

Short Communication

**EVALUATION OF FRUITING ABILITY AND FRUIT QUALITY THROUGH
DIFFERENT TRAINING SYSTEMS OF APPLE**

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INTRODUCTION

Apple is a popular fruit crop among Sri Lankans which is supplied mainly through importation at a huge expense of foreign exchange. In year 2103 alone, rupees 1.8 billion were spent for importation (AgStat, 2013). Imported fruits with harmful chemicals that are being used for long shelf life is the major issue of faced by Sri Lankan in consuming this fruit. There are some Apple (*Malus domestica*) trees cultivated in a few home gardens in Up Country Intermediate Zone (UPIC) and Up Country Wet Zone (UCWZ) in Sri Lanka. Climatic conditions in both these agro-climatic zones are conducive for flowering and fruit bearing of apple. However, the pruning systems used is not appropriate to obtain quality fruits and an economical yield. Most commonly used tree pruning types are Centre leader and Centre open approach. Hence, new training types and agronomic practices are required to increase the productivity of Apple trees in Sri Lanka. Therefore, this study was carried out to evaluate fruiting ability in UCIZ through different training systems of Apple.

MATERIAL AND METHODS

The experiment was conducted at the Regional Agriculture Research and Development Centre (RARDC), Bandarawela from August 2012 to June 2013. The experiment was carried out with six years old Apple trees with 4.5 x 4 m spacing. Selected trees for which treatments were imposed has been subject to Centre open pruning. The crop management practices were done according to the DOA recommendations. In the experiment, treatments were taken as Centre open pruning + branches angle 45⁰ - 60⁰ from vertical (T1), Centre open pruning + excess flowers thinning (T2), Centre open pruning + branches angle 45⁰ - 60⁰ from vertical + excess flowers thinning (T3) and Centre open pruning (T4) as a control were laid out in a Randomized Completely Block Design (RCBD) with four replicates. Data recording was

started from the beginning of flower blooming and continued up to fruit maturity. Aforesaid tree training methods were started at the vegetative stage of the tree.

Fruit quality parameters such as fruit weight, firmness, pH and Brix (TSS) were also measured in the horticulture laboratory. The experiment was arranged according to a Completely Randomized Design (CRD) with four replicates. Data were subjected to ANOVA procedure to obtain treatment means using SAS 9.1.3 statistical software. The statistical differences among treatment means were tested by DUNCAN procedure ($P=0.05$) test. Sensory evaluation was done by panelist's evaluation of Apple fruits. The parameters of taste, colour and mouth feel (crispiness) were evaluated. Ten numbers of panelists were involved in the sensory evaluation. Data were analyzed using SPSS statistical software.

RESULTS AND DISCUSSION

Flower blooms and fruit let count

At the beginning of the reproductive stage of tree, flower blooms were counted according to the as per the Table 1. Highest mean value of number of flower blooms was recorded in control (T4). The lowest mean value of number of flower blooms was recorded in T3. However, flower blooms count was not significantly different within treatments. Fruitlets count also showed the lowest mean value in T3. Fruitlets setting were same in T1 and T2. When comparing Table 1 and Table 2, treatment 1 showed a failure in fruit set due to the wind damage or problem regarding pollination. However, fruitlet development was not significantly different in between treatments.

Table 1. Flower blooms fruitlets initiated as affected by different plant training systems.

Treatment	Mean value of number of flower	Mean value of number of fruit lets per plant
T1	11.3 a	2.6b
T2	7.0a	2.6b
T3	6.6a	0.3b
T4	11.6a	4.0a
CV (%)	12.7	11.3

Note: Means followed by the same letter in each column are not significantly different at $p=0.05$

The significantly higher fruitlets formation in trees without use of any training system was recorded in flower blooms as well. The lowest mean fruitlets count was also evident T3. Fruitlets setting were same in T1 and T2. However, fruitlet development was not significantly different between treatments. Table 2 shows the mean value of fruit

yield of Apple from maturity stage to harvesting stage. Highest fruit yield was recorded in plants without use of any training systems. Lowest fruit yield was recorded in Treatment 3. Fruit yield also not significantly different within treatments.

