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EFFECT OF DIFFERENT MULCHES ON WEED FLORA AND ITS POPULATION IN CHILLI (*CAPSICUM ANNUUM* L.*) CV.* KALIPEETH

O. P. PRAJAPATI*, P. K. GUPTA, RAJESH LEKHI AND JAYRAM PATIDAR

Department of Horticulture, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, 474001, Madhya Pradesh, India

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ABSTRACT

The dominant weed flora found in chilli consisted of *Cyperus rotundus* L., *Cynodon dactylon* (L.) pers, *Convolvulus arvensis and Chenopodium album.* The treatment of T_2 (hand weeding at the interval of 15 days) with hand weeding every 15 days interval up to harvesting is the most effective for controlling of *Cyperus rotundus* L., *Cynodon dactylon* L. pers, *Convolvulus arvensis* and *Chinopodium album.* The treatment of mulching with black polythene is the most effective after hand weeding for controlling of *Cyperus rotundus* L., *Cynodon dactylon* L. pers, *Convolvulus arvensis* and *Chinopodium album*. The minimum weed biomass was recorded in mulching with T_2 (hand weeding at the interval of 15 days) over control. The maximum weed control efficiency was recorded in the treatment T_2 (hand weeding at the interval of 15 days). The weed competition index was found minimum in treatment T_2 (hand weeding at the interval of 15 days) followed by T_9 (three hand weeding 15, 30, 45 DAT + black polythene mulch (50 μ)) and T_{10} three hand weeding (15, 30, 45 DAT) + white polythene mulch (50 μ).

Keywords:
Chilli, Weed flora, Weed Control Efficiency, Weed Competition Index

INTRODUCTION

Chilli (*Capsicum annuum* L.) widely known as pepper, is a member of family Solanaceae. Chillies are one of the rich sources of vita min A (292 IU) and C (111 mg) per 100 g fresh weight available. It is a vegetable as well as spice and one of the most important cash crops of India. It is used for industrial purpose due to extraction of oleoresin. Green fruit of chilli and sweet peppers are one of the richest sources of anti- oxidant vitamins such as vitamin A, C and E, these antioxidant in food protect occurrence of cancer. The capsaicin alkaloid is responsible for pungency and it has medicinal value also. At ripening stage, fruit become red in colour due to presence of capsanthin pigment. In India, the major chillies growing states are Andhra Pradesh, Karnataka, Maharashtra, Orissa, Tamil Nadu, Madhya Pradesh and Rajasthan. India occupies 0.794 million ha area and annual production 1.304 million tons, while in Madhya Pradesh it occupies 0.054 million ha area and produce 0.093 million tons, (Indian Horticulture data base, 2013).

The infestation of field with weeds is a limiting factor in the production of chilli. The presence of weeds in the crop reduces the availability of nutrient and water and thereby photosynthetic efficiency, dry matter production and its distribution to economical parts, reduces sink capacity of crop resulting in poor fruit yield. Thus, the extent of reduction in fruit yield of chilli has been reported to be in the range of 60 to 70 per cent depending on the intensity and weed density in standing crop (Patel *et al.* 2004). It is well established that 30 to 60 day after transplanting is the most critical for crop-weed competition in chilli. Hence, managing weeds during this period is most critical for higher yields. But, the competing weeds pose problem greatly and need effective management to obtain higher yields.

The mulches can be used to solve the problem of weed infestation. It stimulates the microbial activity in soil through improvement of soil properties, it minimizes the requirement of nitrogen fertilizer, warms the soil and suppresses weed growth and therefore increases yield. Mulching is a cropping practice that entails placing organic or synthetic materials on the soil close to plants to provide a more favorable environment for growth and development. Organic mulches include banana leaves, palm leaves, hay, straw, grass clippings, and compost, all of which provide nutrients to the soil during the decomposition process. Inorganic mulches on the other hand, include red, white, and black plastic mulches which are usually used in combination with drip irrigation for enhanced plant establishment and to consume soil moisture. Worldwide, polyethylene mulch is extensively used for crop production because it controls weeds, conserves soil moisture; increases soil temperature, increases crop yield and quality. It is readily

**Corresponding author Email:* omprakashcoa@gmail.com

available in the market and has a relatively low cost. However, there are some disadvantages of mulching. These include greater initial cost of materials and the removal and disposal of mulch materials from the field.

