronone). Other contributing factors have been changes in production practices that allow weeds to spread and thrive, such as the increased use of fertilizers, increased use of mowing instead of burning for pruning and the use of mechanical harvesters and other equipment that spreads weeds. In the future, growers can expect an increasingly diverse weed flora. It is important to understand the activity and limitations of available weed control options and to use herbicides in conjunction with other practices to manage weeds.

A blueberry weed management program should follow the principles of Integrated Pest Management (IPM). IPM is a pest management strategy that integrates preventive, cultural, mechanical, biological and chemical control methods to achieve a sustainable production system that balances economic, health and environmental concerns. IPM is based on dynamic principles rather than a definitive set of rules and can vary from farm-to-farm or even from field-to-field. A weed management program that follows the principles and practices of IPM is often referred to as an integrated weed management (IWM) program.

Components of an Integrated Weed Management Program

I. Weed Identification and Biology

When planning a weed management program, blueberry producers must first be able to identify the weeds present in each of their fields. Most weed guides do not include many of the important blueberry weeds. The New Brunswick Department of Agriculture, Aquaculture and Fisheries maintains an integrated pest management (IPM) image bank on the www.gnb.ca/agriculture website, available directly [here](#). This site contains images of diseases, insects, weeds and other disorders affecting New Brunswick's blueberry crop. Most images are available in both low and high resolution and the site is completely bilingual. The site can be accessed by three different methods: 1) the Browse feature where a pest category and/or crop can be selected to find the appropriate images, 2) the Search feature using a key word search or 3) the Complete Listing showing all images in the bank. Clients with slower Internet connections should only select lower resolution images to avoid long download times. Other excellent illustrated publications for identification of blueberry weeds are: *Weeds of Eastern Canadian Blueberry Fields* by M.G. Sampson, K.V. McCully and D.L. Sampson. NSAC Bookstore, Truro, N.S. 229 pp or *Guide d'identification Alliés et Ennemis du Bleuets Nain*, by É-C. Desjardins and R. Néron, Centre de Référence en Agriculture et Agroalimentaire du Québec.

Knowing how plants are classified or grouped helps to understand similarities and differences between them. An understanding of the life cycle and the reproductive strategy of weeds is needed in order to use the best approach to their control. Based on life cycle, weeds within wild blueberry fields can be categorized as annuals, biennials or perennials.

A) Annuals

Annuals are becoming increasingly common in blueberry fields. Annuals reproduce only by seed and complete their life cycle in less than one year. They grow rapidly, produce large amounts of seed and may require control in both the sprout and crop year. Control methods must focus on preventing annuals from producing and spreading seed. Most annuals found in wild blueberry fields are summer annuals that germinate in the spring, produce flowers and seed and die in late summer or fall. These include such weeds as lamb's quarters, hemp-nettle, cow wheat and witch grass. There are also a few winter annuals found in blueberry fields. Winter annuals germinate in the fall and then over-winter in a seedling or rosette stage. They produce flowers and seeds the following summer and then die. Winter annuals include such weeds as common chickweed and Canada fleabane.

B) Biennials

Biennials complete their life cycle in two years. They produce a low-growing rosette of basal leaves with a taproot that over-winters. Biennials 'bolt' to produce a flowering stalk, set seed and die in the second year. Examples include yellow evening-primrose, wild carrot and meadow goat's-beard. Biennials are also becoming increasingly common.

C) Perennials

Perennial weeds are the most common in blueberry fields and generally more difficult to control. They live for more than two years and can be either herbaceous or woody. Perennial weeds may reproduce primarily by seed (daisy); by both seed and vegetative means (sheep sorrel); or primarily by vegetative means (bunchberry). Many perennial weeds grow in the same manner as the blueberry plant. Therefore, some of the production practices that promote blueberry growth (like pruning) also promote the growth of these weeds. Perennials which are low growing and spread vegetatively by interconnected underground root systems are the most difficult to control and cannot be controlled by hand-weeding. Some perennials can be controlled with selective or non selective herbicides, but for many, there are no satisfactory controls.

Annuals, biennials and perennials can be grouped in other ways. Flowering plants can be broadly classified as dicots (broadleaves) and monocots. There are also primitive plants that do not produce flowers. Plants can also be grouped into herbaceous (non-woody) and woody species.

1) Flowering Plants

Flowering plants produce seed and can be divided into broadleaved species or dicots (with two seed leaves) and monocots (with one seed leaf). Dicot leaves have a branching network of veins and flowers with petals, although these can be inconspicuous, as shown by alders or lamb's quarters. Monocots have leaves with parallel veins. With the exception of lilies and related plants, monocots have flowering heads of many small, reduced flowers (or florets) without petals that produce a single seed. Monocots include grasses, that are annuals or perennials with jointed stems that are usually hollow and round in cross section; sedges, which are usually perennial plants that form tussocks with leaves that are V-shaped and stems that are triangular in cross section; and rushes, that are annuals and perennials with tussocks of needle-like leaves that are round, jointless and filled with a whitish pith in cross section.

2) Non-flowering Plants

There are also primitive, non-flowering plants that reproduce by microscopic spores that include ferns, horsetails and mosses. Ferns, with stalks and fronds, and horsetails, with narrow leaves in whorls at joints of hollow stems, both spread by underground rhizomes and are difficult to control. Mosses are tolerant to most herbicides but may be suppressed by fire.

II. Scouting and Weed Mapping

Scouting and proper weed identification are the foundation of any integrated weed management program. Scouting involves walking fields in a pattern (e.g. “W” pattern) thereby allowing monitoring for potential weed problems over the entire field. Scouting provides an opportunity to evaluate weed control programs and to look for any herbicide injury. Scouting also provides an opportunity to identify and target new invasive weed species that have the potential to become serious weed problems in the future. Scouting results can be compiled into weed maps to highlight the locations of different weed species. Mapping for weeds from year-to-year is helpful in monitoring changes in weed species, weed densities, distribution, as well as providing an opportunity to plan your future weed control strategy. The management strategy must target the dominant weeds and prevent the spread of others.

The following should be documented when scouting and mapping:

- the weed species and its life cycle (annual, biennial, perennial);
- the size or growth stage of the weed (seedling, small, medium, large, flowering, seed formed, seed dropped);
- the density of the weed (counts or categorize as low, medium, high);
- the distribution (uncommon, scattered throughout, a few patches, numerous patches, common throughout; or estimate the percent blueberry field covered per weed species);
- the location of the weed infestations on a field map;
- the date of scouting.

Weed scouting in sprout fields should be done:

- a) just before blueberry emergence to monitor for bunchberry presence and growth stage;
- b) soon after blueberry emergence to monitor for potential grass problems;
- c) late June - early July for weeds growing above the blueberry plants that would be susceptible to wiping treatments;
- d) late summer-early fall for wiping and evaluating the current year's weed control program and also for planning next year's weed control program.

Weed scouting in crop fields should be done:

- a) before blueberry buds swell to determine if Velpar or Callisto applications are required;
- b) mid-May to mid-June to scout for grasses;
- c) mid-July to harvest to determine presence, densities and location of weeds for fall treatments or next year's weed control program.

Special note should be made of weeds that appear to be increasing significantly in distribution and density or any new weeds. For example, burnweed has been noted in greater abundance in many New Brunswick fields. Weeds which may be undesirable for reasons other than competition should also be noted. Examples include weeds flowering during pollination, weeds known as alternate hosts for insects or diseases, or weeds which can interfere with harvesting.

III. Weed Thresholds and Action Levels

Weed thresholds have not been determined for New Brunswick blueberry fields. As a result, the decision to target a weed for control must be based on knowledge of the weed within your farming

system. From a strictly economic perspective, there is no reason to apply control measures unless the weed population inflicts crop damage greater than the cost of the control measure. To make knowledgeable decisions, growers must scout and monitor their fields and continuously observe weeds and evaluate their effect on the crop. Decisions to control weeds may be made even when the cost of control is greater than the losses resulting from weed competition. For example, weeds may have to be controlled despite low densities when they interfere with harvest, act as alternate hosts for insect pests or diseases, attract bees during pollination, or if they have a high potential to cause future problems if not controlled.

IV. Control Methods

With the information gathered through scouting and the knowledge about the weeds present in your fields, you can make the decision as to whether or not a weed should be targeted for control. If action is warranted, it is important to choose the methods that optimize costs and effectiveness, while minimizing potentially adverse effects. The most economical and effective blueberry weed management programs combine preventive, biological, cultural, mechanical and chemical practices within an integrated system.

A) Preventive

Preventive weed control includes all practices that prevent the introduction and spread of weeds into a blueberry field. It is important to be aware of activities which can introduce new weeds and try to prevent the weeds from being introduced. This will help minimize the build-up and spread of new weed introductions.

An important preventive practice is to clean equipment between fields. This is important as weed seeds and other plant parts can attach to equipment and soil and be transported by farm equipment. This is a particular problem with mowers, wipers and harvesters. Recent wild blueberry research has determined that 200,000 to 400,000 weed seeds could be found on individual blueberry harvesters. All equipment, including tractors, land levelling equipment and berry boxes, should be cleaned. Seed dispersal within and between fields can be limited by avoiding equipment operation through dense weed patches during peak periods of seed drop.

Limiting seed production will also help prevent weeds from spreading. Keeping weeds under control in ditches, field edges, and roadsides can minimize the introduction of new problem weeds. Weeds can also be introduced into blueberry fields through the use of weedy straw used for burning. It is critical that growers obtain as weed-free straw as possible. Purchase straw from a reputable source and, if possible, visit the grain field before harvest to check for weeds.

B) Cultural

Cultural practices that encourage a vigorous, dense and healthy crop help to reduce weed pressures as a result of less bare ground being exposed. The use of wood chips, sawdust or bark mulch can reduce weed problems and encourage clone expansion into bare areas. Bare areas can also be planted with blueberry plants to increase crop cover. The presence of some grasses, especially in bare spots, reduces invasion of broadleaved weeds and encourages blueberry expansion.

C) Fertility

Wild blueberries are adapted to grow and produce a crop on soil that is considered, by most agricultural specialists, to be poor in fertility. Plants have a requirement for nutrients from the soil (nitrogen, phosphorus and potassium, among others). Blueberries have a number of adaptations which allow them to thrive in this environment. Weeds are generally better adapted to respond to applied fertilizer than are blueberries. Excessive fertilizer rates that promote weed growth and

vigour should be avoided. Proper fertilizer rates should coincide with adequate weed control to maximize the benefit from each of these inputs. A reliable tool to determine fertility levels is leaf tissue analysis, outlined in this [fact sheet](#).

Blueberries are adapted to a low pH environment, with a relatively low pH near 4 to 4.5. Many weeds, especially annuals and grass species, are not adapted to these conditions. More forest-type species, like lambkill and bunchberry, will not be affected by lowering the pH of the soil. Sulphur application can reduce the availability of soil nutrients for the weeds but allows the blueberries to grow because they are well adapted to acid soil. Approximately 112 kg/ha (100 lb/acre) of sulphur is required for a reduction of 0.1 pH unit. Do not apply more than 1120 kg/ha (1000 lb/ac) of sulphur in any given year. Application should not occur when the ground is saturated or injury to blueberries could result. Change in pH may take several years to be completed, with limited results soon after application.

D) Biological

Biological weed control is the deliberate use of highly selective enemies to reduce the population of a target weed to an acceptable level. In Atlantic Canada, there have been releases of either insects or pathogens against some weed species, including St. John's wort, Canada thistle, perennial sowthistle and toadflax. Biological control is generally most effective on introduced, non-native species in relatively undisturbed, pesticide-free agricultural habitats like pastures and rangelands. Naturally occurring disease epidemics have been observed for St. John's wort and bracken fern in blueberry fields, giving significant control in some years. The use of insecticides and fungicides as production practices within blueberry fields also makes the use of insects and pathogens as biological control agents more challenging. The prospect for biological weed control in wild blueberry is limited.

E) Mechanical

Mechanical methods of weed control include such practices as hand-pulling, pruning (mowing/burn) and clipping.

1. Hand-pulling

Hand-pulling is one of the oldest methods of weed control and is most effective against annuals, biennials and perennial seedlings. Established perennials can only be controlled effectively if the entire root system is removed. This is not possible, in most instances, although hand-pulling perennials can be effective in preventing seed production. If fields have both flowering and non-flowering weeds, flowering weeds should be removed first in order to prevent seed formation. It is also important to remove pulled weeds from the field, as many can still produce viable seed when lying on the soil surface. Hand-pulling is easier when the soil is wet.

2. Pruning (mow/burn)

The main purpose of pruning is to rejuvenate blueberry plants but it also aids in control of some weeds. Burning will control coniferous species and some shallow rooted grasses. The top growth of many woody and herbaceous perennials is generally killed by burning but underground parts re-sprout. Burning also reduces the return of many weed seeds from mature plants to the soil, and will kill many of the weed seeds present near the soil surface. Unfortunately, most burning operations provide only partial or erratic control results. Mowing as a pruning method may give some short-term suppression of perennial weeds and is generally not recommended as the sole method of control. Weeds must be mowed or cut several times during the season to ensure suppression. Species such as maple, birch and willow should be cut back to the ground level. Regrowth from the roots is common and frequently results in additional cuttings. Burning or

mowing alone may promote growth of many perennial weeds with extensive underground root systems by releasing apical dominance.

3. Selective mid-season clipping

Clipping the tops off weeds before seeds ripen prevents seed formation and helps reduce future weed problems. Clipping of species in June, July and August for a few seasons may help suppress weeds to acceptable levels. Clipping weeds every mid-summer has also been found to help control or suppress bracken fern, bayberry, *Prunus* spp., wild rose, and other weeds. Bracken fern should be cut just as the fronds unfold, at least two times, at four-to-six week intervals. Flowering weeds should be clipped before weeds which have not yet flowered. For weeds growing above the blueberry canopy, selective clipping can be performed with “whipper-snippers” or other similar equipment. Alternatively, non-woody weeds can be clipped through whipping. Hand clippers can also be used to target individual low growing weeds, such as sweet fern or lambkill. Clipping is labour intensive and does not generally result in permanent control.

F) Chemical

The use of herbicides to control weeds in blueberry fields is an important component of an integrated weed management program. Herbicides must be used responsibly and judiciously and as just one component within an overall program. Herbicides cannot be used as a cure-all for poor management. No single herbicide or combination of herbicides will control every weed within a blueberry field. Furthermore, excessive weed control that results in long-term bare ground should be avoided as this practice leads to soil erosion and impairs blueberry clone expansion.

Herbicides used within blueberry fields are either selective or nonselective. Following labelled rates and recommendations, selective herbicides control specific weeds without significantly injuring blueberry plants. Some selective herbicides (e.g. Velpar) are only safe to use at prescribed rates and times of application. If excessive rates are applied they are no longer selective and can cause severe crop injury. Nonselective herbicides kill both weeds and crop plants (e.g. glyphosate) and therefore caution must be exercised when applying them. Blueberry herbicides are applied either pre-emergence (applied before any blueberry plant or weed foliage emerges); or post emergence (applied after blueberry plant and weed foliage has emerged). Pre-emergence herbicides provide residual control, whereas post emergence treatments provide little or no residual control. To keep fields relatively clean, growers need both a “base program” and a “clean-up program”. The base program refers to the primary method relied on to control most weeds. For blueberry growers, Velpar is relied on most frequently to provide this base level of weed control. The clean-up program relies on herbicides such as Callisto, Ultim, Venture L, Poast Ultra, Spartan, Roundup, Lontrel or Banvel II to target specific weeds that escape the base program.

Even when label instructions are followed, not all weeds will be controlled. Each herbicide controls only specific weed species, and if timing and rates are not followed, control may be poor. In addition, other factors can also reduce weed control. For example, if heavy rains follow pre-emergence applications on sandy soils, some herbicides may leach away from the weed seed germination zone. Likewise for post emergence herbicides, if rain-free periods are not respected, control can be reduced. A pre-emergence herbicide may not be effective if labelled weeds have emerged before herbicide application. If emerged weeds are too large, control with post emergence herbicides will be reduced. Control from herbicides can also be reduced if weeds are under stress. For example, drought stress can cause weeds to form thicker layers of wax on leaf surfaces, thereby reducing herbicide uptake.

Herbicide Use

1. Methods of Application

There are several methods of applying herbicides, depending on the properties of the herbicide and target weed. The label gives detailed instructions on mixing and application of each product and should be carefully followed to ensure applications are safe and effective. The following gives general information on methods of applying the approved herbicides discussed in [Notes on Herbicides Registered for Use in Wild Blueberry](#).

A) Overall Broadcast Spray

Overall broadcast spraying involves the use of boom sprayers to apply herbicides uniformly over entire fields or large areas. An overall broadcast spray is recommended for treating areas with a uniform rate of herbicide, such as pre-emergence applications of Velpar in the spring of the sprout year. Broadcast applications can also be made to large infestations of some species, such as sweet fern or lambkill, to treat them in the fall of the crop year with Banvel II. Pronone 10G can also be applied as a broadcast treatment by using a granular applicator such as a Vicon spreader. To apply the herbicides at the recommended rate, the equipment must be calibrated and in proper working order. Avoid irregular spray applications by using flagging tape, foam markers, appropriate dyes or GPS systems as guides.

B) Directed Spot Sprays

The objective of directed spot spraying is to apply herbicides to the weed foliage while avoiding contact with the blueberry foliage. Spot sprays are applied with either backpack or handheld sprayers or by operating a handgun from a line connected to a tractor-mounted sprayer. Depending on the product used and the time of application, blueberry plants can be injured or killed if the foliage is sprayed. Applications are often made in the summer of the sprout year, and can result in crop injury. Many species such as alders, sweet-fern, bayberry, lambkill and blackberry retain their leaves in a viable condition longer than the harvested blueberries. Treatment in the fall after blueberry leaf drop helps to reduce the potential for crop injury.

Herbicide applications to fully expanded leaves of brush species can be useful where there are limited numbers of escaped brush species. Unless otherwise stated on the label, applications should be limited to bushes that are less than 2 meters in height. If higher, they should be cut and the regrowth treated. Coverage should be uniform and thorough to wet all leaves and stems. Mix with water only and spray until wet, but avoid spraying to the point there would be runoff. Extreme caution must be used with any non-selective herbicide. Any spray contacting blueberry plants can cause severe injury or death. Applications made to actively growing bushes will be the most effective when there are good growing conditions and adequate soil moisture. Foliar applications are generally the most effective just after full leaf expansion in late spring or early summer. If foliage remains green and in good condition on some species (e.g. alders, bayberry, sweet-fern, willows and others), effective applications can also be made in early fall after harvest. There may be less herbicide injury to blueberry plants if applications are made after blueberry foliage has turned red and begun to drop, but careful application is still required.

C) Roller and Wiper Applications

There are several roller-type applicators now available, including several tractor-mounted models and small one-man portable machines for use in small fields. The herbicide is slowly delivered to an absorbent covered drum that wipes and transfers herbicide to the foliage of tall weeds. In order to improve coverage, most rollers must be operated relatively slowly. Wipers are also available that do not have a rotating drum. Wiping in two directions improves coverage and results in better

control. Do not wipe in a second direction until the herbicide from the first pass has dried. Wiping and rolling methods can be used where weeds are taller than the blueberry plants. A commercially available “hockey-stick” applicator has been used effectively for applying Roundup and similar products within small areas.

D) Stump Treatments

A stump treatment is a safe and effective way of controlling bushes and small trees. Stump treatments involve herbicide applications to tree stumps that were recently cut, thereby causing the stumps to decay faster. 2,4-D (low volatile ester formulation) or Garlon in oil can be either sprayed or painted onto freshly cut stumps and exposed roots. Best results are usually obtained on stumps 5 cm across or larger (refer to individual labels). All exposed bark, roots, and cut surfaces should be wet thoroughly either by painting or spraying. Most of the stump treatments will control crown suckering species, like birches, maples and pin cherries, but there may be regrowth of species that sucker from lateral roots, like poplars. Many woody weeds are affected by these treatments, and on certain species, stump treatments are more effective than foliage applications.

Stump treatments can be applied any time of the year, including the winter months as long as snow or water does not prevent application. Trash from brush cutting operations such as sawdust, leaves, branches, etc. should also be removed from the base of the stumps before treating. Unless otherwise stated, applications should be made to freshly cut stumps. For old stumps, it is best to drill several holes or split the stump with a wedge before applying the treatment. Care must be taken to ensure that all cut stems in a clump have been treated or regrowth can result. Dye can also be added to the mixture to help ensure all exposed surfaces of the stump have been treated, and stumps do not get retreated or skipped.

Unless otherwise stated on the label, the herbicides used as stump treatments should be applied in vegetable or mineral oil to help penetrate the exposed bark and cut surfaces. If regrowth appears it should be treated with an appropriate herbicide. Note that 2,4-D alone, glyphosate and Garlon are registered for general weed control and used in preparing land for blueberry production. These products are not registered for use in producing blueberry fields and can cause crop damage if applied directly to actively growing blueberry plants. Crop damage can be minimized by careful application.

E) Basal Bark Treatments

Many shrubs and small trees (up to 15 cm diameter) can be controlled by spraying or wiping the basal parts of their stems or tree trunks from the soil level up to a height of 50 cm or as recommended on the label. Basal bark treatments are advantageous because the entire shrub or tree does not require spraying. Treatments are applied in vegetable or mineral oil as recommended on the label. Use a nozzle that forms a very narrow band or stream when spraying basal bark treatments. Low volatile esters of 2,4-D or Garlon in oil can also be used for basal bark treatments. Old or rough bark requires more volume than young or smooth bark. Treatments can be applied any time of the year except when snow or water prevents application to the lower trunk and exposed roots.

