

Carol Ramsay  
Washington State University

# **Label Language: Temperature Inversions**

February 2009

Helicopter application of glyphosate

Application from 2:00 to 5:00 pm

Wind 2-3 mph from N.

Temperature inversion

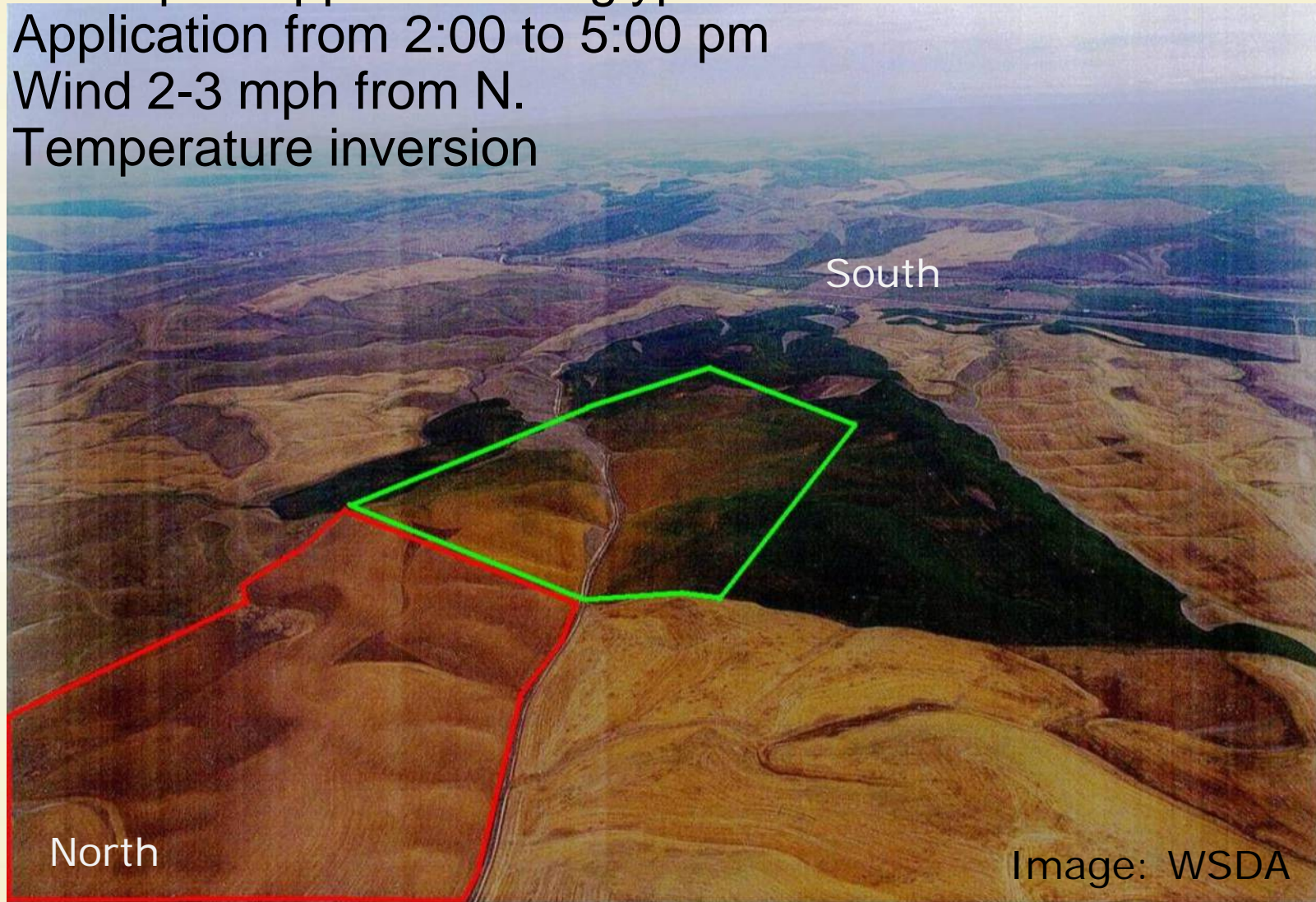


Image: WSDA



July 11, 2009  
Colfax, Washington  
3-5 pm afternoon



Carol Ramsay, WSU

## PASQUILL STABILITY CATEGORIES

SURFACE WIND SPEED (at 10 m) m/sec	<u>INSOLATION</u>			<u>NIGHT</u> THINLY OVERCAST < 3/8 OR > 4/8 LOW CLOUD CLOUD	
	STRONG	MODERATE	SLIGHT		
2	A	A-B	B	F	F
2-3	A-B	B	C	E	F
3-5	B	B-C	C	D	E
5-6	C	C-D	D	D	D
6	C	D	D	D	D