MATERIALS AND METHODS

The present experiment entitled 'Effect of different mulches on weed flora and its population in chilli' was conducted during *Rabi season* of 2014-2015 at experimental farm of the Department of Horticulture, College of Agriculture, R.V.S.K.V.V. Gwalior (Madhya Pradesh). The experimental site is situated in Gird Zone of M.P. at latitude of 26°.13' North and longitude 76°.14' east with an altitude of 211.52 meters from mean sea level. The soil of the experimental field was alluvial having sandy loam texture with uniform topography. The experiment consisting of fifteen treatments on chilli variety Kalipeeth transplanted in plots (2 X 3 m^2) in Randomized Block Design (RBD) with three replications. The row and plant spacing was maintained at 60 cm and 50 cm respectively and each plot accommodated 20 plants. Mulching material: (i) Plastic mulching-After taking the required length of film for crop, (2x3 m^2/plot) one end of the mulch film was anchored in the soil approximately 4-6 inch and then film was unrolled along the length and width of the plot. A sharp tin on a handle was used to easily cut a hole on tightly laid mulched at 50 cm spacing and then transplanting done.(ii)Organic mulching- before lying of paddy and soybean straw, transplanting distance of 50 cm was marked. After marking, seedlings were transplanted and simultaneously organic mulches spread.

The objectives of the present investigation were to study the effect of mulches on weed flora and its population in chilli, to find out the response of different mulches on weed flora & its control in chilli. The analysis of variance was calculated using formula proposed by Panse and Sukhatme (1963). Weed control efficiency was calculated by the formula as suggested by Mani *et al.* (1973) and weed index was worked out by Gill and Kumar (1966).

Details of different fifteen treatments applied in chilli:

T_1	:	Control (without treatments)
T_2	:	Hand weeding (At the interval of 15 days)
T_3	:	Paddy straw mulch
T_4	:	Soybean straw mulch
T_5	:	Black polythene mulch (50 μ)
T_6	:	White polythene mulch (50 μ)
T_7	:	Three hand weeding (15,30,45 DAT) +Paddy straw mulch
T_8	:	Three hand weeding (15,30,45 DAT) + Soybean straw mulch
T_9	:	Three hand weeding (15,30,45 DAT) + Black polythene mulch (50 μ)
T_{10}	:	Three hand weeding (15,30,45 DAT) + White polythene mulch (50 μ)
T_{11}	:	Paddy straw mulch + Soybean straw mulch
T_{12}	:	Paddy straw mulch +Black polythene mulch (50 μ)
T_{13}	:	Paddy straw mulch +White polythene mulch (50 μ)
T_{14}	:	Soybean straw mulch+Black polythene mulch (50μ)
T_{15}	:	Soybean straw mulch+White polythene mulch (50μ)

Weed control efficiency (%)-Weed control efficiency (WCE) denotes the magnitude of weed reduction due to the weed control treatment. The weed control efficiency was calculated by using the formula given by Patel *et al.* (1987).

$$WCE\ (\%) = \frac{\text{Weed dry wt. in weedy check - Weed dry wt. in treatment}}{\text{Weed dry weight of weedy check}} \times 100$$

Weed competition index (%)-Weed competition index indicates the decrease or increase in yield of weeded and treated plots affected by the crop weed competition and is calculated by the formula as suggested by Gill and Kumar (1969).

$$\text{Weed index} = \frac{X-Y}{X} \times 100$$

Where,
X= Yield of weeded check
Y= yield of treatment.

