Unmanned Aerial Pesticide Application System Task Force (UAPASTF) update on best management practice development for safe and effective application of pesticides using unmanned aerial spray systems (UASS)

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Uncrewed Aerial Spray System (UASS) Use is Increasing in Agriculture and Offer Potential Benefits

Examples! Benefits will differ based on the region

Flexibility	Amenable technology for hard-to-access locations: Drones can easily reach areas that are difficult and unsafe for traditional equipment to access such as muddy fields, areas below power lines, and irregular shaped fields
	A complementary spray solution alongside traditional application technologies such as tractors and airplanes
	Larger areas can be treated precisely with multiple coordinated drones (called swarms)
Cost	Relatively less expensive machinery compared to more expensive and larger equipment (e.g., large ground sprayers)
	Decreased application costs due to optimized applications and potential reduction of chemicals needed
	Decreased crop damage due to minimizing field passes
Worker Exposure	Decreased operator exposure, especially in the case of replacing backpack applications, due to the physical separation of the application and the operator, thus enhancing worker safety
Innovation	Enabling the future of digital and precision tools including targeted and optimized applications
	Positive industry disruption, including attracting a diverse and technology-advanced workforce, creating new business models such as spray-as-a-service, and engaging technology partners not traditionally associated with agriculture
	Uses beyond agriculture that support public and environmental health: (mosquito applications, dam and railway maintenance, forestry, rights-of-way maintenance, land, invasive species, etc.)
Environment & Sustainability	Input reduction via customized rates, optimal timing, and placement: Drones can apply inputs such as fertilizers and pesticides more efficiently
	Emissions reduction: Using drones, which primarily rely on battery power, can lower the carbon footprint compared to traditional machinery if they utilize solar power
	Reduced water consumption due to lower required water volumes
	Soil health due to less soil compaction
	Enables specialty crop care in small acreages, orchards, and vineyards, promoting agricultural diversity in the food supply

Global regulatory landscape of UASS application technology

North America

USA: EPA defers to states provided aerial application is allowed on the federal label

CAN: Some registered labels for UASS, overall policy being developed

Latin America

BRA, CRI, URY: UASS application is allowed once aerial application is already approved on the label

GTL, COL: Some UASS application permitted

MEX: Some UASS application permitted
Regulation under discussion

ARG: Strong Interest

ECU, PER: UASS application not allowed
Regulation under discussion

Europe, Middle East, Africa

EU: Mostly aerial application banned except with specific exemptions

HUN, CZE: UASS applications allowed

DEU, TUR, UK: UASS application allowed for specific applications

ESP, GRC, ITA, FRA: Strong interest

Other Europe:
CHE: UASS application allowed for specific applications

GBR: Strong Interest

Africa:
Ghana: UASS application allowed

Burkina Faso (BFA), Ivory Coast (CIV), Kenya (KEN), Zambia (ZMB), Zimbabwe (ZWE), Malawi (MWI), South Africa (ZAF): Strong interest

Asia Pacific

JPN, KOR: Most advanced countries for regulations on UASS and applications allowed

CHN: Leading drone platform innovation (XAG/DJI). Largest acreage globally treated by UASS. Regulation under discussion.

MYS, PHL, IND, TWN: Regulations in place.

THA, IDN, VNM: Commercial use permitted/permitted soon while guidance is developed in parallel

AUS: UASS application allowed under aerial framework

PAK, MMR: Regulations under development

Information not intended as legal guidance

As with many Emerging Technologies, there are open research needs for UASS which will help to address Regulatory Gaps

OECD Drone/UAV Subgroup of WPP

Overview of Participants

OECD 60

A global effort

- OECD member countries, led by the United Kingdom
- European Commission
- Business at OECD (BIAC)
- Invited Experts

Examples of past representation

Academic researcher

https://www.oecd-ilibrary.org/environment/report-on-the-state-of-the-knowledge-literature-review-on-unmanned-aerial-spray-systems-in-agriculture_9240f8eb-en

BIAC / industry seen as a partner in the Subgroup

OECD Drone/UAV Subgroup of WPP

Key Steps

published on the APVMA, OECD website at :
https://apvma.gov.au/node/91741
https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ENV/CBC/MONO(2021)39&docLanguage=En

