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Government of India

कृषि एवं किसान कल्याण मंत्रालय

Ministry of Agriculture & Farmers Welfare

कृषि, सहकारिता एवं किसान कल्याण विभाग

Department of Agriculture, Co-operation & Farmers Welfare

वनस्पति संरक्षण, संगरोध एवं संग्रह निदेशालय

**DIRECTORATE OF PLANT PROTECTION, QUARANTINE & STORAGE**

केंद्रीय कीटनाशी बोर्ड एवं पंजीकरण समिति

**Central Insecticides Board and Registration Committee**

एन. एच. 4, फरीदाबाद (हरियाणा)-121001

**N.H. IV, FARIDABAD (HARYANA)-121001**

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Dated: 16<sup>th</sup> July, 2021

**PUBLIC NOTICE**

**Subject: Public notice inviting comments of stakeholders on the draft SOP for use of drone application of pesticide for crop protection (small marginal and organized sector) in agriculture, forestry, non-cropped area -reg.**

Reference is invited to the decision taken by the Registration Committee at Agenda Item No. 10.40 in the 429<sup>th</sup> RC meeting held on 24.06.2021, 28.06.2021 and 30.06.2021.

Accordingly, the draft SOP containing the present and proposed requirements in the SOP for use of drone application of pesticide for crop protection (small marginal and organized sector) in agriculture, forestry, non-cropped area for registration of pesticides or for label claim related matters is enclosed at Annexure for inviting comments of stakeholders.

All stakeholders are requested to submit their comments on the draft SOP within 30 days of hoisting of this Public Notice on the website of Dte. Of PPQ&S through email at cibsecy@nic.in and deficiency.pack-cibrc@nic.in.

This has the approval of APPA & Secretary (CIB&RC).

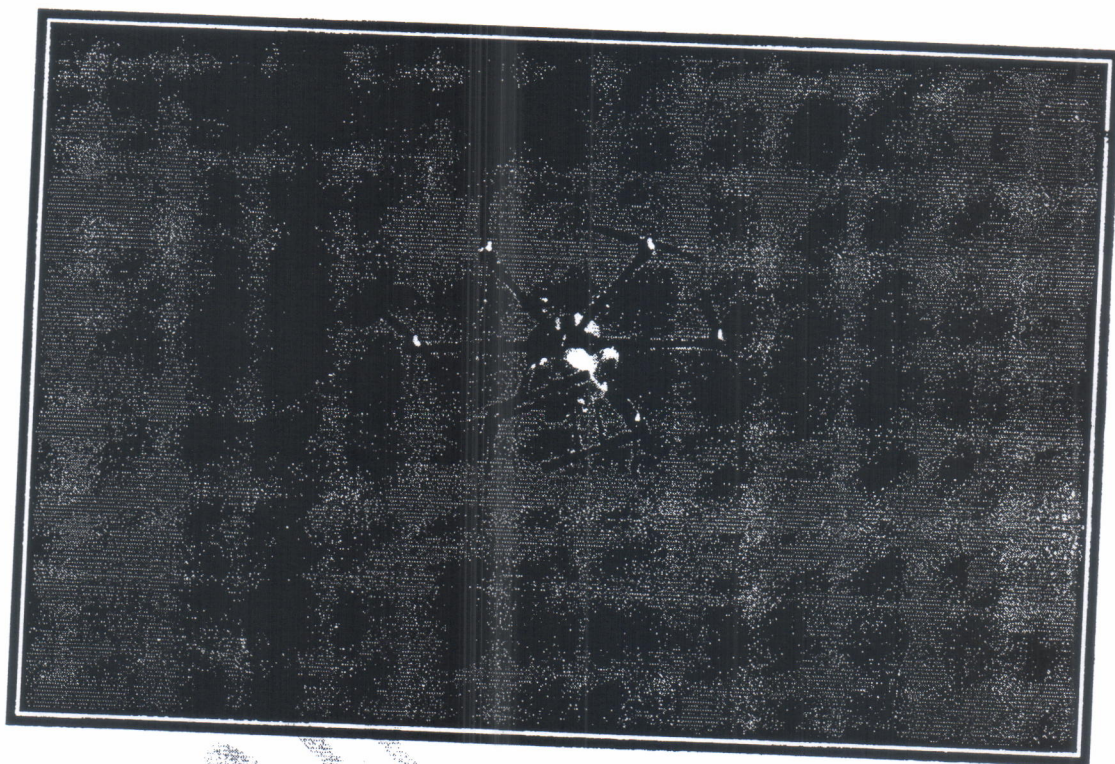
Encl: As above.