Weed relative density (%)-Weed population was counted before harvesting in each treatment and relative density calculated by the following formula as suggested by Mishra (1968).

$$\text{Relative density (\%)} = \frac{\text{Number of individual species}}{\text{Number of individual of all species}} \times 100$$

RESULTS AND DISCUSSIONS

Weed prevalence-The weeds competing with chilli crop consisted of *Cyperus rotundus* L.,*Cynodon dactylon* (L.) Pers., *Convolvulus arvensis* and *Chenopodium album* (Table1). Similar weed species were also reported by Prakash *et al.* (2003) and Shaikh (2005).

Weed density and Relative density -A perusal of data presented in the (Table 2 & 3). clearly indicated that the weed density of *Cyperus rotundus* L., *Cynodon dactylon* (L.) Pers. *Convolvulus arvensis and Chenopodium album*, were significantly influenced by the different organic and inorganic mulches at 60, 90 and 120 DAT. The minimum weed density and relative density of all the dominant weed species were found in treatment T_2 (hand weeding at the interval of 15 days), followed by T_9 (three hand weeding (15, 30, 45 DAT) + black polythene mulch (50 μ)) and T_8 - (three hand weeding (15, 30, 45 DAT) + Soybean straw mulch), while, the maximum weed population in all the crop growth stages were recorded under in control. This might be due to that the black plastic mulch does not allow the sunlight to pass through on to the soil. Oxygen and hydrogen also cannot pass through the sheet, hence, it restricts the photosynthesis below the mulch and it arrests the weed growth. The result was in close proximation to Hosmani (1993) and Schonbeck (1999) who reported that the light stimulus eliminates weed seed germination. The organic mulches were also effective in suppression of weeds and helped to retain the soil moisture. The soybean straw mulch was effective to control the weed population in the experimental field. It controls weeds by preventing them receiving the sunlight needed for growth thus,

Table 1: Weed diversity in experimental field of chilli

S. No.	Common name	Botanical name	Family	Group	Life cycle
I.	Motha	*Cyperus rotundus* L.	Cyperaceae	Monocot	Perennial
II.	Doob grass	*Cynodon dactylon* (L.) Pers.	Gramineae	Monocot	Perennial
III.	Hirankhuri	*Convolvulus arvensis*	Convolvulaceae	Dicot	Annual
IV.	Bathua	*Chenopodium album*	Chenopodiaceae	Dicot	Annual

Table 2: Effect of different weed control treatments on Number of weeds and Relative density in chilli

