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THE EFFECT OF COVER CROP AND SOIL SOLARIZATION ON TURNIP GREEN YIELD FOLLOWING A NITROGEN AND BORON RATE STUDY

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INTRODUCTION

Soil solarization is the utilization of clear polyethylene sheets to trap solar energy to heat the soil to lethal temperatures. The beneficial aspect of this procedure has been documented in recent years. It has been effective in controlling weeds (Egly, 1983; Katan, 1981; Rubin and Benjamin, 1984) and soil-borne diseases (Katan, 1980; Martyn and Hartz, 1985). There have been reports of increased yields of several vegetables (Hartz et al., 1985; Hartz and Bogle, 1989; Earhart et al., 1987). Chen and Katan (1980) reported an increase in soluble organic matter and minerals in extracts of solar heated soils with the greatest increase in NO_3^- concentration. Potassium, NH_4^+, Ca^{2+}, Mg^{2+} and Cl^- were also increased. Stapleton (1985) found that the increases in soluble mineral nutrients following solarization gave an additional economic benefit. Hasson et al. (1987) showed solarization to be effective in retarding and delaying nitrate production and preventing N loss by leaching.

The purpose of this study was to determine the effect of solarization on N and B utilization by turnips after cover cropping.

MATERIALS AND METHODS

On 17 May 1988, 60 lbs/ac of sorghum sudan (*Sorghum bicolor* var.) was drill seeded in an area that, in Fall 1987, had been subjected to fertilizer treatments. These treatments had included all possible combinations of 0, 50, 100, 150 and 200 lbs N/ac from ammonium nitrate (NH_4NO_3) and 0, 1.2 and 2.4 lbs B/ac from Borate 40®. Pre-plant overall fertilization had included 60 lbs P_2O_5, 46 lbs K_2O, 22 lbs Mg and 45 lbs S/ac. Evaluator crops had been broccoli and cauliflower. In Spring 1988, a similar test had been initiated with the same fertilizer N rates and plot location used in the Fall test with the exception that N rates had been applied in three equal split applications. Boron had not been reapplied. The test crops had included Chinese cabbage, Chinese mustard and broccoli.

The cover crop was rototilled into the soil on 18 July 1988. The area was pre-irrigated by overhead sprinkler on 25 July 1988. Clear plastic, 1 mil thick and 10 ft. wide, was applied across one-half of each split plot that was 20 ft. long and 13 ft.

wide. The plastic was removed on 13 Sept. 1988, after a 7-week solarization time. Turnip seed (Purple Top) was drilled on 4 Oct. 1988 at the rate of 2 lbs/ac. The first harvest was on 17 Nov. 1988 (45 growing days). On 28 Nov. 1988, a blanket application of 20 lbs N/ac was applied. The second harvest was on 3 Jan. 1989. Data were obtained on yield/ac for both harvests.

RESULTS AND DISCUSSION

Foliage (greens) yield of Purple Top turnips from 17 Nov. 1988 harvest is presented in Table 1. The solarized treatments at each level of N showed greater yield than non-solarized. There was no significant difference due to previous N or B rates. Solarization significantly increased yield by 2735 lbs/ac over the non-solarized treatment. There was a dramatic increase in yield up to the 100 lb/ac N rate when the plots were solarized, and up to 150 lb/ac when non-solarized. The decrease in yield of solarized and non-solarized treatments above 100 and 150 lbs N could be attributed to excessive biomass which may have tied up available N.

Foliage yield of turnips from the 3 Jan. 1989 harvest is presented in Table 2. The same trend in yield that occurred for the first harvest is evident. The blanket N application 28 Nov. 1988 tended to ameliorize the solarization effect since there were no significant yield differences found. Yield effect was due to N rate.

SUMMARY

Solarization may increase the availability of N trapped by cover crops by increasing mineralization of organic matter. Farmers and home gardeners could benefit from solarization by limiting repeated and excessive N applications. This could be of both economic and environmental importance.

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Table 1. Influence of solarization on yield of turnip foliage following previously applied N rates and cover crop.

Rate lb N/ac	Yield lb/ac		
	Solarized	Nonsolarized	Average
0	5414	3478	4446 a
50	6506	3942	5224 a
100	8145	3810	5977 a
150	6284	4790	5537 a
200	7375	4033	5704 a
Average	6745 A[z]	4010 B	

[z]Means followed by the same letter are not significantly different by Newman-Keuls mean comparisons, upper case .01, lower case .05.

Table 2. Influence of solarization on yield of turnip foliage following previously applied N rates and cover crops plus blanket N applications.

Rate lb N/ac	Yield lb/ac		
	Solarized	Nonsolarized	Average
0	3438	2906	3172 b
50	3293	3549	3421 ab
100	4696	4314	4505 a
150	4067	4590	4328 a
200	3951	4124	4038 ab
Average	3889 a[z]	3897 a	

[z]Means followed by the same letter are not significantly different by Newman-Keuls mean comparisons at the 0.05 level.