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Possibilities of copper reduction with the patented combination of copper with formulated Potassium hydrogen carbonate (Armicarb, Karma, Kumar)

Way Forward in Organic Plant Health Care Strategies 17.-18.11.2022

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Overview

- What is Synergy
- Why does it work
- Trial results 2022
- Summary

® **Trademarks:** Cuprozin® progress and Funguran® progress are from Cosaco GmbH, Karma® and Kumar® from Certis Belchim B.V., Armicarb® is a registered trademark of Church & Dwight USA, Inc



Efficacy of observed Synergy

Colby, extended according to Welte

X = observed efficacy of product A

(e.g. 0,6 = 60 %)

Y = observed efficacy of product B

(e.g. 0,5 = 50 %)

E = expected efficacy of mixture

(e.g. 0,8 = 80 %)

$$E = X + Y - X*Y$$

O = observed efficacy of mixture A + B

(e.g. 0,9 = 90 %)

Result:

If $O > E$ then: **Synergy**, if $O < E$ then: Antagonism

Z = **Efficacy of observed Synergy** (Welte)

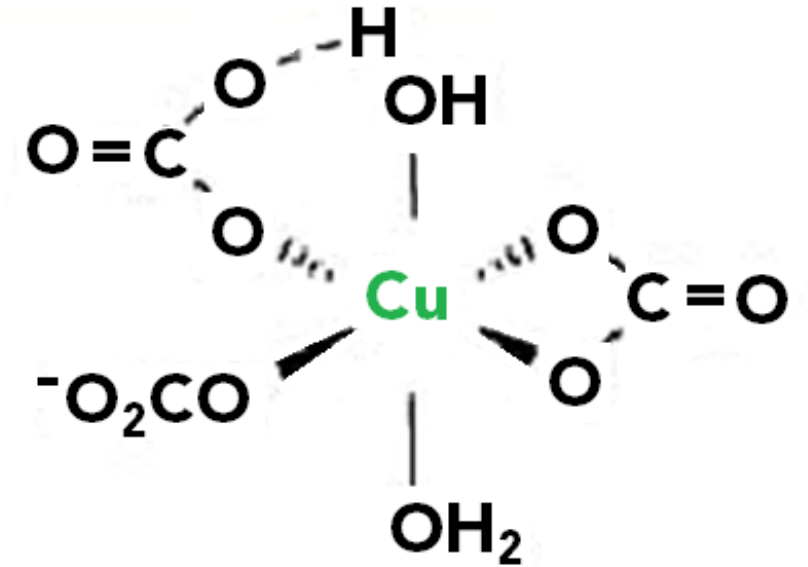
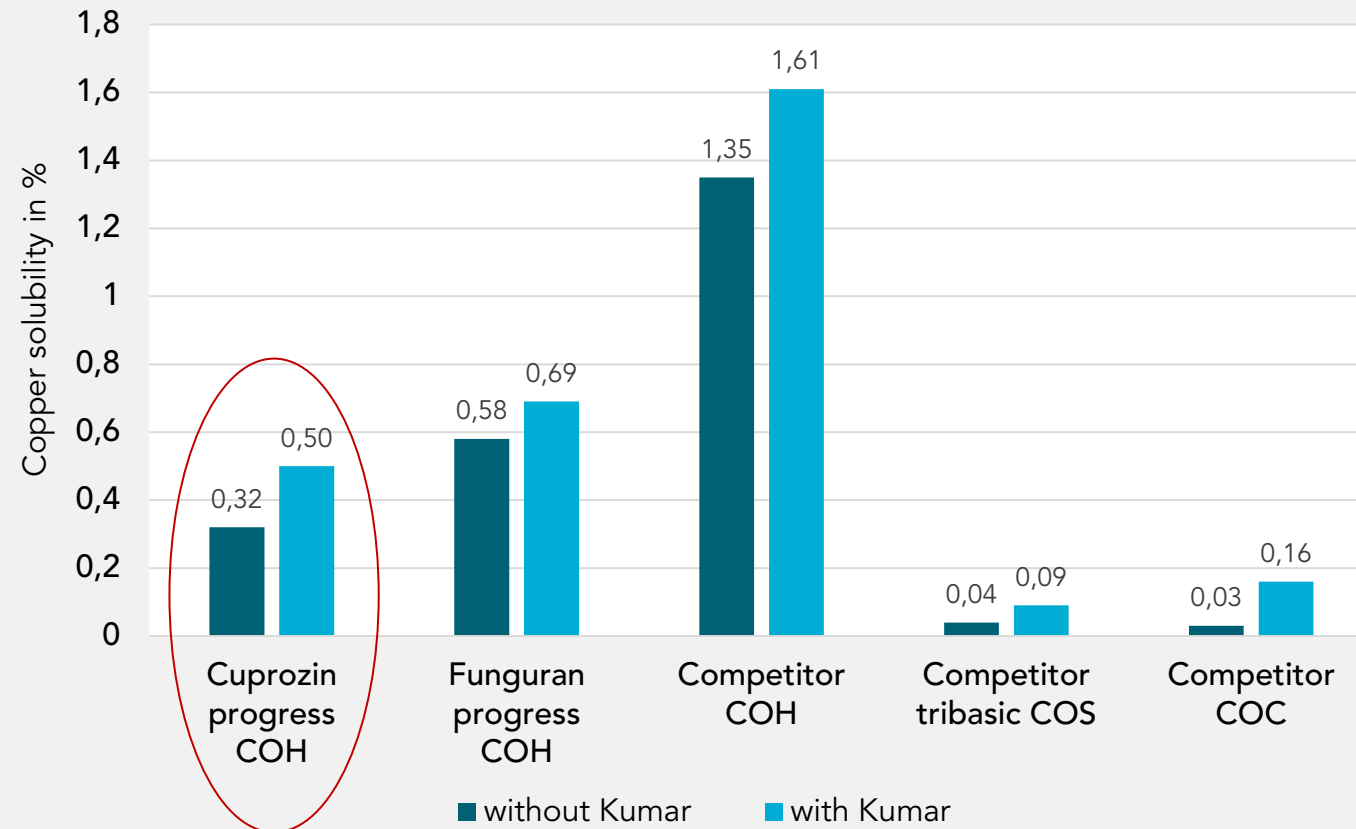
$$Z = \frac{O - E}{1 - E}$$

