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INCREASED PRODUCTION OF FALL TRANSPLANTED BROCCOLI BY THE USE OF SOIL SOLARIZATION

D. R. Earhart, D. R. Paterson, and K. E. Cushman

Soil solarization is the process by which solar energy is used to eliminate or decrease the action of soil pests. This is accomplished by the use of transparent polyethylene film (1-2 mil) placed over moist soil in order to trap solar energy and raise the soil temperature to lethal and sublethal thresholds (9). The optimum time for solarizing soil in East Texas is during July and early August. The film is usually left in place for 6-7 weeks. The majority of the studies with solarization have been in the area of annual perennial weed control (2, 6, 7, 10, 14, 15, 16) and soil-borne disease control (3, 4, 8, 9, 10, 11, 12, 13, 14). Solarization has also been shown to improve plant growth and yield of a number of crops (5, 7, 9, 14). In most cases, the increase in yield was attributed to disinfected soil. However, the growth of plants has been shown to be enhanced when grown in noninfected soil that was solarized, which was found to increase soluble organic matter and minerals (1).

Broccoli (*Brassica oleracea* L. var. Italica) is one crop which is being looked at in the East Texas area for possible commercial production. This study was conducted to determine the effect of soil solarization on growth and development of broccoli under autumn conditions. The test was conducted in 1985 at the Texas A&M University Agricultural Research and Extension Center at Overton. The field site was a Bowie fine sandy loam which had previously been cropped to broccoli, cauliflower, and cabbage in Autumn 1984 and tomatoes in Spring 1985.

METHODS AND MATERIALS

On 16 August 1985, the area was preirrigated to saturation by set sprinkler. On 19 August, clear polyethylene film 1-mil thick and 10 ft. wide was applied to alternate 10 ft. strips over the plot area. Soil temperature was recorded at depths of 1, 2, 4, 6, 12, and 18 in. for 15 min. out of each hour over a 168 hr. period by a 24-point recording potentiometer. The polyethylene film was removed on 23

September. The plot area was then bedded using a 2-row bed shaper instead of bedders in order to pull as little untreated soil into the bed as possible. On the same day, transplants of broccoli (Green Comet, Cruiser), which had been seeded in the greenhouse on 14 August, were transplanted. The plants were spaced 12 in. in the row on beds 40 in. apart. Each plot was 25 ft. long separated by a 15 ft. alley. The experimental design was a split-plot complete block with solarized vs. bare soil treatments as the main plots and varieties as the subplots. There were 3 replications. All plots were sidedressed on 3 October with 800 lbs per acre of 13% N, P_2O_5, K_2O. An additional application of 50 lbs per acre of 34% NH_4NO_3 was applied on 1 November. All plots were sprinkler irrigated as needed. Dipel 4L (*Bacillus thurengensis*) was used for looper control according to label directions. Weed control was by shallow cultivation. Harvest began on 13 November and continued through 2 December. Data were obtained on soil temperature, maturity, plant growth, yield and head size.

RESULTS AND DISCUSSION

Solarization increased soil temperatures substantially when compared to bare soil plots (Table 1). Temperatures of 108°F were maintained up to 4 in. deep. Higher temperatures were also reached at 18 in. depths.

Plant growth was significantly influenced by solarization (Table 2). Stem caliper was increased by 29%, leaf area 25%, and plant volume 104%. This in turn showed a highly significant effect on maturity (Fig. 1). Solarization produced earlier yields and production was maximized at an earlier date. Also mean yield was increased 49% and head size was increased 20% (Table 3).

Due to the time of year (late summer) the test was initiated, maximum soil temperatures did not reach levels reported by other researchers in Texas (5). However, favorable results have been obtained when what is termed "sublethal" temperatures were reached (14). The present study indicates that solarization could be a useful practice in the East Texas area which does not have hot, dry summers like those found in other areas of the southwest. Also, it could be used to prolong production on available land.

Table 1. Maximum soil temperatures during the solarization period 19 August - 23 September 1985.

	Maximum soil temperature (°F)					
Treatment	1 in	2 in	4 in	6 in	12 in	18 in
Solarized [z,y]	108	108	108	102	102	90
Bare Soil	96	96	94	87	81	80

[z]Mulched with 1 mil polyethylene film.
[y]Irrigated to field capacity on 16 Aug. 1985.

Table 2. Effect of solarization on stem caliper, leaf area and plant volume of autumn transplanted broccoli.[z]

Treatment	Stem caliper (in)	Leaf area (in^2x100)	Plant volume (in^3x1000)
Solarized	.22	5.0	4.5
Bare soil	.17	4.0	2.2
Difference	.05**	1.0*	2.3**

[z]'Green Comet' and 'Cruiser' data pooled.
** = significant at 1% level, * = significant at 5% level.

Table 3. Effect of solarization on yield and head size of autumn transplanted broccoli.[z]

Treatment	Mean yield (lbs/acre)	Mean head size (in)
Solarized	5015	3.0
Bare soil	3387	2.5
Difference	1628**	.5*

[z]'Green Comet' and 'Cruiser' data pooled.
** = significant at 1% level, * = significant at 5% level.

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