Journal of Crop and Weed, 17(3): 233-236 (2021)
ISSN- O : 2349 9400 ; P : 0974 6315
http://cwssbckv.org
www.cropandweed.com

Effect of mulching on growth, flowering and yield of chrysanthemum (*Chrysanthemum morifolium* Ramat.) cv. Ratlam Selection

S. M. VAMAJA, *D. S. BHATT, [1]S. T. BHATT, S. L. CHAWLA, M. A. PATEL AND S. M. PATEL

Department of Floriculture and Landscape Architecture
ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat - 396 450
[1] Polytechnic in Horticulture, Navsari Agricultural University, Navsari, Gujarat - 396 450

Received : 13.07.2021 ; Revised : 19.10.2021 ; Accepted : 28.10.2021

DOI: https://doi.org/10.22271/09746315.2021.v17.i3.1515

ABSTRACT

An investigation on effect of mulching on growth, flowering and yield of Chrysanthemum (Chrysanthemum morifolium Ramat.) cv. Ratlam Selection was carried out at Floriculture Research Farm, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat to know the usefulness of different synthetic and organic mulch during 2018-19. The experiment was laid out in Randomized Block Design with three replications and nine treatments, consisting various types mulches viz., no mulching, black polythene mulch (30 µ), white polythene mulch (30 µ), yellow polythene mulch (30 µ), red polythene mulch (30 µ), silver polythene mulch (30 µ), sugarcane trash mulch @ 5 t ha^{-1}, paddy straw mulch @ 8 t ha^{-1}and dry grass mulch @ 6 t ha^{-1}. The results revealed that plants mulched with sugarcane trash @ 5 t ha^{-1}was noticed promising to increasing growth, flowering and yield parameters as compare to other mulches which registered maximum plant height (50.13 cm), plant spread in N-S direction (30.68 cm), plant spread in E-W direction (34.20 cm), leaf area (11.84 cm^2), number of branches per plant (9.67), flower diameter (6.59 cm), flower stalk length (8.73 cm), flowering duration (66.73 days) with highest number of flowers per plant(79.27) and flower yield (219.03 g plant^{-1}; 5.48 kg plot^{-1}; 12.42 t ha^{-1}). Thus, it can be concluded that sugarcane trash mulching @ 5 t ha^{-1} enhanced vigorous growth, improved flower quality with enhanced yield of flowers and found best to get highest net returns and benefit : cost ratio for the production of chrysanthemum cv. Ratlam Selection.

***Keywords*:** Black polythene, chrysanthemum, mulch, Ratlam selection, sugarcane trash, paddy straw, yellow polythene

Chrysanthemum (*Chrysanthemum morifolium* Ramat.) is an herbaceous perennial, short day plant belongs to family Asteraceae, a popular flower grown commercially for cut flowers, loose flowers as well as a pot plant in all over the world. It is native to northern hemisphere, chiefly Europe and Asia with a few in other areas. Chrysanthemum var. Ratlam Selection is tall showing spreading habit having simple and deeply-lobed leaves. Flowers are decorative type, creamish-white in colour and are large-sized. It possesses multiple resistance of moderate to high degree to leaf spots caused by *Phomachry santhemicola* and *Septariachry santhemella* (Gill *et al.,* 2000). Water scarcity and weed are the serious problems for successful crop production in chrysanthemum. As plants need sufficient amount of moisture to uptake nutrients from soil, moisture conservation techniques must be followed properly to maintain soil moisture and aeration. Mulching is an effective means for conserving moisture (Schonbeck and Evanylo, 1998), regulate soil temperature (Tarara, 2000), provide nutrients, moderate erosion, suppress weed development and improves soil condition (Harris *et al*., 2004). It also provides more favorable condition for plant growth, development and efficient crop production. Among various cultural practices followed in chrysanthemum, mulching is considered as an important practice to maintain the soil temperature during winter season and also control the weed. Hence, the present investigation was carried out with objective to study the effect of mulching on growth, flowering and yield of chrysanthemum cv. Ratlam Selection.

