

Efficacy of Zoxium and Mancozeb (Electis) against Late blight and other diseases of tomato.

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ELECTIS Product Profile (Italy)

Active Ingredient	8.3% w/w zoxium (Zoxamide) + 66.7% w/w mancozeb
Crop/Situation:	Potatoes, Tomato (field), Vine
Diseases controlled	Downy mildew (PHYTIN, PLASVI), alternaria and septoria (also activity on many other diseases due to broad spectrum of mancozeb)
Formulation	WDG
Mode of Action	Nucleic division + multisite
Range of Doses:	1.5 to 2.0 kg product /ha
Max No.Treatments:	5 per crop
Water Volume:	200–1000 litres
Latest Time Appln	28 days (vines), 7 day (potato), 3 day (tomato)
Spray Interval	8 - 12 days
Pack size	1kg, 10 kg vacuum sealed

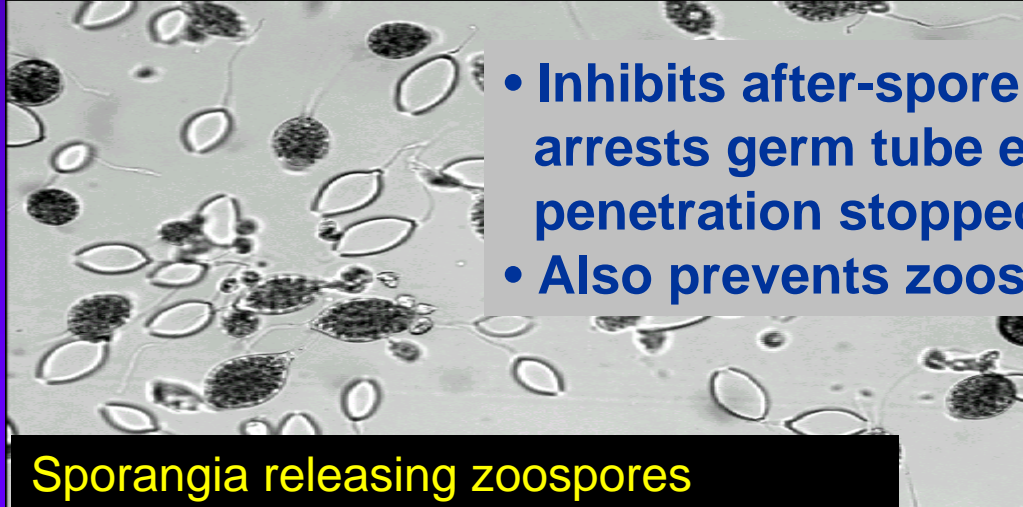
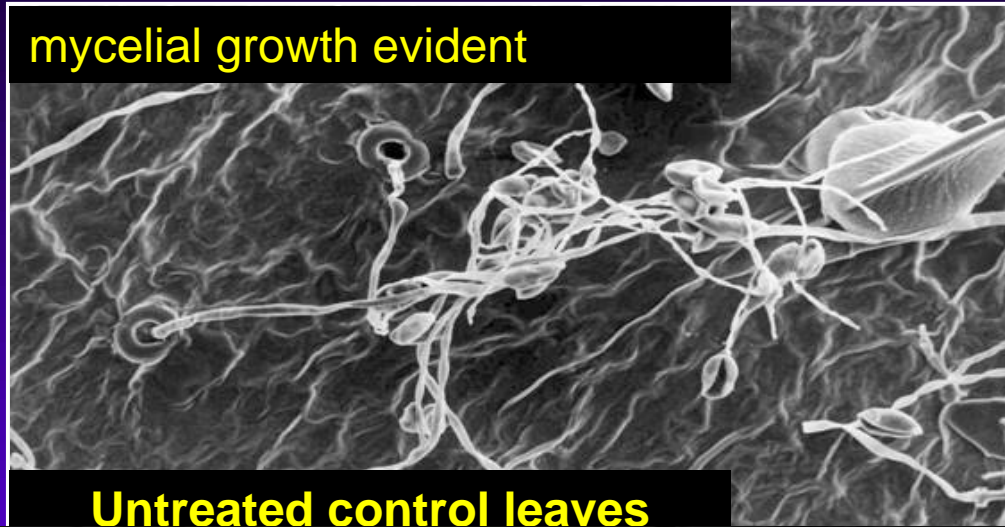
ZOXIUM

- ZOXIUM is a low use rate protectant fungicide from the benzamide chemical class, FRAC MOA group 22
- Only commercialized example to date from the Benzamide class.
- Protectant fungicide. Highly active against the Oomycetes.
- ZOXIUM binds irreversibly to the beta tubulin of Oomycetes through a covalent attachment.
- Potential resistance management tool.
- High level of protection of foliage and fruits / tubers.
- Excellent rainfastness.
- Excellent regulatory profile.
- Completed Annex I process

Mancozeb

- Mancozeb is an important broad spectrum fungicide with activity on all fungal groups
- MoA: Multi-site: Activity on 6 metabolic pathways including respiration in mitochondria and cytoplasm
- Protectant fungicide with redistribution properties on leaf surface and vapour activity
- No resistance issues in over 40 years of use. essential blend component for many other actives
- Completed Annex I process
- Annex III fully supported to gain as maintain as many crops as possible and maintain blend products from other manufacturers