(Suman Jakhar)  
Section Officer

Copy to:

- (i) All Pesticide Associations/ICAR/SAU's
- (ii) Chairman, Registration Committee
- (iii) PPS to JS(PP)/ PPS to PPA/PPS to APPA & Secretary (CIB&RC)
- (iv) IT Cell, Hq. Faridabad for uploading the same on the official website.

**Standard Operating Procedure (SOP) for use of Drone application with pesticides for crop protection in agricultural, forestry, non-cropped areas, etc.**



**Government of India**  
**Ministry of Agriculture and Farmers Welfare**  
**Department of Agriculture, Cooperation and Farmers Welfare**  
**Directorate of Plant Protection, Quarantine & Storage**  
**N.H.IV., Faridabad-121001**

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## **Endorsement**

This Standard Operating Procedure (SOP) for use of Drone application with pesticides for crop protection in agricultural, forestry, non-cropped areas, etc. is prepared by the Directorate of Plant Protection, Quarantine & Storage, Faridabad under the relevant provisions (Rule 43) of the Insecticides Act 1968 and Insecticides Rules 1971 for undertaking safe and effective control of Pest and diseases by Drone application through aerial spraying. This SOP will render guidance to the stakeholders/ pilot/operators/ users/regulators while undertaking safe and effective control of Pest and diseases by Drone based Pesticide application.

**(Dr Ravi Prakash)**

**Plant Protection Adviser  
Directorate of Plant Protection, Quarantine & Storage,  
NH-IV, Faridabad-121001 India**

## 2. Objective:

Indian Agriculture has gone through much advancement and benefited by research and adoption of new technologies by farmers. Technologies like drip irrigation, mechanized farming for planting, harvesting and grading are being successfully used for sustainable agriculture in India. In recent years, use of drone in agriculture has gained prominence and some states are actively engaged in checking the suitability of this new technology in Indian agriculture. Application of agrochemicals using drones has a great potential as we are moving more and more towards commercialization and precision in agricultural crops. Drones are going to be important for increasing efficiency of application of crop protection chemicals by reducing manpower requirement, reducing time of application, reducing volume of water, quantity of chemicals and saving drift to environment along with reducing exposure to human being to hazardous chemicals. In conventional agricultural practices, pesticides are sprayed either manually or with the help of tractor-mounted sprayers where high quantity of agrochemicals and water is used also a sizable portion of spray go waste in environment. It is the understanding that drones based agro-chemical sprays requires less amount of water and pesticide due to better bio-efficacy and application efficiency.

To achieve the stated objective Drone as future technology for pesticide spraying, custom hiring and cooperative use of drone may be encouraged and facilitated by Ministry of Agriculture and Farmers Welfare for widespread availability by most of the small and marginal farmers of the country. Drone as future technology for pesticide spraying must be linked with Agriculture insurance system for tackling any kind of damage and loss. Drone regulation for pesticide application should cover important aspects like flying permissions, Area's Distance restrictions, Weight classification, Overcrowded Areas Restriction, Drone registration, Safety insurance, Piloting certification, operation plan, Air Flight zones, weather conditions, SOP's for pre, post and during operation, Emergency handling plan etc.

## 3. Statutory Provisions:

1. As per the provisions of the Insecticides Rules 1971, Under the Insecticides Act, 1968 one of the functions of the board (Central Insecticides Board) constituted under section 4 of the Act, is to specify the uses of the classification of insecticides on the basis of their toxicity as well as their being suitable for aerial application [Rule 3 (b)].

