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Growth and yield of Maize (*Zea mays*) influenced by organic mulching in rainfed Alfisols of Southern Karnataka

Shashikanth, Murukannappa and Thimmegowda MN

Abstract
A field experiment was studied in rainfed Alfisols of southern Karnataka, University of Agricultural Sciences, Gandhi Krishi Vignana Kendra, Bangalore during *kharif* 2019 to study the growth yield and economics of maize under different mulching practices. The soil of experimental site was red sandy loam in texture, slightly acidic in reaction, low in available nitrogen, medium in Phosphorous and Potassium. The experiment consisted of seven treatments *viz*, mulching with paddy straw, mulching with saw dust, mulching with grass, mulching with news paper, mulching with dry leaves, dust mulching and control which were replicated thrice and laid out in Randomized Complete Block Design. The maize crop with dry leaves mulching treatment resulted in higher crop growth *viz*., higher plant height (190, 208 and 228 cm) at 60, 90 DAS and at harvest, respectively. The similar results on number of leaves, leaf area index and yield parameters at harvest *viz*., number of cobs per plant (2.67), cob length (15.70 cm), 100 seed weight of grains (24.33) and grain weight per cob (145.79), grain yield (7228 kg ha^{-1}) and stover yield (9305 kg ha^{-1}). The higher gross income (Rs. 86745 ha^{-1}), net income (Rs. 56556 ha^{-1}) and B:C ratio (2.87) was also obtained with same treatment.

Keywords: Organic mulches, dust mulch, maize

Introduction
Maize is the third most important cereal crop after rice, wheat and is an important staple food in many countries of the world. It is also known as the 'Miracle Crop' or 'Queen of Cereals' due to its high productivity potential in the poaceae family. Maize is extensively grown in developed countries and consumed mainly as second-cycle produce, in the form of meat, eggs and dairy products. In developing countries, maize is consumed directly and serves as staple diet for 200 million people. In Karnataka, maize is grown over an area of 1.18 million hectares with production of 3.27 million tones and average productivity of 27.73 q ha-1 [7]. In Karnataka, most of the traditional crops like cotton, groundnut, ragi, sorghum have been replaced by maize and the crop being considered as exhaustive, resulting in soil fertility loss. Hence, Achieving sustainability in yield and soil health is possible through moisture conservation and addition of organic matter. Among various moisture conservation practices, organic mulching is one of the technology, which assumes greater importance in covering soil surface with crop residues. It has a favorable effect on physical, chemical and biological properties, soil aggregates stabilization, enhance soil organic matter, soil nutrients, reduce runoff and soil erosion by intercepting raindrops, thus reducing soil erosion. Further mulches are also useful in reducing evaporation, suppressing weeds and moderating soil temperature. Indeed for better growth of crop plants, addition of organic manures, also conserve the moisture and resulted in for improvement in physical, chemical and biological properties of soil. Hence a study was under taken to assess the impact of organic mulches on growth and yield of maize.

Material and Methods
Field experiment was carried out in University of Agricultural Sciences, GKVK, Bengaluru during *kharif* 2019. The soil was red sandy loam in texture having 36.16, 33.84 and 21.47 per cent coarse sand, fine sand and clay, respectively. The soil was slightly acidic in pH (5.80) and low in available N (159 kg ha^{-1}), medium in available P_2O_5 (17.6 kg ha^{-1}) and available k_2O (109 kg ha^{-1}). The experiment consisted of seven treatments *viz*, mulching with paddy straw (T_1), mulching with saw dust (T_2), mulching with grass (T_3) mulching with news-paper (T_4),

mulching with dry leaves (T_5), dust mulching (T_6), and control (T_7). The treatments were laid out in complete randomized block design and replicated thrice. The treatments were imposed at 30 days after sowing (Muntasir *et al*., 2001) [5]. Five plants were randomly selected from net plot area and tagged for recording various observations on growth parameters at 60, 90 DAS and at harvest. The yield and the yield attributes were recorded at harvest adopting standard procedure, and data on various parameters were subjected to statistical analysis to draw the interpretation of the data.