Treatments	Motha (*Cyperus rutundus* L.)				*Doob grass (Cynodon dactylon* L. Pers)			
	Number of weeds (m^2)			Relative density (%)	Number of weeds (m^2)			Relative density (%)
	60 DAT	90 DAT	120 DAT		60 DAT	90 DAT	120 DAT	
T_1 - Control (without treatments)	4.97	9.34	11.55	30.27	6.34	8.43	9.77	29.73
T_2 - Hand weeding (At the interval of 15 days)	1.84	2.68	3.02	38.19	1.01	2.10	3.10	29.22
T_3 - Paddy straw mulch	3.97	6.34	7.62	25.95	6.01	7.43	8.10	31.90
T_4 - Soybean straw mulch	3.63	5.68	7.28	26.49	5.34	7.23	7.97	33.54
T_5 - Black polythene mulch (50 µ)	3.3	4.68	6.63	27.14	4.34	6.43	7.10	33.73
T_6 - White polythene mulch (50 µ)	3.63	4.68	6.96	26.33	4.68	6.77	7.77	33.58
T_7 - Three hand weeding (15,30,45 DAT) +Paddy straw mulch	2.33	3.67	4.64	28.60	2.33	4.93	5.77	34.19
T_8-Three hand weeding (15,30,45 DAT) + Soybean straw mulch	2.14	2.98	4.46	27.64	2.13	4.77	5.43	34.75
T_9 - Three hand weeding (15,30,45 DAT) + Black poly. mulch (50 µ)	1.97	2.83	4.01	30.98	1.68	3.10	4.77	32.41
T_{10}-Three hand weeding (15,30,45 DAT) + White poly. mulch (50 µ)	2.04	2.97	4.39	29.61	1.89	3.43	5.26	32.37
T_{11} - Paddy straw mulch + Soybean straw mulch	3.63	5.01	7.28	26.25	5.01	7.10	7.77	33.49
T_{12} - Paddy straw mulch + Black polythene mulch (50 µ)	2.67	4.34	5.65	24.10	3.01	5.77	6.43	28.94
T_{13} - Paddy straw mulch + White polythene mulch (50 µ)	2.97	4.67	6.56	26.98	3.68	6.43	6.77	32.53
T_{14} - Soybean straw mulch+ Black polythene mulch (50 µ)	2.63	3.68	4.72	27.38	2.44	5.32	6.21	33.42
T_{15} - Soybean straw mulch + White polythene mulch (50 µ)	2.97	4.34	5.97	27.11	3.68	6.43	6.63	34.37
S.Em+	0.025	0.049	0.092	-	0.048	0.051	0.047	-
C.D.at 5 % level	0.061	0.118	0.221	-	0.116	0.123	0.113	-

Table 3: Effect of different weed control treatments on Number of weeds and Relative density in chilli

Treatments	Hirankhuri (*Convolvulus arvensis*)				Bathua (*Chenopodium album*)			
	Number of weeds (m^2)			Relative density (%)	Number of weeds (m^2)			Relative density (%)
	60 DAT	90 DAT	120 DAT		60 DAT	90 DAT	120 DAT	
T_1 - Control (without treatments)	3.68	4.36	5.04	16.02	5.34	6.36	8.03	23.98
T_2 - Hand weeding (At the interval of 15 days)	0.34	1.03	1.36	12.51	1.01	1.36	1.56	20.09
T_3 - Paddy straw mulch	3.34	3.70	4.36	16.94	4.68	5.70	6.70	25.21
T_4 - Soybean straw mulch	3.01	3.70	4.02	17.68	3.68	4.03	6.03	22.28
T_5 - Black polythene mulch (50 µ)	2.34	3.03	3.36	16.66	3.34	3.70	4.70	22.46
T_6 - White polythene mulch (50 µ)	2.68	3.36	3.70	17.26	3.68	3.90	5.36	22.82
T_7 - Three hand weeding (15,30,45 DAT) +Paddy straw mulch	1.46	1.91	2.22	15.50	2.01	2.53	3.36	21.71
T_8-Three hand weeding (15,30,45 DAT) + Soybean straw mulch	1.37	1.82	2.03	15.59	2.01	2.46	2.86	22.02
T_9 - Three hand weeding (15, 30,45 DAT) + Black poly. mulch (50 µ)	1.12	1.36	1.70	15.22	1.46	2.36	2.04	21.39
T_{10}-Three hand weeding (15, 30,45 DAT) + White poly. mulch (50 µ)	1.34	1.70	2.04	16.73	1.47	2.46	2.70	21.29
T_{11} - Paddy straw mulch + Soybean straw mulch	3.01	3.36	4.02	17.70	3.68	4.03	5.70	22.56
T_{12} - Paddy straw mulch + Black polythene mulch (50 µ)	3.01	3.36	4.02	20.66	3.68	4.03	5.70	26.30
T_{13} - Paddy straw mulch + White polythene mulch (50 µ)	2.34	3.03	3.36	17.22	3.34	3.70	4.70	23.27
T_{14} - Soybean straw mulch+ Black polythene mulch (50 µ)	1.68	2.36	2.70	16.91	2.34	2.90	3.58	22.29
T_{15} - Soybean straw mulch + White polythene mulch (50 µ)	2.13	2.70	3.04	16.52	3.01	3.36	4.03	21.99
S.Em+	0.027	0.028	0.032	-	0.036	0.037	0.053	-
C.D.at 5 % level	0.066	0.068	0.077	-	0.086	0.090	0.126	-

