



Rapid Product Assessment **Agricultural Sprayer Test Method**

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Introduction

This method describes the protocol for testing a portable rotary atomizer sprayer consisting of a spinning atomizer (usually a disc or cup) onto which spray liquid flows to produce spray droplets. The atomizer is driven by a small electric motor that can be powered through a DC source using batteries. The sprayer can be carried within the carrying handle, on the operator's belt, or on a strap slung over the operator's shoulder, depending on the use. Spray liquid flows onto the atomizer by gravity from a small bottle mounted on the spray head, from a backpack, or from a shoulder-slung tank.

This document aims to provide step-by-step guidance on how to conduct product testing of portable sprayers with a spinning atomizer. Qualitative and quantitative data will be collected from the tested sprayer. The data collected will be analyzed to compare the performance of the sprayers. It will also be used to highlight shortcomings of a sprayer and provide corrective recommendations, while also improving the market viability of the product.

[Kijani Testing](#) developed the testing protocol with CLASP in support of [VeraSol](#), a quality assurance program for off-grid solar solutions.

Methodology

During the testing period, different tools and equipment will be used to capture data from specific metrics. The data will be collected by taking direct measurements from measuring equipment. Data will be stored and accessed on a database from testing equipment like a data logger. The time and frequency of the data collection will be dictated by the kind of metric that is being taken against the application of the sprayer. Part of the data will also be collected through observations and judgments based on directions in the procedure. Data will be analyzed and presented in a report with graphs, tables, and charts.

Tools and Equipment

1. Measuring Tape
2. Clamp Meter
3. Phase Tester
4. Decibel Meter

Visual analysis

This covers the basic product information, user manual, warranty information, product packaging, and product condition on arrival where each aspect is observed and recorded, and rated accordingly as being good, satisfactory, needs improvement, or poor. The table below details how observations are recorded.

METRIC	IS MARKING PRESENT? (YES/NO)	LOCATION (PRODUCT PACKAGING, USER MANUAL, ETC.)	ARE MARKINGS SUBSTANTIALLY RESISTANT TO REMOVAL?
Manufacturer/Distributor			
Product Name and Batch No.			
Capacity [Litre]			
Voltage [V]			
Frequency [Hz]			
Safety markings			
Power supply type (AC, DC, or AC/DC)			
Power [W]			

QUALITATIVE RATING											
METRIC	DESCRIPTION	RATING (GOOD/SATISFACTORY/ NEEDS IMPROVEMENT/POOR)	COMMENT								
Labelling	A qualitative assessment of the product's labelling, as determined by a visual inspection.										
User Manual	<p>A qualitative assessment of the product's user manual, as determined by a visual inspection.</p> <p>User manual checklist:</p> <table border="1"> <tbody> <tr> <td>Assembly</td> <td></td> </tr> <tr> <td>Identification of parts</td> <td></td> </tr> <tr> <td>Performance specifications</td> <td></td> </tr> <tr> <td>Cleaning, maintenance, and storage</td> <td></td> </tr> </tbody> </table>	Assembly		Identification of parts		Performance specifications		Cleaning, maintenance, and storage			
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Warranty and Warranty Length	A qualitative assessment of the presence, clarity, accessibility, and relevance of warranty and the number of months the product is covered under warranty, according to the nominating company.										
Product Packaging	A qualitative assessment of the packaging and protection present to avoid damage to product.										

Safety

This section assesses the physical, chemical, and electrical characteristics of the sprayer and if they pose any threat to a user. The table below describes the characteristics assessed and how observations are recorded.

