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Effect of different mulches on weed control in chilli (*Capsicum annuum* L.)

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Abstract

A field experiment was conducted at the College of Horticulture, Dr. Y.S.R. Horticultural University, Anantharajupeta, Andhra Pradesh, to evaluate different mulches for weed management in chilli (*Capsicum annuum* L.) genotype LCA-625. The experiment was conducted in Randomized Block Design with six treatments and three replications. Silver-on-black polythene recorded the lowest weed density (18.33 weeds m^{-2}), fresh weed weight (142.67 g m^{-2}) and dry weed weight (31.67 g m^{-2}). It also recorded the highest weed control index (86.72%) and weed control efficiency (86.81%). Black polythene was the next most effective treatment, while unmulched control recorded maximum weed infestation.

Keywords: Chilli, LCA-625, mulching, weed density, weed biomass, weed control index, weed control efficiency

1. Introduction

Chilli (*Capsicum annuum* L.) is an important vegetable and spice crop cultivated widely for its green and dry fruits. Weed infestation is one of the major problems in chilli production, particularly during the early stages of crop growth. Weeds compete with chilli plants for water, nutrients, light and space, which can affect crop growth and yield. Manual weeding is labour-intensive and increases the cost of cultivation. Therefore, mulching is an important alternative method for weed management. Mulch covers the soil surface and suppresses weeds by reducing light penetration and creating a physical barrier to weed emergence (Teasdale and Mohler, 2000) [15].

Plastic mulches, particularly black and silver-on-black polythene, are widely used in vegetable crops because they effectively suppress weeds and modify soil temperature and moisture conditions (Tarara, 2000 and Lamont, 2005) [14, 8]. Organic materials such as neem leaves and dry grass can also reduce weed emergence by shading the soil surface and physically restricting weed growth (Schonbeck and Evanylo, 1998) [11]. The effectiveness of different mulches varies with their colour, material, thickness and persistence. Therefore, evaluation of different mulch materials is important for selecting an effective weed-management practice in chilli. Hence, the present study was undertaken to evaluate the effect of different mulches on weed control in chilli genotype LCA-625.

2. Materials and Methods

The field experiment was conducted during Summer 2024 at the College of Horticulture, Dr. Y.S.R. Horticultural University, College of Horticulture-Anantharajupeta, Andhra Pradesh, using chilli genotype LCA-625. The experiment was laid out in a Randomized Block Design (RBD) with six treatments and three replications.

The treatments included silver-on-black polythene mulch (T_1), black polythene mulch (T_2), transparent polythene mulch (T_3), neem leaf mulch (T_4), dry grass mulch (T_5) and no mulch/control (T_6). Mulching materials were applied uniformly to the respective plots, while all other crop-management practices were followed uniformly. Weed observations were recorded from randomly selected areas of each plot. Weed density (No. m^{-2}), fresh weed weight (g m^{-2}) and dry weed weight (g m^{-2}) were recorded. The collected weeds were weighed for fresh weight and then oven-dried to constant weight for determining dry weight.

Weed Control Index (WCI) and Weed Control Efficiency (WCE) were calculated using standard formulas:

$$\text{WCI (\%)} = \frac{W_c - W_t \times 100}{W_c}$$

$$\text{WCE (\%)} = \frac{D_c - D_t \times 100}{D_c}$$

where W_c and W_t represent weed dry weight in control and treatment, respectively, while D_c and D_t represent weed density in control and treatment, respectively.

The data were statistically analysed using Randomized Block Design, and treatment means were compared at the 5% level of significance following Gomez and Gomez (1984) [3].

3. Results and Discussion

The different mulching treatments influenced weed infestation in chilli genotype LCA-625. The results for weed density, fresh and dry weight of weeds, weed control index (WCI) and weed control efficiency (WCE) are presented in Table 1.

3.1 Weed density

The lowest weed density was recorded with silver-on-black polythene mulch (18.33 weeds m^{-2}), followed by black polythene mulch (26.67 weeds m^{-2}). Transparent polythene, neem leaf and dry grass mulches recorded 41.67, 58.33 and 72.67 weeds m^{-2} , respectively. The highest weed density (142.33 weeds m^{-2}) was recorded in the unmulched control. The lower weed density under plastic mulches may be due to restricted light penetration and the physical barrier created by the mulch, which prevented weed emergence. Teasdale and Mohler (2000) [15] reported that the physical properties of mulch, particularly light interception, strongly influence weed emergence. Similar weed-suppressing effects of polyethylene mulch were reported by Kasirajan and Ngouajio (2012) [7]. Plastic mulch can also modify soil temperature and moisture, which may influence weed germination and establishment (Tarara, 2000 and Lamont, 2005) [14, 8].