- Decision to start with existing data / info (Oct 2019 – Jan 2020)
- Consultant to review existing data / info write data evaluations (DERs) / overview document (June – Oct 2020)
- DERs / overview document completed (Mar 2021)
- WPP Approved Public Release of 'state of knowledge' Document (July 2021)
- Industry sponsored task force –Task Force (UAPASTF) established
- Information collection requests (Mar 2020 & Oct 2020)
- Subteam to work with consultant (July 2020 – Feb 2021)
- WPP Recommendation for next steps agreed - *shifting Subgroup to facilitate global development of UAV application regulations, implementing 'state of knowledge' document recommendations*
- *Work Packages in-progress* (July 2021 - present)

OECD WPP Drone/UASS Subgroup – State of the Knowledge Report Recommendations

- **The Subgroup has become an advisory body to provide expert input on how to fill knowledge gaps**
  - Grouping of 'state of knowledge' recommendations needed to develop / implement
  - Workstreams Established, work in-progress

Work Package #1 – off-site exposure including exposure modeling (BIAC / CDN / US)

Work Package #2 – scanning / survey to stakeholders (Australia, UK)

Work Package #3 – 'best practices' guidance (BIAC)

Work Package #5 – connect to ISO (Research Institute / ISO representative)

Grouping of Recommendations from 'State of Knowledge' Report
#7. Develop an empirical database and standard drift curve or model to estimate off target exposure. **#9. Develop a useable publicly available model for predicting spray deposition and drift including parameters for static hovering, forward speed and spray equipment.**
#1. Establish database to classify UASS into groups to reduce burden of testing each different platform/configuration. **#2. Survey manufacturers about future trend of UASS design/ use profiles to produce a benchmark platform as a common starting point for regulators (others may differ and need bespoke assessment but would cover most common uses).** **#8. A data gathering exercise for operational practices mixing, loading, cleaning and transport scenarios.**
#5. Develop and publish a user-friendly summary of best practice (including the essential nature of calibration), pitfalls and a trouble shooting guide (both for generating trials data and applying pesticides in practice), including preliminary recommendations for operational parameters (release height, application volumes, forward speed and spray quality). **#6. Promote the advice in Annex D recommendations for researchers conducting UASS drift studies.**
#4. Develop set of standard methodologies that will support regulatory decision making.
#3. Encourage manufacturers to develop improved spray systems including the pump systems, nozzle placement and closed transfer loading systems. * ISO standard project

Unmanned Aerial Pesticide Application System Task Force (UAPASTF), LLC.

- Based in the US - but global in its work / focus
- UAPASTF global core mission is to supply regulatory data / information to inform the potential use of UAV-based pesticide application
  - Where appropriate, the UAPASTF will focus on generating data for submission to pesticide regulatory authorities to inform estimates for off-site movement, determine potential operator/handler exposure, and assess crop residue contribution to human dietary exposure in risk assessment and regulatory approval processes
- UAPASTF interacts with OECD Drone/UASS Subgroup of WPP, regional / national regulators, CropLife, & other stakeholders to develop & provide information / data
  - UAPASTF alignment with work of the OECD WPP Drone/UASS Subgroup critical to success
  - Established and seeking collaborative and confidentiality agreements with UAV-application companies and experts (e.g., additional UAV-application companies in other world areas, UAV & nozzle manufacturers)
- UAV-based pesticide application a part of progression toward precision / digital agriculture with the potential for increasing sustainability

UAPASTF

Member Company	*Administrative Committee*	*Technical Committee*
BASF Corporation	Rebecca Willis	**Frank Donaldson (Chair)**
Bayer CropScience LP	**Greg Watson (Chair)**	Jane Tang
Corteva Agriscience	**Travis Bui (Vice Chair)**	Rajeev Sinha
Gowan Company LLC	Raymond Layton	Jason A. McDonald
FMC Corporation	Hector Portillo	Roberto Barbosa
NuFarm Americas Inc.	Patti Turner	Tyler Gullen
Syngenta Crop Protection LLC	**Nestor Algarin (Treasurer)**	Jo Davies
Valent U.S.A. LLC	Robin Charlton	Christopher Read
Task force managers	*Rhonda Bichsel*	*Eric Bruce*

Parties interested in the work of, or registrants interested in joining the UAPASTF should contact:
Dr. Greg Watson,
Chair, UAPASTF Administrative Committee greg.watson@bayer.com
+1 314 343 8120

