

# Sugar Beet Yield Response Following Oil Radish Green Manure Nematode Trap Crops In South Central Idaho

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Nematode resistant oil radish (*Raphanus sativus L.*) green manures have been researched extensively for almost 20 years in southwestern Idaho with effective sugarbeet (*Beta vulgaris L.*) cyst nematode (SBCN, *Heterodera schachtii*) reduction documented along with increased sugarbeet production. However, sugar beet yields on fields with low SBCN pressure (i.e. one viable cyst or less per 500 cubic centimeter soil) following oil radish green manures have not been as well noted. The objective of this study was to determine if oil radish green manures used on low organic matter (1.5 to 2.0%), high pH (>8.0) soils with excess lime (>1%) but with low SBCN pressure would sufficiently increase sugarbeet production to be economically feasible. A study was initiated on two fields in south central Idaho in 2002 following winter wheat. Straw was baled and stubble shred. Field Trial A was harrowed and disked prior to broadcast applying fertilizer with oil radish seed (cv. Colonel®). Soil incorporation of oil radish seed was accomplished with another harrow pass on August 15, 2002. For field Trial B fertilizer and oil radish seed (cv. Colonel®) were broadcast directly after straw shredding and harrowed and packed on August 27, 2002. After several irrigations and an application of 2,4-DB® for broadleaf weeds and Assure II® for grass weeds (i.e. mostly volunteer grain), the radish was plowed under in late October. In the spring, sugar beets were planted with only CounterCR® insecticide applied during the growing season. Trial A had a 4.4 ton/ac yield increase and 0.13% higher sugar yield over the check strip. Trial B had a 3.3 ton/ac yield increase and similar sugar percent compared to the check strip. At \$20.50 nets per cwt. sugar the gross payback of increased yield over the no radish check strips would be \$158.00/ac for Trial A and \$99.00/ac for Trial B. Estimated cost to grow the oil radish was \$122.00/ac for Trial A and \$75.00/ac for Trial B with a net profit of \$36.00/ac for Trial A and \$24.00/ac for Trial B. On these soils, oil radish green manures have the potential to increase yields to economic feasible levels even when cyst nematode pressure is low.

The objective in this study is to determine the late season root growth and sugar percent increase for use in calculating an early harvest financial incentive for the Magic and Treasure Valleys.

## METHODS

Field trials were conducted at five locations in 2002 and 2003, and at two locations in 2004. Locations were selected to be representative of the two major climatic regions found in the Amalgamated Sugar Company's growing area. At two of the locations in 2002, four varieties were evaluated while the other three locations were single variety trials. All five of the 2003 locations were single variety trials. In 2004 both locations were planted to two varieties, a high tonnage variety and a high sugar variety.

All trials were randomized complete block designs with six replications in 2002 and eight replications in 2003 and 2004. Individual plots were four rows wide on 22 inch centers and 25 to 36 feet long depending on the irrigation system used. Harvesting started around the 10<sup>th</sup> of September each year and was repeated on 10 to 14 day intervals for three to four harvests depending on the location and year. The middle two rows of each plot were hand harvested taking a two-inch diameter cut off the crown and cleaning each beet. Each plot was weighed and then two sugar samples of 8-10 beets each were taken.

Sugar samples were analyzed (pol sucrose) at the Amalgamated Sugar Company's tare lab in Paul, Idaho for percent sugar, nitrate nitrogen, and conductivity. Root weights and sugar sample data were used to calculate the yield in tons per acre, percent sugar, and estimated recoverable sugar per acre. The approximate yield dates to study were chosen from historical harvest dates.

## RESULTS AND DISCUSSION

### Tons per Acre

Figure 1 summarizes three years of studies in the Magic Valley. In 2002 and 2003 the slopes are similar with .07042 and .07314 tons/acre/day, respectively. In 2004 root growth was higher with an increase of .1442 tons/acre/day. The average growth rate for the three years is .09592 tons/acre/day. The Magic Valley growth rates in tons/acre/day are linear while the Treasure Valley (Fig. 2) rate is linear in 2002 and slightly exponential in 2003 and 2004. If the harvest began earlier in the season than September 8<sup>th</sup> to the 12<sup>th</sup> the yield curves may be more quadratic. The cumulative growth increase at Magic Valley (Fig. 1) and Treasure Valley (Fig 2.) from September 9<sup>th</sup> to October 20<sup>th</sup> indicates a three year average of 3.93 and 5.2 tons/year, respectively. Both locations show the fall of 2004 increasing the most in tons/acre.

The 2002 - 2004-average growth rate (Fig. 3) of .0959 tons/acre/day in the Magic Valley is higher compared to the 77 - 78 research in Kimberly of .0665 tons/acre/day. This is an increase of 1.23 tons over the 42 days (September 8<sup>th</sup> to October 20<sup>th</sup>) analyzed compared to the 77 - 78 studies. This may be due to improved varieties and cultural practices.

Figure 1. Late season root growth at Magic Valley.