THE NEUTRAL CATEGORY, D, SHOULD BE ASSUMED FOR OVERCAST  
CONDITIONS DURING DAY OR NIGHT

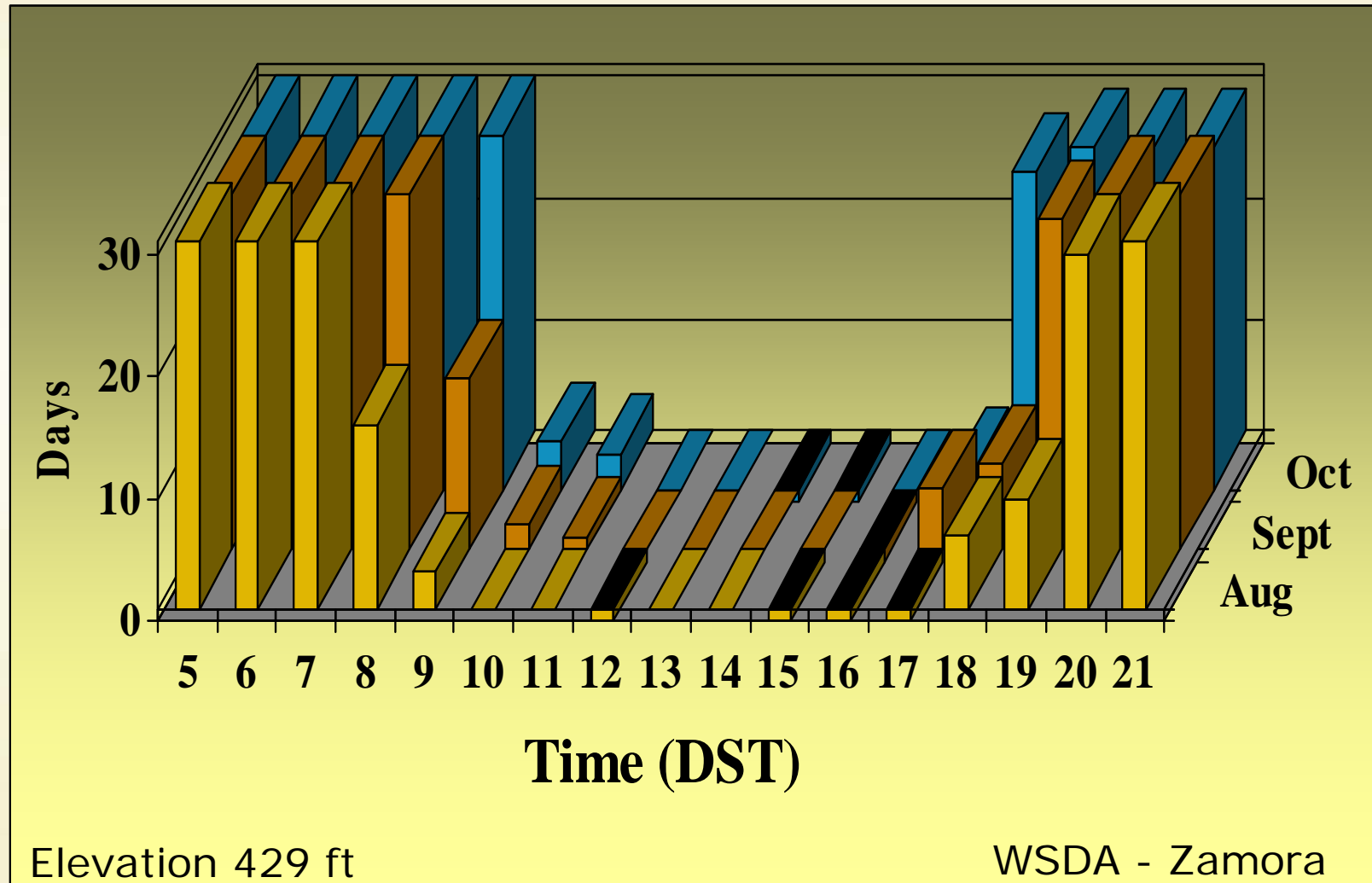
A-EXTREMELY UNSTABLE  
B-MODERATELY UNSTABLE  
C-SLIGHTLY UNSTABLE

D-NEUTRAL  
E-SLIGHTLY STABLE  
F-MODERATELY STABLE