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Unmanned Aerial Pesticide Application System Task Force (UAPASTF)

- ***Technical teams actively working***
  - **Off-site movement GLP study protocol & trials (Frank Donaldson, BASF)**
    - **Environmental / Ecological Exposure Subteam (Naresh Pai, Bayer Crop Science)**
  - **'Best practices' guidance (Hector Portillo, FMC)**
  - **Field crop residue project – Agriculture & AgriFood Canada (Greg Watson and Sheila Flack, Bayer Crop Science)**
  - **Occupational / Applicator / Non-dietary Exposure Subteam (Edgars Felkers, Bayer Crop Science)**

Unmanned Aerial Pesticide Application System Task Force (UAPASTF)

Cycles of incorporating feedback

- **‘Best practices’ guidance (Hector Portillo, FMC)**
  - **Preparation of draft completed by UAPASTF 4th Q '22**
  - **Shared with UAPASTF external experts & collaborators 1st Q '23**
  - **Final initial draft sent for broad expert review Apr-May '23**
  - **OECD Cooperative Research Program funded workshop, in-person, May 23rd & 24th, 2023, York, UK**
  - **Request review & input of updated draft from key UAPASTF external experts, collaborators, and member companies by Jan '24**
  - **Request review & input of updated “final” draft from OECD Drone/UASS Subgroup by May '24**
  - **“Version 1.0” of *Best Management Practices for Safe and Effective Application of Pesticides Using Unmanned Aerial Spray Systems (UASS)* to be posted to the UAPASTF Website **coming soon** Sept '24**

UAPASTF Best Management Practices for Safe and Effective Application of Pesticides Using Unmanned Aerial Spray Systems (UASS)

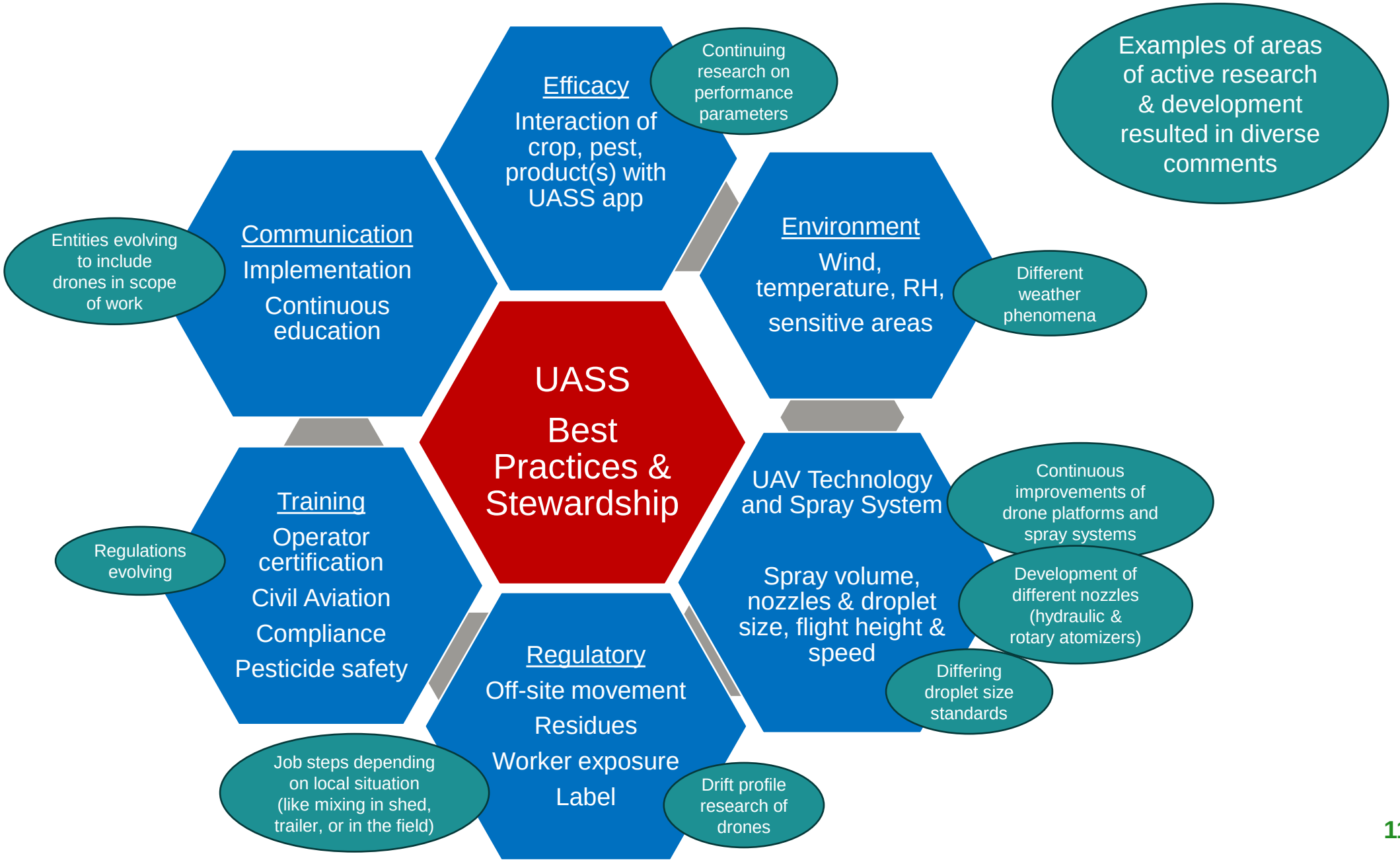
Company/ Organization	UAPASTF BMP Tech Team Rep
BASF	Mark Ootslander
Bayer	Sarah Hovinga
Corteva	Rajeev Sinha
FMC	**Hector Portillo - Lead**
	Ted Lang
	Roberto Barbosa
Nufarm	Tyler Gullen
Syngenta	Neill Newton
Valent	Banugopan Kesavaraju