2. Sprayer Calibration

Calibrating the sprayer regularly is extremely important. Broadcast herbicide applications should be made with an accurately calibrated boom sprayer. Blueberry plants can be injured if too much herbicide is applied. Backpack and air-blast sprayers should not be used for broadcast herbicide applications as coverage and distribution will not be uniform. Complete directions on sprayer calibration and calculating the amount of herbicide required can be found in the New Brunswick

Department of Agriculture, Aquaculture and Fisheries's Sprayer Calibration Fact Sheet ([C.1.2.0](#)) or in the Guide to Weed Control (Publication 75) from the Ontario Ministry of Agriculture and Food (available [here](#)). Calibration of fertilizer spreaders for Pronone 10G application is equally important, with more information found in this fact sheet: [C.4.4.0](#).

The boom should be adjusted to the appropriate height above the target, either the ground for pre-emergence applications or the weed canopy for post emergence applications. The sprayer must be set up and operated to provide the correct amount of spray overlap. Overlap within a boom swath depends on both nozzle spacing and boom height. Overlap between boom swaths can result in a double application and crop injury. GPS systems and various boom-end marking systems (foam markers) can be used to mark the outer edge of the swath pass.

Herbicides are usually applied with flat fan nozzles. Nozzles such as the Delevan Raindrop nozzles or the air induction (venturi) type nozzles are effective. Cone-type nozzles are not recommended as spray pattern and distribution are poor at the lower pressures required for herbicide applications. Sprayer pressure should not exceed 276 kPa (40 psi) for herbicide applications unless otherwise recommended by the equipment manufacturer.

3. Best Management Practices

Blueberry growers can respond to the public's concern for the environment in a proactive manner through the adoption of Best Management Practices (BMP). Best Management Practices are recommendations and guidelines to help growers make sound environmental decisions in their farming operation. They are a combination of management, cultural, and structural practices that are considered effective and economical in reducing environmental impacts. They provide opportunities for growers to evaluate and choose the best management practices that are most appropriate for their own operation. Many of the production and management activities that blueberry growers practice influence not just themselves but their neighbours and community. Anything that can be achieved to prevent environmental pressures will make both the grower's operation and the blueberry industry more sustainable.

It is important that growers identify problem areas within their operation and select and implement the appropriate changes. Examples of Best Management Practices include:

- scouting fields and spray only when and where necessary
- making sure your sprayer or spreader is calibrated properly and accurately
- matching appropriate herbicide rates with soil type
- not mixing or loading near water, bringing the water to the sprayer
- not applying herbicides to rock formations and exposed ledges as they may provide a direct channel to groundwater
- avoiding spraying if heavy rainfall or winds are forecast
- using an anti-backflow device when filling sprayers from a water source to prevent contamination from backflow
- leaving an untreated vegetation strip near any water sources to act as a buffer and filter
- reading and following all instructions as stated on the labels

The use of hexazinone (Velpar DF, Pronone 10G) has been associated with groundwater contamination and soil erosion. A fact sheet, Best Management Practices for Hexazinone ([C.4.5.0](#)), has been prepared to help minimize these problems. It is important that these instructions be followed to safeguard the use of this herbicide.

4. Tank Mixing

A tank mix of a pest control product occurs when two or more products are applied at the same time through the same set of nozzles. Tank mixes can be mixtures of the same product type (herbicide + herbicide) or of different types (for example, herbicide + fungicide). Tank mixing provides benefits to producers by broadening the spectrum of pests controlled, helping to manage pest resistance and reducing application time and costs. Products may not be suitable for tank mixing due to physical incompatibility, increased risk of crop injury or decreased pesticide performance.

Some pesticide labels provide specific recommendations and instructions for applying products as tank mixes. These tank mixes have been evaluated for performance and safety. When using a labelled tank mix, follow all directions included on the product label. If a tank mix does not appear on a product label, producers can apply unlabelled tank mixes for registered products, provided that these six conditions are met:

- a) All products are registered for use on the crop;
- b) The tank mix only includes an adjuvant when specifically required by one of the tank mix partner labels. If an adjuvant is not required on the label of any tank mix partner, then no adjuvant may be added to the tank mix;
- c) The stage of application for the crop and all pests for all products must overlap. The pests and crop must all be in an appropriate stage for application for all products in the tank mix;
- d) All label directions are followed, including the use of the most restrictive buffer zone, personal protective equipment, restricted entry interval etc.;
- e) Tank mixing is not excluded on any of the product labels. Some pesticide labels specifically prohibit mixing with other products;
- f) Applying the products together provides a value to the end user, either through increased pest control spectrum, reduced application time/costs or resistance management.

Anyone who recommends or applies an unregistered tank mix does so at their own risk and liability. More information on the use of unlabelled tank mixes can be found in these documents: [Memo – Use of Unlabelled Tank Mixes](#) or [Frequently Asked Questions](#).

Before tank mixing any pesticides, it is very important to test the compatibility of the products. When certain pesticides are mixed, they may gel or form a precipitate, either of which will be difficult to clean out of spray equipment. An easy method to test compatibility is a jar test. Before beginning the jar test, make sure to wear the appropriate personal protective equipment. Add water to a small jar or container, then add small amounts of the pesticides you are interested in mixing, in the order and ratios in which you plan to apply the products. Cover the jar and shake it vigorously, then leave it to settle for 15 minutes. If the mixture is smooth and free of clumps, the products should be physically compatible. If the jar feels warmer, or if there is any clumping or particles that do not disappear after additional shaking, the products are not compatible and should not be tank mixed. The jar test only evaluates physical compatibility. A tank mix may be physically compatible but may still cause crop injury or decreased pest control.

Tank mixing may reduce the margin of crop safety. The potential risks associated with tank mixes may be reduced if the products are applied using the correct rates, under ideal environmental conditions and at the proper growth stages. Follow the application recommendations on all product labels closely, with special attention to the environmental conditions associated with crop injury. Avoid tank mix application during stress or when environmental conditions may create stress conditions in the future, like periods of drought or heavy rains. Adding multiple products (more than two) and pesticide types may increase crop injury risk.

The weeds, crop and other pests targeted with the tank mix treatment must all be in the proper stage for each tank mix partner. Applying a control too early or too late for a given pest could decrease the level of control and not provide the desired economic benefit for the crop. In some cases, applying the proposed tank mix as two separate treatments, timed according to the proper pest stage, will provide an economic benefit greater than the costs saved by only having one sprayer pass.

Some pesticide formulations, like Venture L, have surfactants built-in with the pesticide. Others, like Poast Ultra, require additional surfactant to be added. When tank mixing pesticides, adding two surfactants will increase the risk of crop injury. If both pesticides require a surfactant, consider adding only a single surfactant and do not 'double-up' the surfactant applied to the crop.

When applying pre-emergent herbicides, tank mixing generally decreases the margin of crop safety for emerged blueberry sprouts. To reduce crop injury risk, ensure any pre-emergent herbicide applications are made well in advance of the expected blueberry plant emergence in the spring.

Consider using higher water volumes when tank mixing. More water will allow for better product dilution and mixing, which is very important when using dry herbicide formulations. Higher water volumes will also improve product coverage and may help improve pest control.

Follow all mixing instructions on the product label. When the label does not provide mixing instructions, pesticides may be mixed in the following manner. Fill the spray tank $\frac{1}{2}$ full with water and start agitation. Add in the different formulations in the order below, allowing time for complete mixing and dispersion of each product.

- 1) Dissolvable Packs (WSP)
- 2) Wettable Powder (WP, W)
- 3) Water-Dispersible Granules and Dry Flowables (WDG, DF)

Maintain agitation and fill the spray tank to $\frac{3}{4}$ of the final water volume, then add:

- 4) Water-based Solutions (S, L, SC, F)
- 5) Emulsifiable Concentrates (EC, E)
- 6) Spray Adjuvants (surfactants, fertilizers)

Finish filling the tank and maintain agitation throughout the entire spraying procedure.

Notes on Herbicides Registered for Use on Wild Blueberry

Herbicide label information overrides any discrepancies between information presented in this guide and the label. Herbicides are presented in alphabetical order and rates are given in kilograms or litres of commercial product. Additional information on weed susceptibility, herbicide use and toxicity are given in tables that follow.

1. Authority 480 (sulfentrazone)

Authority is a selective, soil applied herbicide for the control of wild buckwheat, lambs quarters, pigweed and other broadleaf weeds. Under research conditions, sheep sorrel was suppressed following Authority application. Authority may be applied as a broadcast spray. Applications should be made to dormant blueberry plants and only once in a two year period. Research evaluations were made either in the late fall of the crop year following mowing and blueberry leaf drop or in the early spring of the sprout year before blueberry emergence. Applications to blueberry plants with emerged growth are not recommended due to leaf burning and possible stand loss.

Use 0.22 to 0.29 L/ha (0.09-0.12 L/ac) of Authority per application, depending on soil organic matter and texture. Use the higher rates within the rate range for soils with pH less than 7.0 and organic matter greater than 3%. Do not use on coarse soils classified as sand which have less than 1% organic matter. Do not apply in fine textured soils with less than 1.5% organic matter. Do not apply in any type of soils with an organic matter content greater than 6%. Do not use on soils with a pH of 7.8 or greater. Refer to the product label for specific rate recommendations and weeds controlled.

Apply in a minimum water volume of 100 L per hectare. Do not apply to saturated soils. When soils are wet, do not apply if heavy rainfall is expected within 24 hours. Do not apply to frozen soil.

Authority is taken up by plant roots and shoots. Moisture is required to activate the herbicide in the soil. Adequate moisture of at least 18 mm is required within 14 days after application for optimal control. If adequate rainfall is not received in a timely fashion, irrigate with a minimum of 18 mm of water. When activating moisture is delayed, a reduced level of weed control may occur.

Authority is persistent in the soil. The total amount available in any given soil is determined by the interaction of soil type (mainly clay content), percent organic matter, soil pH, soil moisture and application rate. Both clay and organic matter bind Authority, making it less available to plants. As soil pH increases, availability of Authority in the soil increases. Irrigation with highly alkaline water (pH above 7.5) may increase the amount of Authority available in soil solution and may cause an adverse crop response. Residual weed control may be reduced when the herbicide is applied where heavy crop residue exists (such as leaves, straw and /or weeds).

Apply no more than 0.292 L/ha of Authority per season in a single field. Do not continually apply Authority to the same field for multiple seasons. Do not apply Authority to fields treated in the previous year (only apply Authority in one field season over a two year period). Authority may leach through the soil and into the water table, especially in sandy soils or in areas where the depth to the water table is shallow. Only apply one treatment of a Group 14 soil-residual herbicide per season to avoid crop injury and/or soil residual issues. Soil residual Group 14 herbicides include Authority and Chateau.

2. Callisto 480 SC (*mesotrione*)

Callisto is a selective broadleaf herbicide for the control of labelled weeds in the sprout or crop year of wild blueberry production. Callisto has both pre-emergent (soil) and post-emergent (leaf) activity. Callisto can be broadcast using ground application, once per year, over the top of the blueberries. Within the cropping season, applications must be made prebloom to the crop. Treated areas cannot be harvested within 60 days of application. Apply in 100-200 L water per hectare with a spray pressure of 206-300 kPa. Two application timings are registered; however, most grower experience indicates improved weed control from post-emergent use.

Pre-emergent: Up to the 2 leaf weed stage, apply 0.3 L Callisto/ha. No surfactant is required.

Post-emergent: Up to the 8 leaf weed stage, apply 0.3 L Callisto/ha. A non-ionic surfactant, Agral 90, must be added at 0.2% v/v (2 L Agral 90 per 1000 L spray solution).

In susceptible plants, herbicide activity results in bleaching symptoms, followed by plant death. Bleaching typically begins in leaf foliage and at growing points 3-5 days after application, with weed death 2-3 weeks later. Although weed competition is quickly halted, visual symptoms of dying weeds (discolouration) may take up to 2 weeks to appear, depending on the weed species and growing conditions. The bleaching symptom may be noted on less susceptible plants (like tree species) but may not result in plant death. For best results, apply Callisto to actively growing weeds. Weeds that emerge after an application may be controlled when they absorb the herbicide

from the soil provided there is sufficient moisture for uptake. When applied post emergent, thorough coverage of emerged weeds is essential for effective control. Under unfavourable conditions, such as drought, heat, flooding or prolonged cool temperatures, adequate control may not be achieved and re-growth may occur. Active weed growth is required for optimal herbicide activity.

Temporary crop injury (bleaching) may occur if applications are made under extreme weather conditions or when the crop is under stress. Blueberry growers have observed more crop injury when applications are made under hot and/or humid conditions or when the crop is stressed from flooding. The injury is most visible where excessive rates have been applied, such as sprayer overlaps. If heavy rain is expected within 48 hours, application should be delayed. For improved crop safety, make applications under cooler conditions (early morning or evening) or when daytime temperatures are below 21 °C. Do not make a foliar post-emergent application of any organophosphate or carbamate insecticide within 7 days before or 7 days after Callisto application or severe crop injury may occur. No tank-mixes with Callisto are currently registered for use in wild blueberry. There is an increased potential for crop injury when extra surfactant is added. The use of high surfactant rates or non-labelled surfactants has caused leaf burning to the crop.

In wild blueberry production, mid-June applications have provided the most consistent weed control. This product has a more limited control spectrum than hexazinone (Velpar/Pronone) and is best used to supplement current weed control practices. Improved weed control has been shown when a hexazinone application is followed with a Callisto application post-emergence, especially on difficult to control weeds like goldenrod species. More information on the use of Callisto in wild blueberry is available in this fact sheet ([C.4.6.0](#)).

3. Casoron G-4 (dichlobenil)

Casoron is a soil-active herbicide that controls broadleaved and grassy weeds at germination and growth initiation. Casoron G-4 is a ready to use granular product. It can be spread on the soil surface by hand, using small hand-held or backpack equipment or by tractor mounted spreaders. Do not apply more than 20 kg product/day when using small handheld equipment. Do not apply more than 75 kg product/day if using push-type granular spreaders. Casoron is volatile and should be applied when the air temperature is less than 15 °C. Water is necessary to move the product into the soil. Soils should be moist after application to activate the product. Avoid application if heavy rain is expected.

Apply at a rate of 110-175 kg/ha (40-70 kg/ac) during the dormant period of the blueberry crop, typically late fall or early winter. Use the high rate for grasses and to control tough perennial weeds when entering the sprout (vegetative) year and the low rate for annual weeds or when entering the crop (fruiting) year. The preharvest interval is 100 days. This herbicide has not been frequently used by the blueberry industry. As a result, the weed spectrum controlled is not well documented.

4. Chateau (flumioxazin)

Chateau is a pre-emergence herbicide used for suppression of hair-cap moss and control of selected grass and broadleaf weeds. All applications should be made to dormant wild blueberries in the sprout year (spring and/or fall) or as a dormant post harvest (fall). Ideally, applications should be made in the late fall of the crop year, following crop pruning or complete blueberry leaf drop. Unacceptable crop injury, including yield loss, can occur if Chateau comes into contact with non-dormant blueberry plant parts, including green leaves or green bark. Research trials have shown extensive crop injury when Chateau is applied to non-dormant blueberry plants.

The application rate is dependent on soil texture and weed target. To suppress hair-cap moss apply 280 g/ha on coarse-textured soils or 420 g/ha on medium-textured soils. A lower rate is registered for control of lamb's quarters and other labelled annual weeds. Apply 140 g/ha on coarse soil and 210 g/ha on medium textured soils when controlling annual weeds (as listed on the label). Do not apply Chateau on soils with greater than 5% organic matter (OM) or on fine-textured soils like clay. A second application may be applied if required for weed control for a maximum of two applications per year. The second application must not occur until 30 days following the first application when the blueberry plants remain dormant.

Control is most effective when applied to clean, weed-free soil surfaces. Apply in adequate water volume to ensure thorough coverage. For residual weed control, moisture is required to activate the herbicide in the soil. Dry conditions following application may reduce effectiveness. Crop injury may occur from applications made to poorly drained soils or applications made under cool, wet conditions. Spray equipment must be thoroughly cleaned after Chateau use to ensure that herbicide residue in the sprayer does not harm the crop when the sprayer is next used. Only apply one treatment of a Group 14 soil-residual herbicide per season to avoid crop injury and/or soil residual issues. Soil residual Group 14 herbicides include Authority and Chateau.

5. Dicamba (Banvel II, Hawkeye, Oracle)

Dicamba is the active ingredient found in Banvel II, Hawkeye and Oracle herbicides, formulated at 480 g dicamba per litre. Other formulations and concentrations may be available. These non-selective broadleaf herbicides, when applied to the foliage, are absorbed by the leaf and translocated throughout the plant. Dicamba can be applied alone or in combination with 2,4-D L.V. (low volatile) ester as either an overall broadcast or spot spray. Dicamba or dicamba plus 2,4-D L.V. ester can cause serious damage to lowbush blueberries if applied directly on actively growing blueberry plants, or if applied improperly.

Broadcast application

Application must be made in the fall of the fruiting year when the weeds are moderately green but after **90%** of the blueberry plants have dropped their leaves. Two application rates are registered.

1. Dicamba alone. For control of lambkill and suppression of sweet fern, apply Banvel II (480 g/L), Hawkeye (480 g/L) or Oracle (480 g/L) at a rate of 4.6 to 7.1 L/ha (1.9 to 2.9 L/acre).

2. Dicamba + 2,4-D L.V. ester. For additional control of broadleaf weeds, Banvel II, Hawkeye or Oracle may be mixed with 2,4-D L.V. ester (600 g/L) and applied in the fall of the crop year. Apply Banvel II, Hawkeye or Oracle at 2.3 L/ha (0.93 L/acre) with 2,4-D L.V. ester (600 g/L) at 5.7 L/ha (2.3 L/acre).

Many different formulations of dicamba may be available. For formulations of dicamba other than 480 g/L, follow label directions for the amount of product to apply.

If possible, fall pruning should be carried out 4 to 5 weeks after spraying. In New Brunswick research, there was no change in weed control or crop injury when mowing was carried out 2 to 3 weeks after application. If spring pruning is planned, it should be done as early as possible to reduce the chance of injury to the blueberry plants by this herbicide. Dicamba should be applied in 550 L of water per hectare. Blueberry tolerance decreases with the use of lower water volumes. Rainfall within 4 hours of application may reduce effectiveness. Significant delays in emergence have been observed in the spring following a fall application, particularly where mowing has replaced burning. A longer delay of emergence and a lower blueberry plant density have been observed if mowing height is not adequate. Proper sprayer calibration and agitation in the spray

tank is essential to avoid crop injury. When working with these herbicides, growers should experiment on a small area for the first time until they become familiar with broadcast applications.

Spot spray application

During site preparation, dicamba can be applied as a spot spray to control Velpar resistant weeds such as maple, alders, willows and honeysuckle. Apply 2.1 L of dicamba per 1000 L of water. Contact with actively growing blueberry plants must be avoided or severe injury or death will result.

6. Garlon (*triclopyr*)

On newly cleared sites, Garlon can be used to control alder, ash, birch, poplar, pin cherry, maples, and other woody species. Some species (e.g. red maple and choke cherry), are more difficult to control and may require re-treatment the following year. Two formulations of Garlon are available for use. Garlon XRT should be mixed with oil, either vegetable or mineral oil, where 13 to 19 L of Garlon XRT is added to enough oil to make 100 L of spray mixture. Garlon RTU is ready to use and does not require any additional oil before treatment. Apply either formulation using a knapsack or backpack sprayer with a flat fan or solid cone nozzle, or with a wick attachment. Low pump pressures of 70 to 210 kPa are recommended. Blueberry plants are very sensitive and may be killed if Garlon comes in contact with the plants. Only one application per year is permitted. Rainfall within 2 hours of application may reduce effectiveness.

Garlon is registered for the control of woody weed species during field site preparation as either a basal bark or stump treatment. For basal bark application, spray the basal or lower 30 cm of trunks up to 15 cm in diameter as well as to any roots that may be exposed. To control re-sprouting of cut stumps of woody species, all exposed bark, roots and cut surfaces should be wet thoroughly either by painting or spraying. This solution can also be applied to the base of suckers or saplings with a small brush for effective control of many species. All surfaces should be coated, including individual stems when applying to clumps of trees.

7. Glyphosate (*Roundup, etc.*)

There are a number of commercial products currently registered for use in wild blueberry that contain the active ingredient glyphosate. These include Roundup, Roundup WeatherMax, Touchdown, Credit, Vantage, Factor, Sharpshooter and Glyfos with several formulations for each commercial product. Although glyphosate is common to each of these products, the salt formulation and surfactants present in these products may vary. In addition, the application rate and rain-fast period can differ for each type of product. Differences in weed control between these products are generally considered minimal by many weed scientists. Consult the label for additional information on the use of individual glyphosate products.

Glyphosate is effective against most broad leaved species including maple, beech and ash. Glyphosate is absorbed into the foliage and translocated throughout the plant, killing both above and below ground growing points. It is generally most effective when applied in June through August to fully expanded and actively growing foliage. To be effective, application must be made immediately after cutting the plant if used as a cut stump treatment. It is not effective as a bark treatment as it does not readily penetrate bark. Glyphosate will not have any activity on conifer species. Glyphosate has no activity when applied to the soil and provides no residual weed control.

Glyphosate can only be used in blueberry fields if it is selectively applied to the weed foliage. Glyphosate has a role in the preparation of fields for blueberry production and also as a spot or wiper treatment in established fields. Glyphosate can be applied selectively, either as a directed spot spray or as a wiping treatment. Blueberry plants are very sensitive to glyphosate treatments and contact will result in blueberry plant injury or death. Rainfall within 1 to 6 hours may reduce

effectiveness, depending on the commercial product used. Glyphosate, mixed and applied in hard water, is known to result in reduced weed control. For optimal results, glyphosate should therefore be applied in soft water. The addition of ammonium sulfate to hard water can counteract the negative action of the hard water and improve weed control.

