PZL M18B DROMADER FIXED WING AIRCRAFT CHARACTERIZATION

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Introduction

Every year, Piedmont Mosquito Control employs up to ten helicopters to apply mosquito larvicide products to rice fields across the expansive rice growing area of Piedmont (Mosca et al., 2008). These applications require a significant financial commitment (Mosca & Roberto, 2007). In 2008 a test with fixed wing aircraft was completed to evaluate alternatives that may improve efficacy and cost effectiveness.
A PZL M18B "Dromader" aircraft equipped with an agricultural spray kit was evaluated (Fig 1). This airship is usually employed for crop and forest protection (Hardy, 1987). For this kind of work the airship mounted proper nozzles (Fig. 2).


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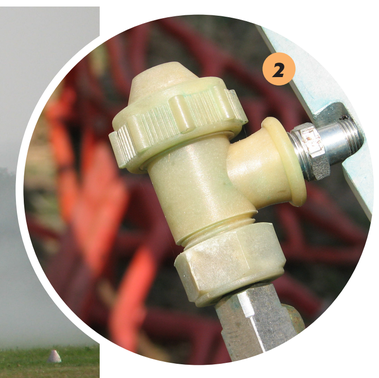
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Material and methods

The spray kit was modified, changing the type and the number of nozzles in order to optimize on-target deposition of liquid larvicides and minimize production of small drops (drift) during application. The configuration was designed to obtain a theoretical spray rate in the range of 15-20 L/ha (Fig. 3). Fifteen 40-degree flat fan nozzles (TP4015), with an estimated flow rate of 5.3 L/min at 39 psi (2.69 bar) were mounted with an angle of 0 degrees respect the air-stream, straight-back and parallel with ground (Fig. 4). The nozzles were mounted on each boom at 0, 95, 190, 285, 380, 475, 570 and 665 cm from the centre of the fuselage.

A static flow test at full operative power showed a total flow of 88.6 L/min. This would result in a theoretical distribution of 17.73 L/ha, assuming a ground speed of 200 Kph, a swath of 15 meters. Card deposition tests were then carried out to estimate the actual amount of spray deposit on the intended targets. For each test two 50-meter card lines were placed perpendicular to the flight path of a pre-established single-pass spray. Kromekote-R cards were placed flat on the ground to detect spray deposit of an aqueous Allura-red dye solution. During spray, the aircraft flew at 200 Kph and two different altitudes (Fig. 5). Cards were scanned using a flat-bed scanner (Cannon LiDE60) and evaluated using Stainalysis software to determine characteristics of the spray pattern.

SUGGESTED BAR CONFIGURATION M18B DROMADER

BLANK	TP4015	TP4015	TP4015	TP4015	TP4015	TP4015	TP4015	TP4015	TP4015	TP4015	TP4015	TP4015	TP4015	TP4015	TP4015	BLANK
-885	-665 CM	-570 CM	-475 CM	-380 CM	-285 CM	-190 CM	-95 CM	0 CM	95 CM	190 CM	285 CM	380 CM	475 CM	570 CM	665 CM	885

LENGTH OF BAR USED	13.3	METERS
TOTAL WING/BAR	17.7	METERS
TOTAL NOZZLES	15	NOZZLES
PERCENT OF WINGSPAN USED	75%	
SUGGESTED PRESSURE	39	PSI
	2.69	BAR
EXPECTED SPRAY RATE	12.0	LITERS/HECTARE
EXPECTED FLOW	80.1	LPM
EXPECTED PER NOZZLE	5.3	LPM
AIRSPEED	200	KPH
ASSUMED SWATH	20	METERS

