



**RESPONSE OF KINNOW CROP WITH RESPECT TO GROWTH, YIELD AND QUALITY TO DIFFERENT LEVELS OF PRUNING**

<sup>a</sup> Akbar Hayat\*, <sup>a</sup> Ehsan-Ul-Haque, <sup>a</sup> Muhammad Asim, <sup>b</sup> Naveeda Anjum, <sup>a</sup> Muhammad Zubair, <sup>a</sup> Muhammad Nawaz, <sup>a</sup> Raza Salik

<sup>a</sup> Citrus Research Institute, Sargodha,

<sup>b</sup> Barani Agricultural Research Institute, Chakwal

\*Corresponding email address: [akbar\\_saggu@hotmail.com](mailto:akbar_saggu@hotmail.com)

**ABSTRACT**

Pruning is a technique that is employed in orchards to control growth, remove dead or diseased wood, to stimulate formation of flower and fruit buds. It has in common the objectives of manipulating the vegetative or reproductive growth. Some of the benefit traditionally attributed pruning had been called into question by field research in past few decades. A proper training and pruning program is essential for maintenance of a healthy and productive orchard. To quantify the pruning intensity and level on the quality and yield in Kinnow fruit crop was studied in the department of Citrus Research institute, Sargodha from 2013 to 2015. The research trial was conducted according to the RCBD with five replications. Mature and fruit bearing trees of Kinnow mandarin were pruned as No-pruning (T<sub>1</sub>), light-pruning 10 % (T<sub>2</sub>), medium-pruning 25% (T<sub>3</sub>) and heavy-pruning 35 % (T<sub>4</sub>). Fruit yield per tree in terms of number of fruits was highest in third year in all contestant treatments i.e. 979 in medium-pruning, 957 in light-pruning, 929 in no-pruning and 853 in heavy-pruning. Medium pruning in respect of quality parameters like average fruit weight and juice percentage excelled among all treatments with results 223g and 54.6% respectively. Conclusively Maximum yield and quality of Kinnow fruit crop was obtained in medium-pruning which appeared to be the best pruning methodology in Kinnow crop.

**Key word:** Kinnow, pruning, TSS, acidity, quality of Kinnow.

**INTRODUCTION**

Growth habit in citrus is sympodial naturally, grown as a heavy bush (6-7 meter tall) if pruning is not carried out. (Malik and Bashir, 1994). As long as the tree remain healthy they can flower and fruit for years on end, sometimes for as long as twenty or thirty years. Pruning as a tool to improve yields in citrus (Mazhar and Nawaz, 2006). Sensible removal of vegetative parts called pruning, is an important cultural practice for the fruit crops (Palti, 2012). This practice can extend the fruit bearing span of the citrus crop. Citrus tree without pruning becomes a shady tree rather than a fruiting tree, as it inhibits light and spray penetration (Cary, 1981). Which results in slow photosynthesis activity and leave sprout (Intrigliolo and Rocuzzo, 2011). Light is very important for photosynthesis. If light is not intercepted properly it becomes a limiting factor in dense plants and plantation which results in low yield and poor quality fruits (Evans and Poorter, 2001). Gaps must be made in the canopy of the plant at width, top and hedging angle to maximize penetration of sunlight (Zaragoza and Alonso, 1982). Sunlight enhances color development and quality by inducing the flowering and fruit set in citrus crop. Pruning of the bearing trees develops strong framework and ensures the regular bearing each year (Tucker *et al.*, 1994). Different varieties require different quantity and intensity of pruning, thus this study was initiated to investigate the effect of pruning levels on quality and yield and various other parameters of Kinnow crop.

