NOBACTRA TOMATO
FOR THE CONTROL OF BACTERIAL CANKER

November 1, 2016

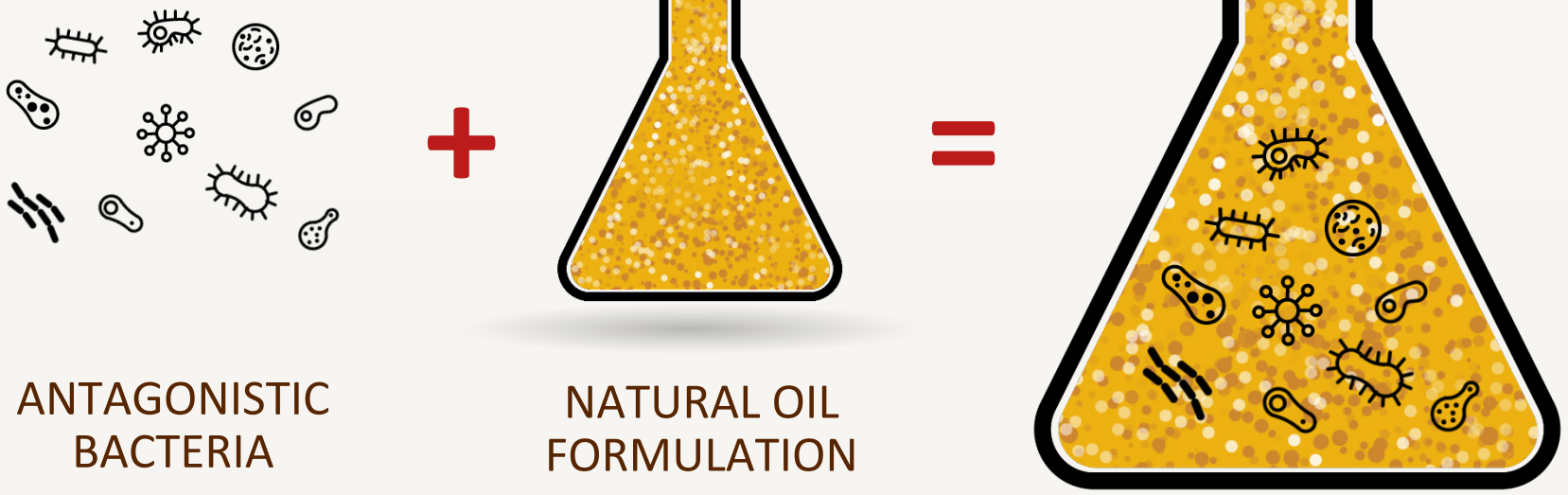
Our Mission:

To develop **BREAKTHROUGH, ENVIRONMENTALLY FRIENDLY** solutions for **BACTERIAL DISEASES** in agriculture.

SCIENTIFIC BACKGROUND

THE BREAKTHROUGH

SYNERGISTIC combination of antagonistic bacteria & natural oils fight bacterial diseases, fungi & nematodes

