PHILIPPINE NATIONAL STANDARD

PNS/BAFS 361:2023
ICS 65.060.40

Multi-Rotor Remotely Piloted Aircraft-Powered Sprayer — Methods of Test

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Foreword

In 2022, the Department of Agriculture (DA)-Fertilizer and Pesticide Authority (FPA) proposed the development of the General Guidelines on the use of Remotely Piloted Aircraft Systems (RPAS) for fertilizer spraying in crop production. This is in compliance with the issuance of Memorandum Order No. 63, series of 2021 (Promoting the Use of Agricultural Drones Towards the Transformation of Philippine Agriculture). As part of DA-Bureau of Agriculture and Fisheries Standards (BAFS)' standards development process, the proposal was presented to the Task Force on the Identification and Prioritization of the Philippine National Standards (PNS)/Philippine Agricultural and Bioprocessing Engineering Standards (PABES) for Development, Review, and Revision (TF-PNS/PABES) of the DA-Philippine Council for Agriculture and Fisheries-Committee on Agricultural and Fisheries Mechanization (PCAF-CAFMech) for review and endorsement. The TF-PNS/PABES agreed to refocus the proposal on the standardization of the sprayer component. The DA-PCAF-CAFMech then endorsed the development of PNS on Drone-Powered Sprayer — Specifications and Methods of Test through DA-PCAF-CAFMech Resolution No. 14, series of 2022 (Recommending to the DA-BAFS and Agricultural Machinery Testing and Evaluation Center [AMTEC] the Prioritization of the Development of PNS [Specifications and Methods of test] for Cacao bean fermenter, Egg incubator, and Drone-powered sprayer).

In response, the DA-BAFS created a Technical Working Group (TWG) to develop the PNS under the following Special Order (SO):

1. SO No. 487, series of 2022 (Addendum to the SO No. 103, Series of 2022 Entitled "Creation of TWG for the Development of PNS for Agriculture and Fishery Products, Machineries, and Infrastructures");
2. SO No. 617, series of 2022 (Amendment to SO No. 487, Series of 2022 [Addendum to the SO No. 103, Series of 2022 Entitled "Creation of TWG for the Development of PNS for Agriculture and Fishery Products, Machineries, and Infrastructures"]); and
3. SO No. 146, series of 2023 (Creation of TWG for the Development of PNS for Agricultural and Fishery Products, Machinery, and Infrastructures).

The TWG is composed of representatives from relevant DA agencies, other National Government Agencies (NGA), academe/research institutions, private sector, and Civil Society Organizations (CSO). The draft PNS underwent a series of TWG meetings and stakeholder consultations conducted via online platforms from June 2022 to March 2023 prior to its endorsement to the DA Secretary for approval.

This PNS was drafted in accordance with the editorial rules of the DA-BAFS-Standards Development Division (SDD) Standardization Guide No. 1 (Writing the Philippine National Standards).

Table of Contents

1 Scope

This Standard specifies the methods of test and inspection for a multi-rotor remotely piloted aircraft (RPA)-powered sprayer. Specifically, it shall be used to:

a) Verify the mechanism, dimensions, materials, accessories of the machine, and the list of specifications submitted by the test applicant;
b) Determine the field performance of the RPA-powered sprayer;
c) Evaluate the ease of handling and safety features; and
d) Prepare the report for the test.

2 Normative References

The following documents are referred to in the text in such a way that some or all their contents constitute the requirements of this document. The latest edition of the referenced document (including any amendments) applies.

Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (2023). Multi-rotor RPA-powered sprayer — Specifications (PNS/BAFS 360:2023)

3 Terms and Definitions

For this Standard, the definitions given in PNS/BAFS 360:2023 (Multi-rotor remotely piloted aircraft-powered sprayer — Specifications) and the following shall apply:

3.1
actual field capacity
actual area covered per unit of time of operation, expressed in ha/h (Agricultural Machinery Testing and Evaluation Center [AMTEC]-University of the Philippines Los Baños [UPLB], 2015, *modified*)

3.2
application rate
function of liquid solution sprayed during field operation and actual sprayed area, expressed in L/ha (AMTEC-UPLB, 2022a)

3.3
crop canopy
aboveground portion of a plant cropping or crop, formed by the collection of individual plant crowns (Campbell & Norman, 2010)