- The BMPs provided here are intended to supplement information on the product label and the registered and current product label should ultimately be followed above any other source of information. Readers should therefore ensure that this guidance is adapted or supplemented by other country/state/region specific needs, conditions, laws, and regulations, as relevant, including official and required UAV pilot training, to ensure safe operations, which may not be explicitly mentioned on labels.

- This document was developed by the Unmanned Aerial Pesticide Application System Task Force (UAPASTF) and utilizing information from many entities also working in the Best Management Practice (BMP) space including but not limited to: CropLife organizations (CropLife International, CropLife America, CropLife Asia), International organizations (FAO, ISO), Government entities (India, Japan, USDA), Associations (NASDARF), Academic experts (Auburn University, Ohio State), Pesticide industry expertise (UAPASTF company members and others), Pesticide application specialists, and Drone spraying service providers.

- While this document was reviewed by and incorporates inputs from these and other organizations, this document is not endorsed or approved by any other organization besides the UAPASTF; any mention of another organization is intended to identify a source of information utilized to create this document and how input into the review of the document was implemented.

Unmanned Aerial Spray System (UASS) Best Practices Components



The High Number of Drone/UASS Platforms Makes it Difficult to Make Broad Recommendations

Single Rotor- Gasoline/Battery

Single Rotor – Battery

Multi (4) Rotor
& in-line CDA nozzle

Fixed Wing – Battery/No Rotors

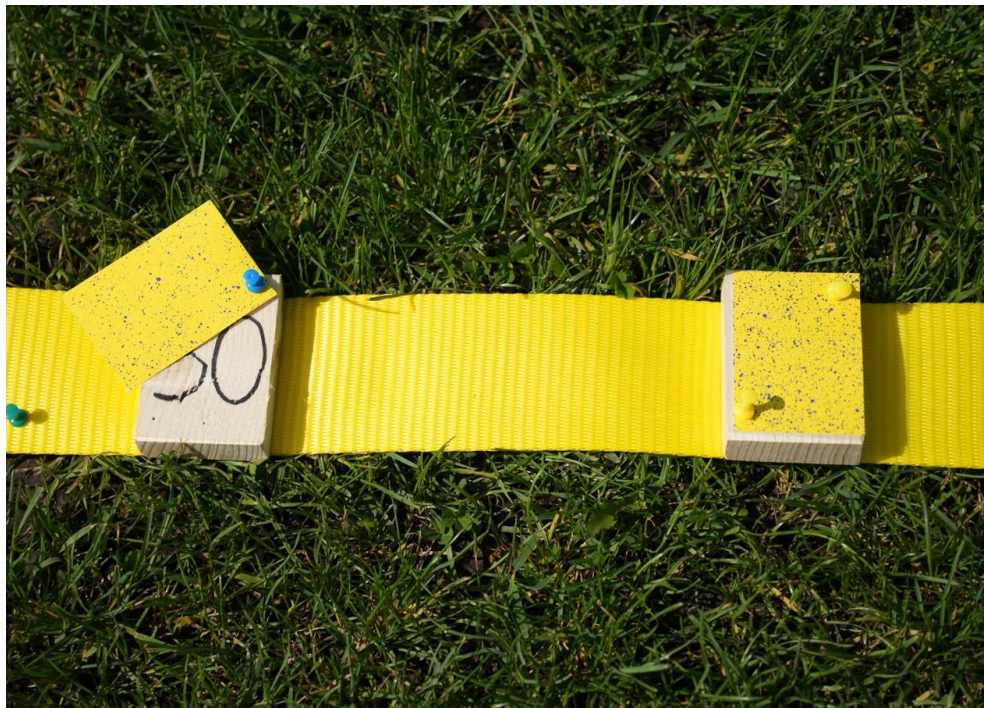
Multi (8) Rotor
& in-line hydraulic nozzle