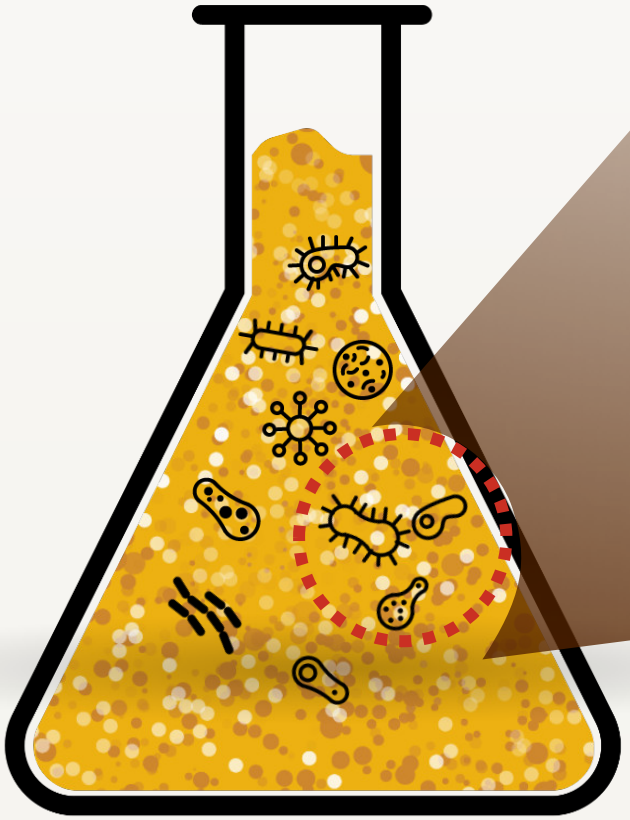


ANTAGONISTIC BACTERIA

NATURAL OIL FORMULATION

EFFECTIVE, ENVIRONMENTALLY FRIENDLY **NATURAL FORMULATION**

BACTERIAL COCKTAIL
delivers clear advantages



Multiple modes of action

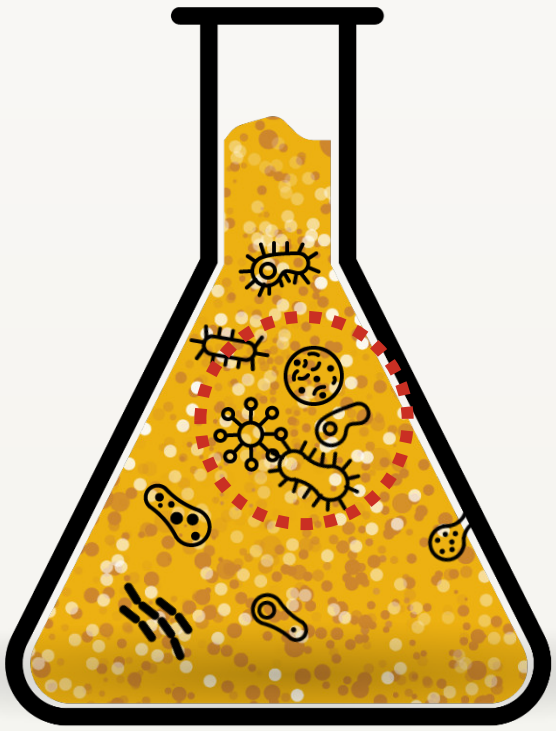
Low probability of resistance

Effective in multiple growing seasons

Consistency in range of soil and climatic conditions

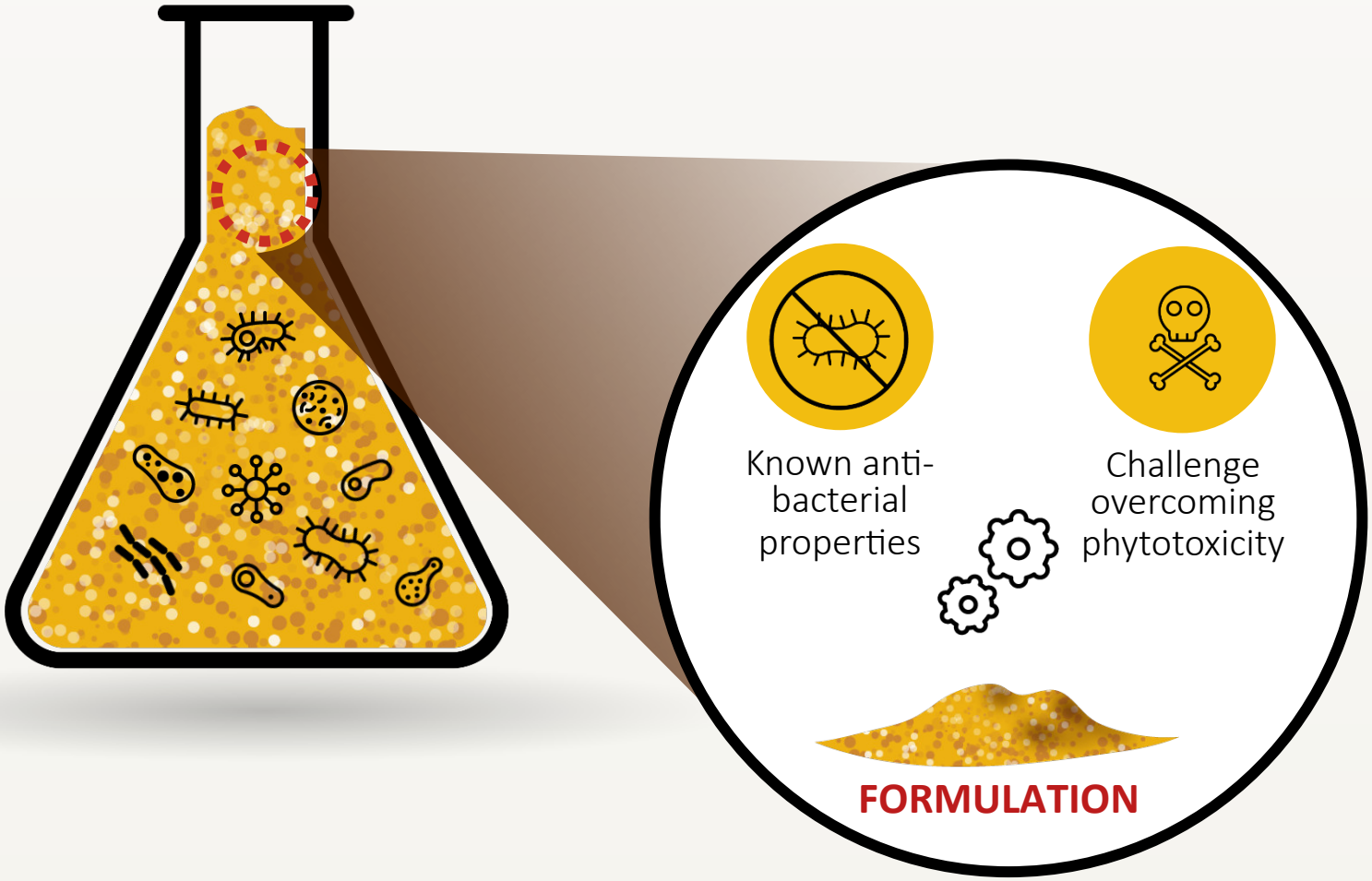
Increased spectrum of uses for product

BACTERIAL COCKTAIL
safe for users and the environment

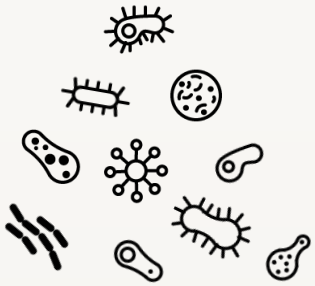


- 10 known and identified bacteria with full DNA mapping and bioinformatics
- Isolated from agricultural fields in Israel
- Classified as non-pathogenic to humans, plants and animals
- No genetic modification
- Stable
- Have limited survivability in the environment
- Toxicology and environmental fate studies show no toxicity, pathogenicity, negative impact

