RESEARCH PROTOCOL: DISEASE & PEST CONTROL, SEED PRODUCTION & BREEDING, 2018
Fusarium control in garlic

Farmer-researcher
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This document outlines the steps that Felicia will follow to execute her research project, *Fusarium control in garlic*, including design, execution, data collection and data sharing. It also serves as a Memorandum of Understanding between Felicia and EFAO.

Experimental Design
Felicia grows an acre of garlic to sell as clean seed (analyzed nematode free), and plans to expand up to 5 acres over the next few years. She is looking to prevent loss to *Fusarium* by testing two methods. Copper sprays work for *Fusarium* control in wheat so Felicia wants to try this in garlic, based on soil tests. She also wants to trial an organic biostimulant, Rhizovital 42.

Predictions
Felicia predicts that copper will provide the best control for *Fusarium* as fungi are highly sensitive to copper. Organic wheat farmers in her area control *Fusarium* in that crop by ensuring there are adequate copper levels in the soil. Felicia also predicts that plots treated with Rhizovital 42 will be less affected by *Fusarium* than control plots. This product supports plant growth and promotes disease resistance.

General management
Felicia planted garlic in late October/early November of 2017. The 1-acre field is made up of 21 raised beds, each 400 ft long. Two rows of garlic are in each raised bed, with each clove spaced 6-8 inches a part. A straw mulch was spread to prevent frost heave and provide some weed control.

On March 1, 2018, Felicia sent four soil tests to Kinsey Ag to determine copper levels in soil and determine how much will need to be added to copper treatments (see Figure 1). For all garlic, Felicia will keep the straw mulch through the season and hoe as needed for additional weed control.

Felicia will mark each plot using stakes colour coded with **blue** for control, **red** for copper, and **green** for RhizoVital®.

Figure 1. Location of the 4 soil samples sent for Cu analysis in March, 2018.

The experiment will be set up as a Randomized Complete Block with 5 blocks, one replicate of each treatment per block. Each treatment would be 7 rows wide (35 ft) and 80 feet long.

Table 1. Treatment and control with application details for treatments, which Felicia will apply with a SPRAY DETAIL.

Treatment	Code	Detail	Rate	Mixing Formula	Spray times	Spray frequency
Copper spray	Cu	Micronutrient spray			As soon as Felicia receives the	

					results of soil tests, ~ mid-April	
Rhizovital	R	Soil inoculant			late April after garlic has emerged	
Control	C	No spray			N/A	

** Felicia will minimize the chance of spray drift by spraying when there is little wind and holding the wand close to the target plants.*

Experimental Layout with double rows per bed and 6-8" between seed. Cu = copper; R = Rhizovital and C = control (no spray); Plot codes = treatment-replicate, example: Cu-3 is replicate three of the copper treatment.

ft	ft	Block	1-7	8-14	15-21
400	80	1	Cu	C	R
	80	2	R	C	Cu
	80	3	C	R	Cu
	80	4	R	Cu	C
	80	5	C	R	Cu

Measurements

1. Testing for level of *Fusarium* infection (OMAFRA), which also includes confirming the garlic is nematode free for biosecurity reasons. Felicia will choose this bulb at random from the second row in each bed before emergence and flag with tape.
2. Ratio of garlic plants not infected with *Fusarium* for each plot with:
    a. Count and record all garlic plants in middle row
    b. Count of garlic plants not affected by *Fusarium* from visual inspection
    c. Ratio = b/c
3. Weigh all garlic plants not infected with *Fusarium* for each plot (fresh weight)
    a. Average weight of sellable garlic = total fresh weight / 2b

Felicia will manually harvest the **middle bed of every plot for measurements** 2 & 3, as follows:

1. Harvest by replicate in case you have to stop mid-way
2. Weigh and label all crates with plot code and tare weight (crate weight empty) (15 total crates); scale is a Rubbermaid Digital Utility Scale (accuracy 0.2 lb or 0.1 kg)
3. Count and record all garlic plants in the middle row (or non-edge row that is representative)
4. Working a plot at time, harvest all plants; sort out any plants with visible signs of *Fusarium* (these plants do not have to be kept separate)
    a. Garlic that is severely affected will be stunted and start to yellow in mid-June.
    b. Garlic that is less severely affected will look fine above ground, but when Felicia looks at the base there will be some rotting at the basal plate.
5. Count all non-infected (“good”) plants and place in a crate, labeled well with the appropriate plot
6. Weigh the fresh weight of garlic in each crate within two days of harvest
    a. (Assuming empty tare weights of all crates are recorded before weighing)
    b. Be sure to weigh all crates at the same time to avoid bias from some drying more than others.

Statistical test

An analysis of variance (ANOVA) for each of the measurements listed above.

Materials and Research Expense Budget. Prices are approximate; NA or in-kind for any materials that you already own or have access to. Please indicate if you intend to give any of the supplies to EFAO’s Tool Library for others to use after you are finished with them.

Material	Quantity	Unit	Total Cost	EFAO’s Tool Library (Y/N)
Rhizovital spray	500	mL	$80	N
Cooper spray			TBA	

Fusarium testing on cloves	15 (1 per plot)	cloves	$800	N
Soil tests	4	samples	$300	N
Weigh labels (large labels with strings)				N
Total			Max $1000	

Deadline for data and and photo submission:

October 31, 2018 or earlier if possible

Acknowledgements

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Memorandum of Understanding

Please refer to **efao.ca/research-mou** for Memorandum of Understanding.

Contact

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