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Nursery performance of some apple cultivars under different mulching treatments

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Abstract

The present investigation was carried out on farm of KVK, Shuhama, SKUAST-K, Shalimar, during the year 2014 and 2015. During this investigation the effect of different mulching treatments on the growth parameters of apple cultivars *viz.*, Firdous, Shireen, Red Delicious and Golden Delicious raised on M-9 rootstock under nursery conditions was assessed. Among all mulching treatments, black polyethylene resulted in greater plant height, plant girth, scion weight and root weight as compared to other treatments. Cultivar Red Delicious proved to be superior among all in terms of various growth parameters than Firdous, Shireen and Golden Delicious.

Keywords: Mulching, apple, cultivars, scion weight, root weight, rootstock

Introduction

Apple is considered as the most important temperate fruit. In Jammu and Kashmir this crop occupies an area of 1.62 lakh ha with the productivity of 17 lakh 26 thousand Metric tonnes/hectare (Anonymous, 2017) [1]. In spite of the fact that this is the only state where yield of apple varieties is highest in the country yet it compares poorly to the yields obtained by other horticulturally advanced countries. Apart from climatic and edaphological constraints, the non-availability of quality planting material is responsible for low productivity of apple. Also, the importance of suitable rootstock in successful orchard management cannot be ignored (Sinha et al, 1985) [6]. Any fruit crop is perennial in nature and takes a minimum of three years after planting to bear the first fruits. In spite of repeated cautioning, the farmers fail miserably in establishing their orchards due to faulty planting materials. Whenever due care is not taken to procure genuine planting materials, farmers will face a lot of problems in undertaking maintenance operations, thereby they lose their hope and incur heavy loss. Mulching is one of the simplest and most beneficial practices we can use in the garden as well as in orchard. Mulch is simply a protective layer of a material that is spread on top of the soil. Mulches can either be organic such as grass clippings, straw, bark chips, and similar materials inorganic such as stones, brick chips, and plastics. Organic mulches also improve the condition of the soil. As these mulches slowly decompose, they provide organic matter which helps keep the soil loose. This improves root growth, increases the infiltration of water, and also improves the water-holding capacity of the soil. Organic matter is a source of plant nutrients and provides an ideal environment for earthworms and other beneficial soil organisms. Mulches used to protect plants over winter should be loose material such as straw, hay, or pine boughs that will help insulate the plants without compacting under the weight of snow and ice. One of the benefits from winter applications of mulch is the reduction in the freezing and thawing of the soil in the late winter and early spring. These repeated cycles of freezing at night and then thawing in the warmth of the sun cause many small or shallow rooted plants to be heaved out of the soil. This leaves their root systems exposed and results in injury or death. Mulching helps prevent the rapid fluctuations in soil temperature and reduces the chances of injuries. Therefore, an attempt has been made to find out the effect of different mulching treatments on the growth parameters of different apple cultivars under nursery conditions.

Material and Methods

The investigations were carried out at the Experimental Farm of Krishi Vigyan Kendra, Srinagar, SKUAST-K on 3 year old apple nursery where apple cvs. Firdous, Shireen, Golden Delicious and Red Delicious were raised on Malling (M-9-) rootstock and were given four different mulching treatments *viz.* black polyethylene, rice straw, Lucerne, red clover and clean cultivation (control).

The climate is temperate cum Mediterranean and of continental type. Winter is severe extending over 100 days from the middle of December to March, during which the temperature often goes below the freezing point and the whole valley remains covered with snow. The valley is marked by extreme of temperature, ranging from a maximum of 35°C in summer to a minimum of -10°C in winter. The annual mean temperature is 15°C. The climate is cold and rainfall is optimum, well distributed about 80 cm per annum, mostly in the form of snow during winter. (Anonymous, 2015). The experiment was laid out in a randomised block design (RBD) factorial and each treatment was replicated thrice. Data on different parameters were recorded on 8-10 successful grafts per combination at the end of one year after uprooting and sectioning the plants. During experimentation, black polythene was kept as such while other mulching treatments like rice straw, Lucerne and red clover layers were provided as soon as they were decomposed.

Results and Discussion

Plant height (cm)

Plant height was maximum in Red delicious cultivar (150.0cm) followed by Golden delicious (Table-1). Minimum height was recorded in Shireen under mulch treatment lucerne (131.70). Blackpolythene mulch exerted a significant influence over other treatments; maximum value was noted in red delicious whereas, minimum was recorded in shireen. Further, the interaction effect of cultivar and mulch (CXM) was found significant. Maximum plant height was noticed in a combination comprised of red delicious under blackpolythene mulch raised on M-9 root stock, while minimum plant height increment was observed in shireen under lucerne mulch material. Among the four mulching treatments, black polythene imparted greater height to all the scion cultivars as compared to rice straw, red clover and Lucerne (Table-1). Similar trend was also observed in rice straw, red clover as well as in clean cultivation (control). In young apple trees there is a positive correlation between trunk diameter and future yield, suggesting that mulching enhances the potential for future production (Mathews *et al.*, 2002) [4]. These results may be attributed due to the better moderation of soil hydro-thermal regimes which have increased the absorption capacity of the water and nutrients in the upper fertile layer of the soil. These results are in conformity with Thakur *et al.* (1993) [8].

