THE IMPACT OF GREEN MANURE CROPS GROWING IN SUGARBEET ROTATION ON SUGARBEET CYST NEMATODE AND SUGARBEET YIELDS

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At least 29 species of plant parasitic nematodes within 16 genera can affect sugarbeet production. The overall sugarbeet yield losses attributed to nematodes is estimated to be in the range of 10-70%. The sugarbeet cyst nematode *Heterodera schachtii* account for most of the loss. Nematologists and plant pathologists agree that nematode are the major pest affecting sugarbeet production everywhere beets are grown commercially. The most common practices for sugarbeet nematode management is the use of nematicides (chemical control) at a cost of $100 to $300 per acre. The future availability of the most commonly used nematicides is uncertain because of health and environmental concern. These have come under attack by several environmental groups. Also there is a great public concern over the toxic hazards of these materials. Therefore, research emphasis needs to be directed towards developing environmentally safe alternative methods for sugarbeet nematode management.

A promising approach is the use of trap crops; plants that allow penetration yet are poor hosts for the nematode. Various plants with potential as trap crops have been shown to stimulate hatch, including sugarbeet (*Beta vulgaris*), oilseed radish (*Raphanus sativus* var. *oleifera*), white mustard (*Sinapis alba*), and buckwheat (*Fagopyrum esculentum*). Nematode-resistant cruciferous crops, particularly oilseed radish, may be useful as crop rotations that reduce *H. schachtii* populations. Cultivars of oilseed radish, white mustard, and buckwheat that stimulate hatch and depress *H. schachtii* reproduction have been developed in Europe. The research presented here was conducted to assess the usefulness of these cultivars for *H. schachtii* management in sugarbeet production.

I. THE EFFECT OF OIL RADISH AND MUSTARD VARIETIES FALL PLANTED IN INFESTED FIELD ON SUGARBEET CYST NEMATODE *Heterodera schachtii* POPULATION.

Seven varieties of oil radish (*Raphanus sativus* var. *oleifera*) and white mustard (*Sinapis alba*) were planted following wheat in sugarbeet cyst nematode infested field in the fall of 1992 in Parma, Idaho. Each variety was replicated four times in a complete randomized block design and a fallow treatment was included as a control check for comparison. All varieties were mechanically chopped three months after planting. Roots and forages were incorporated in the soil by double disking. Soil samples before planting in the fall and in the following spring were collected for nematode assay. Results of nematode assay indicated that all varieties reduced the total number of eggs and larvae significantly (Table 1). Oil radish (Adagio var.) causes the highest % of reduction in comparison to fallow (51%). White mustard (Martigena var.) causes the lowest % of reduction (21%). The same test was repeated in the fall of 1993 at the same location to confirm results obtained in 1992-1993.

II. THE EFFECT OF DIFFERENT OIL RADISH AND MUSTARD VARIETIES FALL PLANTED ON SUGARBEET ROOT YIELDS PLANTED IN THE FOLLOWING SEASON IN HEAVILY INFESTED FIELD.

Sugarbeet variety HM-WS-90 was planted following the oil radish and white mustard to evaluate their effect on sugarbeet yield. No nematicides were added to this field and standard insecticides for maggot control were applied at planting. Results showed that most oil radish and mustard varieties increased the sugarbeet yield significantly in comparison with the fallow treatment (Table 2).

III. THE EFFECT OF DIFFERENT OIL RADISH AND MUSTARD VARIETIES ON SOIL NUTRIENT LEVELS.

Incorporating root and forage of the green manure crops will add substantial amount of humus which will enhance soil biological activity. Also, added humus substances to soil will enhance the activity of beneficial organisms and these will enhance soil fertility. Soil analysis before planting the green manure crops and after its incorporation showed significant improvement in soil fertility levels as shown in Tables 3 and 4.

The other secondary benefit observed in the green manure plots was that the weed population was reduced significantly where oil radish and white mustard were growing.

Table 1. The effect of different oil radish and mustard varieties planted in the fall on sugarbeet cyst nematode Heterodera schachtii population. Parma, 1992-93.

Oil Radish or	Viable Cyst		Total Eggs & Larvae		%
Mustard Var.	8/6/92	4/20/93	8/6/92	4/20/93**	Reduction
Adagio Radish	16.8	3.0	2,167	171	92
Ultimo Radish	15.3	4.5	2,010	225	89
Remonta Radish	9.0	2.5	936	110	88
Pegletta Radish	11.5	2.5	1,484	193	87
Metex Mustard	12.5	3.0	1,288	201	84
Maxi Mustard	8.5	2.8	1,139	235	79
Martigena Mustard	11.5	8.0	1,806	688	62
Fallow control	6.8	5.5	1,149	679	41

*Average of 4 replications
**8/6/92 = Before planting the green manure crops.
4/20/93 = Before planting sugarbeets.

Table 2. The effect of different oil radish and mustard varieties planted in the fall on sugarbeet yield planted in the following season. Parma, 1993.

Oil Radish or mustard var.	Sugarbeet Root yield T/A	Sugarbeet yield increase T/A	% of sugar
Radish Adagio	31.4 a*	9.3	17.01
Mustard Metex	29.1 a	7.0	17.20
Radish Pegletta	28.6 a	6.5	16.91
Radish Ultimo	28.2 a	6.1	16.45
Mustard Maxi	28.1 a	6.0	16.80
Radish Remonta	27.6 a	5.5	17.35
Mustard Martigena	25.9 b	3.8	17.13
Fallow control	22.1 b	--	17.37

*Average of 4 replications.
Means followed by the same letter are not significanlty different.

Table 3. The effect of different oil radish and mustard varieties on soil nutrient levels (ppm - N, P, K, Ca).

Variety (crop)	Nitrate NO3 - N		Phosphorus P		Potassium K		Calcium Ca	
	Before	After	Before	After	Before	After	Before	After
R. Adagio	21	19	19	11	197	272	3590	5160
R. Pegletta	23	23	18	22	249	290	4506	2522
M. Metex	17	23	19	21	231	268	3978	5260
M. Maxi	22	22	18	13	176	295	3590	5541
R. Remonta	19	21	15	21	199	241	3872	5475
M. Martigena	31	21	14	13	220	274	3626	5240
R. Ultim	22	28	23	19	248	275	3661	5860
No Plant	23	19	23	19	195	288	3238	5430

Table 4. The effect of different oil radish and mustard varieties on soil nutrient levels (ppm - Na, Zn, Fe, and pH, % lime).

Variety	Sodium Na		Zinc Zn		Iron Fe		pH		% Lime	
	Before	After	Before	After	Before	After	Before	After	Before	After
R. Adagio	294	118	0.6	1.0	75.0	9.8	8.2	7.9	7.5	8.0
R. Pegletta	355	99	0.7	0.9	60.0	9.4	8.4	8.0	9.5	7.0
M. Metex	364	114	0.8	0.9	15.0	9.8	8.4	8.2	7.5	5.0
M. Maxi	274	127	0.9	1.0	15.0	10.8	8.3	8.1	10.0	5.0
R. Remonta	289	101	0.6	0.9	30.0	9.4	8.4	8.2	8.5	6.0
M. Martigena	348	116	0.6	1.0	45.0	9.4	8.3	8.1	12.0	6.0
R. Ultim	369	108	0.6	1.0	15.0	10.1	8.4	8.0	8.5	7.0
No Plant	299	96	0.7	0.9	15.0	10.1	8.5	7.9	12.0	6.0