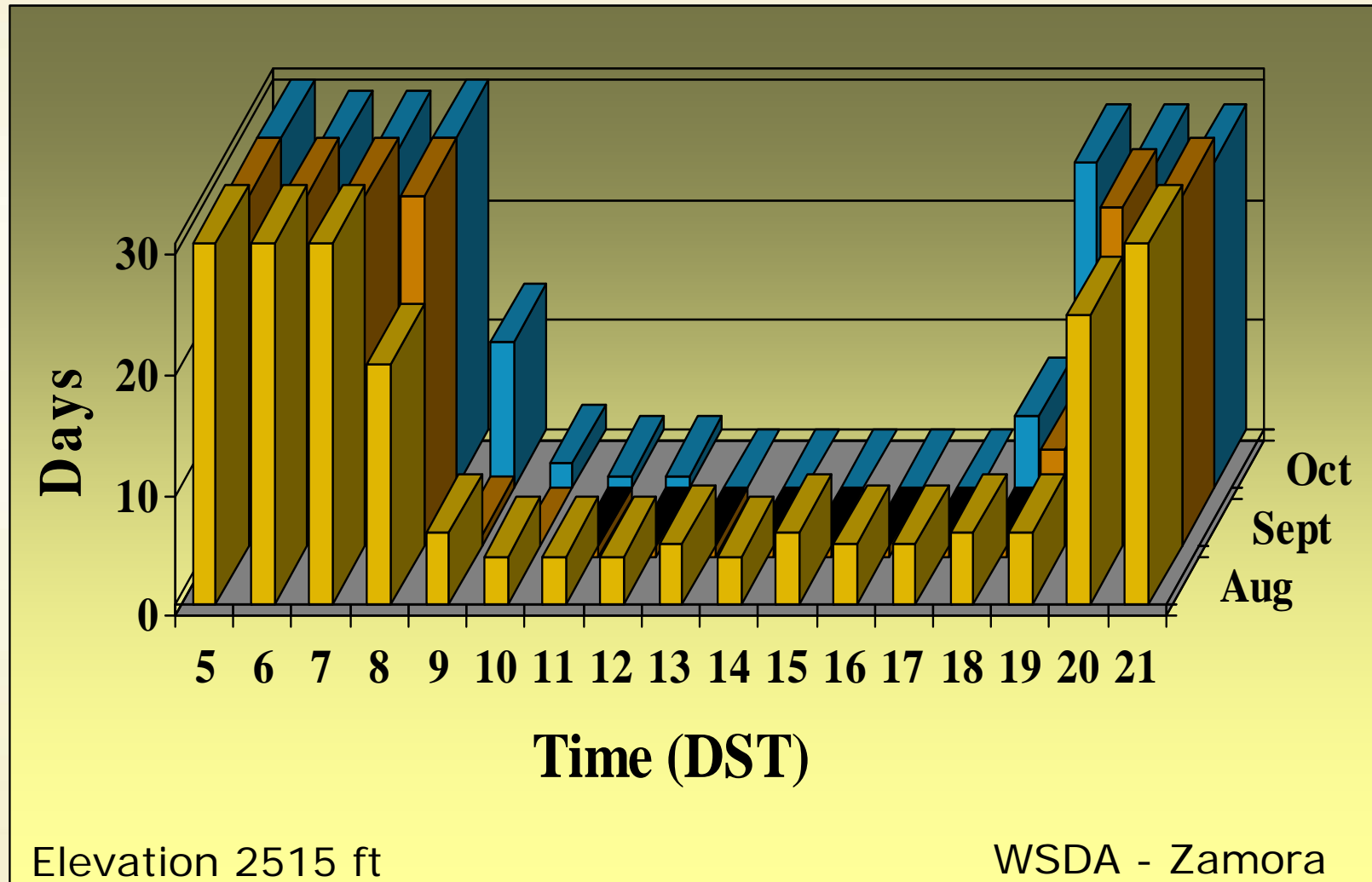




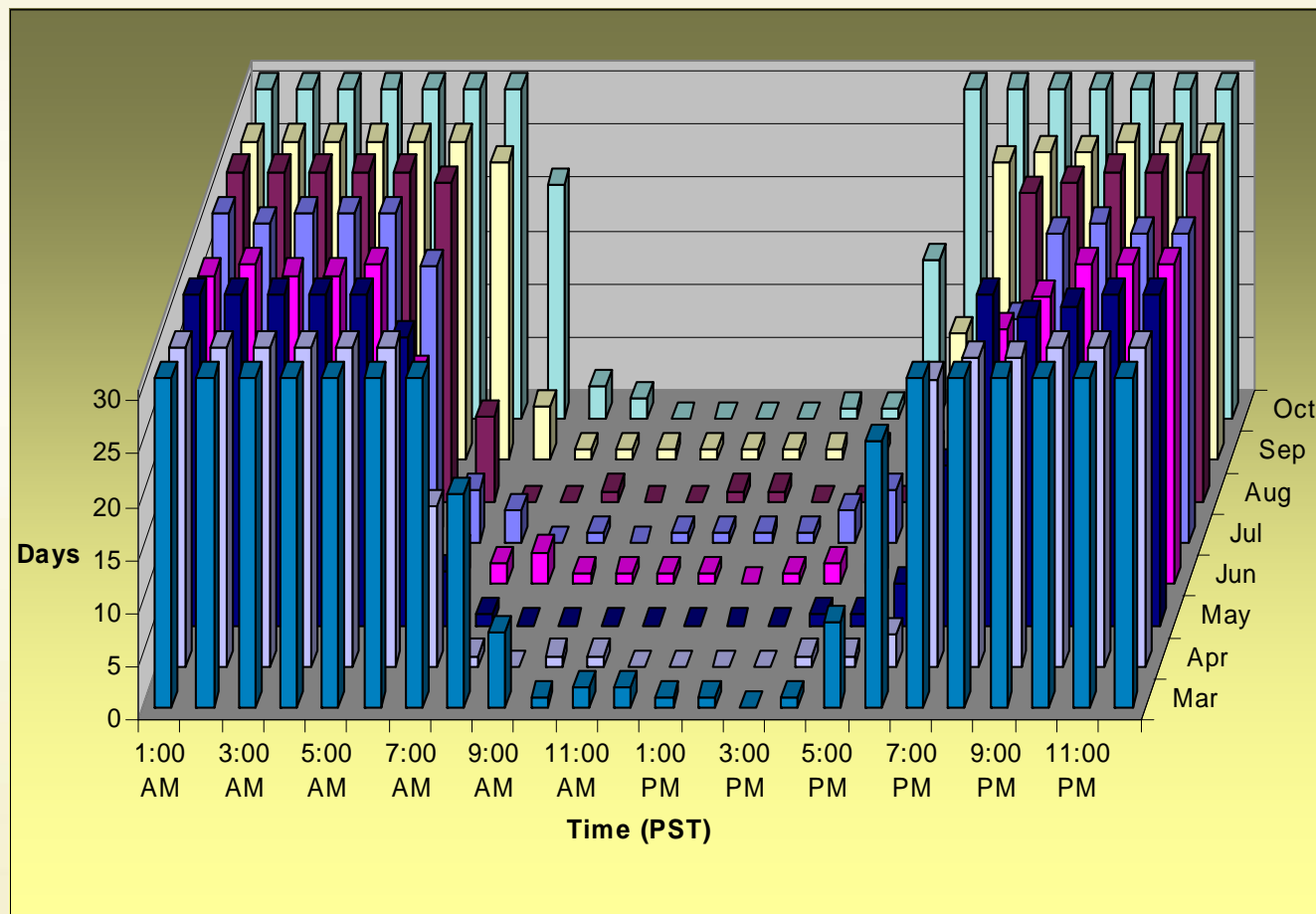
# Inversions – 2002 – Kennewick



# Inversions – 2002 – McClure



# Inversions at Patterson in 2002







Influence of Volume Applied!  
How to Account for on Label?



A. Felsot, WSU

**Nufarm**

# Weedar® 64

## Broadleaf Herbicide

THE 2,4-D AMINE WEED KILLER

TO CONTROL SUSCEPTIBLE BROADLEAF WEEDS IN CEREAL GRAINS, CORN, SORGHUM, RICE, SUGARCANE, SOYBEANS (Preplant only), TURF, NON-CROP AREAS, AND CERTAIN AQUATIC APPLICATIONS.