Table 1: Effect of mulching treatments on plant height (cm) of apple cultivars under nursery conditions

Mulching treatments	Apple cultivars			
	Shireen	Firdous	Golden Delicious	Red Delicious
Black polyethylene	138.80	140.00	145.90	150.00
Rice straw	134.50	136.90	141.70	145.00
Red clover	136.90	138.50	143.80	147.50
Lucerne	131.70	133.40	137.60	140.60
Clean cultivation (control)	132.60	134.80	139.80	142.50
C.D($p \leq 0.05$)	0.20	0.23	0.26	0.42
CD 0.05 Mulch.	0.09	0.11	0.12	0.20
CD _{0.05} CultivarXMulch	0.08	0.09	0.11	0.18

Plant girth

Maximum plant girth (7.55 cm) was recorded in red delicious followed by golden delicious (7.18 cm) under black polythene mulch, however lowest was recorded in Shireen (6.95 cm) under the same treatment, A decreasing trend was observed in

other mulching treatments including control (clean cultivation). This is due to the combined effect of black polythene treatment as well as influence of Malling (M-9) rootstock. Dwarfing M-9 roots accumulate more starch, fat/oils, oxidases and peroxidases than vigorous rootstocks (Berakbane, 1941; Schechter *et al.*, 1991) [2, 5]. This phenomenon restricts the tree size and result in greater plant girth as compared to vigorous rootstocks. Similar observations were in full agreement with Singh and Ananda (2005) [7].

Table 2: Effect of mulching treatments on plant girth (cm) of apple cultivars under nursery conditions

Mulching treatments	Apple cultivars			
	Shireen	Firdous	Golden Delicious	Red Delicious
Black polyethylene	6.95	7.00	7.18	7.55
Rice straw	6.85	6.90	6.97	7.14
Red clover	6.92	6.97	7.10	7.24
Lucerne	6.60	6.69	6.79	6.95
Clean cultivation (control)	6.68	6.72	6.85	7.08
C.D($p \leq 0.05$)	0.22	0.52	0.62	0.99
CD 0.05 Mulch.	0.10	0.24	0.29	0.47
CD _{0.05} CultivarXMulch	0.09	0.22	0.26	0.43

Scion weight

A similar trend of plant girth was observed in scion weight. Lucerne was the least invigorating for all the scion cultivars. Black polythene mulching treatment again proved its superiority over other mulch treatments. in imparting weight to the scion cultivars (Table-3). Maximum scion weight was recorded in Red delicious followed by Golden delicious, Firdous and Shireen. This is because of the reason that the trees grafted on M-9 rootstock transfer more quantity of dry matter to the plants. Also dwarfing rootstock M-9 accumulates more starch mainly due to block in the utilisation of sugars by increased weight of the plants (Westwood *et al.*, 1973) [9].

Table 3: Effect of mulching treatments on scion weight (g) of apple cultivars under nursery conditions

Mulching treatments	Apple cultivars			
	Shireen	Firdous	Golden Delicious	Red Delicious
Black polyethylene	191.00	193.20	196.20	200.20
Rice straw	188.30	191.00	194.40	198.80
Red clover	189.20	192.30	195.50	199.40
Lucerne	185.40	189.70	192.70	195.20
Clean cultivation (control)	186.50	190.50	193.30	197.50
C.D($p \leq 0.05$)	0.29	0.32	0.42	0.51
CD 0.05 Mulch.	0.14	0.15	0.20	0.24
CD _{0.05} CultivarXMulch	0.12	0.13	0.18	0.22

Root weight

It was observed that root weight of scion cultivars differed significantly with different mulching treatments (Table-4). Maximum root weight was recorded in red delicious followed by golden delicious, firdous and shireen under black polythene treatment. The lowest root weight of scion cultivars was recorded in clean cultivation. This is due to the reason that plants under black polythene treatment faces increased temperature which could essentially help in uptake of nutrients and increase the root growth in soil surface. These results are in conformity with the work done by Funke (1982) [3].

Table 4: Effect of mulching treatments on root weight (g) of apple cultivars under nursery conditions

Mulching treatments	Apple cultivars			
	Shireen	Firdous	Golden Delicious	Red Delicious
Black polyethylene	85.00	88.10	90.30	100.00
Rice straw	82.20	85.30	87.40	97.50
Red clover	84.10	87.20	89.60	98.60
Lucerne	80.30	82.40	84.70	95.30
Clean cultivation (control)	81.70	83.80	85.50	96.20
C.D($p \leq 0.05$)	0.21	0.29	0.32	0.70
CD 0.05 Mulch.	0.10	0.14	0.15	0.33
CD _{0.05} Cultivar X Mulch	0.09	0.12	0.13	0.30

Conclusion

From the ongoing research it was found that cultivar red delicious under black polythene raised on malling rootstock M-9 performed better and exploited its potential fully under nursery conditions, however, mulching also has the ability to influence tree performance under nursery conditions. In addition, we aimed at differentiating between various materials on their affectivity, when applied as a mulch.

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