Table 4: Fresh biomass (g / m^2) of various weed floras at different intervals as influenced by various weed control treatments in chilli

Treat.	Fresh biomass (g / m^2) of Bathua (*Chenopodium album*)			Fresh biomass (g / m^2) of Hirankhuri (*Convolvulus arvensis*)			Fresh biomass (g / m^2) of Doob Grass (*Cynodon dactylon* (L.) Pers.			Fresh biomass (g / m^2) of Motha (*Cyperus rotundus* L.		
	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT
T_1	11.46	13.81	16.78	7.13	8.47	12.11	14.8	18.81	21.44	11.8	17.81	24.78
T_2	2.13	3.47	3.11	0.80	2.47	2.78	2.46	4.47	7.44	4.13	6.14	7.44
T_3	9.8	12.14	14.11	6.13	7.81	11.22	12.8	15.81	19.78	8.46	11.47	17.11
T_4	8.13	11.47	13.44	5.46	7.26	10.98	11.46	14.81	18.78	8.13	10.14	16.44
T_5	7.13	9.58	12.78	4.80	6.14	10.11	10.8	12.7	17.34	7.13	8.14	15.44
T_6	7.46	9.81	12.78	5.13	6.81	10.44	11.13	13.14	17.54	7.46	8.47	15.78
T_7	5.35	7.47	10.44	3.34	5.14	8.11	7.8	8.81	11.44	6.3	7.14	12.44
T_8	5.13	7.47	10.44	3.13	4.81	7.78	7.79	8.47	10.78	5.8	6.81	12.11
T_9	4.13	6.14	8.11	2.46	3.81	5.11	5.46	7.14	9.11	4.38	6.47	10.44
T_{10}	4.57	6.81	9.44	2.80	4.47	7.44	7.13	7.81	10.11	5.68	6.69	10.45
T_{11}	7.8	10.47	13.11	5.35	7.14	10.78	11.36	14.47	17.78	7.8	9.14	16.11
T_{12}	7.8	7.92	11.22	5.35	7.14	10.78	11.36	14.47	17.78	6.46	9.14	16.11
T_{13}	6.8	9.47	12.44	4.46	6.03	9.78	9.80	12.47	16.78	6.46	7.81	15.11
T_{14}	5.67	7.81	10.78	3.46	5.47	8.44	8.26	11.47	13.78	6.36	7.45	12.78
T_{15}	6.13	9.27	11.45	4.16	5.81	9.45	9.46	12.47	16.55	11.8	7.48	13.44
S.Em+	0.067	0.074	0.089	0.047	0.046	0.072	0.089	0.110	0.124	0.053	0.084	0.115
C.D.at 5 %	0.161	0.179	0.215	0.113	0.112	0.174	0.214	0.265	0.299	0.127	0.202	0.276

Table 5: Dry weight (g / m^2) of various weed floras at different periodic intervals and weed control efficiency (%) as influenced by various weed control treatment in chilli field

