June 8, 2024

Office of Pesticide Programs
Environmental Protection Agency Docket Center (EPA/DC), (28221T)
1200 Pennsylvania Ave. NW
Washington, DC 20460-0001

RE: EPA's Memorandum Supporting Proposed Decision to Approve Registration for the New Active Ingredient Isomer, Glufosinate-P and its supporting documents; Docket ID: EPA-HQ-OPP-2020-0250.

The National Agricultural Aviation Association (NAAA) appreciates the opportunity to comment on EPA's memorandum supporting the proposed decision to approve the registration for glufosinate-P.

U.S. Aerial Application Industry Background: NAAA represents the interests of the 1,560 aerial application industry owner/operators and 2,028 non-operator agricultural pilots throughout the United States licensed as commercial applicators that use aircraft to enhance the production of food, fiber and bio-energy; protect forestry; protect waterways and ranchland from invasive species; and provide services to agencies and homeowner groups for the control of mosquitoes and other health-threatening pests.

Within agriculture and other pest control situations, manned aerial application is an important method for applying pesticides, for it permits large areas to be covered rapidly—by far the fastest application method of crop inputs—when it matters most. It takes advantage, more than any other form of application, of the often too-brief periods of acceptable weather for spraying and allows timely treatment of pests while they are in critical developmental stages, often over terrain that is too wet or otherwise inaccessible for terrestrial applications. It also treats above the crop canopy, thereby not disrupting the crop and damaging it. Aerial application has greater productivity, accuracy, speed, and is unobtrusive to the crop compared to ground application[1]. Although the average aerial application company is comprised of but six employees and two aircraft, as an industry these small businesses treat nearly 127 million acres of U.S. cropland each season, which is about 28% of all cropland used for crop production in the U.S. In addition to the cropland acres, aerial applicators annually apply to 5.1 million acres of forest land, 7.9 million acres of pasture and rangeland, and 4.8 million acres for mosquito control and other public health concerns.

While there are alternatives to making aerial applications of pesticides, aerial application has several advantages. In addition to the speed and timeliness advantage aerial application has over

[1] Kováčik, L., and A. Novák, 2020. "Comparison of Aerial Application vs. Ground Application." *Transportation Research Procedia* 44 (2020) 264–270.

National Agricultural Aviation Association | 1440 Duke Street, Alexandria, VA 22314
Telephone: 202-546-5722 | Fax: 202-546-5726 | www.agaviation.org

other forms of application, there is also a yield difference. Driving a ground sprayer through a standing crop results in a significant yield loss. Research from Purdue University[2] found that yield loss from ground sprayer wheel tracks varied from 1.3% to 4.9% depending on boom width. While this study was conducted in soybeans, similar results could be expected in other crops as well. Data from a Texas A&M University economics study[3] and the 2019 NAAA industry survey[4] were used to calculate that the aerial application industry is directly responsible for the production of 1.69 billion bushels of corn, 199 million bushels of wheat, 548 million pounds of cotton, 295 million bushels of soybeans, and 3.33 billion pounds of rice annually that would be lost every year without the aerial application of pesticides. The value in additional crop yield that the aerial application industry brings to farmers, input suppliers, processors, and agricultural transportation and storage industries for corn, wheat, cotton, soybean, and rice production in the U.S. is estimated to be about $37 billion[5].

Research summarized by the University of Minnesota[6] describes how soil compaction from ground rigs can negatively affect crop yields due to nitrogen loss, reduced potassium availability, inhibition of root respiration due to reduced soil aeration, decreased water infiltration and storage, and decreased root growth. Aerial application offers the only means of applying a crop protection product when the ground is wet and when time is crucial during a pest outbreak. A study on the application efficacy of fungicides on corn applied by ground, aerial, and chemigation applications[7] further demonstrates that aerial application exceeds ground and chemigation application methods in terms of yield response. The aerial application of crop protection products results in greater harvest yields of crops. This in turn results in less land being used for agricultural production, preserving more wetlands for natural water filtration, forest ecosystems for carbon sequestration and habitat for threatened and endangered species.