Further, as per Insecticide Rules 1971, Chapter VIII Rule 43 on Aerial Spraying Operations, the aerial application of Insecticide shall be subject to the following provisions: -

- a. marking of the area shall be the responsibility of the operators;
- b. the operators shall use only approved insecticides and their formulations at approved concentration and height;
- c. washing decontamination and first-aid facilities shall be provided by the operators;
- d. All aerial operations shall be notified to the public not less than twenty-four hours in advance through competent authorities;
- e. Animals and persons not connected with the operations shall be prevented from entering such areas for a specific period; and

- f. The pilots shall undergo specialization training including clinical effects of the insecticides.
2. Directorate General of Foreign Trade (DGFT)- Drones are covered under ITC HS code 8802 and parts of drones are covered under ITC HS code 8803. The import policy regarding ITC HS code 8803 which covers components of drones is "Free". Hence no change in import policy is required for components and spares required to assemble agriculture drones as they are already in free category.
3. The drone operations are being permitted by Ministry of Civil Aviation (MoCA) and Director General of Civil Aviation (DGCA) through the conditional exemption route. New drone directorates have been established in DGCA recently to speed up the approval process. They have published a detailed DGCA Requirements for Operation of Civil Remotely Piloted Aircraft System (RPAS) Guidance Manual with an objective to acquaint the public and the industry with the procedures being followed for processing all matter pertaining to issue of unique identification number, unmanned aircraft operator permit, and related activities. It will help understand the flow of various processes involved and understand the intricacies of the system.

Further, Requirements for Operation of Civil Remotely Piloted Aircraft System (RPAS) mentions about the Civil Aviation Requirements (CAR) issued under the provisions of Rule 15A and Rule 133A of the Aircraft Rules, 1937 under the Aircraft Act, 1934 (22 of 1934) and lays down requirements for obtaining Unique Identification Number (UIN), Unmanned Aircraft Operator Permit (UAOP) and other operational requirements for civil Remotely Piloted Aircraft System (RPAS). These operation of drones are regulated by Unmanned Aircraft System Rules (UAS), 2021 rules as published by Ministry of Civil Aviation vide GSR G.S.R. 174(E) dated 12<sup>th</sup> March, 2021. Operators have the flexibility to utilize any RPAS/drone in case of agricultural pesticide spraying, irrespective of weight category or use case, provided the discharge of substance is cleared and mentioned in the Unmanned Aircraft Operator Permit (UAOP) issued by the DGCA.

**4. DGCA DO & DON'TS regarding operation of RPAS are as following:**

Unmanned Aircraft System (UAS)/ Remotely Piloted Aircraft System (RPAS), commonly known as drones/ UAV, is a new addition to the aviation sector. This technology has promising effect on economic growth of India; both manufacturing and service industry.

As more people enter the commercial and recreational hobby drone scene; the prospects for drone accidents/ incidents also multiply. This applies not just to newcomers/ amateurs but even to professionals. Here are some operational safety tips to ensure a better and safer flying experience, for self and the people around.

**Do's**

- I. Ensure your Drone (except Nano in uncontrolled airspace upto 50ft) is Digital Sky "No Permission- No Take off" (NPNT) Compliant.
- II. Obtain Unique Identification Number (UIN) from DGCA for operating in controlled airspace and affix it on your drone

- III. Obtain Unmanned Aircraft Operator Permit (UAOP), if applicable from DGCA for commercial operations and keep it handy
- IV. Obtain Permission before each flight through Digital Sky Platform
- V. Ensure drone is in good condition (not damaged) and fit for flying safely.
- VI. Keep an eye on interference: Interference can be from mobile devices or blockage of signals, do watch out when flying your drone.
- VII. Fly only during daylight (after sunrise to before sunset)
- VIII. Fly in good weather: Good weather lets you not only fly your drone better but also keep track of it in the air.
- IX. Fly in visual line of sight (VLOS): Always be within visual range of your drone.
- X. Follow Flying Guidelines
- XI. Do your homework before spending the considerable money for a drone. Make sure you clearly understand all operational and regulatory aspects.
- XII. Be aware of Airspace Restrictions/ No Drone Zones
- XIII. Do stay away from airports and heliports
- XIV. Respect privacy of people
- XV. Keep local police informed about your drone flying activity. If you are ever approached by police provide all requisite information.
- XVI. Do log your flights and intimate concerned authorities (like DGCA, local police etc.) of any incidents/ accidents

