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Short Communication

Effect of Soil Solarization on Growth and Yield of *Amaranthus dubius*

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Green leafy vegetables are the cheapest of all the vegetables within the reach of the poor man with the richest nutritional value. The problem of malnutrition is assuming seriousness in the vulnerable groups' viz., adolescents, pregnancy, lactation and children not because of poverty but because of ignorance, illiteracy and callousness of the people. Soil solarization is a process in which soil temperature is increased by using solar pathogens but research has shown that it has other effects on soil characteristics that can influence the performance of crops, such as nutrient concentration and soluble organic matter content. The physical, chemical and biological principles of soil solarization, as well as its commercial implementation have been researched in many countries around the world and also the effects of solarization have been investigated for many vegetable crops such as artichokes, bell pepper etc. [1]. Further, increased crop growth and yield response was also reported as a collateral effect of solarization not only due to the control of weeds and soil pathogens, but also due to a heat-induced release of soil nutrients [2]. Further Soil solarization increased temperature by up to 21°C in the upper soil layer and increased nutrient level of N, P, K in the solarized soil comparing with an un solarized one. It also improves soil structure and increases that are needed for plant growth. Hence an experiment was conducted to study the effect of soil solarization on growth and yield of *Amaranthus dubius*.

The experiment was carried out in the Department of Horticulture, Annamalai University, Annamalai Nagar, Tamil Nadu. The treatment comprises of summer ploughing once @ 30 and 45 DAS, Twice @ 30 and 45 DAS, Application of transparent polythene sheet of 0.05 mm thickness, application of biodegradable polythene sheet of 0.05 mm thickness with a control check. The experiment was laid out in a randomized block design with three replications. The species of genus *Amaranthus* (*Amaranthus dubius* var. CO-1) were utilized for the present study. The solarization treatment was done for 45 days in May-June by covering with transparent polyethylene film of 0.05 mm thick in one strip and with biodegradable polyethylene film in another strip. The polyethylene films should be wrapped over the levelled soil and the sides were buried into the soil to maintain air tight condition. After the completion of the solarization period the experimental area was ploughed thoroughly to bring it to fine tilth and the field was divided in to beds of 2mX1m size. At the time of last ploughing the required quantity of farm yard manure was incorporated. The seeds of *Amaranthus dubius* were sown separately and irrigations were carried out as per the requirement of crop. The recommended intercultural operations were carried out as per the requirement of the crop. Observations were recorded on randomly selected six plants in each treatment. The observations on plant height, number of leaves per plant, leaf area, stem weight per plant, leaf weight per plant, yield of greens per plant, yield of greens per plot and yield of greens per hectare were recorded and statistically analyzed by statistically analysis system SAS (1999).

In the present investigation, all the growth parameters were significantly influenced due to the various soil solarization treatments. Among the various treatments, the treatment S_6, which received the application of transparent polyethylene film of 0.05 mm thickness recorded the highest plant height with 38.18, 43.18 and 48.24 cm at 15, 30 and 45 DAS respectively. The least plant height (19.18, 24.30 and 30.11 cm) was recorded in S_1 control (Fallow) at 15, 30 and 45 DAS respectively. The data on number of leaves per plant recorded maximum values (20.26, 24.24 and 27.58 at 15, 30 and 45 DAS respectively). The lowest number of leaves (13.20, 15.40 and 18.60) was recorded in S_1 Control at 15, 30 and 45 DAS respectively. The increased vegetative growth of the treatment S_6 might be due to soil solarization through transparent polyethylene film comprised several modes of action including thermal inactivation of weed seeds and weakening of the propagules will alter the plant root environment and result in increased growth response [3]. Similar results were obtained by Pramanick *et al.* [4] in onion. The data on leaf area was observed in the treatment of soil solarization with transparent polyethylene film of 0.05 mm thickness recorded maximum

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values (9.18, 16.80 and 24.41 cm^2) at 15, 30 and 45 DAS respectively. The least leaf area of4.58, 9.48 and 11.27 $cm^2$was recorded under the treatment S_1 control at 15, 30 and 45 DAS respectively. The increased leaf area noticed in the treatment S_6 might be due to better growth of leaves in the solarized plots that would have resulted in better leaf area thereby aiding the higher photosynthetic efficiency. The improvement of plant growth by using soil solarization technique was reported by Abdallah [5]. The increase of leaf area in the best treatment by using soil solarization technique was reported by Luis Ibarra-Jiménez *et al.* [6]. The effects on highest plant growth parameters were mainly owe to biological control of soil borne pathogens and pests, improve soil structure and increase the availability of nitrogen and other essential plant nutrients.