The Texas A&M[4] study revealed that the total area of cropland needed to replace the yield lost if aerial application was not available for corn, wheat, soybean, cotton, and rice production is 27.4 million acres, an area roughly the size of Tennessee. Aerial applicators seed 3.8 million acres of cover crops annually[5]. This means that aerial applicators are responsible for helping to sequester 1.9 million metric tons of CO2 equivalent annually, which according to the EPA would be the equivalent of removing approximately 412,000 cars with carbon-combustion engines from the roads each year.

The aerial application industry is also actively involved in education and research efforts to improve the accuracy and safety of aerial applications. The National Agricultural Aviation Research and Education Foundation (NAAREF) is a non-profit organization dedicated to promoting research, technology transfer and advanced education among aerial applicators, allied

---

[2] Hanna, S., S. Conley, J. Santini, and G. Shaner. 2007. "Managing Fungicide Applications in Soybean." Purdue University Extension Soybean Production Systems SPS-103-W. https://www.extension.purdue.edu/extmedia/sps/sps-103-w.pdf
[3] Dharmasena, S. 2020. "How Much is the Aerial Application Industry Worth in the United States?" Research presented at the 2020 Ag Aviation Expo, Savannah, GA. https://www.agaviation.org/2020aatresearchpapers
[4] National Agricultural Aviation Association. May 2019. "2019 NAAA Aerial Application Industry Survey: Operators." https://www.agaviation.org//Files/Comments/NAAA%202019%20Operator%20Survey.pdf
[5] Dharmasena, S. 2021. "Value of the Agricultural Aerial Application Industry in the United States" Research presented at the 2021 Ag Aviation Expo, Savannah, GA. https://www.agaviation.org/2021aatresearchpapers
[6] University of Minnesota. "Soil Compaction." Accessed April 29, 2021. https://extension.umn.edu/soil-management-and-health/soil-compaction
[7] Thomas, D. 2009. Unpublished research results submitted to EPA. https://www.agaviation.org//Files/Comments/Fungicide%20efficacy%20results.pdf

industries, government agencies and academic institutions. NAAREF's Professional Aerial Applicators' Support System (PAASS) program is a four-hour course offered annually at all state and regional agricultural aviation association conventions. The curriculum is brand new every year and a minimum of one hour of PAASS is focused on environmental professionalism. This ensures aerial applicators are kept up to date on the latest information related to making accurate applications and drift mitigation. Nozzle selection, buffer zones, inversions, precision application technology, dissection of real-life drift incidents, and proper spray boom setup are some of the environmental professionalism topics that have been covered in PAASS.

Five years after PAASS became part of the aerial application annual curriculum in 1999, there was a 26% drop in drift incidents according to Association of American Pest Control Officials drift surveys. In addition, ag aircraft accidents have also significantly declined. From 1999 to 2010, the accident rate per 100,000 hours flown dropped by 21.6% compared to pre-PAASS accident rates. From 2011 to 2019, the accident rate dropped even more—30.8%—compared to pre-PAASS accident rates. Each year we continue to see a drop in our accident rate since pre-PAASS days, but now it declines more incrementally. While aviation safety is the domain of the FAA and not the EPA, the reduction in accidents proves PAASS has had, and continues to have, a significant positive impact on the aerial application industry.

Another NAAREF program is Operation S.A.F.E. (Self-regulating Application & Flight Efficiency). The primary component of Operation S.A.F.E. is a fly-in clinic. At a S.A.F.E. fly-in, aerial applicators can have their aircraft calibrated and application patterns (both liquid and dry) measured and evaluated for accuracy and uniformity. Spray droplet size is also measured at a fly-in to ensure the agricultural aircraft is creating the droplet size required by the labels for products to be applied by the aircraft. Many of the concepts used mitigate the risk of drift from agricultural aircraft have originated from ideas first tested at Operation S.A.F.E. fly-ins.

Just last year, NAAA created a professional certification program for the aerial application industry named C-PAASS for Certified Professional Aerial Application Safety Steward. To be certified under C-PAASS aerial applicators must take the PAASS program annually and Operation S.A.F.E. biennially, in addition to belonging as a member to their state/regional agricultural aviation association and the NAAA. C-PAASS professionals are also required to take and be tested on additional aviation safety and environmental stewardship curriculum offered on-line through a learning management system software NAAA installed. The purpose of C-PAASS is to enhance professionalism in the aerial application industry as our statistics show that those that participate in our educational programs are safer from both an aviation and environmental perspective.

