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REGULATING THE REVOLUTION: A DUAL-PILLAR ANALYSIS OF AGRICULTURAL SPRAYING DRONES IN THE EUROPEAN UNION

REGULÁCIA REVOLÚCIE: DVOJPILIEROVÁ ANALÝZA POĽNOHOSPODÁRSKYCH POSTREKOVÝCH DRONOV V EURÓPSKEJ ÚNII

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I Introduction

Precision agriculture is at a technological inflection point. The drive to meet the European Green Deal's objectives, such as reducing pesticide use and environmental impact, has accelerated the search for innovative application methods. Unmanned Aircraft Systems (UAS), commonly known as drones, are central to this transformation. Equipped with advanced sensors and spraying systems, they can apply plant protection products (PPPs) with high precision, offering the potential to reduce chemical inputs, lower carbon emissions compared to tractors, and minimize operator exposure to hazardous materials[1].

[1] Knoell (2025)

Abstract (EN)

The advent of Unmanned Aircraft Systems (UAS), or drones, promises to revolutionize precision agriculture. By enabling the targeted application of plant protection products (PPPs), drones offer significant environmental benefits, reduced costs, and increased operator safety compared to traditional ground-based machinery. However, their deployment in the European Union is not straightforward. Operators face a complex and high-stakes regulatory environment governed by two distinct and parallel legal frameworks: EU-wide aviation safety rules and EU-wide (but nationally implemented) pesticide application laws. This article analyzes this dual-pillar regulatory system. It first examines the EU aviation framework, which categorizes all pesticide spraying as a 'specific' operation requiring a formal risk assessment (SORA) or adherence to a Pre-Defined Risk Assessment. It then investigates the critical barrier of the Sustainable Use of Pesticides Directive (SUPD), which enforces a general ban on all aerial spraying, penetrable only via national derogations. The analysis concludes that while a clear path for authorization exists, its complexity requires a harmonized approach between aviation and agricultural authorities to unlock the full potential of this technology.

Keywords (EN)

agricultural drones, EU regulation, EASA, specific category (UAS), Sustainable Use of Pesticides Directive (SUPD), SORA

Abstrakt (SK)

Príchod bezpilotných leteckých systémov (UAS) alebo dronov sľubuje revolúciu v presnom poľnohospodárstve. Umožnením cielenej aplikácie prípravkov na ochranu rastlín (PPP) ponúkajú drony významné environmentálne výhody, znížené náklady a zvýšenú bezpečnosť obsluhy v porovnaní s tradičnými pozemnými strojmi. Ich implementácia v Európskej únii však nie je jednoduchá. Prevádzkovatelia čelia zložitému a náročnému regulačnému prostrediu, ktoré sa riadi dvoma odlišnými a paralelnými právnymi rámcami: pravidlami bezpečnosti letectva v celej EÚ a zákonmi o aplikácii pesticídov v celej EÚ (ale implementovanými na národnej úrovni). Tento článok analyzuje tento dvojpilierový regulačný systém. Najprv skúma rámec EÚ pre letectvo, ktorý kategorizuje všetky postreky pesticídmi ako „špecifickú" operáciu vyžadujúcu formálne posúdenie rizika (SORA) alebo dodržiavanie vopred definovaného posúdenia rizika. Potom skúma kritickú bariéru smernice o udržateľnom používaní pesticídov (SUPD), ktorá presadzuje všeobecný zákaz všetkých leteckých postrekov, ktorý je možné prekonať iba prostredníctvom vnútroštátnych výnimiek. Analýza dospela k záveru, že hoci existuje jasná cesta k autorizácii, jej zložitosť si vyžaduje harmonizovaný prístup medzi orgánmi v oblasti letectva a poľnohospodárstva, aby sa uvoľnil plný potenciál tejto technológie.

Kľúčové slová (SK)

poľnohospodárske drony, regulácia EÚ, EASA, špecifická kategória (UAS), Smernica o trvalo udržateľnom používaní pesticídov (SUPD), SORA

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Despite these clear advantages, the use of drones for spraying pesticides is one of the most complex UAS operations to legally conduct within the European Union. The regulatory landscape is uniquely challenging because it exists at the intersection of two separate bodies of EU law:

1. EU Aviation Law: Standardized rules managed by the European Union Aviation Safety Agency (EASA) that govern how a drone can fly safely.
2. EU Pesticide Law: A framework that governs what can be sprayed and by what methods, primarily to protect human health and the environment.

This article provides a comprehensive analysis of this dual-regulatory structure. It will first detail the EASA framework, explaining why spraying drones are automatically placed in the high-risk 'specific' category[2]. It will then explore the mandatory risk assessment process, known as SORA[3]. Following this, the article will analyze the significant hurdle presented by the Sustainable Use of Pesticides Directive (SUPD), which establishes a general prohibition on aerial spraying[4]. Finally, it will discuss the opportunities and persistent challenges for operators navigating this legal maze.

1.1 The EASA Aviation Framework: Regulation (EU) 2019/947

The foundation of EU drone regulation is a risk-based approach, established by Commission Implementing Regulation (EU) 2019/947 and Delegated Regulation (EU) 2019/945[5]. These regulations do not distinguish between commercial and leisure use but instead classify all drone operations into three categories based on their potential risk: 'open', 'specific', and 'certified'.