Table 1 Effect of soil solarization on growth parameters of *Amaranthus dubius*

Treatments	Plant height (cm)			Number of leaves			Leaf area (cm^2)		
	15 DAS	30 DAS	45 DAS	15 DAS	30 DAS	45 DAS	15 DAS	30 DAS	45 DAS
S_1: Control	19.18	24.30	30.11	13.20	15.40	18.60	4.58	9.48	11.27
S_2: Summer ploughing 1 time (30 days)	21.04	27.12	32.40	15.12	16.20	19.84	5.98	10.76	13.73
S_3: Summer ploughing 2 times (30 days)	26.04	34.12	35.21	14.04	18.01	21.96	7.59	12.35	15.87
S_4: Summer ploughing 1 time (45 days)	24.32	29.75	38.05	16.20	15.34	20.90	6.93	11.40	14.89
S_5: Summer ploughing 2 times (45 days)	29.41	36.28	41.26	17.14	20.18	23.02	8.29	13.50	17.72
S_6: Transparent polyethylene sheet	38.18	43.18	48.24	20.26	24.24	27.58	9.18	16.80	24.41
S_7: Biodegradable polyethylene sheet	33.34	39.21	45.11	18.40	22.12	24.56	8.79	15.00	21.61
S.Ed.	0.46	0.90	1.51	0.22	0.44	0.53	0.05	0.06	0.09
CD (p=0.05)	0.92	1.80	3.01	0.45	0.88	1.05	0.10	0.12	0.18

Table 2 Effect of soil solarization on yield parameters of *Amaranthus dubius*

Treatments	Leaf weight (g $plant^{-1}$)			Stem weight (g $plant^{-1}$)			Yield (g $plant^{-1}$)			Yield (Kg $plot^{-1}$)	Yield (t ha^{-1})
	15 DAS	30 DAS	45 DAS	15 DAS	30 DAS	45 DAS	15 DAS	30 DAS	45 DAS		
S_1	0.44	1.19	1.71	0.56	1.53	2.20	1.40	3.80	5.48	0.80	4.01
S_2	0.49	1.26	1.98	0.63	1.62	2.30	1.58	4.04	6.10	0.88	4.39
S_3	0.58	1.41	2.08	0.74	1.82	2.71	1.84	4.52	6.70	0.98	4.90
S_4	0.53	1.34	2.00	0.68	1.73	2.43	1.69	4.30	6.26	0.92	4.59
S_5	0.60	1.47	2.12	0.80	1.88	2.60	1.94	4.69	6.66	1.00	4.98
S_6	1.26	2.56	2.77	1.62	3.29	3.56	4.02	8.20	8.85	1.58	7.90
S_7	1.01	2.39	2.44	1.30	3.07	3.14	3.24	7.65	7.82	1.40	7.02
S.Ed.	0.03	0.05	0.07	0.03	0.03	0.04	0.08	0.10	0.08	0.02	
CD (p=0.05)	0.06	0.10	0.14	0.05	0.06	0.08	0.15	0.20	0.15	0.05	

In the present investigation, the yield parameters were significantly influenced due to the various off-season land management practices that were tested. In the present study, the highest leaf weight per plant (1.26,2.56 and 2.77 g) was recorded in the treatment S_6 (Transparent polyethylene sheet) at 15, 30 and 45 DAS. The least leaf weight per plant (0.44, 1.19 and 1.71 g) was recorded under control (S_1) at 15, 30 and 45 DAS respectively. Similarly, the data on stem weight per plant (1.62,3.29 and 3.56 g) was also recorded in the S_6 (Transparent polyethylene sheet) at 15, 30 and 45 DAS. The least stem weight per plant 0.56, 1.53 and 2.20 g S_1 (Control) at 15, 30 and 45 DAS respectively. This might be due to the increased biomass with more number of leaves which leads to increased stem weight. The data on yield of greens per plant also showed significant variations. Maximum green yield per plant (4.02, 8.20 and 8.85 g) was recorded under the treatment S_6 (Transparent polyethylene sheet) at 15,30 and 45 DAS respectively. Similarly, maximum yield of greens per plot (1.58 kg) was recorded in the treatment S_6 (Transparent polyethylene sheet). The reason for increase of yield characters could be attributed by controlled the weed growth in the soil condition and distribution of nutrients to the soil might have increased the yield of plant. According to Cimen *et al.* [7], solarization for five weeks with a transparent polyethylene film increased yield of soybean by 110% compared with the yield in non-solarized soils. Similar findings on yields of onion, lettuce and carrot were significantly enhanced by solarization [8]. Based on the present investigation, among the various soil solarization practices transparent polyethylene film - 0.05 mm thickness was recommended for cultivation of *Amaranthus dubius*.

SUMMARY

An investigation was conducted to study the effect of soil solarization on growth and yield of *Amaranthus dubius* in the Department of Horticulture, Annamalai University at Annamalai Nagar, Chidambaram in Cuddalore District, Tamil Nadu, India. The experiment was laid out in a Randomized Block Design with seven treatments in three replications consisting of soil management treatments viz., fallow summer ploughing one time in 30 and 45 days, summer ploughing 2 times in 30 and 45 days, application of transparent polyethylene film of 0.05 mm thick for 45 days and biodegradable polyethylene film for 45 days and compared with a control. The growth and yield components viz., plant height, number of leaves per plant, leaf area, stem weight per plant, leaf weight per plant, yield of greens per plant, yield of greens per plot and yield of greens per hectare were recorded at the time of harvest and were analyzed. The results revealed that application of transparent polyethylene sheet significantly increased the growth and yield parameters in *Amaranthus dubius* when compared to the control.

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