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Influence of Tillage and Moisture Regimes with Soil Solarization on Weed Dynamics and Yield of Baby Corn-Groundnut Crop Sequence

M. N. Thimmegowda, H. V. Nanjappa and B. K. Ramachandrappa
Department of Agronomy
University of Agricultural Sciences, Bangalore-560 065 (Karnataka), India

ABSTRACT

Thorough land preparation and irrigation upto field capacity for solarization was found effective in suppressing weeds and increasing the yield of baby corn followed by one ploughing + harrowing and 40 mm of irrigation. The combination of these treatments with one hand weeding at 30 days was crucial in suppressing the weeds and enhancing the productivity in succeeding crop of groundnut.

INTRODUCTION

Weed competition is a major limiting factor to the productivity of crops. The annual global loss due to weeds has been estimated to be Rs. 1980 crore and accounts for 33% yield loss (Gautam and Mishra, 1995). A number of methods are being adopted to manage the weeds where cultural and mechanical methods are laborious, time consuming and expensive. Employing the biological control agents is not practicable in field crops because of complexity of weed problems. Chemical weed control although is one of the effective methods, there has been a growing apprehension among ecologists about the use of chemicals. Soil solarization has been observed to be an efficient tool of weed management and has greater potential. Baby corn is a unique cereal with a difference of value addition in terms of the milky tender cob as a fresh natural food-cum-vegetable gaining importance in recent times. Groundnut, cultivated in late **kharif** faces severe problem of weed infestation. These crops were adapted to limited water condition with severe weed infestation. The present investigation was, therefore, undertaken to evaluate the tillage and moisture requirement for effectiveness of soil solarization in suppressing weeds and improving the productivity of these crops.

MATERIALS AND METHODS

Field experiment was conducted during 2003 and 2004 to study the effect of soil solarization with tillage practices and moisture regimes on weed dynamics and yield of baby corn-ground crop sequence at the Agronomy Field Unit, Main Research Station, University of Agricultural Sciences, Bangalore. The soils were red sandy clay loam with pH 6.53. The available N, P_2O_5 and K_2O were 181.8, 29.6 and 221.1 kg/ha, respectively. The experiment consisting of 18 treatment combinations was laid out in split plot design with three replications with solarization during summer (April-May) followed by baby corn-groundnut crop sequence. The treatment combination included three tillage practices in the main plot (one ploughing+one harrowing, thorough land preparation (two ploughings, two harrowings, clod crushing and levelling) and unploughed control) and six sub-plots with solarization and moisture regimes (solarization with irrigation upto FC, 40 mm, 20 mm and control (dry) with a non-solarized weedy and weed free check). Tillage treatments were imposed and soil solarization with transparent polyethylene wrapping of 0.05 mm thickness during April. Polyethylene sheets were removed after 45 days and 50% of recommended N, 100% P and K (75 : 75 : 40 kg N, P_2O_5 and K_2O/ha) were applied as basal dose through urea, SSP and MOP after opening furrows with the help of hand hoe without disturbing the soil much. Baby corn hybrid (PAC-793) seeds were sown at a spacing of 45 x 20 cm and were thinned out to maintain two plants per hill. The remaining 50% N (75 kg/ha) was applied at the time of earthing up. Recommended package of practices was adopted for raising baby corn. After the baby corn, the land was prepared by shallow digging and the plots were divided into two sub-plots to super impose the treatments one hand weeding at 30 DAS and unweeded control to study the residual effect of soil solarization on groundnut. Recommended dose of fertilizer (25 : 75 : 38 kg N, P_2O_5 and K_2O/ha) was applied after opening furrows with the help of hand hoe. Groundnut seeds (TMV-2) were sown

Table 1. Total weed count and dry weight in baby corn and groundnut as influenced by soil solarization with tillage and soil moisture regime (Pooled data of 2003 and 2004)

