Effects of eggplant rootstocks on root-knot nematode(*Meloidogyne arenaria*, race 2)

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Key words: eggplant, *Meloidogyne arenaria*, rootstock, root-knot nematode

Abstract

Root-knot nematodes cause a significant damage on fruit yield and quality of green house growing crops. To asses the effect of eggplant rootstock, Torvum vigor', 'TaibyouVF' and 'Daitaro' were grafted on eggplants(Solanum melongena cv. Chookyang) and planted in root-knot nematode infested microplot in green house and compared their fruit yield, quality and plant growth with non-grafted control. Eggplant grafted with Torvum vigor had the highest fruit yield and top growth and followed by Daitaro. Non-grafted eggplant had lower yield but had higher root weight because of heavy root-knot nematode infection. Rootstock grafting in eggplant farming is a good alternative technique in root-knot nematode infested green houses without compromising fruit yield and can be applied instantly as organic farming practice.

Introduction

Eggplant (*Solanum melongena*) is one of main cash crops in S. Korea, as it grows in 1,000ha and annual production is more than 47,000 M/T.

Root-knot nematodes occur many green houses in southern part of Korea and among them, *M. arenaria* is a dominant species, occur in 62% of areas and followed by *M. incognita*(Cho *et. al.* 2000). In green house condition, root-knot nematodes reproduce several times and cause a significant damage to vegetable crops such as eggplant.

The influence of root-knot nematode on yield reduction and fruit quality deterioration are well studied in oriental melon (Kim, 2001a, 2001b), but in eggplant, the magnitude of damage caused by root-knot nematode was not fully studied.

Several diseases occur in eggplant, especially bacterial wilt (*Ralstonia solanacearum*) and damping off (*Pythium, Phytophtora* and *Rhizoctonia*). Some eggplant farmers are recently practicing rootstock grafting technique to minimize disease infection and promote plant growth, but the effect of rootstock grafting for the control of root-knot nematode is not described well.

So, this research reports the effect of three rootstocks in root-knot nematode infested soil in a green house.

Materials and methods

Thirty days old eggplant seedling, *Solanum melongena cv. Chookyang*, was grafted on each of three rootstock varieties: 'Torvum vigor' (*Solanum torvum, Takii & Company, Japan*), 'TaibyouVF' (*Solanum spp.*) and 'Daitaro'(*Solanum melongena.,*

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Takii & Company, Japan). After 14 days of curing period, grafted plants were transplanted to microplot. Forty days old non-grafted seedling *cv. Chookyang* was transplanted at the same day as a control.

Microplots, sized 30×60×20cm (W×L×H), were filled with root-knot nematode infested soil. Initial population density of root-knot nematode in each microplot was adjusted to 10 juveniles per $100cm^3$ of soil. Root-knot nematode, *Meloidogyne arenaria* (race 2), infested soils were collected from oriental melon grown green house and population density of second-stage juvenile(J2) counted by the method of Barker(1985). To estimate the multiplication of root-knot nematode, soil temperature was measured by Onset HOBO series (USA, MA) and degree days temperature was calculated based on 5℃(DD_5).

Fruits were harvested, counted and weighed for every 2 days during the harvesting season (June to October, 2008) and plant top part and root growth was measured at the end of the season.

Plots were completely randomized with 5 replicates for each treatment. Statistical analysis was performed by the Duncan's Multiple Range Test (p=0.05, SAS inst. USA).

Results

Soil temperature ranged between 20-30℃ during the experiment and degree days calculated ca. 1,800DD_5(Figure 1). Based on degree days, root-knot nematode could multiplied at least 3 generations(Roberts, *et. al.* 1981) which should each enough nematode population density to evaluate the effect of rootstock grafting on eggplant. Population of J2 nematodes were reached to 1,000 in $100cm^3$ of soil in non-grafted eggplant microplot at the end of the experiment.

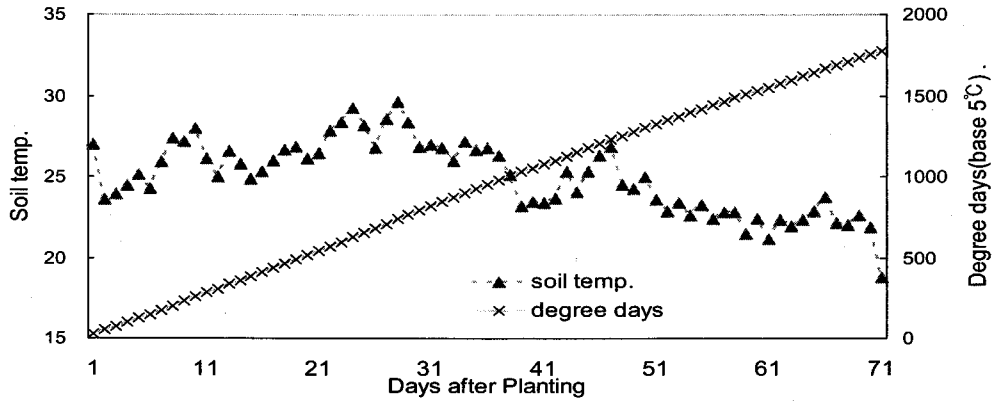

Figure 1: Soil temperature at 10cm depth and degree-days(DD_5) during the experiment(June-Oct. 2008)

