

Cultivation of Aonla Fruit Crop under Eastern Uttar Pradesh

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Aonla (*Embllica officinalis* Gaertn.) also known as Indian gooseberry which associates to the family "Euphorbiaceae" with chromosome no $2n=28$ and is indigenous to Indian subcontinent. It is also called with another names like Amla or Aonla(Hindi), Amalaki(Sanskrit), Nelli (Malayalam & Tamil), Amlakamu(Telugu), Amolphal(Punjabi) and Myrobalan or Indian gooseberry (English). Fruit is highly nutritional and is the richest sources of vitamin C after the Barbados cherry and contains about 500-1500 mg of ascorbic acid/100 g of pulp.

Aonla is rich in various phenolic compounds that exhibit antioxidant, antimicrobial, anti-inflammatory, antipyretic, adaptogenic, antiulcerogenic, hepatoprotective, antitumor, and antidiarrheal effects. Two significant Ayurvedic formulations, Trifla and Chavanprash, are renowned for their health-enhancing benefits. Both fresh and dried Aonla fruit are utilized in the management of ailments such as scurvy, jaundice, diabetes, diarrhoea, and inflammatory conditions.

Aonla fruit is rich in riboflavin, thiamine, proteins, fibers, carbohydrates, and essential minerals including iron, phosphorus, and calcium. It also contains various amino acids and phytochemicals such as polyphenols, tannins, emblicol, linoleic acid, corilagin, phyllembelin, and rutin. Its significance lies in its resilience, ability to thrive in diverse wastelands, and high productivity, making it a crop with substantial production potential that requires minimal maintenance per unit area. Additionally, it can be cultivated in arid regions, poor soils, salt-affected soils, and marginal lands.

Chemical composition of Aonla

Constituent	Amount (%)	Constituent	Amount (mg/100g pulp)
Moisture	77.5-82.50	Iron	1-28
Protein	0.60	Nicotinic acid	0-22
Fat	0.15	Vitamin	200-1814
Minerals	0.6-0.80	Carotene	0.03
Fiber	1.8-3.8	Thiamine	0.05
Carbohydrates	15.12-22.10	Riboflavin	0.06
		Niacin	0.27
Calcium	0.018-0.070	Tryptophan	3.08
Phosphorus	0.050-0.076	Methionine	3.00
		Lysine	19.00

Distribution

On a national level the primary states known for aonla production are Uttar Pradesh, Gujarat, Rajasthan, Tamil Nadu, Haryana, Maharashtra, Andhra Pradesh, Punjab, Karnataka, and Himachal Pradesh.

In India its cultivation is done over **50,000 ha area** with **production of 1, 75, 000 tonnes**. In Uttar Pradesh its cultivation is majorily seen in the districts of Pratapgarh, Raibareli, Jaunpur, Sultanpur, Banda, Kanpur, Agra and Mathura. Uttar Pradesh ranks 1st in overall area and production.

Botanical description

Tree shapes, branching and plant parts (tree, leaves, fruits, seeds) are discussed below:

Tree: Aonla is essentially a medium-sized tree with many branches that grows to a height of 10–20 meters. It operates as an evergreen tree in tropical climates but, because of total leaf defoliation, acts as a deciduous tree in subtropical climates.

Stem: Aonla is having smooth, greenish grey to brown, exfoliating bark, which peels off in thin flakes like that of guava.

Branching: Aonla is having phyllanthoid type branching pattern. These branches are classified as long (indeterminate shoots) & short (determinate shoots). Indeterminate shoots are longer and do not fall from the tree and not exhibit flowers or fruit in it while determinate shoots bears flowers and fruits in it.

Inflorescence: Inflorescence of aonla is racemose type, with male flowers appearing in the leaf axils throughout the branches, while female flowers are located at the distal ends. Male & female flower colours are light yellow and green. Flowering begins in the first week of March. In South India, however, flowering occurs twice, specifically in February-March and June-July. Anthesis occurs in the evening, typically between **5:50 and 7:45 P.M.** Following anthesis, anther dehiscence occurs shortly thereafter, approximately **10 to 15 minutes** post-anthesis. Female flowers require around **72 hours** to fully open.

Fruit: Fruits display a flattened, rounded, or oblate form, frequently possessing a notch at the bottom. They are categorized as capsular (drupaceous) berries, distinguished by a succulent exocarp that may be either smooth or gently lobed, generally consisting of six lobes.

Climate and Soil

Aonla can adapt to wide range of climatic conditions; however, it thrives best in a dry subtropical environment. A fully grown aonla tree can withstand high temperature reaching up to 46°C. Heavy frost during winter is not suitable for its cultivation, for the fruit development warm climate of July-August is favourable. While well-drained, fertile loamy soil is preferred for aonla cultivation with a pH range of 6.5-9.5.