Malik & Bashir (1994) reported that the main objective of pruning is the production of better quality fruit by

maintaining equal balance between vegetative wood and fruiting. Ahmad *et al.* (2006) stated that lightly pruning in young trees of kinnow made it to greater development of shoots and roots and they observed that citrus trees, which were initiated to decline in yield, vigor and fruit size, need pruning to help the return their condition. Decrease in number of fruit buds usually gives less but superior fruit and may also increase the desirable fruits percentage (Janick and Moore, 1996). Yeshitela, *et al.* (2003) reported that there was no statistically significant difference between the experimental treatments for the number of fruit or average fruit per tree in 'TA' mango cultivars.

**Material and Method**

The experiment was conducted at Citrus Research Institute Sargodha on twelve years old Kinnow trees. In the month of January and February of each year, kinnow trees were pruned according to the following treatments:

T<sub>1</sub>= Control (Un-pruned)

T<sub>2</sub>= Light pruning (10%) (Removal of dead, dried, diseased branches)

T<sub>3</sub>= Medium pruning (25%) (Removal of water sprout dried, & diseased branches).

T<sub>4</sub>= Heavy pruning (35%) (Removal of water sprout & diseased branches along with healthy but making narrow and crisscross branches through canopy of plant (figure 1).

Pruning was done just after the fruit harvest. Treatments were replicated five times in order to maintain the accuracy and per treatment five trees were selected according to the Randomized Complete Block Design. Same cultural practices (fertilizer and irrigation) were applied to the Experimental

