Original Research Article

Effect of Organic and Inorganic Mulches on Quality and Soil parameters on ridge gourd

Abstract

Aim: To study the different mulches on quality and soil parameters on ridge gourd

Study design: The experiment was carried out with 7 treatments in Randomized Block Design (RBD) with three replications.

Place and duration of study: Research trial was carried out at P.G block, College of Horticulture, Rajendranagar, SKLTSHU, Hyderabad during *Kharif*, 2021 and Summer, 2022.

Results: Among the organic and inorganic mulches treatments, the results reported that the silver black polyethylene mulch recorded highest in quality parameters and benefit cost ratio compared to other mulches.

Keywords: *Ridge gourd; Organic mulches; Inorganic mulches; Quality, Soil*

1. INTRODUCTION

Ridge gourd (*Luffa acutangula*) is a popular warm-season vegetable that may be grown commercially from seeds. It can be found throughout the tropical and subtropical regions and is cultivated for its green tender fruits during spring-summer and rainy seasons when the temperature ranges between 20 - 32°C. The unripe fruits are consumed as a cooked vegetable and nutritionally the fruits are rich in several minerals and vitamins. Each 100 g of edible fresh fruit contains around 5 mg vitamin C, 0.01mg riboflavin, 33 µg carotene, 92.5% moisture, 0.5g protein, 0.5 g fat, 3.4 g carbohydrate, 18 mg calcium, 26 mg phosphorous and 0.5 mg iron (1). The application of different doses of nitrogen (N) fertilization increased plant growth and yield (2) Phosphorus is necessary for cellular preparation and in the metabolism of starch, protein and fats. One of the most important effects of phosphorus on plants is the stimulation of early root formation and growth. Low available phosphorus content in soil means delay in maturity and poor plant growth (3). Potassium (K) is the nutrient having the strongest influence on plant growth, yield and quality attributes that determine fruit marketability (4). Therefore, considering the importance of different mulching in various vegetable crops, data and the facts, present investigation entitled Studies on effect of mulches on quality and soil parameters on ridge gourd (*Luffa acutangu*la L.)" was planned to be carried out in growing region of Hyderabad, Telangana, India

2. MATERIALS AND METHODS

2.1 The experimental site

The present investigation was carried out during *Kharif*, 2021 and Summer, 2022 at P.G block, College of Horticulture, Rajendranagar, SKLTSHU, Hyderabad, India.

2.2 The experimentally variants and the experiment design

The plots were demarcated into three (3) replications, each replication with seven treatments and experimental design followed is Randomized Block Design (RBD) replicated thrice consisting of Paddy straw- T_1, Paddy husk- T_2, Groundnut shell- T_3, Leaf mould-T_4, Silver black polyethylene sheet-T_5, Clear transparent polyethylene mulch-T_6 and Control-T_7 which replicated thrice.

2.3 The parameters determined

2.3.1 Quality parameters

The data recorded on quality parameters like TSS (^{o} Brix), Ascorbic acid content (mg/100g), Reducing sugars (%), Non reducing sugars (%), Total sugars (%), Chlorophyll content (DA meter reading) and Crude fibre content (%) were analysed.

2.3.2 Soil parameters

The data recorded on soil parameters like pH, EC (dS/m), Organic carbon (%), Available nitrogen (kg/ha), Available phosphorus (kg/ha), Available potassium (kg/ha) were analysed.

2.4 Statistical analysis

The experimental data collected on various quality, soil components of plant were subjected to Fisher's method of "Analysis of variance" (ANOVA) as outlined by (5) were analysed

3. RESULTS AND DISCUSSION

3.1 Quality parameters

TSS (^{o} Brix)

The data enunciated on the TSS (^{o} Brix) as influenced by the effect of mulching on quality in ridge gourd is presented in Table 1.