Treat.	Dry weight (g / m^2) of Bathua (*Chenopodium album*)			Weed control efficiency (%)	Dry weight (g / m^2) of Hirankhuri (*Convolvulus arvensis*)			Weed control efficiency (%)
	60 DAT	90 DAT	120 DAT		60 DAT	90 DAT	120 DAT	
T_1	5.93	6.37	7.11	-	3.13	3.81	4.44	-
T_2	0.8	1.31	1.78	79.96	0.46	0.81	1.28	77.57
T_3	4.3	5.47	6.58	15.77	2.8	3.47	3.78	11.61
T_4	3.7	3.81	5.51	32.92	2.7	3.25	3.44	17.41
T_5	2.8	3.31	4.61	44.77	2.28	2.47	3.04	31.49
T_6	3.06	3.47	4.78	41.73	2.34	2.74	3.34	25.95
T_7	2.13	2.27	3.21	60.79	1.46	1.81	2.44	49.78
T_8	1.8	2.14	3.11	63.68	1.35	1.69	2.11	54.71
T_9	1.46	1.81	2.44	70.58	0.96	1.31	1.44	67.37
T_{10}	1.68	2.12	2.78	66.10	1.3	1.64	1.78	58.49
T_{11}	3.46	3.64	5.08	37.25	2.56	3.01	3.44	20.76
T_{12}	3.46	3.64	5.08	37.25	2.56	3.01	3.44	20.76
T_{13}	2.8	3.27	3.77	49.30	2.15	2.47	3.04	32.63
T_{14}	2.24	2.47	3.25	58.99	1.56	2.14	2.44	46.00
T_{15}	2.46	3.01	3.61	53.22	2.13	2.26	2.84	36.41
S.Em±	0.037	0.039	0.044	-	0.022	0.024	0.026	-
C.D.at 5 %	0.088	0.093	0.106	-	0.053	0.059	0.062	-

Table 6: Dry weight (g / m^2) of various weed floras at different periodic intervals and weed control efficiency (%) as influenced by various weed control treatment in chilli field

Treat.	Dry weight (g / m^2) of Doob Grass (*Cynodon dactylon* (L.) Pers.			Weed control efficiency (%)	Dry weight (g / m^2) of Motha (C*yperus rotundus* L.			Weed control efficiency (%)
	60 DAT	90 DAT	120 DAT		60 DAT	90 DAT	120 DAT	
T_1	6.3	3.36	9.11	-	4.46	5.64	6.78	-
T_2	0.96	7.64	1.61	45.63	1.13	1.31	1.78	75.01
T_3	5.77	4.26	7.24	8.04	3.8	4.84	4.94	19.60
T_4	5.25	3.47	6.78	17.47	3.8	4.44	4.94	21.97
T_5	4.35	3.81	6.28	23.11	3.46	4.14	4.55	28.06
T_6	4.36	3.47	6.28	24.87	3.57	4.24	4.76	25.58
T_7	2.96	5.94	4.55	28.38	2.43	2.79	4.23	44.05
T_8	2.3	2.47	4.11	52.72	2.13	2.36	3.61	52.04
T_9	1.8	4.31	2.78	52.66	1.46	1.64	2.11	69.15
T_{10}	1.96	3.47	3.47	52.61	1.8	2.14	2.78	60.21
T_{11}	4.49	3.64	6.44	22.42	3.8	4.26	4.86	23.51
T_{12}	4.49	3.64	6.44	22.42	3.8	4.26	4.86	23.51
T_{13}	4.13	4.57	5.94	22.04	3.23	4.06	4.44	30.55
T_{14}	3.35	5.81	5.23	23.38	2.46	3.41	4.28	39.91
T_{15}	3.63	1.47	5.78	42.07	3.13	3.97	4.31	32.45
S.Em±	0.044	0.043	0.055	-	0.029	0.036	0.036	-
C.D.at 5 %	0.106	0.103	0.132	-	0.069	0.087	0.086	-

Table- 7: Weed biomass (g / m^2) and weed control efficiency (%) as influenced by different weed control treatment in chilli field