METRIC	DESCRIPTION	RESULTS	COMMENT
Insulation	Check that all the electrical components of the sprayer are properly insulated and sealed to prevent faults (i.e., short circuiting) during operations.	Is all electrical equipment properly insulated? (Yes/No)	
On and off switch	Assesses the placement of the on and off switch. Is it easy to access or can be accidentally turned on?	Is it easy to access the switch? (Yes/No) Can it accidentally be turned on? (Yes/No)	
Signal to indicate operation	A test to assess whether the sprayer produces a visual or acoustic signal to indicate that it has started operation (i.e., sound).	Is there any signal, sound, or light that indicates whether the sprayer has been turned on? (Yes/No)	
Exposed parts that might cause bodily harm	Check for protection against rotating/moving parts that might cause bodily harm.	Are all the rotating parts covered? (Yes/No)	
Portability	To determine whether the sprayer is portable or not during operation, measure the total weight of the sprayer when the tank is filled with water. To meet the FAO minimum standard, a portable sprayer should comply	Backpack tank and battery power source weight: __kg Lance/battery weight: __kg	

	<p>with the following requirements:¹</p> <ul style="list-style-type: none"> • 20 kg maximum for a backpack (or shoulder-slung) tank and battery power source carried on a waist belt or shoulder strap. • 7 kg for a lance/battery case, spray head, spray bottle, and a hand-carried tank, where present. 								
<p>Leakage</p>	<p>The sprayer should not leak.</p> <ul style="list-style-type: none"> • First check that all hose and other connections are tight. • Fill the spray tank to the manufacturer's recommended maximum capacity with water. • Carefully dry the complete outside of the sprayer and its attachments and with the on/off valve in both the open and closed positions, check for leakage. • Pay special attention to the most likely leak points: pump assemblies, hose connections, and on/off valves. • With the tank filled to the manufacturer's maximum recommended capacity, tilt the tank 45 degrees from the vertical in all 	<table border="1"> <thead> <tr> <th></th> <th>Yes/ No</th> </tr> </thead> <tbody> <tr> <td>Are there any leakages from the potential leak points?</td> <td></td> </tr> <tr> <td>Are there any leakages when the tank is filled to the recommended maximum capacity and tilted 45 degrees from the vertical in all directions?</td> <td></td> </tr> </tbody> </table>		Yes/ No	Are there any leakages from the potential leak points?		Are there any leakages when the tank is filled to the recommended maximum capacity and tilted 45 degrees from the vertical in all directions?		
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¹ Wiles et al., 2001

	<p>directions to ensure that the liquid does not leak from the lid or through the ventilation valve.</p>		
Cleaning and maintenance	<p>Cleaning of the sprayer is an essential step to avoid contamination. The parts of the sprayer should be easily accessible for cleaning and doing routine maintenance.</p> <ul style="list-style-type: none"> • Check for instructions on how to clean and maintain the sprayer. • Use the instruction to assess whether one can easily clean and maintain the sprayer. 	<p>Is the sprayer easy to clean from both inside and outside? (Yes/No)</p>	
Material	<ul style="list-style-type: none"> • The material used to make the parts of the sprayer should be non-absorbent, and parts of the sprayer should not retain any amount of liquid to avoid contamination. 	<p>Does the material used to make the sprayer absorb liquid when there are spillages? (Yes/No)</p>	

Functionality

This section focuses on establishing whether each application feature works as per the manufacturer's requirements. Each function is compared to the corresponding requirement to ascertain whether its output is consistent with the end user's expectations. The table below describes the metrics assessed and how observations are recorded.

METRIC	DESCRIPTION	RATED VALUE		TESTED RESULTS		COMMENT
Size	Take a direct measure of the length(L), width(W), height(H), and diameter (D).		Rated		Measured	
		Length		Length		
		Width		Width		
		Height		Height		
		Diameter		Diameter		
Maximum tank capacity	<p>This should be clearly and durably marked. Should be less than or equal to 95% of the total volume of the tank.</p> <p>Using the measured metrics above (length, width, height, and diameter), calculate the volume of the sprayer.</p> <p>Find the ratio between the marked volume and calculated volume and comment whether it is less than or equal to 95%.</p>	Marked volume of the sprayer: -----		Calculated volume: -----		
				% ratio of marked volume to calculated volume: -----		