Comments

NAAA strongly objects to the prohibition of aerial applications of glufosinate-P on non-glufosinate resistant crops. The estimated risk to protected species and areas from aerial applications in the risk assessments is artificially inflated because of the inaccuracy of the Tier 1 AgDRIFT model. NAAA encourages EPA to use the Tier 3 model in AgDRIFT instead of the Tier 1 on the ecological risk assessments and ESA analysis for glufosinate-P. EPA OCSPP leadership has publicly stated they intend to update their atmospheric modeling, referencing NAAA's suggested use of Tier 3 of the AgDRIFT model. This was also confirmed in in the Herbicide Strategy update. . Drift from aerial applications is more accurately estimated by using the Tier 3 model as proposed in a letter sent from NAAA to the Office of Pesticide Programs in

June of 2020[8]. A recent field study conducted at the University of Arkansas concluded the drift estimates from the Tier 1 model were "greatly over-predicting" the amount of drift physically measured in the field study[9].

As an example of the difference in modeled drift between Tier 1 and Tier 3 with NAAA's parameters, the fraction of material applied 200 feet downwind from the edge of the application area to a terrestrial area is 0.0456 with the Tier 1 AgDRIFT model. When the Tier 3 model with all the assumptions described in NAAA's letter to the EPA are used, the fraction of applied material downwind from application area to a terrestrial area is 0.0261, a reduction of 43 percent.

NAAA supports EPA's use of a larger droplet size in the risk assessments for glufosinate-P. However, simply using a larger droplet size in the Tier 1 AgDRIFT model does not eliminate the other inaccuracies associated with the Tier 1 model. For example, as previously mentioned the Tier 1 AgDRIFT model with the default fine to medium droplet size and using the terrestrial assessment, the fraction of applied materials estimated at 200 feet is 0.0456. If the droplet size is increased to medium to coarse, but still using all of the other erroneous assumptions from Tier 1 model, the fraction of applied materials at 200 feet is reduced to 0.0245.

If the Tier 3 model with all the assumptions described in NAAA's letter to the EPA (the exception being setting droplet size to medium to coarse for a direct comparison with the Tier 1 examples in the previous paragraph) is used, the fraction of applied materials is further reduced to 0.0186. This is a 59% reduction in possible drift compared to the Tier 1 model with fine to medium droplet size and a 24% reduction in possible drift compared to the Tier 1 model with the same medium to coarse droplet size. It is important to note when assessing the level of drift reduction achieved using the Tier 3 model, as was done for these examples, that wind speed in the Tier 3 model was set to 15 mph while the wind speed in the Tier 1 model was only at 10 mph.

NAAA fully supports the concept of using wind-directional buffers zones next to protection areas. Furthermore, NAAA strongly feels all buffers proposed on all labels, whether they be for FIFRA or ESA obligations, be wind directional. Science has consistently indicated that drift only moves downwind[10,11,12]. NAAA has routinely recommended all buffer zones for aerial

---

[8] NAAA letter to EPA, June 29, 2020. https://www.agaviation.org//Files/Comments/EPA%20letter%20re%20AgDRIFT%20Tier%203%20aerial%20risk%20assessment%20use%2020200629.pdf

[9] Butts, T.R., B.K. Fritz, K.B. Kouame, J.K. Norsworthy, L.T. Barber, W.J. Ross, G.M. Lorenz, B.C. Thrash, N.R. Bateman, J.J. Adamczyk. 2022. "Herbicide spray drift from ground and aerial applications: Implications for potential pollinator foraging sources." Scientific Reports (2022) 12:18017. https://doi.org/10.1038/s41598-022-22916-4

[10] Kirk, I.W., M.E. Teske, H.W. Thistle. 2002. "What About Upwind Buffer Zones for Aerial Applications?" *Journal of Agricultural Safety and Health* 8(3): 333-336.