The present investigation was carried out during year 2018-19 at Floriculture Research Farm, ASPEE Collage of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat. According to agro-climatic situation, Navsari is placed in 'South Gujarat Heavy Rainfall Zone-I, AES-III'. The soil of the experimental plot was deep, moderately clay with good water holding capacity, medium to poor drainage, pH 7.50, electrical conductivity 0.47 ds m^{-1}, 0.62 % organic carbon, 239.00 kg ha^{-1} available N, 42.50 kg ha^{-1} available P_2O_5 and 371.00 kg ha^{-1} available K_2O. As the soil has high water holding capacity, weed is one of the major problem so mulching helps for suppression of weeds. The experiment was laid out in Randomized Block Design with three replications and nine treatments, consisting various types of mulches *viz.,* no mulching, black polythene mulch (30 µ), white polythene mulch (30 µ), yellow polythene mulch (30 µ), red polythene mulch (30 µ), silver polythene mulch (30 µ), sugarcane trash

Short communication
Email: dipalbhatt@nau.in

mulch @ 5 t ha^{-1}, paddy straw mulch @ 8 t ha^{-1} and dry grass mulch @ 6 t ha^{-1}. After preparation of layout and laying of drip line, different plastic mulches were applied on raised bed according to randomization before transplanting and side of plastic sheet was anchored inside the soil about 5 cm depth. After laying of plastic film square hole each of 7.5 x 7.5 cm were prepared at 30 x 30 cm distance with the help of blade or scissor to facilitate the transplanting of rooted cutting. While organic mulches were applied just after planting.40 days old uniform sized, well developed terminal rooted plants were transplanted in holes of equal dimensions at spacing of 30 x 30 cm on 29th September 2018. At the time of the land preparation FYM @ 10 t ha^{-1} along with half dose of N @ 150 kg ha^{-1} as well as entire dose of P and K each @ 100 kg ha^{-1} were applied as basal dose while remaining half of N was given at 30 days after planting as top dressing. The observations on vegetative, flowering and yield parameters were recorded from randomly selected five plants of each plot in each treatment. Vegetative parameters *viz*. plant height, plant spread in N-S and E-W directions, leaf area and number of branches were recorded at time of full blooming. Flower quality parameters like flower diameter and flower stalk length were measured during second picking of flowers. The number of days taken from the date of first flower opening to the last flowering constituted the flowering duration. Number of flowers per plant was counted during each picking and summed up. Yield of flowers per plant and per plot was recorded by weighing and cumulative weight of flowers was noted and converted to hectare basis by deriving the plant population per hectare. The data collected for all vegetative and flowering characters were statistically analyzed by adopting 'Analysis of Variance' according to the techniques define for Randomized Block Design described by Panse and Sukhatme (1985).

Vegetative growth parameters

Data presented in Table 1 revealed that vegetative growth of chrysanthemum cv. Ratlam Selection significantly affected by various types of mulching application. Maximum plant height (50.13 cm), plant spread in N-S (30.68 cm) and E-W directions (34.20 cm), leaf area (11.84 cm^2) and highest number of branches per plant (9.67) were found in plants mulched with sugarcane trash @ 5 t ha^{-1}.Vigorous growth of chrysanthemum plants mulched with sugarcane trash over other mulches may be due to maintenance of good soil structure, better aeration, conservation of water for longer time period, gradual conservation of organic mulch into humus, better environment for microbial activity (Shrivastava *et al*.,1999). Further, trash mulch may provide more favorable temperature in rhizosphere, which activated the microorganisms and probably enhanced the uptake of macro and micro nutrients and resulted in increase in plant growth (Pramanik *et al.*, 2015). Similar increase in growth parameters due to application of organic mulch was reported by Prakash *et al*.(2011), Barman *et al*.(2015), Patel *et al*. (2014), and Patel (2018) in tuberose, Gamit *et al*.(2019) in marigold, Sanderson and Fillmore (2012) in rose, Barman *et al*.(2005) in gladiolus.

