ROUNDUP READY PLUS.
CROP MANAGEMENT SOLUTIONS

AERIAL HERBICIDE APPLICATION AND MANAGEMENT

What You'll Learn...

- Aerial herbicide application can be an effective and economical method to obtain weed control providing the herbicide labels allow for aerial applications.
- Herbicide drift onto non-target areas or crops is the greatest risk with aerial herbicide applications.
- Proper equipment, adjustments, and settings are necessary to reduce potential drift.
- All labels and state specific regulations must be followed for aerial herbicide applications.

Importance of Aerial Application

Aerial herbicide applications in agricultural crops can be an important and valuable tool provided the herbicide label allows for aerial applications. Large fields, topography, and wet soil conditions are typical situations where aerial applications may be considered.[1]

General Aerial Application Parameters

Herbicide drift onto non-target areas is the greatest risk with aerial applications. Applications conducted outside of labeled methods are likely to result in pesticide exposure to unintended targets and potential contamination. Steps to reduce the potential for aerial drift include:

1. The distance of the outermost nozzles on the boom must not exceed 3/4 of the length of the wingspan or rotor. Reducing the effective boom length to less than 3/4 of the wingspan or rotor length can help further reduce drift without reducing swath width.
2. The nozzles must always point backward, parallel with the air stream and never be pointed downwards more than 45 degrees. Backward facing nozzles, parallel to the air stream, produces larger droplets compared to other orientations. Where states have more stringent regulations, they must be followed.
3. Apply the largest droplets possible that provides sufficient coverage and control.
4. Use high flow rate nozzles to apply the highest practical spray volume.
5. Use the lowest spray pressure listed for the nozzle.
6. Use the minimum number of nozzles that provide uniform coverage.
7. Use a nozzle type that is designed for the intended application. Narrower spray angles generally produce larger droplets. Consider using low-drift nozzles. Solid stream nozzles oriented straight back produce larger droplets than other nozzle types.
8. Application must be made at a height of 10 feet or less above the largest plants unless a greater height is required for aircraft safety.
9. In crosswinds, aircraft path adjustments must be made to compensate for displacement.
10. Drift potential is lowest at wind speeds of between 3 to 10 miles per hour. Applications below 3 MPH should be avoided because of high inversion potential and variable wind direction.
11. At low relative humidity, application equipment should be set to produce larger droplets to compensate for evaporation.
12. Do not apply during a temperature inversion. 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. Fog may or may not be present.
13. When sensitive areas are nearby, apply only when the potential for drift is minimal (wind blowing away). Avoid direct application to water.
14. Follow state specific regulations where applicable.

Airplane versus Helicopter

Airplanes (fixed wings) and helicopters (rotor craft) are the aircrafts used for aerial applications. Each aircraft has benefits and limitations. In general, when compared to helicopters, airplanes can carry a greater payload, operate at lower costs, have more potential for off-site chemical movement, and their use is not permitted with some herbicides. Helicopters are able to land remotely such as in the field where application is occurring, are more maneuverable, can operate at slower speeds, and can be used in areas where there are sensitive crops or surroundings.[2]

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Monsanto Products for Aerial Application

As with any herbicide or chemistry, product labels must be reviewed and followed to properly control the target and to reduce the potential for non-target exposure. Roundup WeatherMAX®, Roundup PowerMAX®, RT 3®, Rowel® Herbicide, Rowel® FX Herbicide, Warrant® Herbicide and Warrant® Ultra Herbicide labels allow for aerial applications by fixed wing aircraft or helicopter for their respective time of application (PRE, POST) (Table 1). The labels indicate that the products should be applied at the appropriate rates in 3 to 15 gallons of water per acre unless otherwise directed on the labels.

Maximum aerial single application rates for Roundup Ready® and Genuity® Roundup Ready 2 Yield®Soybean crops is 44 fl oz/acre. The maximum rate for Roundup Ready® 2 Technology corn products is 32 fl oz/acre. Burndown and PRE aerial maximum rates are 44 fl oz/acre. There are restrictions in Arkansas and California.

Aerial applications of Warrant® Herbicide are restricted to the states of Alabama, Arkansas, Colorado, Georgia, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Nebraska, North Carolina, North Dakota, Oklahoma, South Carolina, Tennessee, Texas, Virginia and other states listed on separately published aerial application supplemental labeling.

Aerial applications of Warrant® Ultra Herbicide are restricted to the states of Alabama, Arkansas, Georgia, Kansas, Kentucky, Louisiana, Mississippi, Missouri, Nebraska, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia.

Aerial applications of RT 3® are allowed for the control of annual and perennial weeds in Colorado, Idaho, Montana, Nevada, North Dakota, Oregon, South Dakota, Utah, Washington, and Wyoming and designated counties in Kansas, Minnesota, Nebraska, New Mexico, Oklahoma, and Texas.

Tank mixtures with Roundup WeatherMAX®, Roundup PowerMAX®, RT 3®, and Warrant® Herbicide may be possible; however, labels must be reviewed and followed for each herbicide in the tank mix. The most restrictive label must be followed. Some of the products may not be registered for use in some states.