Spot Spray

Apply as 1% to 2% solution of 356 g acid equivalent per litre of glyphosate (356 g.a.e./L – Roundup Original formulation). A 2% solution is equivalent to 2L of product in 98L of water. For Roundup WeatherMax, apply as 0.67% to 1.34 % solution. A 0.67% solution is equal to 670 mL of product with enough water to make a 100 L solution and a 1.34% solution is equal to 1.34L of product with enough water to make a 100 L solution. The mixture should be applied to the foliage of woody weeds in the sprout year. Ensure uniform coverage and apply enough product to wet the leaves but not to the point of runoff.

Roller and Wiper Treatments

The use of glyphosate in rollers or wipers is an effective way to control weeds growing above the blueberry plants. The roller or wiper should touch the weeds at a minimum 5 cm above the blueberry canopy, ideally 15 cm above the crop. Care must be taken to avoid dripping the product from the application equipment onto the blueberry crop. For roller applicators, prepare a 5 to 10% solution by mixing 0.5 L to 1.0 L of 356 g.a.e./L herbicide with enough water to make 10 L of solution. For Roundup WeatherMax, prepare a 3.3-6.7% solution (0.33 to 0.67 L with enough water to make 10 L of solution). Roller speed should be maintained at 50 to 150 rpm. For wick or other wiper applicators, mix 1L of herbicide with 2L of water to prepare a 33% solution. For Roundup WeatherMax, mix a 22% solution (0.57 L in 2 L of water). Not all glyphosate products are registered for use in rollers or wipers and rates may vary between products. Please consult the glyphosate label for more specific information before using in this manner.

Fall Roundup WeatherMax Use for Lambkill Control

This herbicide treatment pattern for Roundup WeatherMAX is only registered within newly cleared wild blueberry production. There still is a risk of crop injury when using this treatment, although this potential risk is better tolerated during early production years. Crop safety of this application pattern in mature fields was not evaluated and use in mature fields cannot be recommended at this time. Grower experience has shown better results in fields that have been managed for one or two cycles, as compared to applications made to fields just starting the land clearing process. The current recommendation is to only apply glyphosate to fields that have experienced a commercial harvest because weed control is improved and there is less risk of injury to blueberry plants. Other glyphosate formulations can still be used in wild blueberries as spot or wiping treatments in established fields but are not recommended for a late fall application for lambkill control. These glyphosate formulations were not tested using this application pattern and cannot be recommended at this time.

As the correct application conditions are a balance between the stage of development of the lambkill and blueberry plants, potential treatment areas should be monitored closely in the fall. Since harvesting the crop places stress on the blueberry plants and contributes to early leaf drop, any treatment areas should be harvested in the year of application. Applications should be made in the fall before pruning the field, when blueberry plants have 95% leaf drop. The typical timing in research evaluations was late October or November.

Apply Roundup WeatherMAX at 1.67 litres per hectare in 200-300 litres per hectare of clean water using a boom applicator. Do not add adjuvant to the spray mixture. Treat only areas of the field which have lambkill present. Do not prune for at least 14 days after application. All fields treated

with Roundup WeatherMAX must be pruned post treatment in the fall or pruned the following spring before May 15th. Any delay in pruning in the spring can decrease the level of weed control. Pruning as close as possible to the ground is recommended to improve weed control and to limit injury to blueberry plants.

Only one application of glyphosate is registered in a typical cropping cycle (2 year rotation). As a general precaution, only apply fall glyphosate once within two cropping cycles. One glyphosate application, if made under the proper application conditions, generally provides a very high level of lambkill control and follow-up lambkill control treatments are usually not required. More information on the use of glyphosate to control lambkill is available in this fact sheet ([C.4.7.0](#)).

8. Ignite SN Herbicide (glufosinate)

Ignite is a non-selective herbicide used for the burn-down of annual and perennial weeds. Ignite may be applied with ground (boom) spray equipment, high volume orchard spray guns or hand-held pump-type and backpack sprayers. The addition of an anti-foaming agent may reduce foaming, especially when using soft water.

Weeds that emerge after application will not be controlled. Apply to actively growing weeds. Speed of weed control is influenced by environmental factors. At low temperatures (below 10 °C), poor moisture and low humidity conditions, the speed of action may be reduced. Use higher rates when weed growth is dense, when weeds are mature or when environmental conditions are cool or dry. Do not make more than 2 applications of Ignite per year. Do not apply more than 6.7 L/ha total product in one season.

Avoid contact of Ignite spray, drift or mist with green bark, stems, or foliage, as this contact may injure the plants. Only sprouts with mature brown bark should be sprayed. Alternatively, blueberry plants could be pruned before application. Contact of Ignite with parts of plants other than mature brown bark can result in serious damage.

Broadcast application

Broadcast application must be made to dormant lowbush blueberry plants. Field must be entering into the sprout (vegetative) year in the season following application. Broadcast application can be made after blueberry leaf drop in the late fall of the cropping season but before blueberry sprout emergence in the spring following pruning.

Apply Ignite at 2.7-5 L/ha for the control of annual grasses, broadleaf weeds and suppression of perennial weeds. Apply in a minimum of 110 L/ha of water and ensure uniform, thorough coverage. Ignite may be tank mixed with Sinbar WDG or Velpar DF for control of weeds listed on the respective labels, including control or improved control of hawkweed, sheep sorrel and many annual and perennial grasses. Do not apply a tank mixture of Ignite + Sinbar or Ignite + Velpar more often than once per year.

Spot application

Mix Ignite at 27-50 mL of product per 10 litres of spray solution for the control of annual grasses and broadleaf weeds. Ten litres of spray solution should be used over an area of 100 m². Provide thorough coverage of the weeds, but not to the point that the product 'runs off' the leaves. Use as a directed spray if sprouts have emerged. Avoid contact of Ignite spray, drift or mist with green bark, stems, or foliage, as injury may occur to plants. Repeat treatments may be necessary to control new germination of annual weeds. Do not make more than 2 applications of Ignite per year.

9. Kerb SC (propyzamide)

Kerb is a soil active herbicide that will control or suppress many perennial grasses, including Venture L and Velpar-tolerant fescues. It does not control poverty oat grass or woody species. It has little activity on broadleaved species, but has shown activity on sheep sorrel. Kerb is registered for use at 4.1 to 5.6 L/ha (1.7 to 2.3 L/acre) in late October and November of either the sprout or crop year. Application should be made in 300-500 L water per hectare. Applications should be made when the ground is cool but before it freezes. Rainfall is required to move Kerb into the soil where it is active. Herbicide losses are greatest when applications are made to frozen ground or when soil temperatures are high (greater than 10 °C). Weed control is best when the soil moisture level is high and soil temperatures are cool. Lowbush blueberry is very tolerant to Kerb. Variability in weed control has been found with this product, mainly attributed to poor weather at application (e.g. too dry, too warm, frozen ground).

10. Lontrel 360 EC (clopyralid)

For the control of tufted vetch apply Lontrel 360 in late spring of the sprout year when tufted vetch is in the early flowering stage. Lontrel 360 generally gives excellent control of established tufted vetch but it gives no control of seedlings that emerge after application. Research evaluations have shown control of hawkweed in both early and late spring sprout year applications, either before blueberry emergence or later in June of the sprout year. Early application provides a longer period of weed control and will prevent seed production. Often there are no obvious visible crop injury symptoms following application, but there may be a reduction in bloom and blueberry canopy the following crop year, particularly if late applications, which can interfere with the developing fruit bud, were made. Applications in July and August have resulted in blueberry yield loss. In extreme cases, there may be malformations of the blossoms. **Lontrel 360 should never be applied in fruiting blueberry fields.**

Only one application per year is permitted. Small infestations can be treated with backpack or hand-gun applicators; larger infestations can be treated with a calibrated boom sprayer. Applications should only be made to areas infested with vetch. Application to the crop should be avoided as much as possible. When using a hand gun or backpack sprayer to treat small infestations, apply Lontrel 360 herbicide at a rate of 42 ml per 1000 m² area in 200 L of water. When applying with a boom sprayer to treat larger infestations, apply 420 ml per hectare (2.5 acres) in 150 to 200 L of water.

11. Option 2.25 OD + UAN (foramsulfuron)

Option is registered for use in the spring of the sprout year when the targeted weeds are at the appropriate leaf stage. This herbicide will control mainly grasses in wild blueberry, including quackgrass (3-6 leaf stage), witchgrass (2-4 leaf stage) and suppress fescues (1-6 leaf stage of fine-leaf sheep fescue, sheep fescue, red fescue and tall fescue). Timing of application is very important for fescue control. The appropriate stage can vary from field to field and season to season, but typically occurs after blueberry emergence in the sprout year, but before seedhead emergence of the fescue. This timing is earlier than the typical post-emergent grass timing in wild blueberry, so proper scouting and staging is required for best results. In research evaluations for wild blueberry, Option has controlled ticklegrass and suppressed poverty oatgrass. Only a few broadleaf weeds may be controlled, including lamb's quarters and redroot pigweed. For best results, apply to emerged, young, actively growing weeds. Option will have an effect on more mature weeds, but the speed of activity and level of control will be reduced.

Apply Option at 1.56 L/ha. Option must be applied with a spray-grade liquid nitrogen fertilizer, such as 28% UAN, at a rate of 2.5 L/ha. Grassy weed control will be decreased if the fertilizer is not

used. Apply in a minimum of 150 L water per hectare and at a pressure of 175 – 275 kPa. The use of 80° or 110° flat fan nozzles is highly recommended for optimum spray coverage and canopy penetration. Use 50 mesh filter screens or larger. Do not apply Option to any field more than once per year. Apply by ground application only.

The speed of action of Option is influenced by environmental factors. Weed growth typically stops within 1-3 days following application. Warm, moist conditions promote the activity of herbicide action. Typically, the weeds will turn yellow, usually in 5-10 days. Under cool and/or dry conditions, activity may be reduced or delayed. Weed control may also be reduced if application is made when weeds are covered by dust or in the presence of heavy dew, fog or mist/rain. Option works primarily as a contact herbicide with limited soil residual activity. Uniform spray coverage is important to achieve consistent weed control. Control may be reduced if the blueberry canopy has closed over the weeds, intercepting the spray.

12. Poast Ultra + Merge (sethoxydim)

Poast Ultra can be applied broadcast in the late spring of both the sprout and fruiting year for post emergent control or suppression of certain annual and perennial grasses. Poast Ultra is a contact and a systemic herbicide. Uptake into the plant is primarily through its leaves. Thorough coverage of the foliage is important for consistent grass control. Degree of control will depend on the level of susceptibility to the herbicide and the rate applied. Once treated, susceptible grasses that were actively growing prior to treatment stop growing and undergo a burn-back. Colour changes first to a yellow, then purple and finally a brown colour. The time required for complete control is normally 7 to 21 days following treatment, depending on growing conditions and crop competition.

Control of quackgrass (and other perennial grasses) happens more slowly than control of annual grasses. Poast Ultra is translocated through the quackgrass plant to the rhizomes and kills actively growing rhizome buds, as well as above ground vegetation. Dormant rhizome buds will remain unaffected by the spray and regrowth can occur from these buds. When Poast Ultra is applied according to label directions, the regrowth of the quack grass will not be significant until 6-8 weeks after treatment, depending on growing conditions and crop competition.

Apply 0.47 L/ha Poast Ultra plus 1 L/ha Merge post emergence for the control of annual grasses at the 1 to 6 leaf stage (witch grass and fall panicum) and for ticklegrass control. Apply 1.1 L/ha Poast Ultra plus 1-2 L/ha Merge for the suppression of quackgrass, poverty oat grass, blue grasses and other perennial grasses. Apply when perennial grasses have 10 cm of new leaf growth – usually in late May or early June. These applications are useful in some grass-infested fields during the crop year to increase harvest efficiency. Assist Oil Concentrate can be substituted for Merge Adjuvant at the same rates. Poast Ultra should be applied in 100 to 200 L water per hectare. Blueberry plants are very tolerant to Poast Ultra, even during bloom.

Most effective control is achieved when application is made at the 2 to 5 leaf stage when annual grasses are small and actively growing, soil moisture is good, and the crop is small enough to permit thorough spray coverage. Applications made to grasses greater than 20 cm in height or grasses that have reached the heading stage will not give adequate control or suppression. When grasses are stressed due to drought, flooding, hot or prolonged cool temperatures (15°C or less), control can be reduced or delayed since grasses are not actively growing. Grass escapes or re-tillering may occur under prolonged stress conditions or low fertility. Do not make applications to grasses stressed longer than 20 days due to lack of moisture, as unsatisfactory control can result. If stress conditions exist at the time of application and have existed for less than 20 days, then use the higher recommended rates of Poast Ultra.

Rainfall within one hour of application may reduce the effectiveness of the spray. This product does not provide residual control. The preharvest interval is 15 days. Poast Ultra does not control rush, sedge or broadleaf weeds. Do not mix or apply Poast Ultra with any other additive, pesticide or fertilizer unless recommended on the label. Allow 4 days between application of Poast Ultra and any other chemical.

13. Princep Nine-T (simazine)

Princep Nine-T (1.5 to 2.0 kg/ha; 0.6 to 0.8 kg/acre) is registered for use in lowbush blueberries. This herbicide should be applied in a minimum water volume of 300 L/ha. This herbicide has not been frequently used within the blueberry industry. As a result, the weed spectrum controlled is not well documented. Woody weeds and most established perennial species will not be controlled with simazine. Princep Nine-T can be applied in late fall or early spring when blueberries are still dormant. Only one application is permitted per season. Apply the lower rates on coarse sandy soil and the higher rates on clay soils and soils high in organic matter. Rainfall is required to activate simazine. Crops must not be harvested within 60 days of application.

14. Sinbar WDG (terbacil)

Sinbar is recommended for grass and hay-scented fern control, but is also effective against lamb's quarters and other annual broadleaf weeds. Sinbar is residual and provides control of many later germinating weeds. It is not recommended to continuously apply Sinbar as this may promote the growth of tolerant broadleaf weeds, such as goldenrods, sheep-sorrel and asters. Apply Sinbar at 1.5 to 2.5 kg/ha (0.6 to 1 kg/acre) in the spring of the sprout year, after the pruning operation, but before new blueberry shoots emerge. Later applications may cause crop injury. Sinbar can be applied in late fall of the crop or sprout years when blueberry plants are dormant. Apply the lower rates on coarse sandy soil and the higher rates on clay soils and soils high in organic matter. Use a minimum of 200 L water per hectare. Agitation of the product in the spray tank is essential to ensure proper mixing and to avoid application issues. Apply Sinbar within 24 hours of mixing as product degradation may result. Moisture within 2 weeks of application is required to activate Sinbar. Do not tank mix with Venture. Do not apply Sinbar within the two weeks before or after an application of Venture or crop injury may result.

15. Spartan + Agral 90 (tribenuron methyl)

Broadcast applications for bunchberry control

Spartan is a post emergent herbicide that must be absorbed through emerged weed foliage to be effective. Proper application timing is critical with this herbicide and will directly influence the level of bunchberry control and crop injury. For bunchberry control, apply Spartan at 40 g/ha (16 g/acre) with 0.2%v/v Agral (200 mL per 100 L water) in 150 to 250 L water per hectare. Add Agral 90 after Spartan is well mixed and in suspension. Spartan may degrade in water and should be applied on the day it is mixed. Disperse the granules in a small amount of water before adding them to the spray tank to ensure the herbicide is thoroughly in suspension. Only one application per year is permitted. Rainfall within 4 to 6 hours after application may also reduce control.

In the year following Spartan application, some bunchberry regrowth can be expected, but densities will be much lower than pre-treatment levels. It may be necessary to use Spartan in following sprout years to maintain bunchberry control levels. When used in the manner described below, Spartan has generally resulted in 70 to 90% control of bunchberry with minimal effect on the crop. Two distinct application timings are registered, with more information available in this fact sheet ([C.4.3.0](#)). The fall timing has shown increased and easier weed control with a wider application window and should be the preferred method of treatment.

i) Spring, sprout year application

This is the original application window registered on the Spartan label. For best results, applications should be made when the majority of the emerged bunchberry plant leaves have unfolded to form a 45 degree angle, but no later than when the first white blossoms are visible on the most advanced plants. Bunchberry plants generally turn pinkish red to yellow following spraying but may take weeks to die down. If Spartan applications are made too late, bunchberry plants turn red and remain so for the entire season and reduced control can be expected. If Spartan is applied too early, bunchberry regrowth can be expected later in the season.

Spartan should also be applied before blueberry sprout regrowth exceeds 2 cm in height. Some stem height reduction, with yellowing and reddening of the blueberry leaves, might be observed for 6 to 8 weeks after application. This is more likely to occur if there have been prolonged cool temperatures or wide fluctuations in day and night temperatures just prior to or soon after treatment. Blueberry plants, however, recover and fruit bud numbers and potential yields are not generally affected. Recommended fertilizer applications before or after Spartan applications may be beneficial. Applications made at later stages of blueberry development or applications in spring-burnt fields are not recommended due to potential crop injury and potential yield reductions.

ii) Fall, crop year application

A fall application timing, evaluated through research conducted in New Brunswick, has been accepted for registration. This timing occurs one to four weeks after the completion of the blueberry crop harvest. Typically, this application would occur in September of the crop year. There are no restrictions on crop stage, although application should be made while bunchberry has active growth. Reddening of bunchberry may occur after harvest, especially in mechanically harvested areas. No effect of harvest type, either hand or mechanical harvest, was found in research trials. Higher levels of weed control in sprout year evaluations were noted following fall applications, as well as decreased visual crop injury as compared to typical spring Spartan applications. However, no difference in blueberry yield was measured between the spring and fall application timings in research trials.

Spot applications

Spartan can be used as a directed spot spray with a backpack sprayer or handgun to control alders, bracken fern, wild rose and yellow loosestrife. Mix 2.5 g of Spartan plus 20 mL Agral 90 for every 10 L of water and spray to thoroughly wet the foliage. Apply only during the summer of the sprout year when the foliage is fully expanded. Alders and wild rose can be controlled with early fall applications as they retain their leaves longer. Bracken fern shows few symptoms after application but control the following year is excellent. Foliage of the other species turns yellow or red and the stem terminals die soon after application. Control of vetch, poplars, willows, goldenrods and fly honeysuckle has been erratic and others like chokepear, bayberry, black bulrush, sweet fern, and birch, are resistant. Blueberries growing among treated weeds generally show few symptoms. However, when the crop is sprayed directly, it may be stunted, with reduced bloom and yield. Spartan may degrade in water and should be applied the same day it is mixed.

16. Ultim 75 DF + Agral 90 (nicosulfuron/rimisulfuron)

Ultim is a post-emergent herbicide registered for use with two distinct application methods in wild blueberries, discussed below. Ultim is a contact herbicide and will not provide residual control of grass or broadleaf weed seedlings that may germinate after application.

When mixing the product, disperse the granules in a small amount of water before adding them to the spray tank to ensure the herbicide is thoroughly in suspension. Add the surfactant after Ultim is well mixed and in suspension. Ultim 75 DF should always be applied with a recommended non-ionic surfactant (equivalent to 2 L per 1000 L water or 200 mL per 100 L water). Ultim spray solutions should be used within 24 hours of mixing or product degradation may occur. Mix no more than can be used in one day. Rainfall within 2 to 4 hours after application may reduce Ultim effectiveness. Do not apply within 14 months of harvest.

Broadcast applications

For control of quackgrass, annual grasses and redroot pigweed, plus suppression of poverty oatgrass, ticklegrass and black bulrush, apply one water soluble bag of Ultim (33.7 grams/ha) with a recommended non-ionic surfactant (Citowett Plus, Agral 90 or Ag-Surf) at 2.0 litres per 1,000 litres of spray solution (0.2% v/v). Apply within a minimum of 140 L water per hectare. Apply with ground equipment only. Make only one application per growing season

Apply Ultim when annual grasses have 1-6 leaves (up to early tillering) and perennial grasses have 3-6 leaves. Application must be made in the spring of the sprout year (non-bearing year) Stunting and yield losses may occur if blueberry plants are contacted by the spray. Increased crop safety will occur when applications are made before blueberry emergence.

Ultim may be tank mixed with Velpar or Sinbar to control annual grasses, quackgrass and many broadleaf weeds. Follow the recommended rates and timings outlined on the Velpar or Sinbar labels. Application must be made in the spring of the sprout year (non-bearing year) before blueberry crop emergence, or severe crop injury may result to emerged plants. Consult the tank mix partner label for additional application instructions and use precautions.

Spot applications for black bulrush

For control of black bulrush, apply Ultim 75 DF plus Agral 90 in June of the sprout year. Apply when the first flower heads begin to emerge from the bulrush tussock. Ultim 75 DF should be applied as a directed spot spray to thoroughly wet bulrush foliage. Control may be erratic or unsatisfactory from later applications or if the bulrush is under stress. Stunting and yield loss may occur when blueberry plants are sprayed directly, but with careful application, injury is minimal to those plants growing among the bulrush. Ultim 75 DF is pre-packaged in water soluble bags containing 33.7 g commercial product, or enough to mix 800 L of spray solution. This is equivalent to 4.2 g per 100 L of spray solution. Apply with 0.2% Agral 90 surfactant (equivalent to 200 mL per 100 L water).

17. Velpar DF and Pronone 10G (hexazinone)

A. Formulations

Two commercial formulations containing the active ingredient hexazinone are available: Velpar DF, a 75% dry flowable granule that is mixed with water and Pronone 10G, a 10% solid granule. Velpar DF and Pronone 10G are pre-emergence residual herbicides applied for the control of many grasses, broadleaf weeds, and woody weeds. More information on the hexazinone formulations is available in this fact sheet ([C.4.1.0](#)).