The Zoxium Effect: On sporangia and zoospores of blight on potato leaf surface



- Inhibits after-spore germination, arrests germ tube elongation and fungal penetration stopped.
- Also prevents zoospore formation



96 hr after inoculation with zoospore and sporangial suspension

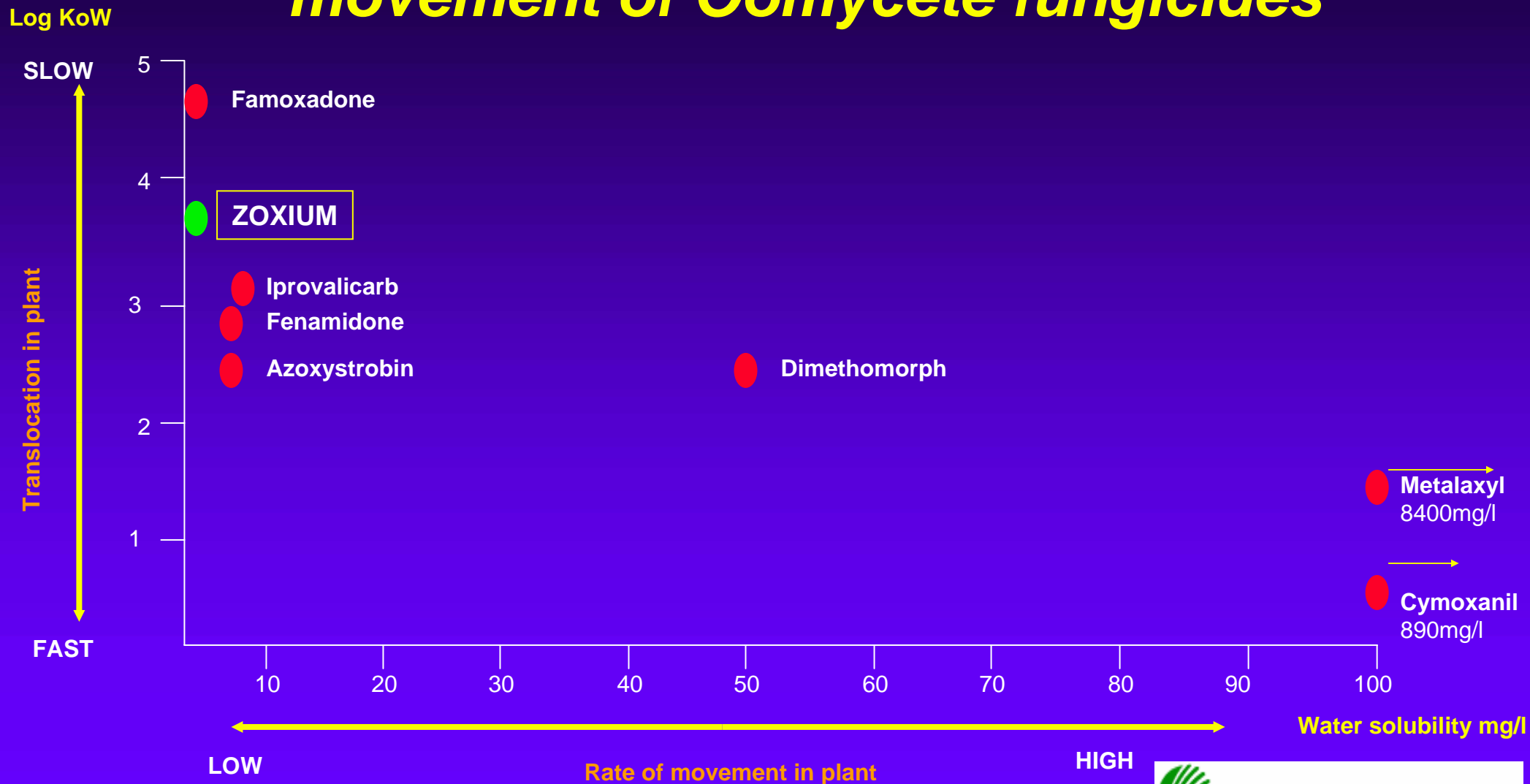
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Zoxium: In vitro Antifungal spectrum

<u>Organism</u>	<u>EC50 (ppm)</u>
<i>Pythium ultimum</i>	0.006
<i>Phytophthora infestans</i>	0.009
<i>Phytophthora capsici</i>	0.35
<i>Venturia inaequalis</i>	0.44
<i>Sclerotinia homeocarpa</i>	0.58
<i>Pseudocercospora herpotrichoides</i>	0.75
<i>Botrytis cinerea</i>	0.75
<i>Monilinia fructicola</i>	1.7
<i>Mycosphaerella fijiensis</i>	2.0
<i>Pyricularia oryzae</i>	7.8
<i>Pythium aphanidermatum</i>	>16
<i>Alternaria mali</i>	>16
<i>Septoria nodorum</i>	>16
<i>Rhizoctonia solani</i>	>16
<i>Fusarium roseum</i>	>16