NOBACTRA ESSENTIAL OIL FORMULATION:
kills the pathogen not the plant

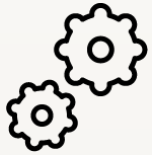


NOBACTRA INNOVATIVE PLATFORM



Nobactra

INNOVATIVE PLATFORM



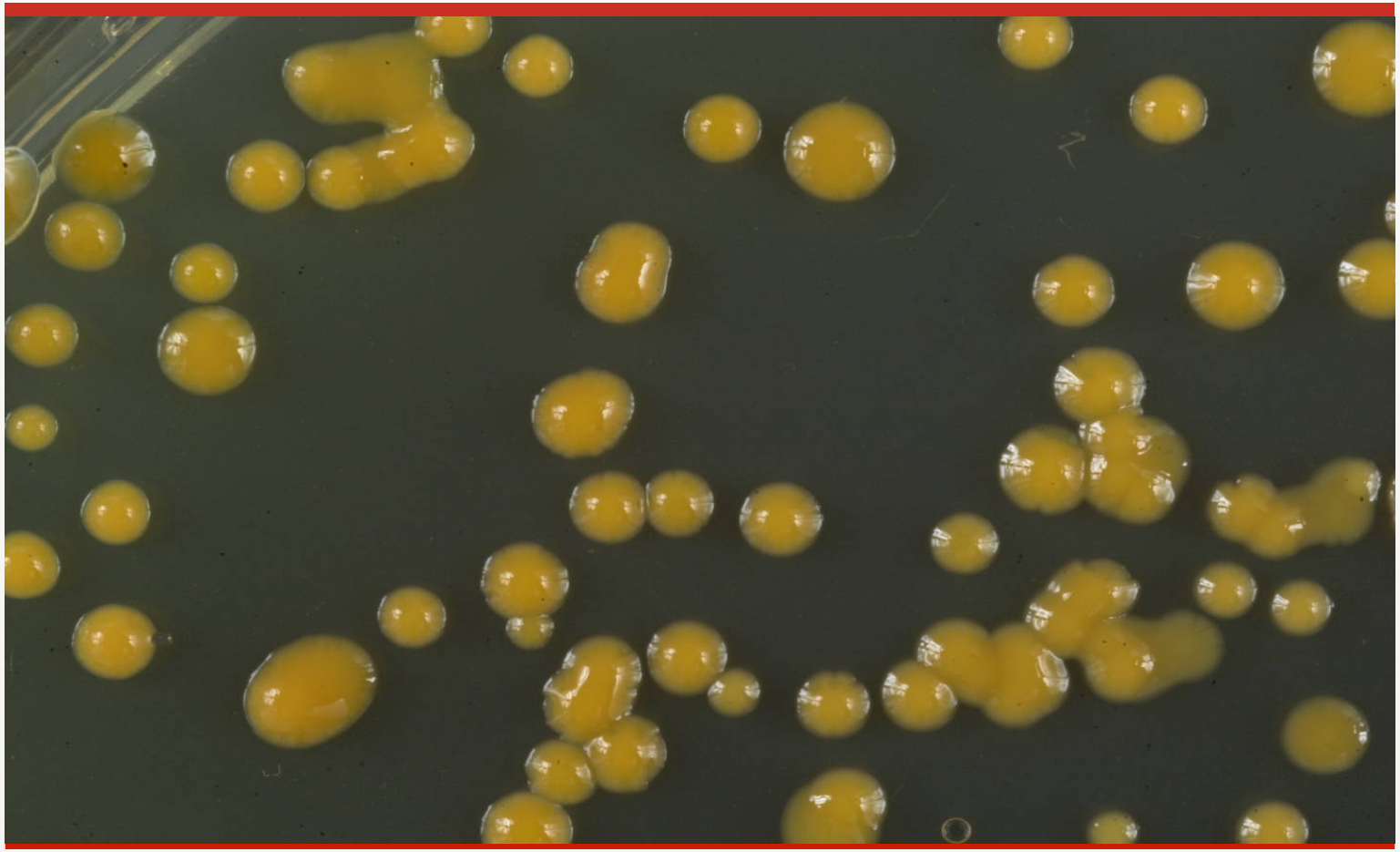
WIDE SPECTRUM OF APPLICATIONS

BACTERIAL CANKER OF TOMATOES: *CLAVIBACTER MICHIGANENSIS*

IDENTIFICATION CARD
CLAVIBACTER MICHIGANENSIS

- Short names – CBM; CMM
- Gram positive bacteria
- Seed transmitted & seed borne
- Soil borne – up to 4 years without the host
- Water borne – survive, transmitted and multiply
- Survive in plants debris as long as they are not composted
- Tomato plant can be infested through soil or upper parts of plants
- Pathogen penetrates plant through natural openings or wounds, roots and transmitted by laborers, water and agricultural tools
- Survive in the rhizosphere of weeds, especially of Solanum family