Pronone 10G consists of clay granules impregnated with the herbicide. Following rainfall, the herbicide is released by leaching. Pronone 10G is approved only for sprout year applications and is applied with a calibrated fertilizer spreader, such as the Vicon spreader, and not a conventional pesticide sprayer. Calibration information on the Vicon spreader is available here ([C.4.4.0](#)). Patchy crop injury or control indicates uneven distribution of granules. Control may therefore be poor during dry weather, but gradual release may prolong and improve control of some species.

If blueberry sprouts or leaves have emerged, the risk of crop injury is much less from Pronone 10G applications than from liquid sprays of Velpar DF. However, herbaceous weed control is generally better with pre-emergence applications of Velpar DF than with Pronone 10G. When using Velpar DF, follow label instructions to ensure the dry flowable granules completely disperse in the spray tank before application.

B. Sprout year applications

Velpar DF is registered for use in the sprout year at 1.92 to 2.56 kg/ha (0.78 to 1.0 kg/acre) and Pronone 10G at 14 to 20 kg/ha (5.7 to 8.0 kg/acre). The high rate is recommended for use in weedy or new fields to control common herbaceous and woody weeds. The low rate is recommended for maintenance weed control in relatively clean fields. Applications should be made in the spring after the pruning operation, but before new sprouts or leaves emerge. Apply Velpar DF in at least 200 litres of water per hectare. Agitation of Velpar DF in the spray tank is essential to ensure proper mixing and to avoid application issues. Do not apply to extremely sandy or gravelly soils or where the terrain does not permit even and accurate application.

On mature, well-established fields, it is suggested that growers experiment with different hexazinone rates in order to determine the minimal effective rate for the weed types present. In some instances, it may be feasible to even skip hexazinone applications or just treat known problem areas. For growers who are concerned that unmanageable weed populations may result if hexazinone applications are skipped, it is suggested that only a small area of their field be left untreated. If weed levels in the area are acceptable, then the untreated area could be expanded the following cycle.

Crop tolerance to Velpar DF is generally the greatest and weed control the best when applications are made soon after pruning but before new blueberry sprout emergence or new leaf growth. Best results occur when the herbicide is present in the root zone during active growth of the target weeds. There is no difference in tolerance between mowed and burned blueberry plants. Applications made after the foliage has emerged can cause serious leaf burn. Crop injury has consistently been associated with late applications. However, blueberry plants on sandy or shallow soils, or those weakened by heavy weed competition or frost heaving, may be more prone to hexazinone injury than those in vigorous stands.

Hexazinone is principally a soil acting herbicide that is leached by rain into the root zone. Herbicide activity is affected by too little or too much rainfall and by soil texture. Lower rates are used on light textured soils and higher rates are used on heavier soils and in high organic matter soils. Hexazinone is very water soluble and subject to leaching and lateral movement. Therefore, do not apply to gravelly soils or on steep slopes or to roadways or other areas subject to erosion in the absence of plant cover. Follow Best Management Practices to minimize the risk of contaminating water sources, as outlined here ([C.4.5.0](#)).

Experience has shown that blueberry rhizomes do not colonize ground kept bare by repeated hexazinone use. Hexazinone is an important tool in developing blueberry fields and managing weeds, but over-use that results in bare ground may lead to soil erosion and prevent clone expansion.

C. Velpar DF in the fruiting year

Velpar can be applied in the early spring of the crop year, although the risk of crop injury is high when applied at this time. When the crop contains weed species that could affect its development or harvest efficiency, an application of 1.3 kg/ha (0.53 kg/acre) Velpar can be made. It is recommended that this treatment be applied only to those areas of the field where weed density will cause yield losses or harvesting problems. This treatment will control or suppress most

goldenrods, asters, sheep sorrel, some annual broadleaved weeds and most grasses that have not developed hexazinone tolerance. Timing of application is critical. Applications should be made no later than the early bloom stage before the flower buds separate and show the white floral tube. This corresponds to when the bud scales are separating or the F1 and F2 developmental stages as described in the Monolinia blight control fact sheet ([C.3.1.0](#)). This stage generally occurs no later than mid May. Later applications can result in serious crop injury and much reduced yield. This treatment should only be used on soils with a well-developed organic layer and should not be used on sandy or gravelly soils. Crop injury is strongly influenced by soil and environmental conditions. Velpar application in the crop year should only be used as a rescue treatment for severe weed infestations. Growers should evaluate alternative weed control options before using Velpar applications in the crop year.

D. Response of weeds to hexazinone

Repeated hexazinone use has led to many changes in the weed flora of blueberry fields. It is now difficult to predict the response of some species to hexazinone. The susceptible/tolerant ratings of common weed species in [Table 1](#) are based on trials in fields with little or no previous exposure to hexazinone and may be most applicable to new fields. The susceptibility of some species has changed with long-term exposure to hexazinone (or reduced rates) in the following ways:

Incomplete control. Majority of seedlings and immature plants may be killed but mature plants recover from initial injury and reproduce, especially in the fruiting year. Examples of weeds which show incomplete control include many perennial herbaceous species, like black bulrush, black knapweed, St. John's wort, goldenrods, vetch, ferns, and others. The level of weeds which exhibit incomplete control increases as growers decrease the herbicide rate, as shown by the increase in sheep sorrel and narrow-leaved goldenrod in fields which have used reduced hexazinone rates.

Inherent tolerance. Like the blueberry plant, many other plant species are tolerant to labelled rates of hexazinone, e.g. bunchberry, bayberry, chokeberry, yellow loosestrife, lilies and orchids, and others. Some 'new' weeds like goat's-beard and sow-thistle appear to have inherent hexazinone tolerance.

Developed tolerance. Many native grasses have developed hexazinone tolerant populations with repeated exposure, as have some annual ones like witch grass. There is no evidence that populations of herbaceous broadleaved weeds have developed tolerance, or if the decreased control of some woody weed species (e.g. wild rose, bristly arilia, blackberry) results from decreased rates of herbicide or increased tolerance.

Germination patterns. Although residual, hexazinone may only provide several months of weed control. Many weed species germinate and establish later, like witch grass, chickweeds and others. Annual weeds germinate in both the sprout and fruiting year. When plants like lamb's quarters, witch grass, and hemp-nettle germinate in the crop year, control by sprout-year hexazinone is not achieved. Observing emergence patterns can help determine why some weed species are not controlled.

It is clear that many weed problems cannot be solved with hexazinone use. Growers must adapt their control strategy to control these escaping species.

18. Venture L (fluazifop-p-butyl)

Venture L can be applied broadcast in the late spring of both the sprout and fruiting year for post emergent control or suppression of certain annual and perennial grasses. Degree of control will depend upon their level of susceptibility to the herbicide and the rates applied. Susceptible annual grasses like witch grass or native perennials like ticklegrass (rough hair grass) can be controlled

with Venture L, but many native grasses, like poverty oat grass and blue grasses, are more tolerant and are only suppressed. Suppressed grasses are severely stunted and flowering and vigour is greatly reduced for at least one season. The presence of these suppressed species, particularly in bare areas of blueberry fields, is beneficial and may enhance expansion of blueberry clones and reduce soil erosion. Other grasses, however, are highly tolerant.

Apply 1 L/ha (0.4 L/acre) Venture L post emergence for control of annual grasses at the 2 to 5 leaf stage (e.g. witch grass and fall panicum) and for tickle grass suppression. Apply 2 L/ha (0.8 L/acre) Venture L for the suppression of quack grass, poverty oat grass, blue grasses and other perennial grasses. Apply when perennial grasses have 10 cm of new leaf growth, usually in late May or early June. These applications are useful in some grass-infested fields during the crop year to increase harvest efficiency. When applications are made to grasses greater than 20 cm in height or grasses that have reached the heading stage, the grasses will not be adequately controlled or suppressed. Venture L should be applied in 100 to 200 L of water per hectare. Blueberry plants are very tolerant to Venture L, even during bloom. Venture L requires a minimum 2 hour rain-free period after application and has no activity in the soil. The preharvest interval is 60 days. Venture L does not control rushes, sedges nor any broad-leaved weeds.

Notes on Herbicide Tables

Information provided in the following tables are provided to facilitate choosing the best treatment and are not a guarantee of performance. Producers should refer to the product label for more specific information. Factors such as weather, stage of growth, herbicide rate and difference in tolerance among plant populations can influence the information presented. Selective treatments can be applied with little risk of crop injury, provided label directions are followed. Non-selective herbicide treatments must be applied only to the weeds as blueberry plants that come in contact with the herbicide spray may be injured or killed.

Table 1. Herbicide Effect on Common Blueberry Field Weeds

Ratings s - susceptible t - tolerant sd - suppressed v - variable n/a - not applicable A - Annual P - Perennial	Life Cycle	Pre-Emergence				Post Emergence					Spot Treatments					
		Authority	Chateau	Kerb	Sinbar	Velpar/Pronone	Callisto	Option	Poast Ultra	Ultim	Venture	Casoron	dicamba	Glyphosate	Garlon	Lontrel
Grass Type Weeds																
Black bulrush	P		t	t	v	sd	t	s	t		sd	t	s		t	t
Browntop	P			s	s	t	s		s			t	v	t	t	t
Canada blue grass	P			s	s	t	sd	sd	v	sd		t	v	t	t	t
Fescue (<i>Festuca sp</i>)	P		s	v	v(3)	t	sd	t	v	t		t	v	t	t	t
Kentucky blue grass	P				s(3)	t		sd		sd		t	v	t	t	t
Mexican muhly grass	P			sd	v(3)	t		sd		sd		t	v	t	t	t
Poverty oat grass	P		t	s	s(3)	t	sd	sd	sd	sd		t	v	t	t	t
Quack grass	P		v	sd	sd	t	s	sd	sd	sd	sd	sd	t	v	t	t
Tickle grass (Rough hair)	P			s	s(3)	t	s	s	sd	s		t	v	t	t	t
Rush Species	P				v	v		t		t		sd				
Witch grass	A			s	v(3)	t	s	s	s	s		t	v	t	t	t
Herbaceous Broadleaf																
Asters	P		t	t	v	v	t		t		s	s	s		v	v
Bunchberry	P		t	t	t	t	t	v	t			n/a		t	s(1)	
Burnweed	A				v	s	t		t			s		sd		
Cinquefoil (Rough, 5-finger)	P			s	v	v	t	v	t			n/a			v	
Cow wheat	A				v	s	t	t	t			n/a				
Fireweed	P			s	s	sd	t		t			s				
Goldenrods	P		t	t	v	sd	t	sd	t		s(1)	s		v	v	
Hawkweed	P			sd	v	t	v	t	sd	t		n/a		s		
Lamb's quarters	A	s	s		s	v	s	s	t	sd	t	s	s	s	t	
Old field toadflax	A,P					sd	t		t			n/a		t		
Ox-eye daisy	P			t	s		t		t			s	s	v		
Sheep sorrel	A,P	sd		sd	t	v(3)	t	v	t	v	t	sd	s	n/a	v	
Spreading dogbane	P			t	t	v	v	t	v	t	v	s	s	s	t	t
St. John's wort	P		t	t	t	v	t	t	t			s	s	t	t	
Vetch	P		t	t	v	sd	t	sd	t		v	s	v	s	v	
Wild lily of the valley	P			t	t			t	t	t		n/a		t	t	
Yellow loosestrife	P			t	t	v	t	t	t		v	s	s	t	s	
Woody Weeds																
Alder	P		t	t	t	t	t	t	t		s	s	s	t	s	
Barrenberry	P		t	t	t	v	t	t	t		s	s		t	t	
Birch	P		t	t	s	v	t	t	t		s	s	s	t	t	
Cherry (<i>Prunus spp</i>)	P		t	t	t	t	t	t	t		s	s	v	t		
Huckleberry	P		t	t	t	t	t	t	t		t	s	t	t	t	
Lambkill	P		t	t	s(1)	t	t	t	t		s	v	v	t	t	
Maple	P		t	t	t	t	t	t	t			s	s(2)	t	sd	
Poplar	P		t	t	v	v	t	t	t		s	s	s	t	v	
Rhodora	P		t	t	s(1)	t	t	t	t		sd	v	v	t	t	
Wild rose	P		t	t	t	v	t	t	t		s	v	s	t	s	
Willow	P		t	t		v	t	t	t			v	s	t	v	
Non-flowering Plants																
Bracken fern	P			t	v	s(1)	t	t	t		s	s		t	s	
Hair-cap moss	P		s(1)	t	t	t	t	t	t			t	t	t	t	t
Sweet fern	P			t	t	t	t	t	t		s	v		t	t	

(1) may require additional applications in following cycles for satisfactory control

(2) Red maple requires high rate and possible re-treatment

(3) Herbicide Resistant species suspected

Table 2. Herbicides Registered for Broadcast Application

Active Ingredient	Product	Product Rate		Water Volume	Pre Harvest Interval (Days)	Application Timing (see label for additional information/precautions)
		kg or L / ha	kg or L / ac			
Pre-emergent, before blueberry growth (Early Spring)						
glufosinate	Ignite SN	2.7-5 L/ha	1.1-2 L/ac	Min 110 L/ha (10 gal/ac)	Non crop year	Dormant spray, after blueberry leaf drop in crop season but before blueberry sprout emergence in the sprout year.
hexazinone	Pronone 10G Velpar DF	14-20 kg/ha 1.92-2.56 kg/ha	5.7-8.1 kg/ac 0.78-1.0 kg/ac	Min 200 L/ha (18 gal/ac)	None available	Spring of sprout year, before new blueberry plant growth emerges.
sulfentrazone	Authority 480	0.22-0.29 L/ha	0.09-0.12 L/ac	Min 100 L/ha (9 gal/ac)	Non crop year	Dormant spray, after blueberry leaf drop in crop season but before blueberry sprout emergence in the sprout year.
terbacil	Sinbar WDG	1.5-2.5 kg/ha	0.6-1.0 kg/ac	Min 200 L/ha (18 gal/ac)	None available	Spring of sprout year, before new blueberry plant growth emerges or late fall, when dormant.
Post-emergent, after blueberry growth (Late Spring/Summer)						
fluazifop-p-butyl	Venture L	1-2 L/ha	0.4-0.8 L/ac	100-200 L/ha (9-18 gal/ac)	60 fruit, 420 sprout	Late spring, sprout and fruiting year, control of grasses only. Low rate for annual grass control.
foramsulfuron	Option 2.25 OD	1.56 L/ha + 2.5 L/ha UAN	0.63 L/ac + 1 L/ac UAN	Min 150 L/ha (13 gal/ac)	None available	Sprout year only. One application per season after blueberry emergence.
mesotrione	Callisto 480 SC + Agral 90	0.3 L/ha + 200 ml Agral 90 per 100 L water	0.12 L/ac + 200 ml Agral 90 per 100 L water	100-200 L/ha (9-18 gal/ac)	60	Late spring of sprout or crop year, prebloom. Apply up to 8 leaf weed stage. Can be applied before weed emergence. One application per season.
nicosulfuron/ rimsulfuron	Ultim 75 DF + Agral 90	33.7 g/ha + 200 ml NIS per 100 L water	13.6 g/ac + 200 ml NIS per 100 L water	Min 140 L/ha (12 gal/ac)	14 months	Apply with approved surfactant. Crop stunting may occur when applied later in season. One application per season.
sethoxydim	Poast Ultra + Merge or Assist	0.47-1.1 L/ha + 1-2 L/ha Merge or Assist	0.19-0.45 L/ac + 0.4-0.8 L/ac Merge or Assist	100-200 L/ha (9-18 gal/ac)	15	Late spring, sprout and fruiting year, control of grasses only. Low rate for annual grass control.
Dormant application (Late Fall)						
dicamba	Banvel II/Hawkeye Oracle	4.6-7.1 L/ha	1.9-2.9 L/ac	550 L/ha (50 gal/ac)	None available	Fall of fruiting year after 90% blueberry plant leaf drop. Change rate for other formulations.
dicamba + 2,4-D ester	Banvel II/Oracle + 2,4-D LV ester 600	2.3 L/ha + 5.7 L/ha	0.93 L/ac + 2.3 L/ac	550 L/ha (50 gal/ac)	None available	Fall of fruiting year after 90% blueberry plant leaf drop. Only use low volatile formulations of 2,4-D ester.
flumioxazin	Chateau WDG	Suppress Moss: 0.28-0.42 kg/ha	Suppress Moss: 0.11-0.17 kg/ac	Min 100 L/ha (9 gal/ac)	None available	Apply to dormant blueberry, ideally late fall of crop year after pruning.
glyphosate	Roundup Weathermax	1.67 L/ha	0.68 L/ac	200-300 L/ha (18-27 gal/ac)	None available	Newly cleared land only. Fall of fruiting year after 95% blueberry plant leaf drop. Must prune after treatment.
propyzamide	Kerb SC	4.1-5.6 L/ha	1.7-2.3 L/ac	300-500 L/ha (27-45 gal/ac)	None available	Late fall of fruiting or sprout year, after blueberry plant defoliation. Best results when soil temperatures are low, but above freezing and soil moisture is high.

Table 3. Herbicides Registered for Spot Application

Active Ingredient	Product	Type of Application	Herbicide Mixture (g or L product)	Pre Harvest Interval	Application Timing (see label for additional information)
Selective spot herbicide treatments					
clopyralid	Lontrel 360	Spot spray	Spot: 42 ml in 200 L water, treat 1000 m ² Boom: 420 ml/ha in 150-200 L	10 months	Sprout year – June or when tufted vetch is early bloom. Later applications may result in yield reductions the following year.
dichlobenil	Casoron 4G	Granular	110-175 kg/ha (40-70 kg/ac) spread directly on soil	100 days	Apply during dormant period (late fall). Do not apply above 15 °C. Low rate for crop year.
glufosinate	Ignite SN	Spot spray	27-50 ml in 10 L spray solution	Non crop year	Directed spray if sprouts have emerged. Two applications may be needed, 6.7 L/ha maximum.
nicosulfuron/ rimsulfuron	Ultim 75 DF + Agral 90	Spot spray	Spot: 4.2 g plus 200 ml Agral 90 per 100 L water	14 months	Early summer of sprout year - black bulrush.
tribenuron methyl	Spartan + Agral 90	Spot spray	2.5 g in 10 L water plus 20 ml Agral 90 per 10 L water	None available	Summer or early fall of sprout year. Varies with weed targeted.
		Bunchberry	40 g/ha + 0.2% v/v Agral 90 (20 ml Agral 90 per 10 L water); Spray in 150-250 L water/ha	None available	Spring sprout year: Bunchberry leaves unfolded at a 45 degree angle, before blueberry re-growth more than 2 cm. Late summer fruiting year: apply 1-4 weeks after blueberry harvest.
Non-selective spot and wiper herbicide treatments					
2,4-D LV ester	Numerous trade names	Spot spray	Consult individual labels	None available	Site preparation, non crop.
dicamba	Banvel II / Hawkeye Oracle	Spot spray	2.1 L per 1000 L water	None available	Site preparation – brush control.
glyphosate	Roundup Original, Roundup Weathermax, Touchdown Total, Factor, Factor 540, Credit, Credit Plus, Glyfos, Vantage Plus MAX, Polaris, Traxion and others	Spot spray	1-2 % solution Roundup Weathermax: 0.67 to 1.34 % solution	Non crop year	Site preparation, sprout year, after harvest.
		Roller	5 to 10 % solution Roundup Weathermax: 3.3–6.7 % solution	Non crop year	
		Wiper	33 % solution Roundup Weathermax: 22% solution	Non crop year	
triclopyr	Garlon	Spot spray or wiper	13 – 19 % solution in mineral or vegetable oil for Garlon XRT; No mixing for Garlon RTU	None available	Site preparation, one application per year.

Pre Harvest Interval (PHI): The minimum number of days between the last application of the pesticide and harvest. **Label Information:** Information listed in this guide is provided to growers as a convenience. Pesticides must be applied according to label directions. Please refer to the product label before application and for more information on each product. Label information overrides any discrepancies between information presented in this guide and the label. Label information can be found at the Health Canada Pesticide Label Search, available [on-line](#).

Table 4. Additional Information for Herbicides Used on Wild Blueberry

Active Ingredient	Product	Group	Hazard	Protection Equipment	Buffer Zone (metres)		Restrictions (hours)		Herbicide Activity		Leaching Potential	Bee Toxicity	Winter Storage
					Water <1m	Terrestrial Habitat	Rain-free Period	Re-Entry Interval	Foliar	Soil			
2,4-D	2,4-D	4	Warning	d f g j	1	2	2	12	yes	no	moderate	low	C
clopyralid	Lontrel	4	Caution	a f j	-	2	4	12	yes	no	low to moderate	low	B
dicamba	Banvel II /Oracle	4	Warning	d f	1	15	4	12	yes	limited	very high	low	B
dichlobenil	Casoron	20	Caution	a f g	-	-	-	12	no	yes	low	low	C
fluazifop-p-butyl	Venture	1	Caution	d f h j	1	2	2	12	yes	no	very low	low	B
flumioxazin	Chateau	14	Caution	d f g j m	5	25	0	12	limited	yes	low	low	C
foramsulfuron	Option	2	Caution	a f g	1	3	2	12	yes	limited	low	low	C
glufosinate	Ignite	10	Warning	a f j m	1	1	4	12	yes	no	high	low	A
glyphosate	Various	9	Caution	a f j	15	15	1-6	12	yes	no	extremely low	low	B
hexazinone	Pronone	5	Warning	b f	50	-	0	48	no	yes	very high	low	C
hexazinone	Velpar	5	Caution	a f j	1	5	0	48	limited	yes	very high	low	C
mesotrione	Callisto	27	Caution	a f j	1	4	3	12	yes	yes	low	low	B
nicosulfuron/rimsulfuron	Ultim	2	Warning	a f h	1	5	2-4	12	yes	no	high	low	C
propyzamide	Kerb	15	Caution	d f h	-	10	0	24	no	yes	low	low	A
sethoxydim	Poast Ultra	1	Caution	d f h j	1	2	1	12	yes	no	low	low	B
simazine	Princep Nine-T	5	Warning	d f h j	1	5	0	12	no	yes	high	low	C
sulfentrazone	Authority	14	Caution	a f g	1	10	-	12	limited	yes	high	low	B
terbacil	Sinbar	5	Caution	a g j	10	35	0	12	limited	yes	very high	low	C
tribenuron-methyl	Spartan	2	Warning	a f j	1	10	4-6	12	yes	no	moderate	low	C
triclopyr	Garlon	4	Caution	d f h j	-	-	2	12	yes	no	low	low	B

Protection Equipment: a - long-sleeved shirt and long pants, b - coveralls or disposable spray suit, d - coveralls or disposable spray suit over long sleeved shirt and pants, e - waterproof gloves, f - chemically-resistant gloves, g - shoes plus socks, h - chemically resistant footwear plus socks, j - protective eye wear, l - chemically resistant head gear for overhead application, m - approved respirator, n - chemical-resistant spray suit. **Winter Storage:** Winter storage requirement codes are: **A** - Do not allow to freeze, **B** - Preferably should not freeze. If frozen, return to original state by allowing product to warm to 10-20°C and agitate thoroughly before use, **C** - Not usually damaged by freezing. Store in cool dry place.

