

A-2.2.3 Development of alternative methods to Methyl bromide for controlling soil-borne plant pathogens and nematodes

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Summary

Control effect of several sorts of soil fumigants for ginger plant rhizome corruption disease was examined in order to search for a substitute chemicals of methyl bromide. As a result control effect of alternative fumigants under generating condition that an attack of no process zone seemed to exceed 90 % was not necessary enough when it was compared with methyl bromide.

And that loss in quantity of methyl bromide was possible was shown by use of low penetrativity coating material (Orgaro film).

When effect of soil fumigants in the actual place farm was watched, Kilper liquid medicine treatment was equivalent to methyl bromide .

When control effect of soil fumigants for melon phytophthora lot was watched, each place law of nature of chloropicrin pill, imbedding of CP tape were watched, and the scatter mixture handling of treatment and Kilper liquid medicine was almost equal with methyl bromide.

For melon monosporascus root rot, enough control effect was not provided by the scatter handling of Kilper pill for that control effect of degree with a thing inferior to methyl bromide in chloropicrin or CP tape handling a little could expect you.

In the soil of green pepper mosaic virus (PMMV) infection green pepper cultivation farm, PMMV existed to depth of 30 cm at least, and the quantity of PMMV in the soil was guessed with a decreasing at the condition lower part that cultivation of susceptible varieties was continued, and was not cultivated immediately comparatively.

Soil fumigation by Kilper liquid medicine was not effective in the soil infection of PMMV, and as for fumigation by the state that the resolution of residues of a previous crops was insufficiency, possibility to promote the soil infection was suggested.

The effect of soil sterilization by the hot water injection for to tomato root rot was almost equal with methyl bromide.

When was inferior in effect in the farm that hardened with a case with the hard layer of permeability and a large quantity of carbonated water under mold, hot water injection handling for melon monosporascus root rot was thought about.

Heated water handling and Kilper liquid medicine (the soil surface scatters 10 times dilute solution) were inferior in effect of chloropicrin pill a little highly as a result of having examined methyl bromide substitute medicine for watermelon monosporascus root

rot and control effect of the hot water soil sterilization.

But was inferior to methyl bromide in undiluted solution point note handling of Kilper liquid medicine and sprinkling handling of 100 times dilute solution, but practical control effect was shown.

The influence that heated water handling gave to bacterial globule was examined in order to examine possibility to supplement effect of the hot water soil sterilization for root rot nematode with natural enemy budding bacillus pass two ria fungus.

As a result the influence of hot water to proliferating ability (the highest arrival temperature 65 °C) was bought in surface of the earth lower part 20 cm or less almost.

Root rot nematode control that natural enemy bacillus and hot water handling were put together so that most root rot nematode became extinct in 65 °C is possible.

Control effect was higher as a result of having examined the influence that a difference of hydrothermal temperature and throughput gave to control effect of tomato wilting in the hot water soil sterilization method when rise in temperature quickened by high temperature and a large quantity of heated water handling.

Thermal death condition of the major soil disease-causing germs was examined, and heat resistance was the highest *Fusarium oxysporum* in fungi tested.

When it could be evaded, from this thing, the damage by the other major soil pathogenic mold was thought about by hot water handling along thermal death condition of *Fusarium* fungus.

As for necessary sterilization depth, it became clear to be surface of the earth lower 30 cm so that control did the eggplant *Verticillium* wilt.

Key words soil sterilization with hot water, *Fusarium* fungus, nematode, soil-borne virus, watermelon monosporascus root rot, ginger root rot, tomato *Fusarium* wilt

1. Foreword

There is working for the soil pest of having many kinds such as a virus, a bacillus, filamentous fungus, nematode, and methyl bromide becomes indispensable for maintenance of agriculture production as soil fumigant.

But international genuine quality abolishing use by 2005 years by being ozone layer depletion was agreed.

Therefore development and the use of the soil pest control technology for this medicine become urgent business.

2. The research purpose

The effectiveness such as the hot water soil sterilization method for the major soil pest or other medicines is examined, and substitute technology of methyl bromide for the soil sterilization or control technology by heat-treatment, a medicine and biological technique sold are developed.