#### **Don'ts**

- I. Don't fly a Nano drone above 50ft (15m) from the ground level
- II. Don't fly a Micro drone above 200ft (60m) from the ground level
- III. Don't fly drones more than 400ft (120m) from the ground level
- IV. Don't fly drone near other aircraft (manned or unmanned)
- V. Don't fly drone near airports and heliports
- VI. Don't fly drone over groups of people, public events, or stadiums full of people without permission
- VII. Don't fly drone over government facilities/military bases or over/ near any no-drone zones.
- VIII. Don't fly drone over private property unless permission is given.
- IX. Don't fly drone in controlled airspace near airports without filing flight plan or AAI/ADC permission (at least 24 hours before actual operation).
- X. Don't drop or carry hazardous material
- XI. Don't fly drone under the influence of drugs or alcohol
- XII. Don't fly drone from a moving vehicle, ship or aircraft

### **5. Critical parameters to be considered for Drone based pesticide application:**

#### **5.1. Drone related:**

- a. Only Director General of Civil Aviation (DGCA) certified/approved drone shall be permitted to carry-out agriculture spray. The reliability of the drone is assured through DGCA certification process.

- b. The drone must have capability to handle variable payload (depleting tank). The nozzle system should be attached in a manner that the spray swath is continuous when sprayed from the minimum permitted height above the uniformly distributed crop (e.g. paddy/sugarcane).
- c. The drone must be fitted with accurate altitude sensor to ensure desired height above the crop is maintained throughout the spraying mission.
- d. The GPS accuracy of the drone and accuracy of the map shall be characterized and the same shall be utilized to define the safety/buffer margin while creating the geo-fencing around the field or obstacles.
- e. The drone spray system must support variable flow control to ensure uniform dispensing of the payload.
- f. The drone must have necessary fail-safes including Return to Home (RTH) on empty tank and auto mission restart from the point RTH was engaged.
- g. The drone spray system should be leak proof and dripping of agrochemical should be avoided during the application. (Check before flight)
- h. The drone spray system should be properly calibrated to ensure accuracy of  $\pm 10\%$  on quantity of input sprayed.

### 5.2. Agrochemical

- a. Only Central Insecticides Board and Registration Committee (CIB&RC) approved agrochemical shall be used.
- b. The dose can vary as per the droplet size as bio-efficacy increases with lower droplet size.
- c. The agrochemical (liquid/solid) compatibility with the drone spray system shall be established prior to the mission for the desired dilution. This is to ensure agrochemical solubility formulation stability and ability to spray with the type of nozzles provided in the drone. In case of mixing of more than one agrochemical, CIB&RC specified guidelines must be adhered to.
- d. Crop residual data to be considered for every crop.
- e. The minimum dilution shall be decided based on the fulfilment of the above-mentioned requirements and ensuring satisfactory coverage of sprayed input both horizontally and vertically.
- f. Agrochemical should be diluted only in clean water.

### 5.3. Environment Limitations

The drone based spray should be undertaken and may be permitted under the conducive weather conditions to get the best results in terms of appropriate Wind speed, Temperature & Relative Humidity etc.



#### 5.4. Pilot Training

- a. Only DGCA certified pilots shall be permitted to fly the agri drones.
- b. A training module to be devised encompassing agrochemical handling, agri-mission specific ops protocols, and relevant crop protection guidelines shall be made mandatory for pilots operating agro input spray drones.

#### 5.5. Critical Operational Parameters

Drift Management: In India majority of land holdings are small and there are possibilities of spray drift to the nearby crop fields while spraying with drones. The possible ways to reduce the spray drift has to be identified, like selection of pesticide formulation according to crops

- a. Field trials test with drone compatible pesticides by using the different type of nozzles viz. (Flat pan, Rotary, Centrifugal) for different pesticide have to be conducted by the applicant to standardize the best suitable nozzles and boom configuration for pesticide application in different crops.
- b. Standardization of flying speed: The ideal speed as per the available references may be considered as 6.5 m/second., Max flight speed may be less than or equal to 20Km/h. Flow rate may be 1-5 Litre/min or as approved after the evaluation of the submitted data.

To minimize the spray drift, apart from wind limitation, the following may be considered:

- a. Spray height above crop canopy
- b. Speed of the drone
- c. Droplet size
- d. A buffer zone can be demarcated (geo fenced)
- e. Spray schedule should be at appropriate time gap either before rainfall or after rainfall.