Treatment		Baby corn								Groundnut							
		Total weed count (No./ m²)				Total weed dry weight (g/m²)				Total weed count (No./m²)				Total weed dry weight (g/m²)			
		1 plough+ 1 harrow	Thorough land ppn.	Unploughed control	Mean	1 plough+ 1 harrow	Thorough land ppn.	Unploughed control	Mean	1 plough+ 1 harrow	Thorough land ppn.	Unploughed control	Mean	1 plough+ 1 harrow	Thorough land ppn.	Unploughed control	Mean
FC Irron.+ Solarization	One HW	6.9 (47)	6.4 (41)	8.0 (64)	7.1 (51)	4.0 (15.6)	3.9 (14.9)	4.8 (22.4)	4.2 (17.6)	7.5 (56.3)	6.6 (43.0)	9.3 (85.5)	8.9 (80.6)	8.0 (64.1)	7.2 (51.4)	10.1 (101.6)	9.5 (93.1)
	Weedy									9.7 (92.7)	8.7 (75.0)	11.4 (131.3)		10.1 (102.5)	9.5 (89.0)	12.3 (149.9)	
40 mm irrn.+ Solarization	One HW	7.2 (51)	6.8 (46)	8.5 (73)	7.5 (57)	4.2 (17.0)	4.1 (16.0)	5.1 (25.2)	4.4 (19.4)	8.1 (65.0)	7.2 (51.3)	9.7 (86.3)	9.4 (90.9)	8.6 (73.8)	7.7 (59.5)	10.5 (109.6)	10.1 (104.4)
	Weedy									10.4 (108.0)	9.3 (86.3)	11.9 (141.3)		11.1 (123.7)	10.0 (99.2)	12.7 (160.6)	
20 mm irrn.+ Solarization	One HW	8.2 (67)	8.0 (64)	9.6 (93)	8.6 (75)	4.8 (22.2)	4.7 (21.2)	5.6 (31.1)	5.0 (24.8)	8.8 (77.7)	8.4 (71.3)	10.6 (96.3)	10.2 (104.7)	9.5 (90.0)	8.9 (79.3)	11.4 (129.7)	10.9 (120.0)
	Weedy									10.9 (119.0)	9.8 (96.3)	12.3 (151.7)		11.7 (136.0)	10.5 (110.6)	13.2 (174.0)	
No. Irron.+ Solarization	One HW	9.1 (83)	8.8 (78)	10.3 (106)	9.4 (89)	5.3 (27.5)	5.5 (21.9)	6.0 (35.0)	5.5 (29.5)	9.4 (88.0)	9.1 (83.3)	11.2 (109.7)	10.8 (117.4)	10.1 (102.3)	9.9 (97.2)	12.1 (146.4)	11.6 (135.2)
	Weedy									11.5 (131.7)	10.5 (109.7)	12.9 (165.7)		12.4 (152.0)	11.1 (123.4)	13.8 (189.8)	
Non-solarized Weedy	One WH	11.5 (131)	10.9 (120)	12.5 (155)	11.6 (135)	6.6 (42.7)	6.3 (39.5)	7.3 (52.2)	6.7 (44.8)	10.7 (113.0)	9.2 (83.7)	11.4 (140.7)	11.7 (140.1)	11.4 (129.4)	10.2 (103.2)	12.3 (151.4)	12.5 (159.7)
	Weedy									12.6 (157.8)	11.9 (140.7)	14.7 (215.2)		13.3 (177.6)	12.5 (155.6)	15.5 (241.1)	
Non-solarized Weed free	One HW	0.7 (0)	0.7 (0)	0.7 (0)	0.7 (0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	7.3 (53.3)	6.9 (48.0)	7.3 (83.0)	8.6 (76.2)	8.0 (62.8)	7.4 (54.7)	7.8 (60.8)	9.2 (87.3)
	Weedy									10.1 (101.7)	9.1 (83.0)	10.9 (117.7)		10.8 (116.0)	9.8 (94.9)	11.6 (134.9)	
Mean (M)		7.3 (63)	6.9 (58)	8.3 (82)		4.6 (20.9)	4.5 (19.6)	5.3 (27.6)		9.8 (97.0)	8.9 (81.0)	11.1 (126.9)		10.6 (110.9)	9.7 (93.2)	12.1 (145.8)	
Mean (W)										8.8 (79.7)	11.0 (120.9)			9.7 (92.6)	11.9 (140.6)		

LSD (P=0.05)

Crop	Parameters	Main plot (M)	Sub-plot (S)	Sub-sub plot (W)	S at same level of M	M at same or diff. level of S	W at same level of T	W at same or diff. level of T	S at same level of W	W at same or diff. level of S
Baby corn	Weed count	0.13	0.19		0.43	2.43				
	Weed DW	0.06	0.08		0.20	0.80				
Groundnut	Weed count	0.35	0.14	0.09	0.25	0.29	0.15	0.21	0.21	0.18
	Weed DW	0.28	0.22	0.10	0.39	0.37	0.21	0.20	0.24	0.25

Figures in parentheses indicate the original values.

Table 2. Yield attributes of baby corn and groundnut as influenced by soil solarization with tillage and soil moisture regimes (Pooled data of 2003 and 2004)