### ACTIVE INGREDIENT:

2,4-Dichlorophenoxyacetic acid,  
dimethylamine salt\* ..... 46.8%

OTHER INGREDIENTS: ..... 53.2%

TOTAL: ..... 100.0%

\*2,4-Dichlorophenoxyacetic acid equivalent 38.9% by weight or 3.8 pounds per gallon. Isomer specific by AOAC method No. 978.05

## Spray Drift Management

### Temperature Inversions

If applying at wind speeds less than 3 mph, the applicator must determine if: 1) conditions of temperature inversion exist, or b) stable atmospheric conditions exist at or below nozzle height. Do not make applications into areas of temperature inversions or stable atmospheric conditions.

2009 label



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**Dow AgroSciences**

**Milestone®**

### Specialty Herbicide

©Trademark of Dow AgroSciences LLC

- For control of susceptible weeds and certain woody plants, including invasive and noxious weeds, on rangeland, permanent grass pastures (including grasses grown for hay), Conservation Reserve Program (CRP) acres, non-cropland areas (such as roadsides, non-irrigation ditch banks, natural areas (such as wildlife management areas, wildlife openings, wildlife habitats, recreation areas, campgrounds, trailheads and trails), and grazed areas in and around these sites.

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Industrial, Noncropland Label - 2007



### **WIND**

Drift potential increases at wind speeds of less than 3 mph (due to inversion potential) or more than 10 mph. However, many factors, including droplet size and equipment type determine drift potential at any given wind speed. **AVOID GUSTY AND WINDLESS CONDITIONS.**

**Note:** Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect spray drift.

### **TEMPERATURE INVERSIONS**

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



**DuPont™**  
**Harmony® Extra SG**  
herbicide (with TotalSol® soluble granules)

## 8.1 Aerial Equipment

All labeled treatments may be made by aerial application, provided that the applicator complies with the precautions and in separate supplemental labeling published by Monsanto. **DO NOT APPLY THIS PRODUCT USING AERIAL APPLICATION CONDITIONS SPECIFIED IN THIS LABEL.**

Use the recommended rates of this herbicide in the label or otherwise specified on this label, or in separate supplemental labeling published by Monsanto for this product. Use 44 fluid ounces per acre using aerial spray equipment. See the sections of this label for recommended volume and application instructions.

FOR AERIAL APPLICATION IN ARKANSAS AND CALIFORNIA, REFER TO THE FEDERAL SUPPLEMENTAL LABELING IN THAT STATE OR COUNTY FOR SPECIFIC REQUIREMENTS.

This product, when tank-mixed with dicamba, may be applied for aerial application in California. Tank mixture may be applied by air in California for fallow and red top pasture renovation applications only.

Ensure uniform application. To avoid streaked application, use appropriate marking devices.

### AERIAL SPRAY DRIFT

The following drift management requirements apply to movement from aerial applications to agriculture.

1. The distance of the outermost nozzles on the wingspan or rotor.
2. Nozzles must always point backward, parallel to the wingspan or rotor. If nozzles are pointed downwards more than 45 degrees, they should be observed.

### Importance of Droplet Size

The most effective way to reduce drift potential is to apply the largest droplet size possible. Applying larger droplets reduces drift. If applications are made improperly, or under unfavorable conditions, the "Wind", "Temperature and Humidity" and "Relative Humidity" on this label.

When making applications in low relative humidity, set up equipment to produce larger droplets. Drift potential is most severe when

there is an inversion because drift potential is increased. This cloud can move in unpredictable directions during inversions. Temperature inversions with altitude and are common on wind. They begin to form as the sun sets. An inversion can be indicated by ground fog; also be identified by the movement of smoke or smoke generator. Smoke that layers and does not dissipate (under low wind conditions) indicates an inversion. Smoke that rapidly dissipates indicates good vertical air movement.

potential for drift to adjacent sensitive areas, known habitat for threatened or endangered species (e.g., when wind is blowing away from the area).

After each day of spraying to remove residue from spraying or from spills. PROLONGED EXPOSURE TO STEEL SURFACES MAY RESULT IN CORROSION. LANDING GEAR IS MOST SENSITIVE TO PAINTING (PAINT), WHICH MEETS AEROSPACE REQUIREMENTS.

