



Influence of Intensity of Pruning on Yield and Physico-Chemical Properties of Khasi Mandarin (*Citrus reticulata* Blanco)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Khasi Mandarin orange is well suited in Arunachal Pradesh as well entire north eastern states of India. Besides the ample rainfall and good sun shine received in Arunachal Pradesh; its productivity is too low as compared national average. The negligence of orchards without proper management practices is the major cause of low productivity. In this regard canopy management play vital role for good yield. The requirement of pruning varies with species therefore, the present experiment was carried out to investigate the influence of pruning intensity on the yield and quality of Khasi mandarin fruit.

The highest No. of fruits (245), and highest yield (12.24 T/ha) with T₄- (Removal of dried & diseased branches, thin shoots, water sprouts and selected laterals) while, highest average fruit weight (130 g), maximum fruit diameter (6.2 cm), maximum fruit length (5.6 cm) were noticed with

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T₅-(T₄+ Removal of selected leaders and formation of open centre canopy) and it was also observed lowest No of fruits, size and yield were recorded in control. Therefore, It is concluded from the result that T₄ (Removal of dried & diseased branches, thin shoots, water sprouts and selected laterals) is best practice of higher yield but T₅ (T₄+ Removal of selected leaders and formation of open centre canopy) is best practice for little lower yield than T₄ but for good market quality fruits.

Keywords: Mandarin; pruning; intensity; canopy management; yield and quality.

1. INTRODUCTION

The Khasi mandarin is one of the most economically important citrus crop in north eastern region of India but its productivity is only 5.86MT/ha (in the region)' that is too low than national productivity of 11.08MT/ha [1]. Khasi Mandarin is known for its distinct sweet and sour taste with its unique blend of sugar and acid [2,3].

Citrus has naturally sympodial growth habit, formed a large bush (18 - 20 feet tall) if left unpruned. Pruning prolong the bearing age of the tree. An un-pruned tree becomes very large, inhibiting light penetration. As, a result, leaf sprout is decreased and photosynthesis activity remains low. Pruning, the judicious removal of any vegetative part, is an important culture operation for the fruiting trees Singh et al. [4]. Light becomes a limiting factor in crowded groves and pruning improves light access. Adjustments must be made in the height, row middle width, and hedging angle to maximize sunlight penetration through the canopy Chadha [5]. Sunlight not only influences the flowering and fruit set but also enhances fruit quality and colour development of fruit [6]. Malik [7] stated that the objective of pruning is to produce maximum fruit of good quality by maintaining a balance between fruiting and vegetative wood. Chadha [5] reported that lightly pruned, young trees of Limon made greater development of roots and shoots. Singh et al. [4] observed that citrus trees, which were begun to decline in vigor, yield and size of fruit, need pruning to help the restore their condition. Decreasing the number of fruit buds will usually give fewer but larger fruit and may increase the percentage of desirable fruits [8].

The requirement of pruning varies with species therefore, thus the present experiment was carried out to investigate the influence of pruning intensity on the yield and quality of Khasi mandarin fruit.

2. MATERIALS AND METHODS

The present experiment was carried out by Krishi Vigyan Kendra, Yachuli, District Lower Subansiri

to find out the Effect of canopy management in Khasi Mandarin (*Citrus reticulata*)" in acidic soils of Arunachal hills. The experimental trial was conducted on seven year old Khasi mandarin trees in the farmer's field at Yachuli rural area during January of the year 2021-22. The trees were pruned in the month of January after the fruit harvesting with five treatment levels viz. T₁-un-pruned (control), T₂- (Removal of dried, & diseased branches), T₃-(T₂+ Removal of thin shoots and water sprout arising from leaders), T₄-(T₃+ Removal of selected laterals), T₅-(T₄+ Removal of selected leaders and formation of open centre canopy). Randomized Block Design was adopted and in order to maintain the optimum level of accuracy experiment was replicated three times and three trees per treatment were selected for observation.