Pesticide Emergency Information	
Poison Control Centres	
New Brunswick	Dial 911, ask for Poison Information
Newfoundland	Dr. Charles A. Janeway Child Healthcare Centre, St. John's (709) 722-1110
Nova Scotia Prince Edward Island	The Izaak Walton Killam Hospital for Children, Halifax 1-800-565-8161
Environmental Pesticide Spill	
New Brunswick Prince Edward Island Nova Scotia	1-800-565-1633
Newfoundland	1-800-563-9089
PMRA Websites	
Pesticide Label Search	
http://pr-rp.hc-sc.gc.ca/lr-re/index-eng.php	
Drift Mitigation	
Buffer Zone Calculator Link	

Helpful Conversions
Units
kPa x 0.14 = pounds per square inch
hectares x 2.47 = acres
kilograms x 2.2 = pounds
1000 grams (g) = 1 kilogram (kg)
millilitres x 0.035 = fluid ounces
litres x 35 = fluid ounces
litres x 0.22 = imperial gallons
1000 millilitres (mL) = 1 Litre (L)
$^{\circ}\text{F} = (^{\circ}\text{C} \times 9/5) + 32$
$^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times 5/9$
miles per hour x 1.61 = km per hour
5 mL = 1 tsp
Volume per Area
kg per ha x 0.89 = pounds per ac
kg per ha x 0.40 = kilograms per ac
g per ha x 0.015 = ounces per ac
tonnes per ha x 0.45 = tons per ac
L per ha x 0.40 = litres per ac
L per ha x 0.09 = gallons per ac
L per ha x 14.17 = fluid ounces per ac
L per ha x 0.71 = pints per acre
mL per ha x 0.015 = fl. ounces per ac
L per ha x 0.11 = US gallons per ac
L per ha x 0.86 = US pints per ac

Abbreviations	
Formulation	Measurements
DF Dry flowable	ac acre
EC,E Emulsifiable concentrate	g gram
F Flowable	g.a.e. grams acid equivalent
G Granular	ha hectare
L Liquid	kg kilogram
LV Low Volatile	kPa kilopascal
SC Suspension concentrate	L litre
Sn Solution	m metre
SP Soluble Powder	mL millilitre
WDG Water Dispersible Granule	psi pounds per square inch
WP,W Wetable Powder	% v/v percent volume to volume
WSP Water Soluble Pouches	
Personal Protection Equipment	
Gloves	
e - waterproof gloves f - chemical resistant gloves	
Head and Lung	
j - eye protection, application m - approved respirator	
l - chemically resistant headgear for overhead application	
Clothes	
a - long-sleeved shirt/pants b - coveralls or disposable spray suit	
d - coveralls or disposable spray suit over long sleeved shirt/pants	
n - chemical-resistant spray suit	
Footwear	
g - shoes plus socks h - chemically resistant footwear plus socks	

Herbicide Activity: Foliar – Indicates whether or not susceptible weeds will be controlled by herbicide contact with above ground plant tissue (leaves). **Soil** – Indicates whether or not late emerging susceptible weeds will be controlled for some time after application by residual herbicide activity as they germinate from the soil.

Group: Weed Science Society of America's nationally accepted grouping of herbicides based on site of action.

Bee Toxicity: Degree of toxicity to honey bees. If possible, all pesticide applications should be avoided during times of bee activity within fields, such as mid-day during bloom periods.

Hazard: The signal words Danger, Warning and Caution appear on the pesticide label and indicate the level of hazard associated with handling or using the product. Products bearing the signal word **Danger** have an extreme or high hazard rating. Products labeled **Warning** have a moderate hazard rating and a **Caution** warning is associated with a low level of hazard. The degree of hazard may be due to toxicity, flammability, explosiveness or corrosiveness.

Buffer Zones: Distance between the closest point of direct pesticide application and the nearest downwind edge of sensitive terrestrial habitats (such as grasslands, forested areas, shelter belts, woodlots, hedgerows, riparian areas and shrublands) and sensitive freshwater habitats (such as lakes, rivers, sloughs, ponds, prairie potholes, creeks, marshes, streams, reservoirs and wetlands). Water < 1m refers to wet areas with less than 1 meter of water depth. All buffer zones are for boom sprayers unless indicated. A buffer zone calculator is available [here](#).

Rain-free Period: The recommended minimum time in hours between pesticide application and rain. If rain occurs during the rain-free period, pest control may be significantly reduced.

Restricted-Entry Interval (REI): The minimum time in hours before you can enter a field that has been treated with the pesticide.

Leaching Potential: The potential for a pesticide to be leached or carried by surface run-off is determined by characteristics of both the pesticide and the field. Surface slope, proximity to surface water, low organic matter content, depth to aquifer and heavy rainfall are some of the factors which lead to run-off and leaching problems when combined with pesticides of a moderate to high leaching potential.



TRIBENURON METHYL GROUP 2 HERBICIDE

HERBICIDE WITH TOTALSOL®
SOLUBLE GRANULES

Soluble Granule

For Use on Cereals, ExpressSun® Sunflowers, Grass grown for seed, Fallow and as a Pre-plant or Post-harvest Burndown Herbicide

Active Ingredient	By Weight
Tribenuron methyl	50%
Other Ingredients	50%
TOTAL	100%

EPA Reg. No. 279-9594

Contains 0.50 lb. active ingredient per pound.

EPA Est. No. 352-IL-001

Nonrefillable Container Refillable Container

Net: Weight 15 oz OR Net: _____

**KEEP OUT OF REACH OF CHILDREN
CAUTION**

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand this label, find someone to explain it to you in detail.)

FIRST AID

IF ON SKIN: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-331-3148 for emergency medical treatment information.

**PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS**

Caution: Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Avoid contact with skin, eyes or clothing.

For medical emergencies involving this product, call toll free 1-800-331-3148.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Mixers, loaders, applicators, and other handlers must wear:

Long-sleeved shirt and long pants.

Chemical resistant gloves made of any waterproof material such as polyethylene or polyvinyl chloride.

Shoes plus socks.

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

Sold By:



FMC Corporation
2929 Walnut Street
Philadelphia, PA 19104

ENGINEERING CONTROL STATEMENTS

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

Important: When reduced PPE is worn because a closed system is being used, handlers must be provided all PPE specified above for "Applicators and Other Handlers" and have such PPE immediately available for use in an emergency, such as a spill or equipment breakdown.

USER SAFETY RECOMMENDATIONS

USERS SHOULD:

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

ENVIRONMENTAL HAZARDS

Do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment washwaters or rinsate.

Surface Water Advisory

This product may impact surface water quality due to runoff of rain water. This is especially true for poorly draining soils and soils with shallow ground water. This product is classified as having high potential for reaching surface water via runoff for several weeks or more after application. A level, well-maintained vegetative buffer strip between areas to which this product is applied and surface water features such as ponds, streams, and springs will reduce the potential loading of this product from runoff water and sediment. Runoff of this product will be greatly reduced by avoiding applications when rainfall or irrigation is expected to occur within 48 hours.

Windblown Soil Particles Advisory

This product has the potential to move off-site due to wind erosion. Soils that are subject to wind erosion usually have a high silt and/or fine to very fine sand fractions and low organic matter content. Other factors which can affect the movement of windblown soil include the intensity and direction of prevailing winds, vegetative cover, site slope, rainfall, and drainage patterns. Avoid applying this product if prevailing local conditions may be expected to result in off-site movement.

Non-target Organism Advisory

This product is toxic to plants and may adversely impact the forage and habitat of non-target organisms, including pollinators, in areas adjacent to the treated area. Protect the forage and habitat of non-target organisms by minimizing spray drift. For further guidance and instructions on how to minimize spray drift, refer to the Spray Drift Management section of this label.

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.

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. 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.
- Shoes plus socks.

EXPRESS® herbicide (with TotalSol® soluble granules), referred to below as EXPRESS herbicide, must be used only in accordance with instructions on this label or as otherwise permitted by FIFRA. Always read the entire label, including the Limitation of Warranty and Liability.

To the extent consistent with applicable law, FMC will not be responsible for losses or damages resulting from the use of this product in any manner not specified by FMC.

EXPRESS herbicide may be used on wheat (including durum), barley, triticale, oats, burndown, certain grasses grown for seed, and DuPont™ ExpressSun® sunflowers in most states. Check with your state extension service or Department of Agriculture before use, to be certain EXPRESS herbicide is registered in your state.

PRODUCT INFORMATION

EXPRESS herbicide is a water soluble granule that is used for selective postemergence weed control in wheat (including durum), barley, triticale, oats and ExpressSun® sunflowers; and for post-harvest burndown, fallow, and pre-plant burndown weed control. The best control is obtained when EXPRESS herbicide is applied to young, actively growing weeds. The use rate will depend on weed spectrum and size of weeds at time of application. The degree and duration of control may depend on the following:

- Weed spectrum and infestation intensity
- Weed size at application
- Environmental conditions at and following treatment

EXPRESS herbicide is noncorrosive, nonflammable, nonvolatile, and does not freeze. Mix EXPRESS herbicide in water and apply as a uniform broadcast spray.

Biological Activity

EXPRESS herbicide is absorbed through the foliage of broadleaf weeds, rapidly inhibiting their growth. Leaves of susceptible plants appear chlorotic from 1 to 3 weeks after application and the growing point subsequently dies.

EXPRESS herbicide provides the best control in vigorously growing crops that shade competitive weeds. Weed control in areas of thin crop stand or seeding skips may not be as satisfactory. However, a crop canopy that is too dense at application can intercept the spray and reduce weed control.

EXPRESS herbicide may injure crops that are stressed from adverse environmental conditions (including extreme temperatures or moisture), abnormal soil conditions, or cultural practices. In addition, different varieties of the crop may have differing levels of sensitivity to treatment with EXPRESS herbicide under otherwise normal conditions.

Treatment of sensitive crop varieties may injure crops. To reduce the potential of crop injury to cereals, tank mix EXPRESS herbicide with 2,4-D (ester formulations perform best—see the Tank Mixtures section of this label) and apply after the crop is in the tillering stage of growth.

In warm, moist conditions, the expression of herbicide symptoms is accelerated in weeds; in cold, dry conditions, the expression of herbicide symptoms is delayed. In addition, weeds hardened-off by drought stress are less susceptible to EXPRESS herbicide.

Weed control may be reduced if rainfall or snowfall occurs soon after application. Several hours of dry weather are needed to allow EXPRESS herbicide to be sufficiently absorbed by weed foliage.

RESTRICTIONS

- Injury to or loss of desirable trees or vegetation may result from failure to observe the following:
 - **Do not** apply, drain or flush equipment on or near desirable trees or other plants or on areas where their roots may extend, or in locations where the chemical may be washed or moved into contact with their roots.
 - **Do not** use on lawns, walks, driveways, paved surfaces, or tennis courts. Prevent drift of spray to desirable plants.
 - **Do not** discharge excess material on the soil at a single spot in the field, grove, or mixing/loading station.
- **Do not** store pesticides near well sites.
- **Do not** apply EXPRESS herbicide by air in the state of New York.
- The maximum amount of the active ingredient tribenuron-methyl for all uses is 0.5 ounces (0.0313 Lb. ai) per acre per year.
- The maximum amount of EXPRESS herbicide for all uses per acre per year is 1 ounce (0.0313 Lb. ai/A).
- The maximum number of applications per year of EXPRESS herbicide for all uses is four (when using less than the maximum single application rate), refer to the summary table in each use section for specific number of application for a given crop.

PRECAUTIONS

- Injury to or loss of adjacent sensitive crops and vegetation may result from failure to observe the following:
 - Take all necessary precautions to avoid all direct or indirect contact (including spray drift) with non-target plants or areas.
 - Carefully observe all sprayer cleanup instructions both prior to and after using this product, as spray tank residue may damage crops other than wheat, barley, oats and DuPont™ ExpressSun® sunflowers.
- Varieties of wheat (including durum), barley, oats and triticale may differ in their response to various herbicides. Consult your state experiment station, university, or extension agent as to crop sensitivity to any herbicide. If no information is available, limit the initial use to a small area.
- Under certain conditions such as heavy rainfall, prolonged cold weather, or wide fluctuations in day/night temperatures prior to or soon after EXPRESS herbicide application, temporary discoloration and/or crop injury may occur. To reduce the potential of crop injury, tank mix EXPRESS herbicide with 2,4-D (ester formulations perform best - see the "TANK MIXTURES" section of this label) and apply after the crop is in the tillering stage of growth.
- Dry, dusty field conditions may result in reduced control in wheel track areas.
- Calibrate sprayers only with clean water away from well sites.
- Make scheduled checks of spray equipment.
- Ensure that all operation employees accurately measure pesticides.
- Mix only enough product for the job at hand.
- Avoid overfilling of spray tank.
- Dilute and agitate excess solution and apply at labeled rates or uses.
- When triple-rinsing the pesticide container, be sure to add the rinsate to the spray mix.

WEED RESISTANCE MANAGEMENT

EXPRESS herbicide, which contains the active ingredient tribenuron-methyl is a group 2 herbicide based on the mode of action classification system of the Weed Science Society of America.

Proactively implementing diversified weed control strategies to minimize selection for weed populations resistant to one or more herbicides is a best practice. A diversified weed management program may include the use of multiple herbicides with different sites of action and overlapping weed spectrum with or without tillage operations and/or other cultural practices. Research has demonstrated that using the labeled rate and directions for use is important to delay the selection for resistance.

The continued effectiveness of this product depends on the successful implementation of a weed resistance management program.

To aid in the prevention of developing weeds resistant to this product, users should:

- Scout fields before application to ensure herbicides and rates will be appropriate for the weed species and weed sizes present.
- Start with a clean field, using either a burndown herbicide application or tillage.

- Control weeds early when they are relatively small (less than 4 inches).
- Apply full rates of EXPRESS herbicide for the most difficult to control weed in the field at the specified time (correct weed size) to minimize weed escapes.
- Scout fields after application to detect weed escapes or shifts in control of weed species.
- Control weed escapes before they reproduce by seed or proliferate vegetatively.
- Report any incidence of non-performance of this product against a particular weed to your FMC representative, local retailer, or county extension agent.
- Contact your FMC representative, crop advisor, or extension agent to find out if suspected resistant weeds to this MOA have been found in your region. If resistant biotypes of target weeds have been reported, use the application rates of this product specified for your local conditions. Tank mix products so that there are multiple effective sites of actions for each target weed.
- If resistance is suspected, treat weed escapes with an herbicide having a site of action other than Group 2 and/or use nonchemical methods to remove escapes, as practical, with the goal of preventing further seed production.
- Suspected herbicide-resistant weeds may be identified by these indicators:
 - Failure to control a weed species normally controlled by the herbicide at the dose applied, especially if control is achieved on adjacent weeds;
 - A spreading patch of non-controlled plants of a particular weed species; and
 - Surviving plants mixed with controlled individuals of the same species.

Additionally, users should follow as many of the following herbicide resistance management practices as is practical:

- Use a broad spectrum soil-applied herbicide with other sites of action as a foundation in a weed control program.
- Utilize sequential applications of herbicides with alternative sites of action.
- Rotate the use of this product with non-Group 2 herbicides.
- Avoid making more than two applications of EXPRESS herbicide and any other Group 2 herbicides within a single growing season unless mixed with an herbicide with a different site of action with an overlapping spectrum for the difficult-to-control weeds.
- Incorporate non-chemical weed control practices, such as mechanical cultivation, crop rotation, cover crops and weed-free crop seeds, as part of an integrated weed control program.
- Use good agronomic principles that enhance crop development and crop competitiveness.
- Thoroughly clean plant residues from equipment before leaving fields suspected to contain resistant weeds.
- Manage weeds in and around fields, during and after harvest to reduce weed seed production.

INTEGRATED PEST MANAGEMENT

This product may be used as part of an Integrated Pest Management (IPM) program that can include biological, cultural, and genetic practices aimed at preventing economic pest damage. IPM principles and practices include field scouting or other detection methods, correct target pest identification, population monitoring, and treating when target pest populations reach locally determined action thresholds. Consult your state cooperative extension service, professional consultants or other qualified authorities to determine appropriate action treatment threshold levels for treating specific pest/crop systems in your area.

APPLICATION INFORMATION

EXPRESS herbicide may be tank mixed with other suitable registered herbicides to control weeds listed as partially controlled, weeds resistant to EXPRESS herbicide or weeds not listed under the "WEEDS CONTROLLED" sections of this label.

TANK MIX INFORMATION

Read and follow all label instructions on timing, precautions, and warnings for any companion products before using these tank mixtures. It is the pesticide user's responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

WHEAT, BARLEY, OATS AND TRITICALE

APPLICATION TIMING

Apply EXPRESS herbicide after the crop is in the 2-leaf stage, but before the flag leaf is visible.

For spring oats, make applications after the crop is in the 3-leaf stage, but before jointing. **Do not** use on "Ogle", "Porter" or "Premier" seed varieties as crop injury may occur.

Since EXPRESS herbicide has very little or no soil activity, it controls only those weeds that have germinated; therefore, apply EXPRESS herbicide when all or most of the weeds have germinated. Annual broadleaf weeds must be past the cotyledon stage, actively growing, and less than 4" tall or wide.

Restriction:

- **Do not** apply to wheat, barley, oats or triticale underseeded with another crop.
- **Do not** apply EXPRESS herbicide to wheat, barley, oats or triticale that is stressed by severe weather conditions, drought, low fertility, water-saturated soil, disease, or insect damage, as crop injury may result. Risk of injury is greatest when crop is in the 2 to 5- leaf stage. Severe winter stress, drought, disease, or insect damage following application also may result in crop injury.
- Grazing, Feeding, and Harvesting
 - Allow at least 7 days between application and grazing of treated forage.
 - Allow at least 7 days between application and feeding of forage (green chop) from treated areas to livestock.
 - Allow at least 30 days between application and feeding of hay from treated areas to livestock.
 - Allow at least 45 days between application and harvesting of grain. Harvested straw may be used for bedding and/or feed.

CEREALS USE RATE

Use EXPRESS herbicide at 0.5 oz/A (0.0156 Lb. ai/A) (except oats) for heavy infestation of those weeds listed under the "WEEDS CONTROLLED" section of this label or when application timing and environmental conditions are marginal (see "BIOLOGICAL ACTIVITY").

Use EXPRESS herbicide at 0.25 (0.0078 Lb. ai/A) to 0.375 oz/A (0.0117 Lb. ai/A) (except oats) for light infestation of the weeds listed under the "WEEDS CONTROLLED" section of this label. Conditions at application shall be optimum for effective treatment of these weeds.

Two applications of EXPRESS herbicide may be made on this crop provided the total amount does not exceed 0.5 oz/A (0.0156 Lb. ai/A) per year.

For oats, apply 0.2 oz/A (0.0063 Lb. ai/A) of EXPRESS herbicide for control of light populations of the weeds listed in Weeds Controlled table. In oats, EXPRESS herbicide must be tank mixed with another registered herbicide. **Do not** make more than one application of EXPRESS herbicide on oats per year.

Restrictions:

Active Ingredient in EXPRESS herbicide: Tribenuron-methyl								
Crop/ Use	Application Timing	Maximum Oz/A of Product per Single Application	Maximum AI Lb./A per Single Application	Maximum Oz/A of Product per-Year	Maximum AI Lb./A per-Year	Maximum Number of Applications per Year	Minimum Treatment Interval (Days)	Pre-Harvest Interval, Days
Wheat, Barley, Triticale	Postemergence	0.5	0.0156	0.5	0.0156	2	14	45 (for grain)
Oats	Postemergence	0.2	0.0063	0.2	0.0063	1	Not Applicable	45 (for grain)

TANK MIXTURES FOR CEREALS

It is the pesticide user's responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

With 2,4-D (amine or ester) or MCP (amine or ester)

EXPRESS herbicide may be tank mixed with 2,4-D and MCP (preferably ester formulations) herbicides for use on wheat, barley, oats and triticale. In tank mixes containing 2,4-D or MCP, add 1 to 2 pt of nonionic surfactant per 100 gallons of spray solution; in tank mixes containing the active ingredients 2,4-D or MCP, add 1 pt of nonionic surfactant per 100 gallons of spray solution.

When using higher rates, use of additional nonionic surfactant may not be needed, unless specified otherwise in the 2,4-D or MCP label, or local guidance.