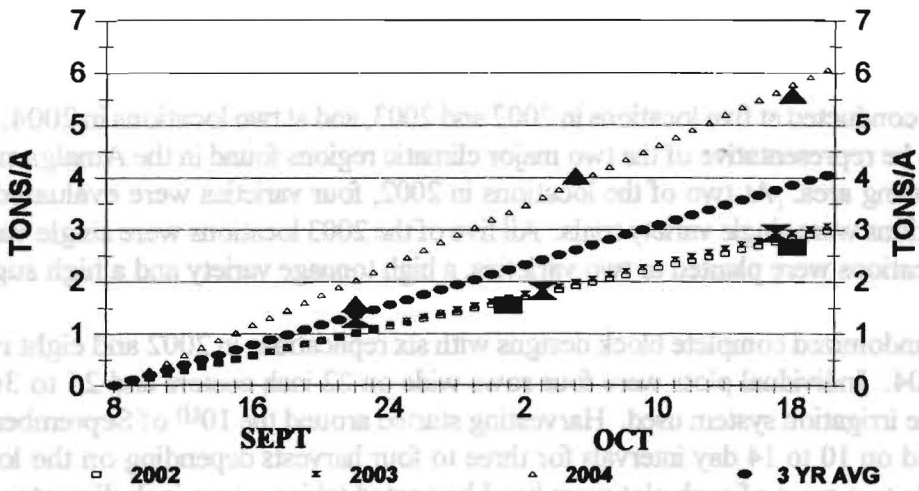


Figure 2. Late season root growth at Treasure Valley.

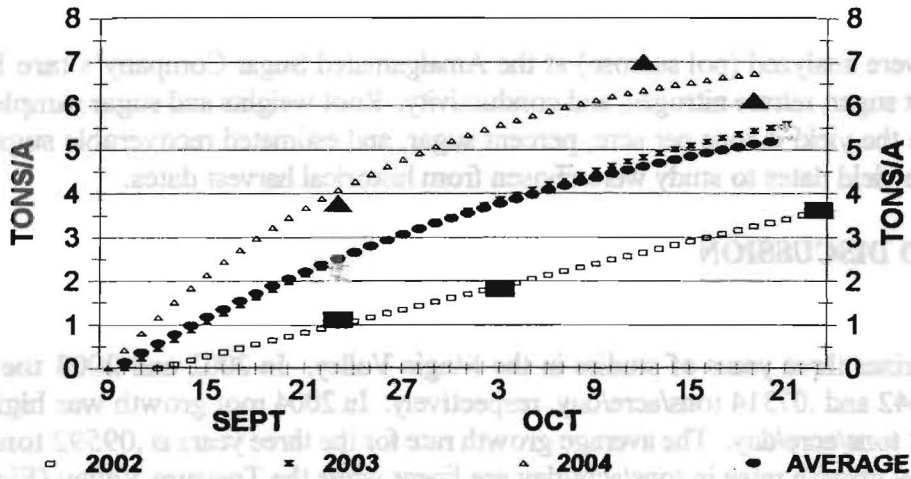
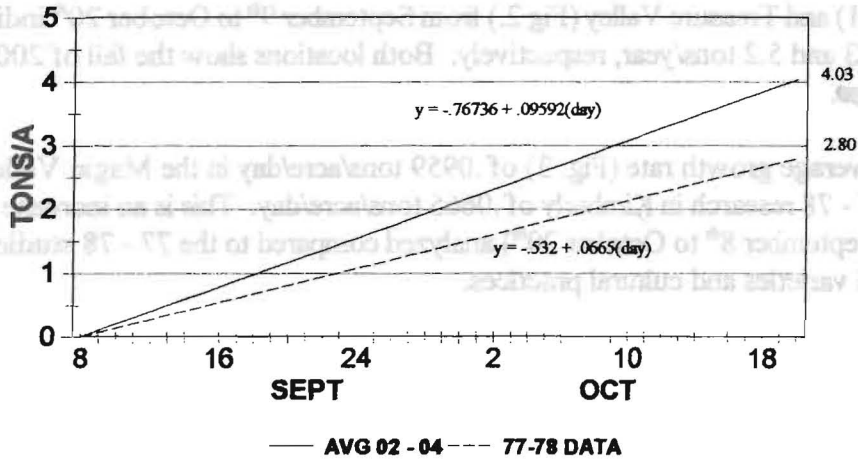


Figure 3. Late season root growth at Magic Valley comparing 2002 - 2004 with the 1977 - 1978 data.



**Sugar Increase**

Each of the growing areas has a tare lab where grower's samples from that area are analyzed making it possible to compare experimental plot results with growers' tare lab data for each area. The sugar increase of the experimental plots and the tare lab are compared in the Magic Valley (Fig. 4) and Treasure Valley (Fig. 5). The slope of the tare lab lines increases at a more rapid rate in September and then is approximately parallel through October. The Treasure Valley begins their early harvest later, approximately September 22nd, and the tare lab and experimental plots

Figure 4. Late season sugar increase comparing the 2002 -2004 experimental plots, tare lab 2002 -2004, and the 1977 - 1978 data.