Table 1. Effect of mulching on TSS (^{0} Brix), ascorbic acid content (mg/100g) of ridge gourd during *Kharif*, 2021 and Summer, 2022

Treatments	TSS (^{0} Brix)		Ascorbic acid content (mg/100g)	
	Kharif 2021	**Summer 2022**	**Kharif 2021**	**Summer 2022**
T_1: Paddy straw	3.89	4.23	10.21	10.43
T_2 : Paddy husk	3.55	3.49	9.49	9.75
T_3 : Groundnut husk	3.63	3.56	9.56	9.89
T_4 : Leaf mould	3.60	3.35	9.41	9.64
T_5 : Silver black polythene sheet	4.64	4.82	12.82	13.39
T_6 : Clear transparent polythene sheet	3.97	4.58	11.58	12.64
T_7 : Without mulch	2.98	3.27	9.25	9.47
S.Em±	**0.05**	**0.05**	**0.12**	**0.13**
CD at 5%	**0.15**	**0.15**	**0.38**	**0.40**

From the data it is clear that there was significant differences observed among the treatments with respect to TSS during *Kharif* season. Significantly maximum TSS (4.64) was recorded in T_5 (Silver black polyethylene mulch) followed by T_6 (clear transparent polyethylene mulch) (3.97), while the minimum TSS (2.98) was recorded with T_7 (without mulch).

During Summer season among all the treatments, T_5 (Silver black polyethylene mulch) recorded maximum TSS (4.82) followed by T_6 (clear transparent polyethylene mulch) (4.58), while the minimum TSS (3.27) was recorded with T_7 (without mulch).

Ascorbic acid content (mg/100g)

The data presented in Table 1 revealed that during *Kharif* season, significantly maximum ascorbic acid content (12.82) was observed with T_5 (Silver black polyethylene mulch) followed by T_6 (clear transparent polyethylene mulch) recording the ascorbic acid content (11.58). The minimum ascorbic acid content (9.25) was recorded with T_7 (without mulch).

During Summer season, significantly maximum ascorbic acid content (13.39) was observed with T_5 (Silver black polyethylene mulch) and was at par with T_6 (clear transparent polyethylene mulch) recording the ascorbic acid content of 12.64. The minimum ascorbic acid content (9.47) was recorded with T_7 (without mulch).

Reducing sugars (%)

The data enunciated on the reducing sugar as influenced by the effect of mulching on quality in ridge gourd is presented in Table 2.

From the data it is clear that there was significant differences observed among the treatments with respect to reducing sugars during *Kharif* season. Significantly maximum reducing sugars (4.86%) was recorded in T_5 (Silver black polyethylene mulch) followed by T_6 (clear transparent polyethylene mulch) (4.51%), while the minimum reducing sugars (3.45%) was recorded with T_7 (without mulch).

During Summer season among all the treatments, T_5 (Silver black polyethylene mulch) recorded maximum reducing sugars (4.98%) followed by T_6 (clear transparent polyethylene mulch) (4.54%), while the minimum reducing sugars (2.39%) was recorded with T_7 (without mulch).

Non reducing sugars (%)

The data presented in Table 2 revealed that during *Kharif* and Summer season, significantly minimum non reducing sugars (1.45 and 1.47%) was observed with T_5 (Silver black polyethylene mulch), while the maximum reducing sugars (1.73 and 2.50 %) were recorded with T_7 (without mulch) during *Kharif* and Summer season respectively.

Total sugars (%)

The data enunciated on the total sugars as influenced by the effect of mulching on quality in ridge gourd is presented in Table 2.

From the data it is clear that there was significant differences observed among the treatments with respect to total sugars during *Kharif* season. Significantly maximum total sugars (6.31%) was recorded in T_5 (Silver black polyethylene mulch) followed by T_6 (clear transparent polyethylene mulch) (6.03%), while the minimum total sugars (5.18%) was recorded with T_7 (without mulch).