Result and Discussion

Growth and growth attributes

The results of the study revealed that the significant difference was observed among the growth components with respect to different treatments at 60, 90 DAS and at the harvest (Table 1). Among different treatments, mulching with dry leaves recorded significantly superior growth parameters *viz*., plant height (190 cm, 208 cm and 228 cm), number of leaves per plant (12.49, 13.79 and 12.47), leaf area (5332.59, 7598.24 and 2371.60 cm^2 $plant^{-1}$), leaf area index (2.59, 4.36 and 1.09) at 60 DAS, 90 DAS and at harvest respectively (Table 2). Mulching with dry leaves in maize crop resulted in higher growth attributes as compared to other treatments might be due to the soil helps in improving the soil moisture content which results in better uptake of moisture from each plant in the treatment. Decomposition of mulched materials might contributed nutrients in to the soil resulting in better uptake by the plant. The combined effect of increased moisture and nutrient uptake might helps in cell turgidity and eventually higher meristematic activity leading to more foliage development, greater photo synthetic rate which was manifested in terms of higher dry matter. These results are conformity with the earlier findings of Mal *et al*., (2001) [4].

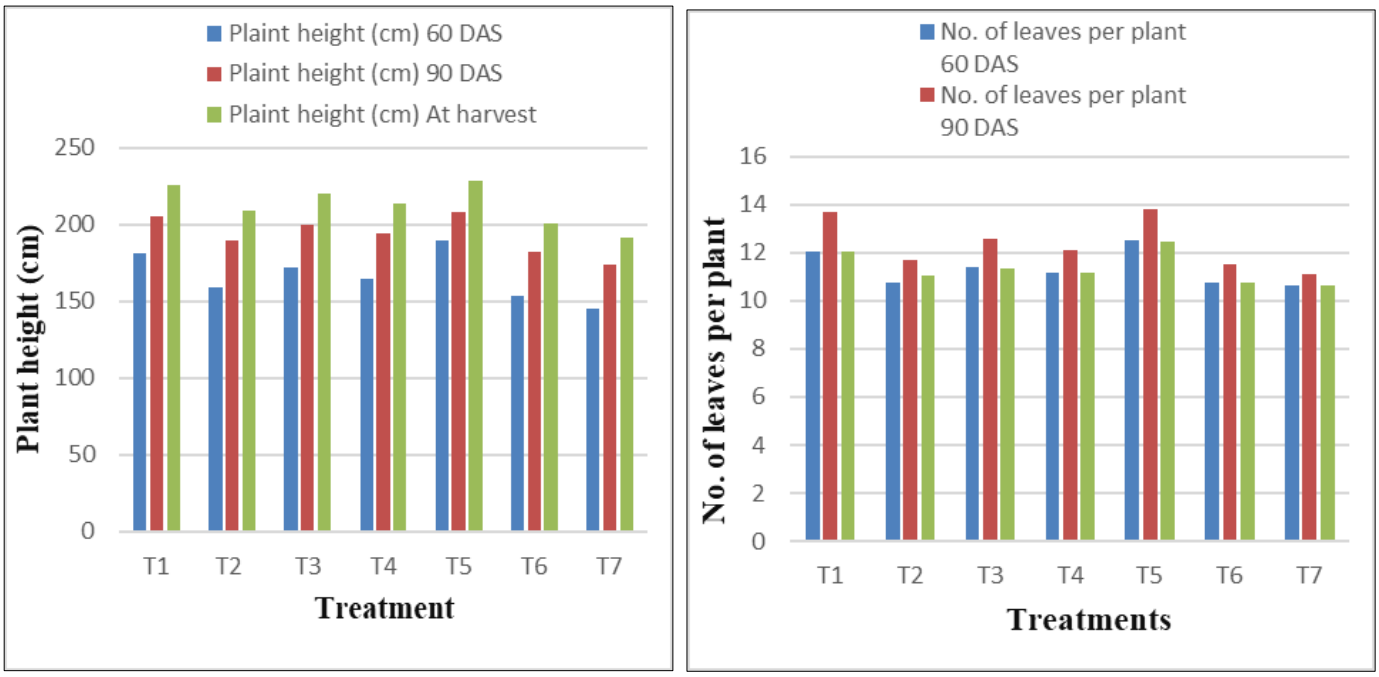


Fig 1: Effect of organic mulching methods on growth parameters of maize

Table 1: Effect of organic mulching method on growth parameters of maize

Treatment	Plaint height (cm)			No. of leaves $plant^{-1}$		
	60 DAS	90 DAS	At harvest	60 DAS	90 DAS	At harvest
T_1: Mulching with paddy straw	181.83	205.53	226.09	12.06	13.71	12.04
T_2: Mulching with saw dust	159.03	189.83	208.82	10.76	11.68	11.03
T_3: Mulching with grass	172.00	199.87	219.85	11.38	12.58	11.36
T_4: Mulching with newspaper	165.07	194.33	213.77	11.19	12.13	11.17
T_5: Mulching with dry leaves	190.00	208.00	228.80	12.49	13.79	12.47
T_6: Dust mulching	153.70	182.53	200.79	10.76	11.50	10.74
T_7: Control.	145.17	174.00	191.40	10.64	11.13	10.62
S.Em +	1.19	1.38	1.52	0.03	0.05	0.03
CD (P =0.05)	3.68	4.25	4.68	0.09	0.16	0.08

