IMPROVEMENT OF SPRAY RETENTION ON BARLEY LEAVES BY ADJUVANTS

gembloux agro bio tech — Université de Liège
Département Sciences et Technologies de l'Environnement
Unité de Mécanique et Construction

*BOUKHALFA Hassina Hafida[1,2] *, MASSINON Mathieu[2] and LEBEAU Frédéric[2]*

[1]University Mohammed Khidar Biskra, Algeria
[2] Gembloux Agro-Bio Tech, University of Liège, Belgium
* E-mail: hassinaboukhalfa@gmail.com

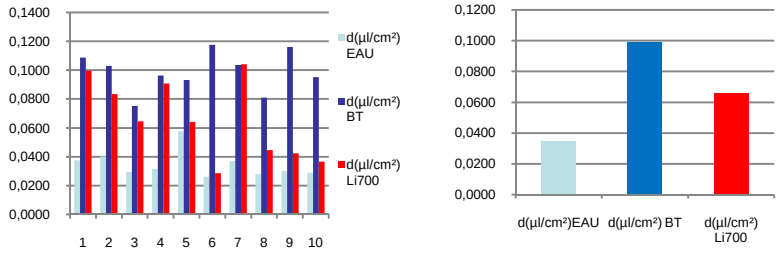
INTRODUCTION

The most obvious priority of spraying is to achieve a distribution of pesticide such that sufficient active ingredient reaches the sites required for effective pest control. Wastage occurs from material reaching the ground and from off-target drift have a large potential for environmental damage. So their reduction is not just an economic demand but is deemed necessary both in good practice and in legislation.

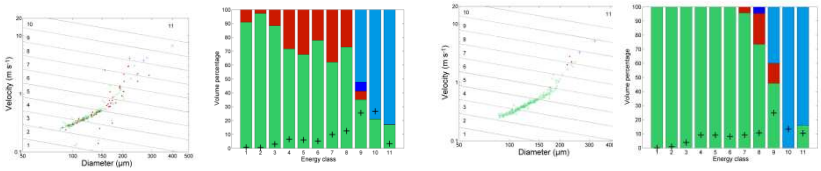
Adjuvants are used in spraying to increase deposits on foliage. These products are often described in the technical literature as wetting and/or spreading agents. On these basis, the aim is to investigate the eventual effect of changes in spraying operations upon retention efficacy with two approaches: spectrofluorometry and high-speed shadowgraphy.

RESULTS AND DISCUSSION

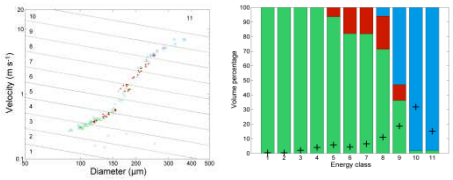
The spectrofluorometry provided that the quantity of retention on Barley leaves were doubled by addition of Li700 comparing to water, while Break-Thru triples it.



The imaging method provides information on the quality of impact on barley leaves. It appears that rebound has been considerably decreased by Break-Thru® and the adhesion increased greatly.
The addition of Li700® increased the fragmentation and decreased the rebound relatively.
This method allowed us to observe that VMD has been increased by Li700® addition, which can promote the fragmentation .
Spray retention was better increased by the organ silicone surfactant (Break-Thru) than by the phospholipid one (Li700).



Water **Break-Thru® S240 0,1% v/v**



Li700® 0,25% v/v

Δ adhesion ●rebound +fragmentation (Cassie-Baxter) x fragmentation (Wenzel)

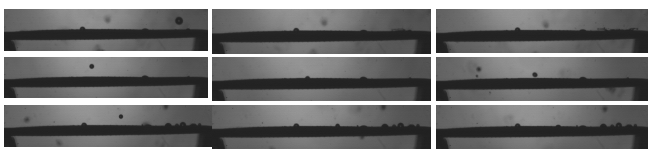
Our results corroborate those of Holloway and al. (1999): there was complete leaf coverage from sprays containing organ silicone surfactants, as would be predicted from their high surface-active nature, while the phospholipid adjuvants gave 20% less spray coverage.

Because leaf pieces were mounted horizontally, impaction volume was greater than the retention volume obtained by spectrofluorometry on vertical plants in the first experimentation. It should be regarded only as comparative indicators of impact types and qualitative effect of surfactants used. Barley foliage was oriented mainly vertically and the leaves are difficult to wet because of their dense covering of microcrystalline epicuticular wax. None of the additives examined increased fluorescein retention.

x fragmentation W

● rebound

Δ adhesion



MATERIAL AND METHODS

Retention, defined as the amount of spray retained by plant leaves, and drop impact types were studied for two adjuvants and compared to water on barley leaves (BBCH12). Break-Thru® S240 (Organ silicone surfactant) at the concentration of 0,1% and Li700® (Phospholipid surfactant) at the concentration of 0,25% were applied to foliage in aqueous sprays. The sprays were produced by a flat-fan nozzle Teejet 11003 and a pressure of 2bars, mounted 50cm height above the target on a ramp moving at a speed of 2m/s. Sprayings were performed in the laboratory at a temperature of 24°C and relative humidity of 60%.

Retention was quantified on whole plants using fluorescent tracer at a concentration of 0,2 g/l. The results were compared to those of a spray of water with fluorescein at the same concentration (Figure 1).

Figure 1

Impact types were determined on small pieces of Barley leaves (0,3 cm²) using a high-speed camera coupled with a retro-LED lighting. The size and velocity of drops were extracted by image analysis, and the impact type was determined by the operator. Volumetric proportions of the three impact types adhesion, rebound and fragmentation were determined (Figure 2).

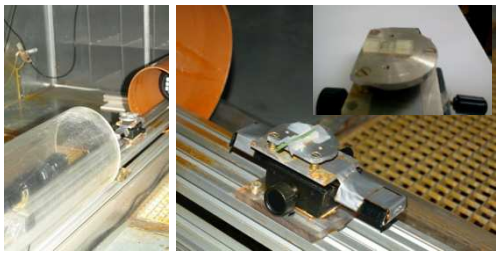


Figure 2

CONCLUSION

The high-speed imaging method support chemical results and provide a better understanding of spray retention phenomenon. It can determine the impact behavior, the size and velocity of spray droplets .

The results confirmed that tank-mix adjuvants can have a considerable influence on the delivery efficiency of aqueous sprays. However, the magnitude of this effect is dependent on the nature of the additive. It affects the physicochemical properties of droplets.

Further study will focus on the link between retention assessed by spectrofluorometry and that determined by high speed imaging.