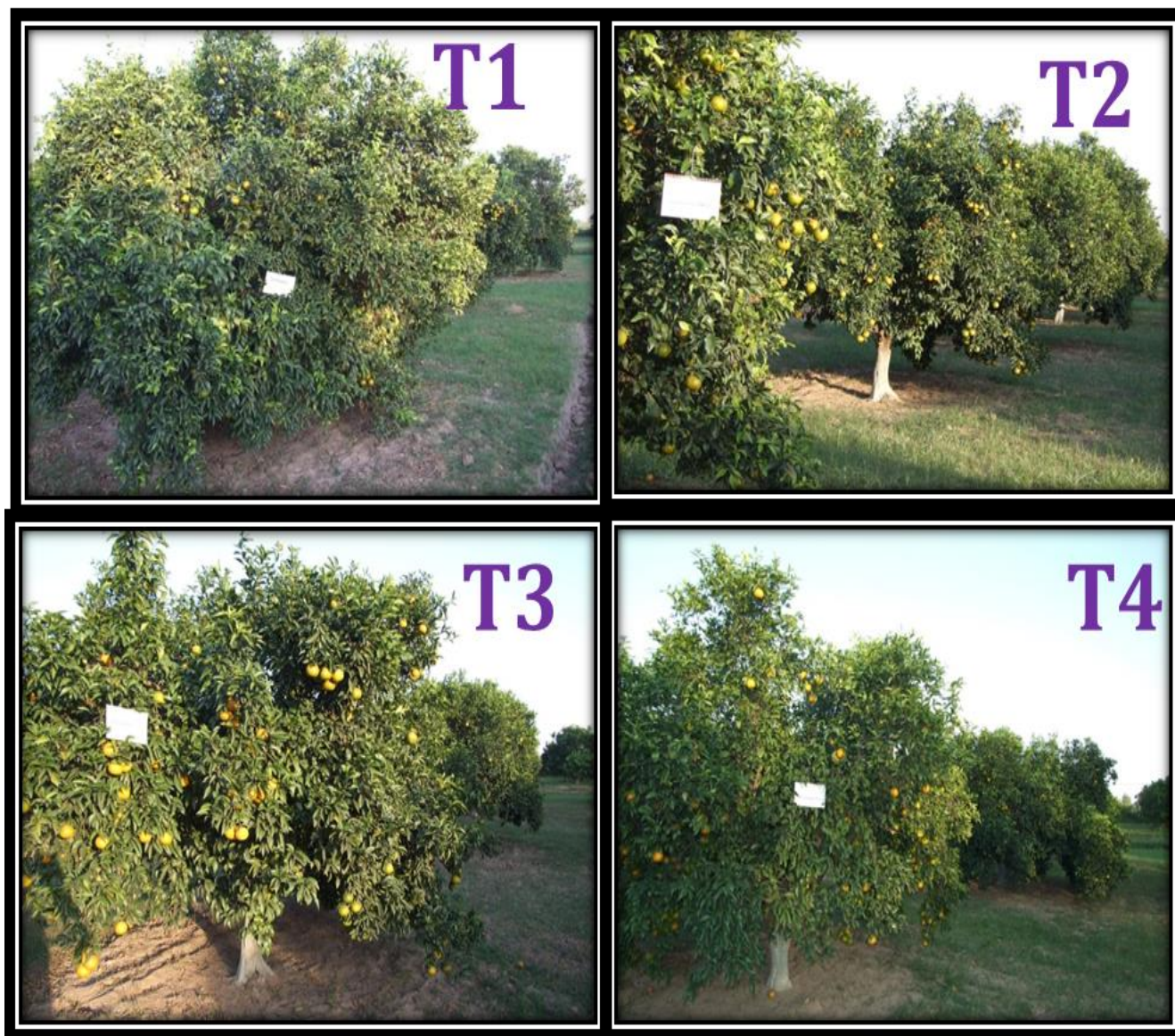


Figure 1: Puning experiment at Citrus Research Institute Sargodha, Pakistan

T1= Control (Un-pruned)

T<sub>2</sub>= Light pruning (10%) (Removal of dead, dried, diseased branches)

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material. Data of the qualitative and quantitative parameters was recorded. Yield data was recorded in terms of No. of fruit/plant at the time of harvesting in individual treatment. The fruit size was measured along with minor diameter (width) in millimeter. The sample of twenty fruits was weighed and average weight was achieved. Juice of these twenty fruits was extracted and expressed as percent of the total fruit weight. Peel and rag percentage were calculated with the same procedure. Hand Refractometer was used to determined total soluble solids (T.S.S), while acidity was

measured by titrating of juice sample against N/ 10 sodium hydroxide using a few drops of phenolphthalein as indicator. The results were stated as percent citric acid using the factor that is 0.0064 for each sample. To calculate the T.S.S/ Acid ratio the total soluble solids (T.S.S) was divided by acidity. Number of seeds was counted in individual fruit.

#### RESULT AND DISCUSSION

Statistically significant difference was noted in average fruit weight among different treatments. After pruning promising results regarding all parameters under study were observed

from 2012 to 2014. The data obtained regarding number of fruits per tree during 2012, 2013 and 2014 is given in figure 2. The maximum number of fruits per plant 918 (in 2012), 957 (in 2013) and 979 (in 2014) was observed in plants which were pruned 25 % (medium pruning) as compared to minimum number of fruits recorded 626 (in 2012) 718 (in 2013) and 853 (in 2014) in heavy pruned plants. Maximum average fruit weight was attained in medium pruning 189 g (in 2012) 206 g (in 2013) and 223 g (in 2014), while minimum average fruit weight remained in heavy pruning (152.8g & 172.6g) during year 2012 & 2013 respectively which seems mainly due to removal of some vegetative wood capable of fruit bearing (figure 4). In comparison to control all three pruning treatments had better results even heavy pruning excelled in average fruit weight although in heavy pruning various useful branches capable of fruit bearing were removed for attaining of quality yields. Above findings are sustained by (Ahmad *et al.*, 2006) who stated that the trees which have initiated to decline in yield, vigor and fruit size need the pruning to help in restore their condition. Similarly fruit size or diameter was also favorably affected by each of pruning treatment as compared to control. Among all the results for three years specifically medium pruning yielded best fruit size in third year 86.3 mm followed by 83.3 mm in the second year because pruning increase plant vigor and growth (Ghosh, 2015). Results of juice percentage yielded same pattern among all of the treatments under test; highest juice percentage was attained in medium pruning in third year 54.6% followed by 52.6 % in the second year for the same treatment, results supported by (Ahmad *et al.*, 2006). Higher peel thickness was measured 4.85mm during third year in medium level of pruning, which is close with 4.32mm observed during the year 2014 in Heavy pruning.

