

# Fruit production and quality improvement in aonla (*Emblica officinalis* Gaertn.) through canopy management

S. N. Ghosh\*, B. Bera<sup>1</sup>, A. Kundu<sup>1</sup>, and S. Roy<sup>1</sup>

Department of Fruits and Orchard Management, Bidhan Chandra Krishi Viswavidyalaya, Nadia-741252, West Bengal  
<sup>1</sup>MPS Farm, Jhargram, Paschim Midnapore – 721504, West Bengal

## Abstract

In order to maintain the health and vigour and to sustain the productivity, a pruning experiment was conducted on four year old 'Balwant' cultivar of aonla grown in laterite soil, planted at a spacing of 5x5m. To find out the best pruning method, six levels of pruning was performed i.e., i) Light judicious pruning, ii) Detopping of primary branches at 8 feet from ground level + removal of all secondary branches, iii) Detopping of primary branches at 8 feet from the ground level + removal of all secondary branches at 2 feet from the base of primary branches, iv) Detopping of primary branches at 8 feet from the ground level + removal of all secondary branches at 1 feet from the base of primary branches, v) Light judicious pruning + Detopping of plant canopy of at 8 feet from the ground level, vi) No pruning (control). Results of three consecutive years of investigation revealed that light judicious pruning of thin, overlapping, criss-crossed, dead, unproductive and looping branches gave highest fruit yield in all the three years and resulted 64.4 per cent yield increment over control when average of three years was considered. Severe pruning of primary and secondary branches caused drastic reduction of yield for two consecutive years after pruning. Judicious pruning helped to produce better sizeable and quality fruits.

**Key words :** Aonla, close spacing, pruning, canopy management, yield, fruit quality.

## Introduction

Aonla or Indian gooseberry (*Emblica Officinalis* Gaertn.), a versatile tree, is adaptable in diverse soil and climatic condition. Aonla is considered to be one the important fruits for its nutritive, medicinal and industrial value. Due to its multipurpose importance, cultivation of this crop is gradually spreading in different land situation including waste lands. It can be grown in the soil having pH 5.0 (acidic) to even in 8.5 (saline and alkaline). In West Bengal, an eastern state of India, the crop is being grown in red and laterite zone where the soil is red and lateritic type and pH ranges between 4.5 and 5.5. In this zone, the crop show luxuriant growth under proper nutritional care and the branches are need to be pruned within six years of planting for better aeration, sunlight penetration, improving yield and to minimize the pest population like mealy bug and shoot hole borer. The pruning is an art of removal of unwanted growth of plant parts in a scientific manner with the view to improve the productivity and efficacy of the orchard. In every fruit crop requires specialized pruning method in various agro-climatic situation. No work has been carried out on canopy management through judicious pruning in mature aonla plants grown under moderate planting

system in laterite soil. So, an intensive investigation was made for three consecutive years to optimize the best and effective pruning method for increasing the yield and quality of fruits of aonla grown in laterite soil at 5 m x 5 m spacing.

## Material and methods

The trial was conducted in a farmer's field in the district of Paschim Midnapore, West Bengal, India during 2006 to 2008 on four year old plants of 'Balwant' cultivar of aonla of uniform vigour and productivity. The plants were planted at a spacing of 5 x 5m. The soil of the experimental orchard was lateritic having pH 5.7. The experiment was conducted in Randomized Block Design (RBD) having four replications with four plants in each replication. There were 6 pruning treatments viz.,

- T<sub>1</sub> : Light judicious pruning (removal of thin, overlapping, criss-cross and looping branches near the ground level).
- T<sub>2</sub> : Detopping of primary branches at 8 feet from ground level + removal of secondary branches.
- T<sub>3</sub> : Detopping of primary branches at 8 feet from ground level + removal of all secondary branches at 2 feet from the base of primary branches.
- T<sub>4</sub> : Detopping of primary branches at 8 feet from ground level + removal of secondary branches at 1 feet from the base of primary branches.

\* Corresponding author's e-mail :  
profsnghosh@yahoo.co.in



T<sub>1</sub>: Light judicious pruning + detopping of the canopy at 8 feet from the ground level.

T<sub>6</sub>: No pruning except removal of dead branches (control).

The pruning operation was conducted on 5<sup>th</sup> February, 2006. The plants were fertilized with yearly dose of 30 kg FYM; 200g N; 100g P<sub>2</sub>O<sub>5</sub> and 100g K<sub>2</sub>O per plant in two split doses viz., April and July. The plants were irrigated once in a month during February to May.

Observation on fruit yield was recorded on the basis of actual weight of mature fruits harvested per plant. Physico-chemical characteristics of mature fruits were observed in each year following standard method (A.O.A.C., 1990) and average was presented. All the collected data were statistically analyzed.

