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EFFECT OF DIFFERENT TYPES OF MULCHING ON GROWTH AND FLOWERING OF *Freesia alba* CV. AURORA

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The effect of different mulching materials such as transparent plastic sheet, rice straw and black plastic sheet was investigated on growth and flowering of Freesia cv. Aurora. There were four treatments, i.e. rice straw, white plastic sheet (transparent PS), black plastic sheets (black PS), and control (no mulching) and each treatment was replicated thrice. The results showed that time to germination was decreased and germination percentage was significantly improved by black mulch as compared to control in freesia plants. Straw mulch produced maximum plant height; earlier flower emergence, highest number of flower spikes per plant, floret per spike and flowers per plant. Maximum flower diameter was also observed in black polythene mulch. From the results of this experiment it can be concluded that black plastic mulch triggers plant growth and development (vegetative growth) while straw mulch encourages flower production both qualitatively and quantitatively in freesia plants.
Keywords: Freesia, mulch, rice straw, black plastic sheet

INTRODUCTION

Floriculture has been identified as a potential business due to divergence of farmers towards high value floral crops and utilization of flowers in social events as well as for industrial production in Pakistan (Younis *et al*., 2002). Owing to enhanced profit levels, commercial floriculture is emerging as a potential field of horticultural production (Anderson *et al*., 2010). In Pakistan, the most important floricultural crops for cut flower trade are roses, gladiolus, tuberoses, iris, carnation, narcissus, lilies, freesia, statice and gerbera etc. (Ahsan *et al*., 2012). Production of cut flowers is estimated to be in the range of 10-12 thousand tons per annum and floriculture is fast emerging business as a profitable venture for small farmers in Pakistan (Younis *et al*., 2010a).

Freesia is one of the commonly produced cut-flower among bulbous, tuberous, and rhizomous ornamental plants that bears fragrant flowers in the spring. Freesia belongs to Iridaceae family and is native to Africa. It is suitable for growing in borders and in containers outside or as houseplant (Manning and Goldblatt, 2008). Freesia cultivation, both for cut flower and bedding plant requires proper root temperature and sufficient moisture. It is grown in Europe and Japan as a popular cut-flower crop.

In soil management, mulch act as a protective cover placed over the soil to hold moisture, provide nutrients, moderate erosion, encourage seed germination and suppress weed development. Mulching and its skillful application can lead to improved soil organic matter contents and by improving other soil characteristics (Harris *et al*., 2004). Generally straw, rice husk, crop residues or plastic mulch can be used as artificial mulches in ornamental crops (Wilhoit *et al*., 1990; Stowell, 2000). Many types of mulches have been used for reduction of water losses of outdoor garden and landscape plants (Ashworth and Harrison, 1983; Robinson, 1988).

It has been proved that municipal wastes are considered as one of the effective mulching material in horticultural crop production (Tariq *et al*., 2012). Black plastic mulch was proved effective for aster (*Callistephus chinensis*) with healthier vegetative growth, maximum flower production and petal pigmentation while minimum yield was obtained in control (Solaiman *et al*., 2008). In addition, mulching also improves berry weight, fruit yield, plant growth and quality in strawberry (Fan *et al*., 2012). In different parts of the world different materials are used for mulching, but black polyethylene is mostly used for good production (Hassan *et al*., 2000; Sharma *et al*., 2001; Singh *et al*., 2006).

The usefulness of different mulching materials to different floriculture crops is well accepted. However, a limited work has been done on use of mulches in Freesia production. Present experiment has been designed as preliminary effort to investigate the effect of different mulching material on growth and flowering of Freesia. The main objectives of this research study were to check the effect of mulching on germination, growth and flowering of Freesia.

MATERIALS AND METHODS

Freesia bulbs were grown during the year 2010-2011 in Floriculture Research Area, University of Agriculture, Faisalabad, Pakistan. Aurora, a yellow variety of Freesia was selected for present study. The germplasm (bulb) was collected from Green view nursery, Lahore, Pakistan.

***Mulching Materials*:** Mulching comprised of four treatments i.e rice straw, white plastic sheet (transparent PS), (0.4mm), black plastic sheets (black PS), (0.4mm) and control (no mulching).

***Methods*:** The freesia bulbs were grown in the nursery and were transplanted maintaining plant to plant; 6cm and row to row; 60cm distance. For this an open field was selected in floriculture area, firstly the field was cleaned and all weeds were eradicated. FYM was added @ 2 tones/acre and mixed with soil. After the bulbs were planted, four types of mulches were applied as per treatments. Other cultural practices were uniformly practices. The experiment was carried out under Randomized Complete Block Design (RCBD) with four treatments comprising 30 plants in each treatment with three blocks, making a total population of 120 plants.