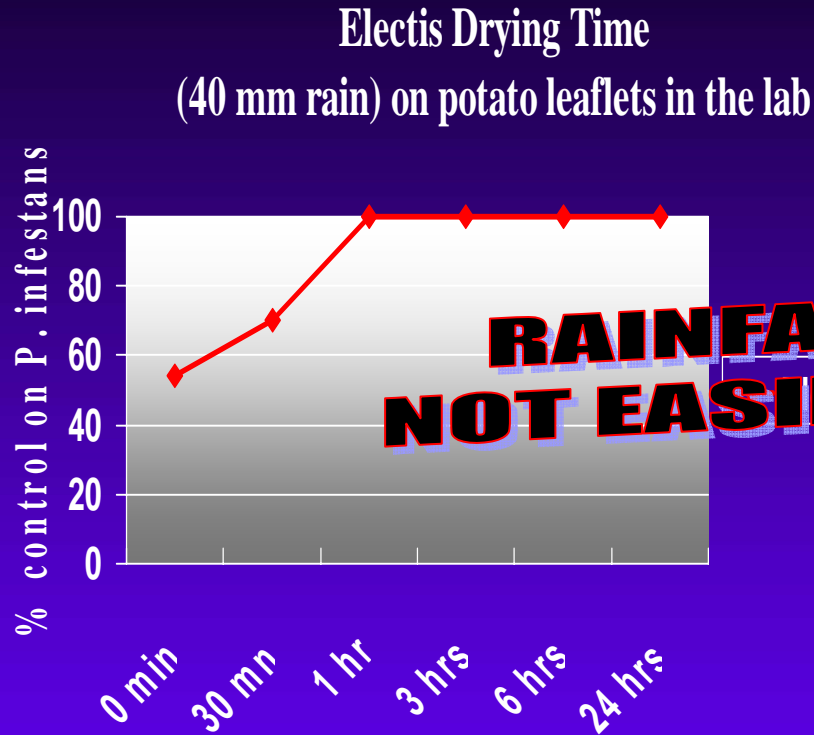
Comparative translocation and internal movement of Oomycete fungicides



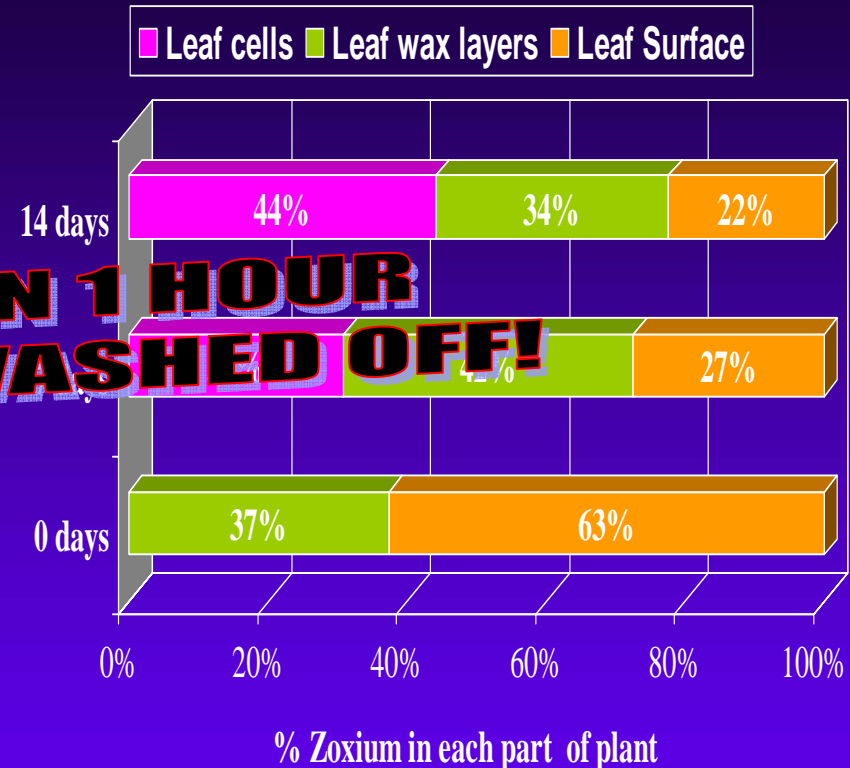
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Zoxium is Highly Rainfast



**RAINFAST IN 1 HOUR
NOT EASILY WASHED OFF!**



- Zoxium is highly lipophilic: It penetrates fast into the leaf wax layer where it is tightly bound to leaf waxes. Therefore: Less likely to be washed off.
- It provides a reservoir and slowly enters the leaf cell, so it is not metabolised fast by the plant and hence offers protection for longer

Resistance *monitoring / risk assessment.*

- *Phytophthora infestans* is inherently a high risk disease, though recently downgraded by FRAC to medium risk.
- Zoxium novel mode of action amongst commercialised Oomycete fungicides. No site specific cross resistance anticipated with current commercial products.
- Mancozeb as multi-site is important resistance management tool
- No shift in baseline monitoring since launch
- Laboratory mutagenesis and adaption studies have failed to generate resistant mutants.
- No cross resistance observed to strains of *P. viticola* resistant to; metalaxyl, cymoxanil, dimethomorph and strobilurins