With 2,4-D or MCP (amine or ester) and Dicamba

EXPRESS herbicide may be applied in a 3-way tank mix with formulations of (Banvel® herbicide, EPA Reg. No. 66330-276/Clarity® herbicide, EPA Reg. No. 7969-137) (active ingredient: dicamba) and 2,4-D or MCP.

Make applications at 0.25 oz/A (0.0078 Lb. ai/A) - 0.5 oz/A (0.0156 Lb. ai/A) of EXPRESS herbicide + (Banvel herbicide, EPA Reg. No. 66330-276/Clarity herbicides, EPA Reg. No. 7969-137) (active ingredient: dicamba) + 2,4-D or MCP (ester or amine) at label rates. Use higher rates when weed infestation is heavy. Add 1-2 pt of nonionic surfactant per 100 gallons of spray solution to the 3-way mixture, where necessary, as deemed by local guidance. Use of additional nonionic surfactant may not be needed with the higher phenoxy rates and ester phenoxy formulations. Consult the specific 2,4-D or MCP and dicamba labels, or local guidance for more information.

Apply this 3-way combination to winter wheat after the crop is tillering and prior to jointing (first node). In Spring Wheat (including Durum), apply after the crop is tillering and before it exceeds the 5-leaf stage.

Do not apply this 3-way mixture at high rates more than once a year, or more than twice per year at the low rates.

With Bromoxynil containing products

EXPRESS herbicide may be tank mixed with bromoxynil containing herbicides registered for use on wheat, barley or triticale. For best results, add bromoxynil containing herbicides to the tank at label rates. Tank mixes of EXPRESS herbicide plus bromoxynil may result in reduced control of Canada thistle.

With fluroxypyr containing products

EXPRESS herbicide may be tank mixed with fluroxypyr containing herbicides for improved control of Kochia (2-4" tall) and other broadleaf weeds. For best results, add fluroxypyr containing herbicides at label rates. 2,4-D and MCP herbicides (preferably ester formulations) may be tank mixed with EXPRESS herbicide plus fluroxypyr.

With Other Broadleaf Control Products

EXPRESS herbicide can be tank mixed with other broadleaf herbicides registered on cereals including HARMONY® SG Herbicide (with TotalSol® soluble granules) (active ingredient: thifensulfuron-methyl, EPA Reg. No. 279-9595), ALLY® XP herbicide (active ingredient: metsulfuron-methyl, EPA Reg. No. 279-9575), WideMatch® herbicide (active ingredients: clopyralid & fluroxypyr, EPA Reg. No. 62719-512), Aim® EC herbicide (active ingredient: carfentrazone-ethyl, EPA Reg. No. 279-3241), Stinger® herbicide (active ingredient: clopyralid, EPA Reg. No. 62719-73), or Curtail® herbicide (active ingredients: clopyralid & 2,4-D, EPA Reg. No. 62719-48).

Tank mixes of EXPRESS herbicide plus metribuzin may result in reduced control of wild garlic.

Tank mixes of EXPRESS herbicide plus (Banvel herbicide, EPA Reg. No. 66330-276/ Clarity herbicide, EPA Reg. No. 7969-137) (active ingredient: dicamba) may result in reduced control of some broadleaf weeds.

With Pinoxaden

EXPRESS herbicide can be tank mixed with Axial® XL herbicide (active ingredient: pinoxaden, EPA Reg. No. 100-1256) for improved control of wild oats and other grasses.

With Clodinafop-propargyl

EXPRESS herbicide can be tank mixed with Discover® NG herbicide (active ingredient: clodinafop-propargyl, EPA Reg. No.100-1173) for improved control of weeds in spring wheat.

With Flucarbazone-sodium

EXPRESS herbicide can be tank mixed with Everest® 3.0 herbicide (active ingredient: flucarbazone-sodium, EPA Reg. No. 66330-429) for improved control of weeds in spring wheat.

With Mesosulfuron-methyl

EXPRESS herbicide can be tank mixed with Osprey® herbicide (active ingredient: mesosulfuron-methyl, EPA Reg. No. 264-802) for improved control of weeds in Fall-sown or winter wheat.

With Pyroxsulam

EXPRESS herbicide can be tank mixed with PowerFlex® HL herbicide (active ingredient: pyroxsulam, EPA Reg. No. 62719-643) for improved control of weeds in winter wheat and triticale.

EXPRESS herbicide can be tank mixed with Simplicity™ CA herbicide (active ingredient: pyroxsulam, EPA Reg. No. 62719-568) for improved control of weeds in spring and winter wheat including durum and triticale.

EXPRESS herbicide can be tank mixed with TeamMate™ herbicide (active ingredient: pyroxsulam, EPA Reg. No. 62719-686) for improved control of weeds in spring and winter wheat including durum and triticale.

With Other Grass Control Products

EXPRESS herbicide can be tank mixed with other grass control herbicides registered on cereals.

With Fungicides

EXPRESS herbicide may be tank mixed or used sequentially with fungicides registered for use on cereal crops.

With Insecticides

EXPRESS herbicide may be tank mixed or used sequentially with insecticides registered for use on cereal crops. However, under certain conditions (drought stress, or if the crop is in the 2-4 leaf stage), tank mixes or sequential applications of EXPRESS herbicide with organophosphate insecticides may produce temporary crop yellowing or, in severe cases, crop injury. The potential for crop injury is greatest when wide fluctuations in day/night temperatures occur just prior to or soon after application.

Test these mixtures in a small area before treating large areas.

Restriction:

- **Do not** apply EXPRESS herbicide within 60 days of crop emergence where an organophosphate insecticide has been applied as an in-furrow treatment because crop injury may result.
- **Do not** use EXPRESS herbicide plus Malathion because crop injury may result.

With Liquid Nitrogen Solution Fertilizer

Liquid nitrogen fertilizer solutions may be used as a carrier in place of water. Run a tank mix compatibility test before mixing EXPRESS herbicide in fertilizer solution. EXPRESS herbicide must first be slurried with water and then added to liquid nitrogen solutions (e.g., 28-0-0, 32-0-0). Ensure that the agitator is running while the EXPRESS herbicide is added. Use of this mixture may result in temporary crop yellowing and stunting.

If using low rates of liquid nitrogen fertilizer in the spray solution (less than 50% of the spray solution volume), the addition of surfactant is necessary. Add surfactant at 0.5 pt - 1 qt per 100 gal of spray solution (0.06 -0.25% v/v) based on local guidance.

When using high rates of liquid nitrogen fertilizer solution in the spray solution, adding surfactant increases the risk of crop injury. If 2,4-D or MCP is included with EXPRESS herbicide and fertilizer mixture, ester formulations tend to be more compatible (see manufacturer's label). Additional surfactant may not be needed when using EXPRESS herbicide in tank mix with 2,4-D ester or MCP ester and liquid nitrogen fertilizer solutions. Consult your agricultural dealer, consultant, field advisor, or FMC representative for guidance before adding an adjuvant to these tank mixtures.

Note: In certain areas east of the Mississippi river unacceptable crop response may occur with use of straight or dilute nitrogen fertilizer carrier solutions where cold temperatures or widely fluctuating day/night temperatures exist. In these areas consult your agricultural dealer, consultant, field advisor, or FMC representative for guidance before using nitrogen fertilizer carrier solutions.

Restriction: Do not use low rates of liquid nitrogen fertilizer solution as a substitute for a surfactant. Liquid nitrogen fertilizer solutions that contain sulfur may increase crop response.

Restriction: Do not use with liquid fertilizer solutions with a pH less than 3.0.

BURNDOWN - POST HARVEST, FALLOW, PRE-PLANT

APPLICATION TIMING

EXPRESS herbicide may be used as a burndown treatment when the majority of weeds have emerged and are actively growing. EXPRESS herbicide may be applied to crop stubble, as a fallow treatment, or as a pre-plant burndown prior to planting any crop. See "CROP ROTATION" for the minimum interval allowed between the burndown application and when a crop may be planted.

BURNDOWN USE RATE

Apply 0.25 oz/A (0.0078 Lb. ai/A) to 0.5 oz/A (0.0156 Lb. ai/A) of EXPRESS herbicide as a burndown treatment prior to planting any crop (except cotton), or shortly after planting wheat (including durum), barley or triticale (prior to emergence). Use the 0.5 oz/A (0.0156 Lb. ai/A) rate when weed infestation is heavy or predominantly consists of those weeds listed under the "Weeds Partially Controlled" section of this label, or when application timing and environmental conditions are marginal.

See "CROP ROTATION" for the minimum interval allowed between the burndown application and when a crop may be planted.

Sequential treatments of EXPRESS herbicide may also be made provided the total amount of EXPRESS herbicide applied during one post harvest/fallow/pre-plant time period does not exceed 0.5 oz/A (0.0156 Lb. ai/A).

Apply EXPRESS herbicide in combination with other suitable registered burndown herbicides (See the "TANK MIXTURES" section of this label for additional information).

For cotton, apply 0.25 oz/A (0.0078 Lb. ai/A) of EXPRESS herbicide as a burndown treatment any time up to 14 days prior to planting. Seedling disease, nematodes, cold weather, deep planting (more than 2"), excessive moisture, high salt concentration, and/or drought may weaken cotton seedlings and increase the possibility of crop injury. Cotton resumes normal growth once favorable growing conditions return.

Restrictions:

Active Ingredient in EXPRESS herbicide: Tribenuron-methyl								
Crop/ Use	Application Timing	Maximum Oz/A of Product per Single Application	Maximum AI Lb./A per Single Application	Maximum Oz/A of Product per-Year	Maximum AI Lb./A per-Year	Maximum Number of Applications per Year	Minimum Treatment Interval (Days)	Pre-Harvest Interval, Days
Fallow, Burndown, Post-Harvest	-----	0.5	0.0156	0.5	0.0156	2	14	--
Burndown Prior to Cotton Seedling	-----	0.25	0.0078	0.25	0.0078	2	14	--
Soybeans	pre-plant & burndown, Post-harvest	1	0.0313	1	0.0313	1	Not Applicable	--
Field Corn	Pre-plant & burndown, Post-Harvest	1	0.0313	1	0.0313	1	Not applicable	--

TANK MIXTURES IN BURNDOWN APPLICATIONS

It is the pesticide user's responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

EXPRESS herbicide may be tank mixed with one or more herbicides that are registered for use at the appropriate burndown timing, including glyphosate, 2,4-D, and dicamba. Read and follow all label instructions on timing, precautions, and warnings for any companion products before using these tank mixtures.

DUPONT™ EXPRESSSUN® SUNFLOWERS

EXPRESS herbicide is intended for application only to sunflowers with the ExpressSun® trait. Apply only on sunflowers labeled ExpressSun® and warranted by the seed supplier to not be sensitive to direct application of EXPRESS herbicide. **DO NOT** apply EXPRESS herbicide to sunflowers that are not labeled ExpressSun®.

APPLICATION TIMING

Apply EXPRESS herbicide to ExpressSun® sunflowers any time from the 2-leaf stage of growth up to but not including the bud formation stage.

Temporary crop yellowing may be observed shortly after application of EXPRESS herbicide, especially when applied to crops growing under environmentally stressful conditions.

Depending upon rainfall or other environmental conditions, annual weeds may have a second flush of germinating seedlings. To maximize control of such weeds, it may be necessary to apply EXPRESS herbicide again, 14 or more days after the prior application.

Application to ExpressSun® sunflowers that are, or have been, stressed by severe weather conditions, frost, abnormally hot or cold or wet or dry conditions, low fertility, drought, water saturated soil, disease and/or insect damage prior to application may result in crop injury. If the above stress conditions are expected to occur within 3 days after application of

EXPRESS herbicide to ExpressSun® sunflowers, crop injury may also occur.

Restriction:

- **Do not** apply EXPRESS herbicide within 70 days of sunflower harvest.
- **Do not** apply EXPRESS herbicide to ExpressSun® sunflower fields in which germination is uneven (i.e., some plants are outside the specified leaf stage for application), as crop injury may result.
- The combined rate of the postemergence applications cannot exceed 1.0 oz/A (0.0313 Lb. ai/A) of EXPRESS herbicide per year.
- **Do not** apply EXPRESS herbicide within 60 days of crop emergence where an organophosphate insecticide has been applied as an in- furrow treatment because crop injury may result.
- **Do not** use EXPRESS herbicide plus Malathion because crop injury may result

EXPRESSSUN® SUNFLOWER USE RATE

Apply EXPRESS herbicide at a rate of 0.25 oz/A (0.0078 Lb. ai/A) to 0.5 oz/A (0.0156 Lb. ai/A). Use the 0.5 oz/A (0.0156 Lb. ai/A) rate when weed infestation is heavy or predominantly consists of those weeds listed under the "Weeds Partially Controlled" section of this label, or when application timing and environmental conditions are marginal.

Restriction: Do not apply more than 1.0 oz/A (0.0313 Lb. ai/A) of EXPRESS herbicide postemergence per year.

CULTIVATION

A timely cultivation may be necessary to control suppressed weeds, weeds that were beyond the maximum size at application, and/or weeds that emerge after an application of EXPRESS herbicide.

- Cultivation up to 7 days before the postemergence application of EXPRESS herbicide may decrease weed control by pruning weed roots, placing the weeds under stress, and/or covering the weeds with soil and preventing coverage by EXPRESS herbicide.
- **Restriction: Do not** cultivate for 7 days after application to allow EXPRESS herbicide to fully control treated weeds.
- Optimum timing for cultivation is 7 – 14 days after a postemergence application of EXPRESS herbicide.

Restrictions:

Active Ingredient in EXPRESS herbicide: Tribenuron-methyl								
Crop/ Use	Application Timing	Maximum Oz/A of Product per Single Application	Maximum AI Lb./A per Single Application	Maximum Oz/A of Product per-Year	Maximum AI Lb./A per-Year	Maximum Number of Applications per Year	Minimum Treatment Interval (Days)	Pre-Harvest Interval, Days
DuPont™ ExpressSun® Sunflowers	Postemergence	0.5	0.0156	1	0.0313	2	14	70
	Do not use other products that contain tribenuron-methyl.							

TANK MIXTURES FOR DUPONT™ EXPRESSSUN® SUNFLOWERS

It is the pesticide user’s responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

For the control of annual grasses, apply a grass herbicide such as DuPont™ ASSURE® II herbicide (active ingredient: quizalofop p-ethyl, EPA Reg. No. 352-541) (refer to the ASSURE® II product labeling for use rates, weed size, adjuvant selection, precautions, and restrictions). For maximum performance, apply ASSURE® II Herbicide at least one day before, or seven days after, the application of EXPRESS herbicide.

GRASS GROWN FOR SEED (in the states of ID, OR, UT, WA)

EXPRESS herbicide may be used for selective postemergence control or suppression of certain broadleaf weeds in seedling and established stands of bentgrass, bluegrass, annual ryegrass, orchardgrass, tall fescue, and fine fescue grown for seed.

EXPRESS herbicide may be used on seedling and established perennial ryegrass providing user accepts all risk of possible crop injury and/or reduced seed yield.

EXPRESS herbicide may cause temporary yellowing and stunting of grass. Certain varieties of grass may be sensitive to EXPRESS herbicide. When using EXPRESS herbicide for the first time on a particular variety, limit use to a small area.

Apply EXPRESS herbicide in combination with other suitable registered herbicides (See the "TANK MIXTURES" section of this label for additional information). Always use a nonionic surfactant of at least 80% active ingredient at the rate of 0.25% v/v (1 qt per 100 gal of spray solution).

Restrictions:

Do not apply more than 0.5 oz/A (0.0156 Lb. ai/A) of EXPRESS herbicide per year.

Do not apply EXPRESS herbicide in a tank mix with organophosphate insecticides as severe crop injury may occur.

Do not apply to grass that is under stress from severe weather conditions, drought, low fertility, water saturated soil, disease or insect damage, as crop injury may result. Under certain conditions such as prolonged cool weather (daily high temperature less than 50° F) or wide fluctuations in day/night temperatures just prior to or soon after treatment, temporary yellowing and/or crop stunting may occur.

Active Ingredient in EXPRESS herbicide: Tribenuron-methyl								
Crop/ Use	Application Timing	Maximum Oz/A of Product per Single Application	Maximum AI Lb./A per Single Application	Maximum Oz/A of Product per-Year	Maximum AI Lb./A per-Year	Maximum Number of Applications per Year	Minimum Treatment Interval (Days)	Pre-Harvest Interval, Days
Grass Grown for Seed: • Seedling stands of annual ryegrass, orchardgrass, fine fescue & tall fescue • Seedling stands of bentgrass • Seedling stands of perennial ryegrass	Postemergence	0.25	0.0078	0.25	0.0078	1	Not Applicable	Not Applicable
Grass Grown for Seed: • Seedling stands of bluegrass • Established stands of bentgrass, bluegrass, annual ryegrass, orchardgrass, fine fescue & tall fescue • Established stands of perennial ryegrass	Postemergence	0.5	0.0156	0.5	0.0156	1	Not Applicable	Not Applicable

TANK MIXTURES FOR GRASS GROWN FOR SEED

It is the pesticide user’s responsibility to ensure that all products are registered for the intended use. Read and follow the applicable restrictions and limitations and directions for use on all product labels involved in tank mixing. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

Always use EXPRESS herbicide in a tank mix with another broadleaf herbicide such as 2,4-D, MCP or dicamba as these herbicides safen the effects of EXPRESS herbicide on grasses while improving weed control performance on most broadleaf weeds. Testing has shown that 2,4-D and dicamba are more effective in a tank mix with EXPRESS herbicide than MCP.

EXPRESS herbicide can be applied with liquid fertilizers. Liquid fertilizers (20%, 28%, 32% N at a minimum of 4 gal/100 gal of spray solution) enhance the performance of EXPRESS herbicide and may improve crop safety. Always use a surfactant and another broadleaf herbicide when using liquid fertilizer with EXPRESS herbicide.

BENTGRASS, BLUEGRASS, ANNUAL RYEGRASS, ORCHARDGRASS, FINE FESCUE AND TALL FESCUE

Seedling Stands: For use on annual ryegrass, orchard grass, tall fescue and fine fescue, apply at 0.25 oz/A (0.0078 Lb. ai/A) after stand is in 4-leaf stage. For use on bentgrass, apply at 0.25 oz/A (0.0078 Lb. ai/A) after stolens are 3 to 5 inches across. For use on bluegrass, apply at 0.25 oz/A (0.0078 Lb. ai/A) to 0.5 oz/A (0.0156 Lb. ai/A) after stand is in the 4-leaf stage.

Established Stands: For stands that have been established for at least one growing season (fall or spring), apply EXPRESS herbicide at 0.25 oz/A (0.0078 Lb. ai/A) to 0.5 oz/A (0.0156 Lb. ai/A). Use the higher rate for larger weeds and hard to control weeds like wild carrot. Apply prior to jointing.

PERENNIAL RYEGRASS

Perennial ryegrass is more sensitive to EXPRESS herbicide than other grass species. Crop injury in the form of stunting and possible reduced seed yield may occur. To minimize the risk of crop injury, use the 0.25 oz/A (0.0078 Lb.

ai/A) rate and always use either 2,4-D or dicamba and liquid nitrogen with EXPRESS herbicide.

Seedling Stands: Apply EXPRESS herbicide at 0.25 oz/A (0.0078 Lb. ai/A) in a tank mix with another suitable broadleaf herbicide after grass is in the 5- to 6-leaf stage.

Established Stands: For stands that have been established for one growing season (fall or spring) apply EXPRESS herbicide at 0.25 oz/A (0.0078 Lb. ai/A) to 0.5 oz/A (0.0156 Lb. ai/A) in a tank mix with another suitable broadleaf herbicide. Apply prior to jointing.

Note: Use the 0.5 oz/A (0.0156 Lb. ai/A) rate of EXPRESS herbicide only for the control or suppression of problem weeds like wild carrot where the benefit of weed control may offset by possible crop injury including possible yield reduction.

WEED CONTROL INFORMATION

WEEDS CONTROLLED

EXPRESS herbicide effectively controls the following weeds when used according to label directions:

Black mustard	Marestail***†
Blue/Purple mustard	Marshelder†
Bushy wallflower/Treacle mustard†	Mayweed chamomile/Stinking chamomile/dog fennel (<i>Anthemis cotula</i> L.)***†
Canada thistle**	Miners lettuce
Coast fiddleneck	Narrowleaf hawksbeard** ***
Common Chickweed†	Nightflowering catchfly
Common Groundsel	Pineappleweed
Common Lambsquarters†	Poison hemlock***
Common Purslane	Prickly lettuce***†
Corn, Gromwell**	Puncturevine
Corn spurry	Purslane speedwell (@ 0.5 oz/A, 0.0156 Lb. ai/A)***
Cowcockle	Redroot pigweed†
Cressleaf groundsel *** (butterweed)	Russian thistle***†
Curly Dock**	Shepherd's-purse
Dandelion	Slimleaf lambsquarters
Deadnettle††	Small-flower buttercup (@ 0.5 oz/A, 0.0156 Lb. ai/A)***
Early whitflowgrass	Smallseed falseflax†
False chamomile/Wild chamomile/Scentless chamomile (<i>Matricaria maritima</i> L.)	Tansymustard
Field pennycress	Tarweed fiddleneck
Flixweed†	Tumble pigweed (@ 0.5 oz/A, 0.0156 Lb. ai/A)
Hairy buttercup	Tumble/Jim Hill mustard**
Kochia***†	White cockle (@ 0.5 oz/A, 0.0156 Lb. ai/A)
London Rocket	Wild mustard†

WEEDS PARTIALLY CONTROLLED*

EXPRESS herbicide partially controls the following weeds when used according to label directions:

Annual sowthistle	Pennsylvania smartweed
Burning Nettle**	Prostrate knotweed
Common cocklebur†	Redmaids
Common sunflower (volunteer)***†	Redstem filaree ***
Common vetch**	Wild buckwheat
Eastern black nightshade†	Wild carrot
Hairy nightshade	Wild garlic
Hairy vetch**	Wild radish**
Henbit	

* Partially controlled weeds exhibit a visual reduction in numbers as well as a significant loss of vigor. For better results, use 0.375 (0.0117 Lb. ai/A) to 0.5 oz/A (0.0156 Lb. ai/A) of EXPRESS herbicide and include a tank mix partner including 2,4-D, MCP, bromoxynil or dicamba. See the "TANK MIXTURES" section of this label.

