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Evaluation of Pre-emergence Herbicides and Soil Solarization for Weed Management in Brinjal (*Solanum melongena* L.)

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ABSTRACT

A field experiment was conducted during the summer seasons (December-January to April-May) of 1998-99 and 1999-2000, to study the relative efficacy of four pre-emergence herbicides and soil solarization treatment in reducing weed infestation and in enhancing the yield of brinjal. Season-long crop-weed competition reduced the yield of brinjal by 51 and 49% during 1998-99 and 1999-2000, respectively. Soil solarization for one month registered the highest fruit yield during both the years (18.92 and 18.12 t/ha, respectively). The pre-emergence herbicides alachlor (2.0 and 2.5 kg a. i./ha), oxadiazon (0.5 and 0.75 kg a. i./ha) and pendimethalin (2.0 kg a. i./ha) and hand weeding twice treatments recorded fruit yields comparable to that of soil solarization. As far as weed dry weight is concerned, alachlor (2.0 and 2.5 kg a. i./ha) recorded excellent weed control comparable to weed free check at 30 and 60 DAT.

INTRODUCTION

Brinjal is an important vegetable crop of Kerala. Presently its cultivation is picking up in the reclaimed alluvial soils of Kuttanad. Usually it is planted during the summer months i. e. December-January. During this period, light and frequent irrigations are given which provide ideal conditions for heavy weed infestation, thus causing substantial reduction in yield. Due to the hike in labour wage rate and labour scarcity experienced in the state, chemical weed control will be an economic weed control strategy for this important vegetable crop of the state.

MATERIALS AND METHODS

Field experiments were conducted during the summer seasons of 1998-99 and 1999-2000 at the Regional Agricultural Research Station, Kumarakom. The soil of the experimental field was riverine alluvium of the order Entisol. The soil texture was silty clay and it was acidic in pH (5.5) and low in available P and K (12.0 and 120 kg/ha, respectively) and high in organic nitrogen content (1.3%).

Twelve treatments comprising fluchloralin, pendimethalin and oxadiazon each at two doses, a soil solarization treatment, hand weeding twice and a weedy and unweeded check were compared. The experiment was laid out in a randomized block design with three replications. Seedlings of the brinjal variety 'Swetha' were raised in well prepared nursery beds. Thirty days old healthy and uniform seedlings were transplanted during the second fortnight of December. The plots for solarization treatment after thorough land preparation, levelling and wetting were covered with transparent polyethylene sheet of 0.15 mm thickness for 30 days thereby increasing the soil temperature to 46^0C. Without further soil disturbance seedlings were transplanted at a spacing of 75 x 60 cm. Well decomposed FYM @ 25 t/ha was applied uniformly at the time of land preparation. In addition, the crop was fertilized with 70 kg N, 40 kg P_2O_5 and 25 kg K_2O/ha. Half the dose of N and K and full dose of P were applied at the time of transplanting and the remaining N and K were top dressed in two equal splits at 30 and 60 DAT. Light irrigation was given just after transplanting and subsequent irrigations were given as and when required. The herbicides fluchloralin (0.75 kg a. i./ha), pendimethalin (1.0 and 2.0 kg a. i./ha), alachlor (2.0 and 2.5 kg a. i./ha) and oxadiazon (0.5 and 0.75 kg a. i./ha) were applied two days before transplanting and mixed well with the top soil. The herbicides were applied with a manually operated back pack sprayer with flat fan nozzle, the spray volume being 500 l/ha. In hand weeding twice (HWT) treatment, two hand weedings were done at 30 and 60 DAT. In weed free check (WFC), weeds were removed at weekly intervals. Observations on floristic composition of weeds as well as dry weight at periodic intervals were recorded

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with a 0.25 x 0.25 m quadrat at two randomly selected places from each plot.