***Morphological attributes*:** Time to germination and germination percentage were recorded with due course of time. On acquirement of maximum growth and development stage, the parameters like days to first flower, number of flower spikes per plant, florets per spike and flowers per plant, number of flowers per plant, flower diameter (cm) and plant height (cm) were recorded.

***Statistical Analysis*:** Data were collected and analyzed statistically according to analysis of variance (ANOVA) techniques to the Randomized Complete Block Design, and the statistical means of different sources of variation were distinguished by using Least Significant Difference (LSD) test at $p< 0.05$ (Steel *et al*., 1997).

RESULTS

Data regarding effect of various mulching treatments on germination time was subjected to analysis of variance which showed that there was highly significant difference ($P<0.05$, LSD value = 2.904) in the performance of various mulching treatments on the germination of bulbs. Comparison of means showed that maximum time to germination (36.27 days) was observed when bulbs were sown without any mulch (control), however black polythene, transparent polythene and rice straw mulching treatments reduced this duration to 19.33, 21.50 and 24.44 days, respectively (Fig. 1). Results indicated that effect of various mulching treatments on germination percentage was highly significant ($P<0.05$, LSD value = 2.416). The comparison of means revealed that black polythene mulch exhibited highest germination percentage (99.67 %); however it was reduced to (93.78 %) when no mulch was used. Transparent polythene (97.00 %) and straw mulch (96.11 %) treatments showed same results as there was statistically no significant difference between them (Fig. 2).

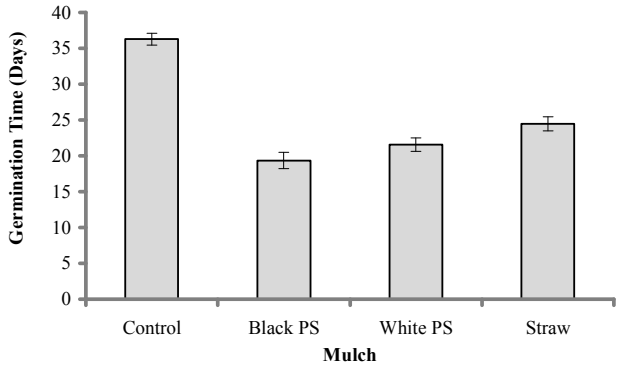

Figure 1. Effect of different types of mulching on time to germination

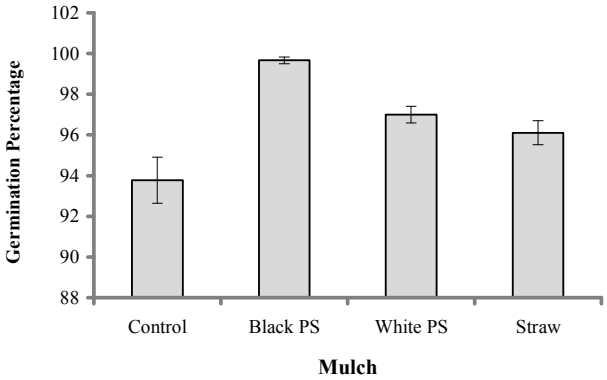

Figure 2. Effect of different types of mulching on germination percentage

Comparison among mulch treatments indicated that control showed maximum days to emergence of first flower (149.16) and it was statistically different from all other mulch treatments (Table 1). Minimum days to emergence of first flower (122.67) were observed in case of rice straw mulch. Minimum days to first flower results showed that it was due to the early germination of the plant that may have resulted due to straw mulching. The data regarding role of mulching treatments on the plant height showed that straw mulch resulted in maximum plant height (37.11 cm) than other treatments. Minimum plant height (23.56) was observed in control (without mulch). Data regarding flower diameter showed significant results as maximum flower diameter (6.22 cm) was observed in black polythene mulch. Straw mulch was ranked second with flower size of 5.49 cm while control (without mulch) and transparent polythene mulch produced smaller flowers, i.e. 4.64 and 4.74 cm,