[11] Teske, M.E., S.L. Bird, D.M. Esterly, S.L. Ray, S.G. Perry. 2003. "A User's Guide for AgDRIFT ® 2.0.07: A Tiered Approach for the Assessment of Spray Drift of Pesticides." https://usermanual.wiki/Pdf/AgDriftusermanualpubFes2003.1946090729.pdf

[12] Butts, T.R., B.K. Fritz, K.B. Kouame, J.K. Norsworthy, L.T. Barber, W.J. Ross, G.M. Lorenz, B.C. Thrash, N.R. Bateman, J.J. Adamczyk. 2022. "Herbicide spray drift from ground and aerial applications: Implications for potential pollinator foraging sources." Scientific Reports (2022) 12:18017. https://doi.org/10.1038/s41598-022-22916-4

applications of all pesticides be wind directional in numerous comments submitted to the EPA throughout the years.

NAAA applauds the EPA for proposing a solution that protects conservation areas as well allows growers to utilize pesticides to control pests on their entire field. Wind-direction-based buffers zones will minimize impact to growers because these areas can still be treated by aerial applicators when the wind is blowing away from conservation areas. The buffers will also fully protect sensitive areas from spray drift because they will be implemented when the wind direction is towards the sensitive site. They provide a win-win solution that balances the needs for optimum agricultural production and protection of conservation areas.

NAAA supports the 10-foot release height for aerial applications, requiring a medium or coarse droplet spectrum, prohibition of spraying during an inversion, the boom length restrictions, and the upwind swath displacement. However, NAAA objects to the 10-mph wind speed limit for aerial applications of glufosinate-P. In some parts of the country, wind speeds can commonly exceed 10 mph during critical portions of the application season. Limiting application to wind speeds below 10 mph would have a negative impact on the ability to make timely applications. There are existing labels that allow application in wind speeds up to 15 mph. The list of these products includes but is not limited to Headline AMP, Baythroid XL, Folicur 3.6F, Graslan L, Warrior 2, Hero Insecticide, Belt SC, Belay Insecticide, Besiege Insecticide, and Flexstar GT.

Numerous recent registration review proposed interim decisions from the EPA have included proposed label statements that allow for aerial applications in wind speeds up to 15 mph. The proposed label requirement for working in wind speeds from 11 to 15 mph has been a boom length restriction of 65% of wingspan for fixed wing aircraft and 75% of rotor diameter for helicopters, as well as an increase to ¾ swath displacement when winds are 11 to 15 mph. NAAA recommends the maximum allowed wind speed for aerial applications of glufosinate-P be 15 mph with the requirement that in wind speeds from 11 to 15 mph there is a boom length restriction of 65% of wingspan for fixed wing aircraft and 75% of rotor diameter for helicopters, as well as an increase to ¾ swath displacement for both application platforms.

When combined with the medium droplet size required for aerial applications, the potential for drift with these restrictions is less with a 15-mph wind than what EPA models using the tier 1 model in AgDRIFT. For example, when running the Tier 1 AgDRIFT model with the default parameters and using the terrestrial assessment, the fraction of applied materials at 200 feet is 0.0456. If the droplet size is increased to medium, wind speed is increased to 15, boom length is reduced to 65% of wingspan, and swath displacement is increased to 0.75, the fraction of applied materials at 200 feet is 0.0319, a 30% reduction in drift. It is important to note for this example that wind speed in the Tier 3 model was set to 15 mph while the wind speed in the Tier 1 model was only at 10 mph.

NAAA urges EPA to allow aerial applications of glufosinate-P on all crops, both glufosinate resistant and non-glufosinate resistant, and all non-crop sites that are allowed on the label. To further mitigate the risk of drift when making aerial applications non-glufosinate resistant crops and non-crop areas, NAAA recommends the label restrict aerial applicators to using a very coarse or coarser droplet size and a maximum boom length of 65% of wingspan for fixed wing aircraft and 75% of rotor diameter for helicopters at all wind speeds. If EPA is concerned aerial applicators might not be aware of how to set their aircraft up and verify its performance, they could consider requiring aerial applicators to be certified by NAAA's C-PAASS program in order to make these types of applications.

Decreasing boom length and increasing droplet size to reduce the risk of drift from aerial applications was documented in NAAA's June 2023 letter to EPA. When the Tier 3 AgDRIFT model is run with NAAA's parameter settings (as described earlier) using a very coarse droplet size and a 65% boom length, the fraction of applied materials estimated at 200 feet downwind is 0.0049. This is an 89% reduction in drift compared to the inaccurate Tier 1 AgDRIFT model. The additional mitigations of an increased droplet size and reduced boom length, along with wind directional buffer zones, will be sufficient for protecting sensitive areas.