(e.g. 0,5 = 50 %)



Effect on solubility of mixture

Solubility of copper is increased in all test items



Copper carbonate complex is formed with free copper ions

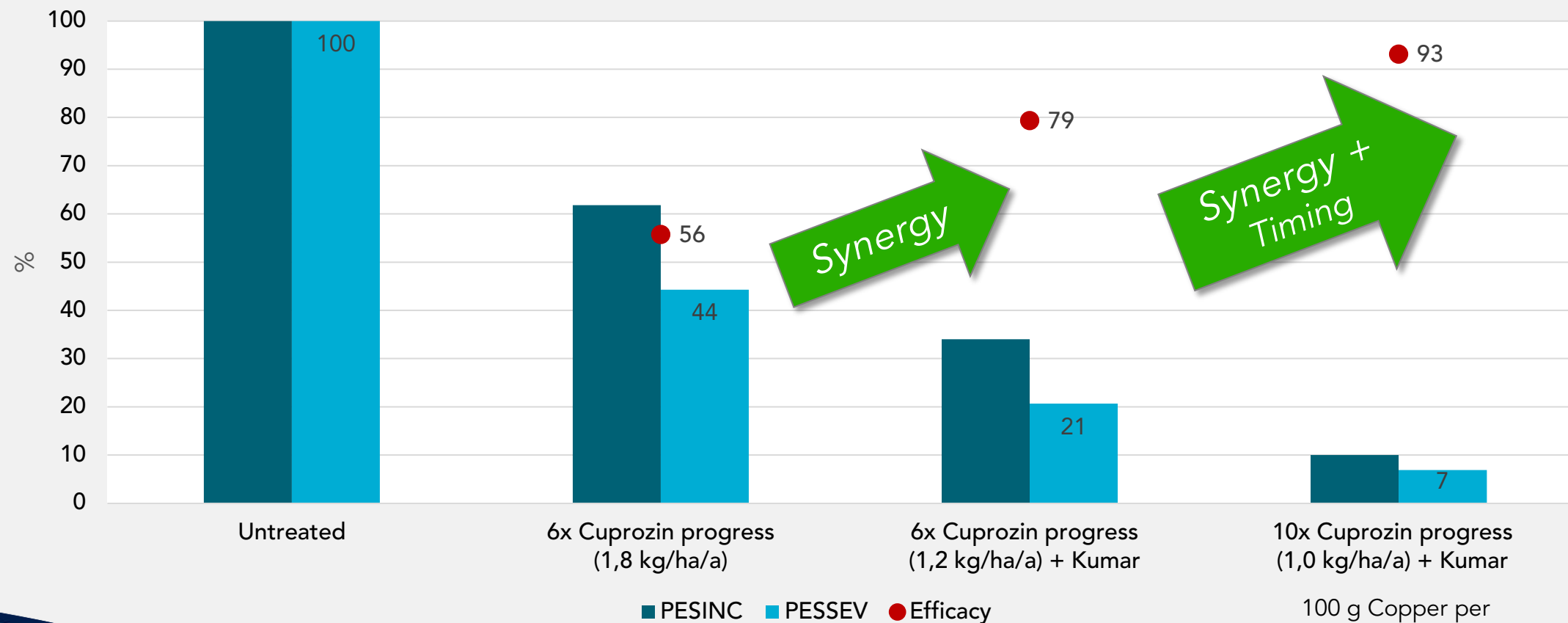
pH of mixture is not changed

Copper solubility of Cuprozin progress + Kumar is below
Funguran progress and competitor copper hydroxide
Therefore ecotox is not increased

Peronospora Trial in Austria 2018

Hiebler Agricultural Engineering – Pest severity berry 2.07.2018 (ES 77)

Variety: Weissburgunder, Trial location: Pöllau, Styria, Austria



All treatments (b) are significant better than untreated (a)

100 g Copper per application but more treatments

Peronospora protocol in AT 2022

Hiebler, Variety: Weissburgunder, Trial location: Pöllau, Styria, Austria

Trt	Treatment	Form	Form	Form		Rate	Other	Other	Copper	Copper	Appl.	Appl.
No.	Name	Conc	Unit	Type	Rate	Unit	Rate	Rate Unit	Rate	Rate Unit	Code	Missing
1	Untreated Check											
2	CUPROZIN progress	383	GA/L	SC	0,8	l/ha	306	g ai/ha	200	g/ha	A	
	CUPROZIN progress	383	GA/L	SC	1,2	l/ha	460	g ai/ha	300	g/ha	C	
	CUPROZIN progress	383	GA/L	SC	1,6	l/ha	610	g ai/ha	400	g/ha	E	G,I,K,M,O
3	CUPROZIN progress	383	GA/L	SC	0,4	l/ha	153	g ai/ha	100	g/ha	A-F	G-O
	KUMAR	850	GA/KG	WP	2	kg/ha	1700	g ai/ha			A-F	G-O
4	Copper oxychloride	639	GA/L	SC	0,263	l/ha	166	g ai/ha	100	g/ha	A-F	G-O
	KUMAR	850	GA/KG	WP	2	kg/ha	1700	g ai/ha			A-F	G-O
5	Copper (II) oxide	839	GA/KG	WG	0,133	kg/ha	112	g ai/ha	100	g/ha	A-F	G-O
	KUMAR	850	GA/KG	WP	2	kg/ha	1700	g ai/ha			A-F	G-O

Trial stopped after application F as 100% PESSEV at bunches in all plots

Peronospora VitiMeteo

Station: Markt Hartmannsdorf, 01.01.2022 00:00 - 02.07.2022 11:00

Erstellt 27.06.2022 12:13 Daten vorhanden bis: 27.06.2022 10:45 Wettervorhersage bis: 02.07.2022 11:00

Keimbereitschaft: 01.05.2022 Wachstum angegeben für: Riesling
Austrieb (BBCH11): 01.05.2022 pro Haupttrieb (ohne Geiztriebe)