During Summer season among all the treatments, T_5 (Silver black polyethylene mulch) recorded maximum total sugars (6.45%) and was at par with T_6 (clear transparent polyethylene mulch) (6.33%), while the minimum total sugars (4.89%) was recorded with T_7 (without mulch).

Table 2. Effect of mulching on reducing sugars (%), non-reducing sugars (%), total sugars (%) of ridge gourd during *Kharif*, 2021 and Summer, 2022

Reatments	Reducing sugars (%)		Non-reducing sugars (%)		Total sugars (%)	
	Kharif 2021	**Summer 2022**	**Kharif 2021**	**Summer 2022**	**Kharif 2021**	**Summer 2022**
T_1: Paddy straw	3.74	4.27	1.72	1.96	5.41	6.23
T_2 : Paddy husk	3.69	3.65	1.57	1.52	5.30	5.17
T_3 : Groundnut husk	3.73	3.60	1.58	2.14	5.32	5.74
T_4 : Leaf mould	3.56	3.42	1.64	1.76	5.20	5.18
T_5 : Silver black polythene sheet	4.86	4.98	1.45	1.47	6.31	6.45
T_6 : Clear transparent polythene sheet	4.51	4.54	1.52	1.79	6.03	6.33
T_7 : Without mulch	3.45	2.39	1.73	2.50	5.18	4.89
S.Em±	**0.05**	**0.05**	**0.02**	**0.03**	**0.07**	**0.08**
CD at 5%	**0.16**	**0.15**	**0.07**	**0.08**	**0.23**	**0.23**

Chlorophyll content (DA meter reading)

The data presented in Table 3 revealed that during *Kharif* season, significantly maximum chlorophyll content (1.49) was observed with T_5 (Silver black polyethylene mulch) followed by T_6 (clear transparent polyethylene mulch) recording the chlorophyll content of 1.26. The minimum chlorophyll content (0.87) was recorded with T_7 (without mulch).

During Summer season significantly maximum chlorophyll content (1.68) was observed with T_5 (Silver black polyethylene mulch) and was at par with T_6 (clear transparent polyethylene mulch) recording the chlorophyll content of 1.52. The minimum chlorophyll content (0.99) was recorded with T_7 (without mulch).

Crude fibre content (%)

The data presented in Table 3 revealed that during *Kharif* season, significantly minimum crude fibre (2.32) was observed with T_5 (Silver black polyethylene mulch) followed by T_6 (clear transparent polyethylene mulch) recording the chlorophyll content of 2.53. The maximum crude fibre (2.96) was recorded with T_7 (without mulch).

During Summer season significantly minimum crude fibre (2.21) was observed with T_5 (Silver black polyethylene mulch) followed by T_6 (clear transparent polyethylene mulch) recording the crude fibre of 2.50. The maximum crude fibre (2.87) was recorded with T_7 (without mulch).

The improvement in the quality parameters by using silver black polyethylene sheet might be due to better availability and uptake of nutrients which in turn might have lead to more nitrogenous compounds in plant tissues and ultimately resulted in their efficient metabolism. (6,7)

Table 3. Effect of mulching on chlorophyll content, crude fibre content of ridge gourd during *Kharif*, 2021 and Summer, 2022

Treatments	Chlorophyll content		Crude fibre content	
	Kharif 2021	**Summer 2022**	**Kharif 2021**	**Summer 2022**
T_1: Paddy straw	1.13	1.57	2.58	2.53
T_2 : Paddy husk	0.99	1.17	2.64	2.60
T_3 : Groundnut husk	1.14	1.21	2.67	2.58
T_4 : Leaf mould	0.94	1.06	2.80	2.72
T_5 : Silver black polythene sheet	1.49	1.68	2.32	2.21
T_6 : Clear transparent polythene sheet	1.26	1.52	2.53	2.50
T_7 : Without mulch	0.87	0.99	2.96	2.87
S.Em±	**0.01**	**0.02**	**0.04**	**0.04**
CD at 5%	**0.04**	**0.05**	**0.12**	**0.11**

3.2 Soil analysis

pH

It is clear from Table 4 that pH did not vary significantly with different treatments during *Kharif* and Summer season respectively.