Cultivar

Some of the named cultivars basically NA-4, NA-5, NA-6, NA-7, NA-10, NA-25 & NA-26 etc are the most prominently cultivated and released from SAU- ANDUA&T, Kumarganj, Ayodhya, Uttar Pradesh.

NA-4(Kanchan)

Chance seedling selection of Banarasi from Pratapgarh. Tree is semi tall with spreading growth habit and bears moderately. The fruit is medium to large in size, flattened, conical, angular in shape. Skin is very smooth, yellowish in colour with red blush on the surface. Flesh is fibreless, hard and semi-transparent and highly astringent. It is early maturing and shy bearing and resistant to fruit necrosis.



NA-5(Krishna)

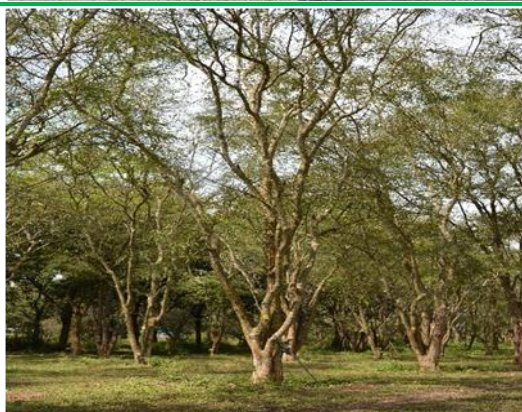
It is also a seedling selection form Chakaiya. It is a heavy and regular bearing cultivar with medium sized, high fibre content fruits. Fruit is small to medium (30-40 g), skin smooth, yellowish in colour and ideally suited for preparation of pickles. The variety has been adopted very well in the semi-arid regions and produce 150-200 kg fruits per tree. Late maturity, fruit has a good keeping quality and is free from necrosis.

**NA-6(Amrit)**

It is a seedling selection from Chakaiya which adopt an ideal tree shape with prolific and heavy bearing. Owing to low fibre content, it is an ideal cultivar for preserve and candy. This is the most promising variety of aonla so far available for plantation.

**NA-7(Neelum)**

This variety is a precocious, prolific and regular bearer clone of Francis. The fruit is free from incidence of necrosis. Successfully grown in states of Uttar Pradesh, Bihar, Jharkhand, Rajasthan, M.P, A.P, T.N and J&K. The major limitation of NA-7 is brittleness of branches, that can break under the weight of its own fruit. Ideal for processing. Fruits are medium to large size, smooth and yellow surface.

**NA-10**

Agra Bold, a chance seedling selection from Banarasi. Tree are Semi-tall, semi-spreading with deep pink and long inflorescence while fruits are round, brown, rough skin with yellowish green and pink tinge, slightly fibrous, whitish green flesh, soft, juicy, and highly astringent. Earliest maturing variety with good keeping quality, mildly susceptible to fruit necrosis.

**NA-25**

In this aonla variety flowering starts early, from last week of February. It starts bearing of fruits from 4th year onwards while fruit ripening takes place in month of November & earliest among all the released varieties. Fruit shape is flattened round.

NA-26

In this variety also flowering starts early from last week of February and fruits full ripening takes place in month of December. Ripened fruits are attractive bright green yellow colour with smooth thin skin. Fruit shape is as NA-25 only.

Planting

Planting material- Aonla is propagated by budding (shield or patch) or soft wood grafting.

Planting season- In the month of July to August its planting can be done.

Spacing- Grafted or budded plants should be spaced 4 to 5 meters apart when planted in a square layout, ideally during the months of July to August or February.

Planting method- Pits measuring 1 to 1.25 meters in size are excavated two months prior to the planting process. Each pit is filled with a mixture of 3 to 4 baskets of well-decomposed FYM and either 1 kg of neem cake or 500 grams of bone meal combined with the soil. In areas with sodic soil, 5 to 8 kg of gypsum and 20 kg of sand are added to the pit. Typically, ber, guava, and lemon trees can be used as filler plants at the center of each square formed by aonla plants. Additionally, hedge-row planting is being experimented with, maintaining a distance of 8 meters between rows, while the spacing between individual plants is reduced to 4 to 5 meters.

Nutrient management

A dosage of 10 kg of farmyard manure, along with 100 g of nitrogen (N), 50 g of phosphorus (P), and 100 g of potassium (K), is recommended for plants that are one year old. This dosage should be increased annually until the tenth year, after which a consistent dosage will be maintained. The complete amount of farmyard manure, phosphorus, and half of the nitrogen and potassium should be applied in the tree basin during the months of January and February. The remaining half of nitrogen and potassium should be applied in August. In sodic soils, it is advisable to incorporate 100-500 g of boron (B) and zinc sulfate along with the fertilizers, adjusted according to the age of the tree.