#### 5.6. Safe guarding the non-targets

The non-targets shall be safe guarded by adhering to the following operational protocols:

- a. Sufficient Buffer zone to cater to agrochemical drift, shall be maintained between the adjacent farms or different crops to avoid spray on non-targets. The buffer zone may be increased based on the severity of the agrochemical on the non-targets.
- b. During the spray operation operator should always maintain suitable distance from the drone and avoid windward direction as much as possible.
- c. No human or animal movement shall be permitted within or in the close proximity of the farm during and immediately after the spray operations.

d. Drone based spray operations should be conducted at an appropriate distance from water bodies, residential areas, fodder crops, public utilities, dairy, poultry etc.as per DGCA or other concerned authority guidelines.

**6. Details, precautions prerequisites etc. before, during and post-operation for Drone based Pesticide application**

The Standard Operating Procedure (SOP) for Drone Operation with pesticides must consist of following details, precautions prerequisites etc. before, during and post-operation:

**6.1. Pre-application:**

1. Confirm not to fly in the drone-forbidden area (airport or electronic station).
2. Understand the local aviation laws and regulations where they operate.
3. Ensure the operators are trained on both drone operation and safe use pesticide.
4. No alcoholic drinks within 8 hours preceding operation.
5. Calibrate drone spray system to ensure nozzle output and accurate application of labelled rates.
6. Check drone in good condition, no leak in the spraying system.
7. Confirm place for takeoff and landing, tank mix operations.
8. Check and mark the obstacles (walls, trees) around the field for safe operation.
9. Set up at least buffer zone (as specified by DGCA) between drone treatment and the non-target crop.
10. Confirm water sources - Do not spray pesticides near water sources (less than 100 m) to avoid polluting water sources.

**6.2. During Application:**

1. Read labels carefully to understand safety guidance.
2. Wear Personal Protective Equipment (PPE).
3. Do not eat, drink or smoke while spraying.
4. Confirm the flying route was reasonable to minimize turn around.
5. Operation team shall always stay at the downwind end of the field and backlight direction.
6. To spray with pure water first to test operation for at least 5 min.
7. Two step dilutions to fully dissolve the pesticide.
8. Adopt proper pressure for optimized droplet spectrum ( $>100\mu\text{m}$ ).
9. Check weather conditions for:
  - a. Appropriate Wind speed,
  - b. Appropriate Temperature,
  - c. Appropriate Humidity
10. Appropriate Flying height above target crop.

11. Appropriate Water volume.
12. Appropriate Flying speed.
13. Avoid having to walk through crop which has been contaminated by drifting spray.
14. Do not spray during active bee foraging period of the day. Avoid spray drift to flowering nectar crop.
15. When spraying pesticides that are toxic to non-target organisms such as fish, birds and silkworm, strictly abide by the product label requirements and take effective measures to avoid risks.
16. Use anti-drift nozzle to decrease drift to human and environment.

### **6.3. Post Application:**

1. Timely evacuation and transfer to fresh air.
2. Triple rinse of empty container is mandatory.
3. Ensure waste generated is kept to a minimum.
4. The disposal of waste must conform to the local laws.
5. Never burn or bury hazardous waste.
6. Never leave empty containers in the field. It should be disposed of as per the Insecticides Rule 1971.
7. Set up warning signs in the spray area for reminding people.
8. Take a shower and put on clean clothes.
9. To prevent leakage of plant protection products in the process of transport and waiting to use.
10. Securely stored plant protection products away from unauthorized people, animals and food when transporting and storing PPP. Safely dispose all spills immediately.
11. Follow the maintenance schedule as prescribed by the Drone manufactures.

### **7. Registration requirements of pesticides for drone application:**

As the agrochemicals are to be used at very higher concentrations as compared to conventional system, crop-chemical wise assessment of probable phytotoxicity helps in précising the safe dosage of agrochemicals and ensures the safety of crop and environment. Thus, phytotoxicity data on parameters such as leaf injury on tips/surface, wilting, vein clearing, necrosis, epinasty and hyponasty, and number of dead plants etc. must be available.

The Pesticide industry should conduct spraying trials with drone on different crops in different agro-climatic zones for generating the data on pesticide applications by use of drones specially on Phytotoxicity and residue as a result of use of higher concentrations of pesticides by low volume drones sprayers unlike the use of back pack and other high volume sprayers to certify that whether there is no change in per ha active ingredient of the already registered pesticide for use in Drone application, or there is change in per ha doses of the pesticides for use in drone spraying, Besides the data of Phytotoxicity and residue in crops,

the precaution and cautionary statement related data on label and leaflet may also be submitted to CIB&RC for endorsement/registration.