For quality analysis, fruits were harvested at optimum time of maturity. The data of Total Soluble solids TSS % were recorded as given in figure 3. Best results for total Soluble solid (Brix) 11.90 (in 2012), 11.90 (2013) and 13.38 (2014) were recorded in medium level of pruning. TSS was significantly increased in the treatment of medium pruning from first to third year i.e. 11.9, 12.7 and 13.4 consecutively. The TSS value of fruit in other levels of pruning was also increased gradually from first to third year. TSS attained in all three pruning treatments was significantly better as compared to control during third year data as supported by study (Ingle *et al.*, 2005). Decreasing trend in values for percent acid in all three pruning treatments from first to third year was observed (figure 3). In medium pruning percent acid remained 0.66, 0.61 and 0.59 respectively for three years as compared to 0.75, 0.79 and 0.78 for control treatment as reported by (Ahmad *et al.*, 2006; Zekri, 2011). Brix acid ratio an indicator of fruit maturity index also remained better in the treatment of medium pruning progressively increased from first to third year i.e. 18.0, 19.8 and 21.6 respectively (figure 3). Maximum TSS acid ratio was recorded 18.03 (in 2012), 19.83 (in 2013), and 21.59 (in 2014) in medium level

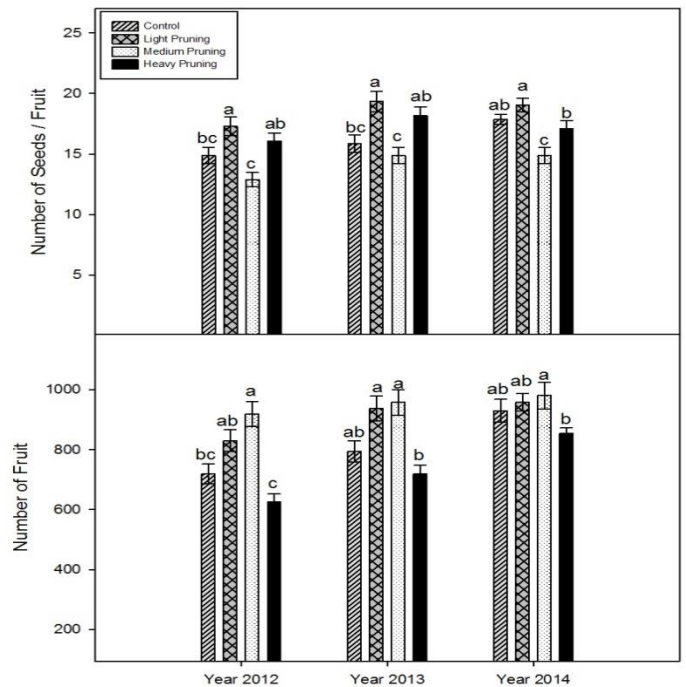


Figure 2: Effect of different level of pruning on number of fruit and number of seeds