Mancozeb: Crops and Diseases



CEREAL	SEPTORIA TRITICI SEPTORIA NODORUM PUCCINIA RECONDITA FUSARIUM NIVALE TILLETIA CARIES USTLAGO AVENAE HELMINTHOSPORIUM GRAMINEUM USTILAGO HORDEI	PLUM TREE	TRANZCHELIA PRUNI SPINOSAE	CABBAGE	PERONOSPORA PARASITICA
		BLACK CURRANT	PUCCINIA RIBESII CARISIS	UCURBITS	COLLETOTRICHUM LAGENARIUM CLADOSPORIUM CUCUMERINUM PHYTOPHTHORA CRYPTOGEA PUCCINIA CICHORII
		CURRANT BUSH	GLOEOSPORIUM RIBIS SEPTORIA	ENDIVE	
		STRAWBERRY	ZYTHIA ALTERNARIA	BEAN	BOTRYTIS FABAE COLLETOTRICHUM LINDEMUTHIANUM UROMYCES APPENDICULATUS
		RASPBERRY	PHRAGNIDIUM RUBI IDAEI SEPTORIA RUBI GLOEOSPORIUM VENETUM DIDYMELLA APPLANATA	TURNIP	PERONOSPORA PARASITICA
POTATO	HELMINTHOSPORIUM SOLANI RHIZOCTONIA SOLANI PHYTOPHTHORA INFESTANS ALTERNARIA SOLANI	GARLIC	PERONOSPORA DESTRUCTOR	ONION	BOTRYTIS SQUAMOSA PERONOSPORA DESTRUCTOR
		SHALLOT	PUCCINIA ALLII BOTRYTIS SQUAMOSA	LEEK	PHYTOPHTHORA PORRI PUCCINIA PORRI
		ARTICHOKE	BREMIA LACTUCAE	TOMATO	PHYTOPHTHORA INFESTANS CLADOSPORIUM FULVUM ALTERNARIA SOLANI COLLETOTRICHUM ATRAMENTARIUM <i>SEPTORIA LYCOPERSICI</i>
GRAPE	PLASMOPARA VITICOLA GUIGNARDIA BIDWELLII PHOMOPSIS VITICOLA PSEUDOPEZIZA TRACHEIPHILA	ASPARAGUS	ASCOCHYTA HORTORUM RAMULARIA CYNARAE		
		EGG PLANT	PHYTOPHTHORA CAPSICI	ORNAMENTALS	SPHACELOMA ROSARUM PHRAGMIDIUM SUBCORTICIUM MARSSONINA ROSAE CLADOSPORIUM ALTERNARIA PERONOSPORA SEPTORIA
APPLE	VENTURIA INAEQUALIS	RED BEET	PERONOSPORA SCHACHTII CERCOSPORA BETICOLA RAMULARIA BETAE		
PEAR	VENTURIA PIRINA GYMNOSPORANGIUM SABINAE SEPTORIA PIRICOLA	CARROT	UROMYCES BETAE ALTERNARIA DAUCI PLASMOPARA NIVAE		
APRICOT	TRANZCHELIA PRUNI SPINOSAE	CELERY	SEPTORIA APIICOLA		
PEACH	TRANZCHELIA PRUNI SPINOSAE FUSICLADIUM CARPOPHILUM				

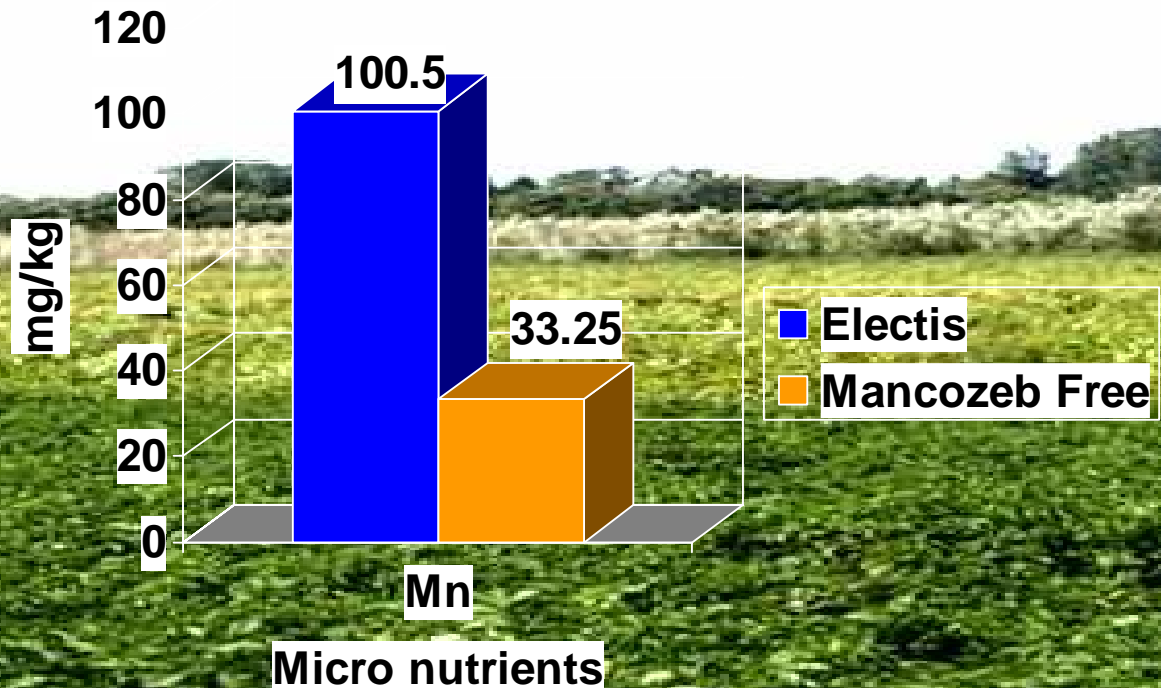
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Added benefits of Mancozeb, Increased Crop Health

