

Investigation of ginseng growth and root rot pathogens (*Cylindrocarpon* sp.) using soil fumigation in ginseng replanted fields

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I . Abstract

Background : This study aimed to develop a control system for ginseng root rot caused by *Ilyonectria* species complex (*Cylindrocarpon* sp.). To effect of soil fumigant on the control of ginseng root rot, growth characteristics and root rot ratio of 2-year-old ginseng was investigated after soil fumigant (dazomet, dimethyl disulfide) or biosolarization in ginseng replanted field.

Methods and Results : Soil fumigation (dazomet or dimethyl disulfide) or biosolarization was performed to control replant injury in soil infected with ginseng root rot pathogens. Soil fumigation (dazomet or dimethyl disulfide) was treated for 4 weeks. And biosolarization was performed by covering the plot with transparent polyethylene film after adding green manure of maize for 4 weeks. Mean maximum temperature at 10 cm depth was 33.5°C and 42.2°C, 13 cm depth was 29.3°C and 32.6°C in the control and biosolarization plots, respectively. The density of *Cylindrocarpon* sp. in soil was significantly decreased on all experimental plot. But it has not been reduced to the density of nematodes in biosolarization plots.

Conclusion : The Soil fumigation was effective in inhibiting ginseng root rot by decreasing the density of root rot pathogen in soil.

II. Material & Method

- Field : 6-years-old ginseng was harvested in 2015 and 2021
- Test : control group –Non (replanted field)
experiment group - Soil fumigation (dazomet or dimethyl disulfide)
- Biosolarization
- Density of *Cylindrocarpon* sp. in soil (Taqman probe Real-time PCR)
- Density of nematodes in soil (Baermann funnel)

Temperature change by soil depth during solar disinfection

- Control**
 - 10 cm : Min. 20.3°C ~ Ma.x 33.5°C (deviation 13.2°C)
 - 30 cm : Min. 21.8°C ~ Max. 29.3°C (7.5°C)
- Biosolarization**
 - 10 cm : Min. 24.1°C ~ Max. 42.2°C (18.1°C)
 - 30 cm : Min. 25.2°C ~ Max. 32.6°C (7.4°C)