The experimental material was kept under similar cultural practices (fertilizers and irrigation). Data were recorded of fruit yield and quality characters. The highest and lowest value with average value of all parameters was recorded. The yield was measured as number of fruit and fruit weight during harvest, per tree. The fruit size both in length and width was measured with the help of Vernier callipers and expressed in centimeters. The total fifteen fruits per treatment (five fruits per tree; a treatment had three trees, then the total no of fruits= 5 fruit x 3 tree= 15 fruits per treatment) were weighted and per unit mean weight were recorded. The No. of seeds in individual fruit was counted and average number of seed was noticed. The juice percent was recorded after juice extraction with per cent of total fruit weight. Total soluble solids (T.S.S) were determined with the help of hand refractometer (Erma 0-32 0Brix range). Physico chemical characteristics of mature fruits were recorded each year using standard method [9].

3. RESULTS AND DISCUSSION

It depicted from table-01 that levels of pruning significantly affect the retention percentage of fruit of Khasi mandarin. Highest retention percentage of fruits (59.87%) recorded in fruits

pruned heavily (T₅) with centre opening while, lowest fruit retention (43.33%) noticed in un-pruned plants (T₁).

Highest fruit retention per plant in open canopy may be due to greater penetrating of sunlight and better air circulation, creating a micro-climate conducive to synthesis of carbohydrates and phyto-hormones. It is also indicated in Table-01 that the pruning significantly affect mortality of branches, lowest mortality /plant (1.4 kg on fresh weight basis) were recorded in T₅ levels of pruning while, highest mortality were recorded in control.

Treatment T₂ recorded at par with T₃. It may be due fungal attack on unpruned plants, while less mortality in heavily pruned plant may be due to well penetration of sun light and less fungal infestation. This is in conformity with the result of Ghosh and Bera [10] and Sharma et al [11].

Table-01 shows that levels of pruning significantly affect the yield and quality of Khasi mandarin. Statistically significant difference was noted in yield among various treatments (Table-01). The plants, which were pruned at T₄ level, produced maximum number of fruits 245.5/ plant followed by heavily pruned T₅ (232 fruits/plant) as compared to the minimum number (145.00) of fruits per plant in un-pruned plants. Treatment T₄ found at par with T₅ and T₃ with T₂. These findings are in support of findings of Singh et al. [4] and Sharma et al. [11], who mentioned that trees, which have begun to decline in vigor, yield and size of fruit need pruning to improve their condition. In present investigation it can be concluded the pruning of old and undesirable branches stimulated the growth of new shoots to obtain new fruiting wood. So the numbers of fruits were more in pruned trees as compared to un-pruned and light pruned trees while, very heavy pruning (T₅) may reduce the number of branches therefore, no of fruits reduced (232) with very less difference than T₄ (245) but the fruit length, diameter (5.65 and 6.20 cm, respectively) and weight (130.53g) was recorded highest in heavily pruned trees T₅ while, was minimum length, diameter and weight (4.7, 5.2 cm and 97.47g, respectively) in control. It may be due to better light penetration in heavily pruned tree which helps in increase the fruit size in comparison to T₄.

Fruit length and diameter recorded significant with pruned tree with control but at par within treatments. Fruit weight in case of T₅ significantly

differs with T₁ (control) but at par results noticed between treatments. Simliar observations also recorded by Tayde and Ingle [12] and Ramanna et al. [13]. Highest yield per plant 30.60 kg and Yield/ha 12.24 tones were recorded from T₄ (Medium pruned) followed (29.60 kg and 11.92 tones, respectively) from T₅ (heavy pruned plants) while, was recorded lowest in control plants (Table-1). It was also observed that treatment T₅ was at par with T₄. These results are also correlated with the findings of Singh et al. [4]. It may be due to availability of more number of branches in medium pruned branches and high fruit yield in comparison to T₅, which may increase the number of fruits per plant and result of that little increase in yield per plant and per ha (Table-1).

Table-02 shows that pruning of Khasi mandarin plants significantly affects the juice percentage of T₄, and T₅ in experiment with control. Maximum juice percentage (44.60) was noted in fruits, which were harvested from the heavily pruned plants (T₅) followed by T₄ (43.40 per cent) in medium pruning. It was also recorded that fruit juice percentage recorded at par of T₁ with T₂, T₂ with T₃, T₃ with T₄, T₄ with T₅.