Mancozeb free
blight programme
(Shirlan based)

Electis 1.8kg/ha



Manganese is important for chlorophyll production = Photosynthesis = Yield

Electis: Favourable to Food Chain and the Environment

- Accepted On grower Produce protocols.
- Transformation in tomato for canning and Juice is important and fully supported.
- 3 day PHI in tomato



- Favourable environmental profile:

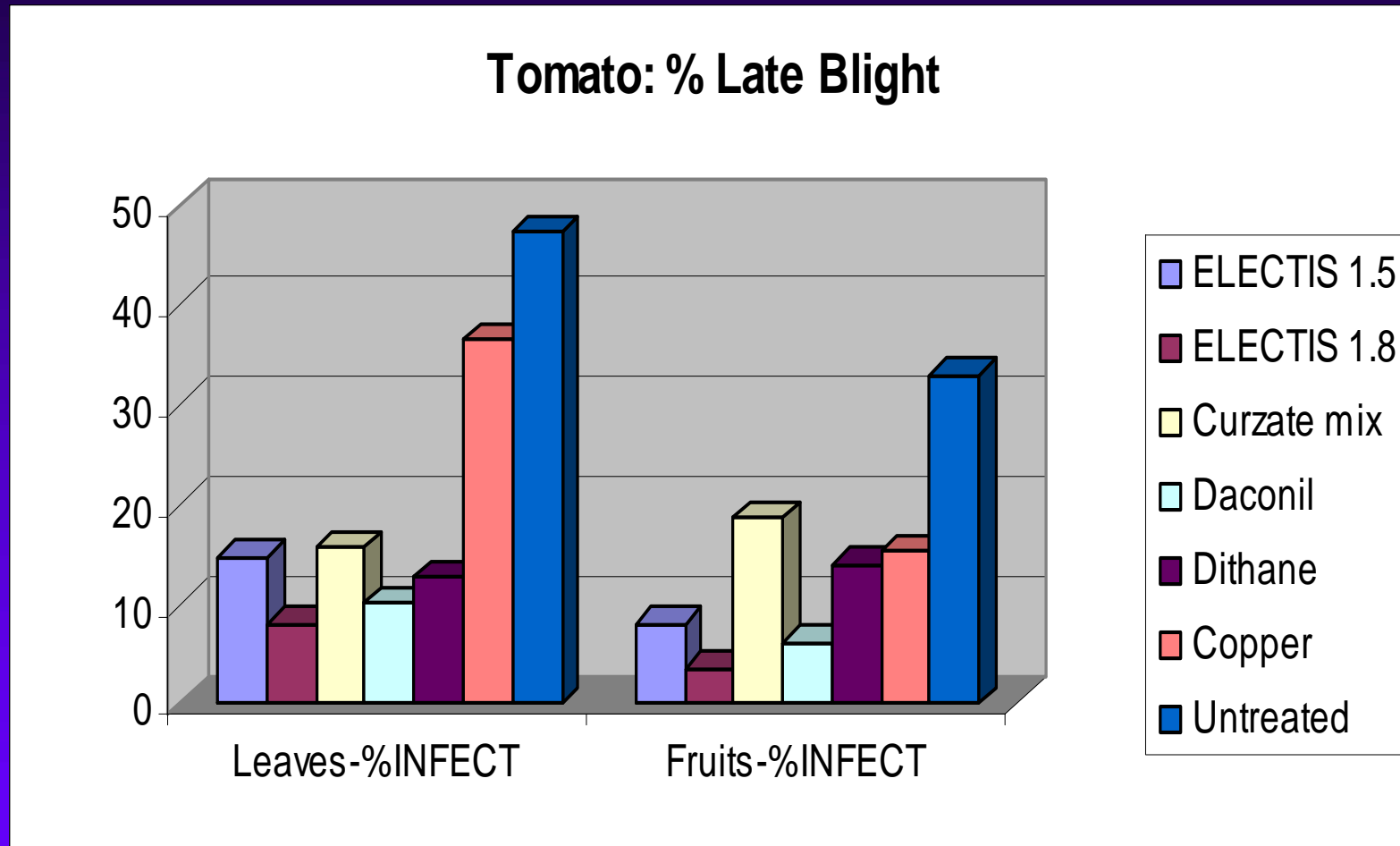
- On IPM protocols for tomato
- Breaks down rapidly in soil and water
- Short half life: <1-10 days soil, < 1 day in water
- Low persistence in the environment,
- Does not leach, Low potential for run-off,
No groundwater issues, no bio- accumulation
- High operator safety



Tomato: *Phytophthora infestans*



ELECTIS: Late Blight of Tomato (Summary of 11 Trials)