3.4
discharge rate
amount of liquid solution discharged from nozzles for a period of time, expressed in L/min (AMTEC-UPLB, 2022a)

3.5
effective swath
width of the area that can be covered by the spray application operation. This is determined using multiple passes which are lapped one over the other to obtain an average spray pattern with a coefficient of variation (CV) ≤ 25% (Martin et al., 2022, modified)

3.6
field efficiency
ratio of the actual field capacity to the theoretical field capacity, expressed in percent (%) (Iowa State University, 2016)

3.7
operating time
flight time
the total time of operation of the RPA-powered sprayer from system power up, takeoff, hovering, flying into position, refilling of chemical solution, replacement of battery, spraying, return to home, landing, and system power off (AMTEC-UPLB, 2022a)

3.8
overall height
distance between the horizontal supporting plane surface and the horizontal plane touching the uppermost part of the RPA-powered sprayer (AMTEC-UPLB, 2022a)

3.9
overall length
distance between the vertical planes perpendicular to the median plane of the machine, each plane touching the front and rear extremities of the RPA-powered sprayer (AMTEC-UPLB, 2022)

3.10
overall width
distance between the vertical planes parallel to the median plane of the machine, each plane touching the outermost point of RPA-powered sprayer on each respective side (AMTEC-UPLB, 2022a)

3.11
running-in period
preliminary operation conducted before the actual testing of the RPA-powered sprayer to make various adjustments until the operation is stable (AMTEC-UPLB, 2015, *modified*)

3.12
spray time
the duration when the nozzle starts spraying operation until the time it stops (AMTEC-UPLB, 2022)

3.13
test field
area with required size and shape used for testing the RPA sprayer (AMTEC-UPLB, 2022a)

3.14
theoretical field capacity
function of traveling speed and effective swath, expressed in ha/h (AMTEC-UPLB, 2010, modified)

3.15
travelling speed
speed of the RPA-powered sprayer during operation, expressed in km/h or m/s (AMTEC-UPLB, 2022a)

3.16
water sensitive paper
paper coated with bromophenol blue which turns the yellow film to blue when in contact with moisture (Ahmad et al, 2022)

4 Principle of the Test

The test shall be carried out to assess the actual specification of the multi-rotor RPA-powered sprayer. Its specifications shall be validated with PNS/BAFS 360:2023 (Multi-rotor RPA-powered sprayer — Specifications).

5 Test Instruments and Materials

The suggested list of minimum field and laboratory test equipment and materials needed to carry out the machine test is shown in Annex A (Minimum list of test equipment and materials). The instruments to be used shall be calibrated regularly and physically checked before and after each test.

6 General Considerations

6.1 Test site conditions

The test should be conducted in an area with permissible wind velocity as specified by the manufacturer in order to clearly observe the RPA-powered sprayer. The test shall be conducted during daytime. Licensed controller and a representative of the test applicant should be present during testing.

6.1.1 Size and field condition of test

6.1.1.1 The test field shall be rectangular with sides in the ratio of 2:1 as much as possible. Its size shall not be less than 5000 m^2 with length not less than 100 m. The total size of the prepared test fields shall be sufficient for the required

number of test trials and running-in. Test field size should be adequate enough to accommodate flight time of the RPA-powered sprayer.

6.1.1.2 The test plot shall be flat and free of obstructions, such as trees, buildings, and other structures, that may hamper the flight path.

6.1.1.3 The duration of the test shall depend on the capacity of a fully charged battery or the capacity of chemical solution tank.

6.1.1.4 If the test field are not conforming to the recommended parameters, the test shall be suspended.

6.1.2 Wind speed

The maximum allowable wind speed shall conform to the manufacturer's recommendation. If there are no manufacturer's recommendations, then the maximum allowable wind speed shall not be more than 5 m/s. If the wind speed is greater than the maximum allowable, the test shall not proceed or the test shall be suspended.

6.1.3 Machine setting

The multi-rotor RPA-powered sprayer shall be tested at the manufacturer's recommended settings for altitude of drone (m), application rate (L/ha), discharge rate (L/min), and travelling speed (m/s) as stated in the operator's manual.

If there are no manufacturer's recommended settings, then the altitude to be used should be 4 m above the crop canopy and shall be tested at maximum application rate per hectare and maximum allowable travelling speed.