III. Results

Effect of pathogen death according to fumigant type and reaction temperature

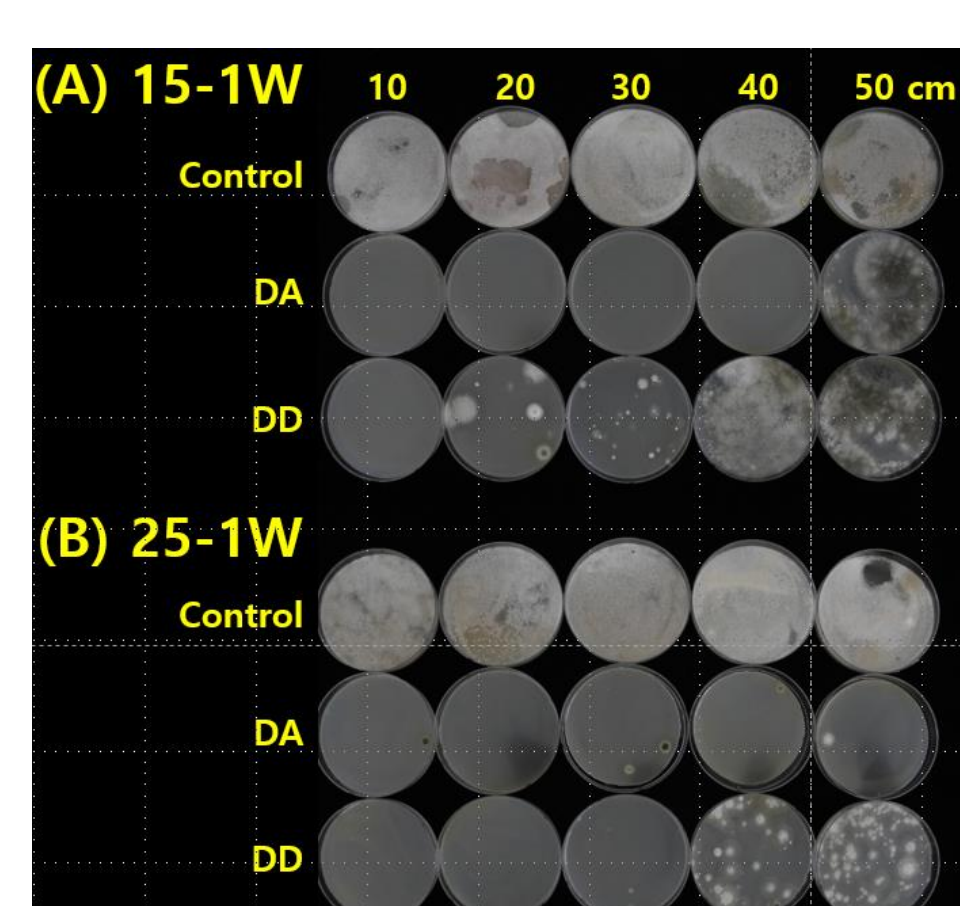
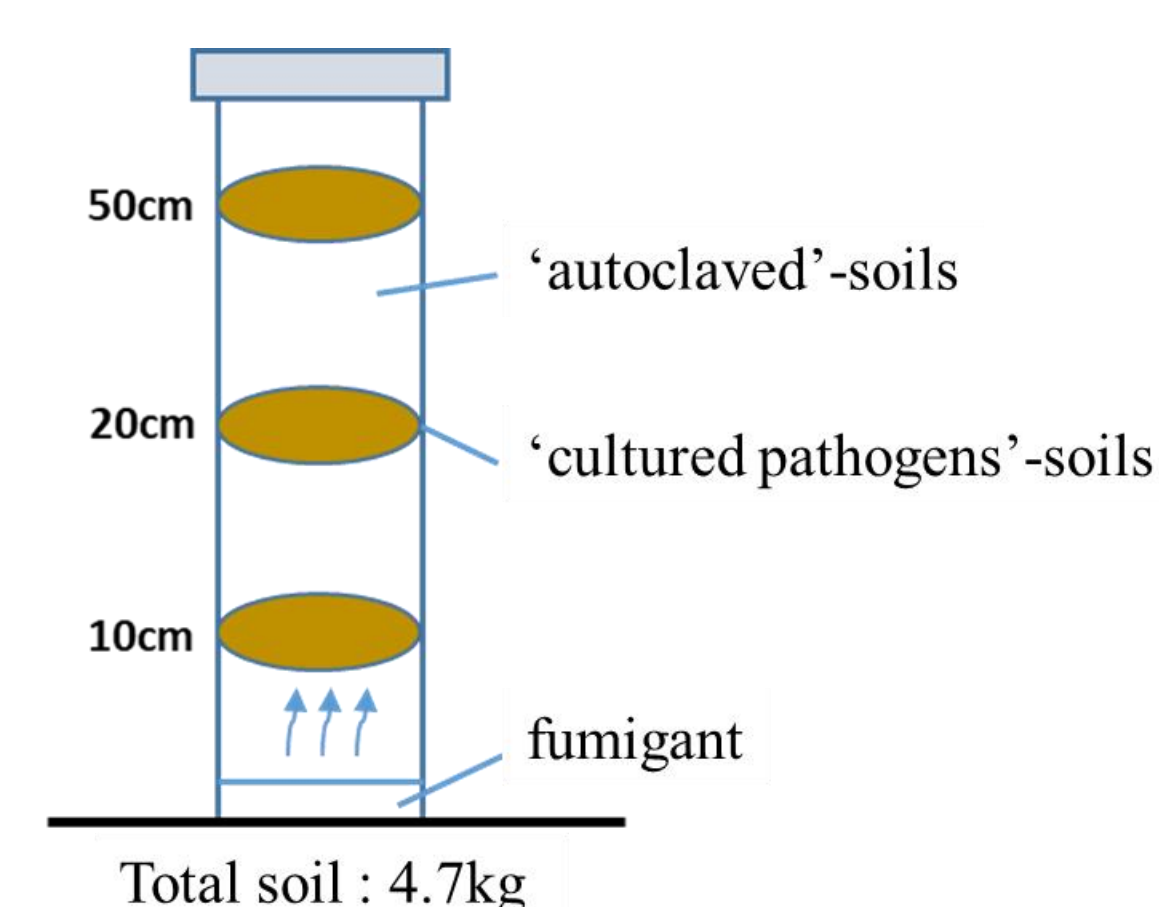