Summary of 11 Efficacy studies

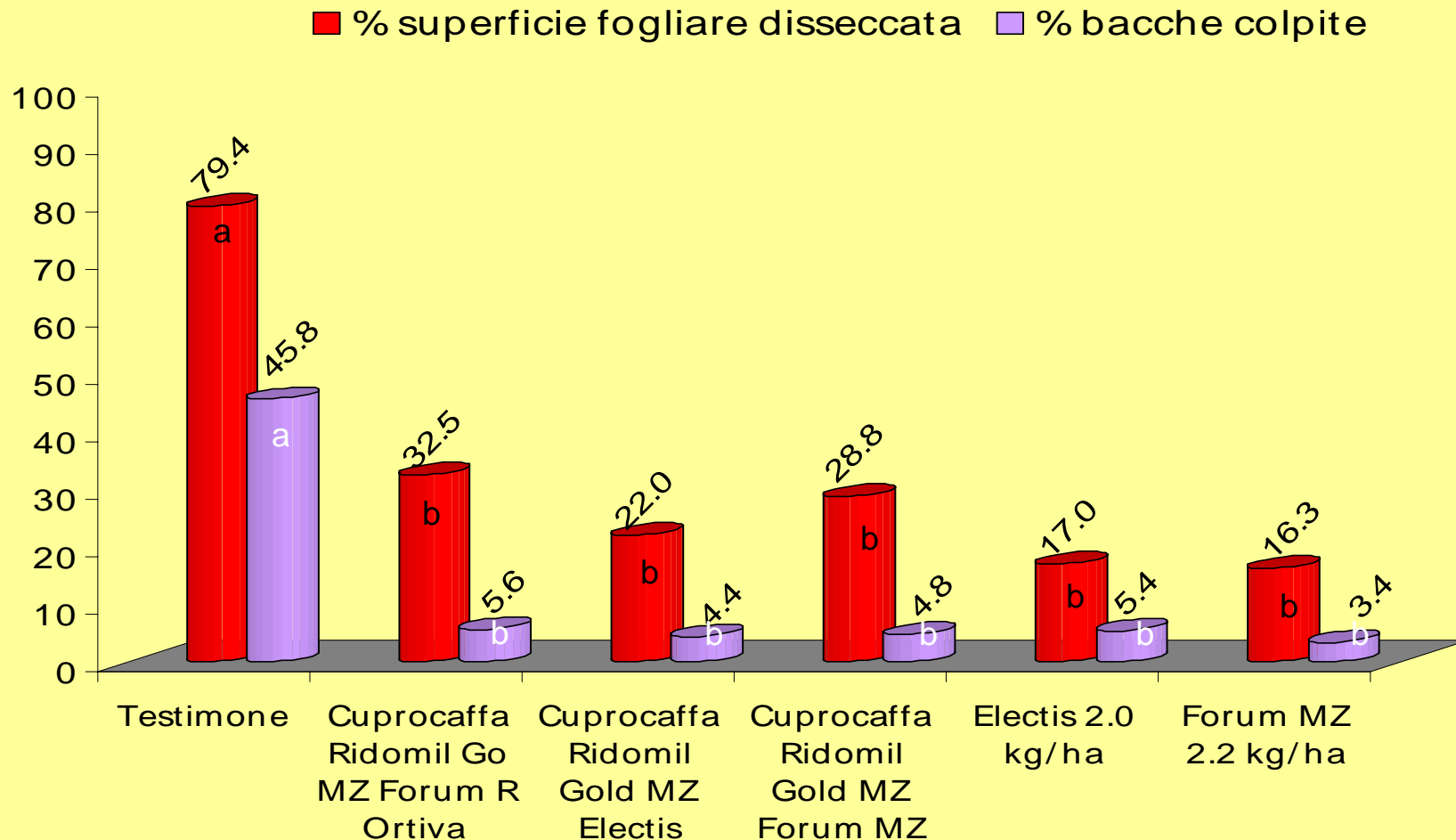
Application schedule: 7-10 days

%INFECT on Leaves and Fruits collected across studies after 6-9 applns

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Tomato: *Phytophthora infestans* (% foliar disease and % incidence)

