Current Horticulture 12(2): 38–41, May–August 2024
DOI: 10.48165/chr.2024.12.1.02
Received: 15 August 2021; Accepted 5 February 2024

Optimizing mulch thickness for enhanced vegetative growth of khirni (*Manilkara hexandra*)

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Abstract

A field experiment for optimizing mulch thickness for enhanced vegetative growth of khirni (*Manilkara hexandra* Roxb.) cv. Thar Rituraj was conducted during the 2019-20 at College of Horticulture and Forestry, Jhalawar, Rajasthan. Among different thicknesses application of T6-12 cm thickness of dry grass to individual plants was significantly superior to all other treatments, but it was on at par with T5-10 cm thickness of dry grass. In treatment T6, an increase in shoot and leaf parameters, such as rootstock girth (10.98%), scion girth (11.05%), plant height (32.61%), number of nodes/shoot (80.52%), number of internodes/shoot (94.33%), number of leaves/plant (39.94%), leaf length (13.45%) and leaf area index (1.50%), were recorded during February 2020.

Key words: Development, Growth, Mulching, Thickness, Vegetative growth

Khirni (*Manilkara hexandra* Roxb.) is one of the important underutilized fruit crop of tropical and sub-Tropical region of India. It belongs to family Sapotaceae with a somatic chromosome number, 2n= 26. Major *khirni* growing states are Madhya Pradesh, Gujarat, Rajasthan, Karnataka, Maharashtra and Tamil Nadu.

Mulching is an essential cultural technique which helps to produce healthier plants. Mulching conserve soil moisture by reducing water loss thorough evaporation, minimizing soil erosion, moderating soil temperature, inhibiting weed growth, encouraging the growth of beneficial soil microorganism and reducing the spread of soil-borne pathogen by preventing soil form splashing onto plants during rainstorms and watering. It can also be used as winter and summer protection, improving soil structure and quality, and returning nutrients to soil. No work has been carried out on the effect of mulching on *khirni* plants, hence an experiment was conducted.

Material and Methods

This field experiment was conducted at Department of Fruit Science, College of Horticulture and Forestry, Jhalarapatan, Jhalawar, in the newly established orchard of *khirni* cv. Thar Rituraj during 2019-20. It consists of six mulch treatments along with the control, T_0 (Control), T_1 (2 cm thickness of dry grass), T_2 (4 cm thickness of dry grass), T_3 (6 cm thickness of dry grass), T_4 (8 cm thickness of dry grass), T_5 (10 cm thickness of dry grass) and T_6 (12 cm thickness of dry grass) laid out in randomized block design with three replications. The treatments were applied during first week of March 2019 after recording initial (base) growth and development parameters of plants and observations were noted at 2 months interval for a total period of 12 months.

For the measurement of rootstock and scion girth of plant marked at a fix point with white paint and values were expressed in mm. The plant height was recorded from the base of soil to highest tip of the plant with the help of measuring scale and noted in centimeter (cm). The numbers of nodes and internodes/ shoot and number of leaves/plants were counted manually. For measuring leaf length, selected tagged leaves under various treatments of *Khirni* were measured in April, June, August, October, December and February. The average increase in leaf length was calculated on the basis of cumulative increase in initial value. The average increase in LAI was calculated on the basis of recorded values of leaf area and plant spread as per the given formula (Watson, 1947);

LAI = (Leaf area) / (ground area)

The data were statistically analyzed as per analysis of variance technique as suggested by Panse *et al.* (1995).

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The significance of the treatments was tested through F test at 5 per cent level of significance. The critical difference CD was calculated to assess the significance of difference among the different treatments.

Results and Discussion

Thickness of dry grass mulch significantly influenced growth of plants. The highest increase (10.98%) in rootstock girth was observed in T_6-12 cm thickness of dry grass and found at par with T_5 -10 cm thickness of dry grass (10.37%) (Table 1). The lowest increase (4.27%) in rootstock girth was noted in T_0- control. Similarly, maximum increase (11.05%) in scion girth was noted in T_6 followed with T_5 (10.48%) and minimum increase (4.55%) was observed in T_0 treatment (Table 2). Plant height maximum (32.61%) application of 12 cm thickness of dry grass followed with application of 10 cm thickness of dry grass (31.72%) and minimum increase with the control (11.22%) (Table 3). It apparently appears that maximum increase in number of nodes and internodes (80.52% and 94.33%, respectively) was observed with treatment T_6 and it was found at par with T_5 (76.70%, 89.14%, respectively). The lowest increase in number of nodes and internodes (50.00% and 58.33%, respectively) was recorded in control at the time of completion of experiment.

The shoot parameters were recorded comparatively better with T_6-12 cm thickness of dry grass treatment as compared to rest of treatments. Healthier shoot attributes observed under T_6 treatment may be due to relatively more amenable effect of this treatment in modification of microclimate, better improvement in texture of soil, conservation of soil moisture, improvement of fertility and control of weeds. This treatment might also influence hydrothermal regimes by changing radiation balance, rate of heat, water vapour transfer and minimized hit of soil with sun more effectively in comparison to other treatments. Effective prevention of moisture deficit leading to improved cell division and elongation, perhaps also led to better shoot parameters in T_6 (12 cm thickness of dry grass) treatments over other treatments evaluated. Similar effect of the mulching on the plant growth was reported by Chattopdhyay and Patra (1992), Borthakur and Bhattacharyya (1996), Mal *et al.* (2006). Ali and Gaur (2013).