RESULTS AND DISCUSSION

Floristic Composition of Weeds

The experimental field was infested with *Eleusine indica, Digitaria sanguinalis* (L.)*, Paspalum* sp., *Eragrostis* sp. among grassy weeds; *Ageratum conyzoides* (L.), *Leucas aspera, Ludwigia perennis, Commelina benghalensis, Cleome viscosa, Phyllanthus niruri, Vernonia cinerea* among broad-leaved weeds and *Cyperus rotundus* (L.), *C. iria* and *Killinga monocephala* among sedges.

Effect on Crop

During both the years of study, soil solarization treatment registered the highest fruit yield (18.92 and 18.12 t/ha, respectively) which, however, was on par with weed free check and hand weeding twice (HWT). The HWT treatment was on par with alachlor (2.5 kg a. i./ha) which was comparable with oxadiazon (0.5 and 0.75 kg a. i./ha), alachlor (2.0 kg a. i./ha) and pendimethalin (2.0 kg a. i./ha) during the first year (Table 1). However, during the second year, HWT was on par with alachlor (2.0 and 2.5 kg a. i./ha) and oxadiazon (0.5 and 0.75 kg a. i./ha). The magnitude of yield increase due to pendimethalin did not touch the level of statistical significance. The higher yield obtained in these treatments was attributed to reduced crop-weed competition and efficient utilization of resources by the crop. Season long crop- weed competition reduced the average fruit yield by 51 and 49% during the first and second years, respectively. Nandal and Pandita (1988) reported that brinjal crop kept free from weeds between 20 and 40 days of transplanting produced yield equivalent to weed free condition and reduced the cost of weeding.

A critical analysis of the yield data clearly indicated that the crop yield was higher in treatments which were effective in controlling weeds. The extent of weed growth and the consequent competition were the major factors which decided the fruit yield. The direct influence of weed competition on yield of vegetables has been reported by several workers (Singh *et al.*,1982 in okra and Singh *et al.*, 1993 in tomato).

The major yield attributes also followed a similar trend as that of fruit yield. Fruit yield in brinjal is positively and significantly correlated with number of fruits per plant. In the present study also corroboratory results were obtained and the highest number of fruits per plant was recorded by soil solarization treatment (20.83 and 22.37 during the first and second years, respectively). Among other yield attributes, fruit length was significantly influenced by the treatments and all the treatments except unweeded control were on par. As far as girth of fruit is concerned, except weedy check and fluchloralin (0.5 kg a. i./ha) all other treatments were statistically on par in determining this yield attribute. The direct influence of weed competition on yield attributes and yield of brinjal has been reported earlier (Chakrabarthi, 2000).

In plant height also, the highest value was

Table 1. Effect of weed control treatments on the plant height, yield attributes and yield of brinjal

Treatment (kg/ha)	Plant height (cm)		No. of fruits/ plant		Length of fruit (cm)		Girth of fruit (cm)		Fruit yield (t/ha)	
	I yr	II yr	I yr	II yr	I yr	II yr	I yr	II yr	I yr	II yr
Fluchloralin 0.5	80.67	76.47	14.07	12.83	9.47	11.00	10.03	10.67	9.91	12.55
Fluchloralin 0.75	77.70	75.33	15.67	13.33	10.00	9.83	1077	10.43	9.51	11.48
Pendimethalin 1.0	84.60	81.97	13.43	14.43	10.23	10.20	11.50	11.00	10.16	11.79
Pendimethalin 2.0	73.27	79.40	13.90	14.33	10.40	10.96	11.00	11.57	11.53	12.99
Oxadiazon 0.5	79.83	83.77	16.40	14.67	10.07	11.03	11.63	11.57	11.77	15.14
Oxadiazon 0.75	83.10	84.83	16.37	16.50	11.00	11.07	10.80	11.57	12.79	15.66
Alachlor 2.0	88.50	98.97	17.00	16.17	11.30	11.03	10.90	11.63	13.32	15.11
Alachlor 2.5	87.43	101.87	16.63	16.67	10.70	11.27	11.13	11.60	12.35	15.40
Soil solarization	107.7	111.63	20.83	22.00	11.40	11.80	11.77	12.47	18.92	18.12
Hand weeding twice	85.47	99.57	19.43	19.67	1067	11.60	11.30	11.27	15.27	16.69
Weed free check	101.27	107.23	18.97	21.50	10.40	11.80	11.10	12.07	17.24	17.07
Unweeded control	64.60	67.43	10.13	10.00	8.40	8.57	8.67	8.43	8.41	8.76
LSD (P=0.05)	7.217	6.867	2.641	4.998	2.414	1.1794	1.062	1.3329	1.984	1.787