Multi (6) Rotor – Boom config.

Spray Equipment Calibration Is Critical – Not well Understood for UASS

Calibration ensures:

- Delivery of accurate amount of product as label rate
- Uniform distribution of active ingredients over the field or to the targets
- Three major factors influence sprayer calibration:
  - Ground speed, i.e., flight speed (km/h, miles/h)
  - Swath width (meters or feet) – Impacted by flight height, nozzle/boom configuration
  - Flow rate (L/min or g/min)



UAPASTF Best Management Practices for Safe and Effective Application of Pesticides Using Unmanned Aerial Spray Systems (UASS)

- Not our intention to make this a standard (for example ASAE) but the UAPASTF BMPs could be utilized in works towards standards
- Because standards haven't yet fully captured best practices for evolving UASS uses (e.g. models, countries, and uses) these BMPs are general and meant to be a starting point
- Meant to be a starting point to then guide towards local resources
- Higher-level sections (check list) and detailed sections

Draft communication

QR Code Coming Soon

Unmanned Aerial Spray Systems (UASS):

Start Here for Best Practice Resources

UAPASTF

Drone Pesticide Application is Unique and Growing in Popularity

- Changes in UASS technology and regulations are happening rapidly.
- UASS has broad global appeal, with uptake examples in all four regions of the world.
- Regulatory frameworks and best practices are available and will differ based on the local situation.

Best Management Practices (BMPs) and UASS

- Pesticide application requires expertise and stewardship for proper use and safe handling, especially with a new technology like UASS.
- BMPs increase the likelihood of good environmental and operator practices while considering economic factors, availability, technical feasibility, and effectiveness.
- The BMPs provided here are intended to supplement information on the local product label. The registered and current product label should ultimately be followed above any other source of information. Readers should therefore ensure that this guidance is adapted or supplemented by other country/state/region specific needs, conditions, laws, and regulations, as relevant, including official and required aviation training, to ensure safe operations, which may not be explicitly mentioned on pesticide labels.

Purpose and Scope

- This BMP document intends to provide general guidance on best practices for the safe and effective application of pesticides when using UASS primarily for agriculture. The following areas are discussed:
  - **Current licensing regulations in key UASS markets**
  - **User safety in the context of pesticide handling**
  - **Equipment set up and calibration parameters that impact spray deposition while reducing off target movement (drift), including impact of equipment selection and environmental conditions**
- Because changes in UASS technology and regulations are happening rapidly, this document is intended to be updated regularly to ensuring the guidance and references within stay relevant.

While this is an exciting space, it should also be noted that in many geographies, UASS represent a complementary application technique to existing methods, and further understanding of their unique value and best local practices will help position their use appropriately and more effectively.

The Unmanned Aerial Pesticide Application System Task Force (UAPASTF) consists of the pesticide member companies: BASF Corporation, Bayer CropScience LP, Corteva Agriscience LLC., FMC Corporation, Gowan Company LLC, Nufarm Americas, Inc., Syngenta Crop Protection LLC, and Valent U.S.A. LLC. The UAPASTF, convened by industry, generates, submits, and/or shares/provides access to information and data to governmental agencies to address limitations in available regulatory information and to support risk assessment.

Thank you!

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