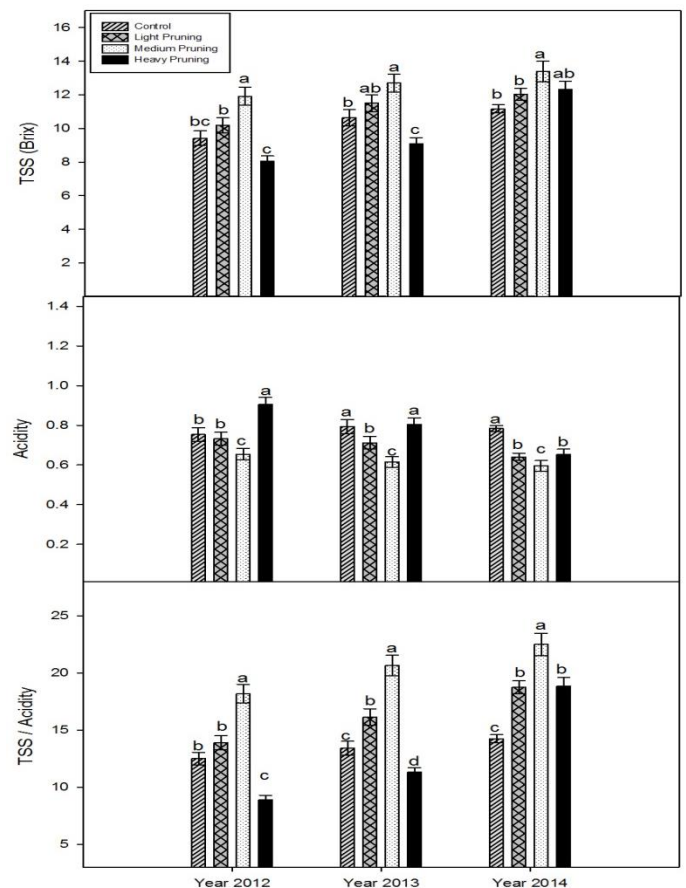


Figure 3: Effect of different level of pruning on TSS, Acidity and TSS/Acidity Ratio.

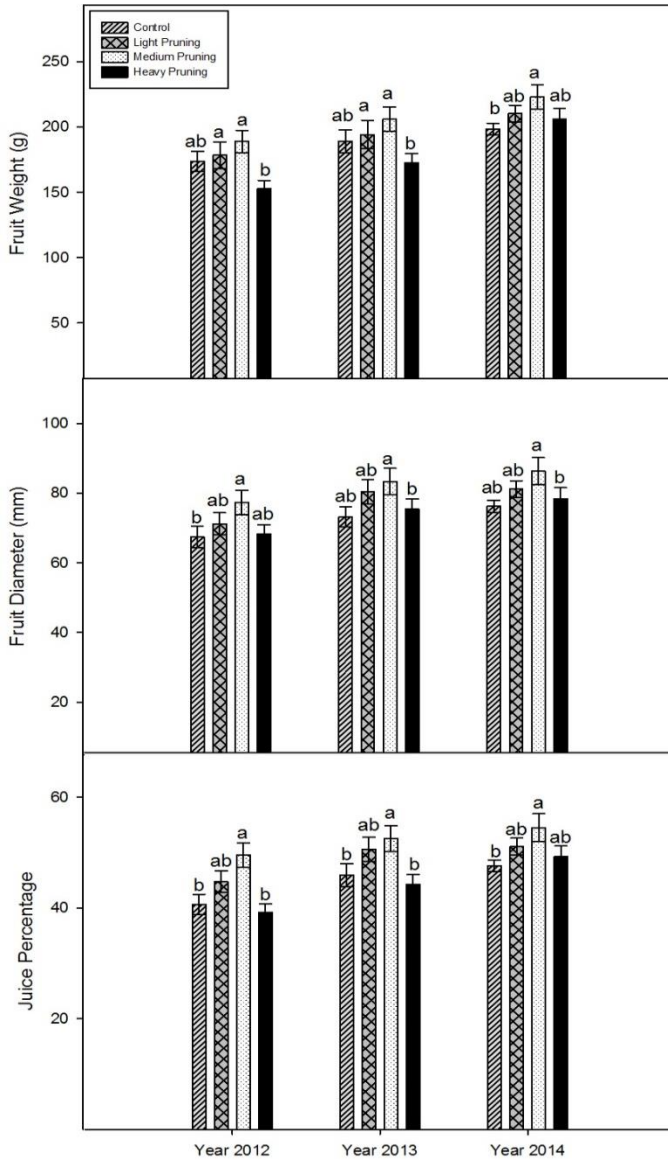


Figure 4: Effect of different level of pruning on Fruit weight, fruit Diameter and Juice percentage of pruning. In present investigation, it can be concluded that pruning of old and undesirable branches encouraged growth of new fruiting wood and bearing branches. Better number of fruits per plant were yielded in pruned Kinnow plants as compared to un-pruned trees except heavy pruning because of excessive removal of fruiting wood as described by (Salama, 2018).