Visibility of liquid inside the tank	The level of liquid in the tank should be visible during filling and as it approaches max filling level.		Is the level of liquid in the tank visible when observed from the outside? (Yes/No)	
Strainer	A strainer should be present to filter water or spray solution.		Is the strainer present? (Yes/No)	
	It should be close fitting and permit safe, easy filling from a non-profiled container at a rate of 25 litres per minute without overflowing, splashing, or lifting from its seat.		Filling rate: __ l/min Are there any spillages/splashing when the container is being filled? (Yes/No)	
Fill Opening	Fill opening should be no less than 100mm across the smallest dimension.		Fill opening diameter: __mm	
	It should be sealed with a lid that can be opened and securely closed with gloved hands and without tools.		Can the lid be securely opened and closed with gloved hands? (Yes/No)	
Lid	When closed, the lid should not collect spray liquid.		Does the lid collect any liquid around it? (Yes/No)	

Start/stop switch	<p>Switch should be easy to operate and have marked positions to inform the operator whether the sprayer is on or off.</p> <ul style="list-style-type: none"> • Power the sprayer and turn on and off using the power switch. • Check for markings for the positions of on and off, if present. 		<table border="1"> <thead> <tr> <th></th> <th>Yes/No</th> </tr> </thead> <tbody> <tr> <td>Is the start/stop switch easy to operate?</td> <td></td> </tr> <tr> <td>Are there markings to indicate start/stop position of the switch?</td> <td></td> </tr> </tbody> </table>		Yes/No	Is the start/stop switch easy to operate?		Are there markings to indicate start/stop position of the switch?		
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Are there markings to indicate start/stop position of the switch?										
Nozzle	<p>The nozzle should be easy to change for different applications.</p> <ul style="list-style-type: none"> • Check the user manual for instructions on how to change the nozzle. • Using the instructions, try changing the nozzle. 		<p>Are the nozzles easy to change/fit using the instructions provide from the manual? (Yes/No)</p>							

Performance

This section focuses on assessing how the sprayer behaves during operation under the manufacturer's recommended voltage and whether this matches the rated product specifications. The table below describes the metrics assessed and how observations are recorded.

METRIC	DESCRIPTION	VALUE	COMMENT								
Run time on a fully charged battery	<p>Evaluating the run time of the sprayer using the recommended voltage setting of the battery stick input.</p> <ul style="list-style-type: none"> Fill the sprayer with water and power it with a fully charged battery. 	<p>Recommended voltage: ___V</p> <p>Duration: ___ mins</p>									
Speed/Volume Outflow	<p>This is the amount of liquid coming out of the different nozzle sizes when the sprayer is working under gravity.</p> <ul style="list-style-type: none"> Mark the provided nozzles as A, B, C, etc. if more than one is provided. Power the sprayer with the tank filled with water and a fitted nozzle (A, B, or C) each time. While the nozzle is facing down, trap the amount of liquid coming out of the nozzle into a different container while recording time. Determine the amount of water coming out of the nozzle in ml/s for the different nozzle sizes. 	<table border="1"> <thead> <tr> <th colspan="2">Flow rate (ml/s) per nozzle</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>ml/s</td> </tr> <tr> <td>B</td> <td>ml/s</td> </tr> <tr> <td>C</td> <td>ml/s</td> </tr> </tbody> </table>	Flow rate (ml/s) per nozzle		A	ml/s	B	ml/s	C	ml/s	<p>Comment on visual appearance of droplets at different settings. Lighter droplets are good for pest management and heavier ones for weed management.</p>
Flow rate (ml/s) per nozzle											
A	ml/s										
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Coverage area	<p>This is the area sprayed per liter.</p> <ul style="list-style-type: none"> • Fill the tank with water up to maximum capacity and note the volume of the water inside the tank. • At a speed of between 1–1.5m/s², run the sprayer across a field until the water is finished inside the tank. • Measure the area covered by the sprayer and calculate the covered area per capacity 	<p>Area sprayed: __ m²</p> <p>Area sprayed by capacity: __ (m/litre)</p>	
Atomizer Disc Speed	<p>Determined by the recommended voltage setting and measured using an RPM meter when there's no load.</p>	<p>Speed: ___ rpm</p>	
Noise level	<p>The noise level coming from the sprayer should not exceed 85dB.³</p> <p>Power the sprayer and measure the level of noise coming from the motor.</p>	<p>Level of noise: ___dB</p>	

² Spencer & Dent, 1991

³ Wiles et al., 2001