While burndown applications and applications to non-crop areas using glufosinate might not be commonly made by aerial applications, this option is critical to growers during periods of prolonged rain or high winds. Growers who normally use ground rigs for glufosinate applications will not be able to get their sprayers in fields when they are wet. Nor can they spray when the winds are too high. While aerial applicators are also restricted by wind speed, for any given period of time when the wind speed permits applications, aerial applicators can treat far more acres. Matthews et al.[13] notes that application timing is a key for Integrated Pest Management (IPM) and that aerial application has an advantage over ground application when and where large areas need to be treated quickly. The option of aerial application is also crucial during this time of weed resistance that is afflicting crop growth and yields.

To compare the productivity between aerial application and ground application in a row crop agricultural setting, an aerial applicator and ground applicator from Mississippi were asked to provide details about the productivity of their application equipment. The aircraft was an Air Tractor AT-502B with a 60-foot swath width and the ground rig was a John Deere R4030 with a 90-foot boom. In both cases a 12-hour day of spraying was assumed, which is appropriate for the height of the spraying season. During an average 12-hour day, the aircraft treats 1,800 acres while the ground rig treats 450 acres, meaning aerial application is roughly 4 times as productive as ground application in this region.

NAAA also believes this productivity reduces drift incidents because growers who utilize aerial application to make herbicide applications in a timely manner do not feel pressured to spray with a ground rig under high-wind weather conditions in order to get the application made. While acknowledging no data to prove it, NAAA hypothesizes that many of the drift incidents that have occurred with the newer formulations of herbicides intended for resistant crops are due to applications in unfavorable weather conditions. Growers are forced to apply in unfavorable weather in order to get all of their fields treated in the tight time period allowed to use some herbicides during the growing season.

This increased productivity of aerial applications also plays a key role in managing pesticide resistance. As more and more pests become resistant to existing pesticides, ensuring that applications of the remaining pesticides that still work for resistant will be crucial. All pesticides have a window when they are most effective on the targeted pest. Applications made after this window passes dramatically decreases the effectiveness of the pesticide, which can result in reduced yield and additional applications to attempt to control escaped pests. It can also speed up the development of resistance to additional types of pesticides.

---

[13] Matthews, G.A., R. Bateman, and P. Miller. 2014. *Pesticide Application Methods*. Fourth Edition. John Wiley & Sons, Ltd.

Regarding the BASF label for glufosinate-P, NAAA strongly disagrees with several statements from *Section 9.3 Controlling Droplet Size – Aircraft* and *Section 9.2 Techniques for Controlling Droplet Size*. To help explain the errors, the table[14] below was created and will be referred to in a breakdown of the label statements.

Nozzle type	Nozzle	Angle	PSI	Speed (mph)	VMD*	%V<200µm**	DSC***
40-degree flat fan	4006	0	40	150	273	31.53	Medium
40-degree flat fan	4012	0	40	150	302	25.64	Medium
0-degree Straight stream	0006	0	40	150	403	15.86	Coarse
0-degree Straight stream	0012	0	40	150	374	18.26	Medium
40-degree flat fan	4006	0	60	150	285	29.63	Medium
40-degree flat fan	4012	0	60	150	317	23.86	Medium
0-degree Straight stream	0006	0	60	150	483	11.49	Very Coarse
0-degree Straight stream	0012	0	60	150	450	14.05	Coarse
40-degree flat fan	4006	15	60	150	238	40.04	Fine
0-degree Straight stream	0006	15	60	150	366	20.27	Medium

* Volume Median Diameter in microns
** Percentage of spray volume contained in droplets smaller than 200 microns in diameter
*** Droplet Size Class