**7.1. Major regulatory requirements at the DPPQ&S shall be as follow:**

**Present System:**

1. Submission and approval of Drone application plan by the recommended pesticides for the approval of Central Insecticides Board for consideration and grant of permission for application of pesticides through drones for the specific purpose and for the specified period. Thereafter, renewal of permission will be required.
2. The proposals received by the, Directorate of PPQ&S for granting permission for use of drone in agriculture/ horticulture will be examined by a Technical Committee (comprising of Plant Protection Experts) constituted by the Plant Protection Adviser prior permitting use of drone in agriculture and put for the approval of the Board.

**Proposed System:**

1. An agenda to be taken up before the forthcoming Central Insecticides Board meeting, for considering of ex-post facto submission and approval of proposals by the applicants on providing detailed application of recommended pesticides through drones in agriculture using only DGCA approved Drone for the said purpose, in prescribed format through secretariat of CIB&RC on biannual basis.
2. The registration of new Pesticides for drone based application and the label claim related approvals shall be made part of the application for registration of pesticides or for endorsement. The same shall be made before the registration Committee through the secretariat of the CIB&RC by the applicant for Registration Committee's approval.
3. The Registration Committee may consider granting suitable priority for recommending pesticides through drones.

**7.2. Following shall be the Data requirements:**

- a. Products with existing label claim in a crop recommended for spray with sprayers and to endorse the use of Drones as alternate/additional spraying equipment.

**Requirement:**

if critical GAP e.g. AI dose/ha, PHI and number of applications is within a determined range of conventional spray then;

1. Crop safety (phyto-toxicity) on the approved crop-pest combination for one season four different agro-climatic conditions, where the target crop is cultivated.

if critical GAP e.g. AI dose/ha, PHI and number of applications is not within a determined range of conventional spray then;

- i. Bio-efficacy data including phyto-toxicity on the approved crop-pest combination for one season four different agro-climatic zones where the target crop is cultivated.

- ii. Residue data for one season four different agro-climatic zones where the target crop is cultivated.

- b. New product registration with use of sprayers and Drones as spraying equipment.

**Requirement:**

- i. Bio-efficacy data including phyto-toxicity on the desired/ approved crop-pest combination for two season three different agro-climatic zones where the target crop is cultivated with drone also.
    - ii. Residue data for two season three different agro-climatic zones where the target crop is cultivated with drone also.

- c. New label claim expansion with the use of sprayers and Drones as spraying equipment.

**Requirement:**

- i. Bio-efficacy data including phyto-toxicity on the desired/ approved crop-pest combination for one season four different agro-climatic zones where the target crop is cultivated.
    - ii. Residue data for one season four different agro-climatic zones where the target crop is cultivated.

- d. New label claim with the use of Drone alone as spraying equipment.

**Requirement:**

- i. Bio-efficacy data including phyto-toxicity on the desired/target crop-pest combination for two season three different agro-climatic zones where the target crop is cultivated.
    - ii. Residue data for two season three different agro-climatic zones where the target crop is cultivated.

**Note:** As practiced in Japan based on their analysis of bio-efficacy and residue data collected through over 30 years on registered applications via radio-controlled helicopters (RCHs) for various crops it can be considered that Bio-efficacy and residue data specifically for drone/ UAV and conventional spray applications may be considered to be equivalent for identical use patterns (if critical GAP e.g. AI dose/ha, PHI and number of applications is within a determined range of conventional spray) and therefore do not require specific UAV bio-efficacy and residue trials, But require an additional crop safety study, under the following conditions:

- The drone use is an extension of a registered formulation from conventional spray.

Further, Registrants to ensure the formulation can be properly used by UAV with ULV (Ultra Low Volume) / Non-ULV application. For formulations that have been specifically developed for drone application, residue studies may be exempted as far as certain conditions are met (if critical GAP e.g. AI dose/ ha, PHI and number of applications is within a determined range of conventional spray), but efficacy and crop safety data are required.