** See the Specific Weed Instructions section of this label for more information.

***2,4-D LVE addition required.

† Naturally occurring resistant biotypes are known to occur.

†† 0.5 oz/A (0.0156 Lb. ai/A) EXPRESS herbicide only

SPECIFIC WEED INSTRUCTIONS

Burning Nettle: For best results, apply 0.5 oz/A (0.0156 Lb. ai/A) of EXPRESS herbicide in a tank mix with Aim EC herbicide, EPA Reg. No. 279-3241 / Shark® EW herbicide, EPA Reg. No. 279-3242 (active ingredient: carfentrazone-ethyl) or ET® herbicide (active ingredient: pyraflufen-ethyl, EPA Reg. No. 71711-7) to small actively growing weeds less than 4" tall.

Canada thistle: For best results, apply 0.5 oz/A (0.0156 Lb. ai/A) of EXPRESS herbicide when all thistles are 4" to 8" with 2" to 6" of new growth. Make the application in the spring.

Corn Gromwell : For best results, apply 0.5 oz/A (0.0156 Lb. ai/A) of EXPRESS herbicide in combination with 2,4-D or MCP (refer to the Tank Mixtures section of this label).

Curly Dock: For best results, apply 0.375 oz/A (0.0117 Lb. ai/A) to 0.5 oz/A (0.0156 Lb. ai/A) of EXPRESS herbicide in combination with 2,4-D or MCP (refer to the Tank Mixtures section of this label).

Kochia: For best results, apply EXPRESS herbicide in a tank mix with Starane® Ultra herbicide (EPA Reg. No. 62719-577, Starane Ultra herbicide + Salvo® herbicide (active ingredient: 2,4-D, EPA Reg. No. 34704-609), Starane Ultra herbicide (active ingredient: fluroxypyr) + Sword® herbicide (active ingredient: MCPA, EPA Reg. No. 228-267-34704), (Banvel herbicide, EPA Reg. No. 66330-276/ Clarity herbicide, EPA Reg. No. 7969-137) (active ingredient: dicamba) and 2,4-D or MCP (ester or amine), or bromoxynil containing products.

Apply EXPRESS herbicide in the spring when kochia is less than 2" tall and is actively growing (refer to the Tank Mixtures section of this label for additional details on rates and restrictions).

Mayweed chamomile/Stinking Chamomile/dog fennel: For best results, apply 0.375 oz/A (0.0117 Lb. ai/A) to 0.5 oz/A (0.0156 Lb. ai/A) of EXPRESS herbicide.

Narrowleaf hawksbeard: During the post harvest, fallow, and/or pre-plant burndown period, EXPRESS herbicide may be used in a tank mix with DuPont™ ABUNDIT® Edge herbicide (active ingredient: glyphosate, EPA Reg. No. 352-922) (at labeled rates) for postemergence control of narrowleaf hawksbeard.

For wheat, EXPRESS herbicide may be used in a tank mix with 2,4-D for postemergence control of narrowleaf hawksbeard. Apply this tank mix only in the spring when the wheat is fully tillered and before the jointing stage.

Russian thistle, Prickly lettuce: For best results, use EXPRESS herbicide in a tank mix with (Banvel herbicide, EPA Reg. No. 66330-276 / Clarity herbicide, EPA Reg. No. 7969-137) (active ingredient: dicamba) and 2,4-D or MCP (ester or amine), or bromoxynil containing products.

Apply EXPRESS herbicide in the spring when Russian thistle, and prickly lettuce are less than 2" tall or 2" across and are actively growing (refer to the Tank Mixtures section of this label for additional details on rates and restrictions).

Tumble/Jim Hill mustard: For best results, apply 0.5 oz/A (0.0156 Lb. ai/A) of EXPRESS herbicide in combination with 2,4-D or MCP (refer to the Tank Mixtures section of this label).

Vetch (common and hairy): For best results, apply 0.375 oz/A (0.0117 Lb. ai/A) to 0.5 oz/A (0.0156 Lb. ai/A) of EXPRESS herbicide when vetch is less than 6" in length. For severe infestations of vetch, or when vetch is greater than 6" in length, apply EXPRESS herbicide in combination with 2,4-D or MCP (refer to the Tank Mixtures section of this label).

Wild radish: For best results, apply 0.25 oz/A (0.0078 Lb. ai/A) - 0.5 oz/A (0.0156 Lb. ai/A) EXPRESS herbicide plus MCP plus 0.25% v/v nonionic surfactant (1 qt per 100 gal of spray solution) to wild radish rosettes less than 6" diameter. Make the application either in the fall or spring. Applications made later than 30 days after weed emergence will result in partial control. Make applications in the fall before plants harden-off.

Volunteer ExpressSun® Sunflowers: For best results, use EXPRESS herbicide in a tank mix with Starane Ultra herbicide (active ingredient: fluroxypyr, EPA Reg. No. 62719-577), Starane Ultra herbicide + Salvo® herbicide (active ingredient: 2,4-D, EPA Reg. No. 34704-609) , Starane Ultra herbicide + Sword herbicide (active ingredient: MCPA, EPA Reg. No. 267-34704), or (Banvel herbicide, EPA Reg. No. 66330-276/ Clarity herbicide, EPA Reg. No. 7969-137) (active ingredient: dicamba) and 2,4-D or MCP (ester or amine), or bromoxynil containing products.

SPRAY ADJUVANTS - ALL CROPS OR USES

Include a spray adjuvant with applications of EXPRESS herbicide. In addition, an ammonium nitrogen fertilizer may be used.

Consult your Ag dealer or applicator, local FMC fact sheets and technical bulletins prior to using an adjuvant system. If another herbicide is tank mixed with EXPRESS herbicide, select adjuvants authorized for use with both products. Products must contain only EPA-exempt ingredients.

NONIONIC SURFACTANT (NIS)

- Apply 0.06 to 0.50% v/v (0.5 pt to 4 pt per 100 gal of spray solution).
- Surfactant products must contain at least 60% nonionic surfactant with a hydrophilic/lipophilic balance (HLB) greater than 12.

CROP OIL CONCENTRATE (COC) - PETROLEUM OR MODIFIED SEED OIL (MSO)

- Apply at 1% v/v (1 gal per 100 gal spray solution) or 2% under arid conditions. MSO adjuvants may be used at 0.5% v/v if specified on local FMC product literature or service policies.
- Oil adjuvants must contain at least 80% high quality, petroleum (mineral) or modified vegetable seed oil with at least 15% surfactant emulsifiers.

AMMONIUM NITROGEN FERTILIZER

- Use 2 qt/A of a high-quality urea ammonium nitrate (UAN), such as 28%N or 32%N, or 2 lb/A of a spray-grade ammonium sulfate (AMS). Use 4 qt/A UAN or 4 lb/A AMS under arid conditions.
- See TANK MIXTURES With Liquid Nitrogen Fertilizer for instructions on using fertilizer as a carrier in place of water.

SPECIAL ADJUVANT TYPES

- Combination adjuvant products may be used at doses that provide the required amount of NIS, COC, MSO and/or ammonium nitrogen fertilizer. Consult product literature for use rates and restrictions.
- In addition to the adjuvants specified above, other adjuvant types may be used if they provide the same functionality and have been evaluated and approved by FMC product management. Consult separate FMC technical bulletins for detailed information before using adjuvant types not specified on this label.

CROP ROTATION

Labeled crops may be planted at specified time intervals following application of labeled rates of EXPRESS herbicide. Use the time intervals listed below to determine the required time interval before planting.

Time Interval Before Planting* (days after treatment with EXPRESS herbicide)

Crop	Days
Barley, Rice, Triticale, ExpressSun® sunflowers and Wheat (including durum)	0
Oats and Soybeans (at EXPRESS herbicide rate of 0.25 oz/A) (0.0078 Lb. ai/A)	1**
Soybeans	7**
Cotton, Field Corn, and Grain/forage, Sorghum	14**
Sugarbeets, Winter Rape, and Canola	60
Any other crop	45

* Refer to individual product labels to determine rotational crop restrictions when tank mixtures are used.

**Where EXPRESS herbicide is used on light textured soils (including sands and loamy sands) or on high pH soils (>7.9), extend time to planting by 7 additional days.

MIXING INSTRUCTIONS

PRODUCT MEASUREMENT

EXPRESS herbicide can be measured using the EXPRESS herbicide volumetric measuring cylinder provided by FMC. The degree of accuracy of this cylinder varies by $\pm 7.5\%$. For more precise measurement, use scales calibrated in ounces.

MIXING

1. Fill the tank 1/4 to 1/3 full of water.
2. While agitating, add the required amount of EXPRESS herbicide.
3. Continue agitation until the EXPRESS herbicide is fully dispersed, at least 5 minutes.
4. Once the EXPRESS herbicide is fully dispersed, maintain agitation and continue filling tank with water. Thoroughly mix EXPRESS herbicide with water before adding any other material.
5. As the tank is filling, add tank mix partners (if desired) then add the required volume of spray adjuvant. Always add spray adjuvant last. Antifoaming agents may be used. Do not use with spray additives that alter the pH of the spray solution below pH 6.0 as rapid product degradation can occur. Spray solutions of pH 7.0 and higher allow for optimum stability of EXPRESS herbicide.

6. If the mixture is not continuously agitated, settling will occur. If settling occurs, thoroughly re-agitate before using.
7. Apply EXPRESS herbicide spray mixture within 24 hours of mixing to avoid product degradation.
8. If EXPRESS herbicide and a tank mix partner are to be applied in multiple loads, pre-slurry the EXPRESS herbicide in clean water prior to adding to the tank. This will prevent the tank mix partner from interfering with the dissolution of the EXPRESS herbicide.

SPRAY EQUIPMENT

Be sure to calibrate air or ground equipment properly before application. Select a spray volume and delivery system that will ensure thorough coverage and a uniform spray pattern with minimum drift. Use higher spray volumes to obtain better coverage when crop canopy is dense. Avoid swath overlapping, and shut off spray booms while starting, turning, slowing, or stopping, to avoid injury to the crop.

For additional information on spray drift refer to Spray Drift Management section of label.

Continuous agitation is not required to keep EXPRESS herbicide in suspension but may be required to keep tank mix partners in solution or suspension. Refer to tank mix partner labels for additional information.

BEFORE SPRAYING EXPRESS HERBICIDE

The spray equipment must be clean before EXPRESS herbicide is sprayed. Follow the cleanup procedures specified on the labels of the previously applied products. If no directions are provided, follow the four steps outlined in the After Spraying EXPRESS herbicide section of this label.

AT THE END OF THE DAY

When multiple loads of EXPRESS herbicide are applied, it is specified that at the end of each day of spraying the interior of the tank be rinsed with fresh water and then partially filled, and the boom and hoses flushed. This will prevent the buildup of dried pesticide deposits which can accumulate in the application equipment.

AFTER SPRAYING EXPRESS HERBICIDE AND BEFORE SPRAYING CROPS OTHER THAN WHEAT, BARLEY, OATS, AND TRITICALE

To avoid subsequent injury to desirable crops, thoroughly clean all mixing and spray equipment immediately following applications of EXPRESS herbicide as follows:

1. Empty the tank and drain the sump completely.
2. Spray the tank walls with clean water using a minimum volume of 10% of the tank volume. Circulate the water through the lines, including all by-pass lines, for at least two minutes. Flush the boom well and empty the sprayer. Completely drain the sump.
3. Repeat step 2.
4. Remove the nozzles and screens and clean separately in a bucket containing water. The rinsate solution may be applied back to the crop(s) specified on this label. If cleaners are used, consult the cleaner label for rinsate disposal instructions. If no instructions are given, dispose of the rinsate on site or at an approved waste disposal facility.

Notes:

1. Steam-cleaning aerial spray tanks is required to facilitate the removal of any caked deposits.
2. When EXPRESS herbicide is tank mixed with other pesticides, examine all cleanout procedures for each product and follow the most rigorous procedure.
3. Follow any pre-cleanout guidelines on other product labels.

GROUND APPLICATION

For optimum spray distribution and thorough coverage, use flat-fan or low-volume flood nozzles.

- Overlaps or starting, stopping, slowing, and turning while spraying may result in crop injury.
- For flat-fan nozzles, use a spray volume of at least 5 gal/A (GPA).
- For flood nozzles on 30" spacing, use flood nozzles no larger than TK10 (or the equivalent), a pressure of at least 30 psi and a spray volume of at least 10 GPA only. For 40" nozzle spacing, use at least 13 GPA; for 60" spacing use at least 20 GPA. It is essential to overlap the nozzles 100% for all spacings.
- Raindrop® RA nozzles are not suitable for EXPRESS herbicide applications, as weed control performance may be reduced.
- Use screens that are 50-mesh or larger.

For application in California refer to the "CALIFORNIA APPLICATION REQUIREMENTS" section of this label for specific ground application requirements.

AERIAL APPLICATION

For aerial application, select nozzles and pressure that provide optimum spray distribution and maximum coverage at 2 to 5 GPA.

Use at least 2 GPA. In Idaho, Oregon and Utah use at least 3 GPA.

Do not apply EXPRESS herbicide by air in the state of New York.

See the **Spray Drift Management** section of this label.

For application in California refer to the "CALIFORNIA APPLICATION REQUIREMENTS FOR PROTECTION OF SENSITIVE CROPS" section of this label for specific aerial application requirements.

CHEMIGATION

EXPRESS herbicide may be applied through sprinkler irrigation systems in the State of Idaho for use in fall-seeded wheat, spring seeded barley and spring seeded wheat. Use 0.375 oz/A (0.0117 Lb. ai/A) to 0.5 oz/A (0.0156 Lb. ai/A) of EXPRESS herbicide in combination with bromoxynil containing herbicides. Apply to wheat and barley after the 3-leaf stage but before the flag leaf is visible. Make only one chemigation application of this tank mixture per year. For best results, apply to broadleaf weeds up to the 4-leaf stage, or 2 inches in height or 1 inch in diameter, whichever comes first.

Apply this tank mix through sprinkler irrigation systems including center pivot, lateral move, side (wheel) roll, solid set or hand move irrigation systems only. **Do not** apply these herbicides through any other type of irrigation system.

Crop injury, lack of effectiveness, or illegal pesticide residues in the crop can result from non-uniform distribution of treated water. If you have questions about calibration, contact State Extension Service specialists, equipment manufacturers or other experts. **Do not** connect an irrigation system (including greenhouse systems) used for EXPRESS herbicide application to any public water system. 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 sprinkler chemigation 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 back flow. 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. 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.

CHEMIGATION REQUIREMENTS

1. In center pivot and continuous lateral move systems, apply EXPRESS herbicide + bromoxynil containing herbicides continuously for the duration of the water application. In solid set systems, apply the tank mix during the last 30 to 45 minutes of the irrigation.
2. Set the sprinkler system to deliver approximately 0.5 inch or less of water/A for best product performance.
3. Fill the supply tank with half of the water amount desired, add the EXPRESS herbicide and agitate it well. Add the bromoxynil containing herbicide and then add the remaining water amount with agitation. Bromoxynil containing herbicides require a dilution with at least 4 parts water to 1 part bromoxynil containing herbicide.
4. Agitation is required in the pesticide supply tank when applying this tank mix.
5. Inject the EXPRESS herbicide + bromoxynil containing herbicides solution at least 8 feet ahead of a right angle turn of irrigation pipe to insure adequate mixing. Allow sufficient time for the herbicide mixture to be flushed through the lines before turning off irrigation water.
6. Follow both EXPRESS herbicide and bromoxynil containing herbicides label instructions for spray tank cleanout both before and after application. Flush lines with clean water following application.
7. **Do not** apply when wind speed favors drift beyond the area intended for treatment. Avoiding spray drift is the responsibility of the applicator.

MANDATORY SPRAY DRIFT

Ground Boom Applications:

- Apply with the nozzle height recommended by the manufacturer, but no more than 3 feet above the ground or crop canopy.
- For applications prior to the emergence of crops and target weeds, applicators are required to use a Coarse or coarser droplet size (ASABE S572.1).
- For all other applications, applicators are required to use a Medium or coarser droplet size (ASABE S572.1).
- Do not apply when wind speeds exceed 10 miles per hour at the application site.
- Do not apply during temperature inversions.

SPRAY DRIFT

Aerial Applications:

- Do not release spray at a height greater than 10 feet above the vegetative canopy, unless a greater application height is necessary for pilot safety.
- For applications prior to the emergence of crops and target weeds, applicators are required to use a Coarse or coarser droplet size (ASABE S572.1).
- For all other applications, applicators are required to use a Medium or coarser droplet size (ASABE S572.1).
- The boom length must not exceed 65% of the wingspan for airplanes or 75% of the rotor blade diameter for helicopters.
- Applicators must use one-half swath displacement upwind at the downwind edge of the field.
- Nozzles must be oriented so the spray is directed toward the back of the aircraft.
- Do not apply when wind speeds exceed 10 miles per hour at the application site.
- Do not apply during temperature inversions.

SPRAY DRIFT MANAGEMENT ADVISORIES

THE APPLICATOR IS RESPONSIBLE FOR AVOIDING OFF-SITE SPRAY DRIFT.
BE AWARE OF NEARBY NON-TARGET SITES AND ENVIRONMENTAL CONDITIONS.

IMPORTANCE OF DROPLET SIZE

An effective way to reduce spray drift is to apply large droplets. Use the largest droplets that provide target pest control. While applying larger droplets will reduce spray drift, the potential for drift will be greater if applications are made improperly or under unfavorable environmental conditions.

Controlling Droplet Size – Ground Boom

- Volume - Increasing the spray volume so that larger droplets are produced will reduce spray drift. Use the highest practical spray volume for the application. If a greater spray volume is needed, consider using a nozzle with a higher flow rate.
- Pressure - Use the lowest spray pressure recommended for the nozzle to produce the target spray volume and droplet size.
- Spray Nozzle - Use a spray nozzle that is designed for the intended application. Consider using nozzles designed to reduce drift.

Controlling Droplet Size – Aircraft

- Adjust Nozzles - Follow nozzle manufacturers recommendations for setting up nozzles. Generally, to reduce fine droplets, nozzles should be oriented parallel with the airflow in flight.

BOOM HEIGHT – Ground Boom

Use the lowest boom height that is compatible with the spray nozzles that will provide uniform coverage. For ground equipment, the boom should remain level with the crop and have minimal bounce.

RELEASE HEIGHT - Aircraft

Higher release heights increase the potential for spray drift. When applying aurally to crops, do not release spray at a height greater than 10 ft above the crop canopy, unless a greater application height is necessary for pilot safety.

SHIELDED SPRAYERS

Shielding the boom or individual nozzles can reduce spray drift. Consider using shielded sprayers. Verify that the shields are not interfering with the uniform deposition of the spray on the target area.

TEMPERATURE AND HUMIDITY

When making applications in hot and dry conditions, use larger droplets to reduce effects of evaporation.

TEMPERATURE INVERSIONS

Drift potential is high during a temperature inversion. Temperature inversions are characterized by increasing temperature with altitude and are common on nights with limited cloud cover and light to no wind. The presence of an inversion can be indicated by ground fog or 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. Avoid applications during temperature inversions.

WIND

Drift potential generally increases with wind speed. **AVOID APPLICATIONS DURING GUSTY WIND CONDITIONS.** Applicators need to be familiar with local wind patterns and terrain that could affect spray drift.

HANDHELD TECHNOLOGY APPLICATIONS:

- Take precautions to minimize spray drift

DRIFT CONTROL ADDITIVES

Using product compatible drift control additives can reduce drift potential. When a drift control additive is used, read and carefully observe cautionary statements and all other information on the additive's label. If using an additive that increases viscosity, ensure that the nozzles and other application equipment will function properly with a viscous spray solution. Preferred drift control additives have been certified by the Council of Producers & Distributors of Agrotechnology (CPDA).

CALIFORNIA APPLICATION REQUIREMENTS FOR PROTECTION OF TOMATO, CUCUMBER, SUGARBEET, OTHER BROADLEAF CROPS, AND TREE & VINE CROPS

Review the required "MANDATORY SPRAY DRIFT" section for all states before applying in California, the below requirements are in addition, duplicative or more restrictive when applying near listed crops in California.

The following drift management requirements must be followed to minimize the potential for exposure of sensitive crops.

Determine the prevailing wind speed and direction before application.

SPRAY QUALITY

Apply with nozzles that give a coarse droplet size spectrum (volume median diameter (VMD) of 350-400 microns) and minimize droplets that are less than 200 microns.

For aerial application:

- **Nozzle orientation:** Nozzles must be oriented so the spray is directed toward the back of the aircraft.
- **Spray volume:** Apply a spray volume between 5 and 10 GPA
- **Wind speed:** Do not apply when wind speeds exceed 10 miles per hour at the application site. **AVOID APPLICATIONS DURING GUSTY WIND CONDITIONS.**
- **Aircraft equipment:** The boom length must not exceed 65% of the wingspan for airplanes or 75% of the rotor blade diameter for helicopters.
- **Application height:** Do not release spray at a height greater than 10 feet above the vegetative canopy, unless a greater application height is necessary for pilot safety. Applications must be made at the lowest application height that provides uniform coverage and must be consistent with safe operation of the aircraft.