recorded by soil solarization treatment followed by WFC and HWT. The HWT treatment was on par with the herbicides alachlor and oxadiazon during both the years at all the three stages of study viz., 30, 60 and 90 DAT indicating the positive effect of these treatments on plant growth.

Effect on Weeds

All the weed control treatments significantly reduced total weed population and weed dry weights as compared to unweeded check during both the years (Table 2). However, the magnitude of reduction in weed biomasss varied depending upon the control measures adopted. The weed dry weight values were very high for HWT on 30 and 75 DAT since weed sampling was done before hand weeding.

The weed free check (T_{11}) recorded the lowest value for weed dry weight during all the three stages of observation viz., 30, 60 and 75 DAT. Treatments 7 and 8 (alachlor 2.0 and 2.5 kg a. i./ha) registered very low weed dry weight values on par with weed free check at 30 DAT. Soil solarization was the next best treatment. At 60 DAT, weed free check was on par with HWT which was on par with both the doses of alachlor (T_7 and T_8). At this stage also soil solarization was the next best treatment. At 75 DAT weed free check was on par with soil solarization which was on par with alachlor 2.5 kg a. i./ha, oxadiazon 0.5 and 0.75 kg a. i./ha and pendimethalin 2.0 kg a. i./ha. This clearly indicates that soil solarization for one month was effective in providing season-long weed suppression. The superiority of this treatment is due to better growth as indicated by growth characters like height and better expression of yield attributes like number of fruits per plant as well as length and girth of fruits alongwith weed suppression. Also the pre-emergent herbicides alachlor (2.0 and 2.5 kg a. i./ha) and oxadiazon (0.5 and 0.75 kg a. i./ha) were effective in reducing weed competition in brinjal. Singh and Tripathi (1988) reported 89.0 per cent yield reduction in brinjal due to uncontrolled weed growth.

On the basis of fruit yield and weed control efficiency, soil solarization for one month and use of pre-emergence herbicides viz., alachlor (2.0 and 2.5 kg a. i./ha) and oxadiazon (0.5 and 0.75 kg a. i./ha) were adjudged as the best alternative to hand weeding in brinjal in the reclaimed alluvial soils of Kuttanad.

Table 2. Effect of weed control treatments on dry weight of weeds in brinjal

Treatment (kg/ha)	Dry weight of weeds (kg/ha)					
	30 DAT		60 DAT		75 DAT	
	I yr	II yr	I yr	II yr	I yr	II yr
Fluchloralin 0.5	33.84	14.84	94.37	85.27	164.13	136.7
Fluchloralin 0.75	25.95	17.60	99.96	89. 53	149.33	130.27
Pendimethalin 1.0	21.21	15.93	104.37	89.04	172.43	148.20
Pendimethalin 2.0	20.59	12.70	93.40	57.80	130.72	90.63
Oxadiazon 0.5	25.68	11.05	94.03	62.94	138.10	119.00
Oxadiazon 0.75	27.13	9.40	107.54	80.67	112.83	119.23
Alachlor 2.0	4.55	2.36	52.71	38.73	118.32	56.63
Alachlor 2.5	2.09	2.32	58.50	38.98	133.63	73.60
Soil solarization	12.17	2.55	89.87	50.27	66.30	74.80
Hand weeding twice	39.71	2.74	3.05	7.36	107.70	51.73
Weed free check	1.76	1.44	2.56	2.11	2.25	1.38
Unweeded control	43.57	38.87	111.17	100.07	252.05	175.60
LSD (P=0.05)	7.002	2.2323	22.733	7.4696	70.155	7.4696

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