Table 2. Apple fruit yield from maturity stage to harvesting stage as affected by different training systems.

Treatment	Mean value of number of fruits per plant (May 2013)	Mean value of number of fruits per plant (June 2013)
T1	2a	1.3a
T2	1a	1.0a
T3	0a	0.0a
T4	3a	2.3a
CV (%)	26.9	24.6

Note: Means followed by the same letter in each column are not significantly different at $p=0.05$

According to the literature, Apple fruit yield can be improved using above training practices in European countries. Temperate countries utilize these strategies to optimize fruit yield through efficient use of sunlight for photosynthesis with correct position of limbs. Because it determines whether branches will produce primarily fruit or continue with vegetative growth. When branches grow straight up, they produce mostly vegetative parts and a very little fruits. However, in this experiment results revealed that different training systems do not significantly affect the flowering and fruiting yield of Apple in UCIZ climatic conditions in Sri Lanka.

Fruit quality

Table 3 reveals that there is no significant different between treatments with any of the parameters measured in terms of quality of the fruit. In the context of TSS values of Apple fruits, highest value was evident in T3 with a comparatively low value in T4. When considering four treatments, there was a significantly different in brix values among fruits in different training systems. According to the literature, Bruce *et al.*, (2008), reports that sugar content is changing with the different training systems of grapes. TSS formation is different with the amount of sunlight capture during the photosynthesis. The results revealed that higher sweetness can be obtained by adopting different training methods than without use of any training system.

Sensory evaluation

According to the sensory evaluation results, Apple fruit taste was significantly different with each treatment. A very clear difference in taste exist from highest to lowest

in a sequence of T3, T1, T2 and T4. The results revealed that training systems of branches at angle 45° - 60° from vertical, excess flowers thinning and Centre open pruning methods are important to improve the Apple fruit taste.

Table 3. Fruit quality parameters of Apple as affected by different plant training systems.

Treatment	Mean value of fruit weight (g)	Mean value of fruit firmness	Mean pH value	Mean TSS value
T1	134.4a	3.1a	2.8a	15.2a
T2	129.7ab	3.4a	2.7a	14.5a
T3	93.6ab	3.3a	2.6a	15.5a
T4	111.1ab	3.3a	2.7a	12.8b
CV (%)	14.6	4.1	2.3	11.3

Note: Means followed by the same letter in each column are not significantly different at $p=0.05$.

Sensory evaluation on color of the fruit revealed that there is a significant difference between treatments. The T4 reported the significantly lowest mean value for colour (1.85). Greenish back ground with red colour was highest in T4 and other treatments were in golden colour back ground with red colour. The character of crispiness (mouth feel) of Apple fruits was significantly different between treatments. Treatments T3 and T2 reported the highest crispness. T1 and T4 were significantly lower in crispiness. Overall results revealed that the T3 has reported the highest value in taste; colour and mouth feel (crispiness). According to the literature Emily *et al.*, (2009) has reported that flower thinning improves fruit quality by limiting number of fruits per cluster.

Table 4. Sensory evaluation of Apple with different treatment.

Treatment	Taste	Colour	Mouth feel (Crispiness)
T1	3.10b	2.7a	2.1b
T2	2.30c	2.55a	2.9a
T3	3.55a	2.9a	3.2a
T4	1.05d	1.85b	1.8b
CV%	10.2	8.3	6.8

Note: Means followed by the same letter in each column are not significantly different at $p=0.05$

CONCLUSION

Based on the results it can be concluded that only plant pruning is sufficient to increase the yield of Apple trees in the UCIZ of Sri Lanka. However, adoption of additional plant training systems can improve the fruit quality of Apple

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