3. The rerserch method

1) The handling of several sorts of fumigants for ginger root rot disease was done before plantation of a large ginger plant.

It was coated with polyethylene film or orgalo film in handling right after.

The gas drainage by cultivation was not done.

- The can of methyl bromide reagent was opened after coating.
- 2) Effect of several sorts of fumigants for ginger root rot was examined in the actual place farm that was ginger plant repeated cultivation place.
 - 3) Control effect of several sorts of fumigants for melon epidemic was done with a method same as 1) after melon inoculation 3rd.
 - 4) A melon rooted, and control effect of several sorts of fumigants for melon monosporascus root rot was done with a method same as 1) before 21st.
 - 5) Plant a seedling permanently with a green pepper in a plastic greenhouse, and purification virus of proline methionine methionine valine isolated stock was inoculated after 7th.
The soil was gathered after cultivation according to the stratum, and a virus was extracted by a fixed rule, and indirect ELISA was done after boiling handling.
The examination of control effect for kill soft-headed liquid medicine went using poly pot.
 - 6) Effect of the hot water injection soil sterilization was examined in the actual place tomato house of Haruno-cho, Kochi where tomato root rot appeared in in last year.
Hot water handling examination for melon monosporascus root rot went in the actual place plastic greenhouse where long-existing bad habit appeared in in the last year, too.
 - 7) Methyl bromide substitute medicine and control effect of hot water handling were examined in the farmhouse farm where watermelon monosporascus root rot of Yabuzukahon-machi, Nitta-gun, Gunma appeared in.
The growth situation of the ground upper part was investigated, and become sick after crop end, and it was investigated.
 - 8) By pot examination, the depth other nematode increase appearance after hot water handling was analyzed.
And adhesion to root rot nematode of natural enemy budding bacillus pass two ria fungus and an increase of bacterial globule in the soil inside were examined.
Tomato wilting fungus was inoculated into the soil in.
 - 9) Pipe house, and the influence that hot water handling temperature and a difference of throughput gave to control effect of tomato wilting was examined.
 - 10) Thermal death condition of the major soil disease-causing germs (damping-off fungus, green pepper Verticillium wilt fungus, spinach wilting fungus, tomato brown root rot fungus) was examined on culture medium.

4. Experimental results

- 1) To some extent, in each place law of nature ward of Kilper liquid medicine for ginger plant root rot disease, grade process zone of chloropicrin pill, attack restraint was recognized until to the end during July, but an attack stock increased rapidly afterwards. An attack was recognized in Gastard granule medicine and methyl bromide process zone from the early time, and the condition of a patient development was slow with methyl bromide process zone for increase of an attack stock having stood out afterwards in Gastard process zone.
In particular, in the ward that coated it with Orgaro film in methyl bromide handling, pothopoesis stump rate changed low until the last investigation time .
In an examination in the actual place farm of ginger plant repeated cultivation place, the influence that Kilper liquid medicine handling gave to yield of a ginger plant was

methyl bromide handling and the same class.

- 2) When several sorts of fumigants for melon epidemic was looked at, the scatter admixture handling of each place law of nature of chloropicrin pill, imbedding treatment of CP tape, Kilper liquid medicine was equal to methyl bromide .

But, in the Kilper liquid medicine scatter admixture handling, strong stimulation from the scatter right after to eye and pharynx department considered according to MITC gas was recognized

- 3) Control effect of soil fumigants for melon epidemic was almost equal with methyl bromide with each place law of nature of chloropicrin pill, imbedding treatment of CP tape, the scatter admixture handling of Kilper liquid medicine.

- 4) As for control effect of soil fumigants for melon sunspot root rot, chloropicrin and CP tape were almost equal, but it was compared with methyl bromide both, and was inferior a little:

Control effect was not recognized in the scatter handling of Kilper liquid medicine.

- 5) PMMV amount in soil was detected to depth of 30 cm in either of three spots as a result of having investigated a quantity of existing PMMV according to depth during the soil in green pepper cultivation farm, but it was not detected most in 30 cm .