6.1.4 Suspension/termination of test

The test shall be suspended, if during the test run, the multi-rotor RPA-powered sprayer results are affecting its performance (due to breakdown or malfunction), or if there are any presence of extreme weather factors (i.e., strong wind velocity).

If the RPA will not be able to continue the operation (due to breakdown or malfunction), the test shall be terminated.

6.2 Pre-test activities

6.2.1 Running-in and preliminary adjustments

The RPA-powered sprayer shall have undergone a running-in period before starting the test. During the running-in period, various adjustments of the RPA-powered sprayer shall be made according to the recommendation of the manufacturer. No adjustments shall be permitted during the test.

6.2.2 Pre-test observations

6.2.2.1 Verification of specifications

The specifications claimed by the manufacturer and other physical details given in Annex B (Specifications of RPA-powered sprayer) shall be verified. A stable and level surface shall be used as a reference plane for verification of dimensional machine specifications.

6.2.2.2 Initial field conditions

Initial data about field conditions shall be obtained before the test, including but not limited to, ambient conditions (wet and dry bulbs), wind velocity and direction, weather condition, and field type where the sprayer will be tested.

7 Performance Test and Procedures

7.1 Field performance test

The machine shall be operated with the spray tank and battery at full capacity at the test site using the recommended settings. All necessary measurements shall be conducted as part of the test, and no further adjustments or modifications shall be allowed during the testing process.

7.2 Test trials

A minimum of two test trials shall be conducted. In case that the data obtained from the first and second test trials are consistent, a third trial may not be necessary.

7.2.1 Data collection

7.2.1.1 Duration of test

The duration of each trial shall last until the spraying operation in the measured area is finished or until the drone’s battery or fuel needs to be replaced or refilled, respectively.

For battery operated RPA-powered sprayer, in case the drone’s battery needs to be replaced before it can finish spraying the area, the actual area covered during spraying shall be measured and the battery voltage or percentage shall be recorded. For fuel operated RPA-powered sprayer, in case the drone’s fuel run out before it can finish spraying the area, the actual area covered during spraying shall be measured and the remaining fuel volume shall be recorded. The measured actual covered area shall be used in computing the actual field capacity instead.

7.2.1.2 Battery condition/fuel consumption

a) Battery condition

The battery condition (voltage or battery percentage) based on the remote controller monitor of the machine shall be recorded before and after each test trial.

Actual measurement of battery condition (voltage) of the machine shall be recorded before and after each test trial. The battery duration shall be tested at maximum application rate per hectare and maximum allowable travelling speed.

b) Fuel consumption

To get the amount of fuel consumed, refill method shall be used. The tank shall be filled to full capacity or to a certain level before the test. After each test, the tank shall be filled with measured fuel to the same level before the test. When filling up the fuel tank, extra attention shall be paid to keep it horizontal and to ensure that empty space is not left inside.

7.2.1.3 Traveling speed

a) The RPA-powered sprayer shall be flown in a straight path at a fixed altitude. Simultaneously, the drone sprayer shall be observed for deviations in its flight path. For a non-straight flight path, the machine shall travel in a loop. The time required for the drone to travel the distance of the longer side of the measured area (from AC to BD) shall be recorded as shown in Figure 1.

Figure 1. Measurement of operating/traveling speed (AMTEC-UPLB, 2022a)

b) The travelling speed shall be calculated using the formula in Annex C (Formulas used during calculations and testing).

7.2.1.4 Application rate

a) Spray time (T) of the RPA-powered sprayer, from the time it started spraying until the time it stopped shall be recorded.

b) Prior to actual operation performance test, the spray tank shall be filled at full capacity on a stable or level surface ground. The amount of test material needed to fill the tank at full capacity shall be recorded.

c) After the operation, the remaining liquid in the spray tank shall be measured using a graduated cylinder or weighing scale. The remaining amount of liquid after the operation shall be recorded.

d) Application rate per unit time, per area covered, shall be calculated using the formulas in Annex C (Formulas used during calculations and testing).

7.2.1.5 Actual field capacity

Area covered (A_t) and spray time (T) shall be recorded for each trial. Actual field capacity shall be computed using the formula in Annex C (Formulas used during calculations and testing).

7.2.1.6 Theoretical field capacity

With the effective swath (S) recorded and operating speed (S_o) computed, the theoretical field capacity shall be obtained using the formula in Annex C (Formulas used during calculations and testing).