TYPICAL CMM COLONIES
ON SELECTIVE DIAGNOSTIC MEDIA



CMM IN TOMATO TISSUE

TRANSMISSION OF CMM FROM PLANT INFECTED SYSTEMICALLY

Every morning pathogens are released in water drops that form from the hydatodes at edges of leaf and are transmitted to neighboring plants by workers hands

NOBACTRA TOMATO

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TARGETING A PEST WITH NO EFFECTIVE TREATMENTS

- Currently no existing effective treatment
- Early application at time of planting prevents spread of bacterial canker, preventing epidemics, even if one plant is infected
- Applied when plants are most susceptible to the disease from planting through five weeks
- First treatment through irrigation; additional five treatments standard spray application, one per week over five weeks
- Safe for plants even at double the recommended dosage which is 0.6%; no signs of phytotoxicity even at higher dosage

NOBACTRA EXPERIMENT TO STOP CMM EPIDEMIC IN TOMATO NET HOUSE

Activity	Exp. #1	Exp. #2
Planting	30.07.2015	04.08.215
Irrigation with Nobactra	31.07.2015	05.08.2015
First Spray with Nobactra	04.08.2015	09.08.2015
Inoculation*	13.08.2015	17.08.2015
Tomato Variety	Tory**	Tory
Seedling /1000m^2	2400	2400
Seedling in Experiment	1650	1650
Practice of Growing	Common***	Common

*CMM mix of local pathogenic isolates

**Syngenta

*** Irrigation, Fertilization, pest control(nematodes ,Fungi & insects) and tying branches the commercial practices in growing tomatoes under insect proof net

NOBACTRA EXPERIMENT TO STOP CMM EPIDEMIC IN TOMATO NET HOUSE

YELLOW: CONTROL
GREEN: TEST GROUPS
RED: ARTIFICIALLY INOCULATED PLANTS
ARROW: THE DIRECTION IN WHICH THE DISEASE SPREAD BASED ON WAY WORKERS TREATED PLANTS

NOBACTRA EXPERIMENT: MATERIALS AND METHODS

- Second plant in each row was artificially inoculated with Cmm using the “scissors method”
- A leaf near the stem of each inoculated plant was cut with scissors dipped in mixture of pathogenic bacteria locally isolated
- Inoculated plant serves as source of inoculum for plants in rest of row
- This represents real life phenomena in which infected plants from the nursery reach the greenhouse and are planted
- Once planted workers transfer the pathogen from plant to plant in the row with their hands

PLANT INOCULATION AS PRIMARY SOURCE OF INOCULUM IN GREENHOUSE (SCISSORS METHOD)