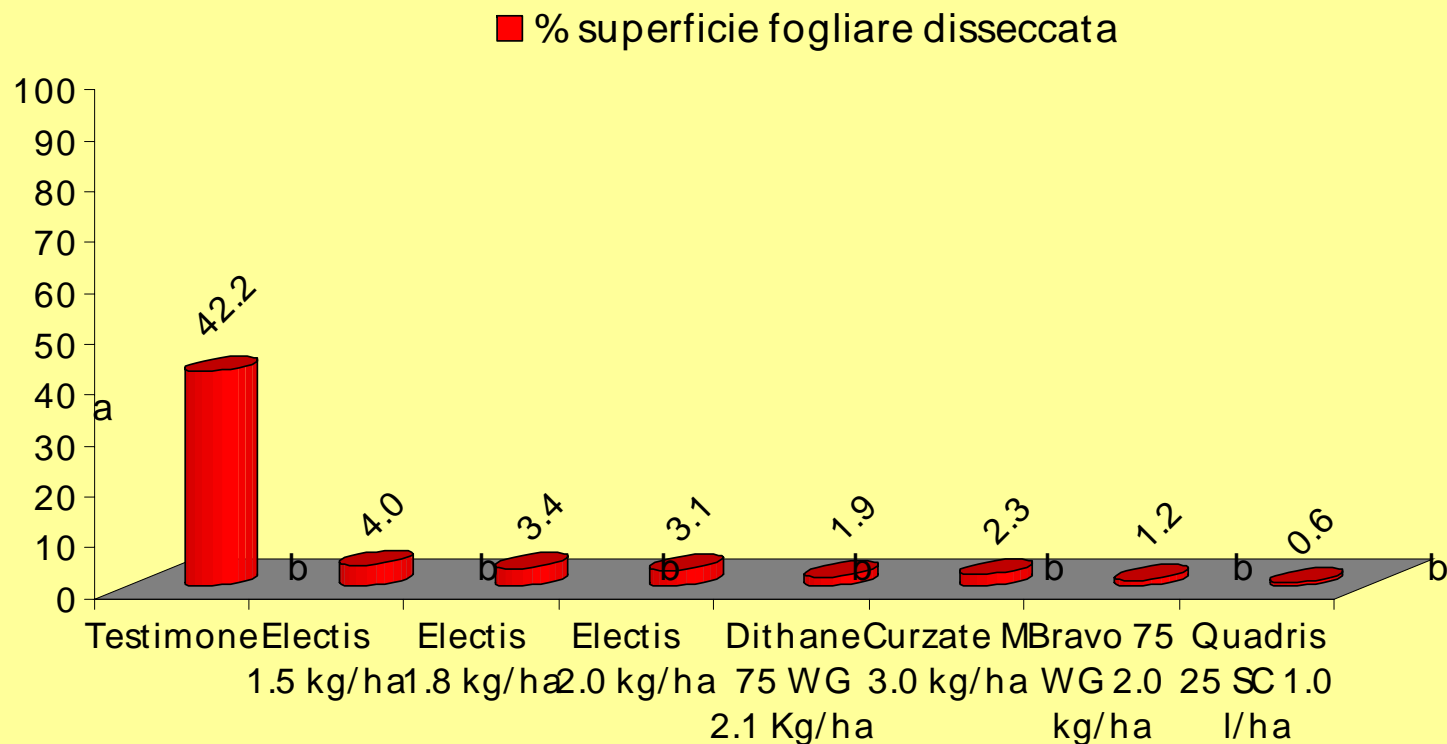


DAS 2004, Tomato, open field. cv. Lincas, Latina (LT) 7 applns, interval 8-12 days

Tomato: *Alternaria* spp.



Tomato: *Alternaria* spp. (% foliar disease)

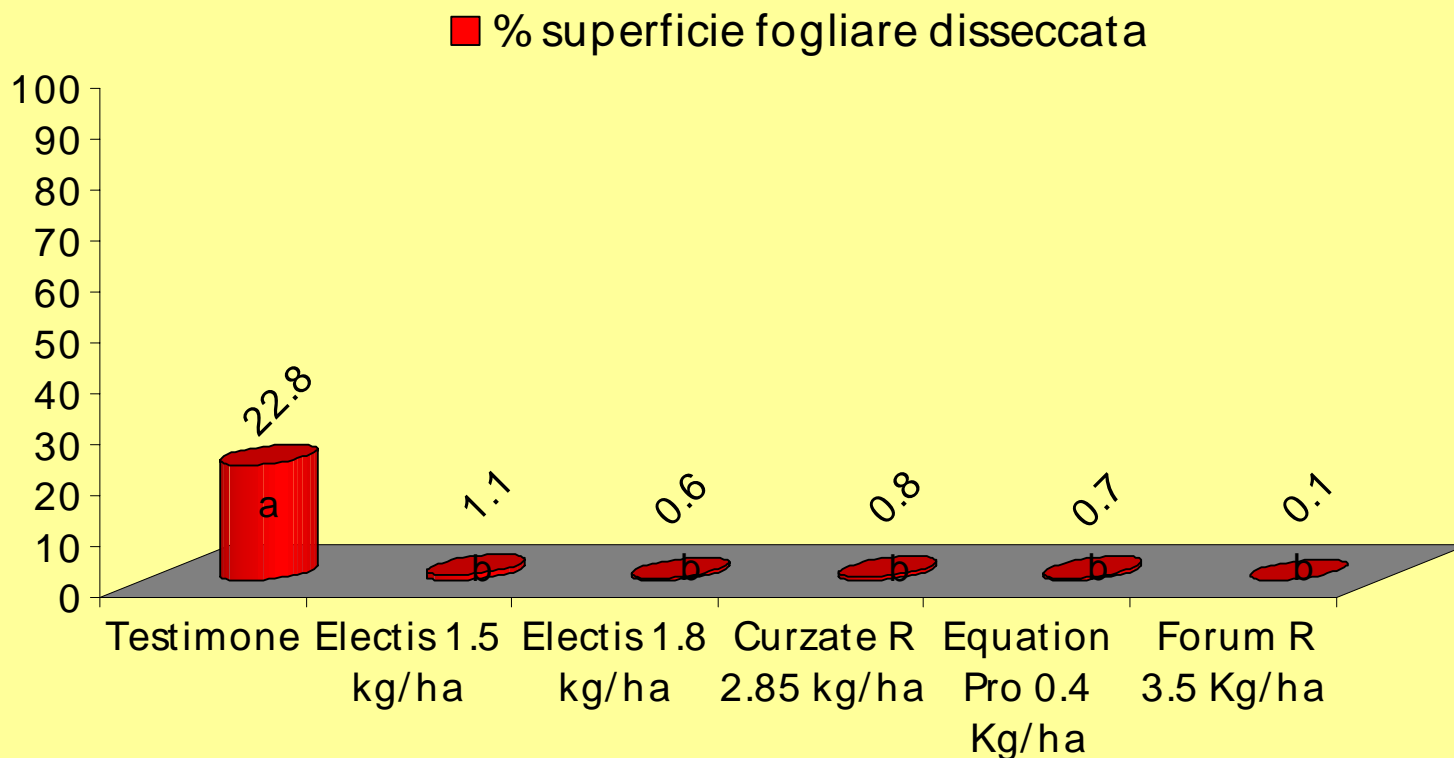


DAS 2004, Tomato open field cv. Red Setter, Latina (LT) 6 treatments, interval 10 days

