NON CHEMICAL ALTERNATIVES FOR SUGAR BEET CYST NEMATODE MANAGEMENT IN IDAHO

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Nematodes are one of the major limiting factors for sugar beet production in Idaho. Sugarbeet cyst nematode (SBCN), *Heterodera schachtii*, is one of the most serious pests for the sugarbeet industry in Idaho, as well as other world-wide production regions. Nematode infestation results in yield decline and reduction in quality thereby contributing economic loss to the industry. Yield loss can be substantial in heavily infested fields; and in warmer growing regions, damage can be exacerbated by secondary pathogens. Management practices include a combination of chemical and cultural practices to maintain nematode populations below economic threshold level there by reduce yield loss and quality damage. Management of SBCN can be enhanced by using nematode resistant trap crops. One approach in using trap crops is to use resistant hosts, such as SBCN-resistant varieties of oil radish (*Raphanus sativus*) and mustard (*Sinapis alba*), to stimulate nematode egg hatch. Resistant varieties of oil radish and white and yellow mustard were first developed in Germany and the concept of using resistant varieties of host plants as green manure trap crops to manage SBCN has been adapted for many sugarbeet growing regions in the United States. However, several factors may influence the effectiveness of green manures against SBCN.

The environment plays an important role in the nematode life cycles and economic threshold levels, onset and severity of nematode infestations, and in determining which green manure trap crops can be grown effectively. Not only do these factors differ on a large scale, but also they can vary within states. For example, due to temperature differences among regions in Idaho, economic threshold levels for SBCN vary within Idaho. The SBCN economic threshold level in south-western Idaho is 2 eggs and larvae per cubic centimetre (cc) soil, while in south-central Idaho, the economic threshold is 3 eggs and larvae per cc soil. Idaho has a relatively short growing season, and green manures require 8 to 10 weeks

growth for maximum effectiveness. Growing a green manure for one season without a main crop is not economically feasible for most growers in Idaho. Consequently, a cropping system that does not include early-maturing crops such as grain or early potato is incompatible with use of fall-planted green manure. Spring-planted green manure in Idaho would be compatible only with cropping systems that include main crops such as corn and bean that are planted in late May or early June. Other factors that influence efficacy of green manure trap crops in Idaho include planting time (mid to late summer, early spring), particularly if a main crop is grown in addition to the trap crop, and the amount of nitrogen applied to the trap crop. Application of nitrogen to green manure trap crops may be critical to aid in the decomposition of previous crop residue and to encourage a dense stand of green manure crop (to inhibit weeds). However, there is potential to over-fertilise the trap crop, causing unnecessary additional cost and potentially reducing sugar yield of the subsequent sugarbeet crop. Evaluating green manure varieties for use against SBCN is important for growers in Idaho, particularly due to the short growing season, current cropping systems, and the variable economic feasibility of growing green manure trap crops. These potential differences necessitate research on oil radish and white mustard trap crops specifically for Idaho.

A series of experiments were conducted for three years to study the efficacy of green manure crops for management of sugarbeet cyst nematode, *Heterodera schachtii,* under field conditions. In all experiments, oil radish and white mustard cultivars were seeded at the rate of 25 lb/acre in fall and incorporated twelve weeks later as the field was prepared for sugarbeet. In the first year, mustard ‘Concerta’ produced 35% more above ground biomass than radish ‘Colonel’ and the viable cysts declined 29% and 19% in oil radish and mustard treatments, respectively. Planting of oil radish and mustard produced significantly more beet yield and sugar per acre than the untreated check (table 1). In the second year, radish ‘Adagio’ produced significantly more above ground biomass than mustard ‘Metex’. Sugar beet yield from the green manure planted plot was significantly higher than the fallow plot. Planting of Adagio as a previous crop gave more beet yield than ‘Metex’ (Table 2). In the third year, biomass (top, root and total) production of oilradish ‘Dacapo’ was significantly higher than mustard ‘Metex’. A significant increase in sugar beet yield has been recorded following of oilradish and mustard, compared to

fallow. Economic analysis of this non chemical management for the period of several years indicated that for every dollar invested in the program, net benefit to the Idaho agricultural industry is estimated to exceed $52.

Table 1. Viable cyst count of sugarbeet cyst nematode prior to planting of trap crop (Aug 97), at incorporation of trap crop (Oct 97), prior to sugarbeet planting (Mar 98) and sugar beet yield.

	Viable Cysts (ct/500 cc soil)					
Treatment	Aug 97	Oct 97	Mar 98	Beet Yield (tons/acre	Estimated Recoverable Sugar (lbs/ton)	Sugar Yield (lbs/acre)
Radish 'Colonel'	13.6	14.4 b	9.7 b	32 a	211 b	6661 a
Mustard 'Concerta'	17.9	16.3 b	14.6 b	29 a	209 b	6001 ab
Untreated check	13.9	32.8 a	23.6 a	25 b	222 a	5579 b

Table 2. Above ground biomass production of oil radish and white mustard and subsequent sugar beet yield

Grenn manure crop	Fresh weight (tons/acre)	Dry Weight (tons/Acre)	Beet yield (tons/A)	Sugar (%)
Oil radish 'Adagio'	9.1 a	0.63 b	41.0 a	15.9
Mustard 'Metex'	7.2 b	0.92 a	39.6 ab	15.8
Fallow	0.0 c	0.0 c	33.2 b	15.9

Table 3. Above ground biomass production of oil radish and white mustard and subsequent sugar beet yield

Grenn manure crop	Fresh weight (t/A)			Sugarbeet and sugar yield	
	Top	Root	Total	Beet yield (tons/A)	Sugar (%)
Oil radish 'Dacapo'	9.1 a	1.6 a	10.7 a	39.3 a	14.2
Mustard 'Metex'	6.9 b	0.3 b	7.2 b	41.2 a	14.0
Fallow	0.0 c	0.0 c	0.0 c	36.4 b	14.6