However, the minimum plant height (40.27 cm), plant spread N-S (23.60 cm) and E-W (27.47 cm), leaf area (8.44 cm^2) and number of branches per plant (6.03) were noted in plants mulched with black polythene (30 µ). This may be due to raise of high soil temperatures which restrict the root growth as well as absorption of water and nutrients from soil. These results are in close conformity with earlier findings of Sujatha *et al*.(2018) in strawberry grown under shade net condition of coastal region of Andhra Pradesh.

Flowering parameters

The data with respect to flowering parameters as influenced significantly by various types of mulch are presented in Table 2. Significantly maximum flower diameter (6.59 cm), flower stalk length (8.73 cm) and flowering duration (66.73 days) were recorded in plants mulched with sugarcane trash @ 5 t ha^{-1}. Improvement in flower quality might be due to spreading of organic mulch which can improve the chemical, physical and biological properties of the soil resulting in greater availability and uptake of nutrients as reflected through increased photosynthesis towards reproductive structure which enhances flowering and quality of flowers. These results are in accordance of Gamit *et al*.(2019) in marigold, Prakash *et al*.(2011), Patel *et al*.(2014), Barman *et al*. (2015) in tuberose and Barman *et al*. (2005) in gladiolus.

Yield parameters

Chrysanthemum plants mulched with sugarcane trash @ 5 t ha^{-1} resulted highest number of flowers per plant (79.27) and maximum flower yield (219.03 g/ plant; 5.48 kg/plot and 12.42 t ha^{-1}) (Table 2). Increase in yield parameters might be due to ability of sugarcane trash to provide organic matter to the soil and also provide nutrients throughout the crop growth period there by increased the number of flowers per plant. It could be evident from the present results that sugarcane trash mulch recorded maximum leaf area and better growth throughout growth period which helps in production and accumulation of more carbohydrates in plants also increased the number of flowers per plant or it may be increase yield by improved microclimate both beneath and above the soil surface. The similar results

Table 1: Effect of mulching on vegetative growth of chrysanthemum cv. Ratlam Selection

Treatments	Plant height (cm)	Plant spread (cm)		Leaf area (cm^2)	Number of Primary branches
		N-S	E-W		
T_1 : Without mulch (control)	40.80	26.87	29.27	9.73	7.60
T_2 : Black polythene mulch (30µ)	40.27	23.60	27.47	8.44	6.03
T_3 : White polythene mulch (30µ)	44.53	29.27	31.33	9.93	9.00
T_4 : Yellow polythene mulch(30µ)	42.20	24.73	28.53	8.61	6.53
T_5 : Red polythene mulch (30µ)	42.18	25.60	28.32	9.43	6.07
T_6 : Silver polythene mulch 30µ	41.09	25.73	28.93	9.35	6.27
T_7 : Sugarcane trash mulch @ 5 t ha^{-1}	50.13	30.68	34.20	11.84	9.67
T_8 : Paddy straw mulch @ 8 t ha^{-1}	46.20	29.80	32.27	9.96	8.40
T_9 : Dry grass mulch @ 6 t ha^{-1}	44.73	26.20	30.13	9.82	7.73
SEm(±)	**1.80**	**1.12**	**1.27**	**0.52**	**0.55**
LSD(0.05)	**5.41**	**3.36**	**3.81**	**1.56**	**1.66**
C.V. %	**7.11**	**7.20**	**7.33**	**9.33**	**12.80**

Table 2: Effect of mulching on flowering and yield of chrysanthemum cv. Ratlam Selection