**8. Model study protocol of bio-efficacy data generation**

For bio-efficacy data generation using Drone for application of pesticides, the study protocol may include data on following:

- A. Trial conditions details**
  - 1. Selection of crop and breed
  - 2. Cultivation conditions
  - 3. Weather conditions
- B. Trial design and arrangement details**
  - 1. Trial pesticide
  - 2. Control pesticide
  - 3. Trial plot arrangement
- C. Pesticide application details**
  - 1. **Application method:** The pesticide application method, time, frequency and dose should be in compliance with the agreement or label instructions. The pesticide application should be in line with the local agricultural practices. The amount of the active ingredients in the pesticide is usually expressed as (g/ha).
- D. Application equipment details**
  - 1. Crop protection Remotely Piloted Aircraft System (RPAS) or Drones
  - 2. Control pesticide application equipment
- E. Operator licensing, registration of UAV details, training etc.**
- F. Requirements on pesticide for control of other diseases, insects and weeds:** If any other pesticide is to be used, the pesticide should have no effect on the trial pesticide and the trial subject, and be applied evenly to all trial plots. The pesticide should be used separately from the trial pesticide and the control pesticide, to minimize their mutual interference. Accurate data about such pesticide, such as the name, application time and application dose, should be recorded.
- G. Droplet distribution determination details**
- H. Survey, recording and measurement methods details**
- I. Meteorological and soil data details**
  - 1. **Weather conditions:** The precipitation (mm), temperature (daily average temperature, maximum temperature and minimum temperature, °C), relative humidity (%), wind force (m/s) and wind direction during the trial period should be recorded. Adverse climatic factors if any, that will affect the trial results throughout the trial period, such as severe or prolonged droughts, heavy rains and hail, must be recorded.
  - 2. **Soil data:** The soil type, soil fertility, irrigation and drainage, algae growth and weeds, among others, should be recorded.
- J. Efficacy calculation method details**
- K. Direct effect on crops --- phytotoxicity survey**
- L. Effect on other organisms**
- M. Effect on other pests and diseases**
- N. Effect on other non-target organisms**
- O. Product yield and quality:**

For herbicides and plant growth regulators, determination of the product yield is generally required. The yield per plot should be recorded and expressed in (kg/ha).
- P. Information on Liquid preparation drifting, droplet size and distribution etc.**

In addition to the registration data requirements described above, applicants should be responsible for the compatibility of the formulation for UAV application, and ensure clogging of nozzles does not occur at low dilution rates for UAV application. They must ensure the safety and emergency handling plans ready for any given situation.

**9. Spray Monitoring Form:**

The enclosed drone based spray monitoring form should also be filled and be submitted with the SOP for approval.

**SPRAY MONITORING FORM**

<b>1</b>	<b>CONTROL LOCATION</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
1-1	Date						
1-2	Name						
<b>2</b>	<b>VEGETATION DATA</b>						
2-1	vegetation type (Grass, Bushes, Trees, Crop)	GBTC	GBTC	GBTC	GBTC	GBTC	GBTC
2-2	height (m)						
2-3	crop names and pest/disease/weed infection/infestation/intensity (%)						
<b>3</b>	<b>PESTICIDE DATA</b>						
3-1	trade name						
3-2	concentration (g a.i./l or %)						
3-3	formulation (EC, ULV, Dust)	EUD	EUD	EUD	EUD	EUD	EUD
3-4	expiry date						
3-5	is insecticide mixed with water or solvent?	YN	YN	YN	YN	YN	YN
3-6	if yes, what solvent and mixing ratio						
<b>4</b>	<b>WEATHER CONDITIONS</b>						
	start and end of control operations	Start	End	Start	End	Start	End
4-1	time						
4-2	temperature (°C)						
4-3	relative humidity (%)						
4-4	wind speed (m/s)						
4-5	wind direction (degrees from N)						
4-6	spray direction (degrees from N)						
<b>5</b>	<b>SPRAY APPLICATION</b>						
5-1	sprayer type (Rotary, Airblast, ENS, Hydraulic, Other)	RAEHO	RAEHO	RAEHO	RAEHO	RAEHO	RAEHO
5-2	sprayer operator (Pilot, Driver, Hired, Other)	PDLHO	PDLHO	PDLHO	PDLHO	PDLHO	PDLHO
5-3	sprayer manufacturer						
5-4	sprayer model						
5-5	sprayer platform (Aerial, Vehicle, Handheld)	AVH	AVH	AVH	AVH	AVH	AVH
5-6	date of last calibration						
5-7	atomizer height above ground (m)						
5-8	ROTARY SPRAYERS: speed setting (blade angle, pulley setting, no. batteries)						
5-9	speed of atomizer (rpm)						
5-10	flow rate setting (which nozzle or restrictor used)						
5-11	flow rate/atomizer (l/min)						
5-12	number of atomizers						
5-13	track spacing (m)						
5-14	BARRIERS ONLY: width and spacing (m)						
5-15	forward speed (km/h)						
5-16	AERIAL SPRAYING: support supplied	GP = ground party available RC = radio communication with aircraft TG = DGPS track guidance					
		GP RC TG	GP RC TG	GP RC TG	GP RC TG	GP RC TG	GP RC TG
5-17	ground marking (GPS, Flag, Mirror, Smoke, Vehicle, None)	GFMSV N	GFMSV N	GFMSV N	GFMSV N	GFMSV N	GFMSV N
<b>6</b>	<b>CONTROL EFFICACY</b>						
6-1	Effectiveness/mortality (%)						
6-2	time after treatment (hours)						
6-3	method of Effectiveness /mortality estimation (Quadrats, Target size, Visual, Cages, Other)	QTVCO	QTVCO	QTVCO	QTVCO	QTVCO	QTVCO
<b>7</b>	<b>SAFETY AND ENVIRONMENT</b>						
7-1	protective clothing: what did the operator wear?	G = goggles M = mask L = gloves O = overalls B = boots					
		GMLOB	GMLOB	GMLOB	GMLOB	GMLOB	GMLOB