Irrigation

In early years of orchard establishment during dry summers under wasteland condition irrigation is given to 15-20 days interval. After manuring & fertilizer application (Jan-Feb) 1st irrigation is given. Irrigation should be avoided during flowering period (mid Mar- to mid Apr).

Harvesting & yield

Aonla fruits are generally harvested between November and December. The harvesting may occur in the early morning or late afternoon. Each Aonla tree can yield between 1 to 3 quintals of fruit, leading to an estimated production of 15 to 20 tonnes per hectare.

Post harvest management

Aonla preserves, candy, Murabba, pickles, Squash, chavanprash, Aonla powder, trifala etc are some of important post-harvest products of Aonla fruit.

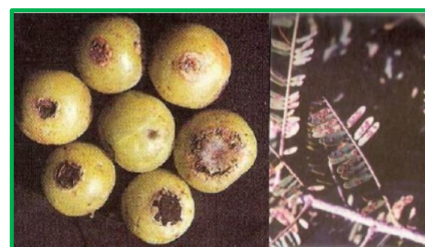
Plant protection

Diseases:

1.Aonla rust: Another name for it is ring rust and caused by *Ravenelia emblicae* var. *fructoidae*. Black pustules first show up on leaflets and fruits, which eventually come together to create a ring that covers a sizable area. The impacted fruits prematurely fall off.

Control: 3-4 sprays of mancozeb at 2.5 g/l of water spaced 15 days apart, or wettable sulfur at 5 g/l of water spaced 1 month apart.

2.Anthraxnose: It is caused due to *Colletotrichum* sp. The symptoms include tiny, round, greyish spots on leaflets with yellow borders; the center of the leaflets stays grey with fruit bodies that resemble dots. Fruit lesions become depressed and black in the middle produced acervuli that are grouped in rings. The size and shape of lesions might vary at high humidity, spore masses form on fruiting bodies.



Control: At 15-day intervals, apply mancozeb (2 g/l of water), copper oxychloride (3 g/l of water), or carbendazim (0.5 g/l of water). Spray again according to severity.

3.Fruit rot: It is brought on by *Phoma* species. Round smoke, brown to black lesions, colorless soft patches, or black ring spots that show up, leading to partial or total fruit decaying.



Control: Fruits has to be given post harvest treatment with difolaton @ 1.5 g/l of water or mancozeb @ 1 g/l of water or carbendazim @ 0.5 g/l of water.

4.Blue mold rot: It is caused by *Penicillium islandicum*. Water soaked areas with brown patches are found on fruits. From the diseased patches yellowish drops of liquid exude, fruit emits a bad smell, with a bluish green or beaded look.



Control: Fruits should be handled properly by avoiding wounds. Manage good sanitary conditions in storage by gas treatment with NCl_3 and ozone. Treat fruit with borax @ 0.5 g/l of water.

Physiological disorder:

Internal necrosis: The browning of the innermost layer of mesocarpic tissue occurs during the hardening of the endocarp, subsequently spreading towards the epicarp and leading to a brownish-black coloration of the pulp.

Control: The application of a combined spray consisting of Zinc sulphate (0.4%), Copper sulphate (0.4%), and Borax (0.4%) during the months of September and October has proven to be effective.

Pests

1.Bark-eating caterpillars (*Indarbela quadrinotata*, *Indarbela tetraonis*): It can cause damage around 80% by making tunnels in main trunk of the tree. Feed on the bark under silken ribbon shaped webs.

Control: Spray of endrin or furadan @ 0.03% or by injecting kerosene oil or petrol in the holes and plugging them with cotton or wet soil during Sep-Oct or Feb -Mar.

2.Shoot gall maker (*Betanosa stylophora*): The tender shoots are bored by young caterpillar and feed in pits during August- September. The damaged region shows gall like formation.

Control: Killing the larvae by inserting iron or spoke or injecting dichlorovos or endosulphon @ 0.05% in the holes. Spraying of monocrotophos @ 0.05% during July-August is effective.

3.Fruit borer (*Deudorix isocrates*): Newly hatched caterpillars make infestation into the fruits and feed on developing seeds. Hole made by the caterpillar facilitates the entry of pathogens and induce fruit rot and drop.

Control: Bag fruits after single spray of dimethoate @ 0.045 % or deltamethrin @ 0.003 % with muslin cloth or butter paper bags.

4.Aphids (*Schoutedenia emblica*): Serious pest of new flush. The aphids make it attack on tender shoots, leaves, flower bud and fruits.

Control: Single spray of neem seed kernel extract @ 2 % at the initiation of new flush.