Table 4. Effect of mulching on P^H, Electrical conductivity (dS/m) and Organic carbon (%) of ridge gourd during *Kharif*, 2021 and Summer, 2022

Treatments	P^H		Electrical conductivity (dS/m)		Organic carbon (%)	
	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022
T_1: Paddy straw	7.17	7.22	0.287	0.288	0.60	0.64
T_2 : Paddy husk	7.26	7.28	0.283	0.286	0.55	0.56
T_3 : Groundnut husk	7.23	7.23	0.287	0.285	0.57	0.60
T_4 : Leaf mould	7.28	7.35	0.289	0.287	0.51	0.53
T_5 : Silver black polythene sheet	7.11	7.17	0.296	0.298	0.67	0.68
T_6 : Clear transparent polythene sheet	7.14	7.20	0.290	0.291	0.64	0.65
T_7 : Without mulch	7.20	7.22	0.279	0.280	0.49	0.51
S.Em±	0.10	0.10	0.004	0.004	0.01	0.01
CD at 5%	NS	NS	NS	NS	0.02	0.02

EC (dS/m)

The data presented in Table 4 there was no significant difference observed between the treatments during *Kharif* and Summer season respectively.

Organic carbon (%)

The organic carbon of the soil as influenced by the effect of mulching by different treatments was observed and the relevant data is presented in Table 4. The highest organic carbon (0.67 and 0.68) was recorded in T_5 (Silver black polyethylene mulch) followed by T_6 (clear transparent polyethylene mulch) recording the organic carbon of 0.64 and 0.65 during *Kharif* and Summer respectively. The organic carbon was lowest in T_7 (without mulch) (0.49 and 0.51) during *Kharif* and Summer season respectively.

The organic carbon increased progressively with advancement of crop growth. The positive response of mulches on organic carbon might be due to increased microbial activity and decomposition of organic matter in the rhizosphere of the crop. (8, 9)

Available nitrogen (kg/ha)

The data pertaining to available nitrogen in the soil after harvest as influenced by the effect of mulching are presented in Table 5.

The data indicated that among the treatments evaluated, significantly maximum available nitrogen content in the soil (267.85 and 269.75) was observed with T_5 (Silver black polyethylene mulch) and was at par with T_6 (clear transparent polyethylene mulch) (255.91 and 258.64), while the minimum nitrogen content in the soil was recorded with T_7 (without mulch) (244.76 and 246.45) during *Kharif* and Summer season respectively.

It was also observed that available nitrogen increased in mulched plot over the non mulch plot. It might be due to less depletion of nutrients and moisture, improved microbial activity, solarization effect and favourable soil characteristics.

Available phosphorus (kg/ha)

The data about available phosphorus in the soil after harvest as influenced by the effect of mulching are presented in Table 5.

The data indicated that among the treatments evaluated, significantly maximum available phosphorus content in the soil (35.59 and 35.90) was observed with T_5 (Silver black polyethylene mulch) followed by T_6 (clear transparent polyethylene mulch) (33.51 and 34.25), while the minimum phosphorus content in the soil was recorded with T_7 (without mulch) (30.63 and 30.43) during *Kharif* and Summer season respectively.

It was observed that available phosphorus increased in mulched plot over the non mulch plot. It might be due to microbial activity, less evaporation of soil moisture content and favourable soil characteristics.

Available potassium (kg/ha)

The data about available potassium in the soil after harvest as influenced by the effect of mulching are presented in Table 5.

The data indicated that among the treatments evaluated, significantly maximum available potassium content in the soil (215.81 and 217.23) was observed with T_5 (Silver black polyethylene mulch) and was at par with T_6 (clear transparent polyethylene mulch) (210.70 and 212.67), while the minimum potassium content in the soil was recorded with T_7 (without mulch) (189.73 and 195.75) during *Kharif* and Summer seasons.