For ground application,

- **Wind speed:** Do not apply when wind speeds exceed 10 miles per hour at the application site. **AVOID APPLICATIONS DURING GUSTY WIND CONDITIONS.**
- **Boom height:** Apply with the nozzle height recommended by the manufacturer, but no more than 3 feet above ground or crop canopy. The buffer zones may be reduced when application is made with a low boom (20 inches) above the top of the crop canopy. The boom should remain level with the crop and have minimal bounce.

California Buffer Zones

The following buffer zones between the treated area and sensitive crops (specified in the table below) are required when these below listed crops are downwind of the application site:

Sensitive Crop	Ground Application Low boom	Ground High Boom	Aerial Application
Tomato, cucumber, sugarbeet	350 ft	500 ft	1,300 ft
Other broadleaf crops	50 ft	50 ft	500 ft
Tree and vine crops	50 ft	50 ft	500 ft
Dormant tree and vine	No buffer zone required		
Tree and vine crops do not require buffer zones when crops are dormant.			

GRAZING, FEEDING, AND HARVESTING

Allow at least 7 days between application and grazing of treated forage. In addition, allow at least 7 days between application and feeding of forage (green chop) from treated areas to livestock. Allow at least 30 days between application and feeding of hay from treated areas to livestock. Allow at least 45 days between application and harvesting of grain. Harvested straw may be used for bedding and/or feed.

PESTICIDE STORAGE AND DISPOSAL

Pesticide Storage: Store the product in original container only. Do not contaminate water, other pesticides, fertilizer, food, or feed in storage. Store in a cool, dry place.

Product Disposal: Do not contaminate water, food, or feed by disposal. Wastes resulting from the use of this product must be disposed of on site or at an approved waste disposal facility.

CONTAINER HANDLING:

Refer to the Net Contents section of this product's labeling for the applicable "Nonrefillable Container" or "Refillable Container" designation.

Nonrefillable Plastic and Metal Containers (Capacity Equal to or Less Than 50 Pounds): 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. Fill the container 1/4 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 for 10 seconds after the flow begins to drip. Repeat this procedure two more times. Then, for Plastic Containers, offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances. For Metal Containers, offer for recycling if available or reconditioning if appropriate, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities

Nonrefillable Plastic and Metal Containers (Capacity Greater Than 50 Pounds): 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. Fill the container 1/4 full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Repeat this procedure two more times. Then, for Plastic Containers, offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances. For Metal Containers, offer for recycling if available or reconditioning if appropriate, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

Nonrefillable Plastic and Metal Containers, e.g., Intermediate Bulk Containers [IBC] (Size or Shape Too Large to be Tipped, Rolled or Turned Upside Down): Nonrefillable container. Do not reuse or refill this container. Clean container promptly after emptying the contents from this container into application equipment or mix tank and before final disposal using the following pressure rinsing procedure. Insert a lance fitted with a suitable tank cleaning nozzle into the container and ensure that the water spray thoroughly covers the top, bottom and all sides inside the container. The nozzle manufacturer generally provides instructions for the appropriate spray pressure, spray duration and/or spray volume. If the manufacturer's instructions are not available, pressure rinse the container for at least 60 seconds using a minimum pressure of 30 PSI with a minimum rinse volume of 10% of the container volume. Drain, pour or pump rinsate into application equipment or rinsate collection system. Repeat this pressure rinsing procedure two more times. Then, for Plastic Containers, offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration. For Metal Containers, offer for recycling if available or reconditioning if appropriate, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

Nonrefillable Paper or Plastic Bags, Fiber Sacks including Flexible Intermediate Bulk Containers (FIBC) or Fiber Drums With Liners: Nonrefillable container. Do not reuse or refill this container. Completely empty paper or plastic bag, fiber sack or drum liner by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into application or manufacturing equipment. Then offer for recycling if available or dispose of empty paper or plastic bag, fiber sack or fiber drum and liner in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances.

Refillable Fiber Drums With Liners: Refillable container (fiber drum only). Refilling Fiber Drum: Refill this fiber drum with EXPRESS herbicide containing tribenuron methyl only. Do not reuse this fiber drum for any other purpose. Cleaning before refilling is the responsibility of the refiller. Completely empty liner by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into application or manufacturing equipment. Disposing of Fiber Drum and/or Liner: Do not reuse this fiber drum for any other purpose other than refilling (see preceding). Cleaning the container (liner and/or fiber drum) before final disposal is the responsibility of the person disposing of the container. Offer the liner for recycling if available or dispose of liner in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances. If drum is contaminated and cannot be reused, dispose of it in the manner required for its liner. To clean the fiber drum before final disposal, completely empty the fiber drum by shaking and tapping sides and bottom to loosen clinging particles. Empty residue into application or manufacturing equipment. Then offer the fiber drum for recycling if available or dispose of in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances.

All Other Refillable Containers: Refillable container. Refilling Container: Refill this container with EXPRESS herbicide containing tribenuron methyl only. Do not reuse this container for any other purpose. Cleaning before refilling is the responsibility of the refiller. Prior to refilling, inspect carefully for damage such as cracks, punctures, abrasions, worn out threads and closure devices. If damage is found, do not use the container, contact FMC at the number below for instructions. Check for leaks after refilling and before transporting. If leaks are found, do not reuse or transport container, contact FMC at the number below for instructions. Disposing of Container: Do not reuse this container for any other purpose other than refilling (see preceding). Cleaning the container before final disposal is the responsibility of the person disposing of the container. To clean the container before final disposal, use the following pressure rinsing procedure. Insert a lance fitted with a suitable tank cleaning nozzle into the container and ensure that the water spray thoroughly covers the top, bottom and all sides inside the container. The nozzle manufacturer generally provides instructions for the appropriate spray pressure, spray duration and/or spray volume. If the manufacturer's instructions are not available, pressure rinse the container for at least 60 seconds using a minimum pressure of 30 PSI with a minimum rinse volume of 10% of the container volume. Drain, pour or pump rinsate into application equipment or rinsate collection system. Repeat this pressure rinsing procedure two more times. Then, for Plastic Containers, offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration. Do not burn, unless allowed by state and local ordinances. For Metal Containers, offer for recycling if available or reconditioning if appropriate, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities.

Outer Foil Pouches of Water Soluble Packets (WSP): Nonrefillable container. Do not reuse or refill this container. Offer for recycling if available or, dispose of the empty outer foil pouch in the trash as long as WSP is unbroken. If the outer pouch contacts the formulated product in any way, the pouch must be triple rinsed with clean water. Add the rinsate to the spray tank and dispose of the outer pouch as described previously.

Do not transport if this container is damaged or leaking. If the container is damaged, leaking or obsolete, or in the event of a major spill, fire or other emergency, contact CHEMTREC (Transportation and Spills) at 1-800-424-9300, day or night.

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The Directions for Use of this product must be followed carefully. It is impossible to eliminate all risks inherently associated with the use of this product. Crop injury, ineffectiveness, or other unintended consequences may result because of such factors as manner of use or application, weather or crop conditions beyond the control of FMC or Seller. To the extent consistent with applicable law, all such risks shall be assumed by Buyer and User, and, to the extent consistent with applicable law, Buyer and User agree to hold FMC and Seller harmless for any claims relating to such factors.

Seller warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes stated on the Directions for Use when used in accordance with the directions under normal conditions of use. TO THE EXTENT CONSISTENT WITH APPLICABLE LAW, FMC MAKES NO WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE, NOR ANY OTHER EXPRESS OR IMPLIED WARRANTIES WITH RESPECT TO THE SELECTION, PURCHASE, OR USE OF THIS PRODUCT.

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This Condition of Sale and Limitation of Warranty and Liability may not be amended by any oral or written agreement.

**DuPont™ Express® Herbicide (with TotalSol® soluble granules)**

Version 2.0

Revision Date 06/17/2015

Ref. 130000012165

This SDS adheres to the standards and regulatory requirements of the United States and may not meet the regulatory requirements in other countries.

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name : DuPont™ Express® Herbicide (with TotalSol® soluble granules)
Tradename/Synonym : DPX-L5300 50SG
B11646119
Tribenuron methyl 50SG
DuPont™ Affinity 2 Herbicide
Affinity 50 SG
Granstar 50 SG
Tribenuron methyl: Methyl 2-[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)methylamino]carbonyl]amino]sulfonyl]benzoate

Restrictions on use : Do not use product for anything outside of the above specified uses

Manufacturer/Supplier : DuPont
4417 Lancaster Pike
Wilmington, DE 19805, USA

Product Information : 1-800-441-7515 (outside the U.S. 1-302-774-1000)
Medical Emergency : 1-800-441-3637 (outside the U.S. 1-302-774-1139)
Transport Emergency : CHEMTREC: +1-800-424-9300 (outside the U.S. +1-703-527-3887)

SECTION 2. HAZARDS IDENTIFICATION

Product hazard category
Skin sensitisation Sub-category 1B

DuPont™ Express® Herbicide (with TotalSol® soluble granules)

Version 2.0

Revision Date 06/17/2015

Ref. 130000012165

Label content

Pictogram :



Signal word : Warning

Hazardous warnings : May cause an allergic skin reaction.

Hazardous prevention measures : Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
Contaminated work clothing should not be allowed out of the workplace.
Wear protective gloves.
IF ON SKIN: Wash with plenty of soap and water.
If skin irritation or rash occurs: Get medical advice/ attention.
Wash contaminated clothing before reuse.
Dispose of contents/ container to an approved waste disposal plant.

Other hazards

The following percentage of the mixture consists of ingredient(s) with unknown acute toxicity: 41.77 %

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS-No.	Concentration
Tribenuron methyl	101200-48-0	50 %
Trisodium phosphate dodecahydrate	10101-89-0	10 - 15 %

**DuPont™ Express® Herbicide (with TotalSol® soluble granules)**

Version 2.0

Revision Date 06/17/2015

Ref. 130000012165

Sodium carbonate	497-19-8	5 - 10 %
Other Ingredients		25 - 35 %

The specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret.

SECTION 4. FIRST AID MEASURES

- General advice : Have the product container or label with you when calling a poison control center or doctor, or going for treatment.
For medical emergencies involving this product, call toll free 1-800-441-3637.
See Label for Additional Precautions and Directions for Use.
- Inhalation : No specific intervention is indicated as the compound is not likely to be hazardous. Consult a physician if necessary.
- Skin contact : Take off all contaminated clothing immediately. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.
- Eye contact : No specific intervention is indicated as the compound is not likely to be hazardous. Consult a physician if necessary.
- Ingestion : No specific intervention is indicated as the compound is not likely to be hazardous. Consult a physician if necessary.
- Most important symptoms/effects, acute and delayed : No applicable data available.
- Protection of first-aiders : No applicable data available.
- Notes to physician : Treat symptomatically.

SECTION 5. FIREFIGHTING MEASURES

**DuPont™ Express® Herbicide (with TotalSol® soluble granules)**

Version 2.0

Revision Date 06/17/2015

Ref. 130000012165

- Suitable extinguishing media : Water spray, Dry chemical, Foam, Carbon dioxide (CO₂)
- Unsuitable extinguishing media : High volume water jet, (contamination risk)
- Specific hazards : Not a fire or explosion hazard. Under severe dusting conditions, this material may form explosive mixtures in air.
- Special protective equipment for firefighters : Wear full protective clothing and self-contained breathing apparatus.
- Further information : (on small fires) If area is heavily exposed to fire and if conditions permit, let fire burn itself out since water may increase the area contaminated. Cool containers/tanks with water spray.

SECTION 6. ACCIDENTAL RELEASE MEASURES

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

- Safeguards (Personnel) : Evacuate personnel, thoroughly ventilate area, use self-contained breathing apparatus. Use personal protective equipment.
- Environmental precautions : Prevent material from entering sewers, waterways, or low areas.
- Spill Cleanup : Sweep up and shovel into suitable containers for disposal.
- Accidental Release Measures : Never return spills in original containers for re-use. Dispose of in accordance with local regulations.

SECTION 7. HANDLING AND STORAGE

- Handling (Personnel) : Wash hands thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove clothing/PPE immediately if material gets inside. Wash thoroughly and put on clean clothing. Wash the outside of gloves before removing. Remove personal protective equipment immediately after handling this product. As soon as possible, wash thoroughly and change into clean clothing.


DuPont™ Express® Herbicide (with TotalSol® soluble granules)

Version 2.0

Revision Date 06/17/2015

Ref. 130000012165

- Handling (Physical Aspects) : Keep away from heat and sources of ignition.
- Dust explosion class : No applicable data available.
- Storage : Store in original container. Do not contaminate water, other pesticides, fertilizer, food or feed in storage. Store in a cool, dry place. Keep out of the reach of children.
- Storage period : No applicable data available.
- Storage temperature : No applicable data available.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

- Engineering controls : Use only with adequate ventilation.
- Personal protective equipment
- Respiratory protection : No personal respiratory protective equipment normally required.
- Skin and body protection : Applicators and other handlers must wear:
 Long sleeved shirt and long pants
 Shoes plus socks
 Chemical resistant gloves made of any waterproof material, such as polyethylene or polyvinyl chloride.
 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
 Shoes plus socks
- Protective measures : Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry. Notify workers of the application by warning them orally or by posting warning signs at entrances to treated areas.

 Exposure Guidelines
 Exposure Limit Values

Tribenuron methyl			
AEL *	(DUPONT)	0.5 mg/m ³	12 hr. TWA
AEL *	(DUPONT)	1 mg/m ³	8 hr. TWA

**DuPont™ Express® Herbicide (with TotalSol® soluble granules)**

Version 2.0

Revision Date 06/17/2015

Ref. 130000012165

Trisodium phosphate dodecahydrate
No applicable data available.

Sodium carbonate
AEL * (DUPONT) 5 mg/m3 8 & 12 hr. TWA Total dust.

Other Ingredients
No applicable data available.

* AEL is DuPont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Physical state : solid
Form : solid, granular
Color : light brown

Odor : mild

Odor threshold : No applicable data available.

pH : 8.4 - 9.4 at 10 g/l 20 °C (68 °F)
(1% solution in water)

Melting point/range : No applicable data available.

Boiling point/boiling range : No applicable data available.

Flash point : Not applicable

Evaporation rate : No applicable data available.

Flammability (solid, gas) : Does not sustain combustion.

Upper explosion limit : No applicable data available.

Lower explosion limit : No applicable data available.

**DuPont™ Express® Herbicide (with TotalSol® soluble granules)**

Version 2.0

Revision Date 06/17/2015

Ref. 130000012165

Vapour Pressure	: No applicable data available.
Vapour density	: No applicable data available.
Specific gravity (Relative density)	: No applicable data available.
Bulk density	: 640 kg/m ³ packed
Water solubility	: soluble
Solubility(ies)	: No applicable data available.
Partition coefficient: n-octanol/water	: No applicable data available.
Auto-ignition temperature	: No applicable data available.
Decomposition temperature	: No applicable data available.
Viscosity, kinematic	: No applicable data available.
Viscosity, dynamic	: No applicable data available.
Oxidizing Substance	: The product is not oxidizing.

SECTION 10. STABILITY AND REACTIVITY

Reactivity	: No applicable data available.
Chemical stability	: Stable at normal temperatures and storage conditions.
Possibility of hazardous reactions	: Polymerization will not occur.
Conditions to avoid	: None reasonably foreseeable.
Incompatible materials	: No materials to be especially mentioned.
Hazardous decomposition products	: No applicable data available.

**DuPont™ Express® Herbicide (with TotalSol® soluble granules)**

Version 2.0

Revision Date 06/17/2015

Ref. 130000012165

SECTION 11. TOXICOLOGICAL INFORMATION

DuPont™ Express® Herbicide (with TotalSol® soluble granules)

Dermal LD50 : > 5,000 mg/kg , Rat

Oral LD50 : > 5,000 mg/kg , Rat

Skin irritation : No skin irritation, Rabbit

Eye irritation : No eye irritation, Rabbit

Sensitisation : The product is a skin sensitiser, sub-category 1B., Guinea pig

Tribenuron methyl

Inhalation 4 h LC50 : > 6.0 mg/l , Rat

Repeated dose toxicity :

The following effects occurred at levels of exposure that significantly exceed those expected under labeled usage conditions.

Oral - feed

Mouse

- 90 d

NOAEL: 500 mg/kg

Reduced body weight gain

Oral

Rat

- 28 d

Reduced body weight gain

Carcinogenicity : Not classifiable as a human carcinogen.

An increased incidence of tumours was observed in laboratory animals.

Target(s):

Mammary glands

Mutagenicity : Animal testing did not show any mutagenic effects.

Tests on bacterial or mammalian cell cultures did not show mutagenic effects.

Reproductive toxicity : No toxicity to reproduction


DuPont™ Express® Herbicide (with TotalSol® soluble granules)

Version 2.0

Revision Date 06/17/2015

Ref. 130000012165

Sodium carbonate

- | | | |
|------------------------|---|---|
| Inhalation 4 h LC50 | : | 1.15 mg/l , Rat
Target Organs: Respiratory Tract
Respiratory irritation |
| Repeated dose toxicity | : | Inhalation
Rat
-
Respiratory tract irritation |
| Mutagenicity | : | Tests on bacterial or mammalian cell cultures did not show mutagenic effects.
Evidence suggests this substance does not cause genetic damage in animals. |
| Reproductive toxicity | : | Animal testing showed no reproductive toxicity. |
| Teratogenicity | : | Animal testing showed no developmental toxicity. |

Carcinogenicity

The carcinogenicity classifications for this product and/or its ingredients have been determined according to HazCom 2012, Appendix A.6. The classifications may differ from those listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or those found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest edition).

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, or OSHA, as a carcinogen.

SECTION 12. ECOLOGICAL INFORMATION

Aquatic Toxicity

DuPont™ Express® Herbicide (with TotalSol® soluble granules)

- | | | |
|------------|---|---|
| 96 h LC50 | : | Oncorhynchus mykiss (rainbow trout) > 120 mg/l |
| 72 h ErC50 | : | Pseudokirchneriella subcapitata (microalgae) > 0.080 mg/l |
| 48 h EC50 | : | Daphnia (water flea) > 120 mg/l |

Sodium carbonate

- | | | |
|-----|---|--|
| 4 d | : | EC50 Daphnia magna (Water flea) 228 - 297 mg/l |
|-----|---|--|


DuPont™ Express® Herbicide (with TotalSol® soluble granules)

Version 2.0

Revision Date 06/17/2015

Ref. 130000012165

Environmental Fate

Sodium carbonate

Biodegradability : The methods for determining biodegradability are not applicable to inorganic substances.

Bioaccumulation : Does not bioaccumulate.

Additional ecological information : Do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment washwaters or rinsate.

SECTION 13. DISPOSAL CONSIDERATIONS

Waste disposal methods - Product : Do not contaminate water, food or feed by disposal. Wastes resulting from the use of this product must be disposed of on site or at an approved waste disposal facility.

Waste disposal methods - Container : Container Refilling and Disposal:
Refer to the product label for instructions.
Do not transport if this container is damaged or leaking.

In the event of a major spill, fire or other emergency, call 1-800-441-3637 day or night.

Contaminated packaging : No applicable data available.

SECTION 14. TRANSPORT INFORMATION

IATA_C	UN number	: 3077
	Proper shipping name	: Environmentally hazardous substance, solid, n.o.s. (Tribenuron methyl)
	Class	: 9
	Packing group	: III
	Labelling No.	: 9MI
IMDG	UN number	: 3077


DuPont™ Express® Herbicide (with TotalSol® soluble granules)

Version 2.0

Revision Date 06/17/2015

Ref. 130000012165

Proper shipping name	:	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Tribenuron methyl)
Class	:	9
Packing group	:	III
Labelling No.	:	9

Not regulated as a hazardous material by DOT.

Marine Pollutants assigned UN number 3077 and 3082 in single or combination packaging containing a net quantity per single or inner packaging of 5 L or less for liquids or having a net mass per single or inner packaging of 5 KG or less for solids may be transported as non-dangerous goods as provided in section 2.10.2.7 of IMDG code, IATA special provision A197, and ADR/RID special provision 375.

SECTION 15. REGULATORY INFORMATION

Other regulations : This Safety Data Sheet is for a pesticide product registered by the US Environmental Protection Agency (USEPA) and is therefore also subject to certain labeling requirements under US pesticide law (FIFRA). These requirements differ from the classification criteria and hazard information required by OSHA for safety data sheets, and for workplace labels of non-pesticide chemicals. The following is the mandatory hazard information required by USEPA on the pesticide label:

CAUTION!

Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Avoid contact with skin, eyes and clothing.

SARA 313 Regulated Chemical(s) : Tribenuron methyl

PA Right to Know Regulated Chemical(s) : Substances on the Pennsylvania Hazardous Substances List present at a concentration of 1% or more (0.01% for Special Hazardous Substances):
Trisodium phosphate dodecahydrate

Title III hazard classification : Acute Health Hazard: Yes
Chronic Health Hazard: No
Fire: No
Reactivity/Physical hazard: No
Pressure: No

**DuPont™ Express® Herbicide (with TotalSol® soluble granules)**

Version 2.0

Revision Date 06/17/2015

Ref. 130000012165

EPA Reg. No. : 352-632

In the United States this product is regulated by the US Environmental Protection Agency (EPA) under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Read and follow all label directions. This product is excluded from listing requirements under EPA/TSCA.

SECTION 16. OTHER INFORMATION

NFPA

Health	:	1
Flammability	:	1
Reactivity/Physical hazard	:	0

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Revision Date : 06/17/2015

Contact person : DuPont Crop Protection, Wilmington, DE, 19898, Phone: 1-888-638-7668

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Significant change from previous version is denoted with a double bar.