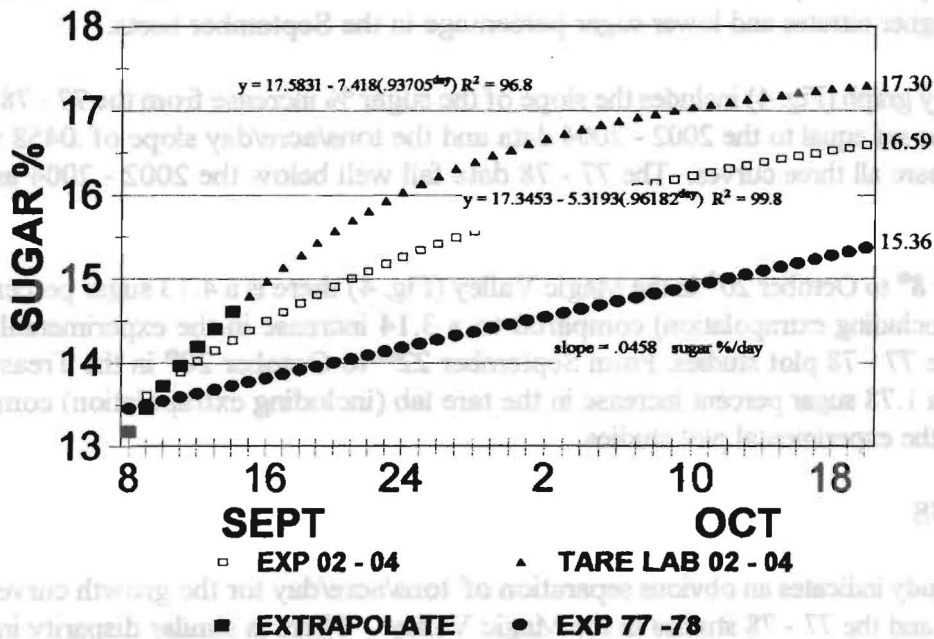
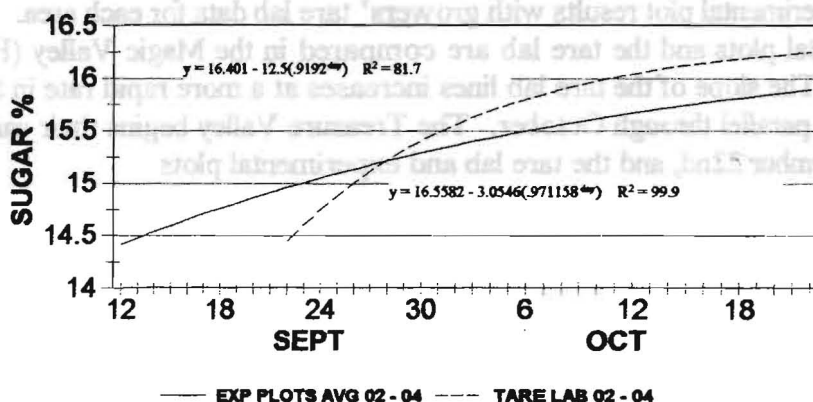


Figure 5. Late season sugar increase comparing the 2002 - 2004 experiment with the 2002 - 2004 tare lab data.



slopes more closely mirror each other after October 7th. The probable reason for the September differences in slope is beet producers harvest their less desirable fields and end rows in September. This results in higher nitrates and lower sugar percentage in the September beets.

The Magic Valley graph (Fig. 4) includes the slope of the sugar % increase from the 77 - 78 data. The starting point was set equal to the 2002 - 2004 data and the tons/acre/day slope of .0458 was added in order to compare all three curves. The 77 - 78 data fall well below the 2002 - 2004 and tare lab curves.

From September 8<sup>th</sup> to October 20<sup>th</sup> in the Magic Valley (Fig. 4) there is a 4.13 sugar percent increase in the tare lab (including extrapolation) compared to a 3.14 increase in the experimental and 1.92 increase from the 77 - 78 plot studies. From September 22<sup>nd</sup> to October 20<sup>th</sup> in the Treasure Valley (Fig. 5) there is a 1.78 sugar percent increase in the tare lab (including extrapolation) compared to a 0.90 increase in the experimental plot studies.

## CONCLUSIONS

The three year study indicates an obvious separation of tons/acre/day for the growth curves between the 2002 - 2004 and the 77 - 78 studies in the Magic Valley. There is similar disparity in the sugar data comparing the 77 - 78, tare lab, and recent studies of 2002 - 2004. The 2002 - 2004 average appears to be the most accurate data available and can be used to pay growers an incentive. The tare lab curves might be more accurate if the data is taken from October and extrapolated through September.

## REFERENCES

1. Carter, J.N., M.E. Jensen and D. J. Traveller. 1980. Effects of mid-to late-season water stress on sugarbeet growth and yield. *Agron. J.* 72:806-815.
2. Gallian, J. J., C. L. Peterson and C. E. Stanger. Predicting the change in value of sugarbeets for different harvest dates. Univ of Idaho CIS No. 747.