INTEGRATING COPPER AND A MICROBIAL CONSORTIUM FOR AN EFFECTIVE CONTROL STRATEGY AGAINST THE BACTERIAL BLIGHT OF WALNUT

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INTRODUCTION

The bacterial blight of walnut is a disease that may cause fruit losses up to 60% during epidemic years. The causal agent is *Xanthomonas arboricola* pv. *juglandis*, a Gram negative organism, which is divided into several, different genetic populations. The most important trait of such organism is its ability to detoxify copper, even at high concentration, making its control in walnut orchards quite cumbersome. Experiments have been done in three commercial orchards during three years in Romagna (Italy), to implement a management strategy where copper sprays could be integrated with innovative products, such as bio-molecules or microbial consortia. Therefore, the final aim was to lower copper inputs and, contemporarily, bypass the known copper resistance of the pathogen.

MATERIAL and METHODS

Experiments have been done along three years in three walnut groves, aged 3-6 years, cv. Chandler, in the province of Ravenna. Seven different treatments have been compared, including the official IPM strategy approved in the Emilia Romagna Region (Table 1). Field monitoring and sampling were done from May until September: during each survey, samples of 100 leaves per thesis and per replicate were collected and evaluated (disease incidence and severity) (Figure 1).

Treatment	Active Ingredient	Dose/hl	Timing
1	Untreated		
2	Microbial consortium	150g+150cc	A
		30g/plant	B
3	Copper 25%	1L	A
4	Phosphonate k 755 g/L+Mancozeb 75%	400cc+200g	A
5	Peptides+Laminarin	400g	A
6	*Pseudomonas* spp.	10^8 CFU/ml	C
7	CuOH 35%+Mancozeb 75%	200g+200g	A

A = From the prayer stage until the end of June, every 7-10 days, depending on the weather

B = Soil treatment in December

C = Five treatments fortnightly, from May 1st to mid-July

Table 1: Six different treatments in field during the experiment.

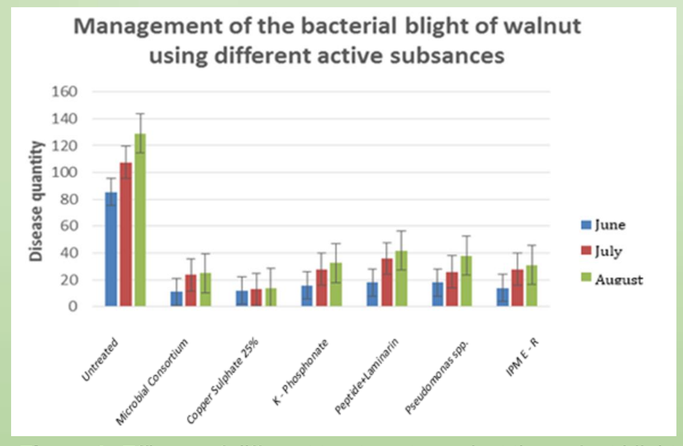

Figure 1: Efficacy of different treatments against the walnut blight.

RESULTS and DISCUSSION

Our experiment showed that disease quantity was significantly reduced by any treatment, when compared to the untreated plots. Disease symptoms mainly appeared in early to mid springtime, and treatments remarkably reduced disease progression as well. Remarkably, microbial consortia, single microbes, or innovative bio-products (e.g. Peptides + Laminarin) showed an antibacterial activity equal to copper+mancozeb treatments.. Results highlighted the excellent performance of the microbial consortium, able to reduce the disease by approx. 85%, and increasing fruit production by appprox. 45% (both when compared to the untreated plots). Since all walnut shoots do not emerge at the same time, the first protective spray was applied when 40% of the shoots were elongating and before leaves expanded, thus explaining the development of symptoms (leaf spots) in early spring. Although use of copper-based compounds are still the main weapons against bacterial walnut blight, integrating copper (+mancozeb) sprays in autumn with bio-products or beneficial microbes during springtime, may increase sustainability of orchard management against *X. arboricola* pv. *juglandis*. Indeed, our results show that an efficient control of bacterial blight might be obtained by reducing copper inputs up to 54%.

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