Research Journal of Chemical and Environmental Sciences
Res J. Chem. Environ. Sci. Vol 11 [2] April 2023: 01-03
Online ISSN 2321-1040
CODEN: RJCEA2 [USA]

Website: www.aelsindia.com/rjces.htm

RJCES

ORIGINAL ARTICLE

Effect of different harvesting methods on sprouting behavior, sprouting percentage and frost damage in mulberry under Kashmir climatic conditions

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ABSTRACT
In Kashmir, mulberry (Morus sps), the only food to silkworm (Bombyx mori L.) remains dormant during the winter months. The buds start sprouting during March-April, the leaves grow gradually and are fed to worms during May-June, the main cocoon crop at farmers' level in the region. The leaf requirement during the 5th stage of silkworm is too high to be met through individual plucking, thereby necessitating leaf harvesting through shoot cutting right from the crown base. This is also the annual pruning of the plant. After this the buds left as such sprout again and grow into shoots of more than one and a half meter with luxuriant leaf till the end of September which can again be used for feeding worms reared during August –September. Individual plucking is laborious and uneconomic and shoot harvesting during this phase is not also feasible. Hence different harvesting methods were tested to identify the most suitable method of leaf harvesting during the second cocoon crop. The results revealed that the sprouting was enhanced by clipping or branch cut as well as by thinning of branches the plant which was completely harvested in autumn showed non simultaneous sprouting in the next spring. Sprouting percentage per plant was the maximum (88 %) in T7 (50% branch cut By Length). Frost damage due to winter frost was the least (2.77%) in T7 (50% branch cut by length) which too was statistically at par with 2.98 percent damage registered in T6 (25% branch cut by length). Hence the study has showed that branch cut reduces frost damage and improves sprouting percentage.
Keywords: *Mulberry, Harvesting, Pruning, Crop, Sprouting,*

Received 20.01.2023 Revised 12.02.2023 Accepted 12.04.2023

INTRODUCTION

Mulberry (M*orus Sp.*) is a typical East Asian plant which can be trained as bush, dwarf and tree. It is widely distributed in varied ecological and geographical zones from intensive cultivation in temperate, subtropical and tropical areas to natural occurrence in forests throughout the world. This clearly indicates that mulberry possesses a high degree of adaptability to changes in the environment. The crop production efficiency is highly influenced by fixed inherent characteristics of the plant itself, the cultivation technique and the environmental conditions during the growth of the plant. The permanent characteristics of the plant are important factors in the cultivation of a crop. In order to increase the efficiency of mulberry field, the first important step is to select better variety of mulberry. The practical characteristics are those which are important for cultivation as well as for silkworm rearing [1].

The leaf requirement during the 5th Instar is so tremendous that the leaf is harvested along with the shoots and fed to worms as such which incidentally coincides with the annual pruning of mulberry. The lower buds left on the stump after pruning the plant sprout again and the leaf becomes available again during August-September which is harvested by individual plucking either along with the petiole or leaving the petiole on the plant to avoid damage to the buds that will sprout in the next spring. In no case can we go for complete pruning as more than one pruning in a year can prove deleterious. Harvesting by individual plucking though helps the plant, is not practicable because it is laborious and moisture which plays a crucial role, is lost faster as compared to leaves harvested along the shoots. The present study therefore aims to find out a suitable leaf harvesting method for the second crop without sacrificing the main crop (spring crop) [2].

The extent of frost damage which was taken in terms of shoot length was the maximum (33.0%) in T2 (100% leaf plucking) being statistically significant from the rest of the treatments. The damage due to winter frost was the least (2.77%) in T7 (50% branch cut by length) which too was statistically at par with 2.98 percent damage registered in T6 (25% branch cut by length).

MATERIALS AND METHODS

The investigation, "effect of different harvesting methods on sprouting, leaf area and leaf yield in mulberry under Kashmir climatic conditions" was carried out at College of Temperate Sericulture, SKUAST-K Mirgund during the year (2018- 2019). Established dwarf mulberry plants of Goshoerami (mulberry variety mostly used for commercial rearing in the region) having uniform growth and vigour were used for the study. Cultural practices were followed as per the package of practices recommended by the College of Temperate Sericulture, SKUAST-K, except leaf harvesting which was done as per the experimental treatments (Listed below). The treatments were given during the 1st week of September (2018), the leaf so got was taken as the autumn leaf yield per plant. The plantation was left as such during the winter and the observations on sprouting behavior, sprouting percentage and frost damage were recorded during spring 2019.

Sprouting: Five branches were selected and tagged from three plants each to take observations from the last week of March on the following:

Sprouting time: This was the time when the dormant winter buds started sprouting

Sprouting behavior: This was taken on the basis of regular observations taken on the selected branches and considered as Simultaneous or non simultaneous based on the togetherness or otherwise of the sprouting in the buds.