## Results and discussion

### Fruit yield

The fruit yield which is the main aim of the experiment was significantly influenced by different pruning treatments. The results clearly indicated that yearly light judicious pruning (T<sub>1</sub>) in aonla was helpful for maintaining its health, vigour and productivity as it resulted highest yield in every year. It was calculated that light judicious pruning gave 192, 63 and 18 per cent more yield as compared to unpruned plants (control). Yield improvement due to light judicious pruning is explained from the fact that removal of overlapping, criss-crossed, dead, thin and dropping and unproductive branches resulted good light penetration and air circulation which may caused higher photosynthetic rate (Pratap *et al.*, 2003). Besides, this pruning method also helped for proper utilization and distribution of reserve food materials by the growing fruits, which were on re-

maining shoots. It was further observed that severe pruning like T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> had detrimental effect on yield in aonla which was due to loss of fruit bearing shoot. Unlike other fruit crops, aonla put forth flowers and fruits on mature shoots of more than one year age. So, removal of primary and/or secondary branches result loss of fruit bearing shoots which was reflected in subsequent years after pruning. Another interesting observation was noted that aonla has strong tendency to alternate bearing as yield pattern in judicious pruned and unpruned plants was like a tide. Beneficial effect of light pruning on yield improvement was also observed by Jadav and Khimani (2003) and Prabhu *et al.* (2003) in aonla.

### Fruit weight

The fruit weight in pruned and unpruned plants was differed significantly. Maximum fruit weight of 25.2 g was measured from judicious pruned plants (T<sub>1</sub>) and minimum weighted fruit (21.4 g) was recorded from the control plants (T<sub>6</sub>). Higher fruit weight in pruned plants was due to more available photosynthates as compared to unpruned plants and this observation was also noted by Sharma *et al.* (1997) in kinnow mandarin; Pratap *et al.* (2003) in Mango; Khan and Syamal (2004) in Kagzi lime.

### Pulp content

As aonla, is mainly utilized for preparation of various bye-products including ayurvedic medicine, pulp recovery is one of the important physical parameter for determining the treatments' effect. Investigation showed that pulp recovery percentage was more in fruits of pruned plants as compared to unpruned plants and it was highest from judicious pruned plants (94.2%). Similar observation was also noted by Jadav and Khimani (2003) in aonla.

**Table 1.** Effect of severity of pruning on yield and fruit quality of aonla cv. NA-10 grown in laterite soil.

Pruning Treatment	Fruit yield/plant (kg)					* Fruit weight (g)	*Pulp content (%)	*T.S.S (°B)	*Acidity (%)	*Vit. C. (mg/100g pulp)
	2006	2007	2008	Total yield in 3 years	Av.yield of 3 years					
T <sub>1</sub>	18.1	6.2	20.0	44.3	14.8	25.2	94.2	10.2	1.4	550
T <sub>2</sub>	0.0	0.5	30.5	31.0	10.3	24.4	93.0	9.4	1.1	538
T <sub>3</sub>	0.6	2.6	13.2	16.4	5.5	23.2	92.8	9.9	1.2	548
T <sub>4</sub>	0.0	2.6	3.9	6.5	2.2	24.1	93.9	9.8	1.2	542
T <sub>5</sub>	12.4	0.2	7.1	19.7	6.6	24.5	93.2	9.4	1.1	540
T <sub>6</sub>	6.2	3.8	17.0	27.0	9.0	21.4	91.6	8.7	1.2	530
C.D. at 5%	4.4	1.1	2.8	3.8	2.2	0.8	0.9	0.5	N.S.	2.8

\* Average of 3 years

T<sub>1</sub> = Light judicious pruning

T<sub>2</sub> = Detopping of primary branches at 8 feet from ground level + removal of secondary branches.

T<sub>3</sub> = Detopping of primary branches at 8 feet from ground level + removal of all secondary branches at 2 feet from the base of primary branches.

T<sub>4</sub> = Detopping of primary branches at 8 feet from ground level + removal of secondary branches at 1 feet from the base of primary branches.

T<sub>5</sub> = Light judicious pruning + detopping of the canopy at 8 feet from the ground level.

#### Total soluble solids

The total soluble solids (T.S.S.) content of fruit is considered to be one of the important parameter for assessing its qualitative value. The T.S.S. content in fruits from the all the pruned plants was higher as compared to unpruned plants which showed the lowest value (8.7° Brix). High T.S.S. content in the fruits of pruned plants was due to accumulation of more carbohydrates and other metabolites. This observation was also corroborated the findings of Singh *et al.* (2004) in ber.

#### Fruit acidity

The fruit acidity in aonla was not significantly affected due to various pruning treatments.

#### Vit. C content

The vit. C or ascorbic acid is an important antioxidant for which aonla is considered to be one of the best nutritious fruit. It is the highest source of vit. C among the fruits after burbados cherry. Investigation showed that the pruning treatments has significant effect on vit. C content of the fruits. The fruits of all the pruned plants have higher vit. C content as compared to unpruned ones. The vit. C content was measured highest (550 mg/100 g) from the fruits of judicious pruned plants ( $T_1$ ) and lowest (530 mg/100 g) in control plants ( $T_0$ ). Improvement in vit. C content in fruits due to different pruning practices was also observed by Ghosh (2008) in ber.

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