All three rootstock grafted eggplant yield more than non-grafted eggplant and *Torvum vigor* grafted eggplant produced the highest yield (Table 1). There was no statistical differents among rootstock varieties(P=0.05). The result shows that rootstock grafting is a good practice to prevent yield loss in root-knot nematode infested soil.

Tab. 1 : Comparison of fruit yield between non-grafted and rootstock grafted eggplant *cv. Chookyang* in *Meloidogyne arenaria* infested soil.

Rootstock	Yield per plant(gram)	Yield per 10a(kg)	Yield index
non-grafted	3,923b*	3,629b*	100
Torvum vigor	6,778a	6,277a	173
TaibyouVF	5,936a	5,490a	151
Daitaro	6,175a	5,712a	157

*Values followed by the same letters are not significantly different at *P=0.05* by Duncan's multiple range test.

Tab. 2 : Comparison of plant growth between rootstock non-grafted and grafted eggplant *cv. Chookyang* in *Meloidogyne arenaria* infested soil.

Rootstock	Fresh wt.(gram)		T/R ratio**	Stem diameter (mm)
	Top	Root		
non-grafted	922b*	207a*	4.4	20a*
Torvum vigor	2,105a	90b	23.4	26a
TaibyouVF	1,718a	131b	13.1	23a
Daitaro	1,891a	124b	15.2	22a

*Values followed by the same letters are not significantly different at *P=0.05* by Duncan's multiple range test

**T/R ratio: weight of top plant/weight of root

Growths were significantly different between grafted and non-grafted eggplant. In case of non-grafted eggplant, fresh weight of top part was light but root weight was heavy compared to rootstock grafted eggplant (Table 2). So, T/R ratio was 3.0-5.3 times higher in grafted eggplant and lower in non-grafted eggplant. It means that in case of non-grafted plant, the root system is severely infected with root-knot nematode, thus heavily galled, so weighted more. As a result, growth of top part of plant was suppressed. Because galled roots were heavier than non-infected root, difference in T/R ratio clearly indicate the magnitude of root-knot nematode infection in eggplant. Eventually the poor growth of top part resulted lower fruit yield. There were significantly less number of egg mass in hairy root in rootstock varieties (data not shown). There were no differences in stem diameter between treatments.

Tab. 3 : Comparison of fruit quality and yield between rootstock non-grafted and grafted eggplant *cv. Chookyang* in root-knot nematode infested soil.

Rootstock	Yield (kg per plant)			Marketable yield per 10a(kg)	Rate of unmarketable fruit(%)
	Early**	Mid	Late		
non-grafted	1.2	1.5	1.2	2,718b*	25a*
Torvum vigor	1.3	3.2	2.2	5,398a	14b
TaibyouVF	1.5	2.8	1.6	4,501a	18b
Daitaro	1.1	2.9	2.1	4,227ab	26a

*Values followed by the same letters are not significantly different at *P=0.05* by Duncan's multiple range test

**early: June 20-July 31, mid: Aug. 01-Sep.10, late: Sep.11-Oct.20.

Non-grafted eggplant had about two times more unmarketable fruits than grafted eggplant(Table 3). In early harvesting period, fruit yield were similar among treatments. But in mid and late season, non-grafted eggplant produced markedly lower fruit yield than grafted eggplant, it as interpreted as that population density of root-knot nematode increased during the period and inhibited the development of root system.

Discussion

In Korea, most of eggplants are produced in green house condition and crop rotation is difficult because of limited land space. For farmers, root-knot nematode is a big problem because crops are continuously cultivated in green house year around. In most of the case, farmers couldn't have enough time for practicing nematode control such as water drench, crop rotation or fumigation. For organic farming, nematicides and fumigants are not allowed, so another kind of definite method is demanded. Grafting may require additional cost and time, but when farmers choose a suitable rootstock for their eggplant cultivar, grafting can be a useful technique to practice organic farming especially in root-knot nematode infested soil.

Conclusions

From this research we have evaluate the effect of rootstock grafting in root-knot nematode infested soil. In addition to the advantage of resistance to several diseases, rootstock grafted eggplant produced good yield and provide satisfactory protection from root-knot nematode. Therefore, we can propose that *Torvum vigor* rootstock grafting is recommendable for organic eggplant farming in root-knot nematode infested green house condition without use of chemicals.

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