

**AGRICULTURE FORUM FOR TECHNICAL
EDUCATION OF FARMING SOCIETY**

Kota, Rajasthan



Ethylene: The Natural Ripening Hormone

Authors

Prasad Patil

Assistant Professor (C) Department of Post Harvest
Management, College of Agriculture, Kerala Agriculture
University, Thrissur, Kerala, India.

INTRODUCTION

Ethylene is one of the five major classes of plant hormones and is the only plant hormone that exists in the gaseous state under normal conditions. It is a simple unsaturated hydrocarbon with the chemical formula C_2H_4 . Despite its simple structure and production in minute quantities, ethylene exerts profound effects on plant growth, development, and senescence. The discovery of ethylene's physiological effects began in the early twentieth century when it was observed that illuminating gas caused abnormal growth and premature leaf fall in plants. Subsequent studies established ethylene as a naturally occurring plant hormone.

Ethylene is synthesized by almost all higher plants and is produced in various tissues such as fruits, leaves, flowers, stems, roots, and seeds. Its production is influenced by developmental stages and environmental conditions. Young growing tissues, senescing organs, ripening fruits, and wounded tissues generally produce higher amounts of ethylene. Environmental factors such as temperature, drought, flooding, mechanical injury, and pathogen attack can also stimulate its synthesis.

Among all the functions of ethylene, its role in fruit ripening is of immense importance in horticulture. Fruits can be broadly classified into climacteric and non-climacteric fruits based on their ripening behaviour. Climacteric fruits such as mango, banana, apple, papaya, pear, guava, and tomato exhibit a sudden increase in respiration and ethylene production during ripening. Ethylene acts as a signal molecule that triggers numerous biochemical and physiological changes responsible for ripening. Non-climacteric fruits such as citrus, grapes, pineapple, and strawberry do not exhibit a pronounced increase

in ethylene production and therefore respond differently to external ethylene application.

The ripening process induced by ethylene involves a series of complex changes. Chlorophyll pigments degrade and are replaced by carotenoid and anthocyanin pigments, leading to attractive colour development. Starch is hydrolysed into simple sugars, increasing sweetness. Organic acids and tannins decline, reducing sourness and astringency. Cell wall components such as pectin and cellulose are partially degraded, resulting in softening of fruit tissues. Furthermore, the synthesis of volatile aromatic compounds enhances flavour and aroma, making fruits more palatable and acceptable to consumers.

Ethylene not only regulates fruit ripening but also influences numerous physiological and developmental processes in plants. It promotes seed germination in certain species, stimulates root hair formation, induces flowering in pineapple, promotes femaleness in cucurbits, accelerates senescence of flowers and leaves, and plays a major role in leaf and fruit abscission. Ethylene also serves as a stress hormone because its production increases under adverse environmental conditions such as drought, waterlogging, chilling injury, salinity, and pathogen infection.

In post-harvest technology, ethylene has great commercial significance. Controlled application of ethylene is widely used to induce uniform ripening of banana, mango, tomato, and papaya, to degreen citrus fruits, and to synchronize ripening for marketing and processing purposes. However, excessive exposure to ethylene may accelerate senescence and reduce the shelf life of fresh produce. Therefore, proper management of ethylene levels during storage and transportation is essential to minimize post-harvest

losses and maintain the quality of fruits and vegetables.

Thus, ethylene is rightly called the "**Natural Ripening Hormone**" because it acts as the master regulator of ripening and several other plant developmental processes. Understanding its biosynthesis, mechanism of action, and practical applications is essential for improving post-harvest management, extending shelf life, and enhancing the market value of horticultural produce.

Characteristics of Ethylene

- Chemical formula: C_2H_4
- Colourless and flammable gas
- Produced naturally by plant tissues
- Active even at very low concentrations
- Diffuses rapidly through plant tissues and the atmosphere
- Known as the **natural ripening hormone**

Biosynthesis of Ethylene

Ethylene is synthesized from the amino acid **methionine** through the following pathway:

Methionine → S-adenosyl methionine (SAM) → 1-aminocyclopropane-1-carboxylic acid (ACC) → Ethylene

The enzymes **ACC synthase** and **ACC oxidase** play important roles in ethylene production.

Role of Ethylene in Fruit Ripening

Ethylene induces several changes during ripening:

- Accelerates respiration.
- Converts starch into sugars, increasing sweetness.
- Degrades chlorophyll and promotes colour development.

- Softens fruit tissues by breaking down cell wall components.
- Enhances flavour and aroma formation.
- Reduces acidity and astringency.
- Improves palatability and consumer acceptance.

Commercial Uses of Ethylene

- Artificial ripening of banana, mango, tomato, and papaya.
- Degreening of citrus fruits.
- Synchronization of fruit ripening.
- Promotion of flowering in pineapple.
- Thinning and abscission of fruits in some crops.
- Used in ripening chambers for uniform ripening and better marketability.

CONCLUSION

Ethylene is a naturally occurring gaseous plant hormone that plays a central role in fruit ripening and several developmental processes in plants. By regulating colour, texture, sweetness, aroma, and other quality attributes, ethylene significantly influences the post-harvest behaviour of fruits and vegetables. Proper understanding and management of ethylene production are essential for reducing post-harvest losses, extending shelf life, and improving the quality and market value of horticultural produce.

“Ethylene is nature's signal that transforms mature fruits into attractive, nutritious, and palatable produce ready for consumption.”