DAS – Days after sow

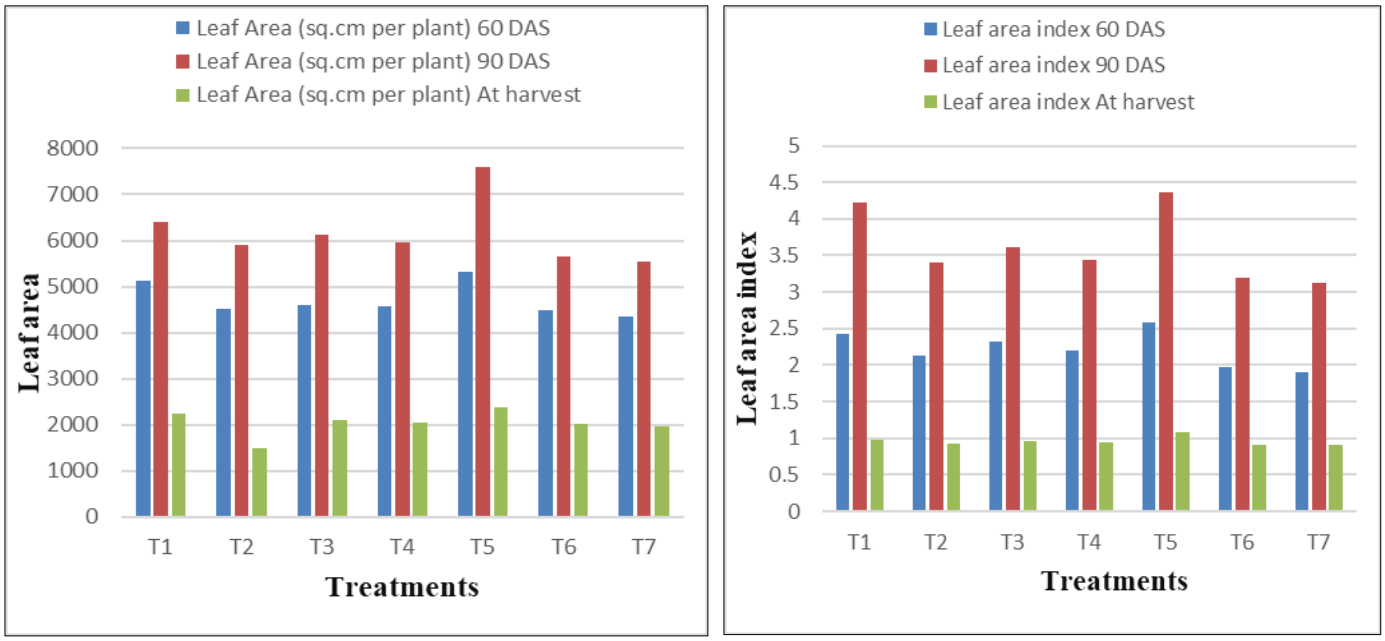


Fig 2: Effect of organic mulching methods on growth parameters of maize