Monsanto Agricultural Herbicide Products Approved for Ground Application Only

Monsanto herbicide products approved for ground applied application only should be considered to add additional sites of action for weed control. The products have different application methods ranging from preplant incorporated (PPI), PRE, and POST.

Additional information regarding Monsanto products can be found on the websites www.monsanto.com and www.RoundupReadyPLUS.com. These websites are beneficial for reviewing and becoming acquainted with new Monsanto chemistries when they are commercially advanced.

Sources:
[1] Ledbetter, K. 2012. Aerial herbicide application focus of Oct. 4 webinar. AgriLife Today. http://today.agrilife.org/2012/09/28/aerial-herbicide-application-focus-of-oct-4-webinar/
[2] Minogue, R.F. 2011. Advances in aerial herbicide application for drift management. 2011 WE Herbicide Applicator Conference. University of Florida.
Roundup PowerMAX® Herbicide Label. 2012. Monsanto Company.
Roundup WeatherMAX® Herbicide Label. 2009. Monsanto Company.
Rowel® Herbicide. Monsanto Company.
Rowel® FX Herbicide. Monsanto Company.
RT 3® Label. 2010. Monsanto Company.
Warrant® Herbicide Label. 2014. Monsanto Company.
Warrant® Ultra Herbicide Supplemental Label. 2016. Monsanto Company.
Web sources verified 4/5/17
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Table 1. Monsanto Agricultural Herbicides Labeled for Aerial Application**

Product	Minimum Water Rate (gallons)	Maximum Single Application Product Rate	Comments
Roundup PowerMAX® Roundup WeatherMAX®	3	32 fl oz for corn products with Roundup Ready® 2 Technology 44 fl oz for Roundup Ready® and Genuity® Roundup Ready 2 Yield® Soybeans, Burndown, and PRE	Limitations in AR & CA, refer to label In-crop application to glyphosate tolerant crops only
RT 3®	3	32 fl oz for corn products with Roundup Ready® 2 Technology 44 fl oz for Roundup Ready® and Genuity® Roundup Ready 2 Yield® Soybeans, Burndown, and PRE	Not labeled for in-crop application Limited to the states of CO, MT, NV, ND, OR, SD, UT, WA, WY and designated counties within the states of KS, MN, NE, NM, OK, TX
Rowel® Herbicide Rowel® FX Herbicide	7 (burndown) 5 (PRE)	2 oz (Rowel® Herbicide) 2.5 oz (Rowel® FX Herbicide)	
Warrant® Herbicide	3	2 qts Max rate varies by soil type	Limited to states of AL, AR, CO, GA, KS, KY, LA, MS, MO, NE, NC, ND, OK, SC, TN, TX, VA or by separate supplemental labels Cannot be used in Nassau and Suffolk Counties in NY
Warrant® Ultra Herbicide	5	Following rates are vary dependent on geography: <1.5% OM 48 fl oz, 1.5% or > OM 60 fl oz on Coarse soils; <1.5% OM 48 fl oz, 1.5% or > OM 65 fl oz on Medium soils; <1.5% OM 48 fl oz, 1.5% or > OM 70 fl oz on Fine soils	Limited to states or designated areas within the states (see label) of AL, AR, GA, KS, KY, LA, MS, MO, NE, NC, OK, SC, TN, TX, VA by supplemental label that expires December 1, 2018 Cannot be used in Nassau and Suffolk Counties in NY Refer to label for map outlining maximum use rates within 4 designated areas

**Respective Herbicide Labels, which must be read and followed.

For additional information, contact your local seed representative. Developed in partnership with Technology Development & Agronomy by Monsanto.
Monsanto Company is a member of Excellence Through Stewardship® (ETS). Monsanto products are commercialized in accordance with ETS Product Launch Stewardship Guidance, and in compliance with Monsanto's Policy for Commercialization of Biotechnology-Derived Plant Products in Commodity Crops. This product has been approved for import into key export markets with functioning regulatory systems. Any crop or material produced from this product can only be exported to, or used, processed or sold in countries where all necessary regulatory approvals have been granted. It is a violation of national and international law to move material containing biotech traits across boundaries into nations where import is not permitted. Growers should talk to their grain handler or product purchaser to confirm their buying position for this product. Excellence Through Stewardship® is a registered trademark of Excellence Through Stewardship.

Roundup Technology® includes Monsanto's glyphosate-based herbicide technologies. **Individual results may vary**, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible.

Always read and follow IRM, where applicable, grain marketing and all other stewardship practices and pesticide label directions.

Roundup Ready technology contains genes that confer tolerance to glyphosate, an active ingredient in **Roundup® brand agricultural herbicides**. Agricultural herbicides containing glyphosate will kill crops that are not tolerant to glyphosate. Rowel® Herbicide, Rowel® FX Herbicide Warrant® Herbicide and Warrant® Ultra Herbicide are not registered in all states and may be subject to use restrictions. The distribution, sale, or use of an unregistered pesticide is a violation of federal and/or state law and is strictly prohibited. Check with your local Monsanto dealer or representative for the product registration status in your state. Genuity®, Roundup PowerMAX®, Roundup Ready 2 Yield®, Roundup Ready®, Roundup Technology®, Roundup WeatherMAX®, Roundup®, Rowel®, RT 3® and Warrant® are registered trademarks of Monsanto Technology LLC.

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