Investigation of aerial-based treatment efficiency in specific cases of Banan Sigatoka diseaces treatment in French West Indies

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Introduction

National and European legislations promote the ban of aerial spraying on crops, arguing of human health and environment safety(Pan 2004). Exemptions would be possible under special conditions, when, for example, there is a lack of ground-based spraying solution providing equivalent efficiency and acceptable operator safety levels than aerial application. The Optiban project was launched in 2008 to meet the requirement of the Food and Agriculture Ministry and the Groups of banana growers of Guadeloupe and Martinique (UGPBAN). It aims to improve aerial application but also to develop ground-based alternatives. From several previous studies lead by Cemagref on aerial-based spraying evaluation (Polveche 2007) and general recommendations synthesized in (Spray Drift Task Force 1997 (2)), some specific configurations have been identified to be reliable to reduce spray drift. This document presents the results of the evaluation of aerial-based spraying in terms of direct application on the canopy and spray drift.

Materials and methods

Two helicopters and one airplane equiped with different set of nozzles have been compared. Swirl nozzles configurations (Albuz ATR for helicopter and Teejet D6 for plane) were defined as references for each aircraft. Then several sets of air injection nozzles (Albuz AVI, CVI) were tested with airplanes. The length of the boom was tested on helicopter. An air deflector device initially developed by airplane company JMD for airplanes was tested too. Spray drift was measured in conformity with the recommendations of the ISO 22866 (November, 2005) standard. The amount of applied product collected on the leaves was estimated by setting up Petri dishes at the canopy level (5 metres above ground). The line of Petri dishes was perpendicular to the aircraft travel. For real applications, paraffinic oil was sprayed, with or without addition of fungicide. As oil can be toxic for the plants at high concentration, different aerial applications with water and fluorescent tracer (Brillant sulfoflavine) were first compared. Then, the optimal applications were tested with oil (Banole) and lipophilic tracer (RADGLO ® CFS 006).

Results

Helicopters

With spraying water, the effect on drift potential of the type of nozzles was more significant than the reduction of boom length (up to 50 % of the rotor width). The use of air injection nozzles (Green CVI 110-015) induces a reduction of the drift value of 64 % in comparison with swirl nozzles (ATR 80 Yellow and ATR 80 Brown) (Fig1). Similar results were obtained with oil (not shown).

With spraying oil, comparison between different types of air injection nozzles showed that the "low pressure" nozzles (with pressure values between 1.5 and 3 bar; Green CVI) are more efficient in drift reduction than the "high pressure" ones (with pressure values between 3 and 7 bar; Purple AVI 110-025).

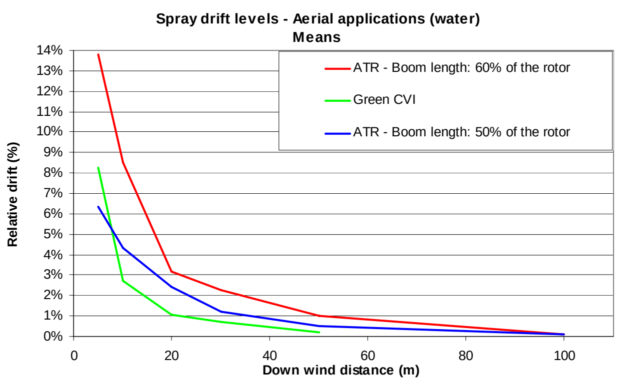

Figure 1: Drift curve obtained for 3 configurations on helicopter (water)

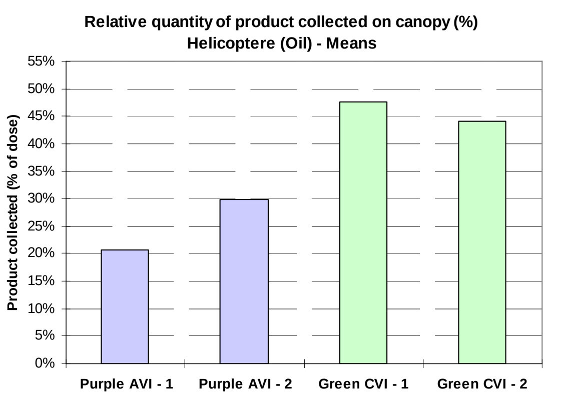

Figure 2: % of product (oil) collected for 2 types of nozzles on helicopter (2 measurements/config)

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Regarding the quantity of collected product on the canopy with air injection nozzles (Fig. 2), it is greater for “low pressure” nozzles than for “high pressure” ones. However, rates of product collected are lower than 50 % of the dose applied.

Plane

With airplanes, first tests compared the spray drift rates obtained with different types of air injection nozzles (blue and grey AVI 110-060, red CVI110-040). As a result, these tests did not show a significant difference between all types of nozzles with water or oil. Another set of tests was then conducted to confirm previous results. Those tests concerned different configurations with water as spraying fluid. A boom deflector combined with air injection nozzles (blue AVI 110-03) was tested. This configuration allowed a reduction of the spray drift of 58 % in comparison with swirl nozzles (Teejet D6). As 52% of drift reduction is due to the contribution of the deflector, the effect of this equipment is largely greater than the single effect of the nozzle type without deflector (see Fig 3).

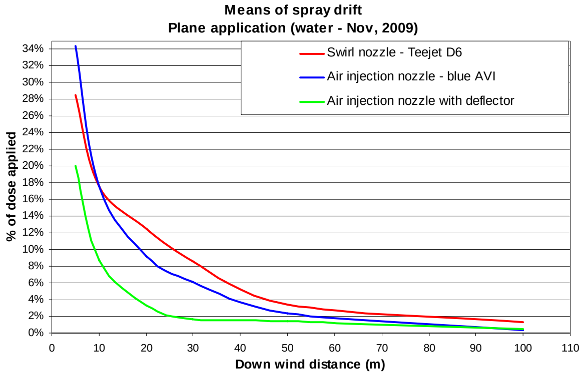

Figure 3: drift curve for different configurations (water spraying)

Nozzles	Banole (oil)	Water	
	1st campain measurement	1st campain measurement	2nd campain measurement
Teejet D6	9.3 %	ND	11.4 %
AVI blue	31.8 %	76 %	87.5 %
AVI + déflector	28.5 %	80.5 %	112.5 %

Table 1 : amount of product collected on the canopy expressed as % of field dose of field dose collected for different configurations

Conclusion

Results on helicopters showed that the use of air injection nozzles can reduce spray drift by more than 50% compared with swirl nozzles. Besides, “low pressure” air injection nozzles (1.5 and 3 bar) reduced spray drift in comparison with “high pressure” ones (3 and 7 bar). Regarding these encouraging results, the acceptance of low drift nozzles by banana growers suppose that the biological efficiency is validated.

Tests on airplanes with oil did not show any significant difference between all configurations (nozzle types). However, experiments with water indicate a reduction of the spray drift when a deflector with air injection nozzles is used.

Surprisingly, we also observed that drift values were consistently higher for water than for oil in similar conditions with airplanes. It is assumed that the oil cloud obtained after spraying do not sediment as rapidly as for water as the oil suspension remained a longer time in the air. This could explain why oil mix is less collected on drift area than for water. Additional tests are underway to explore this hypothesis.

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