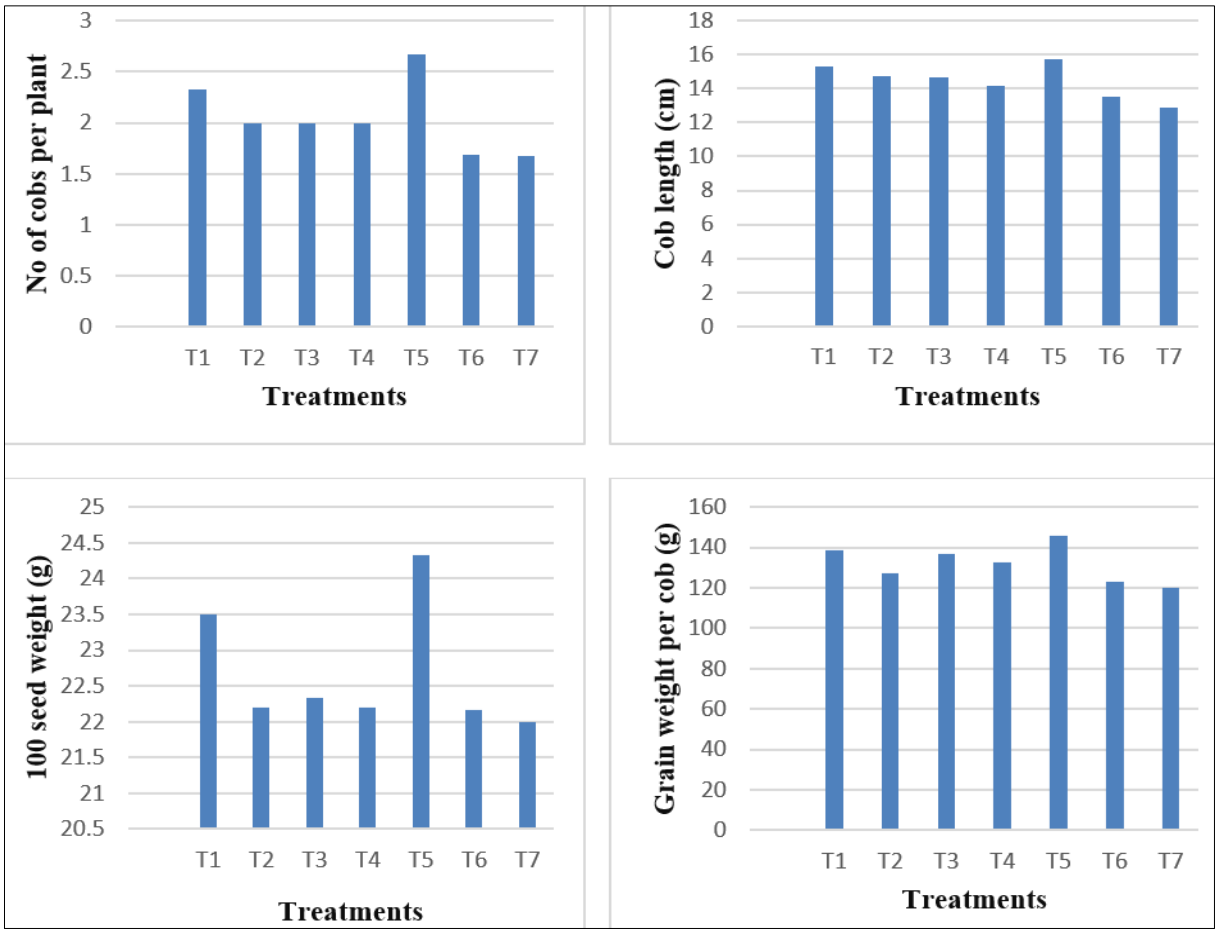
Table 2: Effect of organic mulching method on growth parameters of maize