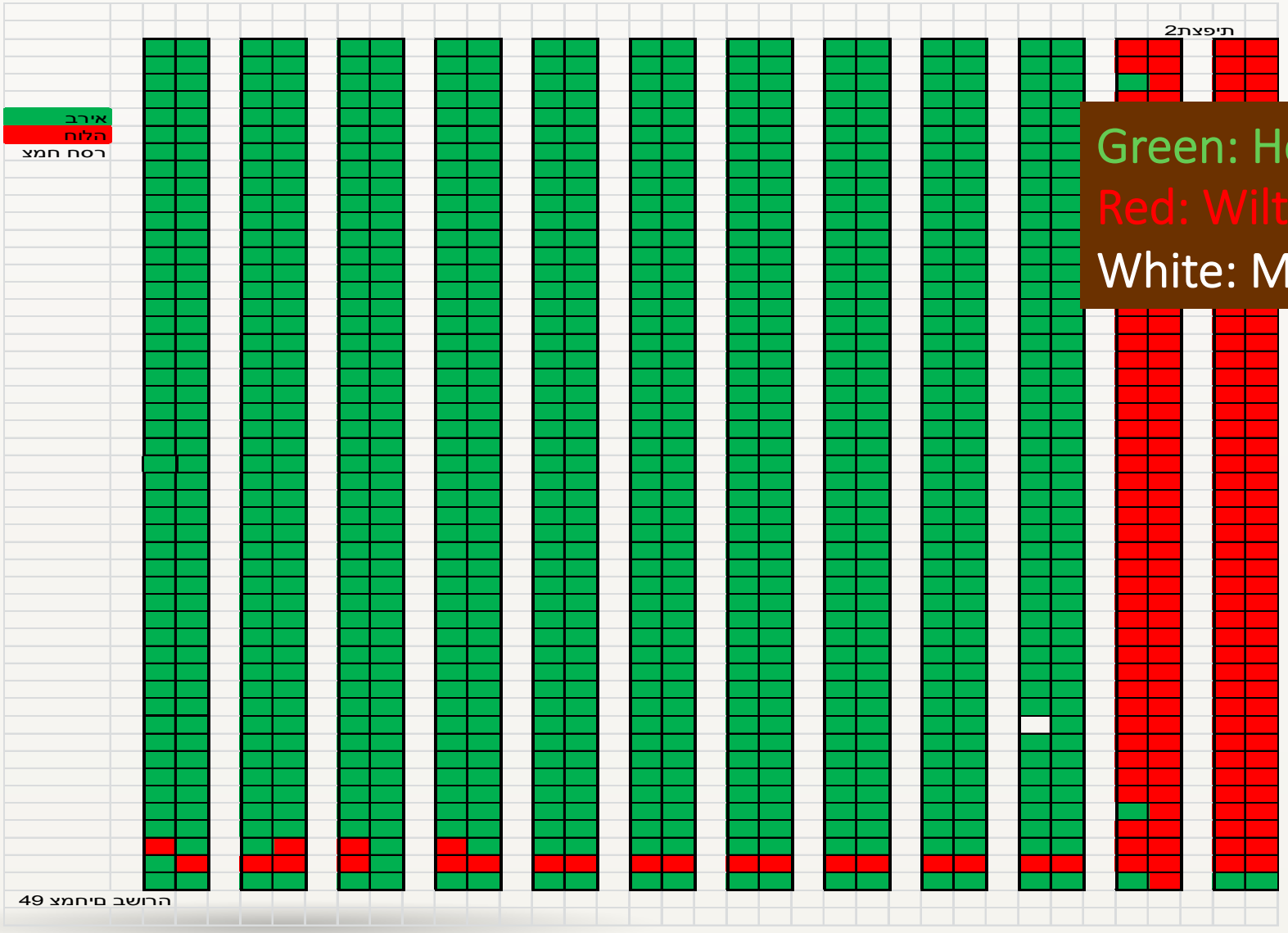
EXPERIMENT CONDUCTED IN QUARANTINE CONDITIONS IN SCREENHOUSE

SPRAY APPLICATION WITH STANDARD GREENHOUSE MACHINERY

NOBACTRA EXPERIMENT #1: CONDITION OF PLANTS ON 15/10/15

Green: Healthy
Red: Wilted
White: Missing

NOBACTRA EXPERIMENT #2: CONDITION OF PLANTS ON 1/11/15



NOBACTRA EXPERIMENT

NOBACTRA EXPERIMENT: UNTREATED CONTROL

NOBACTRA EXPERIMENT: NOBACTRA TOMATO TREATED ON LEFT/ UNTREATED CONTROL ON RIGHT

NOBACTRA EXPERIMENT: UNTREATED CONTROL

Red Arrow: second plant was artificially inoculated and plants in the rest of row were infected by workers hands