7.2.1.7 Field efficiency

The field efficiency shall be calculated using the formula given in Annex C (Formulas used during calculations and testing).

7.2.1.8 Noise level

a) The sound emitted by the machine, with and without load, shall be measured using a sound level meter at the location of the operator during take-off and landing. The noise level, expressed in dB(A), shall be measured 50 mm away from the ear level of the operator, with the RPA at a distance of 5 m from the operator

b) For each data to be taken, there shall be a minimum of five observations. Before taking the data, it should be ensured that the speed and other functional characteristics have stabilized. The time of recording shall be properly spaced during the whole duration of the test trial.

7.2.2 Sampling for droplet analysis

Representative test samples for spray droplet size, distribution, and volume determination shall be collected during laboratory test for analysis. Sampling

procedure is shown in Annex D (Spray pattern and droplet analysis sampling procedures).

7.2.3 Data recording and observations

Record sheet for all data and information during the test is given in Annex E (Performance test data sheet). Necessary observations and other parameters to be taken during the field performance test should be recorded in this sheet.

7.3 Nozzle discharge and dripping performance test

The settings used in field performance tests (i.e., application rate, L/ha and discharge rate, L/min) shall be used. The procedure for measuring the nozzle performance is shown in Annex D (Spray pattern and droplet analysis sampling procedures).

7.4 Spray distribution test

7.4.1 Operation settings

The settings used in field performance tests (i.e., drone altitude, swath, application rate, L/ha, and discharge rate, L/min) shall be used.

7.4.2 Measurement of spray droplet size

The procedure for measuring the spray droplet size is shown in Annex D (Spray pattern and droplet analysis sampling procedures).

8 Formula

The formulas to be used are given in Annex C (Formulas used during calculations and testing).

9 Test report

The test report shall include the following information in the order given:

a) Name of testing agency;
b) Test report number;
c) Title;
d) Summary of results;
e) Purpose and scope of test;
f) Methods of test;
g) Description of the machine;
h) Specifications;
i) Results;
j) Observations (include pictures); and
k) Names, signatures, and designation of test engineers.

Annex A
(Informative)

Minimum list of test equipment and materials

	Equipment	Quantity
	Performance Test	
A.1.1	Timers Minimum resolution: 0.1 s	2
A.1.2	Clamp-on AC/DC power meter Maximum rating: 1000 V	1
A.1.3	Hygrometer Resolution: 0.1%	
A.1.4	Air velocity meter Resolution: 0.01 m/s	
A.1.5	Measuring tape (at least 50 m)	1
A.1.6	Steel tape (at least 5 m)	1
A.1.7	Graduated cylinder Capacity: 1000 mL	1
A.1.8	Weighing scale Capacity: 50 kg	
A.1.9	Digital camera	1
A.1.10	Vernier caliper Resolution: 0.025 mm	1
A.1.11	Sensitive paper	8
A.1.12	Camera	1
A.1.13	Pail or containers	4-8
A.1.14	Marking pegs	15
A.1.15	Graduated cylinder Capacity: 1000 mL	1
A.1.16	Sound level meter, dB(A) Minimum resolution: 0.1 dB(A)	1
A.1.17	Patternator	
A.1.18	Liquid test material	

Annex B
(Informative)

Specifications of RPA-powered sprayer

Name of Applicant : _____
Address : _____
Tel. No. : _____

Name of Manufacturer : _____
Address : _____
Tel. No. : _____

GENERAL INFORMATION

Make : _____ Type : _____
Serial No. : _____ Brand/Model : _____
Date of Unit Manufacture : _____
Testing Agency : _____ Test Engineer : _____
Location of Test : _____ Date of Test : _____

	Item	**Manufacturer's Specifications**		**Verification by the testing agency**	
1	Overall dimensions, mm	Folded	Unfolded	Folded	Unfolded
1.1	Length				
1.2	Width				
1.3	Height				
2	Weight, kg				
2.1	Net weight (excluding battery)				
2.2	Gross weight (including battery and full tank)				
3	Sprayer system				
3.1	Tank				
3.1.1	Material				
3.1.2	Number				
3.1.3	Capacity, L				
3.1.4	Filler hole diameter, mm				
3.2	Filter/strainer				
3.2.1	Shape				
3.2.2	Inside diameter, mm				
3.2.2.1	Top				
3.2.2.2	Base				
3.2.3	Height, mm				

