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Banana Ripening

Science and Technology

Springer

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Preface

There have been many textbooks published dealing exclusively with *Musa* (bananas and plantains) perhaps starting with the one written by my former boss and mentor Professor C.W. Wardlaw (*Banana Diseases: Including Plantains and Abaca* 24 editions published between 1961 and 1974) to several more excellent books. Also, several chapters in various books have also dealt with bananas.

The objective of this book was therefore to deal exclusively with how bananas are ripened. However, the technology used is based on, and has implications with, a whole range of factors. These include the cultivar, growing conditions and how and at what maturity the fruit are harvested and handled. Also, various postharvest treatments can be applied to fruit and how these impact with the ripening process can have effects on the fruit quality.

The ripening process and the changes that occur are therefore considered in detail. There is a well-established successful technology that has evolved and is applied, particularly in more developed temperate countries where bananas are imported, but this technology essentially applies to a single genotype. However, most bananas are marketed locally in the country where they are grown, and often, different technologies are used in the ripening process, which have technical, economic and health implication. All these factors are discussed, and interacting implications are considered. Also, there is often insufficient and even contradictory information on how different ripening methods affect fruit quality including carbohydrates, proteins, phenolic, vitamins, acidity and other phytochemicals as well as texture, colour and flavour.

Banana sea trade began a little more than 100 years ago, but it has helped create great economic empires and sustained the livelihoods of millions of people in producer countries as well as in importing countries. The international banana trade has been very fast in employing new advancements in refrigerated transport and ripening technologies, since they can reduce transport costs and losses and increase the distance they can be successfully transported.

Anthony Keith Thompson
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Abbreviations

1-MCP	1-methylcyclopropene
AA	ascorbic acid
ABA	abscisic acid
ACC	1-aminocyclopropane-1-carboxylic acid
ACC oxidase	an enzyme involved in biosynthesis of ethylene
ACC synthase	an enzyme involved in biosynthesis of ethylene
ACC synthesis	the reaction catalysed by ACC synthase
ACPd	activated carbon impregnated with palladium
ATP	adenosine triphosphate
AVG	aminoethoxyvinylglycine
CA	controlled atmosphere
CMC	carboxymethyl cellulose
DFE	dietary folate equivalent
DPPH	1,1-diphenyl-2-picrylhydrazyl
Ethrel	ethephon (2-chloroethylphosphonic acid)
GA	gibberellins
GA_3	gibberellic acid
IAA	indole-3-acetic acid
IC	inclusion complex powder for slow ethylene release, ethylene-alpha-cyclodextrin
Imazalil	1-[allyloxy-2,4-dichlorophenethyl]imidazole, a fungicide
LDPE	low-density polyethylene film
LPE	lysophosphatidylethanolamine
MA	modified atmosphere
mRNA	messenger ribonucleic acid
PAL	phenylalanine ammonia-lyase
PE	polyethylene film
PG	polygalacturonase
PME	pectin methylesterase
POD	pyrogallol peroxidase
PPO	polyphenol oxidase

pVACs	provitamin A carotenoids
RAE	retinol activity equivalent
RH	relative humidity
RNA	ribonucleic acid
SAM	s-adenosyl-methionine
TA	total acidity; titratable acidity
TBZ	thiabendazole (2-thiazol-4-yl benzimidazole), a fungicide
ton	2240 pounds (lbs) = 1016 kg
tonne	1000 kg
TPC	total phenolic compounds
TFC	total flavonoid compounds
TSS	total soluble solids
ULO	ultralow oxygen

Contents

About the Authors

Jiraporn Sirison is Associate Dean and Assistant Professor in the Faculty of Agro-Industry, King Mongkut's Institute of Technology, Ladkrabang, Thailand. She studied at Maejo University and Mahidol University both in Thailand and Kyoto University in Japan. She is a Nutrition Chemist whose teaching and research are mainly in the area of the effects of processing on nutrients in food and the application of food colloids in food nutrition. She teaches nutrition to undergraduates and has published many research papers on these subjects. Also, she was brought up on her parents' banana farm in Thailand.

Suriyan Supapvanich is Assistant Professor in Postharvest Technology in the Faculty of Industrial Education and Technology, King Mongkut's Institute of Technology, Ladkrabang, Thailand. His field of specialization is postharvest biology and biochemistry of tropical fruit and vegetables. He studied at Kasetsart University and King Mongkut's University Thonburi, both in Thailand, and the University of Nottingham, UK, where he was awarded a PhD degree. He subsequently worked at the University of Natural Resources and Life Sciences in Austria and lectured in the Faculty Natural Resources and Agro-Industry at Kasetsart University. He has 19 years teaching experience in courses on postharvest technology of agricultural products and introduction of food science and technology to undergraduate students and advanced postharvest technology to MSc students. He has also published more than 40 papers in international journals and 2 book

chapters. He is currently coordinating postharvest research projects with KMITL Prince of Chumphon Campus, KMUTT, Thammasat University and Anhui Agricultural University in China.

Anthony Keith Thompson is Visiting Professor at King Mongkut's Institute of Technology Ladkrabang in Thailand and was formerly Professor of Plant Science, University of Asmara, Eritrea; Professor of Postharvest Technology and Head of Department, Cranfield University, UK; Team Leader on an EU project on restructuring the banana industry in the Windward Islands; Principal Scientific Officer, Tropical Products Institute, London; Postharvest Expert for the UN in Sudan, Yemen and Korea for the Food and Agriculture Organization, Ghana and Sri Lanka for the International Trade Centre and Gambia for the World Bank; Advisor to the British, Jamaican and Colombian Governments in postharvest technology of fruit and vegetables; Research Fellow in Crop Science, University of the West Indies, Trinidad; Demonstrator in Biometrics, University of Leeds; as well as Consultant for various commercial and government organizations in many countries throughout the world. He has published over 100 scientific papers and many scientific textbooks.