Datum	Spor- angien- dichte	Infektion	Inkubation		Temperatur °C			Nieder- schlag mm	Blattnässe		Wachstum		Bemerkungen
			27.06.	02.07.	Min	Ø	Max		Std.	Grad- std. bei BN.	Blatt- zahl	Blatt- fläche cm²	
20.05					12,1	20,6	29,3			0	7	473	
21.05					17,5	21,8	28,3		0,5	10	7	559	A BBCH 55
22.05					11,2	18,0	24,5			0	8	629	
23.05					13,8	17,1	21,0	4,0	3,2	36	8	687	
24.05		!!	01.06.		14,3	19,0	25,3	4,2	9,0	140	8	761	
25.05					13,4	16,6	22,3	6,4	10,5	84	9	825	
26.05		!!	02.06.		12,6	16,4	23,3	0,4	9,0	167	9	879	B BBCH 55
27.05					13,1	19,7	26,5			0	9	958	
28.05					9,9	13,4	17,2		1,2	15	10	994	
29.05					6,7	10,1	13,9	3,4	8,8	71	10	994	
30.05					5,4	10,8	17,7		9,0	134	10	1001	
31.05					7,1	15,8	23,7	0,2		0	10	1047	
01.06					12,0	19,3	25,7		3,0	40	10	1117	C BBCH 57
02.06	x	174	!!	07.06.	12,3	18,3	26,3	13,2	13,8	120	11	1187	
03.06	x	208	!!!	08.06.	13,8	20,1	26,5	0,2	9,0	234	11	1258	
04.06	x	300			16,1	22,9	31,2	4,8	1,3	22	12	1355	D BBCH 57
05.06	x	270	!!	10.06.	15,8	20,4	24,2	0,2	9,2	186	12	1423	
06.06	x	197	!!	11.06.	15,3	19,7	27,1	9,8	9,0	145	13	1495	
07.06		!	13.06.		14,5	20,0	25,8	18,6	5,5	88	13	1558	
08.06	x	150	!!!	13.06.	13,1	17,1	23,4	3,6	11,0	255	13	1601	
09.06	x	199	!	15.06.	14,9	16,5	19,1	0,8	6,0	65	14	1651	
10.06					15,4	18,2	21,5		0,3	4	14	1700	
11.06					15,4	20,5	25,0			0	15	1770	E BBCH 62 1. Assess.
12.06					13,7	20,7	27,3			0	15	1832	
13.06					14,3	20,2	25,8		0,8	14	16	1897	
14.06					10,5	17,7	23,6			0	16	1940	
15.06					11,8	19,2	26,6			0	16	1989	F BBCH 69
16.06		!!	22.06.		14,1	19,2	27,1	2,8	8,8	125	17	2046	
17.06	x	201	!!	22.06.	14,4	19,7	26,7		2,0	160	17	2097	2. Assess.
18.06					12,8	20,2	27,8			0	17	2148	