Treatments	Flower diameter (cm)	Flower stalk length (cm)	Flower duration (days)	No. of flowers $plant^{-1}$	Yield of flowers		
					g $plant^{-1}$	kg $plot^{-1}$	t ha^{-1}
T_1 : Without mulch (control)	5.83	7.30	55.33	68.53	172.46	4.35	9.86
T_2 : Black polythene mulch (30µ)	5.69	6.70	58.87	62.27	161.52	4.06	9.20
T_3 : White polythene mulch (30µ)	6.38	7.80	65.80	76.67	209.75	5.11	11.59
T_4 : Yellow polythene mulch (30µ)	5.78	6.77	58.93	62.40	164.82	4.14	9.39
T_5 : Red polythene mulch (30µ)	5.70	6.80	57.40	63.60	170.19	4.19	9.50
T_6 : Silver polythene mulch (30µ)	5.82	7.15	56.07	63.53	168.37	4.15	9.42
T_7 : Sugarcane trash mulch @ 5 t ha^{-1}	6.59	8.73	66.73	79.27	219.03	5.48	12.42
T_8 : Paddy straw mulch @ 8 t ha^{-1}	6.33	7.63	60.73	74.47	202.64	5.02	11.39
T_9 : Dry grass mulch @ 6 t ha^{-1}	5.85	7.57	56.47	69.13	179.47	4.44	10.06
SEm(±)	**0.21**	**0.36**	**2.43**	**2.94**	**11.73**	**0.31**	**0.71**
LSD(0.05)	**0.62**	**1.09**	**7.29**	**8.81**	**35.17**	**0.94**	**2.13**
C.V. %	**6.01**	**8.52**	**7.06**	**7.39**	**11.09**	**11.94**	**11.94**

Table 3: Economics of various mulching treatments

Treatments	Flower yield (t ha^{-1})	Income from flowers (Rs.)	Cost of production (Rs.ha^{-1})					Net income (Rs.ha^{-1})	BCR
			Common cost	Treatment cost	Variable cost A	Fixed cost B	Total cost		
T_1	9.86	394520	134275	0	134275	24658	158933	235587	1.48
T_2	9.20	368160	134275	33040	167315	23010	190325	177835	0.93
T_3	11.59	463680	134275	37760	172035	28980	201015	262665	1.31
T_4	9.39	375720	134275	37760	172035	23483	195518	180202	0.92
T_5	9.50	379840	134275	37760	172035	23740	195775	184065	0.94
T_6	9.42	376680	134275	33040	167315	23543	190858	185822	0.97
T_7	12.42	496920	134275	7500	141775	31058	172833	324087	1.88
T_8	11.39	455600	134275	16000	150275	28475	178750	276850	1.55
T_9	10.06	402320	134275	3000	137275	25145	162420	239900	1.48---

Note: Selling price of flowers @ Rs.40 per kg

were reported by Gamit *et al.*(2019) in marigold, Patel *et al.*(2014), Barman *et al.*(2015) and Patel (2018)in tuberose, Sanderson and Fillmore (2012) in rose, Prakash *et al.*(2011), Barman *et al*.(2005) in gladiolus.

Lowest flower yield was recorded when black polythene was used as mulch. It might be due to increased in soil temperature which reduced reserve carbohydrates and supply of nutrients throughout the crop growth period. Similarly, black polythene mulch also resulted minimum yield in strawberry cv. Camarosa under shade net conditions of costal Andhra Pradesh (Sujatha *et al.,* 2018).

Economics

Cost of production of chrysanthemum as influenced by different types of mulching was calculated and presented in Table 3 While, evaluating the cost of production of different treatments, it was observed that the plants mulched with sugarcane trash @ 5 t ha^{-1}(T_7) resulted in higher net returns of ₹ 3,24,087 ha^{-1} with maximum benefit cost ratio of 1.88 which was followed by paddy straw mulch @ 8 t ha^{-1}(T_8) with net return of ₹ 2,76,850 per ha and BCR of 1.55. Further, without mulching (control – T_1) has less benefit : cost ratio (1.48) and lowest net return (₹ 1,77,835 per ha) and BCR (0.93) was observed in plants mulched with black polythene (30µ) (T_2). Thus, mulching with sugarcane trash @ 5 t ha^{-1} was economically beneficial for vigorous growth, quality flower production as well as higher yield of chrysanthemum cv. Ratlam Selection.