	Item	Manufacturer's Specifications	Verification by the testing agency
3.2.4	Size of filter/strainer mesh, hole/cm^2		
3.3	Number of pump(s)		
4	Nozzle		
4.1	Type		
4.2	Model		
4.3	Number		
4.4	Material		
4.5	Effective swath, m		
4.6	Maximum spray rate per nozzle, L/min		
4.7	Droplet size, DV0.5, µm		
5	RPAS		
5.1	Electronic speed controller		
5.1.1	Brand		
5.1.2	Model		
5.2	Rotor		
5.2.1	Brand		
2.2.2	Type of rotor blade		
5.2.3	Material		
5.2.4	Diameter x pitch, mm		
5.2.5	Weight, g		
5.2.6	Number of rotors		
5.3	Flight Parameters		
5.3.1	Rated takeoff weight, kg		
5.3.2	Maximum takeoff weight, kg		
5.4	Remote controller		
5.4.1	Brand		
5.4.2	Model		
5.4.3	Make		
5.4.4	Weight		
5.5	Battery		
5.5.1	Brand		
5.5.2	Model		
5.5.3	Type		
5.5.4	Number		
5.5.5	Weight, kg		
5.5.6	Capacity/battery life, mAh		
5.5.7	Recommended charging time, h		

Annex C
(Normative)

Formulas used during calculations and testing

C.1 Actual field capacity

$$FC_a = \frac{0.006A_t}{T}$$

where:

FC_a is the actual field capacity, ha/h
A_t is the area covered during test, m^2
T is the spray time, min

C.2 Theoretical field capacity

$$FC_t = \frac{SS_o}{10}$$

where:

FC_t is the theoretical field capacity, ha/h
S is the effective swath, m
S_o is the operating or traveling speed, km/h

C.3 Field efficiency

$$FE = \frac{FC_a}{FC_t} x\ 100$$

where:

FE is the field efficiency, %
FC_a is the actual field capacity, ha/h
FC_t is the theoretical field capacity, ha/h

C.4 Application rate

C.4.1 Based on spray time

$$A_{ct} = \frac{F_v}{T_t}$$

where:

A_{ct} is the application rate per unit time, L/h
F_v is the volume of liquid consumed, L
T is the spray time of sprayer, h

C.4.2 Based on area covered

$$A_{ca} = \frac{F_v}{A_t}$$

where:

A_{ca} is the application rate per area covered, L/ha
F_v is the volume of liquid consumed, L
A_t is the area covered during test, ha

C.5 Operating/traveling speed

$$S_o = \frac{3.6D_t}{T_t}$$

where:

S_o is the operating or traveling speed, km/h
D_t is the traveling distance, m
T_t is the traveling time, s

C.6 Fuel consumption rate

C.6.1 Based on operating time

$$F_{ct} = \frac{F_v}{T_e}$$

where:

F_{ct} is the fuel consumption per unit time, L/h
F_v is the volume of fuel consumed, L
T_e is the total fuel consuming time of engine, h

C.6.2 Based on area covered

$$F_{ca} = \frac{F_v}{A_t}$$

where:

F_{ca} is the fuel consumption per area covered, L/ha
F_v is the volume of fuel consumed, L
A_t is the area covered during test, ha

Annex D
(Normative)

Spray pattern and droplet analysis sampling procedures

D.1 Measuring discharge per nozzle

D.1.1 On a stable and level surface, the spray tank shall be filled at a full capacity. The discharge shall be allowed to continuously flow for one minute.

D.1.2 On each nozzle, the discharge collected for one minute shall be measured using a graduated cylinder or weighing scale. The actual discharge rate for each nozzle shall be computed and recorded. For machines with varying nozzle settings, the discharge rate shall be measured at maximum, intermediate, and minimum discharge settings.

D.1.3 A minimum of two test trials shall be conducted for nozzle discharge test.

D.2 Measuring nozzle dripping

During operation at its rated maximum flow rate, the amount of dripping of the sprayer shall not be more than 1 mL per nozzle for 2 min, starting 1 s after the spray stop control has been engaged.

D.3 Measuring spray droplet size

D.3.1 The test shall be conducted in the field in with a recommended wind speed conforming to 6.1.1.2. Record the ambient relative humidity and temperature during the test.

D.3.2 The multi-rotor RPA-powered sprayer shall be tested at a recommended altitude conforming to 6.1.2.