The present results fully correlated the finds of Sites and Reitz [14]. Significant difference also observed from findings in case of acidity of fruits. Lowest acidity (0.54%) was recorded with T₅ (heavily pruned) while highest in control. It may be happen because of more sunlight penetration induced the size of fruit and juice percentage and reduce the acidity of fruits.

TSS and TSS: acid ratio also influenced with severity of pruning but TSS recorded in T₄ was at par with T₅, and T₃ with T₂. Highest T.S.S and TSS:acid ratio (9.8 °B and 18.14, respectively) noticed in heavy pruning while observed lowest (7.80 °B and 8.86, respectively) in T₁ (control). Studies by Sites and Reitz [14], Bastakoti et al. [15] and Joubert et al. [16] support these results, where he noticed that increased soluble solids contents and improved rind colour was correlated with increased light intensity due to pruning in citrus plantation. It is also indicated from table that significant difference among the treatments T₁ and T₂ in case of seed/fruit were recorded. Maximum numbers of seeds per fruit 23.00 were observed in un-pruned plants was recorded significant with T₂ while, minimum number of seeds 15.6 was found in T₅ (heavy pruning). The treatments T₂ with T₃, T₃ with T₄, T₄ with T₅ are recorded at par. This result is similar with the findings of Ahmad et al. [6].

Table 1. Effect of different intensity of pruning on Yield and yield attributing characteristics of Khasi Mandarin (*Citrus reticulata* Blanco)

Treatments /Parameters	Fruit retention %	Shoot mortality /plant on fresh weight basis (kg)	No. of Fruits/ plant:	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Yield per plant (Kg)	Yield (T)/ ha
T ₁ -un-pruned (control),	43.33	3.50	145.00	4.70	5.20	97.47	13.40	5.36
T ₂ - (Removal of dried, & diseased branches),	48.00	2.80	172.00	5.00	5.60	116.20	18.85	7.54
T ₃ -(T ₂ + Removal of thin shoots and water sprout arising from leaders),	51.27	2.65	194.00	5.20	5.70	119.50	22.50	9.00
T ₄ -(T ₃ + Removal of selected laterals),	55.33	1.91	245.00	5.50	6.0	125.40	30.60	12.24
T ₅ -(T ₄ + Removal of selected leaders and formation of open centre canopy).	59.87	1.40	232.00	5.65	6.20	130.53	29.60	11.92
CD (P=0.05)	3.95	0.50	27.82	0.56	0.41	8.29	3.42	0.96
CV (%)	4.07	10.83	7.48	5.69	3.81	3.74	7.90	5.53

Table 2.-Effect of different intensity of pruning on Physico-chemical characteristics of Khasi Mandarin (*Citrus reticulata* Blanco)

Treatments /Parameters	Fruit juice percentage	Acidity (%)	TSS (°B)	TSS: Acid ratio	No.of seed per fruit
T ₁ -un-pruned (control),	37.60	0.88	7.80	8.86	23.00
T ₂ - (Removal of dried, & diseased branches),	37.83	0.78	8.20	10.51	20.50
T ₃ -(T ₂ + Removal of thin shoots and water sprout arising from leaders),	40.50	0.72	8.50	12.28	19.60
T ₄ -(T ₃ + Removal of selected laterals),	43.40	0.64	9.40	14.68	17.80
T ₅ -(T ₄ + Removal of selected leaders and formation of open centre canopy).	44.60	0.54	9.80	18.14	15.60
CD (P=0.05)	3.40	0.057	0.52	0.13	2.42
CV (%)	4.44	4.26	3.17	0.53	6.66

4. CONCLUSION

It is concluded from above result that highest fruit yield were obtained from T₄ (medium pruning) followed by T₅ (heavily pruned plants), while size and quality improves better in T₅ (heavily pruned plants), therefore medium pruning T₄ (Removal of dried & diseased branches, thin shoots, water sprouts and selected laterals) is best practice of higher yield but T₅ (Removal of dried & diseased branches, thin shoots, water sprouts, selected laterals+Removal of selected leaders and formation of open centre canopy) is best practice for little lower yield than T₄ but for good market quality fruits.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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