Influence of intensity of pruning on yield and Physico-chemical properties of Khasi Mandarin (*Citrus reticulata* Blanco)

ABSTRACT

Mandarin orange is the most common among citrus fruits grown in India. Khasi is a commercially grown variety of mandarin is grown in north eastern states Assam, Mizoram, Tripura, Sikkim and Arunachal Pradesh. It is locally known as Kamala mandarin. Canopy management, the judicious removal of any vegetative part, is an important culture operation for the fruiting trees. Canopy management prolong the bearing age of the tree. An un-pruned tree becomes very large, inhibiting light penetration. Light becomes a limiting factor in crowded groves and pruning improves light access. 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.

It was concluded from the experiment that the highest No. of fruits (245), and highest yield (12.24 T/ha) with T_4-(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 T_5-(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 T_4 (Removal of dried & diseased branches, thin shoots, water sprouts and selected laterals) is best practice of higher yield but T_5 (T4+ Removal of selected leaders and formation of open centre canopy) is best practice for little lower yield than T_4 but for good market quality fruits.

Keywords: *Mandarin, pruning, intensity, canopy management, yield and quality.*

INTRODUCTION:

Though the North eastern India is home to most of the citrus species, and mandarin is one ofthe most economically important citrus crop in this region, but the productivity of mandarin inthe northeast at 5.86MT/ha is way lower than the national productivity of 11.08MT/ha(Barbora *et al*., 2019). Khasi mandarin, commercially grown in the north eastern region and is knownlocally as Soh-sohniamtra in Khasi language and Humoptira or komola in Assamese. KhasiMandarin is known for its distinct sweet and sour taste with its unique blend of sugar and acid (Ngachan*et al*., 2010; Hangsing*et al*., 2016).

Citrus has naturally sympodial growth habit, farming a large bush (18 - 20 feet tall) if left un-pruned. 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. 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. Sunlight not only influences the flowering and fruit set but also enhances fruit quality and colour development of fruit(Ahmad*et al.*, 2006). Malik (1994) stated that the objective of pruning is to produce maximum fruit of good quality by maintaining a balance between fruiting and vegetative wood. Chadha (2001) reported that lightly pruned, young trees of Limon made greater development of roots and shoots. Singh *et al*. (2004) observed that citrus trees, whichwere 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 lager fruit and may increase the percentage of desirable fruits (Densen, 1979).

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.

MATERIALS AND METHODS:

The present experiment was carried out by Krishi Vigyan Kendra,Yachuli, District Lower Subansirito find out the Effect of canopy management in Khasi Mandarin (*Citrus reticulata*)" in acidic soils of Arunachal hills. The experimental trial was conductedon 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 fivetreatment levels viz. T_1-un-pruned (control), T_2- (Removal of dried, & diseased branches), T_3-(T_2+ Removal of thin shoots and water sprout arising from leaders), T_4-(T_3+ Removal of selected laterals), T_5-(T_4+ Removal of selected leaders and formation of open centre canopy).Randomized Block Design was adopted andin order to maintain the optimum level of accuracy experiment was replicated three times and threetrees per treatment were selected for observation.

The experimental material was kept under similarcultural practices (fertilizers and irrigation).Data were recorded of fruit yield and qualitycharacters. The highest and lowest value with average value of all parameters was recorded. The yield was measured as number of fruit and fruit weight duringharvest, per tree. The fruitsize both in length and width was measured with the help of Vernier callipersand expressed in centimeters.The ten fruits were weighted and per unit mean weightwere 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 determinedwith the help of hand refractometer

(Erma 0-32 0Brix range).Physico chemical characteristics of mature fruits were recorded each year using standard method (A.O.A.C., 1990).

RESULT AND DISCUSSION:

It depicted from table-1 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 (T_5) with centre opening while, lowest fruit retention (43.33%) noticed in un-pruned plants (T_1). Highest fruit retention per plant in open canopy may be due to greater penetrating of sunlight and better air circulation, creating a micro-climate conductive to synthesis of carbohydrates and phyto-hormones. It is also indicated in table-1 that the pruning significantly affect mortality of branches, lowest mortality /plant (1.4 kg on fresh weight basis) were recorded in T_5 levels of pruning while, highest mortality were recorded in control. Treatment T_2 recorded at par with T_3.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 (2014) andSharma et al (1997).

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-1shows that levels of pruning significantly affect the yield and quality of Khasi mandarin. Statistically significant difference was noted in yieldamong various treatments (Table-1). The plants, which were pruned at T_4 level, produced maximum number of fruits 245.5/ plant followed by heavily pruned T_5 (232 fruits/plant) as compared to the minimum number (145.00)of fruits per plant in un-pruned plants. Treatment T_4 found at par with T_5 and T_3 with T_2.These findings are in support of findings ofSingh *et al.* (2004) *and*and Sharma *et al*. (1997),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 (T_5) may reduce the number of branches therefore, no of fruits reduced (232) with very less difference than T_4 (245) but the fruit length, diameter (5.65 and 6.20 cm, respectively) and weight (130.53g) was recorded highest in heavily pruned trees T_5 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 T_4.Fruit length and diameter recorded significant with pruned tree with control but at par within treatments.Fruit weight in case of T_5 significantly differs with T_1 (control) but at par results noticed between treatments. Simliar observations also recorded by Tayde and Ingle (1997). Highest yield per plant 30.60 kg and Yield/ha 12.24 tones were recorded fromT_4 (Medium pruned) followed (29.60 kg and 11.92 tones, respectively) from T_5 (heavy pruned plants) while, was recorded lowest in control plants (Table-1).It was also observed that treatment T_5 was at par with T_4. These results are also correlated with the findings of Singh *et al.* (2004).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-2 shows that pruning of Khasi mandarin plants significantly affects the juice percentage of T_4, and T_5 in experiment with control. Maximum juice percentage (44.60) was noted in fruits, which were harvested from the heavily pruned plants (T_5) followed by T_4 (43.40 per cent) in medium pruning. It was also recorded that fruit juice percentage recorded at par of T_1 with T_2, T_2 with T_3, T_3 with T_4, T_4 with T_5.The present results fully correlated the finds of Sites and Reitz (1948).Significant difference also observed from findings in case of acidity of fruits. Lowest acidity (0.54%) was recorded with T_5 (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.

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 (^{0}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**

TSS and TSS:acid ratio also influenced with severity of pruning but TSS recorded in T_4 was at par with T_5, and T_3 with T_2. Highest T.S.S and TSS:acid ratio (9.8 ^{0}B and 18.14, respectively) noticed in heavy pruning while observed lowest (7.80 ^{0}B and 8.86, respectively)in T_1 (control). Studies by Sites and Reitz (1948)and Joubert *et al.* (2000) 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 T_1 and T_2in case of seed/fruit were recorded. Maximum numbers of seeds per fruit 23.00were observed in un-pruned plants was recorded significant with T_2 while, minimum number of seeds 15.6was found in T_5 (heavy pruning). The treatments T_2 with T_3, T_3 with T_4, $T_4$with $T_5$are recorded at par. This result is similar with the findings of Ahmad *et al.* (2006).

CONCLUSION:

It is concluded from above result that highest fruit yield were obtained from T_4 (medium pruning)followed by T_5 (heavily pruned plants), while size and quality improves better in T_5 (heavily pruned plants), therefore medium pruning T_4(Removal of dried& diseased branches, thin shoots, water sprouts and selected laterals) is best practice of higher yield but T_5 (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 T_4 but for good market quality fruits.

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