Peel thickness, peel and rag weight adversely affect fruit quality and juice percentage. Values attained in all these parameters depict better quality in medium pruning respectively decreasing from first to third year. Medium pruning (figure 5) resulted superior quality fruit with lesser peel thickness 3.17 mm in third year while 3.59 mm in second year as compared to peel thickness 4.86 mm attained in control. Similarly peel and rag weight attained in medium

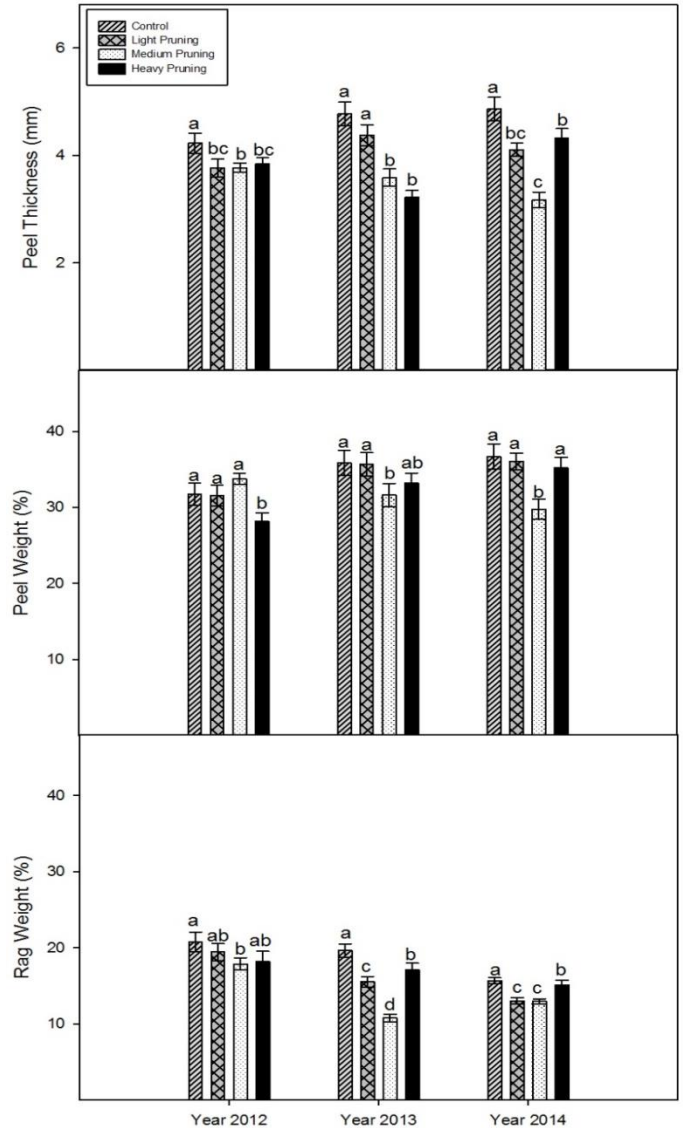


Figure 5: Effect of different level of pruning on rag weight, peel weight and peel Thickness. pruning in third year remained 29.8 and 15.6 percent followed by light pruning 36.1 and 13.0 percent (Fig. 5). Even heavy pruning yielded better results for peel and rag percentage as compared to control (Sauls, 2002). Average number of seeds among all three different levels of pruning and in un-pruned (control) treatment did not differ significantly (figure 2).

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**CONCLUSION**

Maximum yield and quality of Kinnow fruit crop was obtained in medium-pruning which appeared to be the best pruning

methodology in Kinnow crop.

#### **CONFLICT OF INTEREST**

Authors have no conflict of interest

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