Treatment	Baby corn					Groundnut				
	Baby weight (g/hill)		No. of babies/ hill	Husked baby yield (q/ha)	Fodder yield (t/ha)	100-kernel weight (g)	Pod yield (t/ha)	Kernel yield (t/ha)	Haulm yield (t/ha)	Shelling percentage
	Husked	Dehusked								
Main plot : Tillage (M)										
One ploughing + harrowing	77.0	27.5	4.5	10.9	44.62	33.5	2.3	1.6	2.5	69.3
Thorough land preparation	80.3	28.5	4.7	11.3	47.20	35.0	2.6	1.8	2.8	70.7
Unploughed	71.9	25.6	3.6	9.8	41.09	33.5	1.9	1.3	2.1	69.4
LSD (P=0.05)	3.5	1.1	0.20	0.13	3.65	0.75	0.07	0.05	0.07	NS
Sub-plot : Moisture regimes with solarization (S)										
Irrig. upto FC+ PE 0.05 mm for 45 days	88.0	31.3	4.7	11.7	49.89	35.5	2.6	1.9	2.8	70.5
40 mm Irrig.+TPE 0.05 mm for 45 days	83.9	29.8	4.5	11.2	47.53	33.7	2.5	1.7	2.7	70.2
20 mm irrig.+TPE 0.05 mm for 45 days	74.0	26.4	4.2	10.6	43.38	34.1	2.3	1.6	2.6	69.6
Unirrigated+TPE 0.05 mm for 45 days	68.2	24.3	4.1	10.0	40.71	33.7	2.1	1.4	2.4	68.8
Non-solarized weedy check	61.3	21.9	3.8	9.4	36.73	32.1	1.6	1.1	2.0	69.1
Non-solarized weed free check	83.1	29.5	4.4	11.2	47.57	34.8	2.3	1.7	2.6	70.8
LSD (P=0.05)	2.8	1.0	0.18	0.32	1.48	1.01	0.07	0.05	0.07	0.70
Sub-sub-plot : Weeding (W)										
One hand weeding						34.5	2.4	1.7	2.7	69.8
Unweeded						33.5	2.1	1.5	2.3	69.8
LSD (P=0.05)						0.46	0.29	0.22	0.29	NS
Interaction										
S at same level of W (LSD P=0.05)									0.7	
W at same or diff. level of S (LSD P=0.05)							0.7	0.5	0.7	

NS–Not Significant.

at a spacing of 30 x 15 cm.

RESULTS AND DISCUSSION

Effect on Weeds

The important grassy weeds observed were *Digitaria marginata, Dactyloctenium aegypticum, Chloris barbata, Echinocloa colona, Erogrostis spilosa* and *Eleusina indica*. Some of the broad-leaved weeds observed were *Commelina bengalensis, Amaranthus viridis, Lagasca mollis, Euphorbia hirta, Euphorbia geniculata, Borrirea hispida, Portulaca oleraceae, Ageratum conyzoides, Spillanthus acmella, Acanthospermum hispidum, Cleome monophylla, Phyllanthus niruri* and *Achyranthus aspera* besides the sedge *Cyperus rotundus* was present.

Soil solarization with unploughed control, non-solarized weedy and unweeded check recorded significantly higher weed density and dry weight of weeds at harvest in baby corn and groundnut (Table 1). Weed free check recorded the lowest number of weeds followed by solarization with irrigation upto FC and 40 mm. In addition to the residual effect of solarization, one hand weeding in the succeeding crop of groundnut showed greater reduction in weed count compared to the unweeded control.

The magnitude of reduction in weed count in baby corn was 25-40% with thorough land preparation, 40-60% with irrigation upto FC for solarization over control treatments. However, it was 30-45, 35-60 and 34-51% with thorough land preparation, solarization with irrigation upto FC and one hand weeding, respectively, over control treatments.

Yield and Yield Attributes of Baby Corn

Husked baby corn and green fodder yield were superior with thorough land preparation followed by one ploughing + harrowing which were 15.0 and 11.4% superior over unploughed control (Table 2). Increased yield due to thorough land preparation for solarization has also been attributed to the significant improvement in yield parameters like number of babies/hill, length, girth and weight of husked and dehusked baby corn. Significantly lower husked baby corn and fodder yield were noticed in non-solarized weedy check as compared to all other treatments. Solarization with irrigation upto FC recorded significantly higher husked baby corn and fodder yield followed by 40 mm irrigation for solarization and weed free check. The magnitude of yield improvement in solarization with irrigation upto FC was higher (35.8%) followed by weed free check (29.5%), solarization with 40 mm (29.4%), 20 mm (18.1%) and no irrigation (10.8%) over non-solarized weedy check.

Yield and Yield Attributes of Groundnut

Residual effect of solarization with thorough land preparation recorded higher pod yield followed by one ploughing + harrowing which was significantly superior over unploughed control (Table 2). The magnitude of yield increase was 34.8 and 21.2%, respectively, over unploughed control. Among the solarization treatments with moisture regimes, residual effect of solarization with irrigation upto FC recorded greater yield increase (63.1%) followed by 40 mm irrigation (53.0%), weed free check (44.6%) and 20 mm irrigation for solarization (43.9%) as compared to non-solarized weedy check. One hand weeding at 30 DAS alongwith the residual effect of solarization recorded 15.9% higher pod yield over unweeded control. The number of pods and 100-kernel weight were significantly superior with residual effect of solarization with irrigation upto FC followed by 40 mm irrigation and weed free condition for the previous baby corn.

Higher yield with thorough land preparation and one ploughing + harrowing was attributed to effective solarization which created fine seedbed and help to maintain minimum space between the polyethylene and soil surface which hastened the betterment of heat transfer and intense heating, which can be further substantiated with superiority of weed control with these treatments compared to unploughed control.

Thorough land preparation with fine seedbed and irrigation upto field capacity are essential before solarization. This will enhance the solarization effect in terms of controlling of weeds and increased yield of baby corn followed by groundnut. Under non-availability of irrigation for solarization, one ploughing + harrowing and 40 mm of irrigation are required for effective solarization

REFERENCE

Gautam, K. C. and J. S. Mishra, 1995. Problems and prospects of new method of weed management. *Pesticide Information* **21** : 7-19.