D.3.3 A minimum of five wooded blocks, each with a paper clip attached on the top, shall be placed 1 m apart on a table (0.76 m x 0.76 m x 1.8 m) located on the center of the plot and perpendicular to the direction of travel of the multi-rotor RPA-powered sprayer.

D.3.4 Water Sensitive Papers (WSPs, area of 76 mm x 51 mm) shall be inserted into each of the paper clips spray application.

D.3.5 Start the spraying operation. Shortly after spraying, wait for the WSP to dry (1 min to 5 min), then collect the dried spray (WSP) targets and place inside a sealable plastic bag.

D.3.6 Scan each of WSP card and analyze it using an image analysis system or any methods of determining spray droplet size.

D.3.7 Determine the Volume Median Diameter (VMD) and number and volume of spray droplet per area.

D.4 Handling of samples

All representative samples shall be collected properly without damaging or imprinting the sensitive paper for better analysis. They shall be placed in a dry and sealed container.

The samples shall be scanned and analyzed using an image processing software, such as *Image J*, to determine the volume median diameter, droplet distribution, and volume sprayed per unit area.

Annex E
(Informative)

Performance test data sheet

Test Trial No. : _____ Date : _____
Test Engineers : _____ Location : _____
Assistants : _____ Machine : _____
Test Applicant : _____ Manufacturer : _____

Item		Trial 1	Trial 2	Average
1	Test condition			
1.1	Field conditions			
1.1.1	Location			
1.1.2	Field type			
1.1.3	Field dimensions			
1.1.3.1	Length, m			
1.1.3.2	Width, m			
1.1.3.3	Area, m^2			
1.2	Ambient conditions			
1.2.1	Temperature			
1.2.1.1	Wet bulb, °C			
1.2.1.2	Dry bulb, °C			
1.2.2	Relative humidity, %			
1.3	Wind			
1.3.1	Air velocity, m/s			
1.3.2	Direction of wind			
1.4	Weather condition			
2	Field performance			
2.1	Programmed settings			
2.1.1	Field dimensions, m			
2.1.1.1	Length			
2.1.1.2	Width			
2.1.2	Altitude, m			
2.1.3	Application rate, L/ha			
2.1.4	Discharge rate, L/min			
2.1.5	Travelling speed, km/h			
2.2	Area sprayed, m^2			
2.3	Battery voltage, DCV			
2.3.1	Initial			
2.3.2	Final			
2.4	Flight time, s			
2.5	Spray time, s			
2.6	Operating time, s			
2.7	Distance travelled, m			

Item		Trial 1	Trial 2	Average
2.8	Hovering time, s			
2.9	Max operating speed, m/s			
2.10	Volume sprayed, L			
2.11	Actual field capacity			
2.11.1	ha/h			
2.11.2	h/ha			
2.12	Theoretical field capacity			
2.12.1	ha/h			
2.12.2	h/ha			
2.13	Application rate			
2.13.1	L/ha			
2.13.2	L/h			
3	Nozzle performance test			
3.1	Nozzle discharge test			
3.2	Discharge, L/min			
3.2.1	Nozzle 1			
3.2.2	Nozzle 2			
3.2.3	Nozzle 3			
3.2.4	Nozzle 4			
3.2.5	Others			
3.3	Total discharge rate, L/min			
3.4	Average nozzle discharge rate, L/min			
4	Spray distribution			
4.1	Altitude, m			
4.2	Effective swath, m			
5	Remote controller			
5.1	Operating power, W			
5.2	Recommended storage temperature, ℃			
6	Capacity/battery life, mAh			

Item	**Point**							
	I	II	III	IV	V	VI	VII	VIII

7	Droplet size analysis								
7.1	Altitude, m								
7.2	DV, 5, µm								
7.3	Droplet distribution, Spray Droplets/cm^2								
7.4	Spray volume per unit area, µL/cm^2								
7.5	Average DV 5, µm								

8 Observations:

8.1 Number of operators

_____
_____

8.2 Dismantling and maintenance (rotors, batteries, spray tank and etc.)

_____
_____

8.3 Warning and safety stickers

_____
_____

8.4 Failures or abnormalities of the sprayer or its component parts during and after the operation

_____
_____

8.5 Maximum wind resistance recommended by the manufacturer (based on operator's manual)

_____
_____

8.6 Other remarks

_____
_____

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