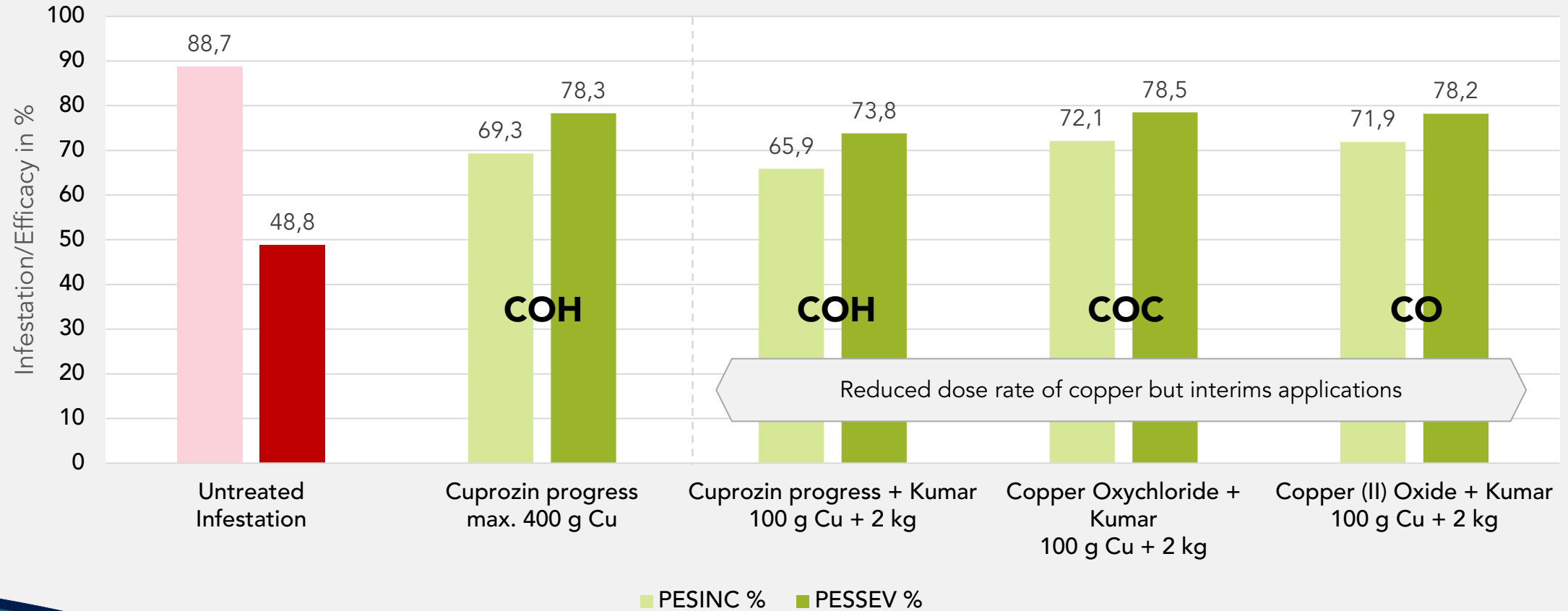
According to the model: timing of applications was good
E might be too late (but it was raining all the time)

The timing C and D were most important. At C already dose rate of Cuprozin progress was 300 g Cu according to growth stage (registered does rate)

Between C and E 5 leaves developed and leaf area grew from 1117 to 1770 cm². More than one week raining!

Leaf pest efficacy at 17.6.22

Peronospora, Vitis vinifera, variety Weissburgunder, Trial location: Pöllau, Styria, Austria



All treatments (a) of same efficacy in PESINC and in PESSEV

Peronospora technical trial in DE 2022

What nozzle type and water rate (concentration) is needed for copper applications