Treatment	Leaf Area (cm^2 $plant^{-1}$)			Leaf area index		
	60 DAS	90 DAS	At harvest	60 DAS	90 DAS	At harvest
T_1: Mulching with paddy straw	5132.02	6398.26	2242.24	2.43	4.22	0.97
T_2: Mulching with saw dust	4522.11	5904.62	1497.91	2.13	3.40	0.93
T_3: Mulching with grass	4584.53	6114.31	2100.56	2.33	3.62	0.96
T_4: Mulching with newspaper	4564.07	5949.77	2046.15	2.20	3.44	0.95
T_5: Mulching with dry leaves	5332.59	7598.24	2371.60	2.59	4.36	1.09
T_6: Dust mulching	4484.25	5666.83	2002.00	1.98	3.20	0.91
T_7: Control.	4359.40	5538.40	1960.93	1.91	3.13	0.90
S.Em+	10.24	17.93	9.96	0.01	0.02	0.00
CD (P =0.05)	31.55	55.26	30.70	0.02	0.06	0.01

DAS – Days after sow

Yield and yield attributes

Yield attributes of maize was found significant among different organic mulches treatments (Table 4). Significantly higher grain yield (7228 kg ha-1) and stover yield (9305 kg ha-1) was obtained with mulching with dry leaves as compared to all other treatments. The higher stover yield and grain yield of maize with dry leaves mulching was due to higher yield attributing parameters *viz*., cob length (15.70 cm), number of cob per plant (2.67), 100 seed weight (24.33 g) and grain weight per cob (145.79 g) as compared to control treatments (Table 3). The higher yield attributing parameters in mulching with dry leaves might be attributed to higher growth and growth attributes. The dry leaves mulching in maize plot soil resulted in higher the organic matter content of the soil, which in turn might contributed better availability of macro and micronutrients in the soil pool for a longer period, which might have synchronized with plant demand. Synchrony in soil nutrient release with plant demand might helped in better uptake and utilization, leading to better assimilation of biomass in terms of growth and yield parameters, finally the yield. These results are in agreement with the findings of Javeed *et al*., (2003) [2].