Extent of sprouting (%): This was recorded in spring after completion of sprouting. Total buds and sprouted ones were counted in each branch to calculate extent of sprouting.

$$\textbf{Extent of Sprouting (\%)} = \frac{\textbf{Number of sprouted buds}}{\textbf{total buds}} \times \mathbf{100}$$

Extent of damage due to Frost: The total length of the selected branches and the length damaged by frost in all the plants was measured after the sprouting was over with the help of a meter rod to calculate frost damage.

$$\textbf{Frost damage (\%)} = \frac{\textbf{Branch length damaged due to frost}}{\textbf{total branch lenght}} \times \mathbf{100}$$

Treatment details:-

T_1 : No leaf plucking
T_2 : 100% leaf plucking
T_3 : 50% leaf plucking
T_4 : 25% branch cut (By No)
T_5 : 50% branch cut (By No)
T_6 : 25% branch cut (By Length)
T_7 : 50% branch cut (By Length)

The observations on sprouting were recorded during March-April, increment in leaf size from 1st May till the 5th stage of spring rearing and leaf yield during both spring and autumn crops coinciding with the 5th stage of silkworm raering. The observation were compiled, average calculated and the data analyzed statistically.

RESULTS

Sprouting of winter buds

The results revealed that the sprouting behavior in all the treatments was 1simultaneous where all the buds sprouted simultaneously within one week except T2 (100% leaf plucking) where sprouting was non simultaneous as the sprouting of winter buds prolonged for three weeks and did not sprout simultaneously. The extent of sprouting was maximum (88 %) in T7 being at par with the values 84.62,83.38,80.23,79.96 and 78.10 percent recorded respectively in T6, T4, T3, T5 and T-1 and significantly different from 49.01 percent sprouting recorded in T2 (100% leaf plucking). as shown in Table 1.

Table-1: Sprouting of winter buds and extent of damage due to frost.

Treatments	*Sprouting Behavior*	*Sprouting (%)*	*Frost Damage*
T-1(No leaf plucking)	*Spontaneous*	78.10[a] (8.83)	30.00[b] (5.48)
T-2(100% leaf plucking)	*Non-Spontaneous*	49.01[b] (6.99)	33.00[a] (5.74)
T-3(50% leaf plucking)	*Spontaneous*	80.23[a] (8.94)	27.67[c] (5.26)
T-4(25% branch cut (By No)	*Spontaneous*	83.38[a] (9.13)	25.00[d] (4.99)
T-5(50% branch cut (By No)	*Spontaneous*	79.96[a] (8.94)	24.00[d] (4.89)
T-6(25% branch cut (By Length)	*Spontaneous*	84.62[a] (9.19)	2.98[e] (1.71)
T-7(50% branch cut (By Length)	*Spontaneous*	88.00[a] (9.37)	2.77[e] (1.66)
C.D (p≤0.05)		**0.707**	**0.285**

- Values in the Parenthesis are square root transformed values.

Sprouting behavior, sprouting percentage and frost damage:-

Observations on sprouting of winter buds and the extent of shoot damage due to winter frost are furnished in Table-1. The sprouting of winter buds started with a rise in temperature during March. The buds sprouted during the first week of April. The results revealed that the sprouting behavior in all the treatments was simultaneous where all the buds sprouted simultaneously within one week except T2 (100% leaf plucking) where sprouting was non simultaneous as the sprouting of winter buds prolonged for three weeks and did not sprout simultaneously. The extent of sprouting was maximum (88 %) in T7 being at par with the values 84.62,83.38,80.23,79.96 and 78.10 percent recorded respectively in T6, T4, T3, T5 and T-1 and significantly different from 49.01 percent sprouting recorded in T2 (100% leaf plucking).

The extent of frost damage which was taken in terms of shoot length was the maximum (33.0%) in T2 (100% leaf plucking) being statistically significant from the rest of the treatments. The damage due to winter frost was the least (2.77%) in T7 (50% branch cut by length) which too was statistically at par with 2.98 percent damage registered in T6 (25% branch cut by length).

DISCUSSION

During the severe winter conditions, the buds in all the treatments remained in a state of dormancy from November till next March. With an increase in temperature the buds became active and started sprouting during April and completed their sprouting by the end of first fort night of April except in T2 (100% leaf plucking).The sprouting of winter buds though a genetic behavior was similar in all the treatments except T2 (100% leaf plucking) which has shown non simultaneous and less percentage of sprouting of winter buds. Similar results have also been reported by [2].The less sprouting in T2 (100% leaf plucking) could be due to less reserve food in the shoots of plants of this treatment because of complete defoliation in the previous autumn and also due to mechanical damage caused to some of the buds due to leaf harvesting.

CONCLUSION

Sprouting of winter buds was non simultaneous and less in the treatment T2 where complete defoliation (100% leaf plucking) was resorted to during the preceding autumn. Also there was tremendous reduction in frost damage by clipping of branches .

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CITE THIS ARTICLE

Aadil H M, Ovais A H, R.K. Sharma, Mushtaq R M and Auqib H G.. Effect of different harvesting methods on sprouting behavior, sprouting percentage and frost damage in mulberry under Kashmir climatic conditions. Res. J. Chem. Env. Sci. Vol 11 [2] April 2023. 01-03