CONCLUSION

From the present investigation it can be concluded that sugarcane trash mulching @ 5 t ha^{-1}enhanced vigorous growth, improved flower quality with enhanced yield of chrysanthemum cv. Ratlam Selection. So sugarcane trash mulching @ 5 t ha^{-1} found best to get highest net returns and benefit : cost ratio for the production of chrysanthemum flowers.

ACKNOWLEDGEMENTS

Authors acknowledge the help provided by scientists of Floriculture Research Farm, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari for facility and support during the course of experimentation.

REFERENCES

Barman, A., Abdullah, A.H.M., Hossen, A., Asrafuzzaman, A. and Rahman, K.M.H. 2015. Effect of mulching on growth and yield of tuberose. *Int. J. Res. Rev.*, **2**(6):301-306.

Barman, D., Rajni, K., Pal, R. and Upadhyaya, R.C. 2005. Effect of mulching on cut flower production and corm multiplication in gladiolus. *J. Ornam. Hort.*,**8**:152-154.

Gamit, D., Patel, G.D., Gaikwad, S.S., Hiral, C. and Naik, B. 2019. Effect of integrated weed management on quality and flower yield of African marigold (*Tagetes erecta* L.). *Int. J. Chem. Stud.*,**7**(2): 1906-1909.

Gill, A.P.S., Singh, M., Arora, J.S., Singh, P.J., Singh, K., Kumar, R. and Dhiman, J.S. 2000. Ratlam Selection - a new variety of chrysanthemum for loose flower production. *J. Punjab Agril.Uni.*, **37**(1/2): 148.

Harris, R.W., Clark, J.R. and Matheny, N.P. 2004. *Arboriculture*.4th Ed. prentice Hall inc., New Jersey.

Panse, V.G. and Sukhatme, P.V. 1985. *Statistical Methods for Agricultural Workers*. ICAR. New Delhi, pp. 381.

Patel, B.B., Chawla, S.L. and Ahlawat, T.R. 2014. Effect of irrigation levels and mulching on growth and yield of tuberose (*Polianthes tuberosa* L.) var. Prajwal. *Green Farming*, **5**(2): 268-270.

Patel, V.H. 2018. Integrated weed management in tuberose. *M. Sc. Thesis*,Navsari Agricultural University, Navsari, pp. 35-51.

Prakash, S., Shripal, Arya, J.K. and Kumar, S. 2011. Effect of mulching on cut flower production and corm multiplication in tuberose. *Int. J. Agric. Sci.***7**(1): 169-170.

Pramanik, P., Bandyopadhyay, K.K., Bhaduri, D., Bhaacharyya, R. and Agrawal, P. 2015. Effect of mulch on soil thermal regimes. *Int. J. Agric. Environ. Biotechnol.,***8**(3): 645-658.

Sanderson, K. and Fillmore, S. 2012. Evaluation of mulch types on growth and development of native wild roses (*Rosa* spp.) for rose hip production in Prince Edward Island, Canada. *Int. J. Fruit Sci.,* **12**(4): 361-371.

Shrivastava, P. K., Parikh, M.M., Savani, N.G. and Raman, S. 1999.Response of banana to drip irrigation, mulches and irrigation scheduling in South Gujarat. *Agr.Eng. Today*, **23**(3/4): 29-38.

Sujatha, S., Suchitra, V., Swami, D.V., Subbaramamma, P., Uma Krishna, K. and Saravanan, L. 2018. Influence of mulching materials on growth and yield of strawberry (*Fragaria ananassa* Duch.) cv. Camarosa under shade net conditions of coastal Andhra Pradesh. *Int. J. Agric. Sci.,* **14(**1):219-224.

Tarara, J.M. 2000.Microclimate modification with plastic mulch. *Hortic. Sci.*,**35**:169-180.