7-2	was soap and water available?	Y N	Y N	Y N	Y N	Y N	Y N
7-3	who was informed of spraying? (Farmer, Nomad, Villager, Official, Beekeeper, others etc.)	F N V O B	F N V O B	F N V O B	F N V O B	F N V O B	F N V O B
7-4	effect on non-target organisms	Y N	Y N	Y N	Y N	Y N	Y N
7-5	if yes, what						
7-6	details of anyone who felt unwell or if other problems were encountered						

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**List of Members of the Committee and Experts for drafting of Standard Operational Guidelines of Drones**

1. Dr Ravi Prakash, Plant Protection Adviser, CIB&RC, Faridabad- Chairman
2. Dr. V K Singh, Head, Division of Agronomy, IARI, New Delhi
3. Head, Division of Horticulture, IARI ,New Delhi
4. Dr. Subhash Chander, Prof. Division of Entomology, IARI ,New Delhi
5. Dr. V. K. Baranwal, Prof. Division of Pathology, IARI, New Delhi
6. Dr. Roaf A Parray, (Scientist, Agril. Eng.), IARI, New Delhi
7. Dr. Manoj Kumar, Director, CPRI, Shimla, HP
8. Shri. C. R. Lohi, Deputy Commissioner (M&T), DAC&FW (Convener)

**Technical Experts from Government organization**

1. Shri Y. Raghunadha Babu, Chairman, Tobacco Board, Ministry of Commerce and Industry, Department of Commerce, G.T.Road, Guntur-522004 (A.P)
2. Dr Brijesh Tripathi DD (Chem.), CIB&RC, DPPQ&S, Faridabad
3. Dr K L Gujar, DD(PP), CIB&RC, DPPQ&S, Faridabad and
4. Dr C S Patni, DD(PP), IPQ Division, DPPQ&S, Faridabad

**Technical Experts from Manufacturers & Associations**

1. Shri Smit Shah, Drone Federation of India
2. Shri Deepak Bhardwaj, IoTech World Avigation Pvt. LTD.
3. Shri Anoop Kumar Upadhyay, IoTechWorld Aviation Pvt Ltd, Gurgaon
4. Shri Asitav Sen, CEO, Crop Life India,
5. Dr Sangeeta Mendiratta, Crop Science Division, Bayer Crop Science Ltd, N Delhi
6. Shri Amit Shekhar, M&M, Ltd
7. Shri Abhishek Burman, CEO,General Aeronautics Pvt. Ltd., Bengaluru 560012,Karnataka
8. Shri J. Gaur, Dhanuka Agritech, Gurgaon, Haryana
9. Shri Ombeer Tyagi, , Vice President, UPL, UPL ltd.

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