In the soil of the farm where an attack by PMMV was recognized in investigation already and susceptibility kind cultivation farm, absorbance high comparatively was shown with ELISA.

Resistant varieties were cultivated, and the absorbance of ELISA was low when several a year cultivation of resistance kind was short in the farm where an attack was not recognized.

As for control effect for PMMV of Kilper liquid medicine, a fall of infection stump rate by handling was not recognized, and the tendency that infection stock rate became higher than no process zone was recognized with process zone by reverse.

- 6) It was sterilized to basement 20 cm with hot water, methyl bromide process zone, but, for tomato root rot fungus in the soil, survival was recognized by basement 30 cm .

After cultivation end, root rot and vascular strand browning were not recognized by root investigation to depend even which ward to dig out.

But root browning considered as brown root rot was looked at, and, as for the outbreak degree, heated water injection ward was lower than methyl bromide .

- 7) Because there was the hard layer which liquid was hard to be put through under tilled soil of 30-40 cm deep in the hot water soil sterilization examination that went in the actual place plastic greenhouse for melon monosporascus root rot, heated water overflowed, and appear in a space between the ribs in the injection latter half. And because it was had firm firmly when soil grain dried after hot water injection finely, the attack in a department was not watched in farmhouse custom ward (methyl bromide 30 kg /10 a handling) in a melon place, but an attack of a few things was recognized when it was compared with methyl bromide 20 kg /10 a handling of contrast in heated water process zone.

- 8) When depth distinction temperature variation by hot water handling in watermelon monosporascus root rot attack farm was looked at, the best arrival temperature was watched at depth of 30-40 cm how many a spot of 40 °C or less was.

Chloropicrin pill was the highest, and hot water process zone was inferior to methyl bromide of contrast in control effect for watermelon monosporascus root rot .

And the point note ward of Kilper liquid medicine (40L/10 a), the effect of sprinkling ward (6,000L/10 a) were bought an amount of comparatively.

- 9) When effect of the hot water soil sterilization for root rot nematode (hot water handling of 85 °C) was watched, temperature of 40 °C or more continued it by 5 cm layer for four hours, but 15 cm or less layer did not reach 40 °C.

In comparison of the second larva number between handling on handling 5th, control effect to nematodes of 85 °C heated water extended to 20 cm layer, but was ineffective in 30 cm layer, and more rather than contrast ward there was many it at the depths of 40 cm or less .

Nematode harm depression effect was recognized by hot water process zone, but it was not possible for the comparison between handling of eelworm increase because the tomato which did dissemination in contrast ward and hot water process zone withered after each handling by on 33rd and 92nd.

In natural enemy bacterial globule of hot water handling right after, the difference was not recognized between handling on attachment rate / adhesion number for the second larva.

But attachment rate / adhesion number of a spore was lower in intentionality than other wards in a ward of surface of the earth lower part 5 cm after 1,2 product did a tomato and 10 cm.

- 10) In the hot water soil examination for tomato wilting, depth distinction temperature of the soil asked the duration of the highest temperature, 55 °C or more, 50 °C or more and 45 °C or more a big value with hydrothermal temperature and throughput increasing.

But, in 95 °C that temperature rose best, 100L / m² ward, the the highest temperature of 20 cm did not reach 50 °C either.

As for control effect of tomato wilting, an attack suddenly rose after an eye with no process zone for permanent planting 57 days, but delay effect of attack was recognized with each heated water process zone for this both.

- 11) In 50 °C that were the temperature that the soil of the shallow stratum could arrive at than 30 cm from the surface of the earth, the fungus except phenylalanine .oxysporum became extinct in during for two or three hours, but, as for the fungus, even handling of 3.5 time did not become extinct.

As for proline .lycopersici, as for arginine .solani, valine .dahliae became extinct by handling on 8th in 40 °C on 3rd for 30 hours.

Sensitivity was the highest in Fusarium lycopersici in the disease-causing germs and subsequently heat resistance of Fusarium oxysporum was most high heat-sensitivity in valine .