3


4


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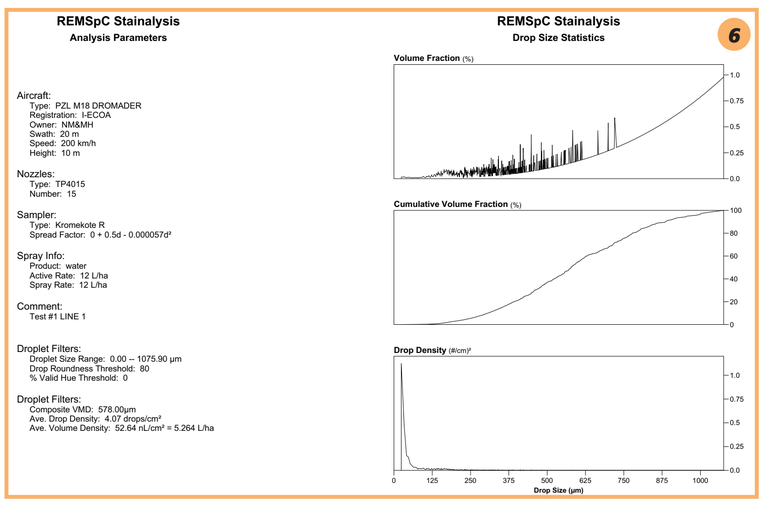
Results

The most homogeneous deposition predicted by this analysis was with an aircraft spray altitude of 15 meters and a lane separation of 15 meters (Fig. 6-11). In this case the mean deposition was 19.2 L/ha (COV = 0.22).



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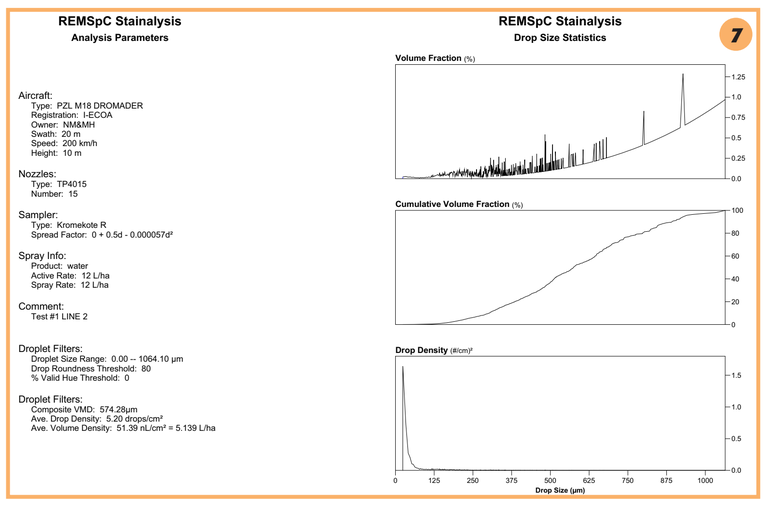

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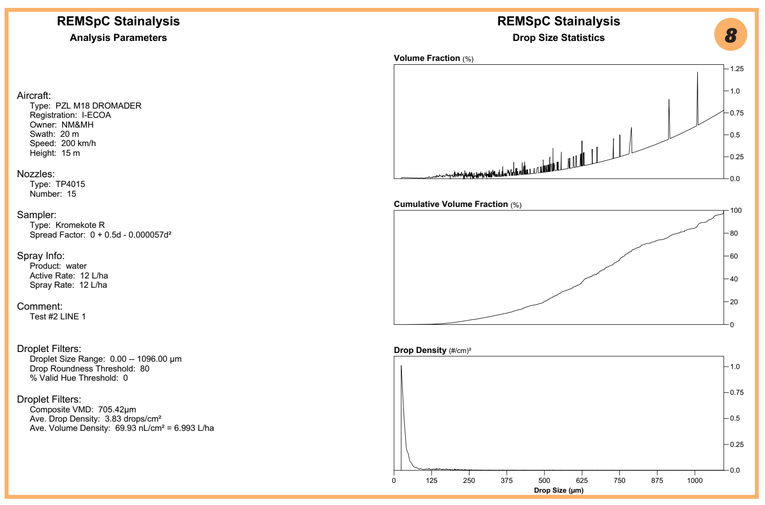