3.2 Fresh and dry weight of weeds

Silver-on-black polythene mulch recorded the lowest fresh weed

weight (142.67 g m^{-2}) and dry weed weight (31.67 g m^{-2}), followed by black polythene mulch with 205.33 and 46.33 g m^{-2} , respectively. The highest fresh and dry weed weights were recorded in the control (1035.00 and 240.00 g m^{-2} , respectively). The reduction in weed biomass under plastic mulch may be attributed to reduced weed emergence and restricted weed growth due to limited light availability. Lamont (2005) [8] reported that plastic mulch is effective in suppressing weeds and modifying the crop microenvironment. Similar results were reported by Kader *et al.* (2017) [6], who indicated that mulching can effectively reduce weed growth by modifying the soil environment.

Neem leaf and dry grass mulches also reduced weed biomass compared with the control. Organic mulches suppress weeds mainly through shading and physical obstruction. However, their effectiveness depends on the thickness, uniformity and persistence of the mulch material (Schonbeck and Evanylo, 1998 and Chalker-Scott, 2007) [11, 1].

3.3 Weed Control Index and Weed Control Efficiency

The highest weed control index (86.72%) and weed control efficiency (86.81%) were recorded with silver-on-black polythene mulch, followed by black polythene mulch with 80.58 and 80.68%, respectively. Transparent polythene mulch recorded 69.42% WCI and 69.54% WCE. Neem leaf and dry grass mulches recorded comparatively lower values. The superior performance of silver-on-black polythene mulch may be attributed to effective light interception and the physical barrier provided by the mulch. The black surface restricts light reaching the soil surface, thereby reducing weed emergence. Teasdale and Mohler (2000) [15] emphasized the importance of light interception in weed suppression by mulches. Similar observations regarding the effectiveness of polyethylene mulches in weed management were reported by Kasirajan and Ngouajio (2012) [7] and Kader *et al.* (2017) [6].

Thus, silver-on-black polythene mulch was the most effective treatment for reducing weed infestation in chilli genotype LCA-625. However, the environmental concerns associated with conventional polyethylene mulch should be considered. Steinmetz *et al.* (2016) [13] reported potential long-term concerns associated with plastic residues in agricultural soils, while Sintim and Flury (2017) [12] suggested biodegradable mulch as a possible alternative.

Table 1: Effect of different mulches on weed parameters in chilli

Treatment	Weed density (No. m^{-2})	Fresh weight of weeds (g m^{-2})	Dry weight of weeds (g m^{-2})	WCI (%)	WCE (%)
T ₁ – Silver-on-black polythene mulch	18.33	142.67	31.67	86.72	86.81
T ₂ – Black polythene mulch	26.67	205.33	46.33	80.58	80.68
T ₃ – Transparent polythene mulch	41.67	318.33	73.00	69.42	69.54
T ₄ – Neem leaf mulch	58.33	426.00	99.00	58.57	58.71
T ₅ – Dry grass mulch	72.67	528.33	121.67	49.08	49.25
T ₆ – Control	142.33	1035.00	240.00	0.00	0.00
S.Em. $\pm$	2.84	18.76	4.31	1.42	1.39
CD (P = 0.05)	8.76	57.86	13.29	4.38	4.29
CV (%)	6.82	7.54	7.21	3.68	3.55

4. Conclusion

The present study revealed that different mulching materials effectively reduced weed infestation in chilli genotype LCA-625. Among the treatments, silver-on-black polythene mulch was the most effective, recording the lowest weed density (18.33 weeds m^{-2}), fresh weed weight (142.67 g m^{-2}) and dry weed weight (31.67 g m^{-2}). It also recorded the highest weed control index (86.72%) and weed control efficiency (86.81%), followed by

black polythene mulch. Neem leaf and dry grass mulches provided moderate weed suppression, while the unmulched control recorded the highest weed infestation. Thus, silver-on-black polythene mulch can be recommended as an effective mulch for managing weeds in chilli genotype LCA-625. Further studies on biodegradable and locally available organic mulches may help identify environmentally sustainable alternatives to conventional plastic mulch.

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