Treatments	Weed biomass (g / m^2)	Weed control efficiency (%)	Weed competition index (%)
T_1 - Control (without treatments)	18.36	-	46.19
T_2 - Hand weeding (At the interval of 15 days)	8.72	52.48	0.00
T_3 - Paddy straw mulch	15.47	15.72	41.84
T_4 - Soybean straw mulch	14.25	22.37	36.53
T_5 - Black polythene mulch (50 µ)	13.52	26.39	32.31
T_6 - White polythene mulch (50 µ)	13.11	28.62	32.79
T_7 - Three hand weeding (15,30,45 DAT) +Paddy straw mulch	11.59	36.89	21.62
T_8-Three hand weeding (15,30,45 DAT) + Soybean straw mulch	9.49	48.29	22.19
T_9 - Three hand weeding (15,30,45 DAT) + Black polythene mulch (50 µ)	9.35	49.06	7.67
T_{10}-Three hand weeding (15,30,45 DAT) + White polythene mulch (50 µ)	9.61	47.64	15.73
T_{11} - Paddy straw mulch + Soybean straw mulch	13.81	24.78	47.34
T_{12} - Paddy straw mulch + Black polythene mulch (50 µ)	13.81	24.78	47.34
T_{13} - Paddy straw mulch + White polythene mulch (50 µ)	13.38	27.12	38.47
T_{14} - Soybean straw mulch+ Black polythene mulch (50 µ)	12.20	33.54	28.11
T_{15} - Soybean straw mulch + White polythene mulch (50 µ)	10.63	42.11	25.30

minimizing weed plants by eliminating competition for water and nutrients. Similar results were also observed under the straw mulch at planting time which suppressed weeds in potato.

Weed biomass -The biomass accumulated by weed is the real index which determines the efficiency of organic and inorganic mulching to control the weed (Table 4). The minimum fresh weed biomass of *Cyperus rotundus* L., *Cynodon dactylon* (L.) Pers., *Convolvulus arvensis, Chenopodium album,* were recorded in the treatment T_2 (hand weeding at the interval of 15 days) followed by T_9 (three hand weeding (15, 30, 45 DAT) + black polythene mulch (50 µ)), T_{10} (three hand weeding (15, 30,45 DAT) + white polythene mulch (50 µ)) and T_8 (three hand weeding (15,30,45 DAT) + Soybean straw mulch). While, the maximum fresh weed biomass were recorded in control. This result is consistent with the findings of Schonbeck (1999) and Ashrafuzzaman (2011). Similarly, dry weed biomass of *Cyperus rotundus* L., *Cynodon dactylon* (L.) Pers., *Convolvulus arvensis and Chenopodium album,* were reported maximum in control and minimum were reported in the treatment T_2 (hand weeding at the interval of 15 days), followed by T_9 (three hand weeding (15, 30, 45 DAT) + black polythene mulch (50 µ)) and T_{10} (three hand weeding (15, 30, 45 DAT) + white polythene mulch (50 µ)). It is very well clear that the decreasing number of weeds m^2, relative density and biomass under the treatment T_9 Three hand weeding (15, 30, 45 DAT) + black polythene mulch (50 µ)) might be due to the antagonistic effect on the weed growth by warming the soil temperature and intercepting the all coming radiations contribute to weed management by maintaining the crop stability to tolerate and compete with weed. Ngouajio and Ernest (2004) reported minimum weed biomass in black plastic mulch. The black plastic mulch suppressed the weeds except a few, which emerged through the planting hole.

Transparent plastic mulch produced maximum weed population and dry matter which might be due to direct entrance of solar radiation through them and as well as due to higher soil temperature and soil moisture content, especially at the upper 5 cm depth. The blue plastic also allowed easy entrance of solar radiation through it, hence, produced moderate weed density and biomass. Black plastic mulch produced weeds only through the punch and no weed was found under the plastic, which might be due to lack of percentage of light through black plastic. Black plastic mulch blocked the weeds, except a few, which emerged through the planting holes (Schonbeck, 1998). Zhang *et al.* (1992) reported that black plastic film mulch resulted in 100% control of all the weeds in maize that supported the present experimental result.