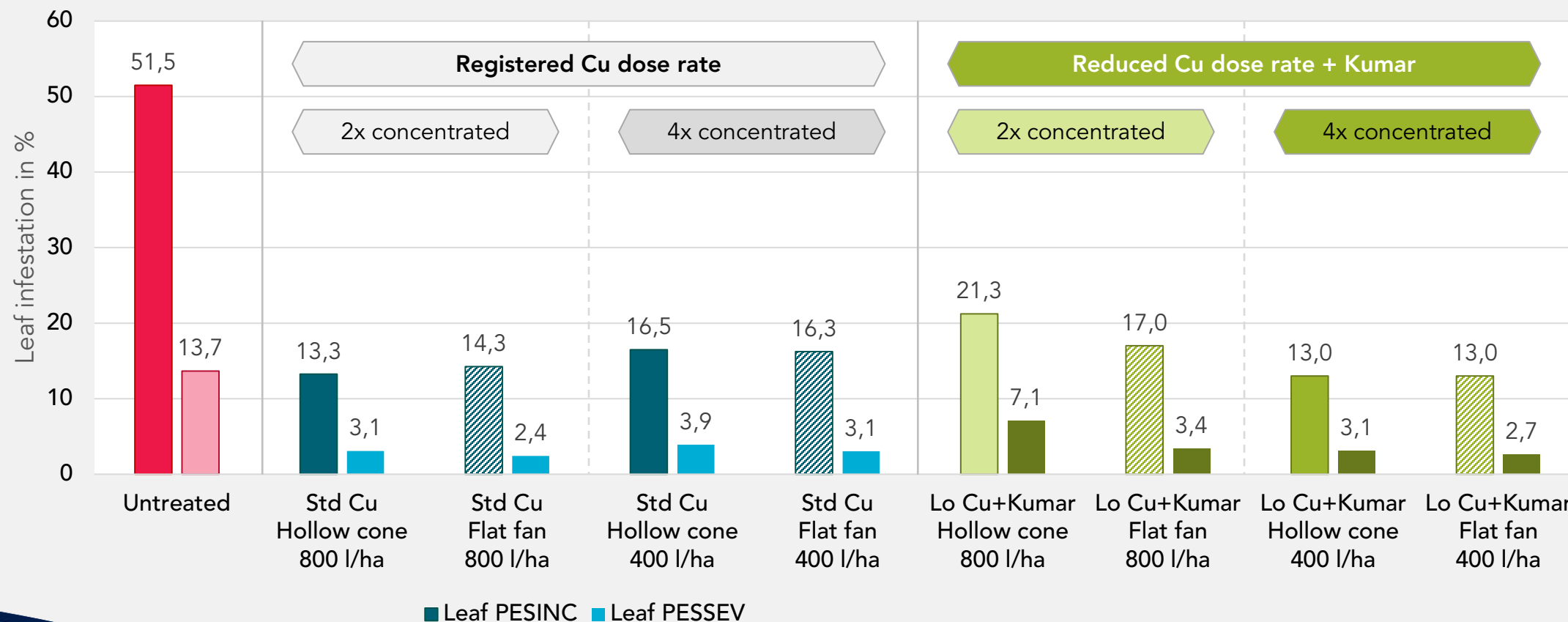
Trt No.	Treatment Name	Product	Max. dose rate	Unit	Max. Cu g/ha	Cu dose rate	Max. water l/ha	Conc.	Nozzle Type
1	Untreated Check								
2	Std Cu Hollow cone 2x	CUPROZIN progress	1,6	l/ha	400	Registered copper dose rate	800	2x	Albuz ATR, hollow cone
3	Std Cu Flat jet 2x	CUPROZIN progress	1,6	l/ha	400		800		Lechler IDK, flat fan
4	Std Cu Hollow cone 4x	CUPROZIN progress	1,6	l/ha	400		400	4x	Albuz ATR, hollow cone
5	Std Cu Flat jet 4x	CUPROZIN progress	1,6	l/ha	400		400		Lechler IDK, flat fan
6	Lo Cu+Kumar	CUPROZIN progress	0,4	l/ha	100	Reduced copper dose rate + Kumar	800	2x	Albuz ATR, hollow cone
	Hollow con 2x	KUMAR	2,0	kg/ha					
7	Lo Cu+Kumar	CUPROZIN progress	0,4	l/ha	100		800		Lechler IDK, flat fan
	Flat jet 2x	KUMAR	2,0	kg/ha					
8	Lo Cu+Kumar	CUPROZIN progress	0,4	l/ha	100		400	4x	Albuz ATR, hollow cone
	Hollow con 4x	KUMAR	2,0	kg/ha					
9	Lo Cu+Kumar	CUPROZIN progress	0,4	l/ha	100		400		Lechler IDK, flat fan
	Flat jet 4x	KUMAR	2,0	kg/ha					

Deviation from study plan: Teejet TXB80 015VK is used instead of Albuz ATR and XR110 015VS instead of Lechler IDK

Peronospora leaf infestation 2022

Eurofins, Vitis vinifera, variety Riesling, Trial location: Dielheim, Germany

Application timing is equal in all treatments, 16.08.2022



All treatments are significant better than untreated
Treatments are not significant different to each other

Summary

- Very heavy *Peronospora* infestation in grape vine in Austria 2022 but rather low in Germany
- Combination with Kumar gives higher solubility of copper salts but within variation of different copper formulations
- Synergy works with all copper formulation (**COH, COC, CO**)
- Reduced dose rate of copper (100 g/ha Cu) and Kumar with higher number of treatments is working in grape vine





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