

# Treatments of apple flowers with EM (effective microorganisms) and the influence of fungicides on the EM microflora



Fig. 1: Effects of treatments with formic acid (0,9%) (phytotoxic damage at left) and EM with stone powder and ceramic (spraying spots on the right)

## Introduction

EM (effective microorganisms) is a mixture of different bacteria and fungi, which is used as a nutrient agent and has a positive effect on plant growth and yield. In organic apple growing it is also employed for leaf treatments. However, questions as to whether the fungicides (copper, sulphur) utilised in organic apple growing could have a negative influence on the growth of the typical EM microflora, or if EM treatments during blossom might have a fruit thinning effect on apple flowers, remained to be clarified. For this purpose, two trials were set up in 2005.

Table 1: Concentrations of applied treatments, pH-values and results of the thinning trial on "Golden Delicious"

Spraying variant	Concentration %	pH-value	Flower buds/4 branches			Fruits per flower bud			Yield (Oct. 21)			
			total (25.4)	2.6	27.6	21.10	Fruits/4 branches	kg/4 branches	g/fruit			
untreated control			134.00	a	0.97 b	0.56 b	0.34 b	44.44	b	3.67	b	93.9 a
EM A + EM 5+ stone powder + ceramic	2% + 0.2% + 0.8%+ 0.2%	7.06	142.13	a	0.90 b	0.44 ab	0.30 b	44.38	b	3.60	b	83.8 a
EM A + EM 5+ stone powder + ceramic	4% + 0.4% + 0.8%+ 0.2%	6.62	138.50	a	0.95 b	0.60 b	0.40 b	54.25	b	4.07	b	76.9 a
EM A + EM 5+ stone powder + ceramic	10% + 1% + 0.8%+ 0.2%	6.38	144.13	a	0.97 b	0.55 b	0.36 b	52.25	b	4.80	b	90.9 a
formic acid	0.90%	2.27	151.50	a	0.81 b	0.43 ab	0.13 a	19.25	ab	1.31	a	71.0 a
formic acid	1.75%	2.46	114.50	a	0.33 a	0.25 a	0.09 a	10.25	a	1.16	a	114.4 a

=ANOVA, S-N-K test, values with different letters differ significantly at alpha=5%

Table 2: Results of the agar spot test (Variant a)

Fungicide	Inhibition		
	MRSagar	YGCagar	Yeast extract agar
Cuprofor(0.1%)	kH	kH	kH
Cuprofor(0.02%)	kH	kH	kH
Soluble sulfur(0.3%)	kH	kH	kH
Lime sulfur(1%)	kH	gH	kH
Coco soap(0.8%)	kH	kH	kH



Fig. 2: Weak inhibition of EMA with lime sulphur (1%) on YGC-agar in the agar spot test (Var. a)

Fig. 3: Weak inhibition of EMA with lime sulphur (1%) on YGC-agar in the well diffusion test (Var. b)

## Materials and Methods

The microbial test culture used was EM A (effective microorganisms activated). The following fungicides used in organic apple growing were tested against several bacterial cultures and cultivated on adequate media (MRS agar for lactobacilli, anaerobic, 37°C, 48 h; yeast extract agar for Rhodopseudomonas, daylight lamp, anaerobic, 28 °C, 72 h; YGC agar for yeasts, aerobic, 25 °C, 72 h): Cuprofor (50 % copper) 0.1%, Cuprofor 0.02%, soluble sulphur 0.3%, lime sulphur 1%, coco soap 0.8%). The antagonistic activity was examined using agar spot (two variations) and well diffusion tests (with and without pre-incubation). Zones of inhibition were evaluated visually (H = inhibition, gH = weak inhibition, kH = no inhibition). The flower spraying trials were applied in a 15-year-old apple orchard with the "Golden Delicious" variety (spindle, M9) in the research orchard of the institute in Vienna. For each variant, four branches on 8 trees with a large number of flowers were marked at the beginning of blossom and the flower buds were counted (minimum 100 per tree). The trees were treated on May 2, 2005 in full blossom with a knapsack sprayer (Table 1) until dripping wet. On June 2 and 27 (before and after the June fall) the fruits remaining on the branches were counted. No hand thinning was completed. At harvest time (October 21, 2005) the number and the weight of all the harvested fruit on the marked branches was registered. A statistical analysis of the data was made with spss 11.0 (Anova with SNK -test,  $\alpha = 0.05$ ).

## Results and Discussion

Lime sulphur (1%) (Table 2, Figure 2-3) exhibited weak inhibitory activity on YGC agar against the yeasts in EM A during the agar spot test (variation a) and the well diffusion test without pre-incubation. No inhibition was observed with all other fungicides irrespective of the culture media or the antagonism test (Fig. 4-7). The trees treated with formic acid showed lesions on leaves and flowers, which may have been caused by the low pH-value of the spraying. No leaf damage was found (Fig. 1) among all the variants treated with EM. As far as the thinning effect on flowers and fruits was concerned, no difference to control could be found on all the variants treated with EM, whereas treatments with formic acid, especially where the concentrations were higher, led to a statistically lower fruit set as compared to the untreated control during summer and at harvest (Table 1). Standard treatments with EM A and EM 5, even in two- or five-fold concentrations during blossom, have no negative effect on the leaves and flowers of the "Golden Delicious".



Fig. 4: No inhibition of EMA with Cuprofor 0.1% with yeast extract-agar in the agar spot test (Var. a)



Fig. 5: No inhibition of EMA with Cuprofor 0.02% with yeast extract-agar in the well diffusion test (Var. b)



Fig. 6: No inhibition of EMA with coco soap 0.8% with MRS-agar after agar spot test (Var. b)



Fig. 7: No inhibition of EMA with soluble sulphur 0.3% on MRS-agar after well diffusion test (Var. a)

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