### Application

3 to 40 gallons of water per acre as a spray, or in separate supplemental labeling for this product. As density of weeds increases, use higher rates to ensure adequate coverage. Use flat spray nozzles. Check spray



**Specially formulated  
for Roundup Ready® crops**

GROUP	9	HERBICIDE
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## Aerial Drift Reduction Advisory

### Wind

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

### Temperature and Humidity

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

### Temperature Inversions

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



### 3 Notations in Different Label Sections:

#### Application Restrictions: Aerial, Do not, and Spray Drift Management-Wind

**Aerial Application:** Drift potential is lowest between wind speeds of 2 to 10 mph. However, many factors, including droplet size and equipment type, should be avoided. **Specimen Label** Application and high inversion potential for temperature. **Spray Drift Management Label Sections**

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

**Do not apply under inversion.** A temperature and lower air temperature behavior of smoke smoke column release direction and velocity indicated by layering or no lateral movement.

#### Herbicide

®Starane is a trademark of Dow AgroSciences LLC  
Salvo® is a registered trademark of Loveland Products, Inc.

For selective postemergence control of annual and perennial broadleaf weeds and volunteer potatoes in small grains and fallow cropland, and for on-farm non-cropland applications

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**Avoid Spray**

Avoid spray drift. Avoid spray drift that may not be visible, may occur during dormant periods, or may be caused by reducing drift, use may be used in accordance with the recommended application rate.

Spray drift can be reduced as possible, by keeping the operator at a recommended distance. Recommended nozzles are available. Do not spray when wind speed is greater than 10 mph. Do not apply when there is a risk of inversion or when there is a risk of rain. Do not apply when there is a risk of rain. Do not apply when there is a risk of rain.

**Do not apply with a mist blower.**



**Dow AgroSciences**

**Lontrel<sup>®</sup>**  
Turf and Ornamental

## **Herbicide**

©Trademark of Dow AgroSciences LLC

For selective postemergence control of broadleaf weeds in non-residential turfgrass, including turfgrass grown for seed or sod farms, and certain ornamental plantings, such as conifers, non-leguminous woody species, and ornamental grasses, in landscapes and nurseries.

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**SAME AI**



©Trademark of Dow AgroSciences LLC

For selective control of broadleaf weeds in wheat and barley not underseeded with a legume, fallow cropland, grasses grown for seed, rangeland and permanent grass pastures, conservation reserve program (CRP) acres and non-cropland

### **Temperature Inversions**

If applying at wind speeds less than 3 mph, the applicator must determine if: a) conditions of temperature inversion exist, or b) stable atmospheric conditions exist at or below nozzle height. Do not make applications into areas of temperature inversions or stable atmospheric conditions.





Herbicide by Monsanto

#### WATER DISPERSIBLE GRANULE

Maverick® herbicide is a selective herbicide for the control of annual and perennial grasses and broadleaf weeds in winter and spring crops.

droplets to remain in a concentrated cloud for several hours in various directions due to the light variable wind. Inversions are characterized by increasing temperature with height on nights with limited cloud cover and light winds that sets and often continue into the morning. If fog is present, fog; however, if fog is not present, inversions are characterized by smoke from a ground source or an aircraft that moves laterally in a concentrated cloud (under low wind conditions) and smoke that moves upward and rapidly dissipates.

miles per hour. However, many factors can influence drift potential at any given time of day or hour due to variable wind speeds and directions. Wind can influence wind patterns. Wind speed and how they affect drift



Dow AgroSciences

# Lorsban®-4E

#### Insecticide

®Trademark of Dow AgroSciences LLC

For control of various insects infesting certain field, fruit, nut, and vegetable crops.

Group	1B	INSECTICIDE
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Active Ingredient:

chlorpyrifos: O,O-diethyl-O-(3,5,6-trichloro-2-pyridinyl)

phosphorothioate ..... 44.9%

Other Ingredients ..... 55.1%

Total..... 100.0%

2009 Label

Ground Equipment by keeping the more of spray manufacturer's type used (low manufacturers) regulations). A inversions. Direct and keep spray to minimize drift reduce the potential



Dow AgroSciences

**Tordon® 22K**

## Specialty Herbicide

©Trademark of Dow AgroSciences LLC

For control of susceptible broadleaf weeds, woody plants and vines on rangeland and permanent grass pastures, fallow cropland, Conservation Reserve Program (CRP) acres, non-crop areas including forest planting sites, industrial manufacturing sites, rights-of-way such as electrical power lines, communication lines, pipelines, roadsides, railroads, and wildlife openings in forest and non-crop areas