5. Consideration

- 1) When control effect of methyl bromide substitute pesticide was insufficiency in severe disease occurrence, for ginger plant root rot, it was thought.

The scatter handling of Kilper liquid medicine was effective, but it was thought about a worker and influence to the outskirts more because MITC of high density was detected with grade from the scatter right after when examination was need.

- 2) When weeding effect could expect you highly, too, for melon epidemic, control effect of chloropicrin pill, CP tape, Kilper liquid medicine was thought about.

But the scatter admixture handling of Kilper liquid medicine includes a problem as a foregoing paragraph.

- 3) When pollution degree of the soil could be grasped quantitatively, it was thought about green pepper mosaic disease (PMMV) by indirect ELISA which built in boiling handling.

When PMMV existed to depth of 30 cm at least in the soil of PMMV infection green pepper cultivation farm, it was thought, and, in the condition that susceptibility kind was continued, and was not cultivated, the quantity of PMMV in the soil was estimated with a decreasing immediately comparatively.

Soil fumigation by Kilper liquid medicine was not effective in the soil infection of PMMV, and, as for fumigation by the state that the resolution of crop residues of a previous work was insufficiency, possibility to promote the soil infection was suggested.

- 4) The effect of the hot water soil injection sterilization for tomato root rot was almost thought about with the same class with methyl bromide.

When seemed to be case with hard permeability layer and heated water injection, and it was hard to be utilized under comparing unfavorably and tilled soil in custom handling of methyl bromide of a thing recognized (30 kg /10 a) in the farm that hardened with a large quantity of carbonated water, as for hot water handling for melon monosporascus root rot, the effect of certain amount was thought about.

- 5) An attack was a slight farm comparatively, and it was thought that effect of chloropicrin pill was high in control of watermelon monosporascus root rot.

It was effective with hot water handling, kill soft-headed liquid medicine, but the effect was thought about when was inferior a little when it was compared with chloropicrin pill, methyl bromide.

It was estimated that humidity of 20 cm did not rise as the cause that control effect of hot water handling was low fully.

- 6) Eelworm density of deep part was maintained long time as a result of having examined the depth other nematode increase appearance after hot water handling || folded it, and in particular, in case of heated water handling, prevention countermeasures of deep part eelworm was thought about with being essential.

Because one which becomes extinct, proliferating ability of natural enemy bacillus are not lost as for most root rot nematode in hot water of 65 °C, temperature setting to be appropriate in the control which put natural enemy bacillus and heated water sterilization together is need.

- 7) In the hot water soil sterilization for tomato wilting, that control effect was high was shown by a large quantity of heated water handling than a high temperature beat you more when rise in temperature quickened.

Fusarium oxysporum was thought about in the fungi tested as a result of having examined thermal death condition of the major soil disease-causing germs when heat resistance was the highest.

From this thing, a difference of habitation depth in the soil needed to be taken into account, but the blight by the other being essential soil disease-causing germs was thought about by hot water handling along thermal death condition of Fusarium fungus when it could be evaded.

6. Conclusion

- 1) For ginger plant rhizome corruption disease, tomato root rot, melon epidemic, watermelon monosporascus root rot, Kilper liquid medicine, chloropicrin pill show methyl bromide and effect to be almost equal, and these are useful as a substitute medicine.
- 2) The hot water soil sterilization method was effective for tomato root rot, tomato wilting, the eggplant Verticillium wilt, crops parasitic eelworm, but it was compared with a substitute medicine for melon and watermelon monosporascus root rot, and the case that effect was low was watched.
- 3) The hot water soil sterilization method is effective for TMV, but effect is low for a green pepper and viral disease of Capsicum annum, and there is for the present not removal method for methyl bromide.

7. The situation of study announcement

1) Hiroshi Sakai, Toshimasa Shiraishi, Hiroshi Hagiwara, Toshiaki Takehara, Takato Nakayama, Hsuo Saito, Toshihiko Urushihara, Masaru Tadenuma: The prevention of the breeding and extermination by the hot water processing and several medicine against water melon monosporascus root rot. The Kanto-Tosan Plant Protection Society 45:77-79, 1998.

8. Quotation literature

Nothing