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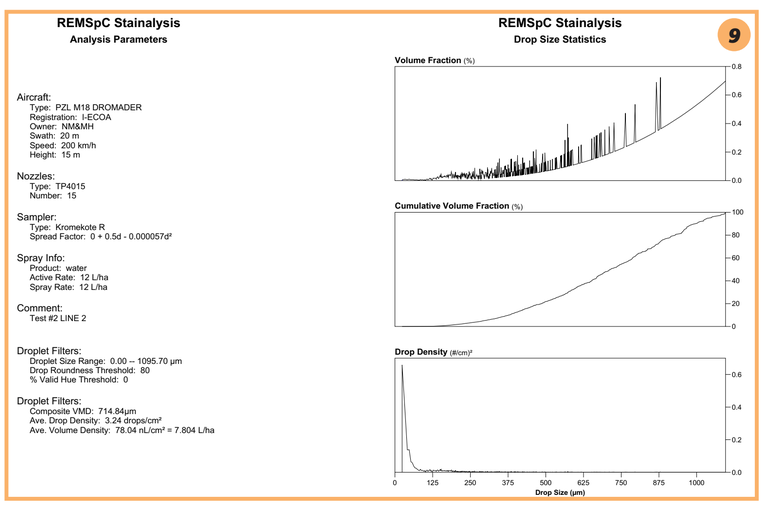

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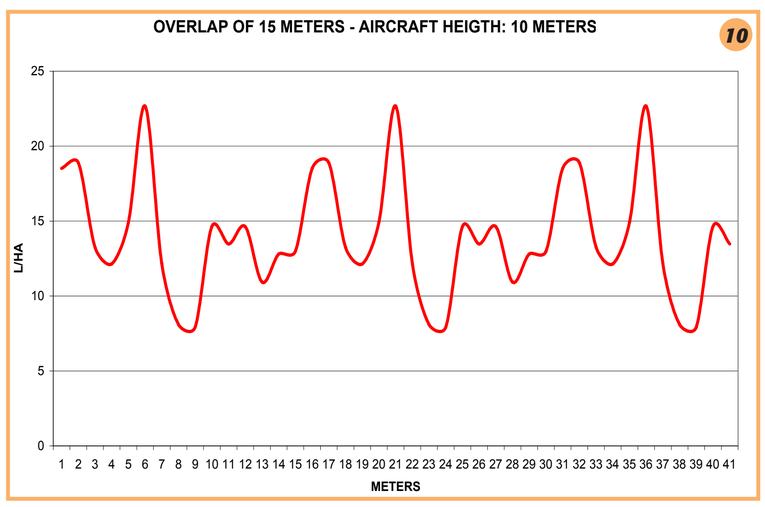

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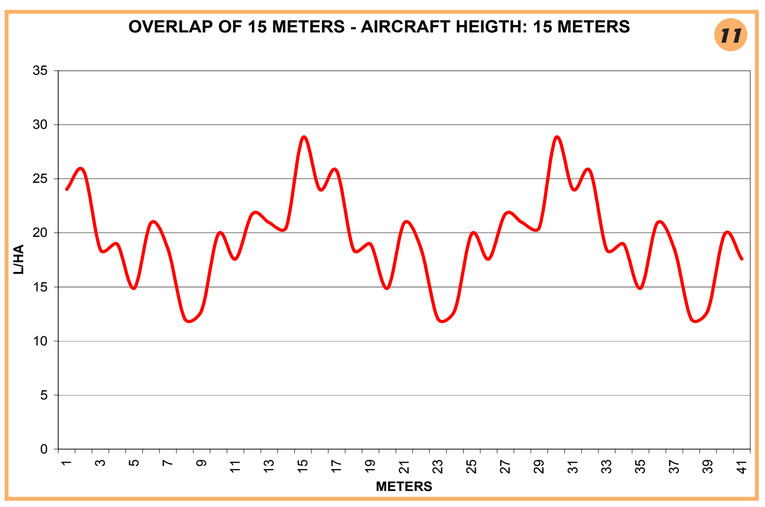

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Conclusions

Further tests are needed to understand if larger spray lanes my be feasible with improved configuration, to evaluate drift potential, to evaluate targeting capacity with GPS, and determine if this kind of aircraft could be efficiently used in operative conditions of mosquito control in the rice fields of Piedmont.

Acknowledgments

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References

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