Table 1. Effect of different types of mulching on growth and flowering

	Treatments				
	Control	**Black PS**	**Trans. PS**	**Rice Straw**	**LSD**
Plant height (cm)	23.56 c	30.89 b	32.78 b	37.11 a	2.39
Days to first flower	149.16 a	126.67 bc	130.44 b	122.67 c	7.57
Number of Flower Spikes plant^{-1}	3.90 c	6.70 b	5.70 b	8.30 a	1.58
Number of Florets Spike^{-1}	5.44 c	6.11 b	6.33 b	9.00 a	1.79
Number of Florets plant^{-1}	20.56 c	40.00 b	36.44 b	74.56 a	13.44
Flower diameter (cm)	4.64 c	6.22 a	4.74 c	5.49 b	0.41

respectively and were statistically similar (Table 1). The results about the number of flower spikes per plant, floret per spikes and flowers per plant also showed significantly different results by mulching treatments. Straw mulch resulted in highest number of flower spikes per plant (8.3) and minimum flower spike count per plant (3.9) was noted in the control. Similarly, maximum floret count per spike was also observed in straw mulch (9.00) and least number of florets per spikes (5.44) was recorded in control. Dominance of rice straw mulch on all other treatments was confirmed as it produced maximum number of flowers per plant (74.56). The control treatment where no mulch was used produced minimum number of flowers per plant (20.56). The comparison of means for number of flower spikes per plant, floret per spikes and flowers per plant indicated that black polythene mulch and white polythene mulch were statistically not different from each other (Table 1).

DISCUSSION

A good mulching material with adequate supply of nutrients is essential for plants to attain maximum production. It was observed from this experiment that black mulch resulted in minimum time to germination and maximum germination percentage of Freesia bulbs. It is predicted that it was due to increase of temperature inside the mulch as black color not only absorbs more heat but also retains it to some extent causing warm and humid conditions around the bulbs hence increasing germination rate. Earlier, Rodrigues *et al*. (1999) and Sharma *et al*. (2001) have reported that black polythene as mulch increased germination in rose plants and strawberry. Another possible reason of this phenomenon can be the activation of glycolysis process and reduction of inhibitory and dormancy inducing substance and the mobilization of auxins. Mulching effectively regulates soil temperature, prevents crust development and preserves soil water (Younis *et al*., 2010b; Iqbal *et al*., 2006). Mulching triggered in the availability of soil moisture contents at every watering amount (Adetunji, 1990).

Diverse mulching materials affected the plant height differently. Results showed that straw mulch induced maximum plant height, days to flower emergence, number of flower spikes per plant, floret per spikes and flowers per plant. Usman *et al*. (2005) reported parallel results for plant growth by using straw mulch. However, Solaiman *et al*. (2008) worked on aster and observed greater plant height with straw mulch while highest number of flower and early flower initiation of the plants under black plastic mulch than straw mulch. It might be due to increase in soil water contents with least evaporation (Baumhardt and Jones, 2002; Zhang *et al*., 2009; Yi *et al*., 2011). Straw mulching had different soil thermal properties under diverse temperatures from that of exposed soil; colder weather had higher soil temperatures under straw mulching than in non-mulched soils and lesser during hot weather (Bristow, 1988; Fabrizzi *et al*., 2005; Sarkar *et al*., 2007). Adequate moisture contents and appropriate temperature of soil lead to maximum plant height earlier flower emergence, higher number of flower spikes per plant, floret per spikes and number of flowers per plant. Conversely, less flowering of plant without mulch was attributed due to poor growth when related with mulched plant (Iqbal *et al*., 2009).

Various mulching materials affected the availability of nutrients to the plants. Mulching is beneficial to improve soil physical, biological and chemical conditions for better crop performance (Al-Rawahy *et al*., 2011; Christopher *et al*., 2011). Mulches play an important role in nutrient uptake as they provide favourable environment for better root growth by increasing the soil temperature and conserving suitable soil moisture regime. The effective use of nutrients in mulch could be attained because of vigorous root system (Younis *et al*., 2010b). Relatively better moisture and thermal regimes enhances root growth which ultimately leads to increase in the potential for efficient nutrient uptake (Kumar and Dey, 2011). Nitrogen and phosphorous are the main elements due to important functioning for growth and development of ornamental crops. The precipitation takes enormous quantity of phosphorous used as nourishment into the soil's immobile pools and plants are unable to use this (Hao *et al*., 2002; Badawi, 2010). Application of mulches reduces the loss of phosphorous by limited precipitation so it may lead to better and quality flowering.

***Conclusion*:** The results regarding this study revealed that mulches were beneficial in altering the temperature of soil, provided favorable soil conditions for plant growth, conserved moisture and reduced the loss of nutrients which

is evident from better plant performance in the studied parameters. However, straw mulch was proved to be more suitable for improving soil environment than other mulches. It significantly improved the growth and flowering of Freesia cv. Aurora as it resulted in maximum plant height, days to flower emergence, number of flower spikes per plant, floret per spikes and flowers per plant. Conclusively, for maximum growth and best quality flower production of freesia it is proposed that straw mulch should be used.

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