The maximum increase of number of leaves/ plant (39.94%) was noted with treatment T_6 followed by treatment T_5 (38.23%) (Table 6). However, minimum increase (21.68%) of number of leaves was observed

Table 1: Effect of mulching on rootstock girth of *Khirni* during growth period

Treatment	Initial value (March)	Rootstock girth (mm)					
		April	June	August	October	December	February
T_0	7.02	7.05 (0.42)	7.09 (0.99)	7.19 (2.42)	7.26 (3.41)	7.29 (3.84)	7.32 (4.27)
T_1	6.14	6.21 (1.14)	6.27 (2.11)	6.46 (5.21)	6.52 (6.18)	6.56 (6.84)	6.59 (7.32)
T_2	6.18	6.26 (1.29)	6.34 (2.58)	6.54 (5.82)	6.59 (6.63)	6.63 (7.28)	6.68 (8.09)
T_3	6.49	6.60 (1.69)	6.67 (2.77)	6.89 (6.16)	6.95 (7.08)	7.01 (8.01)	7.05 (8.62)
T_4	6.99	7.11 (1.71)	7.20 (3.00)	7.45 (6.58)	7.53 (7.72)	7.59 (8.58)	7.63 (9.15)
T_5	6.65	6.79 (2.10)	6.88 (3.45)	7.13 (7.21)	7.20 (8.27)	7.26 (9.17)	7.34 (10.37)
T_6	6.28	6.43 (2.38)	6.53 (3.98)	6.80 (8.28)	6.88 (9.55)	6.91 (10.03)	6.97 (10.98)
SEm ±	-	0.04	0.05	0.12	0.13	0.14	0.23
CD (5%)	-	0.12	0.15	0.37	0.39	0.43	0.69

Data in parentheses indicate per cent increase in rootstock girth

CD has been calculated based on percentage value

Table 2: Effect of mulching on scion girth of *khirni* during growth period

Treatment	Initial value (March)	Scion girth (mm)					
		April	June	August	October	December	February
T_0	3.95	3.97 (0.50)	3.99 (1.01)	4.05 (2.53)	4.09 (3.54)	4.11 (4.05)	4.13 (4.55)
T_1	3.18	3.21 (0.94)	3.25 (2.20)	3.34 (5.03)	3.39 (6.60)	3.43 (7.86)	3.46 (8.80)
T_2	3.23	3.27 (1.23)	3.32 (2.78)	3.43 (6.19)	3.47 (7.43)	3.50 (8.35)	3.54 (9.59)
T_3	3.29	3.34 (1.51)	3.40 (3.34)	3.51 (6.68)	3.55 (7.90)	3.58 (8.81)	3.60 (9.42)
T_4	3.54	3.60 (1.69)	3.67 (3.67)	3.79 (7.06)	3.83 (8.19)	3.86 (9.03)	3.90 (10.16)
T_5	3.91	3.98 (1.79)	4.06 (3.83)	4.20 (7.41)	4.25 (8.69)	4.28 (9.46)	4.32 (10.48)
T_6	3.80	3.89 (2.36)	3.98 (4.73)	4.10 (7.89)	4.16 (9.47)	4.19 (10.26)	4.22 (11.05)
SEm ±	-	0.04	0.06	0.09	0.10	0.13	0.22
CD (5%)	-	0.12	0.18	0.28	0.30	0.39	0.67

Data in parentheses indicate per cent increase in scion girth

CD has been calculated based on percentage value

Table 3: Effect of mulching on height of plant during growth period

Treatment	Initial value (March)	Height of plant (cm)					
		April	June	August	October	December	February
T_0	72.80	73.25 (0.61)	74.69 (2.59)	78.68 (8.07)	79.67 (9.43)	80.10 (10.02)	80.97 (11.22)
T_1	70.45	71.57 (1.58)	73.24 (3.96)	76.87 (9.11)	78.74 (11.76)	80.13 (13.74)	81.42 (15.57)
T_2	71.24	72.45 (1.69)	74.31 (4.30)	77.98 (9.46)	81.12 (13.86)	82.87 (16.32)	84.51 (18.62)
T_3	71.66	73.12 (2.03)	74.84 (4.43)	78.68 (9.79)	81.98 (14.40)	84.35 (17.70)	86.81 (21.14)
T_4	73.54	75.13 (2.16)	77.23 (5.01)	82.26 (11.85)	85.91 (16.82)	87.75 (19.32)	90.32 (22.81)
T_5	68.14	70.12 (2.90)	72.35 (6.17)	78.61 (15.36)	83.02 (21.83)	86.14 (26.41)	89.76 (31.72)
T_6	72.60	74.86 (3.11)	77.32 (6.50)	85.42 (17.65)	89.12 (22.75)	93.05 (28.16)	96.28 (32.61)
SEm ±	-	0.02	0.02	0.07	0.09	0.12	0.30
CD (5%)	-	0.06	0.06	0.22	0.27	0.38	0.91

Data variation lying in the range of 11.22 to 32.61 per cent, they were subjected to Arc sine transformed values. The variation not varying between 0 to 30 or 70 to100 were subjected to Arc Sine transformation (Gomez and Gomez, 1984)

CD has been calculated based on percentage value

with the control. Leaf length and leaf area index were maximum *i.e.*, 13.45% and 1.50%, respectively with the application of 12cm thickness of dry grass. Whereas, lowest increase in leaf length (3.32%) and leaf area index (0.46%) was recorded in T_0-Control.

The effect of mulching on leaf parameters viz., number of leaves/ plants, leaf length and leaf area index observed maximum increase with T_6-12 cm thickness of dry grass. These results may be clarified in the light of improvement of physico-chemical properties of soil through comparatively better congenial environment in the root zone (Kumar *et al.* 2008, Singh *et al.* 2004 in plum and Helaly *et al.* 2017 in gooseberry).

Conclusion

Thus, it may be concluded that application of the treatment T_6 (12 cm thickness of dry grass) had its better effect on growth and development of *Khirni* plants. The (12 cm thickness of dry grass emerged better in its effectivity on growth and development.

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