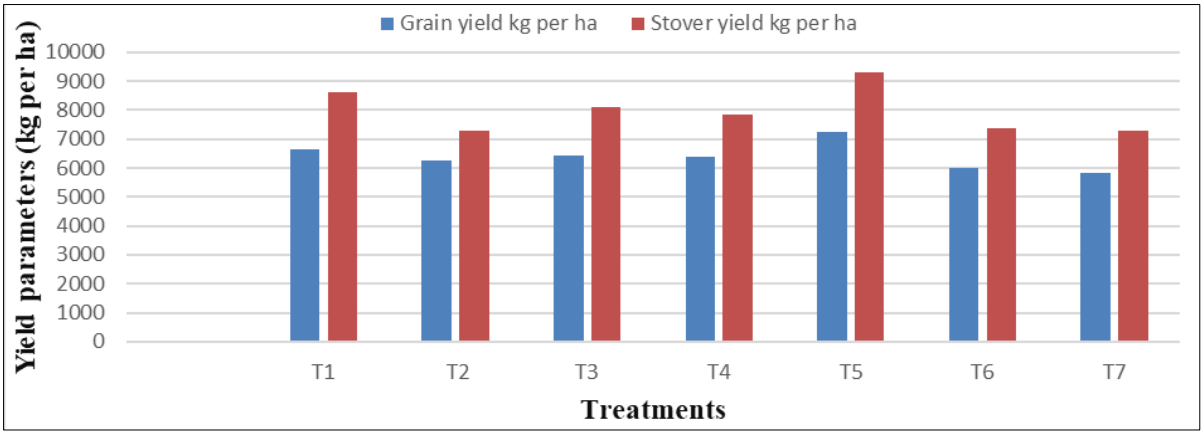


T1: Mulching with paddy straw **T2:** Mulching with saw dust **T3:** Mulching with grass
T4: Mulching with newspaper **T5:** Mulching with dry leaves **T6:** Dust mulching **T7:** Control

Fig 3: Effect of organic mulching methods on yield parameters of maize

Table 3: Effect of organic mulching on Yield parameters of maize

Treatment	No. of cobs plant^{-1}	Cob length (cm)	100 seed weight (g)	Grain weight cob^{-1}
T_1: Mulching with paddy straw	2.33	15.30	23.50	138.60
T_2: Mulching with saw dust	2.00	14.77	22.19	127.31
T_3: Mulching with grass	2.00	14.63	22.33	136.55
T_4: Mulching with newspaper	2.00	14.17	22.2	132.44
T_5: Mulching with dry leaves	2.67	15.70	24.33	145.79
T_6: Dust mulching	1.69	13.53	22.17	123.20
T_7: Control.	1.67	12.90	22	120.12
S.Em+	0.33	0.43	1.16	0.33
CD (P=0.05)	NS	1.32	NS	1.011



T1: Mulching with paddy straw **T2:** Mulching with saw dust **T3:** Mulching with grass
T4: Mulching with newspaper **T5:** Mulching with dry leaves **T6:** Dust mulching **T7:**Control

Fig 4: Effect of organic mulching on grain yield and stover yield of maize

Table 4: Effect of organic mulching on Yield parameters of maize

Treatment	Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})
T_1: Mulching with paddy straw	6624	8638
T_2: Mulching with saw dust	6258	7282
T_3: Mulching with grass	6451	8087
T_4: Mulching with newspaper	6388	7835
T_5: Mulching with dry leaves	7228	9305
T_6: Dust mulching	5989	7391
T_7: Control	5819	7282
S.Em+	12.00	8.87
CD (P=0.05)	36.96	27.34

Table 5: Effect of mulching methods on Economics of maize of maize cultivation (Rs ha^{-1})

Treatment	Total gross returns	Total cost of cultivation (Rs ha^{-1})	Net returns (Rs ha^{-1})	B:C Ratio
T_1: Mulching with paddy straw	79498	31780	47718	2.50
T_2: Mulching with saw dust	75096	31625	31625	2.37
T_3: Mulching with grass	77417	30189	47228	2.56
T_4: Mulching with newspaper	76663	31430	45233	2.43
T_5: Mulching with dry leaves	86745	30189	56556	2.87
T_6: Dust mulching	71879	30589	41290	2.34
T_7: Controls	69834	30189	39645	2.31

Economics

The dry leaves are locally available at no cost expecting the collection and incorporation. The lower cost of cultivation with dry leaves is associated with no cost input. The higher yield with better moisture conservation under dry leaves mulching resulted in higher yield leading to higher gross income. The increased gross income with lower cost of cultivation enhanced net income and B:C ratio. These results are in conformity with the findings of Padhi and Panigrahi, (2006).

Conclusion

Mulching with dry leaves significantly increased crop growth and yield of maize besides higher net returns and B:C ratio as compared to other organic mulch treatments. This mulching technology can be widely adopted by farmers to conserve soil moisture, reducing runoff, soil loss and nutrient losses in rainfed Alfisols of Southern Karnataka.

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