The 'open' category is for low-risk operations. However, Article 4 of Regulation (EU) 2019/947 explicitly states that a drone in the 'open' category "does not drop any material"[6]. The act of spraying pesticides or even fertilizers is, by definition, "dropping material." Consequently, all agricultural spraying operations, regardless of drone size or location, are automatically excluded from the 'open' category and fall into the 'specific' category.

Operating in the 'specific' category requires a formal operational authorisation from the operator's National Aviation Authority (NAA) before any flight can take place[7]. This authorization is granted only after the operator successfully demonstrates that the operation is safe by conducting a comprehensive risk assessment.

1.2 The Path to Authorisation: SORA and PDRAs

The methodology mandated by EASA for this risk assessment is the Specific Operations Risk Assessment (SORA). SORA is an intensive, 10-step process where the operator must systematically identify and mitigate risks[8]. This includes:

- Defining the Concept of Operations (ConOps).
- Determining the intrinsic Ground Risk Class (GRC), based on the flight area and proximity to people.
- Determining the intrinsic Air Risk Class (ARC), based on the airspace.
- Applying mitigation measures to lower these risks, which results in a final Specific Assurance and Integrity Level (SAIL).
- Fulfilling the Operational Safety Objectives (OSOs) corresponding to the determined SAIL.

Recognizing the complexity of SORA, EASA has also published several Pre-Defined Risk Assessments (PDRAs). These are, in effect, ready-made risk assessments for common, standardized operations. For agricultural spraying, the PDRA S-01 (based on the former STS-01) is often applicable. This PDRA simplifies the process, as EASA has already defined the operational limitations and mitigation measures. As of late 2023, EASA policy has confirmed that agricultural operations can be performed under PDRA S-01, which significantly streamlines the authorization process for operators who can adhere to its strict conditions (e.g., flight altitude, defined operational area)[9].

1.3 The Pesticide Barrier: Directive 2009/128/EC (SUPD)

Securing an aviation permit from the NAA is only half the battle. Operators must also comply with the Sustainable Use of Pesticides Directive (SUPD), which presents an even greater hurdle. Article 9 of the SUPD establishes a general prohibition on the aerial spraying of pesticides[10].

This ban was created with manned aircraft (planes and helicopters) in mind, focusing on the significant risks of spray drift over long distances. While drones

2 Mojtoba (2025)
3 European Parliament (2024)
4 Irish Aviation Authority (2024)
5 Agricultural Drone Initiative (2025)
6 EASA (2019)
7 Drone by Drone (2019)
8 EASA (n.d.)
9 EU Drone Port (2024)
10 Federal Office of Civil Aviation (2025)

operate at lower altitudes and speeds, they are still legally defined as "aircraft" and thus fall under this ban.

The only way to legally spray pesticides with a drone is by obtaining a derogation (an exception) from the relevant national authority (e.g., the Ministry of Agriculture). The SUPD states that derogations may be granted only in specific cases where:

a) there are no "viable alternatives" to aerial application; or
b) aerial application presents "clear advantages in terms of reduced adverse impacts on human health and the environment" compared to ground-based methods.

This creates a high legal threshold. An operator must prove that using a drone is demonstrably better or the only option. This has led to Member States granting derogations for specific, well-defined scenarios, such as treating vineyards on dangerously steep slopes where tractors cannot operate safely. Furthermore, the pesticide product itself must be explicitly approved for aerial application, which most currently are not[11].

1.4 Opportunities, Challenges, and the Path Forward

The dual-regulation system creates significant friction. An operator may be fully compliant with EASA's aviation rules but completely blocked by the SUPD's pesticide rules.

Opportunities

The benefits of overcoming these hurdles are well-documented. Scientific studies have shown that drone spraying can be significantly more energy-efficient and have a lower Global Warming Potential (GWP) than conventional tractor-based spraying. The precision of UAS reduces the total volume of pesticides used, aligning perfectly with the EU's "Farm to Fork" strategy[12]

Challenges

The primary concern remains spray drift. Droplets from a drone, while more targeted than from a plane, can still be displaced by wind. There are also concerns that the reduced water volume used in drone spraying leads to a higher concentration of the pesticide in each droplet, posing a risk if drift occurs. Furthermore, the lack of pesticide products specifically tested and approved for drone application forces operators into a legal grey area or a dead end.

[11] Finnish Safety and Chemicals Agency (2021)
[12] Eurofins (n.d.)

For this technology to become viable, a more harmonized approach is essential. This includes:

- National authorities developing clear, standardized processes for SUPD derogations.
- Pesticide manufacturers conducting research and seeking approval for drone-based application on their product labels.

Closer collaboration between National Aviation Authorities and national agricultural/environmental bodies to ensure an operator does not receive one permit only to be denied the other.

II Conclusion

The regulation of agricultural spraying drones in the European Union is a powerful case study in how new technology can outpace legislation. The EASA framework, through the 'specific' category and SORA, provides a clear, if complex, path for ensuring aviation safety. However, the SUPD's general ban on aerial spraying remains the single greatest obstacle, effectively grounding the technology in many Member States. While the environmental and safety benefits of drones are clear, their widespread adoption will remain stalled until EU and national legislators develop a cohesive regulatory pathway that integrates the rules of the sky with the rules of the soil.

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