Improving the Performance of Microbial Agrosolutions: Enhanced Shelf Life and Optimized Delivery

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In recent years, biological alternatives to chemical crop protection products have become increasingly important as consumers look for products containing fewer chemical residues. Growers need alternative modes of action to control resistant pests or prevent resistance build-up of crop protection products. This demand and the regulatory phase-out of many chemical pesticides globally provides an opportunity for biological solutions. However, growers often perceive biological products – especially microbial biopesticides – as having a lower and/or inconsistent efficacy compared to chemical ones.

Common causes of efficacy issues are low stability of the product during storage prior to application, insufficient or unevenly distributed active material on the target. Formulation can help to solve these issues and improve the efficiency of microbial active ingredients. Additionally, conditions to improve shelf life vary with the type of microorganism. For example, moisture can be a critical factor for the survival of fungal spores. Under dry conditions, they can reduce their metabolism and thus survive in agar plates. When the spores were dispersed in the BREAK-THRU® carriers, the survival rate increased to 12% for BREAK-THRU® S 255 in comparison to the neat spores and a commercial WP formulation at 40°C, showing the results of a greenhouse trial (GLP) to control white fly (Bemisia tabaci) in tomato. The biological product used was Naturalis® which is an oil dispersion concentrate of Trichoderma harzianum and other species (see Figure 1). The carrier liquids used were BREAK-THRU® S 301 and BREAK-THRU® S 255. BREAK-THRU® S 301 is a biodegradable superspread based on polyether tristoxane. BREAK-THRU® S 255 is a polysiloxane and can be used as a wetting agent for oil-based formulations.

Increased shelf life for microbial biopesticides

The viability of microorganisms depends on several criteria. Besides suitable growth conditions during production and appropriate downstream processing, the formulation and suitable additives help to reduce loss of viability of microbial active ingredients. Additionally, conditions to improve shelf life vary with the type of microorganism. For example, moisture can be a critical factor for the survival of fungal spores. Under dry conditions, they can reduce their metabolism and thus survive in agar plates. When the spores were dispersed in the BREAK-THRU® carriers, the survival rate increased to 12% for BREAK-THRU® S 255 in comparison to the neat spores and a commercial WP formulation at 40°C. The increase of efficacy of biological control agents by using BREAK-THRU® additives has been demonstrated in greenhouse and field trials. Figure 4 shows the results of a greenhouse trial (GLP) to control white fly (Bemisia tabaci) in tomato. The biological product used was Naturalis® which is an oil dispersion concentrate of Trichoderma harzianum and other species (see Figure 1). The carrier liquids used were BREAK-THRU® S 301 and BREAK-THRU® S 255. BREAK-THRU® S 255 is a biodegradable superspread based on polyether tristoxane. BREAK-THRU® S 255 is a polystoxane and can be used as a wetting agent for oil-based formulations. As can be seen in Figure 1, only 1-2% of the spores of the commercial WP and the neat spores survived under the test conditions and were able to form colonies on agar plates. When the spores were dispersed in the BREAK-THRU® carriers, the survival rate increased to 12% for BREAK-THRU® S 255 and 30-40% for the polyetheroxane-based carriers. The dispersion concentrates are easily diluted in water to form the spray solution and the amphiphilic nature of the carriers aids in the uniform suspension of the spores in the tank (see Figure 2). The increase of efficacy was found using a pinene-based adjuvant at a rate of 0.15 L/ha alone and in combination with adjuvants. By using BREAK-THRU® S 301 as a tank mix adjuvant at a very low rate of 0.15 L/ha the overall efficacy was improved to the level of the full application rate. However, no increase of efficacy was found using a pinene-based adjuvant at a rate of 0.55 L/ha. No phytotoxicity was found using both adjuvants.

Conclusion

Biocompatible BREAK-THRU® additives allow for physically stable solid and liquid microbial formulations. BREAK-THRU® carrier liquids enhance the shelf life of microbials in liquid formulations without the need of cold storage or transport. Additionally, they enhance the delivery of chemical pesticides. The viability of microorganisms depends on several criteria. Besides suitable growth conditions during production and appropriate downstream processing, the formulation and suitable additives help to reduce loss of viability of microbial active ingredients. Additionally, conditions to improve shelf life vary with the type of microorganism. For example, moisture can be a critical factor for the survival of fungal spores. Under dry conditions, they can reduce their metabolism and thus survive in agar plates. When the spores were dispersed in the BREAK-THRU® carriers, the survival rate increased to 12% for BREAK-THRU® S 255 in comparison to the neat spores and a commercial WP formulation at 40°C. The increase of efficacy of biological control agents by using BREAK-THRU® additives has been demonstrated in greenhouse and field trials. Figure 4 shows the results of a greenhouse trial (GLP) to control white fly (Bemisia tabaci) in tomato. The biological product used was Naturalis® which is an oil dispersion concentrate of Trichoderma harzianum and other species (see Figure 1). The carrier liquids used were BREAK-THRU® S 301 and BREAK-THRU® S 255. BREAK-THRU® S 255 in comparison to the neat spores and a commercial WP formulation at 40°C. The increase of efficacy was found using a pinene-based adjuvant at a rate of 0.15 L/ha alone and in combination with adjuvants. By using BREAK-THRU® S 301 as a tank mix adjuvant at a very low rate of 0.15 L/ha the overall efficacy was improved to the level of the full application rate. However, no increase of efficacy was found using a pinene-based adjuvant at a rate of 0.55 L/ha. No phytotoxicity was found using both adjuvants.