There was slight increase of available K initially but gradually it decreased consequent to the utilization of K for the crop and also due to the fixation of K in the soil complex.

In general, the uptake of nutrients was comparatively more in mulched plots than non mulched plots. This might be due to better crop development under mulched plots, consequent of soil moisture content and better utilization of soil nutrients. (10,11)

Table 5. Effect of mulching on N, P and K of ridge gourd during *Kharif*, 2021 and Summer, 2022

Treatments	Nitrogen (kg/ha)		Phosphorous (kg/ha)		Potassium (kg/ha)	
	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022
T_1: Paddy straw	257.75	259.32	33.04	33.15	205.50	207.82
T_2 : Paddy husk	253.07	255.60	32.56	32.88	199.33	201.15
T_3 : Groundnut husk	250.65	251.53	32.11	32.53	202.95	204.74
T_4 : Leaf mould	249.22	250.63	31.54	31.75	193.74	199.45
T_5 : Silver black polythene sheet	267.85	269.75	35.59	35.90	215.81	217.23
T_6 : Clear transparent polythene sheet	255.91	258.64	33.51	34.25	210.70	212.67
T_7 : Without mulch	244.76	246.45	30.63	30.43	189.73	195.75
S.Em±	2.89	2.93	0.41	0.44	2.72	2.78
CD at 5%	8.91	9.03	1.27	1.36	8.38	8.56

Benefit cost ratio

The economics involved as influenced by the effect of mulching has been calculated and presented in Table 6.

Among the treatments during *Kharif* season, significantly T_5 (RDF + Silver black polyethylene mulch) recorded the highest gross returns (Rs. 3,588,00), net returns (Rs. 2,459.49.60) with benefit cost ratio of 2.18:1, Whereas the T_7 (RDF + without mulch) recorded the lowest gross returns per hectare (Rs. 2,265,00), net returns per hectare (Rs. 1,276,49.60) with benefit cost ratio of 1.29:1.

During Summer season, T_5 (RDF + Silver black polyethylene mulch) recorded the highest gross returns (Rs. 3,711,00), net returns (Rs. 2,576,99.60) with benefit cost ratio of 2.27:1, Whereas the T_7 (RDF + without mulch) recorded the lowest gross returns per hectare (Rs. 2,398,50), net returns per hectare (Rs. 1,404,49.60) with benefit cost ratio of 1.41:1. (12)

Table 6. Effect of mulching on benefit: cost ratio of ridge gourd during *Kharif,* 2021 and Summer, 2022

Treatments	Cost of cultivation (Rs/ha)		Gross income (Rs/ha)		Net returns (Rs/ha)		B:C ratio	
	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022	Kharif 2021	Summer 2022
T_1: Paddy straw	102600.40	103150.40	283800	308700	181199.60	205549.60	1.77	1.99
T_2 : Paddy husk	101350.40	101900.40	266550	282450	165199.60	180549.60	1.63	1.77
T_3 : Groundnut husk	102850.40	103400.40	258900	273450	156049.60	170049.60	1.52	1.64
T_4 : Leaf mould	101350.40	101900.40	247800	258450	146449.60	156549.60	1.44	1.54
T_5 : Silver black polythene sheet	112850.40	113400.40	358800	371100	245949.60	257699.60	2.18	2.27
T_6 : Clear transparent polythene sheet	118850.40	119400.40	347550	360900	228699.60	241499.60	1.92	2.02
T_7 : Without mulch	98850.40	99400.40	226500	239850	127649.60	140449.60	1.29	1.41

4. CONCLUSION

From the study it can be concluded that silver black polyethylene mulch had shown positive effect on fruit quality, soil parameters and benefit cost ratio in ridge gourd compared to other treatments, hence it was proved to be the best treatment in ridge gourd.

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