- Number of nozzles: while using a larger orifice may be a good recommendation for a ground sprayer, it does not always apply to agricultural aircraft. For the 40-degree flat fan nozzles, there is an increase in droplet size from the 0.6 GPM orifice to the 1.2 GPM orifice at both 40 and 60 psi. However, for the straight stream nozzles, using the larger 1.2 GPM orifice decreases droplet size, thus increasing the risk of drift. Since the straight stream nozzle creates a larger droplet size, this would be the preferred option for applying glufosinate-P and other herbicides.
- Nozzle orientation: NAAA agrees that orienting the nozzle straight back will produce the largest droplet size. However, locking an aerial applicator into only orienting the nozzle straight back means they can't create a medium droplet size if they select a straight stream nozzle.
- Nozzle type: If an aerial applicator chooses to use a medium droplet size, as is allowed by the label, they may need to use a flat fan, or deflect a straight stream nozzle, both of which are not allowed by this section.
- Pressure: while this section is not under the section specific for aircraft, it does not clearly differentiate the intended application platform. The fact that *boom heigh* in section 9.3, which is specific to aircraft, has a recommendation for ground equipment adds to the confusion. The data in the table above shows that no matter what nozzle type or size is used, increasing pressure increases the droplet size for aerial applications.
- NAAA urges both the EPA and registrants to write technology neutral label language. When labels are written with outdated technical information, professional aerial applicators can't take advantage of the latest technology and techniques to maximize efficacy and reduce the risk of drift. The label should only dictate the required droplet size classification –how that is achieved should be left to the professional aerial

[14] USDA ARS Aerial Application Technology Research Unit. Aerial Spray Nozzle Models. Accessed May 18, 2023. https://www.ars.usda.gov/plains-area/college-station-tx/southern-plains-agricultural-research-center/aerial-application-technology-research/docs/a-models/

applicators.

NAAA also disagrees with a minimum spray application rate of 10 GPA. This recommendation is frequently made under the erroneous assumption it increases efficacy while also reducing drift. In terms of efficacy, there is research that shows lower spray application rates can achieve the same level or better efficacy than higher spray application rates[15,16].

The higher spray application rate can also increase the risk of drift instead of reducing it. For example, an aerial applicator with an AT-502 has about 70 nozzle positions on the boom. If the application is to be made at 10 GPA with straight stream nozzles, the applicator would need to select 0025 nozzles and operate them at 50 psi. With 0-degrees deflection and an airspeed of 150 mph, the resulting droplet spectrum class would be a medium, with a VMD of 364 and a %V<200µm of 20.05%. If the spray application rate was reduced to 5 GPA (older formulations of glufosinate were labeled with a minimum of 5 GPA for aerial applications) the applicator could choose 0012 nozzles operated at 55 psi. This would create a coarse droplet spectrum with a VMD of 431 and a %V<200µm of 15.04%. The 5 GPA application would have a larger droplet size and thus a reduced risk of drift compared to the 10 GPA application. Current research is documenting that large droplets from straight stream nozzles can provide similar or better efficacy than smaller droplets[17,18].

Conclusion

NAAA strongly urges EPA allow aerial applications of glufosinate-P on non-glufosinate resistant crops and non-crop areas. EPA should require a droplet size of very coarse and a maximum boom length of 65% of wingspan for fixed wing aircraft and 75% of rotor diameter for helicopters for these applications. NAAA also recommends EPA reevaluate the risks of aerial applications of glufosinate using the Tier 3 model.

Thank you for this opportunity to comment.

Sincerely,

Andrew D. Moore
Chief Executive Officer

---

[15] Fritz, B.K., I.W. Kirk, W.C. Hoffman, D.E. Martin, V.L. Hofman, C. Hollingsworth, M. McMullen, and S. Halley. 2006. "Aerial Application Methods for Increasing Spray Deposition on Wheat Heads." *Applied Engineering in Agriculture.* Vol. 22(3): 357-364.

[16] Young, B. 2006. "Can all Problems with Application Methods be Resolved with Higher Glyphosate Rates?" https://www.agry.purdue.edu/cca/2006/PDF/young.pdf.

[17] Fritz, B.K. 2022. Straight Stream Nozzle Models to Support Aerial Applications. Presentation at 2022 Ag Aviation Expo. https://education.agaviation.org/aat-expo-presentations

[18] Martin, D.E. 2022. Effect of Application Rate on Fungicide Efficacy from an Aerial Application for Control of Sheath Blight in Rice. Presentation at 2022 Ag Aviation Expo. https://education.agaviation.org/aat-expo-presentations