Tomato: *Septoria lycopersici*



Tomato: *Septoria lycopersici* (% foliar disease)

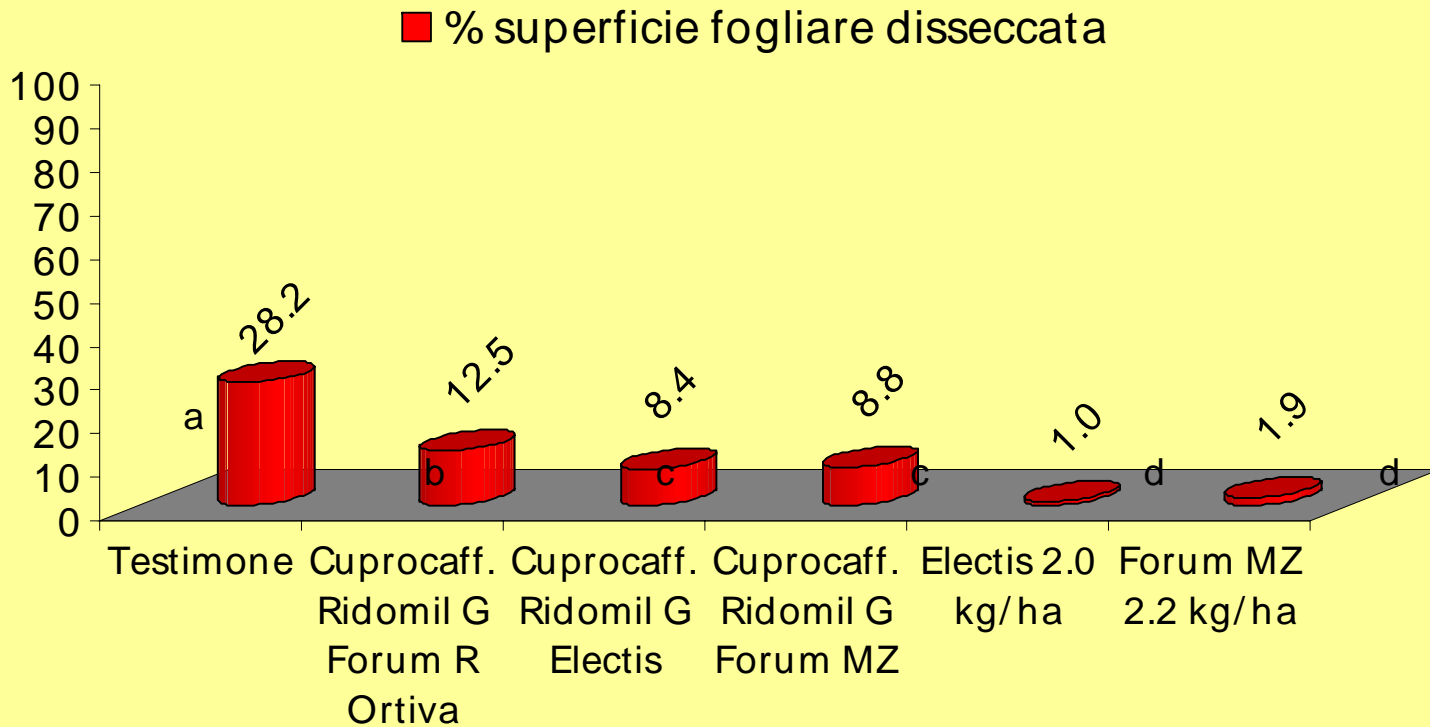


DAS 2005, Tomato open field cv. Smile, Boara (FE) 4 treatments, interval 7-10 days

Pomodoro: *Cladosporium fulvum*



Pomodoro: *Cladosporium fulvum* (% foliar disease)



AgriGeos 2004, Tomato open field cv. Shiren, Marina di Acate (RG) 8 treatments, interval 7-10 days

ELECTIS: Selectivity on Tomato

Selectivity results out of 31 Studies

Varieties tested: MAR, MARMANDE, MARIDA F1, VALENTIN, ATLETICO, BON, FLORADADE, HEINZ 7180, HEINZ 2274, HEINZ 7180, HEINZ 9553, INCAS, TRAYAN, TEELMEC, ALICANTE, BEEFHART, DANIELA, VC 82, FANDANGO, ARLETTE, VALENCIANO

Results: No Crop injury observed in all varieties on Leaves, Flowers and Fruits

No transformation issues with juice and canning

Electis®: *Innovazione e tradizione*

- Electis contain Zoxium, a novel mode of action against oomycete fungi and when combined with the solid broad spectrum multi-site activity of mancozeb they offer excellent protection against downy mildews and other diseases
- Controls key diseases in tomato which enables excellent fruit quality
- An established product in fungicide programmes in potato and vine.
- Useful resistance management tool for use in fungicide programmes
- Excellent rainfastness. Excellent resistance to wash off.
- Low mammalian tox., safe to environment.
- Short pre-harvest interval, accepted by food chain, no transformation issues