Table 1. Measurement of the No. of pathogens colony according to fumigant treatment period

Temp.	Distance (cm)	No. of colony (cfu/ soil 1g)											
		1 week			2 week			3 week			4 week		
		Con	DA	DD	Con	DA	DD	Con	DA	DD	Con	DA	DD
15 °C	10	4.3E+05	nd	nd	3.3E+05	nd	1.0E+01	2.3E+05	nd	nd	1.9E+05	nd	nd
	20	7.9E+04	nd	5.0E+01	6.1E+05	nd	1.0E+01	2.5E+05	nd	nd	1.7E+05	nd	1.1E+00
	30	2.9E+05	nd	3.1E+02	7.7E+05	nd	2.0E+01	3.4E+05	nd	1.0E+00	2.0E+05	nd	nd
	40	3.2E+05	nd	2.4E+03	5.4E+04	nd	4.0E+01	1.1E+05	1.0E+00	nd	1.5E+05	nd	nd
	50	3.2E+05	8.0E+01	3.4E+03	3.6E+05	nd	4.0E+01	2.3E+05	nd	1.0E+00	1.8E+05	nd	nd
25 °C	10	4.4E+05	nd	nd	2.4E+05	nd	nd	2.1E+05	nd	nd	1.6E+05	nd	nd
	20	1.5E+05	nd	nd	3.8E+05	nd	nd	2.0E+05	nd	nd	1.7E+05	nd	nd
	30	3.7E+05	nd	2.0E+01	5.3E+05	nd	nd	4.2E+05	nd	nd	2.5E+05	nd	nd
	40	2.8E+05	nd	4.5E+02	6.8E+05	2.0E+01	nd	2.2E+05	nd	nd	2.0E+05	nd	nd
	50	3.8E+05	1.0E+01	1.2E+03	3.2E+05	nd	nd	2.0E+05	1.0E+00	nd	1.9E+05	nd	nd

Con : control, DA : dazomet, DD : dimethyl disulfide, nd : not detected

Detection of root-rot pathogens by RT-PCR (Taqman probe)

Test	Density of <i>Cylindrocarpon</i> sp. in soil (Starting Quantity, SQ)		
	disinfection		transplantation
	Before (Jun. '22.)	After (Oct. '22.)	Ginseng (Apr. '23.)
Control	8.2E+01	6.9E+01	2.1E+01
Biosolarization		7.2E+01	1.2E+00
Dazomet		2.2E+01	1.3E+00
Dimethyl disulfide		3.2E+01	3.5E+00

Two-Year-Old Ginseng Grown (May, '23.)

Test	control	Biosolarization	Dazomet	Dimethyl disulfide
Seedling (%)	88.6	88.3	87.8	86.4

IV. Summary

- Changes in density of root rot pathogens according to soil disinfection
 - The rate of pathogen death varies depending on the fumigant treatment temperature, but all died after about 3 weeks.
 - The spread of dazomet was faster than dimethyl disulfide, so the *Cylindrocarpon* sp. died faster.
- After soil disinfection, the density of *Cylindrocarpon* sp. decreased, and plans to continue observation later.

Effect of pathogen death according to fumigant type and reaction temperature



- ❖ Repeated cultivation of ginseng
 - 6-years-old ginseng (2015 and 2021)
 - Management of field (maize, 2022)
 - Biosolarization (7.26. ~ 8.25.)
 - Fumigation (9.16. ~ 10.15.)