### Active Ingredient:

picloram: 4-amino-3,5,6-trichloropicolinic acid,

potassium salt ..... 24.4%

be lessened gallons or ureas at the specific nozzle equipment low state to air vegetation y droplets to further

## In addition to Aerial Drift Risk Advisory

### Wind

Drift potential is lowest between factors, including droplet size and speed. Application should be direction and high inversion potential. Every applicator should be familiar

because drift potential is causes small suspended move in unpredictable inversions. Temperature altitude and are common begin to form as the sun be indicated by ground fied by the movement of ke that layers and moves cates an inversion, while d vertical air mixing.



## **DuPont™ Assure® II**

herbicide



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# Questions to Ask For Quality Language

- Mandatory or Precautionary Language
  - If under 3 mph, applicator must . . .
  - Recognize stable air conditions and avoid . . .
- Volume of Applied Spray
  - Spot spray, small volume – how to exempt
  - Is there a lower limit of spray volume, say if apply under 50 gallons by ground in one day?
- Method of Application
  - Spot, injection, directed/basal spray, chemigation, ground boom, aerial
  - Drop size variance: Coarse

# Questions to Ask For Quality Language

- Label Location
  - Spray Drift
  - Spray Drift Aerial Only
  - Per Each Application Method – refer to general inversion precautionary statement
- Herbicide Label Consistency
  - Significant differences among herbicides, other than method of application and site of application
- Location of “Temperature” Inversion
  - Anywhere in area up to 100 feet
  - At or below boom height?

# Questions to Ask For Quality Language

- Critical Time
  - Hours before sunset, sunrise
  - Night-time spraying: insecticides, fungicides
- Indicators
  - Near application site
  - Road dust

## APPLICATION METHODS

### Ground Application:

1. Apply with **ground equipment only**. DO NOT APPLY BY AIR.
2. DO NOT OVERLAP SPRAY PATTERNS BEYOND EQUIPMENT MANUFACTURERS RECOMMENDATIONS AS EXCESSIVE RATES MAY RESULT IN ADVERSE CROP RESPONSES.
3. Apply CAPRENO™ Herbicide alone or in tank mixtures in a minimum of 10 gallons of spray mixture per acre. Uniform, thorough spray coverage is important to achieve consistent weed control.
4. **Keep the spray boom at the lowest possible spray height above the target surface.** Refer to the nozzle manufacturer's recommendations for proper nozzle, pressure setting and sprayer speed for optimum product performance and minimal spray drift.
5. Uneven application, sprayers not properly calibrated, or improper incorporation may decrease the level of weed control and/or increase the level of adverse crop response. Over application or boom overlapping may result in stand loss. Maintain a constant ground speed while applying this product to ensure proper distribution. **MAINTAIN ADEQUATE AGITATION AT ALL TIMES, INCLUDING MOMENTARY STOPS.**
6. **SPRAY DRIFT MANAGEMENT**
  - a. To reduce the potential of spray drift to non-target areas, apply this product using nozzles which deliver medium to **coarse spray droplets** as defined by ASAE standard S-572 and as shown in nozzle manufacturer's catalogs. Flat fan nozzles of 80° or 110° are recommended for optimum post emergence broadcast coverage. Nozzles that deliver COARSE spray droplets may be used to reduce spray drift provided spray volume per acre (GPA) is increased to maintain coverage of weeds. **DO NOT** use nozzles that produce FINE (e.g. - Cone) or EXTRA COARSE (e.g., Flood jet) spray droplets.
  - b. Only apply this product when the potential for drift to adjacent non-target areas is minimal (e.g., when the wind is **10 MPH or less** and is blowing away from sensitive areas). **Do not** apply during periods of temperature **inversions**.
  - c. To avoid potential adverse effects to non-target areas, maintain a 25 foot buffer between the point of direct application and the **closest downwind edge** of sensitive terrestrial habitats (such as grasslands, forested areas, shelter belts, woodlots, hedgerows, riparian areas and shrub lands), sensitive freshwater habitats (such as lakes, rivers, sloughs, ponds, creeks, marshes, streams, reservoirs and wetlands) and estuarine/marine habitats.