Yellow Arrow: First plant not infected because workers touched it with clean hands

NOBACTRA EXPERIMENT: RANDOM INDIVIDUAL PLANTS ALONG ROW THAT DIDN'T RECEIVE INITIAL DRENCH WERE INFECTED BY SOIL

NOBACTRA EXPERIMENT: NOBACTRA TOMATO TREATED

NOBACTRA EXPERIMENT: AVERAGE YIELD SAMPLES FOR 5 REPLICAS OF 20 PLANTS/REPLICA

Trial & Treatment	Number Replicas	Harvest 1 Average Weight/ KG/Replica	Harvest 2 Average Weight/ KG/Replica	Harvest 3 Average Weight/ KG/Replica	Average Weight/ Kg for Plat	% of Control
Control Trial #1	5	421.6	44.2	0	465.8	100
Nobactra Trial #1	5	311.4	502.2	677.3	1490.9	320
Control Trial #2	5	328.2	87.2	0	415.4	100
Nobactra Trial #2	5	362.8	534.6	701.3	2014.1	484.9

NOBACTRA EXPERIMENT: 2013 NEAR DEAD SEA (2ND AND 4TH PLANTS ARTIFICIALLY INOCULATED TWO WEEKS AFTER PLANTING)

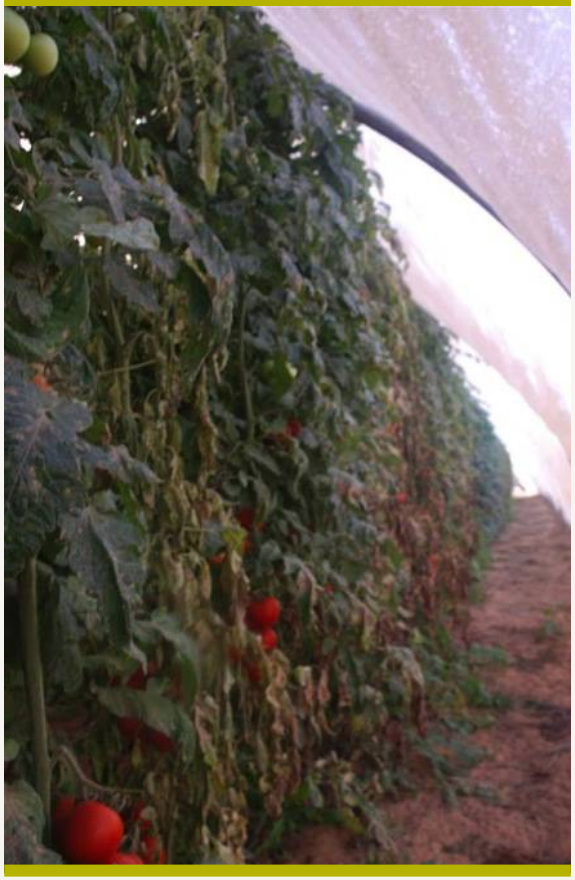
NOBACTRA EXPERIMENT: 2013 NEAR DEAD SEA CONTROL VS NOBACTRA TOMATO

NOBACTRA EXPERIMENT: COMPARISON BETWEEN NOBACTRA AND COPPER COMPOUNDS

- Six replicas in three different screen houses
- Implementation: drench three days after planting and then spray once every seven days for six weeks
- Untreated control
- Standard - treatment with copper compound
- Double dose of Nobactra Tomato at 0.6% active ingredient

Untreated

Copper



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Nobactra's innovative technology controls previously

UNTREATABLE

bacterial diseases

- Nobactra Tomato part of tool box to prevent spread of Cmm
- Five years of field trials show efficacy of solution
- Environmentally friendly, safe and efficient
- in diverse environments
- Avoids resistance through multiple modes of action

"It is too good to be true"

THANK YOU