Weed control efficiency (%)-Maximum weed control efficiency (Table 5 & 6) was observed in the treatment T_2 (Hand weeding at the interval of 15 days) followed by T_9 (three hand weeding (15, 30, 45 DAT) + Black polythene mulch (50 µ)), T_8 (three hand weeding 15, 30 and 45 DAT + Soybean straw mulch) and T_{10} (three hand weeding (15, 30 and 45 DAT) + white polythene mulch (50 µ)). This might be due to better control of weeds by these treatments. Similar result was also reported by Tei (1986).

Weed competition index-The weed competition index (Table 7) also indicates that the yield reduction would be due to weeds over T_1 (control). The maximum reduction in weeds and increase in fruit yield was noted in the T_2 (Hand weeding at the interval of 15 days), followed by T_9 (Three hand weeding (15, 30, 45 DAT) + black polythene mulch (50 µ)) and T_{10} (three hand weeding (15, 30, 45 DAT) + white polythene mulch (50 µ). These results are agreement with findings of Frank *et al.* (1988) and Khakhar *et al.* (2006).

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References

Ashrafuzzaman, M., Abdul Halim, M., Mohd Razi Ismail, Shahidullah, S.M. and Alamgir Hossain, M. (2011) Effect of plastic mulch on growth and yield of chilli (*Capsicum annuum* L.) Braz. arch. biol. Technol, 54 (2):42.67.

Frank, J.R., Schwartz, P.H. and Bourke, J.B. (1988). Insect and weed interactions in bell pepper *(Capsicum annuum* L.*).* Weed Technology 8: 423-428.

Gill, G.S. and Kumar, V.M. (1966). Weed index of new method for reporting weedicides trial. Proc. 2nd weed control seminar (FAVU campus Hisar).

Gill, G.S. and Vijaya kumar (1969). "Weed index" A new method for reporting weed control trials. Indian J. Agron., 16: 96-98.

Hosmani M.M. (1993). Chilli crop (Capsicum annum L.). Soil Chemical Analysis Prentice Hall of India Pvt., New Delhi, pp. 173-175.

Khakhar, K.M., Mehmood, T. and Muhammad, S. (2006). Evaluation of integrated weed management practices for chilli. Pakistan Journal of Weed Science Research16 (3): 203.

Mishra, R. (1968). Community structure ecology work book oxford IBM Publication Company New Delhi 31-33.

Ngouajio, M. and Ernest, J. (2004). "Light transmission through colored polyethylene mulches affected weed population". Horticulture Science 39 (6): 1302-1304.

NHB (2013) Indian Horticulture Data Base-(1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005 & 2006), NHB. Indian Horticulture Road Map (NHB Publication). Government of India, Gurgaon, India. http://www.nhb.gov.in.

Panse, V.G. and Sukhatme, P.V. (1985) Statistical Methods for Agricultural Workers, 4th ed., ICAR, New Delhi, 347.

Patel, A.B., Barevadia, T.N., Patel, B.D. and Meisuriya, M. (2004) Effect of cultural and chemical methods on weed and fruit yield of green chilli. Indian Journal of Weed Science, 36 (3&4): 300-301.

Prakash, V., Pandey, A.K., Singh, R.D. and Gupta, H.S. (2003). Integrated weed management in chilli under Mid -Hill conditions of North- Western Himalayas. Indian Journal of Agronomy 48 (2): 139-14.

Schonbeck, M.W. (1999). Weed suppression and labor costs associated with organic, plastic and paper mulches in small-scale vegetable production. Journal of Agriculture 13: 13-33.

Shaikh, A.R. (2005). Integrated weed management in *Rabi* chilli *(Capsicum annuum* L.*).* Indian Journal of Weed Science 37 (3&4): 285-286.

Tei, F. (1986). Competition between *Echinochloa crus-galli* (L.) Beaur and pepper. *(Capsicum annuum* L.) In Weed Control in Vegetable production. Meeting of the EC experts group, Netherland. Reviews of Weed Science 2: 67–89.